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The Indiana University Information Technology 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, 2003 was the fifth full calendar year, and FY 2003-2004 the fifth 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 2003-2004 as part of the University’s annual budgetary process, realistically it reports accomplishments mainly for the calendar year 2003, given that it is prepared in early 2004. The plan is a five-year plan and will guide IU’s activities and initiatives in IT until the end of 2004. OVPIT has produced 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 2003 are described under these.
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.
**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 lifecycle 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, Macromedia, Symantec, Oracle, Corel, 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, distributed in its first five years 489,429 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 $80M thus far. In addition, a more easily supported common base of software and a common hardware platform allow for improved service to users. In April 2003, IU and Microsoft signed a new agreement that provides Microsoft software to IU faculty, staff, and students for an additional three years, for use on campus and at home. IU also extended a deal with Macromedia to make its popular Web development software package available to students, faculty and staff for two more years.

University Information Technology Services (UITS) and IU Purchasing have negotiated to leverage the mass purchase power of the University to realize the lowest workstation and notebook prices in meeting lifecycle funding objectives. Similar negotiations have resulted in the purchase of more than 23,500 machines by IU Schools and departments, realizing savings of more than $11M.

In May 2003, IU entered a Preferred Partnership with Dell Marketing — IU’s first such agreement — that offers students, faculty, and staff the opportunity to purchase specially configured workstations, laptops, and multimedia machines at more than $500 below standard educational pricing, and discounts of up to 15% below educational rates on the full catalog of Dell computers, printers, and handheld devices.

The successful implementation of lifecycle funding and basic equipment modernization is an impressive achievement in a short time, and has brought IU national attention. (The *Chronicle of Higher Education*, October 4, 2002, featured a story including IU’s workstation bid process and software contract in an article on lifecycle funding.) 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 students and faculty know they can count on access to basic hardware, software, and networks, and generally express high levels of satisfaction in the UITS annual User Survey. (See [http://about.uits.iu.edu/divisions/rac/usersurv.html](http://about.uits.iu.edu/divisions/rac/usersurv.html))

UITs has been recognized for many years as a leader in the effective management of the cost and quality of its services. UITS was one of the first university IT organizations in the nation to develop a comprehensive services list, define all of the processes that comprise those services, and implement Activity Based Costing (ABC). As a result of the ABC effort, UITS is able to identify the total cost, utilization levels, and per-unit cost of everything it produces. Use of ABC metrics is a key tool in analyzing and modifying expenditures that ensure that budget monies are used most effectively.

UITs is also a national leader in assessing customer-based satisfaction. For more than a decade UITS has contracted with an independent survey organization to administer a survey of its customers (users within the University community) to assess satisfaction with UITS services; many service changes have been implemented in recent years as a result of the UITS User Survey.

The 2003 survey results indicate that of those in the IUB and IUPUI community that use UITS services, more than 97% are satisfied with the quality of those services. UITS has been experimenting with other quality methodologies, including the balanced scorecard (which measures innovation and staff satisfaction as well as cost and quality) and six sigma (a total quality management methodology designed to essentially eradicate errors from processes). UITS leadership in the management of cost and quality is indicated by the fact that for the last three years in a row representatives of UITS have spoken on this topic at national conferences.
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!”)
**OFF-CAMPUS ACCESS**

With the long-standing problem of inadequate capacity on the two core campuses solved in 1999, modem service was monitored for quality and usage during 2003. Modem access remains, as a normal operating condition, rapid and straightforward. With the increased availability of local, high-speed, off-campus Internet Service Providers, use of the IUB modem pool dropped again in 2003 as members of the IU community increasingly made use of these service providers.

In June 2001, UITS retired the 856-5212 IUB terminal-only modem pool. In November 2003, as a result of decreased demand, UITS retired 207 lines from the 856-5200 IUB modem pool. While elimination of the service is not likely, the move to high-speed providers by the user community is yielding significant cost savings as UITS downsizes the modem pool into line with lower demand.

These high-speed connections to IU resources from vendor-provided services have been secured by Virtual Private Network (VPN) services. VPN provides a solid and secure link from these service providers, requiring authentication with an IU Network ID before use of the IU network is enabled. This VPN infrastructure also serves to secure the wireless network services being implemented on the campuses, and thus has provided a well-leveraged technology solution for security.

**ON-CAMPUS ACCESS**

I-Light continues to provide vast benefits to the University over previous connectivity, both for intra-campus connectivity and connectivity to the commodity Internet. I-Light’s capacity, which is in addition to existing Internet2 connectivity, is allocated between the campus housing at IUB, the IUB campus, and the IUPUI campus and its connections to the six regional campuses.

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 Bloomington campus housing. In 2003, UITS continued its successful partnership with the Residence Halls Association in helping to determine proper policy and practice for the residential commodity Internet connection. Filters of certain types of data traffic have been successful in managing the bandwidth in campus housing.

On the Bloomington campus during 2003, some 1,845 new data jacks were installed, and more than 12,456 were upgraded, bringing the total number of active Ethernet jacks to 34,531. Of these, 14,380 are capable of supporting up to 100Mbps. Through the gigabit distribution project, 48 new locations at IUB are now connected to the backbone, bringing the total to 61 connected to the backbone at 1Gbps, with plans for adding more buildings in 2004.

Efforts continued in 2003 to replace aging Ethernet equipment with 10/100Mbps-capable switches. Fifteen new buildings were upgraded with new equipment. In 2003, two additional Greek houses were added to the IU Network via GreekNet. A partnership between SBC, IU, and the Greek Houses, GreekNet facilitates access to the IU network from Greek housing.

Nine new on-campus apartment buildings at IUPUI are being added to the backbone, with six completed in 2003. Earlier this year, Inlow Hall was added to the network, bringing the total number of IUPUI buildings on the network to 55. In various buildings, removal of the HP4000 switches has begun. These are being replaced with HP4104s and HP4108s, which have a higher backplane bandwidth. All HP4000 switches will soon be phased out with the new switches in floor closets. At IUPUI some 2,530 new data jacks were installed during 2003, bringing the total number of active Ethernet jacks to 18,570. Of these, 9,967 are capable of supporting up to 100Mbps.
The Wireless Project implementation stage is complete, with wireless coverage available in all academic facilities at IUB and IUPUI. More than 500 VPN-secured access points were installed on the Bloomington campus, and more than 200 are installed at IUPUI. Coverage includes many outdoor areas surrounding buildings.

Installations will continue in perimeter faculty and staff facilities in Bloomington, and in medical facilities at IUPUI. Bloomington campus residences will have wireless coverage as well, with a focus on communal and lounge areas. At IUPUI new campus apartments will have total wireless coverage in addition to coverage in lounges.

UITS has installed a new wireless technology — a Vivato phased-array antenna — on the IUB Memorial Stadium. Vivato uses 13 highly focused antennas to cover large areas over great distances, allowing users to connect to the IU Network via the Virtual Private Network from more than one mile away. More Vivato antennas are slated to be installed at IUPUI on University College and on Inlow Hall.

For a list of UITS-supported secure wireless sites at IUB and IUPUI, see http://www.indiana.edu/~uits/telecom/data/waps.html
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. Participation in the CIC IT salary survey yields valuable information about compensation practices at sister institutions of higher education. Both efforts will provide relevant compensation comparisons.

The implementation of a bonus program has provided an effective mechanism for rewarding staff members for outstanding performance and extraordinary effort on critical initiatives.

**Action 5.** 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 dialog 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. As part of their responsibilities, two campus deans for information technology work closely on these issues with academic leadership and faculty council leadership at IUB, IUPUI, and across the campuses.

**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 continued to support faculty in their use of IT in teaching, research, and service through the provision of grants and fellowships offered in specific areas.

**SBC Fellows Program**

The SBC Fellows Program (formerly Ameritech Fellows Program) funds innovative faculty projects integrating information technology into teaching and...
learning. The fifth round of awards, announced in October 2003, awarded 14 IU faculty projects from across the State a total of $176,280. The technologies proposed include the distance delivery of a science lab, games to promote collaborative learning and track progress, instructional video production, hand-held computers for data collection and analysis, presentation technologies, animated tutorials, online skills placement, and student-programmed robots. The academic areas originating the proposals were equally diverse: health sciences, business, African studies, biology, communication studies, psychology, math, construction science, dentistry, music, new media, and computer and information science.

The program collects the Fellows’ findings and draws upon their expertise for the benefit of colleagues throughout IU and beyond. The project final reports and examples of good practices in teaching and learning with technology are available on the program Web site. (See http://sbcf.iu.edu/goodpract/index.html)

**TECHNOLOGY ASSESSMENT GRANT PROGRAM**

In 2001 the Office of Distributed Education, with the support of OVPIT, launched a small, one-time grant program to support projects that focused on the use of instructional technology in teaching and learning. The Technology Assessment Grant Program (TAG) provided funding to faculty studying the impact of educational technology on their practices and on student, course, or program outcomes. The TAG program awarded more than $68,000 to 14 winners from IU core and regional campuses. Winners submitted final project reports in June 2003 and presented a poster session along with the SBC Fellows at a Summer Leadership Forum (see right).

**SBC/TAG SUMMER LEADERSHIP FORUM**

The SBC/TAG Summer Leadership Forum, held in June 2003 on the IUPUI campus, provided an opportunity for IU SBC Fellows and Technology Assessment Grant (TAG) awardees to present their projects and discuss lessons learned during project development and implementation. The highlighted project, “Creation of a Multimedia Beatles Companion,” by Glenn Gass of the IUB School of Music, was enthusiastically received.

Seventeen projects illustrated the instructional use of such technologies as interactive video, Oncourse and other Web-based courses, Flashlight, multimedia, CD-ROM, trans-national courses via various distance education technologies, computer-based training and assessment tools, online discussion forums, personal digital assistants (PDA), computer simulation, online textbooks, and online quizzing.

These technologies will be applied in academic areas that include music, biology, Chinese language, education, business, anthropology, geology, nursing, English language training, parks and recreation, adult education, English, medical education, social work, and physical education. (See http://sbcf.iu.edu/events.html)

**TEACHING & LEARNING TECHNOLOGY GRANTS**

Teaching & Learning Technology Grants (formerly TLTL Grants in Aid and Media Assistants), funded by the IUB Dean of Faculties Office, provides Media Assistants and/or Grants-in-Aid for projects that need discipline-specific specialized knowledge or talents, or intensive effort. It also provides for materials and training, or other expenses that support project development. Awards to be made in early Spring 2004 will focus on increasing student engagement.
**LOCAL SUPPORT PROVIDER (LSP) SERVICES**

LSP Services, with staff at IUB and IUPUI, provides technical support and consulting services to more than 600 technical staff (LSPs) in academic and other departments in Bloomington and Indianapolis, and at the regional campuses. These services give LSPs access to Windows server and workstation consulting and troubleshooting, lab resources for testing, technical training, Microsoft certification opportunities, online technical tools and resources, and reserved software. Additionally, LSP Services provides third-tier e-mail support for LSPs and the more than 26,000 Exchange/Outlook users on all campuses. LSP Services works closely with LSPs and other UITS service providers to ensure the successful implementation of new services, reviewing departmental technology, and creating and maintaining Knowledge Base documents. The group also plays a major leadership role in supporting mobility computing. For-fee services are available for departments that require personalized, on-site server assistance.

In 2003 LSP Services and University Human Resource Services again partnered to present a series of non-technical, professional development courses designed specifically for LSPs. The Local Support Provider Professional Development Series held at IUB offered the following specialized training courses: The Local Support Provider: Role and Resources, Building Partnerships for Improved Service, Handling Multiple Priorities, The People Side of Change, and Creating Self Reliant Users (UITS IT Training & Education hosted this session).

UITS provided EdCert Training for LSPs on Mac OS X to enable local support providers to support Mac OS X systems in their departments. The training included workstation setup, networking, application installation and upgrades, troubleshooting, OS X command line basics, and system builds for easy distribution on multiple machines. Some 45 LSPs at IUB and 18 at IUPUI attended the workshop series.

**MICROSOFT WINDOWS EdCERT**

In 2003 LSP Services continued to offer technical education classes and certification testing services to University IT professionals as identified in the IT Strategic Plan. LSP Services personnel at IUB and IUPUI are Microsoft Certified Professionals who teach Microsoft Official Curriculum to LSPs and technical support staff from IUB, IUPUI, and the regional campuses. In 2003, LSP Services taught 25 Education Certification Program (EdCert) Microsoft classes to an audience of 250 LSPs and technical staff. Microsoft Certification continues to be available to members of the LSP community. LSP Services provides Microsoft test vouchers for those who pass the appropriate Transcender pre-certification tests, also made available through LSP Services. Other educational initiatives in which LSP Services either hosted or contributed technical resources during 2003 include 25 information...
sharing/user group meetings at IUB and IUPUI attended by some 1,000 participants. (See http://www.indiana.edu/~edcert and https://lspservices.iupui.edu/edcert.asp)

UNIX AND UNIX EdCERTS
The Unix Systems Support Group (USSG) continues to refine and expand its EdCert program in Unix system administration. Since the inception of IU’s IT Strategic Plan, 121 students from IUB, IUPUI, and several of the regional campuses have passed the certification test. Twenty-two students passed the test in 2003. The changes made to the EdCert program will also simplify future updates and maintenance. Spring, Summer, and Fall classes are being planned for 2004.

In addition to EdCerts, USSG offers online education through its Unix Systems Administration Independent Learning (USAIL) program (http://www.ussg.indiana.edu/usail/). This resource is well known and used within the IU and the Unix communities, and along with other Unix resources, generates an average of 200,000 hits a day. Unix users and administrators are also kept current through monthly Unix Users Group meetings. These offer opportunities to share experience and learn about new programs and trends, including open source software. The USSG also offers personalized Unix support in person and by telephone and e-mail.

An important part of UITS educational activities includes efforts to inform students about alternatives to traditional commercial operating systems, including the open source movement. USSG hosts an annual event called LinuxFest, which draws hundreds of students, faculty, and staff to a series of talks and demonstrations that introduce the open source concept and open source software. The 2003 fest featured a keynote speech about IU’s NSF-funded Analysis and Visualization of Instrument-Driven Data (AVIDD) project, including its 1.1-TeraFLOPS IBM cluster running Linux. (1 TFLOPS is one trillion mathematical operations per second.)

SELF-PACED LEARNING
To address the dual needs of IT support for faculty, and training for IT support staff, UITS negotiated a four-year, University-wide licensing agreement in 1999 with National Education Training Group, Inc. (NETg), now Thomson, for access to course titles that include basic IT skills for beginners, advanced training and specialized courses for IT staff, and Microsoft certification training for local support providers. All members of the IU community can use these classes in self-study mode, and IU faculty can incorporate selected courses into their curricula. More than 800 self-paced courses are available, either on the Web or on CD. More than 15,000 students, faculty, and staff have taken courses online, and more than 70,000 courseware CDs have been distributed.

IT Training & Education recently contracted with Element K to provide self-study Macintosh platform courses to the IU community as well. These courses may be accessed through IT Training Online. (See http://ittraining.iu.edu/online)

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. The difference between the costs paid by the University and academic list price amounts to more
than an annual $3M. More important, ease of access to the best software tools for researchers and students greatly enhances the University’s activities in research and teaching.

In 2003, UITS extended the current agreement with Microsoft for its operating system and Office products. In addition, new contracts were negotiated with Thomson/NETg for its courseware products, and with Corel for its WordPerfect software.

IU was pleased to announce the renewal of the Macromedia Software Contract Agreement, extending for two years the license program for the Studio MX suite of products. The contract provides excellent pricing for IU departments and for personal purchase by students, faculty, and staff. In mid-December negotiations were finalized to make Macromedia Contribute available to departments.

IU continued the Apple Technology Assurance Program (Apple Tap) to provide departments with significant savings on Mac OS X. More than 50 departments on all IU campuses took part in the program, saving the University more than $200,000 on upgrade costs during the first two years of the program. In addition, UITS arranged a special purchase of Apple’s FinalCut Pro for 25 departments on four campuses, netting the University savings of more than $5,000.

Symantec security software continues to be distributed University-wide on the IUware CD, the IUware Security CD, the free Orientation CD, the “Run this CD first” CD for the residence hall community, and on IUware Online.

IU’s agreement with Shavlik for its HFNetChkPro software runs through June 2005. This software improves the security of IU’s computer systems and network by allowing system administrators (LSPs) to apply critical security patches to widely dispersed Windows computers from a central location. The software enables LSPs to react quickly to address vulnerabilities before they can be exploited.

The Center for Statistical and Mathematical Computing (Stat/Math Center) manages a large suite of software in support of quantitative research. Central to this is the Enterprise License Agreement for SPSS, the most widely used commercial statistical package at IU. Dozens of other software packages, including the mathematical software Matlab, are licensed and redistributed within the University at a very modest cost.

The Unix Systems Support Group (USSG) negotiates site licenses for commercial Unix software, providing the University with access to such software under very aggressive site licensing terms. USSG also supports the use of Linux, an open source version of Unix that is popular among researchers and students. In December 2003, the University reached an agreement with Indianapolis-based Progeny for its Progeny Transition Service. This service provides software updates for users of Red Hat® Linux® versions 7.2, 7.3, and 8.0, with Version 9 updates to come in May 2004.

UITs Digital Libraries groups and the IU Libraries collaborated to negotiate a University-wide site license for the popular bibliographic software ProCite, ReferenceManager, and EndNote. During 2003, more than 4,000 individual software copies were distributed. Widely used by scholars in many fields, most notably in the humanities, this software greatly enhances the scholarly output of the University.

**SBC/TAG SUMMER LEADERSHIP FORUM**

The SBC/TAG Summer Leadership Forum, held in June 2003 on the IUPUI campus, provided an opportunity for IU SBC Fellows and Technology Assessment Grant (TAG) awardees to present their projects and discuss lessons learned during project development and implementation. See the discussion under Action 7.

**TEACHING AND LEARNING CENTER EXPANSIONS**

Teaching and Learning Centers on University campuses continued to grow and extend their services across their campuses in 2003. See the discussion under Action 11.
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**

After two years of construction, the new Informatics and Communications Technology Complex (ICTC) at IUPUI will open in Summer 2004. The building is located on the southwest corner of Michigan and West Streets on the IUPUI campus.

The 111,073 square-foot ICTC at IUPUI will serve many functions. It will be the new home for University Information Technology Services at IUPUI, housing UITS staff, the Office of the Vice President for IT, the machine room, a 24-hour Student Technology Center, a Support Center, and training facilities. It will also be the center of telecommunications for IU; an anchor of the Indianapolis-Bloomington technology corridor; and a hub of I-Light, the 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 ICTC 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. Additionally, the ICTC will house the School of Informatics with its New Media Program, the School of Journalism, and Program in Music. This facility 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.

UTIS and academic units will move into the building upon completion, and state-of-the-art classrooms will be in use by August 2004. Additional ICTC information and a live Webcam of the site are available on the Web at [http://www.iupui.edu/~uits/CTC_IC/](http://www.iupui.edu/~uits/CTC_IC/).

**IUB**

The Trustees of Indiana University approved the design for the Computation and Information Building (CIB) on the Bloomington campus at the December 2005 Board Meeting. The CIB will be home to supercomputing, massive data storage, and enterprise information systems, and will bring IT resources, staff, and expertise to a central campus location to deliver IT support to IUB’s students, faculty, and staff.

Fundraising plans for the CIB are moving forward, and the design development phase will continue over the next six to nine months.
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 5.
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.

Enhancement of the University’s teaching and learning centers continued during 2003-04 with improvements to facilities and technology to provide a higher level of support to faculty.

**IUPUI – CENTER FOR TEACHING AND LEARNING**

The Center for Teaching and Learning (CTL) continues to expand and improve services for faculty and academic units on teaching and learning issues, multimedia, Web applications, and instructional design. Of the 12 CTL staff members, eight are UITS employees. Members of the Instructional Design and Development staff continue to work with the IUPUI Schools to serve as development and support liaisons. In May 2003, the CTL offered the first Jump Start program for eight faculty members from a range of disciplines. In this intensive four-day workshop, faculty worked with consultants from the CTL and Digital Media Services (DMS) to design their online courses in an accelerated time frame. Another Jump Start program for nine faculty was held in August. In addition, the CTL created Teaching in Support of Student Success, a six-module series designed to provide faculty with information about effective teaching strategies and to serve as a model of online teaching.

**IU KOKOMO – CENTER FOR TEACHING EXCELLENCE**

The Center for Teaching Excellence (CTE) consists of one half-time director (tenured faculty), two instructional technologists, and a part-time student consultant. Staff taught instructional software, including Microsoft, Adobe, and Macromedia, and various learning tools, including MERLOT, Concept Mapping Tools, and Calibrated Peer Review. A two-day “Tech Camp” introduced faculty to Oncourse. CTE staff took over the publication of the monthly newsletter for adjunct faculty, “The Advocate,” and expanded it.
to include technology tips, issues in pedagogy, Internet resources for educators, and so on. At faculty request, the CTE obtained a one-year license to Turnitin.com, a plagiarism detection service.

IU NORTHWEST – CENTER FOR EXCELLENCE IN TEACHING AND LEARNING
The Center for Excellence in Teaching and Learning is funded through Academic Affairs. It promotes IT workshops offered on campus and participates in relevant campus IT initiatives. In 2003 an important addition was made to the Center staff with the hiring of a part-time instructional design specialist. This addition, supported with IT funds, has made a significant difference in the Center’s effectiveness in serving the campus.

IU SOUTHEAST – INSTITUTE FOR LEARNING AND TEACHING EXCELLENCE
Sponsored by the Office of Academic Affairs, the Institute for Learning and Teaching Excellence (ILTE) provides consultation and development for integrating technologies into teaching and learning. It is a contact area for faculty in the design, implementation, and assessment of teaching and learning materials; it sponsors workshops, presentations, and symposia; and provides one-on-one consulting. The Institute coordinates the New Faculty Orientation and Welcome (Back) Week activities, making special efforts to ensure new full-time and adjunct faculty are prepared for the new school year. The ILTE team consists of a half-time director, a technology coordinator, an instructional technologist, and two part-time student workers.

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. In Fall 2003 student usage grew to 81%, up from 77% in Fall 2002, while faculty use grew to 74%, compared to 67% in Fall 2002. The 2003 UITS User Satisfaction Survey logged a 95.5% user satisfaction rate for Oncourse at IUPUI and IUB, compared to 94.7% in 2002.

In May 2003, Oncourse moved to IU’s Central Authentication System (CAS), allowing users to seamlessly transition from one CAS-based service to another, including the OneStart portal.

Development of a mobile application interface for Oncourse was completed in Fall 2003. The application allows pocket PC, WAP phones, and other mobile devices to access Oncourse communication tools. The development was a result of a competition supported by UITS in partnership with graduate students in the Kelley School of Business.

In 2002, a plan was developed for the next generation of Oncourse, to build on in-house expertise and take advantage of new technologies and enterprise resources.
As part of this new plan, Indiana University joined the Open Knowledge Initiative (OKI), a collaborative effort involving multiple universities to build open source, standardized modules for course management systems, rather than buying proprietary vendor modules. The benefits of the OKI initiative are many. The initiative will provide long-term standards and access to applications that are the best of their kind; these will translate into economic benefits for the University. The current Oncourse system will gradually move to the OKI environment and new modules will be added as they are developed. In the future, a modular, customizable learning environment will be available. OKI will speed development and help with the unbundling of services and the integration of chat, mail, forums, and calendaring through the OneStart portal. These OKI-based changes will be made with minimal visible changes in the application and without disruption for users.

The Navigo Project, a framework for online assessment, was the first open source application released to a small number of users for testing in Fall 2003, and will be released to all Oncourse users in Spring 2004. The Oncourse Next Generation (NG) strategy and collaboration continues with involvement from other OKI partners. Future Oncourse NG features will be developed in Spring 2004 based on the successes of this project.

In December 2003 the Andrew W. Mellon Foundation awarded Indiana University a $518,000 grant over two years for IU’s ePortfolio Project. ePortfolios provide a means for students to demonstrate levels of learning achievement and facilitate lifelong learning. IUPUI has already mobilized an academic change initiative based on ePortfolios as part of the University’s gateway courses and funded two developers as part of the Commitment to Excellence. IU will lead the development of this software in cooperation with the Open Source Portfolio Initiative. The software will integrate with IU’s course management system, Oncourse. A commercial partner, the rsmart group, will contribute to development.

Indiana University also received $2,400,000 in Mellon Foundation funding over two years for the Sakai Project. Sakai will create a set of open source tools that are the best of their kind for course management, research collaboration, assessment, portal, and workflow. Such tools, that can be easily shared among universities, will open new doors for discipline-specific innovation in teaching and learning. Michigan, Indiana, MIT, and Stanford will be using a common set of major applications that have all been conformed for easily portability. The ePortfolio and Sakai projects will use a common technology architecture to ensure their compatibility and interoperability.

In keeping with nationwide trends, the decision was made in 2002 to take a decentralized approach to distributed education efforts at Indiana University. As a result, the Office of Distributed Education (ODE) was closed on June 30, 2002. The IT Strategic Plan Actions related to faculty, including promotion and tenure, commercialization of faculty products, fellowships and grants, development of DE courses and promotion of DE activities, is the responsibility of campuses and Schools, with leadership from the Offices of Academic Affairs and support through the campus Centers for Teaching and Learning. The underlying infrastructure and networks that support distributed learning, as well as IT systems such as Oncourse, digital media services, and faculty and student user support, are provided by UITS.
**Action 7.** The University should review its current systems of faculty fellowships and staff development grants, with the aim of expanding those 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 content 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 launched the first phase of the Digital Media Services (DMS) plan in 2002, which focuses on meeting the instructional needs of Indiana University campuses, Schools, and departments. DMS, with professional staff on the IUB and IUPUI campuses, is expected to have a major impact on the University’s ability to develop multimedia and Web content in support of the goals of teaching, learning, and distributed education.

To support the activities of DMS, an advanced multimedia production studio was created at IUPUI. The studio is equipped with a nonlinear, high-definition video and audio editing system; high-resolution flatbed scanners; 35mm slide scanners; an Interactive Classroom Studio for capturing lecture-format instruction; Web servers; interactive CD and DVD authoring systems; a high-capacity CD and DVD duplicator; 3D modeling and animation software; 2D interactive animation software; and digital still cameras. DMS provides services in design, media creation, programming, Web hosting, software evaluation and testing, distribution and access, and project management. DMS works closely with other University staff, including Local Support Providers (LSPs), as they assist faculty and staff in performing their own digital media work and in developing Web content. DMS also complements the instructional design and assessment services offered in the campus Centers for Teaching and Learning.

In Summer 2003, DMS partnered with the IUPUI Center for Teaching and Learning to complete nine IUPUI Online courses, with an additional eight courses to be delivered in Summer 2004. DMS provided video duplicating services in support of Community Learning Network and Kelley School of Business courses, and for the IU School of Medicine.

DMS staff accompanied IUB geologists to south-central Oregon, serving as a video production crew, to document field research in conjunction with a NASA-funded Astrobiology Institute. The resulting footage will be edited into a pilot segment for a full-length documentary and is the first University project to use HDTV technology. The DMS crew will continue to work alongside researchers to capture field research findings in high-quality format for use in documentaries and in the classroom.
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.

The UITS Advanced Visualization Lab (AVL) partners with a variety of educators across the University to apply visual simulation and visualization technologies to a broad range of subjects and teaching scenarios.

New applications in 2003 include three distinct applications with faculty in the School of Engineering at IUPUI: the extension of CNC (computer numerically-controlled) milling simulation software to virtual reality displays; the development of new visualization software for a finite element simulation of an aircraft wing; and the application of specialized volume-rendering hardware to visualize a simulation of material corrosion in mechanical components.

In addition, the AVL is working with educators, researchers, and support staff at IUPUI and IUB to apply advanced stereo and high-resolution displays to standard GIS (geographic information system) software to enhance education and research.

The AVL continues to support a number of ongoing simulation projects and applications of virtual reality and visualization to education, including: scientifically-accurate astronomy simulation software for display in the CAVE and digital planetariums; VR software, scanning hardware, and haptic rendering methods for recording and experiencing cultural heritage sites and artifacts; exploration of new commodity-based hardware and software tools for student development and deployment of interactive art pieces; and immersive volume rendering and analysis software for studying human anatomy and medical scans.

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, lifecycle 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 mobile 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, indicating that faculty are eager to leverage new technology in their teaching.

The Media Center Directors group, which is a continuation of the All Campus Classroom Committee, meets on the second Friday of every month via Polycom. In these meetings all IU campuses compare notes on problems, solutions, and equipment. The July 2003 meeting marked the first in-person meeting; it included a very successful vendor fair. A Crestron classroom technology control seminar was held at IUPUI in early December 2003.

**IUB**

Since the implementation of these Actions in 1999, the number of Advanced Technology Classrooms on the Bloomington campus has increased from 47 classrooms to 101 classrooms. In addition to the 54 new Advanced Technology Classrooms, 29 classrooms have had major equipment and control system upgrades. In 2003, 12 new technology classrooms were added, and major upgrades were done in 13. The basic technology installation model developed for smaller classrooms has been well received by faculty. This model includes a ceiling-mounted LCD projector and a computer, laptop interface, VCR, DVD, and touch screen controls in a small, movable lectern. Even with the increase in advanced technology classrooms, requests for mobile equipment continue to increase, with 2003 requests up 20% over those in 2002.

Routine maintenance and repair, and lifecycle replacement of computers, projectors, and control systems, create a consistent and stable environment that is current and easy to use. In the next year, it will be possible in many cases to immediately diagnose and correct users’ problems interactively over the Internet.

The same system will provide network diagnostics on equipment performance, enabling maintenance or repair at the first hint of a problem. Planning for a new Lecture Hall building that will house five large classrooms ranging in size from 150 to 500 seats has been put on hold because of State budget shortfalls. The original completion date for the building was Fall 2006.

**IUPUI**

Fourteen Type III/IV classrooms received lifecycle replacement projectors in Summer 2003. Planning for additional Type III/IV classrooms has been concluded, and implementation will be associated with the pilot phase of the new classroom services model in 2003-2004, described below. IUPUI has continued to engage the support and input of Schools, faculty, and the campus Learning Environments Committee in planning and installing instructional technology upgrades in classrooms. Project planning is coordinated with the Office of the Registrar and Campus Facility Services. The model for supporting instructional technology at IUPUI is under review. The goal is to reduce costs associated with providing mobile technology support in classrooms. A plan will be developed in phases with the objective of maintaining the highest levels of service. With the implementation of the campus wireless network, informal learning spaces will be addressed.

**IU EAST**

IU East has upgraded several classrooms and a large auditorium. The Virtual Indiana Classroom (VIC) system in Whitewater Hall received an instructional system with a 50” TV monitor for local viewing of document camera and CPU output, and a CPU was added to facilitate classroom use of educational software and the Internet. VIC equipment in the New Castle location is also scheduled for repair or upgrade. The equipment in Vivian Auditorium was upgraded with the installation of an LCD projector, the rewiring of the equipment rack, the reprogramming of the AMX control system, and the installation of a DVD/VCR combination deck. Three Sympodium presentation systems have been purchased. Two will be installed in Advanced Technology Classrooms and the third will be used by the Teaching and Learning Center (TLC) as a demonstration unit. The TLC unit is also available for checkout to faculty and staff.
IU SOUTH BEND

Instructional Media Services (IMS) at IUSB has completed the upgrade of twelve “smart classrooms” featuring a prototype technology desk that is permanently installed in the classroom, but movable so that instructors may position it where it is most effective in the classroom. The rooms include a ceiling-mounted projector, PC, VCR/DVD, document camera, high-quality audio, and a standardized user control interface. Five additional classrooms were upgraded to include ceiling-mounted projectors, computers, and a control interface. Requests For Proposals for the upgrade of two auditoriums have been prepared and will soon go out for bid, and plans are being finalized for the installation of 10 additional smart classrooms. Software is being tested for IP control and monitoring of classroom technology. Implementation is scheduled for 2004.

IU NORTHWEST

IU Northwest upgraded four classrooms to multimedia classrooms following the standard model of Dell PC, Elmo presenter, LCD projector, VCR, projection screen, associated wiring and controls, and Best cypher locks. Five multimedia classrooms received DVD/VCR players to replace VCR players. A multimedia classroom with two LCD projectors received a smart panel switcher that allows easier control of the dual projector inputs. Cypher locks and crash bars were installed in the Advanced Technology Auditorium in Raintree Hall, where the sound system was also upgraded. Physical improvements made under an Energy Savings contract included replacing all classroom lighting and the air conditioning univents in Raintree Hall. Planning for the next set of classrooms to be converted to fixed multimedia classrooms is under discussion. Staff continue to explore ways to add infrastructure and equipment to the Savannah Center auditorium, which was originally built to show movies, but now also serves as a multimedia classroom. Deployment of wireless mice in all multimedia classrooms is also being investigated.

IU KOKOMO

IU Kokomo completed renovating a classroom in the East Building into an Advanced Technology Classroom with two projectors, document camera, computer, VCR, DVD player, and associated hardware. Two technology installations in science labs in Hunt Hall were completed. A student testing area in the Learning Enhancement Center was created by installing six computers with two video cameras to remotely monitor the testing. Kokomo Main 080 was upgraded with a new projector, document camera, and computer, controlled by an auto video switcher. All older classroom computers were replaced. USB extension cables were added to all instructor stations so jump drives or wireless mice could easily be plugged in by the instructors. Twenty-five wireless mice were issued to instructors.

IU SOUTHEAST

Significant progress was made in 2003 in equipping the busiest classroom building, Crestview Hall, with a newly-designed instructor’s station, new computer, and a ceiling-mounted LCD video projector. Crestview’s 20 classrooms are receiving screens recessed in the ceiling, and additional power, phone, and network connections. Crestron’s IP-based Web control system is being piloted for classroom monitoring, troubleshooting, and security. If this project proves viable, it will provide a model for revamping the four other classroom buildings in subsequent fiscal years. Two new Type IV classrooms in other buildings were also completed. A Web-based reservation system for mobile AV was developed locally in Summer 2003 and implemented in Fall 2003. It streamlines the reservation process by using ADS authentication to fill in parts of the form, then checks inventory in the requestor’s building before sending an automated e-mail confirmation. A replacement-cycle strategy is being put in place for the more than 60 LCD projectors, and similar strategies for other control-system components and equipment are being evaluated. The Classroom Committee, the Institute for Learning & Teaching Excellence, and the Academic Council continue to provide guidance on meeting instructional needs.
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 that 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.

In addition to the activities described in connection with the SBC Fellows Program and the SBC/TAG Summer Leadership Forum (see Action 7), in 2002, the University explored new strategies for supporting assessment through the development of an electronic portfolio (ePortfolio) in partnership with IUPUI. As part of the ePortfolio strategy, IU joined the Open Source Portfolio Initiative (http://www.theospi.org/) to develop the ePortfolio in open source code.

The ePortfolio provides users with a mechanism to catalog evidence or artifacts that assess growth and learning over time. The ePortfolio design allows assessment on any scale, from individual to institutional, and provides a means for users to build presentations of their evidence for display in formats such as resumes, vitas, and other templates. Artifacts can include work in such forms as class-assigned reports, transcripts, diplomas, videos of performances, recordings of speeches, images of field work, links to Web sites, and so on.

The Learning Matrix, the first module of the ePortfolio project developed in 2003, is an assessment builder designed to help students gauge their mastery of competencies prescribed by a matrix. An early phase of the Learning Matrix will be made available in a limited capacity to 10 IUPUI learning communities in Spring 2004.

The second module, the Learner Profile, includes user information and a wizard-based tool to help develop goals for college and provide online self-assessments, including learning styles, college readiness, and student engagement. In time it will include access to career planning. The Learner Profile will be available in Summer 2004. Possible future modules include a Presentation Builder for display of the ePortfolio, and an Advising and Knowledge Mapping tool.

IU is represented in the governing body of the Open Source Portfolio Initiative for the development of this open source electronic portfolio. The ePortfolio will eventually move to a new architecture based on Next Generation Oncourse and the Open Knowledge Initiative. (See also Actions 12, 18, 19.)
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 45 under Recommendation 6); and collaboration and communications (Actions 27, 28).
Videoconferencing systems can be categorized into two models: group systems, comprising classroom and conference room systems; and desktop systems. The models have certain similarities, but have differing features of scale, complexity, capabilities, and support. Common to all is the H.323 videoconferencing standard. H.323 is a collection of complex protocols, with the important specification that H.323 systems utilize standard Internet data networking for communications. During 2003 steady growth continued in the deployment and use of videoconferencing. At the end of December 2001, 120 group systems had been deployed. By December 2002, the number had risen to 163. By November 2003, the number of group systems stood at 187. In addition, approximately 210 desktop systems were deployed in 2003, bringing the total number of systems to approximately 397.

Digital Media Network Services launched IStream in Fall 2002 to allow for the automatic streaming and archiving of classes, meetings, and special events. In 2003, the service grew to support nearly 40 semester-long class sections in addition to numerous meetings and other events. During Summer 2003, the implementation and migration began to a new, large storage system. This new multi-terabyte system from EMC allows for replication of streaming data between IUB and IUPUI, ensuring the service remains available, and providing for quick recovery from a catastrophic failure. Current disk usage has grown to more than 700GB.

Information provider usage of streaming services has also increased. There are currently 175 information provider accounts for the streaming servers. In addition to a new QuickTime Streaming Server, DMNS has added a new Windows Media Server that supports the latest features of Microsoft’s Windows Media 9 series.

During 2003, research continued toward selecting an institutional Web conferencing and collaboration tool. Combining efforts with the UITS voice bridging unit, in late 2003 an RFP was distributed to select a vendor to provide a combined phone bridge and Web collaboration solution. The proposal outlines a plan for selecting and implementing such a solution in Spring 2004. In the interim, academic and administrative collaboration needs continue to be met using NetMeeting and locally developed chat tools.

Through the AVIDD (Analysis and Visualization of Instrument Driven Data) grant, the UITS Advanced Visualization Lab (AVL) has deployed 11 large-format stereo displays across the IUB, IUPUI, and IUN campuses to support collaborative, multi-site viewing of 3D models, data sets, and environments. In addition, the AVL has installed one fixed and two portable Access Grid Nodes at IUB and IUPUI. The Access Grid is an ensemble of resources including multimedia large-format displays, presentation and interactive environments, and interfaces to grid middleware and to visualization environments that supports group-to-group interaction across the grid.

The AVL continues to investigate middleware technologies that support visual collaboration between IU faculty and staff and their colleagues at remote locations, including Chromium and TightVNC for application sharing and visual serving; and VTK, OpenDX, and Web-based protocols for distributed and collaborative visualization. The AVL also continues to support production visual collaboration services including a University-wide ActiveWorlds multi-user Web-based server and CAVE-to-CAVE collaborations based on CAVERNsoft/QUANTA and CAVElib software.
**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.

Indiana University’s high performance computing and communication environment enables researchers across a wide range of academic fields to explore new paradigms in science, the arts, and education. Computing resources are available to the IU community without charge in the form of hardware, software, networks, and support. 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. UITS provides a range of consulting and support services in using these tools and in the parallel programming that is a critical part of high performance computing. The intellectual impact of IU’s high performance computing environment is broad and far reaching, as indicated in the extensive list of publications, presentations, and artistic works that relied on UITS high performance computing systems, massive data storage facilities, and advanced visualization environments. (See [http://about.uits.iu.edu/divisions/rac/pubsusers.html](http://about.uits.iu.edu/divisions/rac/pubsusers.html))

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

- Linux clusters (part of the AVIDD facility)
- Distributed shared memory (the IBM SP)
- Shared memory (the Research Database Complex)

Details on these systems follow.

**AVIDD**

AVIDD (Analysis and Visualization of Instrument-Driven Data) is an innovative facility for processing and analyzing data generated by large scientific instruments and is a major new tool for research and teaching at IU. The system has an aggregate capacity of 2.2 TeraFLOPS, 0.5 TB RAM, and 10 TB disk space and was ranked 50th in the June 2003 Top500 list of the world’s largest supercomputers ([http://www.top500.org/](http://www.top500.org/)). AVIDD consists of computational, data storage, and data visualization components as follows:

**AVIDD Linux clusters.** The computational component of AVIDD comprises an integrated quartet of Linux clusters located at IUB, IUPUI, and IUN and tied together as a single computational resource. In June 2005, the system achieved a calculation rate of 1.02 TeraFLOPS. This milestone is believed to be the first time a computational rate of more than one trillion mathematical operations per second has been achieved within the State of Indiana. AVIDD was the first distributed Linux cluster to achieve 1 TFLOPS in real calculations.

**Massive data storage.** The massive data storage equipment funded by AVIDD was incorporated into IU’s existing HPSS infrastructure. New servers, tape drives, and 1.7 TB of disk storage were added to allow high-speed, parallel data transfers. It is now possible to transfer 1 TB of data from the HPSS disks into the Linux clusters in a few hours.

**Visualization.** The visualization components of AVIDD include 11 large-format stereo displays (eight of which are John-e-Boxes, described in Actions 30 and 33) and three Access Grid Nodes deployed across the IUB, IUPUI, and IUN campuses. In addition, the AVL is
installing a centralized, 12-processor, real-time rendering and visualization cluster at IUPUI. This system is based on the next generation of graphics cluster technologies, including Opteron processors, ATI video boards, SATA storage, and Infiniband interconnect, and will provide a local system that is software-compatible with the national TeraGrid visualization cluster housed at Argonne National Labs. To complement these hardware resources, AVL staff have been researching and trialing software and algorithms to support visualization in a grid environment, including methods and tools for parallel rendering, distributed visualization, and remote interaction.

RESEARCH DATABASE COMPLEX
The Research Database Complex (RDC) serves research database needs, providing a large-memory SMP environment, Oracle software, and significant disk storage. The RDC comprises two Sun V1280 systems, each with 12 CPUs and 96GB memory and 6TB shared disk, dedicated research database use, and a Sun V880 system with 4 CPUs and 8GB memory serving as a Web front end to the databases. The complex is used by IU’s leading database researchers and serves several large biomedical and GIS datasets.

UNDERGRADUATE RESEARCH
While many research-oriented services provided by UITS are geared for active researchers, undergraduate students who hope to become researchers also find an ample suite of services provided by the UITS RAC Division. A group of computers collectively referred to as the Steel cluster provides an interactive Unix environment for some 30,000 students. Steel provides a platform for learning research-related skills that range from programming and scripting to Web publishing.

INTERNATIONAL VIRTUAL DATA GRID LABORATORY (IVDGL)
Indiana University was among the consortium of 15 universities that received National Science Foundation funds in 2001 to build the International Virtual Data Grid Laboratory, or iVDGL. The iVDGL consists of a seamless network of thousands of computers at 40 locations in the US, Europe, and Asia, working together as a powerful grid capable of handling petabytes of data. For the Supercomputing 2003 conference, IU took a leadership role in the iVDGL-sponsored Grid2003, a project to create a persistent production grid infrastructure (see “Research in Indiana at SC2003,” below). Grid2003 comprises more than 25 sites and more than 1,500 computers.

IU’s contributions to the iVDGL include a prototype Tier-2 Data Center and the International Grid Operations Center, or iGOC, co-located with IU’s Global Network Operations Center (NOC) on the IUPUI campus. The Tier-2 Data Center was moved in 2003 to be co-located within the portion of the AVIDD Linux cluster located at IUB. Approximately $40K of iVDGL money was used to add 1.5 TB of fast fiber channel disks for user and scratch space on AVIDD. (See http://tier2.iu.edu/)

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 is 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 are provided through iGOC.

IP-GRID
In September 2003, IU and Purdue Universities received a $3M National Science Foundation (NSF) grant to create the IP-grid in Indiana — the network linkages that will extend the NSF TeraGrid to IU Bloomington, Indiana University-Purdue University Indianapolis,
and Purdue West Lafayette. The effort will bring the universities, already connected by the I-Light optical fiber network, into the NSF TeraGrid, a network of half a dozen institutions that provide researchers with tens of teraflops of computing power and more than 1 petabyte of storage capacity. The TeraGrid’s total storage capacity will soon equal 100 times the entire text and digital content of the US Library of Congress.

Funded through NSF’s Advanced Computational Infrastructure program, the IP-grid will be created by extending the I-Light optical-fiber network to a TeraGrid node in Chicago via the acquisition of a new optical-fiber connection. Researchers from the campuses will then be able to collaborate with colleagues at other institutions in real time, as though they were in the same room or laboratory.

As members of the TeraGrid, IU, IUPUI, and Purdue will provide raw computing power and huge amounts of research data. They will also provide such resources as sophisticated visual displays and specialized software for turning data into three-dimensional images; a dataset of thousands of years of global weather data; a year’s worth of sales transaction data from one of the world’s largest retailers of use to economists and social scientists; data on chemical reactions; a Purdue Terrestrial Observatory to provide real-time satellite data on rapid environmental changes caused by major storms, earthquakes, or terrorism; and a crisis grid in which researchers use simulation software to predict outcomes of natural and manmade catastrophes, and develop plans to contain them.

Related to IP-grid is the expansion of the I-Light initiative (see Action 50). IP-grid and I-Light together will enable the State of Indiana to greatly advance its advanced network infrastructure and the research based on this infrastructure. As a result of these initiatives, the State has become home to significant parts of the efforts to make the nation’s vision for cyberinfrastructure a reality, and to build the advanced computing systems of tomorrow.

At the conference, a team led by University Information Technology Services (UITS), the Indiana University Center for Genomics and Bioinformatics (CGB), and the High Performance Computing Center of the University of Stuttgart (HLRS) won a prestigious High Performance Computing Challenge Award. Their project, “Global Analysis of Arthropod Evolution,” took top honors in the category “Most Geographically Distributed Application.” The winning project addressed the long-held belief that arthropods with six legs (insects and their relatives) constitute a single evolutionary family. This project involved advanced high performance and grid computing technology. The HPC Challenge team assembled a global grid of computers spanning six continents and 691 computer processors, all running the IU-managed parallel version of fastDNAml. This demonstration was a significant step toward the day that IU researchers will routinely use thousands of processors at once to solve massive computational problems. (See http://www.research-indiana.org/ and http://www.indiana.edu/~uits/cpo/hpc120203/)
**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.

**ADVANCED VISUALIZATION & VIRTUAL REALITY**

In October 2003, the UITS Advanced Visualization Lab (AVL) deployed its first group of John-e-Boxes, which it developed and licensed. The John-e-Box is a portable, large-format, 3-D stereo display system. It is being used to help scientists and researchers analyze complex data sets and collaborate with colleagues, to help students experience historical spaces and understand important scientific phenomena, and to help artists and designers communicate their innovative concepts and creative experiences. The John-e-Box capitalizes on recent advances in commodity-grade (off-the-shelf) components including small, bright, digital projectors; powerful PC processors and graphics cards; and flexible, open source software tools. The John-e-Box is a key component of ongoing plans to deliver the capabilities of advanced visualization displays directly into the labs, classrooms, and studios of the University’s researchers, educators, and artists, creating a technological bridge to high-end display installations like the CAVE.

The John-e-Box was developed by staff in the AVL and the IUB Chemistry Department. The project was made possible through funding from the Office of the Vice President for Information Technology (OVPIT) and through technical support from the Chemistry Department at IU Bloomington. The John-e-Box has been licensed to and commercialized by CAE-net, an Indianapolis-based company with interests in computer-aided design, collaborative engineering, and video streaming. Licensing was made possible with help from IU’s Advanced Research and Technology Institute.

A total of eight John-e-Boxes are being deployed under the AVIDD (Analysis and Visualization of Instrument Driven Data) NSF grant.

In a related initiative, the OVPIT funded a John-e-Box for use in the School of Fine Arts (SoFA) at IUB. AVL staff members are working with SoFA faculty to refine new development and audio/video input techniques for virtual environments, and to support use of the display in the Fine Arts Gallery.

The AVL has also assisted with a number of new and continuing applications of visualization technologies to traditional scientific and data-intensive areas. These projects include: the integration of advanced stereo and high-resolution displays with standard GIS packages, such as ERDAS IMAGINE and ESRI ArcGIS, to visualize aerial photography and LIDAR elevation models of Indianapolis and Marion County; the extension of CNC (computer numerically-controlled) milling simulation software to virtual reality displays; the development of new visualization software tools for a finite element simulation of an aircraft wing and a cellular automata simulation of material corrosion; the visualization of 3D plots resulting from high-energy physics experiments; the visualization, filtering, and segmentation of volumetric data sets resulting from medical microscopy and radiology scans; the visualization of molecular simulations involving hundreds of thousands of atoms; and the modeling and rendering of astronomical datasets, including interstellar gas clouds and accurate Earth models and satellite animations.
The Research and Academic Computing Division (RAC) provides consulting support services to faculty, staff, and students for research and instruction at Indiana University. Consulting is available in many areas of research, including statistics and mathematics, high performance computing, Unix systems, bioinformatics, and visualization, detailed in the narrative below, and for short- and long-term projects. Help is available through online resources, user groups, in person, and via telephone. The satisfaction rate for RAC services remains high, with an overall satisfaction rate of 96.6% recorded in the 2003 UITS User Survey.

RAC also manages site licenses and software accessibility for the University as a whole in many areas of scholarly endeavor. The primary areas of focus and activity are in statistical computing, mathematical computing, and bibliographic tools.

**Statistical and mathematical software.** The Center for Statistical and Mathematical Computing (Stat/Math Center) manages a large suite of software in support of quantitative research. The centerpiece of this effort remains the Enterprise License Agreement for SPSS. More than 2,000 copies of SPSS, the most widely used commercial statistical package at IU, were distributed throughout the University. This facilitates research and education at all IU campuses. Dozens of other software packages, including the mathematical software Matlab, are licensed and redistributed within the University at a very modest cost. The difference between the costs paid by the University and academic list price amounts to more than an annual $3M. More important, the ease of access to the best software tools for researchers and students greatly enhances the University’s activities in research and teaching.

Among its other activities, the Stat/Math Center delivers (in cooperation with the IT Education and Training Program) short, non-credit classes on statistical and mathematical computing. The Stat/Math Center also provides instructional and consulting support, and a Web site of online resources. The Stat/Math Center and IT Training and Education were honored in 2003 with a first-place award in the ACM SIGUCCS competition for their collaborative creation of the document “SPSS: The Basics.” (See http://www.indiana.edu/~statmath/)

**Unix and open source productivity tools.** The Unix System Support Group (USSG) negotiates site licenses for commercial Unix software, providing the University with access to such software under very aggressive site licensing terms. USSG also supports the use of Linux, an open source version of Unix that is popular among researchers and students. A key part of USSG services is a system that contains a local repository of open source software, including the very popular productivity suite Open Office. Downloads from USSG servers amount to 10 TB per month. The cost avoidance achieved by USSG negotiations for commercial Unix variants is in excess of an annual $1M, and the University achieves substantial savings as a result of the use of open source software as well.

In December 2003, the University reached an agreement with Indianapolis-based Progeny for its Progeny Transition Service. This service provides software updates for users of Red Hat® Linux® versions 7.2, 7.3, and 8.0, with Version 9 updates to come in May 2004.

**Bibliographic tools.** UITS Digital Libraries groups and the IU Libraries collaborated to negotiate a University-wide site license for the popular bibliographic software ProCite, ReferenceManager, and EndNote. During 2003, more than 4,000 individual software copies were distributed (for Windows and Macintosh systems). This software is also available in UITS Student Technology Centers. It is widely used by scholars in many fields, most notably in the humanities. The availability of this software greatly enhances the scholarly output of the University.

**Bioinformatics support.** Bioinformatics and computational biology continue to emerge as important new disciplines, and support by UITS is helping IU carve out a leadership position in these areas. Two full-time consultants (one funded by INGEN) support bioinformatics and bioinformatics databases. Thus, researchers at IU have access to various innovative software applications that enable searching for genes in more than a dozen different genomic databases, analyzing evolutionary trees, and searching for potential new drug compounds. As part of IU’s life sciences
research relationship with IBM, Inc., IU researchers, UITS experts, and IBM are collaborating to create a system for managing and searching information on related groups of proteins. This will be key in using information on the genetics of animals to understand the human genome. UITS leadership in bioinformatics is indicated nationally by the role staff have taken in presenting workshops and papers at national conferences, and in leading the authorship of important position papers on the use of high performance computing and bioinformatics in biomedical research.

UITs provides bioinformatics support for researchers with a wide variety of expertise and experience. For the many faculty who develop their own large-scale bioinformatics applications, UITS offers in-depth programming assistance. And for MD/PhD researchers with little background in cutting-edge computing, UITS has created a very accessible and popular pamphlet, “INGEN’s Advanced Information Technology Facilities: The Least You Need to Know.” Research at IU is enjoying an advantage relative to its peers in the area of advanced information technology in the life sciences because UITS is making it easier for biomedical researchers of long standing to learn about and adopt new technologies, while also providing massive and sophisticated resources for researchers already steeped in use of this technology.

Unix support. Many IU researchers whose investigations require the fastest and most robust computing environments use Unix as an operating system. Supporting them is the Unix Systems Support Group (USSG). USSG negotiates site licenses for commercial Unix software, providing the University with access to such software for $1M per year below the academic list price. USSG also supports the use of Linux, an open source version of Unix that is popular among researchers and students.

The annual LinuxFest, hosted by the USSG, features talks, displays, and demonstrations about Linux. This year, the event featured members of the Research and Technical Services group discussing and demonstrating the new Analysis and Visualization of Instrument-Driven Data (AVIDD) facility’s computational component, a 1.1-TeraFLOPS IBM cluster running Linux. The USSG also conducted a RedHat Gentoo system comparison and displayed systems running advanced multimedia applications and the Advanced Linux Sound Architecture (ALSA).

CREATION OF NEW SOFTWARE

IU has set a goal of enabling IU researchers to perform massive new analyses and simulations at the same time as, or before, their peers at other leading research institutions. Helping IU researchers attack the newest and most important problems in science often requires the creation of new software. The High Performance Computing Support Team (HPCST), Advanced Visualization Laboratory (AVL), and Unix Systems Support Group (USSG) have all participated in such efforts, including the following:

**Radiation transport.** HPCST modified radiation transport applications for use with new therapies being developed by the IU Department of Radiation Oncology, and by the Midwest Proton Radiotherapy Institute. These enable more precise targeting of radiation treatment, and improve the treatment’s effectiveness.

**Evolutionary relationship analysis.** HPCST developed and distributed a parallel version of a computer package for the analysis of evolutionary relationships based on DNA sequences, and a package to discover motifs (highly conserved regions) in groups of related DNA or protein sequences. Versions have been created that run on PCs in the Student Technology Centers when the machines are not being used.

**Geophysics.** HPCST has worked with the Department of Geology to create and parallelize software that models the evolution and seismic signature of complex landforms.

**Cell modeling.** HPCST has worked with the Department of Chemistry to create software capable of modeling the millions of atoms in complex proteins, in order to create models for whole virus and cell simulations.
Grid computing. Grid computing is one of the efforts underway to use otherwise idle PCs to perform massive calculations. Systems using idle computers in this way are experimental and limited in their applicability. HPCST and USSG partnered to create a system called SMBL (Simple Message Brokering Library) that makes it possible to use idle PCs in the Student Technology Centers to perform very large calculations. UITS is working with IU graduate students to make this a computational resource of real value in IU’s research initiatives, while providing additional computing facilities for graduate students.

Centralized Life Sciences Data (CLSD). Molecular biologists require external data from a wide variety of sources to properly analyze their lab data. The Indiana Genomics Initiative IT Core created the CLSD service to provide that external data locally, freeing researchers to spend more time on their research. See the discussion of the CLSD under “Indiana Genomics Initiative” in Action 34, below.

Segmentation of microscopy volumes. A postdoctoral researcher funded through the INGEN IT Core and affiliated with the AVL has been working with researchers at the Indiana Center for Biomedical Microscopy (ICBM) in the IU School of Medicine to develop new methods for automatic and semi-automatic three-dimensional segmentation of volumetric data. These software tools will increase the throughput and productivity of the ICBM’s powerful array of wide-field, confocal, and two-photon excitation optical microscopy systems.

Genetic medicine. The linkage between genetics and medicine offers hope for improving therapies and reducing unwanted side effects. HPCST staff have worked with the Department of Medical Genetics to optimize and parallelize software to discover these connections.

Information visualization. The Advanced Visualization Lab (AVL) has developed several software tools to aid in the visualization of information resulting from biological simulations and databases. PViN (Pedigree Visualization and Navigation) is a system for visualizing the pedigree databases collected by the Hereditary Diseases and Family Studies Division of the IU School of Medicine. The system scales to handle datasets that are beyond the limits of commercial pedigree packages, and enhances user capabilities with new visual querying, browsing, and printing options. Tree3D is a system for the temporal and comparative visualization of phylogenetic trees that result from computational analyses of genetic sequence data. Such analyses are carried out in the Department of Biology and the Center for Genomics and Bioinformatics at IUB. Tree3D served as the basis for the visualization component of IU’s award-winning application in the High Performance Computing Challenge at Supercomputing 2003 (see Actions 29 and 31).
**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.

IU’s Massive Data Storage System (MDSS) (based on the High Performance Storage System (or HPSS) software gives researchers (faculty, staff, and students) at the Bloomington and Indianapolis campuses instant access up to a 1.6-petabyte capacity. The number of users totals 1,057. Of these, 888 are at IUB, 145 are at IUPUI, and 24 are on the regional campuses. Some 76TB of data are stored in HPSS. Of this, 60TB are used by IUB, 15TB by IUPUI, and 130GB by the regional campuses.

With cross-campus data mirroring implemented last year over the high performance I-Light network that connects IUB and IUPUI, IU’s MDSS is the first disaster-tolerant mass store system anywhere. Automatic duplication of data between Indianapolis and Bloomington (resulting in nearly 160TB of data stored on tapes) assures that biomedical and other data, often irreplaceable, will not be lost were a disaster to strike one of the University’s two machine rooms.

During 2003, the MDSS was expanded at the IUB campus, with funding from the Indiana Genomics Initiative, with the addition of higher-capacity tape drives, for a total capacity of nearly 1.6 petabytes. The amount of data IU currently has under storage is the largest of any university in the country.

A number of infoshares and workshops were presented during the year to help raise awareness among IU researchers and more broadly, of the availability and accessibility of IU’s high performance computing and storage resources. A workshop on the mass store system, held in October 2003, was designed for current and prospective faculty, staff, and graduate student users of the MDSS and Common File System (CFS) service.

**CFS**

During Fall 2003, the Common File System (CFS), a storage service designed for general use, replaced a Windows-based file service at IUS. With a total capacity of about 1.63TB, CFS provides on the IUB, IUPUI, and IUS campuses an easy-to-use, Web-based file storage service that is accessible from anywhere in the world. The number of CFS users currently stands at 44,313. Of those 37,635 are at IUB; 3,160 are at IUPUI; 2,199 are at IUS; and 1,321 are at other regional campuses. About 1TB of data are currently stored on CFS.
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.

For the fourth year in a row, Indiana University collaborated with Purdue University and the University of Notre Dame to demonstrate innovations and accomplishments in advanced information technology. The Research in Indiana display showcased developments within the State in life sciences, advanced computing architecture, and emerging technologies. For a discussion, see Action 29.

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 and UITS, as well as faculty from several Schools and both of IU’s main campuses. UITS staff are working with the faculty participating in the AVIDD grant to create new advances in computer science and in sciences that depend upon advanced information technology.

INDIANA GENOMICS INITIATIVE

The Indiana Genomics Initiative (INGEN) was launched in December 2000 with a $105M grant from the Lilly Endowment Inc. The advanced information technology facilities for the Indiana Genomics Initiative comprise five components: supercomputing, massive data storage, advanced visualization, high-speed networking, and staff support. In each area, IU’s facilities, resources, and expertise have repeatedly gained national and international recognition. The Indiana Genomics Initiative is building upon this infrastructure and history of excellence to create facilities that are unique in university-affiliated genomics research institutes.

In 2003, the Endowment awarded Indiana University an additional $50M to advance the Indiana Genomics Initiative, with the stipulation that it be used in areas of greatest need involving INGEN. The Bloomington campus plans to significantly increase faculty involved in life science research and has identified the need for an additional 160,000 square feet of laboratory space.

IU has made great strides in developing its genomics and proteomics strengths with the purchase of high-tech equipment and the recruitment of several national biotechnology leaders. Since its inception, INGEN resources have helped attract an additional $32M in new research grants to IU; as of April 2003, grant applications totaling a further $36M were under review. The grant has enabled IU and its School of Medicine to create and expand advanced laboratory research and service facilities in proteomics, imaging, and other advanced technologies important to genomics research and education.

Working in partnership with IBM, the INGEN IT core in 2003 established a new Centralized Life Sciences Data (CLSD) system to provide researchers at the IU School of Medicine access to a wealth of collective knowledge about the genes and proteins related to disease. This powerful new information system could transform the way researchers...
investigate the origins of disease. The CLSD enables researchers to initiate, with a database query command, complex calculations of genetic similarity, then have the results integrated with the results of queries performed against diverse and heterogeneous biomedical databases, including data from public sources. These consolidated database and computational activities greatly accelerate biomedical research and place the IU School of Medicine in the forefront of institutions using innovative technology. (See http://www.indiana.edu/~uits/cpo/clsd071503/)

The INGEN IT Core is acting as the Fetal Alcohol Spectrum Disorder (FASD) Consortium’s Informatics Core. In leveraging the INGEN IT Core’s advanced IT facilities to provide the data repository and other statistics-related resources for the FASD consortium, the IT Core is supporting multiple research groups at IU as well as researchers around the world working on FASD. In addition, the UITS Advanced Visualization Lab (functioning as a part of the IT Core) led the research into the feasibility and accuracy of 3D laser scanners and is heading the development of software analysis tools for the FASD grant.

The INGEN IT Core maintains the Pharmacology/Toxicology Database for the National Gene Vector Laboratory (NGVL). This database supports research at half a dozen core facilities in the US, including the IU School of Medicine, along with research facilities around the world.

IBM INSTITUTE OF INNOVATION

In June 2003, IU was named one of IBM’s charter Institutes of Innovation. As part of this honor, researchers at IU will collaborate with IBM on life sciences research projects of mutual interest. In addition, they are eligible for a range of benefits to support this research, including early access to next-generation IBM technologies, post-doctoral and research associate opportunities, software through the IBM Scholars university product portal, and participation in the competition for IBM’s university award programs.

The research focus at IU, under the Institutes of Innovation program, is on the 3D modeling of cells. Through the use of parallel and grid computing, IU researchers will create a computer-based simulator of living cells. The project also will utilize genomic, proteomic, and cell physiological data to model metabolic processes. This is of particular importance in drug discovery and targeted treatment solutions. The Centralized Life Sciences Data system, discussed above, is also part of the IU-IBM partnership.

Determining ancestry of ancient groups of organisms. A team led by UITS, the IU Center for Genomics and Bioinformatics (CGB), and the High Performance Computing Center of the University of Stuttgart (HLRS) assembled a global computing grid to examine the ancestry of ancient groups of organisms. The team used the grid of computers spanning six continents and 691 computer processors, all running the IU-managed parallel version of fastDNAml, to address the belief that arthropods with six legs (insects and their relatives) comprise a single evolutionary family. This demonstration, which won the High Performance Computing Challenge Award at SC2003 (see Action 31), was a significant step toward the day that IU researchers will routinely use thousands of processors at once to solve massive computational problems.
PERVASIVE TECHNOLOGY LABS
The Pervasive Technology Laboratories at Indiana University Bloomington and Indiana University-Purdue University Indianapolis continued to make progress in 2003 on the Lilly Endowment-funded research agenda. Lab accomplishments for the year are detailed in separate documents.
VI. INFORMATION SYSTEMS: MANAGING IU’S INFORMATION ASSETS

**Recommendation 6:** University-wide prioritization, coordination, oversight and planning are required in the implementation and development of institutional information systems. In order for these systems to work together in a seamless manner and accommodate an ever-increasing number of users, UIS should implement common interfaces and a common information delivery environment that facilitate their integrated use. A new Student Information System should be a top University priority.
**Action 35.** The Office of the Vice President for Information Technology should establish an effective mechanism for overall prioritization, coordination and oversight of planning for the development and lifecycle replacement of University information systems.

**ADVISORY COMMITTEES**

Advisory committees remained active during 2003. The Student Information System Steering Committee and the Human Resource Management System Steering Committee met regularly to review progress in their respective areas. The OneStart Steering Committee is being reconstituted to reflect future needs for the portal initiative. The Fiscal & Procurement Steering Committee has been revised in order to advise during the upcoming fiscal (FIS) and procurement (TOPS) systems rewrites.

**COMPLETED INFORMATION MANAGEMENT SYSTEMS**

Since the inception of the IT Strategic Plan, the following information systems have been completed and put into production:

- **Financial Information Systems (FIS),** an enterprise-wide computing application designed to manage the majority of IU’s finances, comprises the central functions of transaction processing and decision support.
- **The Electronic Research Administration (ERA) system** provides IU researchers with an electronic system for developing and submitting research proposals.
- **The OneStart Web-based application portal** offers a common front door to online services at Indiana University campuses.
- **Oncourse,** an IU-developed online course management application, allows faculty and students to create, integrate, use, and maintain Web-based teaching and learning resources.
- **IUIE,** the Indiana University Information Environment, provides a Web-based, enterprise-wide reporting environment.
- A new, Web-based Purchasing/Accounts Payable system interfaces with the FIS and other applications.
- **IU’s e-commerce initiative** facilitates transactions for goods and services online. IU Press and the IU Bookstore are among the merchants using its B2C (Business to Consumer) project.
- **The comprehensive Maintenance Management System application** tracks much of the University’s maintenance functions, supporting the University’s physical plant operations.
- **The Library Information System provides access to a wide array of online resources.**
- **The Human Resource Management System provides services for human resources information including personnel records, benefits, and payroll for all of IU’s more than 35,000 faculty, staff, student workers, and retirees.** See the detailed discussion under Action 36b.
- **The Contact and Admissions Modules of the Student Information System provide services for all students interested in, or applying to, any campus of Indiana University.**

**STUDENT ENROLLMENT SERVICES**

Indiana University is embarked upon two major initiatives to improve the service quality and cost efficiencies of student information systems. The first, initiated in 1998, includes the development and implementation of the new Student Information System (SIS), aimed at enhancing student services through the use of current technologies and the Web environment. The second effort was launched in 2001 with then-President Myles Brand’s appointment of the Task Force to Review Non-Academic Administrative Services, charged with the goal of reducing administrative costs in order to reallocate funds for academic priorities. The initial report, released in Spring 2001, recommended a new consolidated Student Enrollment Services (SES) in order to maximize student services available in the new SIS.

Vice Chancellor of IUB Enrollment Services Don Hossler and Associate Vice Chancellor of IUPUI Enrollment Services Rebecca Porter were appointed to the positions of AVP for Academic Affairs to coordinate the University-wide implementation of the new Student Information System; manage the transition in the new information environment, working closely with representatives of the other IU campuses; and oversee the development of the SES.
SCHOOL OF MEDICINE

In October 2002, the IU School of Medicine appointed former UIS Director Vince Sheehan CIO and Associate Dean of Information Technologies, overseeing all aspects of the School’s IT environment. The IU School of Medicine Strategic Plan, introduced in October 2002, supports the critical missions of the School and presents a vision of making the School a leader in the management of information technology to support teaching, research, and service.

In 2003, an Information Services and Technology Management (ISTM) department was created, a Chief Technology Officer and Security Officer were appointed, and security policies to support compliance with HIPAA and other regulations were introduced. The Medical Student Administration System application was implemented. In addition, the School doubled the number of customers who are supported through the Service Level Agreement process.

Plans for 2004 include enhancing support for the research community, improving clinical technologies with the School’s partners, technology planning for new building projects, and continuing the development of administrative systems for the School.

**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 System
- 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 IU’s 100,000 students to move easily through the admissions, enrollment, financial aid, and student financial processes — all in a Web-based environment. The SIS enables IU to streamline operations and reengineer processes to take advantage of best practices. It provides an information environment (the IUIE) for academic and administrative decision making with consistent, integrated data, along with tools for analysis, reporting, and extraction.

**Admissions.** The first module of the SIS, implemented in September 2000, included prospect management, recruiting, communications, and event management for prospective students. The project team configured such data structures as campuses, Schools, degrees, majors, minors, and grading schemes and also converted prospective student data from departmental shadow systems on all IU campuses into PeopleSoft. The second phase of Admissions functionality was implemented in October 2001. Core functionality for processing and evaluating applications for admission for undergraduate, international, graduate, and professional Schools is 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 masse. Much more data and functionality are now available to the campus Admissions offices.

Phase II, introduced in October 2003, marks the beginning of a major phase in implementing all of the remaining core functions of the SIS. In preparation for Fall 2004, this phase supports the all-important construction of the Schedule of Classes within the new system and sets the stage for all future work.

In this phase, a new way to launch the SIS for administrative tasks within IU’s OneStart portal was
implemented for current and new administrative users in Admissions, Student Records, and other offices. New quick clicks within OneStart allow users to avoid lengthy navigation for commonly used components. A single click can give the same results as four clicks, saving administrative staff time.

Students also saw additional self-service functions in their OneStart pages as a result of this implementation, including transfer credit services and financial aid links to national and federal Web sites. Current students, as well as applicants and those admitted to IU, can see how credits from other institutions or credits from advanced placement courses will transfer to IU.

Web registration. As a temporary measure until true Web registration is in place in the new SIS, the ability to register on the Web was made available to all students in March 2001. The new Web registration for Fall 2004 will commence during the normal Spring 2004 registration period.

IUIE. The IU Information Environment (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. A personal reporting environment, the IUIE keeps users informed about the report objects that have been published across the University. The Student Information Environment is being released in step with the SIS implementation.

Room management. The room management software package Ad Astra was placed into production during the October implementation. This software enables campuses to automate classroom assignments and match them with the schedule of classes. The package matches rooms and classes based upon locally configured rules and priorities, while it attempts to maximize facility usage.

Schedule of Classes. In preparation for Fall 2004, SIS functionality to support the construction of the Schedule of Classes was deployed. Data from the legacy version of the Schedule of Classes were converted into the new SIS set of tables. The IUIE contains 23 new Report Objects to support reporting and data analysis of Schedule of Classes information.

36B. HUMAN RESOURCES MANAGEMENT SYSTEM

Human Resource Management System (HRMS) was implemented in December 2002. The new system provides the University community with improved services for most aspects of human resource information including personnel records, benefits, and payroll for all of IU’s more than 35,000 employees, student workers, and retirees.

The landmark HRMS implementation is part of Indiana University’s complete re-engineering of its enterprise-wide information systems. It is one of the largest software development projects among these systems and a key accomplishment for the University. A reengineering success, HRMS is also a striking example of collaboration by University staff from human resources, academic affairs, and the payroll offices on IU’s campuses, and technical staff from UITS.

The new system comprises the PeopleSoft Client, Electronic Documents (E-Docs), and the Information Environment (IUIE) (see Action 39). HRMS provides users with more functionality and easier access to data and information to perform their respective roles. Employee data share a common database with student data to minimize redundancies for those with dual roles, such as staff who are also students. The first change most employees noticed was in January 2003 when, for the first time, all payroll and pay advices were processed using HRMS.

E-Docs, electronic documents for personnel transactions, were among the first of the enterprise-wide applications configured for portal delivery. They are routed by a custom software application developed by IU that electronically implements IU’s business rules and procedures in a simple Web format. They are among the first of the enterprise-wide applications configured for delivery through the OneStart portal.

In October 2003, full electronic routing of E-Docs became available across IU. Currently, when personnel transactions, such as hiring employees or processing pay adjustments, are initiated by Schools or departments
in the HRMS environment, they are automatically routed for approval, based on predetermined routing specifications. Both “initiators” and “approvers” access these transactions through OneStart.

Electronic routing eliminates the use of paper forms and can facilitate quicker approval and routing of all personnel transactions. The October release also included several enhancements including transactions to add people to the HRMS database and to initiate or change “additional pay.”

36C. LIBRARY INFORMATION SYSTEMS

The SIRSI Unicorn software, the basis of IUCAT (the Library’s Web-based, public interface) and Workflows (the client used internally by librarians and circulation desks) continues to mature in its third year with regular software upgrades and enhancements. Faculty, students, and staff can now check their accounts in IUCAT. The ability to “Request Delivery” of items to their library of choice also has been added. (See http://www.iucat.iu.edu/)

Research and development is underway on investigating and implementing two features. These include a system to link the catalog and electronic text articles through the National Institute of Standards Organization’s (NISO) OpenURL standard, which is used for linking citations (author, title, and so on) across databases; and federated searching, the ability to do global searching across the catalog and electronic databases.

The IUIE has been expanded to include financial data for the Library Acquisitions Department for use in collection analysis and fund management. The catalog database continues to grow, keeping pace with acquisitions of the IU Libraries statewide. The database has expanded to include electronic information transfers between the Libraries and vendors and the automated loading of vendor order records.

Infrastructure changes are in progress to maintain compatibility with the PeopleSoft implementation. The library system keeps a database of all patrons – faculty, staff, and students – which is updated with information provided by HRMS and the SIS. This database is also used to send bills to the bursar’s office. With the PeopleSoft implementation, the use of social security numbers for official identification is being phased out in favor of a unique, nine-digit University ID.

The Library Information Systems team (LIS) now works in collaboration with Library Information Technology (LIT), and the IUB Library Web site and its database serves functionally as a front door to the combined resources of SIRSI and electronic resources. (See http://www.libraries.iub.edu/)

36D. FISCAL AND PROCUREMENT SYSTEMS

E-commerce. Indiana University continued developing e-commerce solutions in 2003 that facilitate online transactions for goods and services. During the year, the infiNET Corporation’s QuikPAY student tuition payment system was implemented. IU provides three options for conducting business-to-consumer (B2C) e-commerce on the Web. The B2C project consists of three Web-based applications that can work together, or stand alone:

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

- **IPAS (Internet Payment Authentication System).** IPAS is a method of securely processing credit card transactions over the Web. Through a partnership with CyberCash cash register service and the IU Treasury department, University merchants can accept payment online.

- **TransformEP.** This is a form-processing tool that enables retailers to send customer forms by e-mail, or 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 sites, and send e-mail confirmations for orders received.

TOPS. Development continued in 2003 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, and written in Java, with the data stored in Oracle. It will be accessible through OneStart and will interface with the FIS and other applications. Completion is projected for late 2004.
**TIME.** The Time Information Management Environment (TIME) is an enterprise-wide computing application available through OneStart that tracks the hours that hourly employees work. Employees use TIME to electronically clock in and out, and supervisors use the same system to approve those hours. TIME is now tightly integrated with the new HRMS system. When staff are hired via HRMS, they are immediately available to the TIME system. Plans for 2004 include enhancing TIME to accommodate bi-weekly (non-exempt) employees.

**ERA.** The Electronic Research Administration (ERA) system provides an electronic means for developing and submitting research proposals. In December 2002, ERA joined a national consortium involving several major universities to develop a common platform for submission and management of protocols. Due to technological variance within the consortium, the decision was made in 2003 to develop the Human Subjects Module in-house to maintain a consistent development focus, and a look and feel in keeping with the current ERA modules. A prototype of the Human Subjects module was developed in 2003. UITS Usability Consulting Services advised in the development of the prototype. The Human Subjects Module will be in development through 2004.

Other enhancements to the ERA system in 2003-2004 included a new homepage designed to ease navigation between modules; a direct link to HRMS; and an indicator on the Routing Form to indicate whether a study is a Clinical Trial. The first ERA report, “The Pipeline Report,” was published in December 2003. Plans for ERA in the near future include version control across all modules, enhanced interaction with the OneStart portal, the ability to accommodate Modular Grant applications for the Routing Form and Budget Module, and copy-over features of non-personnel expenses for the Budget Module.

**MMS.** The Maintenance Management System (MMS) is an enterprise-wide application that tracks many of the University’s maintenance functions, including maintenance requests, current project costs, new building plans and additions, inventory, timekeeping for departmental billing, financial data for maintenance, and project management. For accounting purposes, MMS has a linked interface with the FIS, and with the FMS application Interdepartmental (ID) Billings. To more effectively manage inventory and its cost, the system also interfaces with TOPS.

### 36E. DEPARTMENTAL INFORMATION SYSTEMS

Various departmental applications were developed in 2003 and others were enhanced.

- **IUPUI Student Elections.** An IUPUI Student Elections voting application was redesigned and implemented, allowing student elections to proceed on schedule.

- **Financial Aid.** Additions and changes were made to the Web-based forms and tables used by the Financial Aid Department at IUPUI, allowing student financial data and applications to be submitted and stored online.

- **Clinical Radiology - Student Skills Application.** Under development for the IUPUI School of Clinical Radiology is a system that will store student skills data. It will allow students to enter learned skills and receive reports on their skill status.

- **Indiana Humanities Council - Indiana non-profit database.** This is an online interface and SQL Server 2000 database development for the Indiana non-profit database that was formerly kept in Microsoft Access. The application allows users to search, update, add, and delete records over the Web.

- **StarNet.** The award-winning Student Advising Records Network (StarNet), developed for the University Division, is being reworked to use Microsoft SQL Server for its database back end and to draw some of its data from the new Student Information System (SIS).

**School of Music.** A scheduling system was created to handle auditions and interviews. Major modifications were made to the School’s admission system. The School’s standalone financial aid system for admissions was integrated into its SQL Server database.
**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.

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**OneStart**

OneStart is a Web-based application portal designed to provide IU faculty, staff, and students with streamlined and integrated access to online services at Indiana University.

OneStart provides a common front door to online services at IU campuses, including 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. OneStart is customizable and flexible, offering easier and more direct access to online services.

Many improvements were made to the OneStart portal in 2003. The OneStart user interface was improved to provide easier navigation between pages using a tab-based interface. The EDEN Workflow engine was introduced as the mechanism for routing and approving electronic documents for the new HRMS E-Docs and ERA applications. The Action List feature in OneStart provides a common inbox for all electronic-document routing through EDEN Workflow. This eventually will provide one place for users to approve HR E-Docs, purchase requisitions, time-off requests, and the like. As more and more applications convert their workflow process over to using EDEN Workflow and E-Docs, standard business processes at IU will become increasingly streamlined through the use of the Action List in OneStart.

Many new services were added to OneStart in 2003. These include an integrated Web-based calendar that allows users to merge class schedules, personal appointments, Oncourse events, and other University events, all in one place. In addition, a new classified ads service supports buying and selling, finding roommates, arranging or offering rides, and locating partners for sports. Planned new services include threaded messaging boards, chat, and polls. Such enhancements as mobile access to specific OneStart services via “smart” phones and PDAs are being explored.

**Central Authentication Service (CAS)**

IU Central Authentication Service (CAS) provides secure access to IU’s critical enterprise systems via a single sign-on. IU CAS, based on an open source product from Yale University, now provides single sign-on for more than 30 applications, including the OneStart Portal, Oncourse, SIS, HRMS, and the IU Information Environment, with the Library to come. CAS had processed nearly two million authentications each month by the end of 2003, compared to 20,000 per month in 2002.

**Enterprise Directory Service**

The Enterprise Directory Service (EDS) is populated with information about University faculty, staff, students, and affiliates and is designed to better support technology services such as authentication and authorization, as well as online directories. The EDS is based on the open source Lightweight Directory Access Protocol (LDAP), used for the first full year at IU in 2003. When appointments are approved in the new Human Resource Management System, their employee information populates the directory. This means that departments and campuses can allow new faculty and staff to generate their accounts before they start work.

**Usability Lab**

The Usability Lab at IUB concluded another successful year in 2003. Some 20 projects internal to IU were seen through to completion, including several repeat projects such as OneStart, the IUIE, and ERA. The Lab also engaged external clients including Hirons and Company and the NCAA.
The primary research focus in 2003 on the OneStart portal was on the recently implemented tabbed navigation design. Testing revealed that the proposed interface presented some challenges for users. The development team used those results to alleviate problems before implementation. Given the ambitious goals for the portal and the complexities involved in bringing many disparate information systems into one environment, the Lab will continue to play a role in design decisions regarding OneStart.

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**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 goal of the thin client environment is to migrate all systems to a browser-based application environment. The early phase of this project used the Citrix Metaframe product to enable a thin client delivery of traditional client/server applications. In this environment, software is loaded onto servers rather than on several PCs. This environment allows for greater manageability and a more efficient delivery of support. This environment still enables users of the FIS and MMS to access their systems over the Internet. Onbase, Room Scheduling and other smaller applications also use this environment.

The OneStart Portal and EDEN Workflow provide a foundation for true thin client computing at IU. The Java Enterprise computing environment (J2EE) is supported for the delivery of the foundation services and applications including OneStart, Electronic Research Administration (ERA), Purchasing on the Web, E-Docs for HRMS, and the Central Authentication Service (CAS). Using combinations of technologies allows a seamless access to systems even when the underlying technologies are significantly different.

**38B. ENTERPRISE UNIX ENVIRONMENT**

The Database Administration (DBA) and Enterprise System Administration (ESA) groups provided several changes and upgrades during 2003 to support the delivery of Indiana University’s Information System applications.

Several steps were taken to support the additional implementations of the PeopleSoft-based Student Information System in 2003 and early 2004, when self-service functionality will be introduced. The Production PeopleSoft database server, an IBM p670, was upgraded with additional processors and memory, and is currently a 16-way 1500MHz processor with 48 GB of memory. The Production PeopleSoft application servers (Tuxedo Servers) were enhanced with the addition of four IBM p650 servers, each with a four-way 1450 MHz processor set, with 16 GB memory. The Production PeopleSoft Web server farm was enhanced with the addition of eight IBM p615 servers. Additional capacity was added to the PeopleSoft development and test environments. To meet growing online storage requirements, additions were made to the Storage Area Network (SAN). At the end of 2003 the total amount of online storage for the Enterprise Unix Environment was more than 20 Terabytes.

To support the increased demand for backup and recovery capability for more than 100 Oracle database instances, the physical server system used for the Tivoli Storage Management (TSM) backup system (an S7/A server) was retired and replaced with two IBM p660 systems, providing needed throughput capability. The
backup environment was additionally enhanced with the addition of two IBM 3590 tape drives and the conversion of existing drives to Fibre attachment. These tape drives are housed within an IBM 3494 Magstar robotic cartridge system.

The Decision Support environment (IUIE, DSS, reporting), which collects and processes data from all operational environments, continues to experience substantial, dynamic change and high growth. Although upgraded in mid-2002, plans are in place to add additional server resources to this environment in early 2004.

During 2003, a transition was underway to convert the J2EE application server environment to Linux servers. During early 2004, the Library SIRSI application Web servers are slated to be converted to a Linux/tomcat base. Additional Web server capacity is also planned to meet increased demand for Web server CPU resources by the Library’s IUCAT.

A new feature called Flash Copy was tested and implemented within the Storage Area Network, particularly for PeopleSoft, and has been put into production for some applications. This feature quickly copies data from the production PeopleSoft application into the Decision Support Environment. Plans call for increasing the use of this facility in 2004.

The Windows environment also continues to evolve. Added during 2003 were servers for the support of the PeopleSoft Room Management application and PeopleSoft process scheduling and Windows-based reporting. A major initiative in 2004 will be an equipment replacement phase for Windows servers, including Terminal Serving.

A major initiative during 2003 was the upgrade of the Operating System environment for UNIX servers to AIX 5.L levels. Another was maintaining currency on security updates for Windows servers. At the end of 2003, the ESA staff were supporting more than 110 separate physical server systems, including database servers, application servers, Web servers, file servers, and terminal servers.

The EUE infrastructure direction is to migrate from the internal IBM SP switch, which is used for transmission of data from one EUE environment to another. To that end, in 2003, a Gigabit Ethernet internal network was installed and is now operational for several environments. Eventually, all 32-bit nodes within the SP system, along with all internal SP nodes, will be replaced with more cost-effective systems.

38C. STRATEGIC DATABASE MANAGEMENT
Oracle is the primary DBMS technology that supports the data storage and delivery for the suite of UIS applications. At the end of 2003, DBA staff maintained approximately 90 separate Oracle databases or “instances.” All Oracle instances are now at the 9.i release level, giving IU the industry’s most up-to-date database technology. Discussions are underway to plan for the migration to the new Oracle 10 g level. Work continues to phase out activity in the Legacy Sybase and DB2 database environments to Oracle.

Production information systems being supported by Oracle include:
- HRMS (Human Resource Management System and Payroll) - PeopleSoft
- SIS (Student Information Systems) - PeopleSoft
- Visa Management System (part of Student Systems functionality)
- Room Management (part of Student Systems functionality)
- J2EE Development environment
- FIS (Financial Information System)
- ERA: Electronic Research Administration
- MMS: Maintenance Management System
- Timekeeping
- OneStart
- SIRSI Library Automation System
- TOPS Web Purchasing System
- The University Register
- Decision Support Environment
- IUIE: IU Information Environment
- Onbase imaging
- Modem Statistics
- Falcon Enterprise Help Desk system

Oracle is being used in several important, large-scale research computing projects that take advantage of the enterprise license agreement that has been in place since 1998.

Plans in 2004 include readying the PeopleSoft environment for the full implementation of the SIS, beginning the GL and Procurement conversions from the mainframe, and the first implementation of Oncourse NG. Navigo is the open source assessment engine that is the first phase of the New Generation of Oncourse; it will be in production as 2004 begins.
Decision Support Services (DSS) designs, develops, and supports a consolidated environment for storage and facilitated retrieval of institutional data. Users and information systems developers work with DSS in the development and maintenance of two main service tools: the Data Warehouse and the IU Information Environment (the IUIE).

The Data Warehouse contains intelligent data collections modeled to support the reporting and analysis needs of its users. It offers a central location where those who develop or maintain institutional data systems can make their data available to staff, faculty, and students for their reporting needs.

The IU Information Environment 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. A personal reporting environment, the IUIE keeps users informed about the report objects that have been published across the University.

In 2003, The HR Information Environment was implemented alongside the HRMS implementation. The Student Information Environment is being released in step with the SIS implementation. Other noteworthy projects for 2003 were the Student Census implementation and the Payroll re-design targeted for completion in early 2004.

The recent implementation of PeopleSoft HRMS and the new SIS capabilities provide a rich information environment via the IUIE that is much improved over previous services. The CID Committee will likely meet in 2004 to review the University’s institutional data classifications and our access arrangements to systems and data (e.g., SafeWord cards, OneStart).

The Committee plans to meet in 2004 to evaluate issues relevant to data access policy.

No new problems related to Year 2000 emerged in 2003. All systems continue to function correctly.
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 — should the Wrubel Computing Center machine room be rendered unserviceable — proceeded in 2003. The Disaster Recovery command center site, located in IMU 086, has been readied as much as is possible in advance of a disaster, given the need to preserve the functioning of current occupants. Storage units have been equipped with various office supplies and instructions for the activation of the Uniform Call Distribution system (UCD). If a disaster is declared the UCD will turn all phones in IMU086 into a call center for incoming communications. Physical security requirements and takeover procedures for both command and recovery centers have been documented. Formal procedures for initiating Time of Disaster (TOD) items are still being developed.

Information is being developed to educate all UITS staff regarding their respective responsibilities in the event of a disaster, along with specialized information shares for command and recovery team members. Arrangements are being made to provide these information shares online to expedite current training and to inform all new employees regarding DR responsibilities and expectations. Exercises designed to test various recovery scenarios, using the software and established procedures, will begin in the first quarter of 2004.

Disaster Recovery planning has moved forward to the information gathering stage for Phase II of this Action. Phase II is defined as completing a comprehensive recovery program that includes a strategy for the two core campus machine rooms at Indianapolis and Bloomington. This strategy is being developed with the idea that each machine room can accommodate the other as a recovery site in the event of a disaster at either location. Initial efforts to identify the services provided from the IUPUI machine room are being accomplished in conjunction with the planned move for that data center.

The IUPUI data center information will be fed into the specialized recovery planning software to assist with defining requirements for recovery. Redundant services are being identified and documented as a preventive measure to avoid the need to recover services in the event that either location is destroyed. This preventive approach will ensure automatic recovery for many of the infrastructure services via a “failover capability.” In other words, in a multi-server configuration, if a system fails at IUPUI, the load is automatically transferred to a server at IUB, and vice versa.
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.
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.

While VoIP (Voice over IP) is currently not judged mature and cost-effective enough for broad implementation, progress is encouraging and IU continues its involvement in investigations and in providing leadership. A UITS staff member co-chairs the Internet2 VoIP Working Group, which initiated projects in interconnecting voice systems at participating national and international sites using a H.323 gatekeeper located at IUPUI. During the coming year, this interconnection technology will evolve from H.323 to SIP (session initiation protocol). UITS also participates in the EDUCAUSE Net.edu Integrated Communications Strategies steering committee, which explores the full spectrum of telecommunication issues, particularly mobility.

In November 2003 IU hosted a two-day VoIP workshop preceding the Internet2 member meeting. The workshop was attended by more than 70 people, including international participants and was highly successful. Another workshop is planned for May 2004. Among current projects of the VoIP Working Group is SIP.edu, which seeks to integrate the telephone dial plan with local LDAP systems to implement a dial plan based on e-mail addresses. ENUM, which converts E.164 (standard telephone numbers) to e-mail addresses, is also being explored. In addition, the group is working on a project that seeks to implement an IP-based disaster recovery system by working with common carriers (local and long-distance telephone companies) to automatically reroute telephone trunks using SS7 (signaling system 7).

The Group is working with equipment vendors (Cisco, Nortel, Broadsoft, and 3-Com) to provide heavily discounted VoIP equipment and to test SIP interoperability. Long-distance companies are being courted to provide direct IP voice terminations into their networks. IU is also partnering with Interactive Intelligence, Inc. to develop Unified Messaging and Call Center systems for deployment at IU. IU has beta tested the company’s equipment and guided feature development.

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’s two largest campuses, IUB and IUPUI, have established lifecycle funding for the telecommunications infrastructure, which covers the wire and cable plants and voice, video, and data switching and routing equipment. The smaller campuses have made major progress in implementing a similar program.
**Action 48.** A five-year plan for the University’s intercampus networks and commodity Internet connectivity should be immediately developed, funded and implemented.

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

As a key infrastructure component in IU’s IT environment, the telecommunications standards that were reviewed and implemented across the institution in 2000 ensure interoperability and high-quality network services.

I-Light continues to provide vast benefits to the University over previous connectivity, both for intra-campus connectivity and connectivity to the commodity Internet. I-Light’s capacity, which is in addition to existing Internet2 connectivity, is allocated between the campus housing at IUB, the IUB campus, and the IUPUI campus and its connections to the six regional campuses.

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 campus housing. In 2003, UITS continued its successful partnership with Residence Halls Association in helping to determine proper policy and practice for the residential commodity Internet connection. Filters of certain types of data traffic have been successful in managing the bandwidth in campus housing.

**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**

I-Light, a fiber-optic network connecting IUB, IUPUI, and Purdue’s West Lafayette campus to each other, and to the national Internet2 infrastructure, launched in December 2001, made Indiana the first state in the nation to have a fully operational network of this kind.

In 2000, I-Light enabled greater independence in telecommunications through decreased dependence on telecommunication providers. With multiple strands of optical fiber, I-Light increased networking capacity by many orders of magnitude, providing more than enough capacity to meet demand over the next 10 to 20 years. In August 2002, IU achieved a near four-fold increase in capacity for normal Internet traffic — at no increase in cost — by leveraging I-Light and its connectivity and co-location with the national Internet infrastructure in Indianapolis. This increased capacity is in addition to existing Internet2 connectivity. Purdue and the State of Indiana, via the Indiana Higher Education Telecommunication System, also obtained similar capacity improvements at no additional cost using I-Light.
Along with supporting research applications, I-Light supports voice communications, e-mail, and videoconferencing between the campuses and is the primary artery for communications between IUB, IUPUI, and Purdue University West Lafayette. I-Light presents countless possibilities for collaborative research and is an unparalleled platform for distance education. I-Light has allowed its partner universities to pool their high-end computational resources in such new research initiatives as the creation of a distributed supercomputing grid with an aggregate theoretical peak capacity of 1.5 TFLOPS (trillions of mathematical operations per second).

In Fall 2002, IU achieved redundancy for I-Light by striking an agreement with Smithville Telephone to share fiber-optic connections, should either system ever suffer cuts in fiber. A second phase of expansion, called I-Light2, was approved by the Indiana Legislature in May 2003.

At its annual conference in November 2003, EDUCAUSE chose Indiana University and Purdue University to receive its 2003 Award for Excellence in Networking for I-Light. This prestigious award recognizes strategic, innovative networking programs or practices that improve the quality of campus network services through new or enhanced network architectures, infrastructure, integration, management and/or operational practices. The EDUCAUSE Network Award committee commended the collaboration between University, city, and State entities to create I-Light.

In 2002, Abilene began providing native next-generation Internet Protocol (IPv6) service. IPv6 offers several improvements over IPv4, among them 128-bit-long Internet addresses. This vastly increases the number of available addresses and along with other improvements, paves the way for a range of new applications. This deployment makes high performance IPv6 service available to more than 200 Internet2 member institutions and thousands of other research and education institutions across the United States that have access to Abilene.

In September 2002 Abilene established a 10-gigabit-per-second (Gbps) optical connection to StarLight, a Chicago-based advanced optical infrastructure and proving ground for international network services. This link will enable institutions participating in Abilene to leverage high performance research and education networks around the world that also connect to StarLight.
Abilene’s native IPv6 service complements existing IPv6 deployment in other research and education networks around the world, such as ESnet in the United States, Renater in France, and SURFnet in the Netherlands. Deploying native IPv6 continues Abilene’s evolution as a leading-edge network environment that supports the development of new applications. IPv6 is the next version of the Internet protocol, updating the data packaging and routing standard. The current version is IPv4; IPv5 was experimental and was never widely deployed.

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 initiative is valued at $300M.

IU Network Engineering Staff provided leadership for a major upgrade to the Internet2 Abilene network, upgrading Abilene coast-to-coast backbone connectivity to OC-192, or a speed of 10M bits per second, a four-fold increase in the previous capacity. IU’s Engineers were solely responsible for the April 2003 logistical and technical implementation of this major enhancement, and delivered it on schedule and on budget. The remainder of the backbone — the southern route — was completed by July 2003.

**TransPAC**

TransPAC is a high performance network connecting scientists in the United States with their counterparts in the Asia-Pacific region. TransPAC provides fundamental network infrastructure to support e-science collaborations between these researchers in a broad range of scientific disciplines including astronomy, molecular biology, high-energy physics, medicine, meteorology, visualization, and computational science.

Architecturally, TransPAC connects US national and international networks with the Asia-Pacific Advanced Network (APAN) in Tokyo, Japan. Indiana University provides technical and administrative support for TransPAC in the US. KDDI Corporation provides similar support for TransPAC in Japan. The TransPAC network is currently implemented as two OC-12 (622Mbps) circuits connecting Japan with the US: a “northern” circuit to Seattle and a “southern” circuit to Chicago. Major funding comes from the US National Science Foundation and the Japanese Communications Research Laboratory.

TransPAC provides scientists worldwide with high performance access to data and computing resources located in Asia. In addition, TransPAC provides scientists with remote access to exceptional, world-class instruments such as electron microscopes, telescope arrays, and satellite-based imaging devices.

A particularly salient application of TransPAC — and advanced networking in general — occurred in April and May 2003 during the outbreak of SARS in Taiwan. TransPAC cooperated with TANET2 and other international research and education networks to assist medical professionals in Taiwan. To provide for local and international medical consulting, National Center for High Performance Computing (NCHC) researchers quickly created the SARS Grid, a global-scale teleconferencing network that enabled physicians to communicate with one another and to share high-resolution X-rays, diagnoses, and treatment methods. Participating physicians within Taiwan, from the US, and from other Pacific Rim countries could communicate face to face, and with patients inside quarantined areas. This approach greatly reduced transmission of the disease by medical personnel and allowed medical researchers at remote locations immediate, first-hand access to doctors and patients without the need for travel or risk of infection.

Other application highlights from 2003 include a bandwidth-limited distributed analysis of the Large Hadron Collider Atlas detector events using the AIST Grid Datafarm storage technology, and a Japan-US-Netherlands multi-site demonstration of remote telemicroscopy and 3D tomography reconstruction using the unique Osaka uHEVM and computing resources in the US.

Pacific Rim Applications and Grid Middleware Assembly (PRAGMA) is a partnership between organizations in the Pacific Rim and the San Diego Supercomputer Center (SDSC) designed to encourage the development of Grid applications between the US and Asia. TransPAC is also a key supporter of PRAGMA activities in Asia. TransPAC has participated in both the PRAGMA 5 and PRAGMA 4 meetings and has provided technical and organizational support for PRAGMA demonstrations.
The Trans-Pacific Grid Datafarm, a project lead by Osamu Tatebe of the National Institute of Advanced Industrial Science and Technology (AIST) in Japan, won the Distributed Infrastructure Bandwidth Challenge at SC2003. AIST, part of the Pacific Rim Applications and Grid Middleware Assembly (PRAGMA), replicated terabyte-scale experimental data between the United States and Japan over several OC-48 links, including TransPAC. TransPAC engineers provided on-site support for the winning bandwidth challenge. TransPAC was a 2003 Silver sponsor of the Global Grid Forum (GGF). TransPAC had a sponsor booth in Tokyo to demonstrate how TransPAC infrastructure could facilitate US-Asia Grid activities.

As a vehicle for encouraging collaborations between groups in the US and the Asia-Pacific, TransPAC has had notable success. By participating in and supporting the growth of new research communities such as Pacific Rim Applications and Grid Middleware Assembly (PRAGMA), Global Grid Forum, and Asia-Pacific Grid (ApGrid), TransPAC is able to leverage the infrastructure investments made in the network. The idea that science depends on global collaborations and that these collaborations depend on international, reliable, high-speed networking and advanced networking services is borne out in the formation of such communities as PRAGMA and ApGrid.

The US National Science Foundation and the Japanese Communications Research Laboratory have agreed to fund the TransPAC project for an additional year. The project will now conclude on July 31, 2004. During the extension year, goals for TransPAC will center on increasing both production and experimental bandwidth from Asia to the US. Closer relationships will also be developed with international network research efforts such as PlanetLab.

The mission of the Global NOC is to create and maintain the world’s most advanced network engineering and operations service organization for global high performance research and education networking, thereby enabling the advancement of global research and education networks and the applications that utilize those networks.

Through the interconnection of national and international advanced research and education networks in a global framework, researchers and educators in all endeavors are provided access to resources, such as large-scale datasets, grid computing, scientific instruments, tools, colleagues, and collaborative spaces, that would otherwise not be possible. The Global NOC plays a key role in establishing and maintaining the persistent advanced networking infrastructure that makes access to these global resources and collaborations possible.

Some of these global collaborative activities include:

- **International Virtual Data Grid Laboratory.** The iVDGL global data grid serves forefront experiments in physics and astronomy. Its computing, storage, and networking resources in the US, Europe, Asia, and South America provide a unique laboratory that will test and validate grid technologies on international and global scales.

- **Advanced Networking for Telemicroscopy.** Scientists at Osaka University and the University of California, San Diego, utilize international research networks to couple the world’s largest and most powerful transmission electron microscope at the Research Center for Ultra High Voltage Electron Microscopy, Osaka University, to a remote-use computer pavilion set up at UCSD.

- **Grid Datafarm.** The Grid Datafarm is a data-intensive computing project initiated in Japan to develop a peta- to exascale parallel file system exploiting local storages of PCs spread over the worldwide Grid.

- **Data and Information Access Link.** DIAL is a Web-based distributed system to search, access, and visualize satellite remote sensing data for global change research. 3D data are transferred from NASA to NASDA using TransPAC/APAN, then processed and visualized for the Web.
• **iGrid.** Launched in 1998, the biennial iGrid (International Grid) event showcases application and middleware advancements enabled by globally connected, high performance networks. iGrid 2002 challenged scientists and technologists to optimally utilize 10Gbps experimental networks, with special emphasis on e-science, grid, and virtual laboratory applications.

The networks, international connections, and services managed by the Global NOC are listed below.

• **Internet2 Abilene** is a 10-Gigabit-per-second national backbone supporting high performance connectivity and Internet innovation within the US research university community.

• **TransPAC** provides high performance international Internet service connections from the Asia Pacific Advanced Network to US and global advanced networks for the purpose of international collaborations in research and education.

• **The Science, Technology, And Research Transit Access Point (STAR TAP)** is a persistent infrastructure to facilitate the long-term interconnection and interoperability of advanced international networking.

• **The Manhattan Landing (MAN LAN)** is a high performance exchange point in New York to facilitate peerings among US and international research and education networks.

• **AmericasPATH (AMPATH)** provides interconnection of the research and education networks in South and Central America, the Caribbean, and Mexico to US and non-US international research and education networks.

• **The Indiana GigaPoP** provides a Midwest regional aggregation point for connections from research and educational institutions to national R&E networks and the commercial Internet.

• The International Virtual Data Grid Laboratory’s (iVDGL) Grid Operation Center (iGOC) provides a repository for information regarding network, storage, and computing resources of the iVDGL, and serves as a central monitoring point for operational activity at each site and among the sites (the iVDGL in total).

• The Global NOC serves as the watch desk for the REN-ISAC (Research and Education Networking, Information Sharing, and Analysis Center). The REN-ISAC has responsibility for receiving and analyzing network security threat, warning, and attack information within the R&E networking infrastructure.

• The Global NOC was selected to serve as the Services Desk for the new National LambdaRail (NLR) network, and IU engineers were selected to head a task force that will define detailed network services that IU will provide to NLR in the coming years. These roles will grow incrementally as the NLR network grows to completion in 2004. IU’s selection further solidifies its leadership role in providing network operation and engineering services to advanced research network initiatives both nationally and internationally.

The Global NOC is the initial point of contact for all operational matters concerning these connections. Operating 24/365, the Global NOC provides problem, change, security, and performance management; resource allocation, monitoring, communications and coordination; and reporting. The Global NOC is located at Indiana University’s Indianapolis campus and is co-located and operated with the NOC for Indiana University campus and State networks. The Global NOC is funded in part by international connections grants from the National Science Foundation High Performance International Internet Services (HPIIS) program, and the State of Indiana.

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**WIRELESS NETWORKS**

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

In 2002, IU took major strides toward a goal of complete wireless access in a VPN-secured environment. In June the Vice President for Information Technology directed UITS to provide the University’s campuses with comprehensive wireless access within the next 15 months. As a first step, a fulltime Project Analyst was hired in July 2002 to oversee the wireless initiatives for IU, beginning with
Action 52. The networking demands due to the increasing use of multimedia applications should be addressed as the University network continues to develop.

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.

VIDEOCONFERENCE SERVICES

Videoconferencing systems can be categorized into two models: group systems, comprising classroom and conference room systems; and desktop systems. The models have certain similarities, but have differing features of scale, complexity, capabilities, and support. Common to all is the H.323 videoconferencing standard.
H.323 is a collection of complex protocols, with the important specification that H.323 systems utilize standard Internet data networking for communications.

During 2003 steady growth continued in the deployment and use of videoconferencing. At the end of December 2001, 120 group systems had been deployed. By December 2002, the number had risen to 163. By November 2003, the number of group systems stood at 187. In addition, approximately 210 desktop systems were deployed in 2003, bringing the total number of systems to approximately 397.

In 2003, IU’s core videoconferencing servers (MCU, Gatekeeper, Global Addressbook) were made fully redundant by installing failover hardware. In the event any of these systems goes down, the failover device will activate, assuring continued service.

In 2002, Indiana University integrated the ViDeNet Global Dialing Scheme hierarchy, which allows for direct inside and outside dialing to H.323-compliant systems at college campuses worldwide by a numerical “telephone” alias called E.164. This eliminates having to rely on IP addresses. IU is also working toward meshing with H.323 global directory services based on LDAP.

Testing of H.323 compatibility with the proposed IU border firewall continues, as well as providing AES encryption for users who require secure H.323 conferences.

STREAMING MEDIA

Digital Media Network Services launched IStream in Fall 2002 to allow for the automatic streaming and archiving of classes, meetings, and special events. In 2003, the service grew to support nearly 40 semester-long class sections in addition to numerous meetings and other events.

During Summer 2003, the implementation and migration began to a new, large storage system. This multi-terabyte system from EMC allows for replication of streaming data between IUB and IUPUI, ensuring that service remains available, and that should a catastrophic failure occur, recovery would be relatively quick. Current disk usage has grown to more than 700GB.

Information provider usage of streaming services has also increased. There are currently 173 information provider accounts for the streaming servers. In addition to a new QuickTime Streaming Server, DMNS has added a new Windows Media Server, supporting the latest features of the Microsoft Windows Media 9 series.

WEB COLLABORATION

During 2003, research continued toward selecting an institutional Web conferencing and collaboration tool. Combining efforts with the UITS voice bridging unit, in late 2003 an RFP was issued for selecting a vendor to provide a combined phone bridge and Web collaboration solution. The proposal outlines a plan for selecting and implementing a Web collaboration/voice bridging solution in Spring 2004. In the interim, academic and administrative collaboration needs continue to be met using NetMeeting and locally developed chat tools.

As videoconferencing, streaming, and Web collaboration services merge into a unified environment, the ability to reserve, control, and monitor the network elements behind these services has not kept pace. In 2003 research continued into advanced scheduling systems that could meet this need. Of particular interest are those that can incorporate with the PeopleSoft Ad Astra room management system, and with Microsoft Outlook.

In 2003 use of videoconferencing extended beyond distance learning and administrative uses to research areas. Polycom videoconference systems will help IU geologists and biogeochemists lead a $5M NASA-sponsored astrobiology initiative. Polycom systems also provide remote views into crystallography laboratory equipment in the Department of Chemistry, and connect students and researchers in the Department of Astronomy to peers conducting observations at distant observatories.

Among its peer institutions of higher education, Indiana is recognized as one of the leaders in the deployment, support, and operation of videoconferencing networks.
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).
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.

Information Commons
The renovation of the first floor of the West Tower of the Indiana University Main Library began on January 6, 2003. The project transformed the 27,000-square-foot space into the Information Commons (IC), a state-of-the-art, highly integrated technology and information center that fosters student learning and enhances faculty research and teaching opportunities.

A joint effort between the Indiana University Libraries and University Information Technology Services, the Information Commons provides valuable space for collaborative learning. In addition to housing print collections and reference librarians, the Commons is a centrally located place for students and faculty to interact, attend technology training classes, and find full-service access to technology and technologists.

The technology- and information-rich environment includes individual seating and comfortable study areas along with workspace for groups, equipped with more than 250 individual- and group-configured computer workstations and wireless networking. On hand to assist students are IT support resources and consulting including the UITS Support Center. The Information Commons brings together several campus units in one place. The University’s Writing Tutorial Center offers on-site assistance for students who need help writing research papers. IU’s Adaptive Technology Center occupies a prominent location at the entrance of the IC and provides technology-based solutions for students with disabilities, offering, for example, Braille printing and voice-recognition software. Housed within the Commons is a multimedia production lab and IT Training & Education classroom and instruction areas. On hand are Library reference services, providing links to other library research and instruction services, campus resources, and connections beyond Indiana; a Library circulation area for materials, laptops, video equipment, and the like; and a career reference center. The Commons benefits IU students by offering seamless access to a broad and integrated suite of information and resources, accessible 24 hours a day. (See http://ic.indiana.edu/)

Support Center Enhancements
The UITS Support Center, with locations at IUB and IUPUI, enhanced services in 2003 by providing frontline support via telephone for IUSE, IUE, and IUK on evenings and weekends, when local campus help desks are closed. This coverage extends hours on those campuses to 24/7/365, providing the same level of round-the-clock support that is in place on the core campuses.

Walk-in support was expanded in Bloomington to include a location in the Information Commons in the Main Library, increasing the availability and convenience of campus walk-in help. Designed to deliver the services, technology, location, and hours that students have requested, the Commons was an early and immediate success, drawing crowds of students before the official start of Fall classes. (For more, see the narrative above.)
In 2003 the Support Centers on all IU campuses began using Falcon, IU’s trouble-ticket system that provides enterprise management for all areas of technology support. The Support Center also continued work on enhancing the system that includes help desk inquiries, service requests, account management, and requests for instructional technology resources. An automated customer survey delivery and data collection system was added in 2003 and development began on programming interfaces between Falcon and the new Online Support Environment (OSE), discussed below. New support tools from the company Control F-1 were obtained to provide all Support Center consultants with state-of-the-art workstation tools to assist in diagnosing customer problems.

In 2003, the Support Center logged 127,697 phone contacts; 30,973 walk-in contacts; and 27,447 e-mail contacts. The Knowledge Base totaled 10,600,000 hits for the year from the IU system, IU affiliates, and the public.

STUDENT TECHNOLOGY CENTERS & CONSULTING

Student Technology Centers, in partnership with COAS and the IUB Telecommunications department, opened a new multimedia classroom/study facility in support of the Telecommunications New Media program, providing for digital media instruction, development, and production.

In 2003 there were 166,415 consulting contacts in 63 Student Technology Centers (55 at IUB, and eight at IUPUI under direct UITS management). These centers house some 4,000 computers running Windows, Mac OS, and Unix. At IUB, 127 locations with more than 450 department-owned workstations are running the same STC build as the STCs and RTCs. At IUPUI, UITS provides a custom build at 11 department-owned locations.

ONLINE SUPPORT ENVIRONMENT

In Fall 2003, the UITS Teaching and Learning Information Technologies Division and Office of Communications and Planning completed the first stage in the development of a new Online Support Environment (OSE) by redesigning the UITS Web space to focus on support and services. Built on the best of IU’s current support structure, including the Knowledge Base and strong human help presence, the OSE incorporates more than 3,000 pages on accounts, passwords, networks, hardware, and software. It provides an efficient, intuitive virtual support center with help and information 24 hours a day, year-round, that will empower users to make the best use of the University’s IT environment.

One initiative of the OSE, ITHelp Live!, includes tools for remote desktop assistance. Tools include computer diagnostics, automated repair tools and scripts, and full remote control. Users can control the level of access to their computers and view a log of activity in Falcon, the enterprise trouble-ticket system. Other interfaces to user support resources include telephone, and e-mail, along with an online chat option.

Planning is underway to deliver the OSE via the OneStart portal and via a format suitable for access by personal mobile devices. The next phase of the OSE initiative involves a desktop applet that will push news, alerts, and status information to user desktops. A Windows client separate from the Web, the applet will allow information to be shared independent of the Web. (See http://www.uits.iu.edu/)
ADAPTIVE TECHNOLOGY CENTER

In 2003, the Adaptive Technology Center moved into a new, prominent location at the entry of the Information Commons at the IUB Main Library. This location provides additional space and a self-enclosed environment, making it more convenient for customers to locate and use services. Client contacts grew by one-third in 2003 and the Center began supporting students who are working with academic advisors in several programs, including the Groups program. This program serves students who are the first in their family to attend college, who have limited financial resources, and those with disabilities from all racial and economic backgrounds.

A number of initiatives, enhancements, and collaborative efforts were undertaken and expanded in 2003. The Center continued to serve as a beta test site for Kurzweil Educational Systems software, Kurzweil 3000 Version 7. OCR Rocket software, written in-house to automate many of the scanning/recognition steps of the high-speed scanning process, is now offered to non-profit organizations and educational entities via the Web.

Seven adaptive applications are now delivered via server to all the workstations in the Information Commons. Adaptive applications will be standard equipment in more locations in 2004. Staff co-taught more than 12 IUB classes on the importance of adaptive technology in providing access to information for individuals with disabilities. In response to the increased need for training, a visually-based training module was created for use with reading assistance software. The Center began to share books through an agreement with Bookshare.org, a national repository of electronic books.

Students can now use Center workstations to convert their digital texts into MP3 files for access “on the go” — a boon to students who commute. The Center has helped Bloomington-area schools incorporate adaptive technology into their programs, most notably through the use of software to assist students with dyslexia.

In the coming year, the ATC will continue efforts to develop an ATC presence in the new Informatics and Communications Technology Complex at IUPUI.

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In the coming year, the ATC will continue efforts to develop an ATC presence in the new Informatics and Communications Technology Complex at IUPUI.

Twenty-five Residential Technology Centers are located throughout IUB campus housing. Several of these include Academic Support Centers jointly managed by Residential Programs and Services and UITS. Residential Technology Centers include some 275 workstations and 50 Express E-mail Stations.

To enhance network security and to respond to the Blaster Worm threat that affected networked computers around the world, UITS Residential IT Services (RITS) worked with the Information Technology Security Office (ITSO) to assure that student machines in campus housing were secured before being allowed
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. 

UITs now provides IT support for phone and data in IUPUI campus housing, in Ball Residence Hall, and in the new apartment complex. In Ball Residence, IUPUI’s “traditional” dormitory, residents with personal computers can now connect to the IU Network from their rooms using a network cable provided by campus housing and an Ethernet card. Students can also connect to the IU Network using wireless access in designated areas. UITS provides information and recommendations for Ethernet and Wireless cards in The Computer Guide, which is distributed to new students before Orientation. While UITS does not yet support the Ball Residence technology center, it does provide in-room consulting services.

In Fall 2003 IUPUI completed the first phase of its student housing initiative by opening campus housing that comprises 331 units of one-, two-, or four-bedroom apartments. UITS staff handled 500 dial-tone and voice-mail installations and equipped each bedroom with 100 MB data service and cable TV service. VPN-secured wireless access is available in every building and computing consultants provide free, in-room assistance to University residents. Phone numbers from Ball Residence were updated to ensure uniformity with phone numbers in the new campus housing. When IT-related housing services were integrated between campuses, most related Web pages and Web forms, as well as all Knowledge Base entries, were updated to make them relevant to both campuses, and to reflect new services.

In addition to the wiring plant, the Information Technology Policy Office (ITPO), Messaging, and RITS worked together to successfully switch all IUB and IUPUI static IP numbers over to DHCP (Dynamic Host Configuration Protocol) registration before Fall move-in.

Telephony services at IUPUI housing are now paperless. New telephony features including voicemail, three-way calling, call forwarding, and direct-dial
long distance, are being offered to IUPUI campus housing residents for the first time. All services can be ordered and paid for using a secure Web interface and phone bills can be accessed using an interactive voice recognition system.

UITS will continue to work with IUPUI residential planners to ensure that current and future housing develops 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.

Students living in IUB campus housing have access to more than 260 workstations in 29 Residential Technology Centers (RTCs) throughout campus housing. Laser printers are also available in each RTC. Each workstation is configured identically to those found in the Student Technology Centers (STCs) located throughout campus, providing students with a common selection of hardware platform and software packages across campus. The RTCs are staffed by RITS Consultants in the afternoons on Sunday through Friday (2:30-5:30pm) and in the evenings, Sunday through Thursday (6-10pm).

In IUPUI campus housing, UITS provides IT support for phone and data In Ball Residence, IUPUI’s “traditional” dormitory, and in the new apartment complex. While UITS does not yet support the Ball Residence technology center, it does provide in-room consulting services. For students on both campuses, UITS provides information and recommendations for IT equipment in *The Computer Guide*, which is distributed to new students before Orientation. (For more, see the discussion under Actions 55 and 56, above.)

**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. According to the 2003 User Survey, 95.1% of students at IUB stated that they own or have access to a computer at home, as compared with 94.3% in 2002. At IUPUI, the 2003 User Survey shows 95.6% of respondents state they own a computer at home, as compared with 93.9% in 2002. This increase in personal ownership is believed to reflect on the incentives in place that encourage ownership.

Each year UITS provides extensive guidelines to all incoming students in the form of *The Computer 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 vendors to secure special pricing on high-quality computers and software, and by extending University pricing to students for their personal purchases. For example, in 2003 IU and Dell Marketing entered a Preferred Partnership that allows students to leverage the institutional purchases and buy for themselves new Dell Desktop, Workstation, and Notebook computers with discounts of up to $500 off 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 OVPIT, and the University research faculty with leadership from the School of Library and Information Science and the School of Informatics.
Digital Library Brown Bag Series. In an effort to disseminate information about Indiana University digital library activity and research, the Digital Library Program and the School of Library and Information Science sponsored a year-long series of lunch-time presentations and discussions, beginning in Fall 2003. The programs deal with a variety of topics, including project updates, technology updates, research reports, and digital library issues for a general university audience. (See http://www.dlib.indiana.edu/workshops/bbfall2003.htm)

Variations2 Digital Music Library. Work continues on the initiative to support research and education in the field of digital libraries for music. This initiative is funded in part by the National Science Foundation’s Digital Library Initiatives Phase 2 (DLI2) program. Building upon IU’s successful VARIATIONS digital library system, the project aims to establish a digital music library testbed system containing music in a variety of formats, and involves research and development in the areas of system architecture, metadata standards, usability, intellectual property rights, and network services.

In 2005, development was completed on version 2 of the Variations2 software system, which adds improved support for searching and browsing, printing of musical scores, and synchronization of scores and recordings, as well as an interactive instructional tool for diagramming the structure of musical works contained within the library. In addition, the integration of Variations2 with “query-by-humming” software developed at the University of Michigan was demonstrated at the ACM/IEEE-CS Joint Conference on Digital Libraries in May 2003. (See http://variations2.indiana.edu/)

Reciprocal Net. The inter-institutional Reciprocal Net collaboration, led by the IU Molecular Structure Center, is creating a national digital library collection of molecular structures, software tools for interactive visualization of structures, software components for constructing lessons based on the collection, and examples of such lessons. During the past year, the Reciprocal Net has improved its capabilities and expanded its coverage, and has prepared for full integration into the NSF’s National Science Digital Library. The collection now includes structure data from IU, Princeton, the University of Cincinnati, the University of Minnesota, Purdue University, Northwestern University, the University of California San Diego, and the University of Kansas, along with associated education-oriented descriptive materials about more than 500 common molecules and a tutorial on symmetry concepts. The Reciprocal Net is funded in part by an award from the NSF National Science Digital Library program. (See http://www.recipnet.indiana.edu/)

Letopis’ Zhurnal’nykh Statei. In 2003, the Digital Library Program released two online versions of Letopis’ Zhurnal’nykh Statei (1956-1975), a comprehensive Russian-language periodical index published since 1926. This project covers the portion of the index beginning with the period of the Khrushchev “Thaw” and continuing through the first half of the so-called Brezhnev “Period of Stagnation.” The first version of the online index was released in March 2003. In the months following its release, the project team conducted extensive usability testing, which led to
The University should develop a digital library infrastructure that will provide a common technical and organizational base for new and ongoing digital library programs. (See http://www.dlib.indiana.edu/reference/letopis)

CBML (Comic Book Markup Language). Digital Library Program staff continue to lead the development of CBML, an XML vocabulary for encoding comic books and graphic novels. CBML will facilitate the preservation, study, and analysis of these cultural artifacts, which are becoming ever more frequent objects of study in a variety of disciplines, including history, and literary and cultural studies. In 2003, CBML was modified to make it compliant with the Text Encoding Initiative (TEI) Guidelines for Electronic Text Encoding and Interchange, the standard in scholarly electronic text markup. Presentations on CBML were given at the Comic Arts Conference in San Diego and Digital Resources in the Humanities Conference in the UK. (See http://www.cbml.org/)

Text Encoding Initiative Consortium. Digital Library Program staff continue to play a major role in the Text Encoding Initiative (TEI) Consortium, with staff re-elected to the Consortium’s Technical Council in 2003. The TEI is an international and interdisciplinary standard for encoding electronic texts. IU is a founding member of the TEI Consortium. (See http://www.tei-c.org/)

DIGITAL LIBRARY INFRASTRUCTURE

**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.

The Digital Library Program (DLP) continues to work on developing services using the Open Archives Initiative Protocol for Metadata Harvesting (OAI-PMH) to make information about digital library collections more easily available. Descriptive metadata for many DLP-hosted public digital collections are now available via OAI-PMH, positioning our resources to be visible in metadata harvesters being developed by the Committee on Institutional Cooperation (CIC), Institute of Museum and Library Services (IMLS), the Research Libraries Group (RLG), and the Digital Library Federation.

The Digital Library Program has deployed a version of the Fedora open source digital object repository software developed by Cornell University and the University of Virginia as part of the EVIA Digital Archive Project, which will likely eventually serve as a repository for digital collections at IU. (See http://www.fedora.info/)

Sheet Music Consortium. In March 2002, the Digital Library Program began work with UCLA and Johns Hopkins University to create a metadata harvester for sheet music collections using OAI-PMH (Open Archives Initiative-Protocol for Metadata Harvesting). Harvested metadata about sheet music in participating collections is hosted by the UCLA Digital Library Program. The service has been available in test mode since December 2002. The Andrew W. Mellon Foundation funded extensive usability testing at five universities. This work led to extensive revisions and the launch of a revised service in August 2003. Currently, the Sheet Music Consortium offers nearly 100,000 records for sheet music from five libraries. (See http://digital.library.ucla.edu/sheetmusic/)
**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.

A task force was appointed in 2003, with members from both UITS and the IU Bloomington Libraries, to develop an integrated access model for electronic resources, and to make recommendations for projects to better integrate disparate licensed and locally developed electronic resources. The task force recommendations will lead to additional work on federated searching tools, linking tools (based on the emerging OpenURL standard), integration of library services into the OneStart portal, and further work on integrating electronic reserves and other resources into Oncourse.

**SUPPORT FOR DIGITAL LIBRARY INITIATIVES**

**Action 65.** 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.

**DIGITAL LIBRARY SERVICES**

**VARIATIONS:** School of Music digital audio library.

VARIATIONS continues to provide access to sound recordings and a small number of musical score images to School of Music students and faculty in support of instructional and research needs. VARIATIONS delivered 205,668 sound file accesses between January 1, 2003 and November 26, 2003. To date, Music Library staff have digitized approximately 8,590 sound recordings and 321 scores. (See [http://www.dlib.indiana.edu/variations/](http://www.dlib.indiana.edu/variations/))

**LETRS:** Electronic Text Resources for the Humanities. In 2003 all machines in the LETRS Humanities Computing Lab were upgraded. Online collections continued to expand, especially via ongoing in-house projects, such as the Victorian Women Writers Project, the Swinburne Project, and the Wright American Fiction Project. CD-ROM-based electronic text collections also grew. Notable additions include “Nietzsche: Werke,” “PoetriaNova: a CD-ROM of Latin Medieval Poetry (650-1250 A.D.),” and “Political Philosophy: Machiavelli to Mill.” (See [http://www.letrs.indiana.edu/](http://www.letrs.indiana.edu/))

**DIDO:** Digital Images Delivered Online. The Digital Library Program supports a collection of low-resolution digital images selected from the 300,000-image IU Bloomington Fine Arts Slide Library, with access available to all IU campuses. Between January 1, 2003 and November 26, 2003, the Fine Arts Slide Library staff added more than 9,000 images to DIDO, bringing the total to more than 39,000. Additional upgrades to scanning hardware and procedures were completed, a new system for validating and converting image files was developed and deployed, and several hundred commercial images from Saskia, Ltd. were incorporated into the collection. A new art image repository interface, tentatively called DIDO2, will be developed and released in 2004. (See [http://www.dlib.indiana.edu/collections/dido/](http://www.dlib.indiana.edu/collections/dido/))
DIGITAL LIBRARY PROJECTS & COLLECTIONS

Board of Trustees Minutes. The minutes of meetings of the Board of Trustees are being digitized, encoded using the Text Encoding Initiative (TEI), and made fully searchable. The Board of Trustees minutes stretch back to the late 19th century and provide a unique history of Indiana University. Begun in Fall 2002, this project is a collaboration of the Digital Library Program, University Archives, and the Board of Trustees. (See http://www.letrs.indiana.edu/web/i/iubot/)

The “Cymistry” of Isaac Newton. Digital Library Program staff are working with Professor William R. Newman from the History and Philosophy of Science department to digitize and edit the alchemical manuscripts of Isaac Newton. The project also aims to develop an advanced Web-based user interface that allows for user annotation of text and images. The project is a partnership with The Newton Project based at Imperial College, London, in the UK, and is supported by a three-year grant from the National Science Foundation. (See http://www.newtonproject.ic.ac.uk/)

Charles W. Cushman Photograph Collection. In November 2003, the Digital Library Program launched a groundbreaking digital collection of 14,500 color images of everyday life in the middle of the 20th century. The collection is housed in the University Archives which is a project partner. Taken by amateur photographer Charles Weever Cushman between 1938 and 1969, the images document a cross-section of American and international subjects, from inner-city storefronts and industrial landscapes to candid portraits. The site offers sophisticated searching and browsing, which will be further enhanced by March 2004. This project was funded in part by a three-year grant from the Institute of Museum and Library Services (IMLS). (See http://www.letrs.indiana.edu/web/f/findaid/)

Ethnomusicological Video for Instruction and Analysis (EVIA) Digital Archive. The Andrew W. Mellon Foundation has provided a two-year grant to the Department of Ethnomusicology to create the EVIA Digital Archive. The project is a joint effort of Indiana University and the University of Michigan to establish a digital archive of ethnomusicological video for use by scholars and instructors. The archive is being designed by experts in the fields of ethnomusicology, archiving, video, intellectual property, and digital technology. The Digital Library Program is providing technical support for the project at IU and will sustain the repository after the project ends in 2005. (See http://www.indiana.edu/~eviada/)

Film Literature Index. With two-year funding from the National Endowment for the Humanities, the Digital Library Program is working with the Film and Television Documentation Center at the State University of New York – Albany to convert to a single electronic format and publish on the Web the Film Literature Index (1976-2001), currently published only on paper. Film Literature Index is a quarterly subject/author index that provides the most comprehensive survey available of the entire spectrum of current international periodical literature about film and television/video. The project has completed one year. All available issues have been converted to a single format. The project team is working on the user interface for the index and administrative tools to allow the index to be produced more efficiently. (See http://www.dlib.indiana.edu/projects/fli/proposal.html)

Finding Aids at Indiana University. In July 2003, the Digital Library Program made available a searchable collection of finding aids using the standard Encoded Archival Description (EAD) from the Lilly Library and the Indiana University Archives. Currently, more than 100 finding aids are available, with more to come. Other archives and libraries at IU will contribute finding aids in the future. (See http://www.letrs.indiana.edu/web/f/findaid/)

Gennett Recording Studios Digital Archive. In July 2002, the Digital Library Program received an LSTA grant to catalog, digitize, and provide public access to 325 sound recordings from the Gennett Recording Studios. The virtual collection will include sound recordings from the Archives of Traditional Music at Indiana University and the Starr-Gennett Archive in Richmond, Indiana (http://starrgennett.org/). The sound recordings will be accessible via the Variations system at IU and via the Web. To date all sound recordings have been digitized and cataloged. They will be accessible via the Web in Spring 2004.

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. The online index was launched to the public in November 2001 and covered the years 1980-2000. The online index now covers the years 1930-2001. Work continues on two additional 25-year indexes covering the years 1905-1929. (See http://www.lettres.indiana.edu/inmh/)

Digital Library of the Commons. The Digital Library of the Commons (DLC) is a gateway to the international literature on the commons. This site contains a Working Paper Archive of author-submitted papers, as well as full-text conference papers, dissertations, working papers and pre-prints, and reports. The DLC is a collaborative project of the Workshop in Political Theory and Policy Analysis and the Indiana University Digital Library Program. Support has also been provided by the International Association for the Study of Common Property (IASCP) and Indiana University Research and the University Graduate School (RUGS). In 2003 the Workshop in Political Theory and Policy Analysis received a grant from the Andrew W. Mellon Foundation to enhance and expand the project. (See http://dlc.dlib.indiana.edu/)

INDIANAPOLIS PROJECTS

INDiamond Collections (Digital Images And
Manuscripts On Demand): Philanthropy Resources Online – PRO. University Library moved into a production environment in Fall 2002 as part of its development of a digital library infrastructure to support INDiamond. This provided the framework to create and deliver unique scholarly content with an emphasis on philanthropic studies. In January 2003 IUPUI University Library made available Philanthropy Resources Online—PRO, providing digital full-text access to significant but not widely available publications in philanthropic studies. By June 2003 more than 50 publications (including journals, monographs, and essays), amounting to more than 12,000 pages of text, were included in PRO. (See http://indiamond6.ulib.iupui.edu/PRO/)

IUPUI University Photographs. This database is a collection of digital images representing the University’s beginnings, history, developments, events, Schools, departments, buildings, and people. By June 2003, it contained more than 1500 black/white and color images. It is updated daily. (See http://indiamond6.ulib.iupui.edu/IUPUI/photos/)

Climate Data: Indianapolis, Indiana. This site is a product of the IUPUI University Library in cooperation with the Indianapolis-Marion County Public Library (IMCPL). Print copies of data generated by NOAA/National Climatic Data Center and contained within the IMCPL collection have been provided to IUPUI to be scanned and displayed in digital format as part of the University’s INDiamond collection of digital materials. The IMCPL collection also includes similar data for the rest of the State of Indiana. This site features a local dynamic climatological calendar that displays daily high and low temperatures from January 1872 through August 1991; daily precipitation from July, 1948 through December 1994; and monthly snow accumulation (October - May): March 1884 through May 1988. (See http://in-ulib-brayton/climatedata/print/home.html)

The Herron Image Library. This collection currently contains up to 1,000 licensed images of works of art from pre-history through the present for use in teaching and research. Remote access is available with a campus ID and password. Works of art will continue to be added as they are licensed. (See http://indiamond6.ulib.iupui.edu/HIL/)

The Indiana Humanities Council Smart Desktop Initiative. During the 2002-2003 academic year, University Library participated in shared staff collaboration with the Indiana Humanities Council (IHC) on the IHC Smart Desktop Initiative and more specifically, the SDI’s Resource Module. The IHC Desktop will provide full-service education Web-based tools that enable Indiana educators, students, parents, and other education stakeholders to analyze education information; access standards-aligned, humanities-rich resources and instructional materials; and work collaboratively to improve instruction and student learning as well as allow teachers to develop and deliver online classes.

The SDI Resource Module is the digital library of content-rich resources available through the Desktop. It is envisioned as the project’s standards-based content pool that gives teachers fast and direct access to resource items housed in the digital library or at an off-site content provider’s Web site. This database or
Electronic Records Management. University Archives and UITS continued to work together to develop policies and practices for the management and preservation of IU’s electronic records. A review and analysis of the FMS Invoice Imaging System was conducted, with assistance from IU Internal Audit. UITS and the University Archives developed course modules for teaching undergraduate and graduate students about electronic records management. In Spring 2003, these modules were taught in the School of Informatics course I303, “Organizational Informatics,” and in Spring and Fall in School of Library and Information Science course L547, “The Organizational Information Resource.” They were also used to help build a 15-week Web course on electronic records management. This curriculum development was supported in part by a grant from the National Historical Publications and Records Commission (NHPRC).

LOCKSS. Indiana University Libraries are finishing the second year of work in a partnership with Stanford University, New York Public Library, and Emory University on the LOCKSS (Lots of Copies Keep Stuff Safe) project. LOCKSS is a system that allows libraries to safeguard their subscription Web journals. It was designed and is being implemented by Stanford University Libraries with funding from the National Science Foundation, Sun Microsystems, and the Andrew W. Mellon Foundation.

LOCKSS provides tools that use local, library-controlled computers to safeguard readers’ long-term access to Web-based journals. LOCKSS is intended to demonstrate that it is safe for librarians to subscribe to journals’ Web editions and cancel the paper editions. (See http://lockss.stanford.edu/)

Indiana’s role in this project is twofold. Librarians are working with publishers to make appropriate changes to the publishers’ manifest that will enable the LOCKSS software to “crawl” their sites. An IU Libraries programmer is working with the technical staff at Stanford to develop a collection management tool that librarians can use to track what is being archived, and that will allow library technical staff to manage the LOCKSS caches.
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).
The Information Technology Policy Office (ITPO) develops and maintains policies on the appropriate use of IT by the Indiana University community, and administers education programs about common technology and security issues and concerns. The Office coordinates investigations of 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.

In addition the ITPO coordinates computer accounts management for centralized systems. The Global Directory Services project, formerly an ITPO initiative, was moved to University Information Systems in 2003 to allow for better integration with the other central administrative systems. This project includes the Central Authentication Service. (See Actions 37, 44, and 45.)

**EDUCATIONAL MATERIALS**
In cooperation with the Online Support Environment (OSE) Web design project, ITPO revised its Web pages to better serve the University community. In response to the Recording Industry Association of America (RIAA) increasing enforcement of the Digital Millennium Copyright Act, the ITPO stepped up efforts in Summer and Fall 2003 to educate the University community about copyright related to file sharing. (See Action 68.)

**INCIDENT RESPONSE**
Beginning in August 2003, a series of worms and viruses was released on the Internet, taking advantage of various Microsoft vulnerabilities. This burdened an already over-tasked incident response staff. An extended “emergency incident response team” was put together, with other ITPO and UITS staff temporarily reassigned to help. Staffing levels will continue to be adjusted to handle security incidents.

**ACCOUNTS ADMINISTRATION**
The Enterprise Directory Service and Web-based Account Management System were implemented in 2003, moving many manual processes to self-service, Web-based functions, and improving student, staff, and faculty computer account generation and management. As a result of this and of increased activity in Incident Response, one staff member was reassigned from IUPUI Accounts Management to Incident Response.
**Action 67.** UITS, with the Committee on Institutional Data and others in the University community, should develop
security mechanisms that properly enact institutional policy. Implementation of these security mechanisms should include
risk assessment, audit and controls, and education and awareness. UITS should focus special attention on providing reliable
authentication and access management systems.

The primary role of the Information Technology Security Office (ITSO) is to provide proactive security analysis, development, education, and guidance related to Indiana University’s information assets and information technology environment. The overall objective is a safe and secure atmosphere for teaching and learning, research, service, and the conduct of University business. The Office works closely with the Information Technology Policy Office (ITPO), assisting in investigations of and response to reports of abuse or inappropriate use of information technology.

ITSO continues to improve the security of IU’s computer systems. This year the outdated Kerberos (password authentication) protocols were retired and tools were deployed to proactively analyze University network communications for real-time security threats and events. These resources provide additional defense against these threats by allowing the selective filtering of malicious communications (denial of service attacks, “worms,” and so on).

The number and variety of computer attacks against IU systems, originating from external networks, continue to escalate dramatically. In August 2003, viruses and worms were released over the Internet that crippled the networks of many other organizations. Most infections took advantage of vulnerabilities in the Windows operating system. While IU network performance was slowed at times, IU’s aggressive defensive actions prevented network outages. ITSO worked closely with the ITPO, UITS Network Operations, UITS Communications and Planning, and the UITS Support Center, and coordinated with hundreds of department technicians to protect the network and connected computers. Thousands of CDs with security patches and infection removal tools were developed and distributed; network communications were filtered to block the spread of infections; and hundreds of network scans identified vulnerable and infected computers. Nearly 1,000 infected hosts were identified and isolated during this time, which saved tens of thousands of other IU computers from infection. The aggressive response and preventive efforts of ITSO, ITPO, UITS, and department and campus technicians kept IU from the widespread infections that plagued other universities of comparable size.

ITSO and UITS continue to partner on the installation of formal firewall appliances at the perimeter of the UITS-managed data centers at IUB and IUPUI, and to evaluate the feasibility of installing these devices on the University’s connections to external networks. The IUB machine room firewall is now in production, and all new connections in the machine room will be added behind the firewall if possible. An upgrade is planned for late December or January to remove a limitation on which subnets can be served.

The security certification courses developed and delivered by the ITSO have proven popular and are well attended. They cover such topics as general IT security concepts, operating systems security, and vulnerability assessment tools.

IU continues to be active in national security efforts, with staff leading national efforts to improve security in higher education and in the national cyberinfrastructure. The Chief IT Security and Policy Officer is a member of the EDUCAUSE/Internet2 Security Task Force executive committee and is on the advisory boards of several higher education security projects. The Advanced Network Management Lab (of the IU Pervasive Technology Labs) conducts research in this area under contracts awarded by various federal government entities.

The IU Center for Applied Cybersecurity Research was formed to facilitate the sharing of security information among faculty, researchers, and practitioners. The Research and Educational Network Information Sharing and Analysis Center (REN-ISAC) based at IU provides real-time threat and warning information to organizations. Both are described below.
In April 2003, Indiana University launched its Center for Applied Cybersecurity Research (CACR) with a $125,000 private gift and matching funds from the University. The Center serves as a focal point for cybersecurity research and teaching at Indiana University, as well as a meeting ground for cybersecurity scholars and practitioners from each campus.

The Center draws on Indiana University’s wide range of resources and scholarly expertise in computer science, informatics, accounting and information systems, criminal justice, law, organizational behavior, public policy, and other disciplines. The Center will partner with federal and state governments, business, and other education institutions to improve the quality of information assurance practice, research, and teaching at Indiana University and throughout the country.

A primary goal of the CACR will be reality-based teaching, bringing together IT academics, research, practitioners in the private sector, and officials in government offices. The CACR is also securing scholarship and funding monies for students and researchers interested in IT. The Center will significantly enhance IU’s ability to attract funding from external agencies to support and expand its research and other activities in cybersecurity.

THE RESEARCH AND EDUCATION NETWORK INFORMATION SHARING ANALYSIS CENTER (REN-ISAC)

In February 2003, Indiana University established the first higher-education-focused Information Sharing Analysis Center through an agreement with the National Infrastructure Protection Center (NIPC), announced in February in Washington, DC.

The Research and Education Network Information Sharing Analysis Center (REN-ISAC) operated by IU will focus on the high performance network infrastructure dedicated to research and education. The National Strategy to Secure Cyberspace, announced by President Bush in early 2003, calls for establishing information sharing analysis centers to facilitate communication, develop best practices, and disseminate security-related information.

The REN-ISAC also supports the framework to improve information technology security at all colleges and universities developed last year by an expert working group drawn from the membership of EDUCAUSE and Internet2, the two major information technology organizations in higher education. Endorsed by leading national organizations for higher education, the five-point action framework includes raising the level of collaboration among higher education, industry, and government, and integrating the work of higher education into the broader national effort to strengthen critical infrastructure.

Network security is increasingly important to the ability of the research and education community to use advanced networking capabilities to collaborate and access network-connected resources. To ensure continued excellent network service for the research and education connections, the REN-ISAC will combine an expanded set of security services, including proactive security monitoring, assessment, and reporting.

Under the REN-ISAC agreement, the NIPC will provide information about threats, warnings, and attacks reported by other organizations. In addition, summary information gleaned from the REN-ISAC’s analysis of network traffic anomalies that are likely to be related to security incidents will be transmitted to the NIPC and other sector ISACs, when appropriate. The REN-ISAC is the first of what may become several ISACs that serve different aspects of higher education.
The number of Digital Millennium Copyright Act (DMCA) copyright notices that IU received increased in 2003, culminating in more than 320 notices received in April. As a result, a full-time hourly staff member was hired with Action 68 funds to ensure that these notices are processed in the time frame required by law.

This position also coordinated an effort in Summer and Fall 2003 to improve education about copyright and file sharing. With the cooperation of the Dean of Students offices at the IUB and IUPUI campuses, and in consultation with University Counsel, a new process was put in place that requires those implicated in Digital Millennium Copyright Act notices to take an online copyright tutorial and pass a short quiz, all located within Oncourse. Educational efforts continued on the theme “Are You Legal?” Posters were distributed to Student Technology Centers, campus housing, and apartments; 14,000 flyers were distributed; a public service ad appeared on IU Cable TV; and numerous articles appeared in student publications.

In September 2002, the Copyright Management Center (CMC) at IUPUI launched its new Web site, which has attracted more than 2,000 visitors per month since its launch. The site provides information about copyright law, including copyright statutes, fair use information, a fair use checklist, links to seminars on copyright, IU policies, information for librarians, and copyright information for distance education.

New materials added in 2003 include:

- Links to copyright legislation, patent laws, trademark laws, and other areas of intellectual property
- Key court case summaries in fair use cases
- A Copyright Permissions Service with a step-by-step guide to seeking permission to use copyrighted works
- New information on the TEACH Act
- A TEACH Act checklist to determine compliance
- A memorandum of understanding for copyright ownership at IU
- Updated copyright policies on learning management systems
- Information about licensing and transfer of copyrights
- Information about works in the public domain.

(See: http://www.copyright.iupui.edu/)
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