Information Services and Technology

Information Services and Technology (IS&T) continued to work toward the executive vice president's charge of providing services worthy of MIT. Our focus in FY2011 was on delivering robust core services to the community based on available technologies at a reduced cost to the Institute. Our work is aligned with the following key responsibilities:

- Providing efficient and cost-effective information technology (IT) utility (network services, data centers, software infrastructure) to the MIT community
- Partnering with educational and administrative units to develop processes and solutions that improve service and decision making while lowering cost
- Maintaining receptivity to leading-edge IT knowledge embedded in MIT's academic community and leveraging it where appropriate

At the beginning of FY2011, IS&T implemented an overall reorganization. The new IS&T organizational structure is set up to focus on our customers and partners and is organized to support education, research, and administration, with an aim of strengthening our relationships with stakeholders and improving service delivery. This structure requires areas and staff within IS&T to work together across the organization, building stronger relationships and creating a culture of "one IS&T" concentrating on the needs of the MIT community and making it easy for our community to do its work.

We look to the Information Technology Governance Committee, which was chartered by the provost and executive vice president in FY2010 and consists of senior leadership from across the Institute, to make decisions that assist IS&T and its partners in setting direction, determining priorities, and delivering systems and services. In 2011 the IT Governance Committee helped IS&T drive development of technology strategy through review and approval of our strategic and operational plans and a series of IT roadmaps. The committee also reviewed our annual budget and approved the allocation of the FY2011 software development budget. In addition, it chartered and managed committees and working groups in collaboration with IS&T.

The IT Governance Committee expanded the scope of the Student Systems Steering Committee (SSSC) and the Administrative Systems Policy Coordinating Committee (ASPCC) to include responsibility for the Education Systems and Administrative Systems roadmaps, respectively, and to prioritize and manage their associated portfolios of projects and create alignment between various stakeholders. The committee also supported provost Rafael Reif's charge to the MIT Committee on Educational Technology (MITCET) to determine a strategy and direction to transform the residential education experience.

The department reactivated the IS&T Student Technology Advisory Board with a new charter focusing on the importance of the student experience and the impact IT has on students' work. This board provides a way for students to give input concerning the state of computing at MIT as it relates to the student community. In FY2011, the board reviewed the Education Systems roadmap and engaged in discussions about public computing spaces. IS&T also continued working closely with IT Leaders—a group of

IT directors and managers of IT departments from across the campus—to gather input; share roadmaps and strategic directions; seek information, ideas, and advice on IT-related topics; and solicit and identify opportunities for cooperation on IT initiatives.

IS&T continues its partnership with IT Partners, whose members include IT staff from across the Institute. A member from IS&T serves on the group's board. Many speakers for the IT Partners full-day conference are from IS&T and discuss IT topics of interest.

In addition, IS&T senior leaders established periodic meetings with senior leaders from MIT Libraries and Lincoln Laboratory to identify and discuss areas of shared interest.

Highlights

IS&T continued to support strategic community programs throughout FY2011, including:

- Digital MIT
- IT roadmaps
- MIT150
- Massachusetts Green High-Performance Computing Center (MGHPCC)
- MIT Energy Initiative
- MIT Printing and Digital Archiving Project
- MIT space planning (specifically the Novartis lease resulting in IS&T vacating N42)

Digital MIT

Several task forces recommended simplifying processes and reducing costs for current operational systems and services. In implementing new systems, functions, and operational changes with key stakeholders across the Institute to improve services for students, faculty, researchers, and staff, special attention was paid to automation, standardization, process simplification, and mobility. Examples of key projects included:

- Online grading
- Paperless (undergraduate) admissions
- Online travel logistics
- Online paychecks
- Online W-2 forms
- Electronic requests for payment

Information Technology Roadmaps

Based on recommendations of the IT@MIT Working Group, IS&T began working in partnership with our customers to develop and implement roadmaps for the major

business and technical areas we support: Administrative Systems, Education Systems, Data Management, Mobile Computing, Operations and Infrastructure (multiple tracks), and Customer Support. These roadmaps allowed for better planning between the businesses and the IT areas. Four of the roadmaps have been reviewed and approved by the IT Governance Committee. Progress can be summarized as follows.

- *Education Systems Roadmap (2011–2014):* Reviewed and approved September 29, 2010. This moves us toward a robust, high-impact Education Systems portfolio that has customer-facing functionality and a robust, flexible technical infrastructure.
- *Data Roadmap (2011–2014):* Reviewed and approved January 21, 2011. This will result in an improved reporting infrastructure and improved data administration and practices.
- *Mobile Computing Roadmap (2011):* Reviewed and approved January 21, 2011. This outlines work to increase support for MIT Mobile Web, accessibility for all mobile browsers, device capability detection services, and simplification of mobile software design and development. It also includes guidelines for choosing applications for mobile development.
- *Network Security Roadmap (2011):* Reviewed and approved February 15, 2011. This will result in the implementation of hardware, software, and procedures to increase visibility into the MIT network to better detect and remediate intrusive activity.

Roadmaps under development include the Administrative Systems Roadmap, the Customer Support Roadmap, and additional tracks of the Operations and Infrastructure Roadmap: Computing Experience (desktop, end-user tools), Communication (phone, video/voice conference, and email/calendaring), Security (policy, awareness, prevention, protection, and remediation), Data Centers (servers, storage, and virtualization), and Network (fiber, copper, wireless, routers, and switches, etc.).

MIT150

MIT celebrated its sesquicentennial birthday in 2011 and, as part of that celebration, planned a series of events in which IS&T played a major role. Our Departmental Consulting and Applications Development team worked with the MIT150 planning team to create the anniversary website. A new mobile application for the iPhone and Android platforms was developed specifically for MIT150. The application included a self-guided campus tour that continues to be used today. It also provided special highlights of MIT150 events and exhibits. We hosted an IS&T open house focused on adaptive technologies and usability and accessibility services as well as the use of QuickResponse codes (featured on posters and even a cake) for easy access to the mobile applications and websites.

We participated in Institute-wide planning, assisted with equipping and maintaining a business center for visitors to access computers and the network, and enabled wireless network connectivity in a variety of locations around campus hosting MIT150 events.

Massachusetts Green High-Performance Computing Center

Progress continued on this collaboration among MIT, the University of Massachusetts, Harvard University, Boston University, and Northeastern University to build a high-performance computing center in Holyoke, MA. Building design is nearly complete, and construction work has begun. During 2011, IS&T has actively participated in determining operating principles and guidelines, reviewing budget recommendations, and building and planning the network, ensuring that the new facility will meet the needs of MIT researchers and their work. Once completed, this state-of-the-art green data center will house technologically advanced high-performance computing hardware supporting the rapidly increasing computational needs of these academic institutions, where the cost of electricity is lower than in the greater Boston area. The facility is expected to open in early 2013.

MIT Energy Initiative

IS&T has been working closely with the MIT Campus Energy Task Force in support of its efforts to reduce energy and paper use on the MIT campus. The focus this past year has been on promoting smart printing practices through posters, workshops, and outreach at various campus events and deployment of multifunction devices that consolidate desktop printers and enable behavior change. IS&T has partnered with the Department of Energy, the Lawrence Berkeley National Laboratory, and the MIT Department of Facilities to assess energy use in the data center in W91, with the objective of identifying potential energy-saving measures.

MIT Printing and Digital Archiving

IS&T continues to support this task force effort to enable effective printing strategies, reduce distribution of printed materials, develop record retention policies, pursue electronic storage systems, and reduce overall costs. Recommendations from the task force's March report include campus-wide document management availability and guidelines and principles for printing. IS&T has installed energy-saving multifunctional printers in our offices in W92, E17, and E19 and has begun tracking and documenting savings.

MIT Space Planning

In support of the expansion of global research, MIT agreed to lease Building N42 and its adjacent parking lot to Novartis. As part of this MIT space planning effort, IS&T worked with the space planning offices and the Department of Facilities to optimize the use of space in all of IS&T's buildings and relocate approximately 90 staff from N42. The IS&T Customer Support group, which made up the bulk of the staff in N42, was relocated to E17 and E19. The remainder of the staff in N42 moved to W91 and W92. IS&T's primary locations are now W91, W92, E17, and E19.

These moves were accomplished with no impact on IS&T services. The relocation of the Help Desk and Accessibility and Usability services closer to the heart of campus positions us nearer to most of our customers. The E17 and E19 locations put us closer to the regular walking routes of MIT staff and students and are accessible in bad weather through the MIT tunnels. The new space was fully renovated to provide optimal

customer service, including an all-new learning center—for use by both IS&T and others—that is equipped with audiovisual equipment, IPTV, and Cisco TelePresence video conferencing technology.

This move was accomplished with a tight schedule and through a strong partnership between IS&T and Facilities.

New/Expanded Services

IS&T provides a dynamic environment for our customers and stakeholders. Over the past several years, IS&T has expanded its offerings to respond to increasing demands for new IT services across MIT. Examples of these services include the following.

- IS&T began to offer lynda.mit.edu as MIT's online training service
- WebEx and TelePresence services were made available
- New and more cost-effective storage services were implemented
- Phase 1 of the Enterprise Learning initiative delivered a new catalog of professional development courses offered by MIT's central offices along with a robust training administration, development, compliance management, and delivery platform
- Indiana University's SUNAPSIS International Office case management software system was implemented; the new software enables staff to assist international students in maintaining their lawful stay without interruption
- New physical and virtual tape libraries for Operations and Infrastructure were deployed.
- Support was rolled out for a new Matlab for students
- The Sassafras Keyserver pilot was completed with Adobe products to enable broader use of licensed products at lower cost

Decommissioned/Eliminated Projects, Services, and Systems

In order to meet growing demands and the needs of the community, we decommissioned, eliminated, or migrated several services and systems in FY2011, thus reducing our support burden and allowing for more time and focus in support of current technologies. We did the following:

- Migrated the Stellar and Wiki production and development databases to Linux VMS Solaris
- Migrated the undergraduate admissions database from Oracle 10.2.0.2 on Solaris to Oracle 11.2 on Linux
- Ported pre-1994 transcripts from microfilm to electronic storage, retiring the use of microfilm in Education Systems
- Retired Legacy E40 L550 tape libraries
- Retired the International Students Office (ISO) Xroads application

- Retired the SAP Training and Events Module
- Retired our Sun Fire V440 server platform through a collaborative effort with the Office of the Vice President for Finance (VPF), the production Nimbus system (MIT's budgeting system); this was virtualized and is running Oracle 10g, allowing us to remove our last Sun Fire V440 from service
- Retired the insideMIT portal
- Retired WebLogic (software used for undergraduate admissions MyMIT site)
- Retired iPass

Below are additional details of work done in each operational area of IS&T.

Administrative Systems

The Administrative Systems area focuses on enterprise-wide systems that are critical to administration at MIT. This area works in partnership with VPF; Human Resources; Facilities; the Environment, Health, and Safety Office (EHS); and other key community groups to automate manual functions and support business process redesign to achieve a "digital MIT." In addition, it provides systems for payroll, benefits, employee data, appointments, travel, purchasing, general ledger, custodial and grounds, and other functions. The work of this area is regularly reviewed by the Administrative Systems Policy Coordinating Council and the IT Governance Committee, to which ASPCC reports.

In FY2011, as part of the day-to-day operations of Administrative Systems, over 350,000 paychecks and direct deposits for employees, students, and retirees were processed, along with 100,000 purchase orders, 250,000 vendor invoices, 50,000 requests for payment, 350,000 journal vouchers, 600 EHS supervisor injury and noninjury incident reports, and 3,000 EHS inspections and their findings. In partnership with VPF and Facilities, the Institute financial close and Department of Facilities annual planning processes were also completed. New initiatives are planned for FY2012 that will automate job scheduling, expand monitoring, and update the technology used to exchange information among MIT and external systems.

As part of our ongoing work to maintain and enhance administrative systems, SAP was updated to the latest version. In addition, over 800 requests to enhance systems or correct problems were completed in FY2011. Many of these improvements automated manual processes such as third-party remittance for garnishments, payment of child support, purchase order faxing/emailing, visitor parking passes, and stock room receipts. Improvements to the annual salary review faculty spreadsheets allowed for supplements, eliminating a great deal of manual work. A teletypewriter option was created to access Employee Self-Service, SAP, and the telephone directory for people who have a hearing disability. A manual, custom 1042S application was replaced with a standard, automated SAP version.

W-2s were made available online to faculty, staff, and students; 35 percent of participants selected the paperless option, resulting in 7,600 fewer W-2s printed and mailed during

tax year 2010. Requests for payment were also made available online in FY2011, and by December 2010 over 80 percent of these requests were being submitted electronically.

A multiyear initiative called Enterprise Learning started in FY2011 with the retirement of training event management for the administrative training catalog and registration process. The project will continue in FY2012 by first providing an automated training needs identification function to all training providers and later converting EHS training to the new system and retiring EHSweb.

In FY2011, a number of assessments completed with the help of external experts examined administrative system decustomization, technology, user experience, and infrastructure. These will provide the basis for future planning and investment decisions in FY2012 and beyond.

Education Systems

The Education Systems area focuses on enterprise-wide educational systems, including student systems and the Stellar course management systems. The systems included are Learning Management Systems, Student Gateway, the MIT Student Information System (MITSIS), Financial Aid, Admissions, and systems supporting other student, faculty, and course-based activities. Key sponsors are the departments reporting to the dean for undergraduate education, the dean for graduate education, and the dean for student life, as well as MITCET. The work of this area is reviewed regularly by the Student Systems Steering Committee and the IT Governance Committee, to which SSSC reports.

Pilots for online grading in the Independent Activities Period and spring terms were successfully completed. A total of 5,100 grades were submitted online during the spring pilot. Full rollout will allow final grades to be entered online and will eliminate the manual processing of 37,000 grades per term by the Office of the Registrar.

Electronic document integration through the Stargate project was completed, transitioning undergraduate admissions to a paperless reading and decision process.

Phase 1 of online registration was released for a summer pilot. The departments participating include Architecture, Economics, Management, Aeronautics and Astronautics, Mathematics, Writing and Humanistic Studies, and Linguistics and Philosophy. An expanded pilot is targeted for fall. The full rollout will eliminate paper forms on registration day.

The final phase of the Who's Teaching What project is complete and will allow the Institute to move to a paperless subject evaluation process.

The Textbook Information Project was implemented. This joint initiative among Education Systems, Data Management, the Office of the Dean for Undergraduate Education, and the MIT Libraries was designed to meet new regulatory requirements related to providing students online information regarding required course textbooks.

The Learning Management System (LMS) experiment with Blackboard during the spring term was completed, with 14 courses participating. Results of the experiment

will be presented to MITCET in September and used as input in determining the future direction of LMS at MIT.

Direct deposit for account reimbursement in Student Financial Services was implemented. This eliminates the creation and distribution of approximately 6,400 checks annually.

Data Management

The Data Management area pulls together functions from across IS&T to enhance the value of information at MIT. The IT@MIT Working Group recommended that far more emphasis be placed on improving the way in which we provide management information to support our business. The creation of this area helps IS&T move in that direction. The role of Data Management is to work with the MIT community on the development and execution of plans, policies, and practices to collect, protect, deliver, and make better use of the Institute's data and information assets. Key responsibilities include reporting and analytics, metadata management, business intelligence, data modeling and administration, data access management and security, managed data services, and data governance. Plans and decisions for the work of the Data Management area are reviewed regularly by ASPCC.

The Data Warehouse team concentrated a great deal of effort this year to support SAP, including verifying data, data extract, and load procedures; supporting central departmental testing of support packs; and completing modifications to extract and load processes.

Other data- and reporting-related work included:

- Bringing new data into the Data Warehouse in support of abandoned property, travel, the first phase of e-learning, and online subject evaluation
- Enabling real-time contact information in support of the MIT Alert System
- Improving data modeling practices for IS&T and external departmental projects; in terms of IS&T-led projects, conceptual data models were developed for hourly student appointments, electronic transcripts, pensions, scheduling, online registration, service portfolios, and training needs assessments. External departmental projects included those implemented for Physics (learning objectives) and Institutional Research (online surveys)

Work started in FY2010 to assess and create a written recommendation for a next-generation reporting platform that would satisfy MIT's administrative reporting needs and ultimately replace BrioQuery was completed. A report was delivered with a recommendation to proceed with a 120-day proof of concept with the IBM/Cognos tool suite. The proof of concept was completed, and the tool was acquired. Production rollout is scheduled to begin early in fiscal year 2012. MIT community focus groups have been established in the financial and EHS reporting space. These focus groups will help identify and prioritize community reporting requirements. To date, 12 reports have been created in support of financial reporting. Several of these reports directly reduce the reporting pain points identified by the Singapore-MIT Alliance for Research and Technology.

Development of phase 2 of the reporting and forecasting tool is almost complete. Rollout of this phase, which will deliver forecasting of expenses and people, is expected in fall 2011. This collaborative effort involved 16 departments, labs, and centers and groups across IS&T.

The migration of the majority of the administrative databases to Linux has been completed (in conjunction with other areas within IS&T), and more current versions of the Oracle database software are now available.

The Data Warehouse and Business Intelligence teams have been working closely with the Office of Faculty Support to build a reporting dashboard allowing users to produce longitudinal and comparative reports for online subject evaluation. The data and reporting requirements for this project are very complex and intricate. There are 12 reports, each with four different types of dashboard groupings. The first phase is in its final user testing mode and should be ready to release to users (academic department administrators, assistant deans and professors) at the end of summer or in early fall.

Subject evaluation and response snapshots are extracted from MITSIS after the closing of each survey window, and processes are then run to load the various tables in the Data Warehouse. There are roughly three survey windows per academic term (half term, two-thirds term, end of term).

The Data Management area continued to support administrative SAP applications, as follows:

- An SAP Portal landscape consisting of sandbox, development, testing/QA, and production servers to support the deployment of SAP Enterprise Learning functionality was installed
- Teams from across IS&T worked to execute an IXOS disaster recovery exercise
- The patch levels of server components of the SAP ERP, Portal, and ADS(PI) landscapes were updated in support of the SAP Year-End Support Package updates and the generation of year-end reports and the 2011 payroll
- Additional disk capacity was added to SAP production directories
- The Wily Introscope tool was installed and configured to provide better monitoring of SAP Java components (such as the SAP Portal)
- Data Management, Operations and Infrastructure, and Administrative Systems worked together to test and implement the inclusion of purchase order numbers in email notifications generated out of the fax server used with SAP
- Human Resources (HR) testing environments were refreshed to support the Pension Administration project and to facilitate HR production support activities
- Additional meetings were held with SAP, Administrative Systems, and other IS&T resources to plan external batch scheduler and SAP process integration discovery efforts and the enhancement of monitoring within the SAP environment

- In conjunction with Administrative Systems, analysts worked to prototype archived storage of document attachments for purchase orders, invoices, and work orders

Systems Engineering

The Systems Engineering area supports application development and promotes the interoperability of MIT's applications and systems. This area is a consolidation of complementary functions including Quality Assurance, Technical Services, Web Services, Mobile Computing, Departmental Consulting and Applications Development, Training, Kerberos Development, Software Release Management, and User Interface Design.

The MIT iPhone and Android apps combined now have about 25,000 active users, making them by far the most widely used applications provided by MIT. Campus shuttle tracking and campus maps remain the most used modules of the MIT Mobile native apps. The MIT native mobile application for Android was released and gave Android users in the MIT community the same functionality on their devices as iPhone users. There are now about 4,000 active users on the Android platform. The availability of the MIT Mobile Android code as open source under the MIT license permitted students in professor Hal Abelson's class on developing applications for mobile devices to innovate on top of what had been created by IS&T. Also, since the MIT Mobile source code has been made open and available at no cost, 22 other institutions of higher education have adopted it, including Harvard University and Boston College.

The new modules can be deployed and deactivated automatically and centrally to all devices that have the MIT Mobile apps, allowing us to adapt to the seasonality of our campus in useful ways. For example, fiscal year 2012 plans include deploying a module to support Campus Preview Weekend.

In December 2010, IS&T reached an agreement with lynda.com, an online provider of software training from business applications to web design, to provide MIT students, faculty, and staff access to its catalog of 9,000 courses for a low fixed price. Lynda.com was integrated with the existing MIT authentication mechanisms, allowing members of the community to use their existing MIT user name and password to gain access to the catalog via lynda.mit.edu. The response by the MIT community since the January 2011 rollout has been tremendous, with over 25,000 modules of training completed, the equivalent of almost 3,000 hours of instruction.

Outsourcing business software training to lynda.com and CompuWorks allowed the Training team to focus on providing instruction in the use of MIT-specific enterprise applications such as SAP, Data Warehouse, Stellar, and online registration, helping to drive adoption of these systems. In FY2011, 121 training events were conducted on MIT enterprise applications with 790 attendees.

The Quality Assurance team has been working to automate testing of changes made to enterprise applications, relieving individuals of time-consuming manual testing and increasing testing coverage. A total of 140 tests were automated, representing an

anticipated savings of 760 person-hours of SAP Support Package manual testing for the Finance, Logistics/Sourcing, and EHS areas.

Departmental Computing and Application Development completed 62 projects for the MIT community this year, notable among which are the website and databases for the MIT150 celebration, the MIT Global Challenge website, the MIT Investment Management Company (MITIMCo) content management system, the 2010 Community Giving website, the House Dining Idea Bank, and the Sloan School of Management's "Lead On" website.

The Software Release Management team released CertAID for Internet Explorer in December 2010, facilitating certificate installation and maintenance on the Windows platform. Among other highlights of the past year was the release of Office 2010 for Windows and Office 2011 for Mac, allowing the subsequent removal of support for Office 2003 for Windows and Office 2004 for Mac.

Customer Support

The Customer Support area provides an entry point—a front door into IS&T—for help with IS&T products and services. Staff in this area work closely with customers and internal IS&T staff in other areas to ensure that a positive experience is delivered to our customers. The Usability and Accessibility team works with development teams to make IS&T and MIT services easy to use for all community members. They also operate an adaptive technology lab for students and advise on adaptive solutions outside the lab. The Faculty and Student Experience team works closely with groups such as the Office of Educational Innovation and Technology (OEIT) in the Department of Undergraduate Education to nurture innovative partnerships and advocates for IS&T services that meet the specific needs of the faculty and students. The Help Desk and associated customer service groups aim to provide easy access to a comprehensive collection of support services including general computing and telephony help, a self-service knowledge base, accounts and authorizations, hardware and software repair, and distribution of volume and site-licensed software.

Making tools easier to use and improving overall customer service continued to be a focus of Customer Support in 2011. This was accomplished through a variety of activities including events, process and tool improvements, customer experience improvements, special services, and community outreach, as well as a relocation to the east campus.

Successful Back to School 2011 events included five "Computing @ MIT" presentations attended by about 1,000 students. In addition, we conducted another "Computing @ MIT" session attended by 75 students, hosted an N42 open house attended by 35 students, and staffed tables at the Academic Expo and the Health and Wellness Fair through which we had contact with roughly 300 students. We produced version 2.0 of the campus map.

A Help Desk assessment was conducted by Dell Professional Services. Information from this study was used to identify and prioritize Help Desk improvement efforts, including a project currently under way to improve processes used for escalating difficult technical

issues. This project has produced troubleshooting checklists, process maps, and operational-level agreements for commonly escalated issues in Stellar, HR Payroll, and Exchange. Its goal is to improve responsiveness and turnaround time to our customers.

The upgrade to RequestTracker 4.0 (RT) is complete, and this ticket-tracking system is in use by IS&T and about 50 other groups around campus. Ten RT training sessions were held.

Accessibility and Usability teams improved the user experience on more than 100 projects. These included key IS&T projects (RAFT, eW-2, SAP WebDynPro, online grading, mobile apps for the Android platform, the IS&T website, online registration, and IS&T online training) as well as MIT-wide projects (MIT150, TechTV captioning, TIP, OCW [OpenCourseWare] Scholar, OCWare, the Poor Economics presentation, and projects for the Department of Brain and Cognitive Sciences and the Sloan School).

A Pharos hold-and-release printing solution was rolled out to public student printing locations. This will significantly reduce paper waste and provide a more consistent and sustainable public printing strategy. Customer Support also worked with Facilities on plans to rework the Athena cluster in W20 to facilitate use of laptops and small-group work.

MIT Alert is now working with real-time updates to personal contact information. The website was updated to send notifications to the community through the MIR3 system. This allowed Security and Emergency Management Office (SEMO) staff to directly initiate email notification to the community. A two-factor authentication system was implemented for the dashboard to prevent intruders from triggering bogus notifications to the community.

Electronic survey services were supported for both MIT and related outside organizations such as the Consortium on Financing Higher Education. Several surveys were offered jointly by IS&T and the Provost's Office: the Enrolled Student Survey (30 schools), the Senior Survey (6 schools), the Postdoctorate Survey (5 schools), and the Faculty Survey (2 schools).

We supported Campus Preview Weekend registration for pre-freshmen as well as their MIT student hosts, after-action surveys for pre-freshmen and their parents, and the MIT Campus Activities Committee's running of the annual Red Sox ticket lottery.

Both undergraduate and graduate student lotteries were supported. IS&T provided a website where students indicate preferences, with Housing staff running the actual lottery algorithm.

Customer Support provides IS&T representation in developing a vision for MIT 2030 for teaching and learning spaces.

Operations and Infrastructure

The Operations and Infrastructure (OI) area provides MIT's foundational technologies, such as the network, email, calendaring, data centers, and servers. This area enables

delivery of services, provides communication and collaboration services, and advances computing support services in partnership with departments, labs, and centers. Key responsibilities include network operations, network installation (including support of key construction projects across campus), server and system administration, distributed IT support of desktops and servers, desktop virtualization, security systems and services, and research computing support. The work in this area is reviewed regularly by the IT Governance Committee.

IS&T migrated the SAP production environment from older SPARC/Solaris hardware to an Intel-based, virtualized Linux environment; in the process, the production environment was also migrated to a new storage backend and relocated to the OC11 data center. This update provided significantly enhanced performance for SAP applications, as well as improved options for high availability, maintainability, and disaster recovery of MIT's SAP production environment.

IS&T completed the retirement of the five-plus-year-old EMC DMX-800 storage arrays that provided service for our "tier 1" enterprise applications (SAP, Data Warehouse, MITSIS, etc.); this ensured that these critical applications remain stable and highly available. We completed the renewal of our midtier storage platform in our test and development environment; as part of this upgrade, we introduced two new technologies: a lower cost disk tier based on inexpensive SATA drive technology and network-attached storage, IP-based storage connectivity. Both of these technologies allow us to supply highly available, enterprise-grade storage to applications with lower input/output needs at a significantly reduced cost relative to our previous entirely fiber channel–based storage environment; since the deployment, we have been able to migrate over 70% of our test and development virtual machines to this lower cost storage tier. IS&T completed the purchase of the arrays needed to bring this capability to our production environment in OC11 and, at the same time, purchased dedicated storage arrays for our TSM backup environment, which will prevent the performance issues that sometimes arise due to resource contention between TSM and other production workloads. IS&T will now operate more than 750 TB of enterprise storage within its data centers and over 1.5 PB of tape backup and archive data.

We retired our two StorageTek L5500 automated tape library units, housed in W91 and E40. One of these units was replaced with a newer tape library, housed in W91. The other was replaced with a hard-disk-based deduplicating virtual tape library, housed in OC11. Deduplication technology allows for only a single copy of data to be stored when multiple copies of the same data are backed up, greatly increasing storage efficiency. This deployment furthers our strategy of increasing the presence of disk-based storage backends for backup and archival data wherever possible, reducing data center space consumption and greatly increasing the speed of both backup and restore operations.

Our VMware enterprise license agreement was extended, granting MIT use of the VMware View product line for virtual desktop infrastructure (VDI) management. IS&T has also completed a proof of concept demonstrating basic functionality for a Windows-based virtual desktop environment, including client access on all supported IS&T desktop platforms as well as select thin clients and iPad mobile devices. This VDI

deployment will make our desktop management process more secure and efficient and bring many of the benefits MIT has experienced from server virtualization to the desktop.

The Microsoft Exchange servers were upgraded from Exchange 2007 to Exchange 2010 and will provide improved features and the necessary foundation for bringing Microsoft SharePoint to the MIT community. One of the improvements most visible to the community will be the ability of additional non-Microsoft browsers (such as FireFox or Safari) to access an improved version of Outlook Web Access. IS&T is approximately halfway through transitioning into a single voicemail system from multiple systems that are at the end of product support. The combination of Exchange 2010 and the new voicemail system also provides benefits of voicemail integration whereby voicemail goes to users' email inbox, allowing them to listen to a voicemail by clicking on an email in coordination with the desktop new message indicator. This migration is targeted for completion by the end of calendar year 2011.

In order to provide ubiquitous indoor coverage of mobile/cellular signals, we have been working with AT&T to evaluate various network designs and deployment of equipment. The program will be completed in three phases. The first phase will involve 49 buildings, including the new Sloan and Koch Institute for Integrative Cancer Research buildings. The design for all 49 buildings has been approved, with networks in more than 70 percent of the buildings under construction. We expect the benefits to be realized for those buildings by the end of September. We also expect Verizon, Sprint, and other carriers to improve in-building coverage, as the design/equipment is carrier agnostic. AT&T is in active conversations with Verizon and Sprint.

Work has been undertaken to evaluate, integrate, and demonstrate the capabilities of video and web conferencing solutions such as Cisco's TelePresence and WebEx. The interoperability of these solutions with other video conferencing solutions has been explored. MIT TelePresence units have been deployed on campus, including a large-screen unit in E17 and two smaller units in E19. Ties to other groups using this technology, including Academic Media Production Services and the Sloan School, are forming.

IS&T completed numerous network projects, including the following:

- Installation of new networks (wireless and wired) for E62 (the new Sloan building) and 76 (the new Koch Institute building) and substantial completion in W1
- Upgrade of the in-building networks for Buildings 2, 4, 17, E15, E34, and E38; Endicott House; and the Bates Linear Accelerator Center and planning for network upgrades in Buildings 9, 10, 24, N51, N52, and E53
- Upgrade of the W98 (Resource Development, Alumni Association, and Bates) MITnet fiber network from 100 Mb Verizon TLS service to 1 Gb MITnet service
- Provision of high-speed network connectivity to major research networks including the Energy Sciences Network, the Large Hadron Collider network, National LambdaRail, Manhattan Landing, and Internet2 to enable MIT's world-class physicists to stay at the forefront of their research

- Upgrade of networks for/to Buildings 2, 4, 10, 24, 26, N51, N52, E15, E34, E38, and E53 and Endicott House
- Establishment of connectivity and upgrade for Bates from 100 MB 3COM to GB Cisco switches
- Upgrade of the campus wireless network to close to 4,000 802.11n access points, providing higher bandwidth, seamless roaming on campus, and improved manageability via a centralized controller architecture

This year marked a dramatic turn in MIT's IT security philosophy. In concert with key campus decision makers, a new vision has begun to emerge that combines risk management principles with utility-grade technologies to sustain and deepen the confidentiality, integrity, and availability of MIT's digital assets. At the same time, we remained diligent in our efforts to increase campus security awareness and to make MIT a safer, more civil, and more legally compliant computing environment.

Cisco UCS with blade servers has been installed, replacing the older Dell systems. This results in reduced power, space, and heating, which provides for a greener data center.

We began development of an advanced IPTV system with Comcast to replace outdated and expensive cable TV services. The IPTV system does not require traditional cable installation throughout buildings, instead using already-existing fiber optic and wireless networks for distribution of TV content. This will also allow support of many different types of devices, including desktop and laptop computers. Windows/Macintosh computers could be used to receive this service initially. A student pilot is planned for fall 2011.

OI launched an evaluation of IT service management tools, with a focus on developing a more comprehensive change management process using a tool that could easily be extended to improving other IT processes (asset management, incident and problem management, etc.). After a review based on market research and recommendations from peer institutions, we have opted to proceed with BMC Remedy OnDemand, a leading SaaS (software as a service) IT service management solution. OI carried out a proof of concept for this software, culminating in a decision to purchase the product and roll it out to all OI staff by the end of the second quarter of FY2012. Use of this product will greatly improve our ability to track, review, and report on changes made in our production environments, increasing visibility of changes to Customer Support staff and enhancing our internal communications. It will also increase the stability of production and development environments, allowing improved and more consistent service to our customers.

The Red Hat Network service was updated, providing Red Hat Enterprise Linux systems with automated software updates to reduce system administration load and ensuring that servers are running the latest system software and security updates.

Legacy (Integrated Services Digital Network) phones were migrated to Voice over Internet Protocol (VoIP) phones in areas with network infrastructures capable of supporting MITvoip, resulting in more than 9,800 new MITvoip phone accounts. We

reduced the number of primary rate interface lines connecting MIT to Verizon and other primary carriers from 48 to 8. Using Session Initiation Protocol (SIP) trunks for outgoing calls has already saved MIT 50% of its long-distance call rate, and the completion of SIP trunk installations will allow us to drop six more lines.

IS&T Administration

The Administration area includes Communications, Finance, Human Resources, Project and Process Management, and general administration. In support of the operational areas of IS&T, Administration works closely with the associate directors, managers, and staff in IS&T to develop standard work processes to improve the consistency of project and service delivery; streamline accounting and administrative processes to make it easier for IS&T to measure, manage, and account for our services; and provide transparency through communications to our community and staff.

Much of the work in FY2011 focused on process improvement and alignment of administrative services in support of the new organizational structure. Process improvements included:

- Expanding the IS&T Pipeline forum for communication and coordination of changes to IS&T services with end-user or business impact (such as IS&T-wide blackout dates, major releases, patches, updates, and renewals)
- Developing the IS&T service portfolio, including defining and mapping out service families and offerings
- Formalizing the publishing process for IS&T outage reports and drafting email outage procedures
- Coordinating a Project Management and Business Analysis Working Group to focus on the project life cycle and develop templates for business case, scope, stakeholder engagement, the project kickoff meeting, and the communication plan

As part of our approach toward transparency and accountability, we engaged in quarterly project reviews to discuss, address, and examine outstanding issues and risks. This enabled us to better track project deliverables. We also performed quarterly operational reviews to track our progress against the operational plan. The budget was monitored and tracked monthly, and we produced a midyear progress report for our customers and stakeholders.

We launched IS&T News Update, our monthly HTML email newsletter to the community. This newsletter is intended to update community members regarding IS&T's projects and services. Most of the articles focus on work we are doing for and with our customers and stakeholders.

IS&T's ongoing commitment to supporting the growth and development of our employees was addressed in several ways. We were able to hire 46 new staff members and conducted a salary review. Many staff took on new roles with the reorganization. In order to support their new roles and help them adapt to change, we offered a series of classes on various topics including harassment prevention, managing ourselves during change, employment law, providing constructive feedback, the corrective action process,

active listening, and diversity and inclusion. These classes were offered in conjunction with Central HR and the Office of the General Counsel.

Based on what we learned from the Institute-wide Planning Task Force recommendations around location-independent work, we created an online IS&T guidelines and best practices manual that includes flexible work arrangement guidelines.

IS&T hosted another successful Infinite Mile event. We combined our Infinite Mile Award ceremony with the holiday celebration and honored two individuals and two teams during the event. Our rewards and recognition program had an active distribution of 91 spotlight awards for achievements throughout the year.

Summary of FY2011 Financials

IS&T has a complex financial structure supporting the central IT work of the Institute. IS&T's gross expense budget for FY2011 totaled $68.9 million, of which $66.5 million was spent, resulting in a favorable variance of $2.4 million (4 percent) under the gross expense budget. IS&T provides its IT services through various funding models that include the general Institute budget, software development, revenue recovery, and service centers.

The general Institute budget for IS&T in FY2011 was $29.4 million, of which $26.8 million was spent, creating a favorable variance of $2.6 million. This variance can primarily be attributed to a large number of positions that were or became open in FY2011, as well as a significant shift in the amount of time people worked on software development–funded projects.

IS&T used $9.1 million of the annual $9.5 million funding pool for software development projects. Approximately 48 percent ($4.3 million) was spent to develop Education Systems projects, including online grading, online registration, online subject evaluation/Who's Teaching What, and scheduling analysis. An additional 25 percent ($2.3 million) was spent to support software development projects for Administrative Systems, including Appointment Process Redesign 1.1, Enterprise Learning Phase 1 and Phase 2 (Requirements and Design), and hourly student appointments projects. The remaining 27 percent ($2.5 million) was used for software infrastructure projects including the MIT Mobile app, Kerberos, the reporting and forecasting tool (Phase 2), and IBM Cognos proof of concept projects. (Note that the amounts listed above do not include actual expenses incurred for the Pension Administration Outsourcing Project and the Global Initiative Project. These two projects will receive funding that is outside of the annual $9.5 million software development pool.)

Approximately 37 percent of IS&T activity ($21.3 million) is funded from services that are billed to departments for telephone and network services, server management and collocation services, and other rate-recovered services such as desktop support, software distribution, and departmental website and database consulting and development. In FY2011, funding from these sources was $936,000 higher than budgeted.

The Telephone and Network Service Center (TNSC) ended the year with an operating deficit of $279,000, $146,000 higher than the FY2011 budgeted deficit of $133,000. This unfavorable variance, which was due to higher-than-budgeted operational expense settlements and lower-than-anticipated revenues for demand-based services, was partially offset by lower interest rate charges. Investment in new capital assets totaled $10.8 million, or $167,000 less than the FY2011 capital budget of $11 million. TNSC operating and capital expenditures provide funding for telephone and network infrastructure maintenance and upgrades, including building network upgrades, telephone and data communications room renovations, VoIP rollouts, and data center expansions and upgrades.

The Server Operations Service Center (SOSC) ended the year with an operating surplus of $399,000, which represents a favorable variance of $313,000 relative to the budgeted surplus of $85,000. Higher-than-budgeted depreciation and settlement expenses for SOSC were more than offset by higher-than-budgeted revenue. This favorable revenue variance is primarily due to increased demand for server operations services. Capital investment expenses in SOSC for FY2011 totaled $1,744,542 and consisted of server equipment, automatic tape library, and storage area network storage.

Looking Forward

IS&T is proud of its achievements over the past year in improving our services. As we look to the future, IS&T is committed to advancing the Institute's mission by providing foundational IT services that make it easy for the MIT community to communicate, collaborate, and interact with MIT and beyond. In FY2012, we will focus on improving service delivery and increasing self-service while improving the customer experience, optimizing the effectiveness of operations both within IS&T and between IS&T and other groups, reducing technical and security risks to MIT, and engaging and developing our employees through challenging work and growth opportunities.

Marilyn T. Smith
Head of Information Services and Technology