Information Systems and Technology

Information Systems and Technology (IS&T) began a multi-dimensional transformation in fiscal year 2015 to an organization with a new operating model and a new organizational structure. Informed by guiding principles from the Office of the Executive Vice President and Treasurer (EVPT) and by MIT's 2020 IT Vision, the department began its transition to a new infrastructure based on high-velocity innovation, open architecture to meet differentiated needs, and Agile methodology.

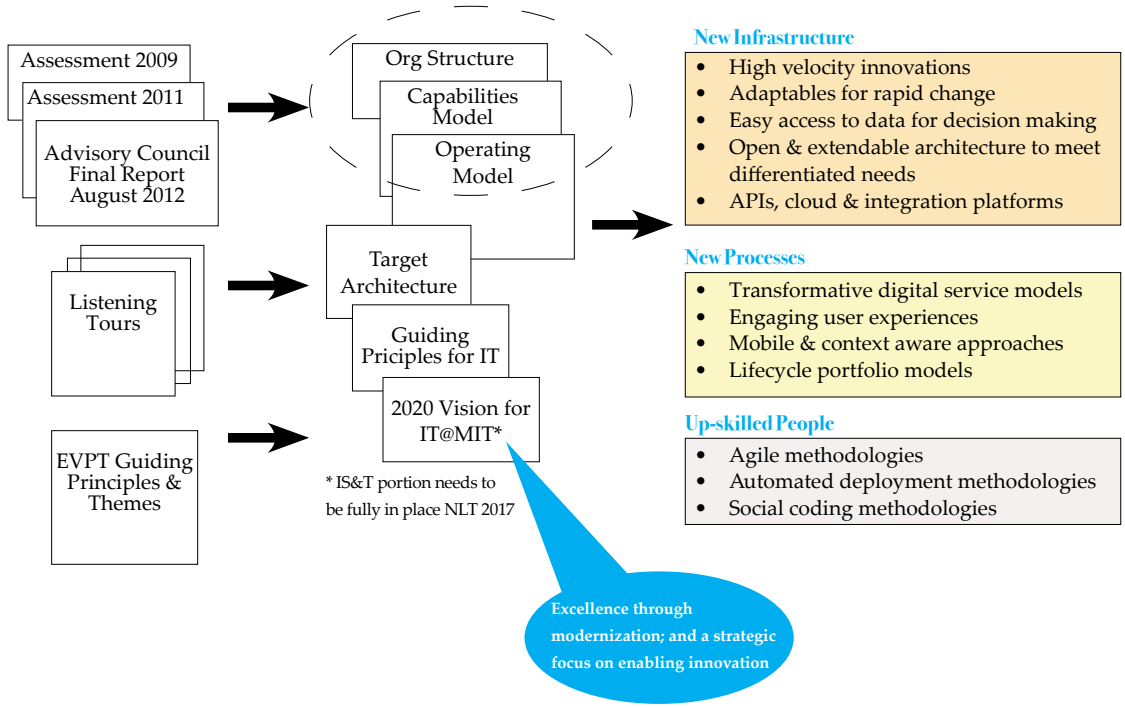

Figure 1. Assessment of Institute's needs: Drove convergence on a vision, guiding principles, target architecture, new operating model, new capabilities mode, and new organizational structure

During FY2015, the IS&T Project Portfolio was finalized; services were mapped to the new organizational structure and teams were matched to services. IS&T consolidated responsibilities and identified ways to improve how IS&T works, created transition workbooks and a change management team, and provided staff with training in Agile and Scrum methodologies.

Enabling MIT's 2020 IT Vision

Proof of Concept Projects

The move to an Agile IT organization that engages with the community began in 2014 with the launch of 16 proof-of-concept projects. The goal was to facilitate the transition to platform-based IT service models designed to better meet the needs of MIT's complex ecosystem of IT service providers and consumers. The proof-of-concept projects, which were completed in FY2015, include:

- Cognos multi-tenant platform system
- Creation of application programming interfaces (APIs) for legacy MIT Student Information System (MITSIS) academic records
- Creation of APIs for legacy MITSIS student accounts
- Creation of APIs for mobile
- Dropbox (next-generation storage services)
- Integrate membership service module with the MITx service platform
- Integrate membership service within the Sloan School's academic and administrative processes
- Knowledge base APIs
- Mendix application development platform: receipt capture
- Mendix application development platform: vacation tracker
- Mendix application development: room inventory and reduced load petition
- Metadata management system
- Roles and governance, risk and compliance integration for segregation of duties conflicts prevention
- SAP APIs
- Self-service private cloud
- Shibboleth-delegated authentication

Senior leaders and stakeholders liked what they saw and have pledged their continued support.

Launch of the 2020 IT Vision

The launch of the 2020 IT Vision began in February 2015 with two initial phases. During the first phase (February 19 to March 19), IS&T identified responsibilities across the department, moved staff to new teams and roles, and encouraged conversations about the transition and cross-team collaboration.

In the second phase (March 20 to April 10), the department began the transition of responsibilities, identified training needs and opportunities, and deployed new tools in support of the strategic vision.

IS&T's New Operating Model

The IT context continues to change at an accelerating pace. In the past, IS&T optimized its services for performance, reliability, and cost. Given today's rapid IT changes, the department is now optimizing for time to market and user experience. Key themes include supporting the work of innovation teams, enabling rapid deployment of new services, and driving operational excellence across all systems and services.

To enable this transformation, the IS&T organization has been streamlined from seven groups with 37 teams to three capability groupings with 14 teams—Emerging Solutions, Enabling Services, and Administration and Planning. This operating model, powered by a sense of strategic urgency, is designed for speed and agility.

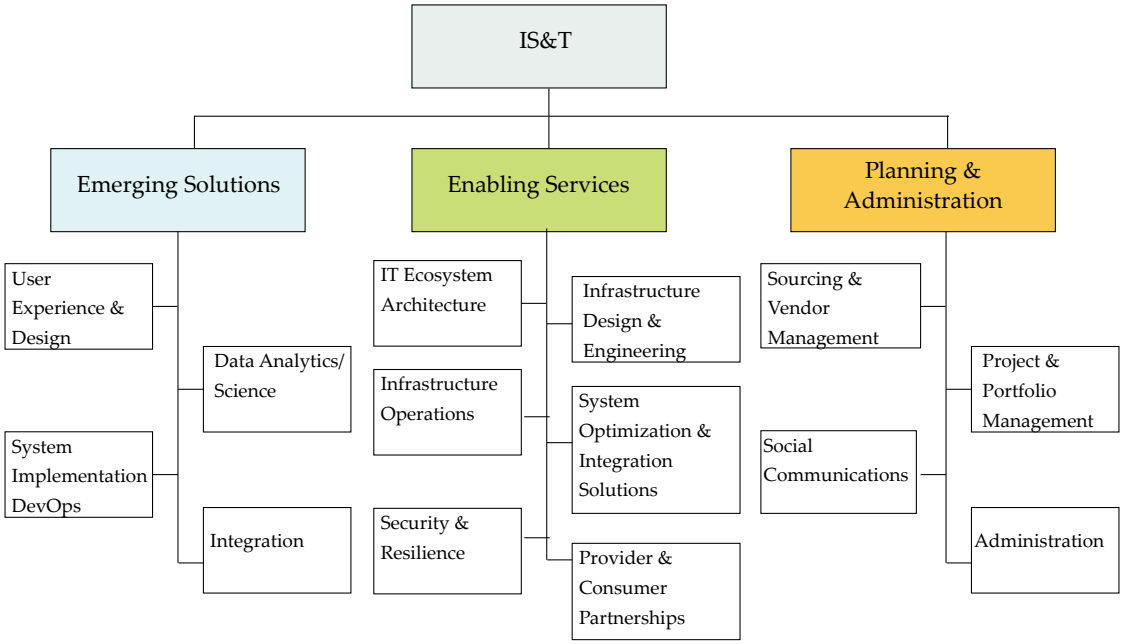

Figure 2. IS&T's New Organization Chart with Three Capability Groupings

Emerging Solutions

This group collaborates with teams across MIT to develop new systems solutions, employing holistic and integrated approaches to transform business outcomes for administrative and student systems. These efforts increase the responsiveness of IS&T (and IT@MIT ecosystem providers) to community needs and enhance MIT's overall capacity for innovation. Emerging Solutions consists of four teams: User Experience and Design, Systems Implementation Developer Operations (DevOps), Data Science, and Integration.

By handing off its projects to Enabling Services, the Emerging Solutions group can focus on the next round of innovations.

Enabling Services

This group is responsible for rapidly deploying at scale new IT services in the IT@MIT ecosystem and for ongoing operations, support, and security of all IS&T IT systems and services. Enabling Services consists of seven teams: IT Ecosystem Architecture, Infrastructure Operations, Security and Resilience, Service and Process Coordination, Infrastructure Design and Engineering, Systems Optimization and Integration Solutions, and Provider and Consumer Partnerships.

Planning and Administration

This group provides project- and portfolio-management and support services, workforce planning, and financial and administrative support services for the Emerging Solutions and Enabling Services groups. Planning and Administration improves consistency and efficiency in the operational processes supporting IS&T. Planning and Administration consists of four teams: Sourcing and Vendor Management, Project and Portfolio Management, Social Communications, and Administration.

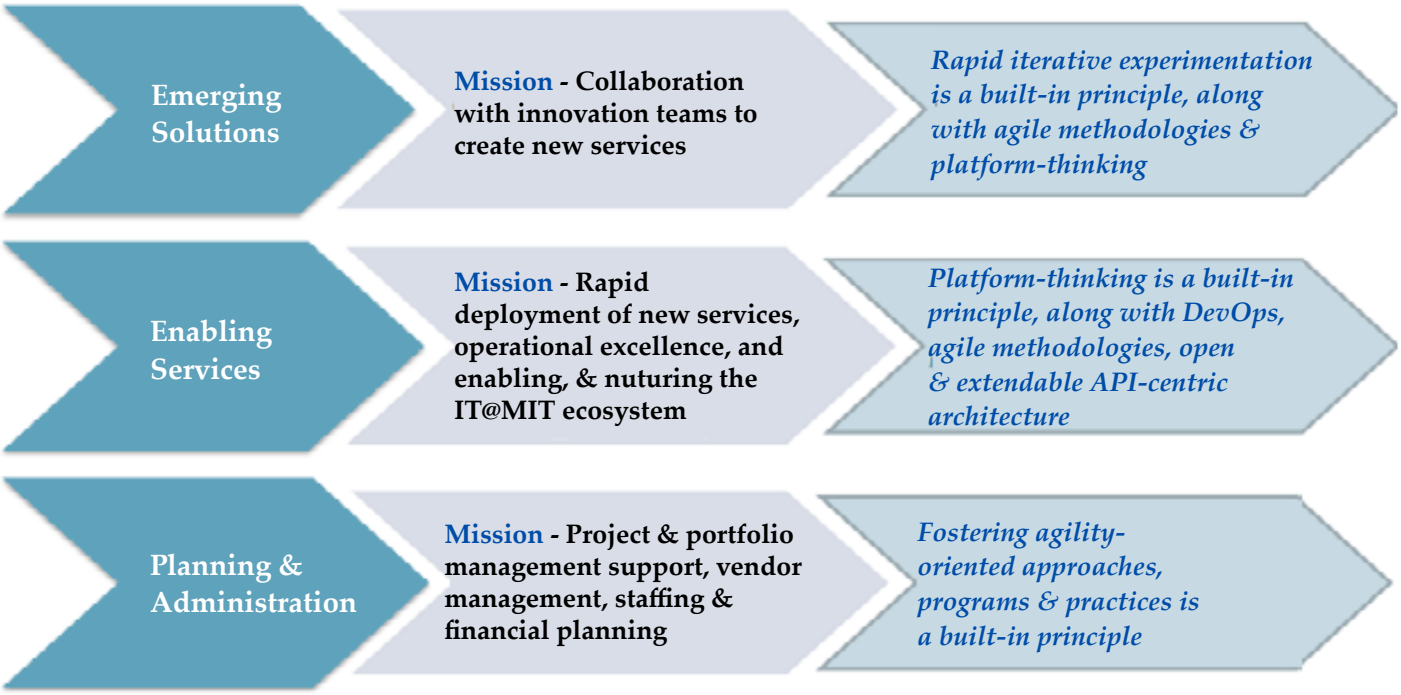

Figure 3. Agility-oriented operating model—designed for speed, strategic urgency

An Agile Mindset through AgileTraining

Over the past year, IS&T has actively fostered agility-oriented mindsets and behaviors, encouraging staff to be proactive and adaptive and to grow and share.

In collaboration with Scrum Inc. the department designed a training program so that all IS&T staff and interested IT partners would have the fundamental knowledge and skills needed to move to Agile methodologies. Courses offered in FY2015 included Fundamentals of Agile, Scrum, and Kanban; User Stories; Scrum Master Training and Certification; and Product Owner Training and Certification.

IS&T Engagement Model and Working Group

Given the extent of these changes, IS&T recognized that it needed to embrace multidimensional engagement for a multidimensional community. An IS&T Working Group was chartered to draft a community engagement model as a way to address different segments of the community and to integrate, streamline, and mature processes. The model's principles of engagement include:

- Put the community experience first, process second, organization third
- Establish consistent, integrated views of the community
- Effect real and meaningful change in the way the community interacts with IS&T
- Build rapid iteration and continuous improvement into the model
- Develop and nurture strong partnerships with the community
- Facilitate and enable digital transformations of MIT's business processes
- Recognize that internal communication and sharing of information within IS&T is key
- Ensure that every relationship has an owner accountable for its success
- Ensure that engagement drives work in IS&T

The team finalized its initial draft model in June 2015.

IT Governance

The IT Governance Committee held meetings with agendas that included a wide variety of topics, efforts, and accomplishments. They included:

- IT@MIT strategic planning
- Faculty IT Policy Committee charter
- Portfolio management
- IT governance roadmap and initiatives
- Information Technology Policy Group
- Duo two-factor authentication demo
- Internet Protocol version 4 and Internet Protocol version 6
- Faculty IT Policy Committee report
- Memorandum on strengthening the security of MIT's IT environment
- IS&T project and service portfolio model
- IS&T transformation metrics
- Committee on Research Computing
- Administrative Systems: Research Administration
- Administrative and Student Services roadmaps
- Anthem data breach and Duo authentication
- Budget update for IS&T's IT portfolio
- IT@MIT Transformation update

Highlights for IS&T

FY2015 was a year of significant change for IS&T, with the adoption of an Agile operating model and the movement of staff members to new teams and roles.

Meetings with key stakeholders validated the new organizational structure and highlighted considerations for how to improve and modify IS&T's engagement model. The department also held Q&A open houses, providing a forum for staff to learn more about the process and providing the Change Management Team with feedback. A Change Advisory Board was created to review major changes to IS&T's critical IT systems and ensure that updates would occur without disruption to the MIT community.

Following are highlights of work completed in FY2015, in alignment with themes from the EVPT.

Enabling MIT's Future

Network Improvements

In FY2015, IS&T improved network connectivity, wireless access, and in-building cellular service; strengthened network security; and offered several new services, including some cloud-based options.

On campus, several network projects were seen to completion.

- Institute network connectivity was improved through the addition of redundant connections to existing service providers, enabling greater resiliency in the event of device or provider failure. Border routers, network devices that link MIT to the internet, were upgraded to provide for increased performance and next-generation networking technologies.
- As MITnet users continue to rely more heavily on the wireless network, the Institute has committed to staying at the leading edge of wireless technology. IS&T's ongoing campus-wide upgrade of the wireless network continued into FY2015 and is approximately 90% complete, with more than 4,500 campus wireless access points upgraded. The new wireless technology, 802.11ac, provides speeds of up to 1.2Gb/s, four times that of the previous technology.
- MITnet connectivity was extended to off-campus Buildings E94, EE19, and EE20.
- IS&T improved in-building cellular service by installing AT&T neutral-host distributed antenna systems in 13 additional buildings on campus.
- Cabling upgrades were made in Buildings 66 and 41.
- IS&T added uninterruptible power supply (UPS) for improved resiliency to more than 45 Edge equipment racks on campus as part of a UPS pilot program; more than 100 Edge networking switches were upgraded.
- With an outside consultant, IS&T completed an assessment for all telecommunication rooms (TRs) on campus and secured more than 60 TRs with card access as part of a TR security pilot program. IS&T also completed a draft standards document for IT infrastructure installations and TR construction.

Two legacy systems were retired, with users migrated to new platforms:

- All users of the Cyrus IMAP email platform were successfully migrated to Microsoft Exchange. This is a major milestone, marking the completion of a 3-year project and allowing for a future move to a cloud-based messaging platform.
- The Tivoli Storage Manager (TSM) desktop backup platform was retired, all users having been successfully migrated to CrashPlan, a cloud-based backup platform. This migration allowed the reclamation of significant storage resources, including 464 data tapes and enterprise-class storage totaling 130 terabytes.

IS&T continued to improve network security in FY2015.

- The Veracode platform was put in place, enabling IS&T to test enterprise applications for security vulnerabilities. It provides automated and human analysis coupled with tailored training to address the source of any vulnerabilities found.
- Splunk, an IT log analysis platform, has been implemented in several operational areas of IS&T and is expanding rapidly. Splunk gathers logs and data across disparate and diverse systems to provide monitoring, correlation, and reporting capabilities that improve visibility and troubleshooting across the IT enterprise.

Connections with external networks and vendors led to several new service offerings:

- MIT became a member of eduroam, which is a secure, worldwide WiFi service that provides network access at thousands of educational and research institutions. The service increases collaboration and provides an easy means for MIT community members to connect to wireless networks at participating institutions.
- MIT regional optical network capacity was expanded to a new point of presence in Albany, providing for additional capacity and enabling future 100 Gbps connectivity.
- XFINITY On Campus, a service that provides television content over the network, was announced to on-campus community members. MIT co-developed this offering for higher education with Comcast over the past several years.
- Private links have been established between MIT and cloud service providers including VMware, Amazon, Ellucian, and SAP. These links allow the MIT community to host services and move computational workloads to the cloud with connectivity at parity with on-campus locations.
- Working with market-leading public cloud infrastructure providers, such as Amazon and VMware, and developing an on-premises private cloud service offering for the community, IS&T continues to explore how cloud technologies can be leveraged to increase IT flexibility and agility.

Advancing Agility of DLCs and Administrative Units

Deployment of Enterprise Software

FY2015 saw the release of many cloud-based enterprise software solutions at MIT. IS&T worked with vendors and other MIT offices to make this happen. Offerings now available to the community include:

- Dropbox for Business, an MIT-wide cloud storage platform
- CrashPlan, a cloud-based desktop and laptop backup solution
- An initial MIT community release of Duo Security for two-factor authentication on an opt-in basis, providing additional security for web applications using MIT Touchstone and MITnet VPN connections
- Microsoft Office 365 mobile applications
- GitHub Enterprise, an MIT-wide software source code management and version control system (working with the MIT Office of Digital Learning)
- Quickbase, an online database platform and application development environment [working with the MIT Office of Major Agreements and the Office of Sponsored Programs (OSP)]
- Pilot deployment of Tableau, a new business intelligence and data visualization tool to complement IS&T's current Cognos reporting offering
- Pilot deployment of LastPass, a personal password management application
- SolidWorks, a solid modeling computer-aided design and engineering software program that runs on Microsoft Windows

In related work, IS&T evaluated a pilot offering of LabArchives, an electronic lab notebook service offering for use by MIT researchers. IS&T also implemented ServiceNow for asset management of IS&T-deployed desktops and laptops, retiring a legacy FileMaker database application

Customer Support

IS&T provided accessibility and usability evaluations for 118 MIT projects, consulted with 142 individuals needing assistive technology solutions, and provided 1,226 course materials in accessible formats for 52 MIT courses. The IS&T Service Desk took 39,000 calls, resolved 41,500 tickets, and saw 5,500 visitors in its walk-in space. The Service Desk also established a new scheduling tool and improved Contact Center and walk-in coverage to minimize the wait time for the community.

IS&T assisted its Distributed IT Support customers with software transitions and rollouts and provided a range of other services:

- A pilot of Casper, enterprise management software for the Apple platform, and of the System Center Configuration Manager within supported departments, laboratories, and centers (DLCs)

- Continued implementation of the Board Effect eBinder solution for Corporation meetings and for use by other committees
- Deployment of more than $2.5 million in equipment
- Assistance with the WIN domain cleanup

Technology consulting was also in high demand during FY2015, from room redesigns to configuration and implementation support. Projects included:

- Redesign and renovation of Room 4-167, a small Athena cluster, into a flexible student learning space (working with Space Planning and the IS&T Student Technology Advisory Board)
- Partnering with the Campus Activities Complex and Space Planning to begin a redesign of Room W20-575 into a more flexible student collaboration and technology-enabled learning space; the most recent milestone was a student design charrette led by Professor Rafi Segal of the MIT School of Architecture and Planning
- Support and workflow implementation for the Radix Endeavor and Taleblazer educational games (out of the MIT Education Arcade in the Media Lab) in Request Tracker
- MIT Computer Science and Artificial Intelligence Laboratory AppInventor architecture and infrastructure updates to support adoption and use in China (in partnership with Professor Hal Abelson)
- Partnering with the Office of Digital Learning on the MITx 3.091r Chromebook configuration, setup, and deployment, managed through the MIT Google Apps domain for supervised testing

Enhancements to Data Center Infrastructure

IS&T completed significant capacity expansions of MIT's data center storage and virtualization environments (Cisco UCS servers and EMC VNX storage) to support new work and add redundancy to existing systems. IS&T also worked with OSP to roll out Kuali Coeus, a major upgrade to MIT's grant management system. IS&T's involvement included contributions and enhancements to the data center infrastructure as well as integrations with SAP and the MIT Data Warehouse.

Modernizing User Experiences

IS&T deployed or upgraded various releases and services of importance to the community:

- A major release of the Atlas administrative portal, including new functionality for commuter benefits, parking, events management, and journal vouchers, in addition to a new high-redundancy infrastructure architecture to reduce risk for future software upgrades;
- A new version of the MIT Kerberos account registration process that eliminates a dependency on the browser Java plugin and simplifies the user experience; and

- A hardware upgrade and expansion of all MIT SAP environments, fully virtualizing these systems and providing additional performance and redundancy.

Two developments are of particular benefit to students, faculty, and DLC administrators at MIT—core development of the Modular Service Framework (MSF) learning management system, the successor to MIT's legacy Stellar platform, and a full-featured proof-of-concept of the Student Dashboard.

The MSF has a focus on customization and extensibility. The MSF platform implements specific learning management system functionality (e.g., course calendar, course materials) as individual Web services that can be used either as standalone modules or as part of an integrated, end-to-end learning management system solution. These services can also be invoked from within other learning management systems such as MITx and Moodle—both of which leverage MSF APIs.

IS&T also implemented a full-featured proof-of-concept of the Student Dashboard, a transactional hub that reimagines the way students access and interact with the universe of information that relates to them at MIT. This personalized transactional gateway enables DLCs and business units to customize the student experience by tailoring events, alerts, and calendar items to particular cohorts, groups, or even individuals.

Other application upgrades that have improved the student experience include:

- New application functionality to streamline the I-9 form process for student employees, including automatic generation of I-9 forms for students and an improved workflow for administrators of graduate student appointments via WebGradAid, and
- A major upgrade of the International Students Office Sunapsis application to support changes in the federal government system (SEVIS) with which it integrates.

IS&T Administration

IS&T Planning and Administration worked closely with senior leadership, team leaders, and staff to manage overall IT resources and IS&T's portfolio of projects and services. The group coordinated planning, management, and execution of multiple projects; managed the workforce planning and administration functions, including oversight for IS&T's organizational change management; and provided transparency through communications to staff and the community.

Energize and Motivate Employees

IS&T continues to support growth, development, and engagement of its employees. The department hired 26 new employees and promoted 31 employees. There were 200 Spotlight Awards, three Infinite Mile Awards, one recipient of the MIT Excellence Unsung Hero award, and one recipient of the MIT Excellence Serving the Client award.

As part of its transformation, IS&T created Agile and DevOps-related job classifications. The department also successfully used bonuses to retain top performers during this period of transition.

IS&T staff participate in, contribute to, and play key formal and informal leadership roles in various professional and industry organizations such as Internet2, Educause, the Common Solutions Group, the Northeast Regional Computing Program, the Boston Consortium, the Ivy Plus groups, the Internet Engineering Task Force security and calendaring standards groups, the SAP International Higher Education and Research Conference, the Association of American Universities Data Exchange, and the Research University CIO Conclave, among others. Staff collaborate with a wide range of vendors and outside groups.

Summary of Financials for FY2015

IS&T provides its IT services through various funding models, which include the general Institute budget, software development, revenue recovery, and service centers. In FY2015, IS&T overspent its recurring general Institute budget allocation of $41.9 million by $95,000 (0.2%). Year-end gross expenses were over budget by $1.6 million, while revenue and transfers to the service centers exceeded their budgets by $620,000 and $919,000, respectively. The main driver of the $1.6 million variance in gross expenses was caused by increased demand for Server Operations and Service Center (SOSC) services (revenue recovered), greater than anticipated use of local computer network services, unbudgeted desktop deployment equipment, and depreciation and interest related to increased SOSC capital spending. These amounts were partially offset by open position savings, lower than anticipated software maintenance expenses, and the removal of TSM billing for FY2015. In addition to these expenses, IS&T spent $3.8 million in IS& transformation funds and $2.3million in infrastructure modernization funds. Both of these accounts are funded by separate sources.

IS&T spent $10.7 million in software development consulting dollars ($3.6 million in recurring software development funds and $7.1 million in IT modernization funds). Approximately 59%, $6.3 million, was spent to develop Education Systems Roadmap projects, including the student accounts platform, enrollment management, digitization of forms and petition implementation, the learning modules core platform, and learning modules application upgrades. An additional 30%, $3.3 million, was spent to support software development projects for Administrative Systems Roadmap projects, including the Mendix Initiatives Project, Atlas, and User Experience Discovery. The remaining 11%, $1.2 million, was used for development of MIT mobile applications.

Approximately 6% of IS&T activity, or $4.2 million, was funded from services billed to DLCs for telephone and network infrastructure services, server management and co-location services, desktop support, software distribution, and departmental website and database consulting and development. In FY2015, funding from these sources was $415,000 lower than budgeted, primarily because of a reduction in SOSC services billed to DLCs outside IS&T, the elimination of TSM billing revenue, and a reduction in

departmental consulting, analysis, and development revenue caused by a shift in focus to non-billable community-wide services.

The Telephone and Network Service Center (TNSC) ended the year with an operating deficit of $18.9 million, which is $2.2 million lower than the FY2015 budgeted deficit of $21.1 million. This favorable variance was because of lower interest rate charges, as well as lower-than-budgeted operational expense settlements caused by a one-time funding transfer of IT Modernization budget dollars to fund capital equipment purchases. This funding transfer will net out after five years as the depreciation from this purchase is expensed. Investment in new capital assets totaled $13.7 million, which was greater than the FY2015 capital budget of $12.1 million. The overage was covered using IT Modernization funds. 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, voice over internet protocol equipment and upgrades, and data center expansion and upgrades.

The SOSC ended the year with an operating surplus of $5.8 million, which represents a favorable variance of $3.2 million compared with the budgeted surplus of $2.5 million. However, after removing SOSC and TSM charges (billed and charged within IS&T), this results in a favorable variance of just $515,000 for the SOSC. Savings resulting from the elimination of TSM billing is partially offset by higher than anticipated depreciation and interest. Capital investment expenses in the SOSC for FY2015 totaled $2.3 million and consisted of server equipment for virtualization, backup, and the SAP environment.

Looking Forward

As IS&T moves ahead, the department is excited to share the anticipated programmatic outcomes of the IT transformation at MIT. A move to platform-based, API-centric architectures will enable MIT's multiplicity of organizational units to use modern toolkits and cloud-based services to extend the functionality of MIT's core systems of record to meet locally differentiated needs and transform business processes. IS&T will modernize core administrative systems to create excellence in term of user experience, discovering better ways to deliver services such as computation and storage infrastructure through cloud or mobile services.

IS&T is also invested in nurturing a diverse ecosystem of IT service providers and consumers at MIT. By adopting an ecosystem model, the Institute can focus on providing platforms that everyone can leverage, from students, faculty, researchers, and staff to distributed and central IT service delivery teams.

With the Institute's senior leadership and IT governance committees fully vested in this transformation, the next three years offer a remarkable opportunity for achieving a "10X" increase in the value delivered to the Institute by the IT@MIT ecosystem.

John Charles
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