

Information Systems and Technology

MIT's 2020 IT Vision continues to shape the work of Information Systems and Technology (IS&T). In Fiscal Year 2017 (FY2017), after two years of organizational transformation, IS&T's realigned teams partnered with the community on many projects and helped to deliver innovative, platform-based systems. With the success of software as a service (SaaS) as an enterprise solution, software portfolio planning became a departmental priority. IS&T's IT modernization efforts also advanced in FY2017: Kendall Wi-Fi was launched in collaboration with several partners and the department continued to migrate its managed server environment to vCloud Air.

Organizational Stability, with a Focus on the Future

IS&T's current organizational structure remains similar to FY2016; one notable change was the migration of the department's Human Resources team to MIT Human Resources (central HR).

IS&T's Architecture Review Board developed a framework for quantifying and reporting deferred maintenance on core MIT IT systems; it presented this work to the IT Governance Committee (ITGC) as part of the FY2018 project planning and budgeting process. At the same time, it was acknowledged that with the department's move to cloud infrastructure and an SaaS enterprise model, IS&T will incur significantly less deferred maintenance going forward.

With guidance from the ITGC and the IT Policy Committee (ITPC), IS&T is exploring steady-state IT financial and governance models for the future.

Governance

The ITGC held four meetings with agendas that included FY2016 project summary; review of infrastructure modernization efforts; cybersecurity review and policy issues; discussion of the IT governance process; update on FY2017 projects; approval of the ITPC report; briefing on the new Software Portfolio Planning Committee; updates on the sale of unused Internet Protocol Version 4 (IPv4) addresses, the IT roadmap, and cloud migration; discussion of project and capacity planning for FY2018; status of data classification security controls; proposal of a student/community IDEAS subcommittee; status report on software portfolio planning; discussion on revitalizing the Student Systems Steering Committee; endorsement of the ITPC report; proposal for web accessibility guidelines; funding sources and investment guidelines for IT projects; FY2018 priorities for administrative and education systems; and an update on Next Generation MITnet.

Highlights

In FY2017, IS&T focused on developing platform-based applications in partnership with departments, labs, and centers (DLC), as well as planning for an SaaS-based enterprise solution. By migrating its managed server environment to vCloud Air, IS&T reduced the space needed for its on-campus data center and firmed up IT disaster recovery. It also

continued to provide the MIT community with robust IT services, from Service Desk support and network improvements to Athena cluster updates. Key achievements for FY2017 include the following.

Delivering Applications in Partnership with the Community

IS&T evaluated, developed, deployed, and updated software releases that benefited DLCs and administrators, often in collaboration with other departments. Some of these releases are integrated with the SAP HANA platform, others with the Data Warehouse or Atlas. The following platform-based projects and applications were completed in FY2017.

Graduate Appointment Portal: This application supports the creation of graduate student appointments, providing real-time integration between SAP, MIT Student Information System, and other back-end systems. The legacy Web Grad Aid system was retired.

Staff Appointments and Distribution (SANDI): Dropped from a previous payroll system, this new version was developed in response to requests from financial administrators. SANDI includes HR appointment, salary distribution, and payroll data for exempt employees, fellows, and graduate students, viewable in end-of-month snapshots for a given fiscal year.

Buy-to-Pay (B2P): MIT's new system for requisitions, purchase orders, invoices, vendors, and payments is based on Coupa, a cloud-based supplier portal that replaces eCat. Developed in partnership with the Office of the Vice President for Finance, IS&T facilitated integrations between SAP, Roles, and Coupa, and has supported these interfaces since the pilot began in August 2016.

Data Warehouse 2.0: This is a multiyear project to migrate MIT's Data Warehouse to the SAP HANA Cloud Platform, delivering real-time access to data and reducing IT support costs. In FY2017, IS&T delivered Facilities, Financial Aid, and Roles data on the new HANA platform.

SAP support pack implementation: IS&T executed its annual update and regression test of MIT's SAP system.

Community of Stewardship, Mobilization of Service (COSMOS): In collaboration with the MIT Department of Facilities, IS&T built a mobile application for use by tradespeople who conduct maintenance and repairs on campus. Communication regarding work is all done online: job assignments, equipment data, and project status are handled by the software.

eBuilder: Working with the MIT Facilities Department, IS&T completed an implementation of eBuilder, a project management information system. eBuilder will be used to track Facilities and Campus Construction projects through their lifecycle.

Four applications were developed or updated in partnership with the MIT Registrar's Office. The Subject Planning application provides a way for department schedulers

to enter, update, and view classroom scheduling requests and assignments. Limited Enrollment Waitlists, part of the Enrollment Tools application, provide an easier way for instructors and department administrators to manage students within their subjects. MIT-to-Harvard Cross-Registration enables MIT students to add Harvard courses via MIT's Add/Drop application. And through Classroom Reservation Requests, all MIT community members can request the use of a classroom for a non-class event.

Assistant Dean's Reporting: IS&T worked closely with the Provost's Office to design, develop, and release a suite of over 70 administrative reports in the areas of finance, HR, payroll, research grants, and chair appointments.

Commuter Program: IS&T implemented changes to the Atlas Commuting Benefits application to encourage green commuting habits. These changes included free or greatly reduced commuter passes for Cambridge campus employees and reimbursement of parking at MBTA stations.

Enriching Diversity pilot: Working with MIT Human Resources, IS&T introduced an application in Atlas that provides benchmark affirmative action data that hiring managers can use in the recruitment process.

Paperless I-9 employment eligibility solution: With a vendor partner, IS&T introduced a paperless I-9 system with supporting services including e-verification, document storage, and email notification to I-9 administrators, employees, and student workers. IS&T also developed application programming interfaces (APIs) to facilitate a seamless interface between the I-9 vendor and SAP, MIT's central HR system of record.

BoardEffect: IS&T selected and made available this cloud-based platform that optimizes the planning of meetings. MIT's BoardEffect portal is HIPAA-compliant and Touchstone- and Duo-enabled.

SolidWorks: IS&T provided several new offerings for SolidWorks (3-D CAD design software) to meet high campus demand. These included virtual machines, auto deployment using a Mac Boot Camp package, and a Citrix virtual application offering.

Application programming interface for Electronic Public Records (EPR): IS&T worked with Institutional Research to build an API that enables other business units to query its EPR for faculty data such as publications, awards, and professorships, at both the individual and departmental level.

Roth IRA sign-up: Working with the MIT Benefits Office and Fidelity Investments, IS&T developed and configured a solution in SAP for employees to sign up for Roth IRAs.

Energize_MIT: In collaboration with the Office of Sustainability and Facilities, IS&T created the first dashboard available to the MIT community that provides detailed data on campus energy use and carbon emissions. This resource is available to MIT students, faculty, and staff for education, research, and decision-making purposes.

The Engine Room: Through this website, innovators can find the equipment, space, services, and expertise needed to develop their ideas. IS&T assisted with all information technology aspects of the rollout of the Engine Room application, including design, integration, and operation.

IS&T also added 12 applications to the software grid, ranging from macOS 10.12 Sierra to math, statistical, and visualization software, such as Maple, SAS JMP, and PyMOL.

Some FY2017 releases benefited the community at large or, in one case, an even broader group—innovators in the greater Boston area.

Enabling Services for Providers and Consumers

IS&T provided many services to information technology providers and consumers on campus, from Service Desk support and IT training to raising awareness about cybersecurity issues. The department also made investments in MIT's IT infrastructure and in physical locations on campus, such as the Athena clusters and the new Atlas Service Center in Building E17.

Support for Providers and Consumers

IS&T offered a range of IT services for the MIT community, from resolving help requests, to producing eLearning courses and in-person workshops, to helping departments with mobile device management.

The IS&T Service Desk—along with Field Service Engineering and the VIP Help Desk—fills an essential role at MIT, helping community members get answers to their IT questions. In FY2017, the IS&T Service Desk resolved 64,173 tickets; Field Service Engineering resolved 4,083 tickets; and the VIP Help Desk resolved 581 tickets. The Field Service Engineering client base grew from 51 to 53 DLCs; the VIP Help Desk expanded its client base from 121 to 127. The Service Desk continued its pilot with CDI Corporation for 24/7 telephone, email, and chat support, and expanded the service to include the MIT Libraries.

IS&T Provider and Consumer Support also provided many other services to the community and to its Distributed Support customers. The group:

- Supported endpoint management by performing major upgrades to Lite Touch and Microsoft System Center Configuration Manager for Windows and Jamf Pro (formerly Casper Suite) for macOS and iOS; and held endpoint management meetings for IT staff in DLCs
- Built a macOS image for lab use and deployed Macs in 32 labs with a configuration that included about 100 software packages
- Built custom Sophos virus protection installers for various DLCs and set up automated reports to keep technicians informed of issues with the machines they manage

- Using ServiceNow and Tableau, created a suite of dashboards and reports to measure performance and make data-driven decisions to improve performance
- Onboarded the MIT Libraries to use the IS&T Service Desk as their first tier of IT support, significantly reducing their in-house support calls; also assisted the Libraries in replacing their public space computers with a complete refresh
- Researched and onboarded a new company to provide IS&T and its campus partners with optimal recycling of computers and other electronic devices; 5,000 machines were picked up for recycling in FY2017
- IS&T provided the community with a wide range of IT training and education opportunities in FY2017. These included:
 - In-person training of over 2,000 community members, including demos of the Buy-to-Pay system and workshops on Microsoft Outlook, Tableau, and Dropbox
 - IS&T eLearning courses in the Atlas Learning Center, taken by over 3,800 community members, as well as support for Lynda.com courses, viewed by over 10,000 community members
 - Partnering with Human Resources; Environment, Health and Safety; the Office of the Vice President for Finance; and other DLCs to support their knowledge management requests
 - Educational workshops and meetings for campus IT technicians
 - Third Thursdays training for Data Warehouse users, plus the Reporting user group
 - Over a dozen IT courses offered during Independent Activities Period
 - Leadership of the Women in IT Employee Resource Group
 - Over 400 new articles added to the IS&T Knowledge Base (KB)

The department sponsored the Spring Cleaning and Back-to-School 2016 events (Academic Expo, and Computing@MIT) and participated in the Executive Vice President and Treasurer (EVPT) Poster Session, the IT Partners Conference, and several laptop-tagging sessions.

IS&T also participated in several events that reached beyond the MIT community. The department:

- Held a Women in Tech event where women IS&T staffers shared what they do with local eighth-grade girls
- Hosted the inaugural Boston Mulesoft user group meeting
- Organized and presented at the Northeast Regional Computing Program ServiceNow user group meeting
- Provided network coverage, monitoring, and bandwidth for the HackMIT event

In terms of physical spaces, IS&T was a key player in the March opening of the Atlas Service Center, an in-person customer center that complements the systems, services, and resources available through Atlas online. IS&T also made significant updates to Athena clusters around campus.

To prepare for the opening of the Atlas Service Center, IS&T moved the location of the IS&T Service Desk twice, handled hardware deployment and configuration, developed a custom service interface for Center staff based on the ServiceNow platform, and provided hands-on training and work instructions in the Knowledge Base. In addition, IS&T renovated six Athena clusters, from updates to a complete rebuild. In two rooms, several 27 inch iMacs were installed.

Information Technology Security

IS&T's Security team continued to strengthen its response to cybersecurity threats, while its Campus Safety and Security Infrastructure (CSSI) team focused on physical security. Highlights for FY2017 include the following:

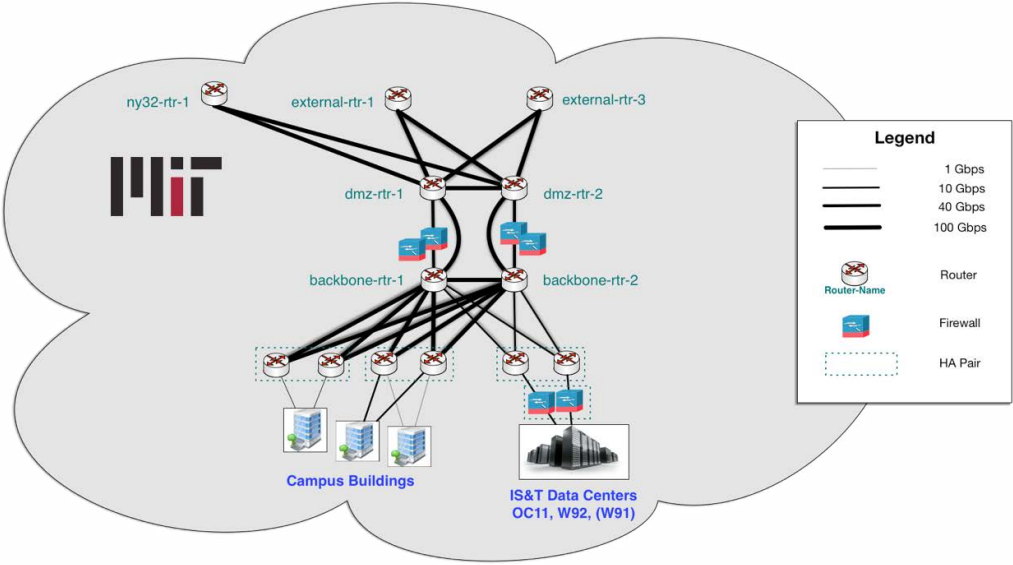
- IS&T appointed an Information Security Officer to lead the development of MIT's IT security strategy.
- IS&T actively responded to security events throughout the year. The department:
 - Improved its automated response to security events, blocking an average of 4,000 unique malicious IP addresses from MITnet daily
 - Mitigated four major denial of service attacks using Akamai's Prolexic service, with no disruption to MITnet
 - Increased its cybersecurity awareness outreach, including a restart of the Security Special Interest Group (SIG)
 - Sent frequent emails to IT Partners and the Security SIG about critical threats and vulnerabilities, from phishing attacks to WannaCry ransomware
- IS&T subscribed to BitSight, a company that provides a security score (much like a credit score) based on externally observed network traffic. Administrative, infrastructure, VPN, and student services segments of MITnet received scores above the education industry average.
- IS&T uses Tenable's SecurityCenter for network vulnerability scanning; in FY2017 it offered accounts to IT staff in DLCs who want the capability to scan computers under their control.
- The former Facilities Security Operations team was integrated with IS&T's CSSI team. CSSI offers comprehensive service for door access and other physical-security-related services across MIT.
- IS&T migrated from Genetec Omnicast to Genetec Security Center to provide a more resilient and unified physical security platform across MIT. As a result, IS&T was able to retire 80 servers.

Network Improvements

In FY2017, IS&T focused on three major network initiatives.

- Kendall Wi-Fi was launched, the result of a three-year collaboration between MIT, Google, Boston Properties, and the City of Cambridge, to provide high-speed outdoor internet service to Kendall Square and nearby residential areas. IS&T played a key role in the design and installation of this network.
- IS&T continued the migration of its managed server environment to VMware’s vCloud Air, including the migration of Atlas, MIT’s administrative computing environment. Over 75% of IS&T’s eligible virtual machines (more than 2,100 servers) have been moved. By establishing redundant environments in New Jersey and California, this cloud-based strategy now provides true disaster recovery.
- IS&T set the groundwork for Next Generation MITnet, a transition of the campus network to internet protocol version 6 (IPv6) addressing. The department upgraded MITnet equipment, increasing bandwidth and speed and enabling an interim dual-stack network that can handle both IPv4 and IPv6 network addresses.

Figure 1. A Diagram of Next Generation MITnet



IS&T also made several updates to network infrastructure:

- IS&T improved wireless network coverage on campus, adding over 400 additional access points (for a total of over 6,000 access points).
- To improve in-building cellular service, IS&T installed AT&T neutral-host Distributed Antenna Systems in nine additional buildings on campus.

- IS&T facilitated an agreement with Verizon to add Verizon small cell equipment to MIT's existing wireless network infrastructure; this improved Verizon coverage in the pilot building (W92) while leveraging MIT's existing infrastructure. Verizon's proof of concept, done in partnership with MIT, decreases cost and installation times.
- Through capital renewal and major construction efforts, IS&T improved the network infrastructure in Buildings 9, E17, E18, E19, E23, and 31.
- IS&T extended MITnet services to Buildings N50, W97, and NW98.
- The department upgraded the power distribution systems to MIT's critical telephony sites in Buildings 24, E19, and NW12.
- Over 1,000 lines were migrated off the 5ESS (an older electronic switching system for phones) to a centralized voice over internet protocol (VoIP) system, including Campus Police, MIT Medical, Facilities Operations Center, and the Haystack Observatory.

Administration

IS&T supports the development and engagement of its employees. The department hired 18 new employees and promoted 13 employees. There were 98 Spotlight Awards, 13 Infinite Mile Awards, and one MIT Excellence Award presented in FY2017.

Staff Development

In the past year, IS&T sponsored a series of project delivery workshops and opened up meetings of the Architecture Review Board to all staff. The department offered six Lunch 'n Learn presentations on topics ranging from Office 365 to component-based design.

The advisory firm Gartner gave a briefing on IT service trends and provided webinars and research documents on IT topics.

IS&T staff participated in, contributed to, and played 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 SAP International Higher Education and Research Conference, the Association of American Universities Data Exchange, and the Research University CIO Conclave, among others. Staff collaborated with a wide range of vendors and outside groups.

Employee Engagement

In FY2017, IS&T continued to offer office hours with senior leaders. It also conducted an employee engagement survey and shared the results with staff.

Sponsored by the Individual Contributor Advisory team, IS&T held its first all-hands poster show in March. Modeled on the annual EVPT poster session, presenters from 25 IS&T teams showcased completed projects and work in the pipeline on topics ranging

from cloud migration to data science. The event allowed IS&T staff to learn and ask questions about a wide range of departmental projects.

Over the summer, IS&T brought in 10 interns, who were assigned mentors and worked on department projects. They attended weekly lunch presentations given by managers or mentors of the teams involved.

The department also engaged with its staff and the larger community through various social media channels; this year it launched an Instagram account. It also sponsored a Raspberry Pi giveaway through Twitter and Facebook and celebrated the Service Desk move into the new Atlas Service Center with an iPad mini raffle.

Summary of Financials

In FY2017, IS&T provided IT services through various funding models that include the General Institute Budget (GIB), software development, revenue recovery, and the service center. In FY2017, IS&T was given a net budget allocation of \$109.3 million, which included a Pool C loan in the amount of \$18.4 million. IS&T spent \$105.5 million (\$3.8 million less than budgeted), which reduced the necessary Pool C loan to \$14.6 million. (IS&T is expected to pay back the Pool C loan.)

Year-end GIB gross expenses were under budget by \$4 million, while GIB revenue exceeded its budget by \$418 thousand, and transfers to the service center were lower than budgeted by \$1.2 million. The main driver of the \$4 million variance in GIB gross expenses was due to open-position savings. This positive variance was partially offset by higher than anticipated software expenses related to the adoption of cloud computing services and an unbudgeted pilot for 24/7 Service Desk services.

IS&T spent \$18.1 million in software development dollars. Approximately 35% of that (\$6.3 million) was spent to support software development projects for the administrative systems roadmap, including the continued implementation of the Buy-to-Pay system and the migration of the Data Warehouse to SAP HANA. An additional 12% (\$2.1 million) was spent to develop education systems roadmap projects, including the replacement of Web Grad Aid with the Graduate Appointment Portal and ongoing work on the CourseLeaf Curriculum Courses module and the redesign of the Undergraduate Research Opportunities Program website.

Twenty-eight percent of the \$18.1 million (\$5.1 million) was spent on nonproject support and enhancement work for MIT's core enterprise systems. The remaining 25%, (\$4.6 million) was spending related to the Department of Facilities effort to modernize campus maintenance, which included COSMOS (\$2.1 million) and eBuilder (\$1.5 million), and the Office of Sponsored Programs Quali Coeus upgrade project (\$961 thousand). IS&T received outside funding to cover these project expenses.

Approximately 5% of IS&T activity (\$4.8 million) was funded from services billed to departments, labs, and centers for telephone and network infrastructure services, desktop support, and software distribution. In FY2017, funding from these sources was

\$206 thousand higher than budgeted, primarily due to an increase in the field service engineering team's desktop-support service level agreements across MIT.

In FY2017, the Telephone and Network Service Center had an operating budget of \$27.5 million, against total operating expenses of \$26.3 million, resulting in a year-end positive variance of \$1.2 million. This favorable variance was due to lower than anticipated expenses related to fiber connectivity, due to a delay in the activation of fiber loop connections linking MIT to the West Coast Data Center. In addition, plant maintenance work by outside vendor LCN, contingent on an emergency or on-call basis, was reduced in FY2017. Investment in new capital assets totaled \$6.5 million, which was equal to the FY2017 capital budget of \$6.5 million. Telephone and Network Service Center operating and capital expenditures provided funding for maintenance and upgrades of telephone and network infrastructure, including network upgrades in buildings, telephone and data communications room renovations, VoIP equipment and upgrades, and data center upgrades.

Looking Ahead

In preparing for FY2018, IS&T established priorities and principles to follow for funding and governance of IT projects. Informed by MIT's 2020 IT Vision, the department is focusing on three strategies:

- Transformation of the IT governance model to support the move to software as a service and cloud computing
- Transformation of the IT financial model to a steady state, with the focus moving from capital expenses to operating expenses
- Developing IS&T career ladders and updating job families, a reflection of new roles after the transformation

IS&T remains committed to working with the community to build a robust portfolio of platform-based systems and applications.

New Governance Model

With guidance from the IT Governance Committee, IS&T is rethinking its governance model for how software product licenses and SaaS offerings are approved. To support this new model, a Software Portfolio Planning committee has been formed and has developed a template for evaluating SaaS offerings. This planning effort will evaluate the lifecycle of software products and services, from funding and implementation through management and retirement.

New Financial Model

In IS&T's earlier model of developing custom software from the ground up, costs were episodic and project-based; this model often led to long periods of deferred maintenance and to modernization gaps. With the shift to cloud service subscriptions and platform-based software, investment is predictable and improvements are delivered regularly by vendors.

With a financial model based on a steady state budget, the next step will be to determine the funding sources for ongoing out-year costs. Options include a cost-sharing model like the one used by the Committee for Renovation and Space Planning, software fees, and other DLC contributions. Top priorities will be mapped to available funding.

Using hosting services such as vCloud Air and HANA Enterprise Cloud also contributes to the steady state model, eliminating the need to acquire and manage data center hardware.

Updated Job Families

Based on input from its employees and guidance from MIT Human Resources, IS&T has developed career ladders and is updating its job families. Three career ladders—Technical, Analytics, and Planning and Administration—can now be used for career planning and development. IS&T will also increase its job families from 18 to 21 and revise them as needed. As an example, the DevOps Engineer job family is being split into two job families: DevOps Engineer and Software Engineer. These changes benefit IS&T staff by aligning them more closely with their current work; this in turn enables IS&T to better serve its customers.

IS&T is moving toward a steady state approach for delivering IT services. With new governance and financial models on the horizon and the shift to the cloud, SaaS, and platform-based applications, the department remains committed to providing reliable and strategic IT solutions to the community. As a stable and forward-looking organization, it is well positioned to achieve MIT's 2020 information technology vision.

John Charles

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