

# Incentives in IT Yield Success at MIT

Massachusetts Institute of Technology provides faculty and students with nonfinancial incentives in the form of IT resources

By **Mary Hanson**

**MIT**  
**Massachusetts  
Institute  
of Technology**

It's not unusual that a world-renowned institute of technology should be stands to reason that you'll be credited with a long history of technological innovation and contribution to educational technology. As John Curry, Executive Vice President at Massachusetts Institute of Technology (MIT), acknowledged, "It's in our name — we can't help it!"

Information technology (IT) makes up a large part of the culture at MIT. The institute was founded on the principle of providing students with a strong scientific and technical base on which to creatively define and solve problems then applied to the real world. To accomplish this, William Barton Rogers, MIT's founder, pioneered the development of the teaching laboratory.

The institute's reputation attracts top-notch faculty and researchers who, among other accomplishments, can claim the invention of the World Wide Web as well as the early implementation of a distributed client-server model (Project Athena) as a campus-wide networked computer system. Today, about 10,000 students, both undergraduate and graduate, and 1,500 teaching staff populate the MIT campus, taking

advantage of the institute's resources. These include a strong — and strongly supported — IT environment.

## **Information Systems at MIT**

Paying attention to the unique characteristics of an MIT education and providing incentives for sustainable change are central to MIT's IT efforts. According to Vijay Kumar, Assistant Provost and Director of Academic Computing, "The idea is not to just say, 'Here is a little stipend for you to develop something.' We're also going to put resources behind [the faculty and students] in a substantial way so that they can actually experiment with their project or initiative."

Information Systems, MIT's central IT organization, is a process-centered, team-based organization structured around three customer foci, called *practices*, that include the Academic Computing Practice, the Office Computing Practice, and the Voice, Data, and Image Networking Practice. Leaders of these practices advocate on behalf of customers to Information Systems and on behalf of Information Systems to its customers, as well as plan for the effective use of IT

resources. The responsibility for developing and operating these resources lies with five IT processes — Discovery, Delivery, Service, Support, and Integration — supported by the Competency Group and the Administrative Business Services Team. You can access the Information Systems strategic plan on the Web at <http://web.mit.edu/IS/org/stratplan.html>.

MIT's Information Systems group focuses its work around four themes: quality, service, value, and leadership. These themes appear in the numerous initiatives, projects, production systems, and support services that make up the IT environment. To support this work, approximately four percent of MIT's budget goes to IT. Supplementary funding comes from foundations, individual gifts, and corporations.

Curry maintains that simplicity and integration are two keys to maintaining the institute's vision. He believes that the use of enterprise administrative systems developed to broad industrial standards permits placing the focus of development on institutional requirements rather than individual departments. A cross-organizational platform lets users in multiple departments use virtually the same software, thus enabling ease of migration and interoperability among departments. It also provides an environment in which IT staff can move from one department to another without having to retrain. In addition, since the platform is based on SAP running on an Oracle database, the same team of developers can create and build services, and help support and maintain cross-departmental functions and needs.

The IT Competency Group concentrates on providing a well-qualified staff by addressing salary parity issues and skills development through training and continuing education for the IT faculty and staff. The group also addresses the quality of leadership, work life, and organizational focus. Intense competition exists for recruiting and hiring IT people between

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Two Athena Quickstations for e-mail, demonstrating MIT's efficient use of space.

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A machine room housing a few Athena workstations and several university servers.

industry (with typically higher pay scales) and academia (with more limited budgets). However, Jeff Schiller, Manager of Network Services at MIT and a network security expert, agreed with Kumar when he said that retaining IT staff at MIT isn't as difficult as recruiting and hiring: "MIT has a reputation of doing great things, and that really helps keep people around."

## Doing Great Things — Project Athena

In 1983, MIT established a five-year program to explore diverse uses of computing and build the knowledge base necessary for the long-term use of computers in the MIT curriculum. The faculty was concerned that too little

was being done to integrate new technology into the undergraduate educational experience. Project Athena was so successful that by 1991 it ceased being a special project with special funding and was adopted as MIT's academic computing infrastructure.

Athena is structured so that a user may operate any workstation on campus and still have access to a customized environment and personal files. Each Athena workstation connects to MITnet, the campus-wide computer network, for access to shared services and software. The Athena environment and its clustered workstations are available to faculty and students 24 hours a day, 365 days of the year.

Aside from e-mail and word process-

ing, Athena is used for coursework and Internet access plus an assortment of individual uses. Since its inception, increasing numbers of faculty have put course material into the Athena environment, varying from the simple, like posting the outline of a lecture and perhaps problems or solutions to those problems, to the more complex, such as the electrical engineering course that has all the lectures online. According to James D. Bruce, Vice President for Information Systems, "There are very few subjects taught at MIT that do not have some presence on the Web."

### Supporting IT on Campus

MIT supports this Web-based teaching in various ways. For starters, the classrooms are all equipped with 10-megabit Ethernet connections. By the end of June 2001, every classroom on campus will have wireless access. Some classrooms, primarily lecture halls, have built-in Athena workstations and projectors. Additionally, some classrooms have large numbers of Ethernet jacks at the students' seats, and some have Athena workstations at every seat. But the support doesn't stop with equipment provision.

MIT's Educational Media Creation Center (EMCC) supports the production of media and Web-based educational material for its academic and professional programs. This work ranges from drop-in consultations to the creation of innovative Web-based courses and programs.

Stellar, an open architecture-based platform for online education at MIT, lies at the center of the EMCC's capabilities. In Stellar, MIT is trying to build a toolkit to lower the threshold required for a faculty member to use the Web as an effective teaching tool.

A more detailed description of the EMCC and Stellar appears at <http://web.mit.edu/emcc/>.

Another collaborative effort designed to support IT is Project iCampus, the MIT-Microsoft alliance for research in

## President Charles M. Vest

"Our greatest challenge is to bring to MIT the best students, the best faculty, and the people and infrastructure to support them. And we must provide the physical facilities and information infrastructure that enable them to



live, learn, and work within an effective and inspirational environment. Recruiting and retaining the very best faculty remains one of our greatest challenges. To do so, we must be able to offer competitive salaries, state-of-the-art research and teaching facilities, and opportunities to work with the very best students.

"We must clearly define our place in the changing galaxy of educational institutions, activities, and alliances. There can be no doubt that emerging information technologies with enormous storage, bandwidth, and display capabilities will profoundly affect the way

we all work, live, and learn. Institutions and groups of institutions will provide various educational services, from specific training and the updating of skills to high-quality degree programs. MIT will define an appropriate balance between using these new capabilities to help educate those beyond our campus and bringing a wealth of information and interaction to those on our campus."

Excerpted from "MIT — The Path to Our Future,"  
<http://web.mit.edu/president/communications/rpt97-98.html#vision>

educational technology. The goal of this initiative is to support research by creating new technologies that will set the pace for university education.

Both faculty and students from any department on campus may submit proposals — a total of 92 in the spring of 2000. MITCET and MIT's Committee on the Undergraduate Program consider the proposals for funding. All of the projects evolve through ongoing assessment, and the final products may differ from the initial visions.

One of the initiatives currently funded by iCampus is a school-wide modular program for fluid mechanics. The goal is to construct a School of Engineering-wide collection of online elements for teaching fluid mechanics at the first-year graduate level. The central element is a library of 3D visualizations, photographs, and audiovisual materials that would give students insight into physical behavior of natu-

ral phenomena. It's anticipated that within the next five years half of each fluid mechanics course will use materials from these modules and that the project will create a paradigm for teaching other interdepartmental courses in a similar way. You can find more information at <http://swissnet.ai.mit.edu/projects/i-campus/index.html>.

### Beyond Cambridge

Once off the Cambridge campus, there's plenty of opportunity for students to learn — opportunity enabled by the use of well planned and implemented IT.

### MIT International Science and Technology Initiatives

The MIT International Science and Technology Initiatives (MISTI) program gives students and faculty the opportunity for international learning and collaboration. It has three goals: to

create new resources on campus for international learning and offer internships in foreign companies and laboratories; to support faculty collaborations abroad; and to work with foreign organizations and governments in exploring the possibilities for international industry, education, and research. Operating through regional programs, MISTI is now in its 19th year and offers programs in Japan, China, Germany, Italy, India, and France. About 150 students participate per year in the MISTI internship programs.

### **Singapore-MIT Alliance**

The Singapore-MIT Alliance (SMA, on the Web at <http://web.mit.edu/SMA/about/index.htm>) is a collaboration among the National University of Singapore, Nanyang Technological University, and MIT that began in November 1998 to promote global engineering education and research. The primary goal of SMA is to create a world-class center for graduate education and research in engineering that features the most technologically advanced distance learning facilities available.

The curriculum is delivered using PictureTel videoconferencing hardware over Internet2-type advanced networking connections. Two streams are transmitted to Singapore from classrooms on the MIT campus. Stream one, the camera/video stream, includes all cameras in the classroom, covering the presenter, students, chalkboard or whiteboard, and document camera. Stream two, the computer stream, includes all computer-generated images, such as PowerPoint slides, animations, simulations, and other software used by the faculty in the classroom.

The remote virtual labs let students in Singapore collaborate with students on the Cambridge campus. The faculty at MIT is excited about the potential of virtual lab use. Bruce suggested the challenge of understanding airflow over an airplane's wing as an example. Up until the mid-1980s, students would spend an entire semester studying the theories involved in aerodynamics, building a model wing,

and then testing the wing's performance against the theory in a wind tunnel. Today, the practical aspects of wing design can be demonstrated and understood in the span of a single afternoon through the use of a virtual laboratory on the computer. He pointed out, "Just think of the power that [students] get in developing an understanding of a simple phenomenon just from being able to observe and make changes to the controlling parameters in a virtual laboratory that's on the screen."

### **Living Large**

Such a large collection of IT must pose a challenge to maintain. According to Schiller, one way of overcoming that challenge is to treat the network as a utility: "The requirements of networking technology are more strenuous [than they were 10 years ago]. People want more bits, faster bits, [and] more interesting applications, which require more bits. Our strategy is to be able to meet that need."

The goal of Information Systems as an operational organization is to provide a zero-congestion network. Schiller stated, "We don't want to have people saying that we don't have enough bandwidth. It's a challenge to stay ahead of that curve replacing equipment and wiring infrastructure." Besides keeping the equipment and wiring infrastructure up-to-date, another way that MIT attempts to overcome congestion problems is through Internet2, a project that allows faster communication between universities, as with the SMA.

Security also constitutes a serious issue at MIT. To keep hackers and unwanted security problems from interrupting the IT systems, Schiller and his collaborators created Kerberos (<http://web.mit.edu/kerberos/www/>), a network authentication protocol designed to provide strong authentication for client-server applications.

In addition to Kerberos, MIT is participating in a new top-level Certificate Authority Service that will be offered to institutions of higher learning by the Corporation for Research and Edu-

cational Networking. According to Schiller, the use of these certificates is more easily scalable to multiple institutions than other technologies. Digital certificates verify both the authenticity of the sender of an electronic message and the integrity of that message, telling the recipient that it has not been altered. The service eliminates the need for each institution to establish secure relationships with every other institution on a case-by-case basis. This service is being developed at MIT as one of three pilot institutions, along with Georgia Institute of Technology and Princeton University.

Overall, MIT's IT environment gives members of the institute's community access to a grand assortment of information resources. The libraries, while not officially part of Information Systems, also provide IT resources.

Aside from numerous book volumes and serial titles, the libraries contain more than 50 databases available through the MIT network. Through Athena the libraries provide a service called Online with Libraries that helps with research, supplies quick factual information, provides information about library services and collections, and imparts technical help with library research tools. Bruce meets with the Director of the MIT Libraries regularly to make sure that the needs of the institute's community are being addressed, and the Information Systems staff work with library staff on a number of projects.

The driving force behind MIT's excellence in IT is based in meeting the institute's needs, not in competition with the rest of the academic world. As Bruce explained, "We tend to just do our stuff and often don't worry about whether we are recognized. We just continue along. You know you're doing a great job when other people look to you for new technology and when they come to you for collaborations." From every perspective, that appears to happen a lot at MIT. *C*

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