

# INFORMATION TECHNOLOGY AT PRINCETON IN THE 21<sup>ST</sup> CENTURY: A STRATEGIC DIRECTION

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## FINDINGS

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*Princeton must consolidate and strengthen its engagement with information technology.*

This is the principal message that emerges from a strategic planning process that has included reviews of emerging IT trends, assessment of Princeton's IT compared to our peers, and presentations, interviews, and focus groups conducted with over 1000 members of the Princeton community, including 28 individual faculty members, 5 trustees, and 34 constituent groups representing department chairs, faculty, library staff, undergraduate and graduate students, administrators, and staff. The details of this strategic planning process, including write-ups of the IT trends, peer assessments, focus groups, and interviews, are presented in the second part of this document. In this first part, we present a summary of our findings.

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## IT TRENDS

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*"The last decade, in short, has seen a global revolution of unprecedented speed and reach in the creation and transmission of knowledge."* Edward Ayers, Professor of History and Dean of the School of Arts and Sciences at the University of Virginia, in "Doing Scholarship on the Web," Journal of Scholarly Publishing, volume 35, April 2004

If the 20th century was the age of computer technology, the 21<sup>st</sup> is emerging as the age of information. IT is pervasive and all-encompassing. Our examination of IT trends reveals that:

***We are deluged with data.*** Last year, more raw information was produced than in all previous human history (IDC Corporation), including an explosion of audio and video materials. Much of this information disappears as quickly as it is produced because we have no way to store it and, even if stored, no effective way to retrieve it.

***We are swamped with software:*** Wikis, Blogs, Microsoft Vista -- we are everywhere besieged by new applications. Even the "old" applications, like Word, keep changing, requiring us to constantly race to acquire new IT skills just to keep up with our colleagues and students (not to mention our kids).

***We are governed by gadgets.*** From Ipods, to dual-mode cell phones, to GPS navigation, to Blackberries, to entire cities blanketed with wireless access points, we are ever more tethered to various forms of IT hardware and ever more dependent on IT to do our work, and even to live our lives.

***We are wedded to the web:*** More and more of the services we access and the intellectual resources we consume are being delivered online. People expect both information and information services to be easily, and universally, accessible. From ordering products, to reading reports, to researching history, to commenting on politics, to applying to college (and soon, to reading a book), people expect to be able to do it online.

***We are exposed and vulnerable:*** Because so much of what we know and so much of what we do is online, we are increasingly susceptible to security breaches, as well as complex and costly litigations arising out of intellectual property issues. And, in education, the lack of clarity around the definition of “fair use” is making it harder to know what is ethical, much less legal.

These IT trends are already affecting, and will continue to affect, everything we do as an institution, from the way we teach and conduct research, to the way we attract new students and carry out the business of the University.

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## PRINCETON AND ITS PEERS

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*“Princeton simultaneously strives to be one of the leading research universities and the most outstanding undergraduate college in the world.”* Princeton home page, [www.princeton.edu](http://www.princeton.edu)

What Princeton will do in the domain of IT, how it reacts to these IT trends, must follow directly from its unique character as an institution dedicated to teaching and research, to intense faculty-student interaction, and to the involvement of students, not just in the acquisition of knowledge, but in the generation of knowledge. Compared to its peers:

- Princeton has few professional schools. It is relatively small and relatively centralized.
- Princeton is uniquely focused on undergraduate education, particularly on the involvement of undergraduates in scholarship and research.
- Princeton is, and will remain, a traditional institution when it comes to the students it educates (18-21) and the way it educates them (intense faculty-student interactions).

Princeton also stands out from its peers in its use of IT. Compared to its peers, Princeton:

- Leads in its support of ERP systems (PeopleSoft, Blackboard).
- Leads in its support of administrative desktop systems (DeSC and SCAD).
- Leads in its support of research computing systems (TIGRESS High-Performance Computing Center).
- Leads in its implementation of a core network infrastructure.
- Leads in its implementation of an effective IT governance model.

All of the areas where Princeton leads share a common characteristic: centralization. This centralization offers us a unique opportunity to leverage central IT resources to deliver cost-effective, robust services to a large part of our community, in a way that is almost impossible for our peers. Princeton’s implementation of centralized ERP systems is the envy of the Ivy League and our recent initiatives in centralized research computing support are being studied and emulated by many of our peers. Less well known is our distributed administrative desktop support service (DeSC), which has allowed Princeton to leverage centralized support to provide robust and secure desktops to our administrative staff.

At the same time, Princeton:

- Lags in its implementation of new technologies, including web applications and social-networking software.
- Lags in the recording and dissemination of classroom lectures.
- Lags in its support for mobile and remote computing.
- Lags in providing authentication and identification services to the extended University community (“identity management”).

In some of the areas where Princeton lags, it does so deliberately. We have chosen not to be on the “bleeding edge” of technology innovation. We have chosen not to offer distance education courses. We do not plan to record and disseminate class sessions (except possibly as an aid to students who cannot attend a class). A number of our peers are offering these initiatives for their own good reasons. Princeton will follow its own path, one that derives from its unique strengths and responds in its own way to the needs of its community.

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## PRINCETON'S NEEDS

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In talking with individuals and groups, we heard many different things, but a number of common concerns and needs were voiced. Our conversations reveal that:

**We need a “data lifeline:”** We are drowning in data, and everyone (students, faculty staff) wants the University to provide them with a “data lifeline.” The need is for a comprehensive data store, along with mechanisms to search and archive the data, and policies that control retention and disposal of the data. Such a system must have very broad applicability because the need is broad: email, research data, reports, forms, and all the various records produced by the University. The actual production of digital content (“digitization” in the narrow sense) represents a very small part of this need; more critical is the need for integrated data repositories that allow people to store, access and share data without burdensome quota restrictions and that will help the University respond to emerging judicial data-reporting requirements and reduce the widespread data duplication and proliferation of “shadow” systems that currently exists on campus.

**We want to collaborate:** Faculty, students, and staff want systems that facilitate collaboration, both at the level of data (shared data stores, collaboration software) and at the level of people (high-quality video conferencing). Collaboration software must therefore be an integral element in the design of our data repositories. And we must evaluate the need for spaces, equipment, and software designed to support high-bandwidth (high-definition) video conferencing.

**We want online access to everything, anytime and anywhere:** It is not enough for our data to be online and shareable. Faculty, students, and staff want data and services to be accessible to all of our devices and from all of our venues. There is a widespread desire for much improved, easier-to-use, and more accessible online services and a concern that we are not implementing web-based services fast enough. Faculty members want better access to data and services from the classroom, from home, and from abroad. Students want better access on their mobile devices. And everyone wants more uniform access to services. Currently, there is a wide disparity among departments (both academic and administrative) in terms of the online services they provide. What online services do exist are often hard to find, and even harder to use.

**We need to consolidate:** A recent survey (March 2007) revealed the existence of 284 departmental IT systems at Princeton. Many of these systems contain unique data or support unique services. But many also contain data replicated from central repositories or provide redundant services (services that are available centrally or have been separately implemented in multiple departments). Each of these systems comes with an associated

maintenance cost, and all represent a potential security exposure. Where possible and appropriate, we need to provide consolidated, secure, robust services that eliminate the need for these redundant systems. Where not possible, we need to provide IT audits for these systems to ensure that they meet stringent data security standards.

**We want more support, not just more technology:** The single, strongest message that emerged from the faculty interviews and from conversations with staff in administrative offices was the need for people who can help faculty and staff members understand how to use IT systems. Although some amount of enhanced online training will help, the most often voiced need was for people who both understand the work of the faculty or staff member and also understand IT well enough to act as a go-between, people who can explain and exemplify the proper use of technology to the individual user. Faculty members do not, in general, feel they know all of the technology they should, or could, know to help them in their teaching and research, and staff members feel that they are not able to leverage the software they have to maximum benefit or explain their IT needs adequately to the IT staff.

In summary, the members of the Princeton community are asking us to provide them with easy-to-use, consolidated data stores and online services that support collaboration and sharing, along with a cadre of knowledgeable IT support staff who also understand their academic and business needs and can help them use technology to maximum benefit.

How can we do this?

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## **PRINCETON'S PATH**

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*"We absolutely must move briskly into the future. Universities that stand still fall behind."* Shirley Tilghman, President of Princeton University, CPUC Meeting, March 2007

We believe that the right path for Princeton in the 21<sup>st</sup> century is a path that builds upon the one we have successfully followed in two specific areas: administrative systems and high performance research computing systems. These two efforts share a common set of elements that have been instrumental to their success:

- 1) Close collaboration between users and service providers.
- 2) Centralized facilities, hardware, software and staff support.
- 3) Centralized funding for infrastructure, with appropriate cost sharing by departments.

We believe that these three ingredients are key to the success of any large-scale IT effort at Princeton. They derive directly from Princeton's unique qualities as an institution, notably its high degree of centralization in governance and funding. We believe that we can address the IT needs expressed by the community by continuing to strengthen our initiatives in administrative and research computing support and by incorporating the same elements that have made these two initiatives successful into a set of new initiatives in two areas. We recommend that Princeton:

## BUILD AN INFORMATION INFRASTRUCTURE

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We have successfully built a network infrastructure and we must continue to support and enhance that infrastructure in the years to come. But providing conduits for the bits is no longer enough. We must take the next step and build an information infrastructure, one that can help us manage the massive amounts of data that we are acquiring and generating, and one that supports collaboration. Core elements of this information infrastructure are:

- Massive central data storage (hundreds of terabytes, if not petabytes), centrally provided and managed.
- Development of comprehensive data repositories that support data access and archiving, along with the implementation of data retention policies.
- Reduction in duplication of data stores, with corresponding enhancement in accessibility of centrally stored information.
- Standardized, simple-to-operate collaboration software that facilitates sharing of data within and beyond the confines of Princeton.
- Digitization services that facilitate the conversion of information from analog to digital form.
- Enhanced support for mobile devices and remote access to University resources from home or while traveling.
- Standardized, simple-to-operate media facilities in classrooms that allow faculty and students to access and share information during class.
- High-definition video conferencing spaces that support real-time collaboration.
- Continued support for the networking and computing infrastructure on which all IT services depend.

## BUILD A SERVICES INFRASTRUCTURE

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Universally accessible shared data access is key to Princeton's future as an institution dedicated to the accumulation, creation, and analysis of information. Equally important is online access to services. We are not proposing to replace face-to-face interactions (in the classroom, dorm room, or office), just the opposite. We are proposing a set of integrated, online services that will facilitate people-to-people interactions by simplifying and standardizing interactions between people and information. Essential elements of this services infrastructure are:

- A comprehensive and secure authentication and authorization system that enables all members of the extended Princeton community to access information services both from within the University network and from external networks.
- Easy-to-use and high-quality departmental and University web sites that support automation of routine information services, with ease-of-use being paramount; if it is not easy to use, people won't use it no matter how functional, unless they have no alternative.
- Online forms, with secure access available both within the University network and from external networks.
- Replacement of "shadow" information systems with a set of secure, centrally-managed services that allow authorized users to access the information they need, when and where they need it.
- A cadre of "business" and "academic" IT specialists who can correlate business and academic needs with IT solutions and can advise and mentor users on how to use

technology in the most appropriate manner. These staff must either be co-located with their customers or be easily dispatchable to offices, classes, or dorm rooms.

We have begun to provide an information and services infrastructure for our administrative systems and our research computing systems, although we have more to do in each of these areas. As we look to other areas, we must keep in mind that Princeton is made up of many communities, and we will always have multiple centers of IT excellence and support; indeed, when it comes to customer support, models based on local staffing can be very effective (e.g., the Woodrow Wilson School). But the scale of the information problems we face demands unified, centralized solutions. Infrastructures are useful only to the extent that they are uniform and universal; we need one information infrastructure, one services infrastructure.

Princeton has a chance to do something that many of its peers cannot do. Because we are small, because we are relatively centralized, and because we are clear about our educational and research mission, we have the opportunity to develop and deliver a set of IT services that are fully matched and appropriate to the University and its mission. Princeton has described itself as an “early follower” with respect to IT. But the trends we have surveyed, and the conversations we have had, make clear that IT is becoming ever more central to the conduct of education and research. If Princeton is to continue to lead as an educational and research institution, it must consolidate and strengthen the IT services it provides to its community. The success of our faculty, our students, and our staff will depend on our ability to do so.