Letter from the CIO

Dear Yale Faculty, Staff, and Students,

Investments in innovation, teaching and learning, research, and infrastructure are of fundamental importance to our future at Yale. Listening to the needs of our community is essential to satisfy the diverse technology needs of the University.

Technologists, faculty, staff, and students across the University recently participated in the development of a comprehensive information technology strategy. All of this effort resulted in the following Information Technology Strategic Plan. This plan will influence University technology priorities, decisions, and projects.

Completing this plan required an open and accessible dialogue. In December 2012, we started this process by forming working groups with membership from across the Yale community. The working groups created draft recommendations that conveyed the goals, objectives, and strategies related to three specific areas:

- Teaching, Learning, and Research
- IT Foundations
- Administrative and Core Services

The working groups posted their draft recommendations on the ITS website for comment from the community. More than 200 people participated in this process by joining in the working groups or by providing feedback through the website. After incorporating feedback into the recommendations, the plan was presented to the ITS Advisory Committee (ITSAC), a provostial committee of faculty and academic administrators from across campus, and then to University officers.

For the past two years, the ITS organization has been focused on the following six guiding principles:

- Staff Development
- Technological Leadership
- Rock-Solid Services
- Community Satisfaction
- Fiscal Management
- Global Recognition

Faculty and staff satisfaction with IT services has increased from 50 to 79 percent over the past two years as a result of these guiding principles, along with improvements to core foundational technologies that were not meeting the needs of these groups.
Our goal is to increase faculty and staff satisfaction with IT to more than 90 percent. To achieve this goal, we must continue to listen, collaborate, and deliver the highest value within our operational and fiscal constraints. Also, IT must be a catalyst for innovation, improvement, and functional excellence.

In order to reach our goals with the resources that are available to us, IT must be fully transparent and aligned with the collective goals of the University. As we enter into the 2014 fiscal year, our new IT governance model will complete its first full year in service. As this structure continues to evolve and mature, IT will become a stronger contributor to the overall success of the University.

We welcome your interest in technology at Yale and invite you to visit our website at http://its.yale.edu and provide us with your feedback.

Sincerely,

Len

Len Peters
University Chief Information Officer and Associate Vice President
cio@yale.edu

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## Contents

Executive Summary .......................................................................................................................... 3

IT Vision, Mission, Values, and Principles .......................................................................................... 5

Scope of Challenge ............................................................................................................................ 6

  New Trends and Emerging Technologies in Higher Education ..................................................... 6

  Where We Are Today in IT at Yale .............................................................................................. 10

FY14-16 IT Strategy ............................................................................................................................ 14

Yale Information Technology Needs and Recommended Strategies .................................................. 15

  Teaching, Learning, Research .................................................................................................... 17

    Information & Digital Asset Management IT Strategy Recommendations .................................. 17

    Research Technologies IT Strategy Recommendations ............................................................ 21

    Teaching & Learning with Technology IT Strategy Recommendations .................................... 25

IT Foundations .................................................................................................................................... 29

  Cloud File Backup & Synchronization IT Strategy Recommendations ........................................ 29

  Data & Integration Services IT Strategy Recommendations .......................................................... 31

  Desktop Virtualization IT Strategy Recommendations ............................................................... 35

  Email IT Strategy Recommendations ......................................................................................... 37

  Identity & Access Management IT Strategy Recommendations ............................................... 42

  Information Security & Risk Management IT Strategy Recommendations .................................. 44

  Information Technology Service Management IT Strategy Recommendations ....................... 47

  Infrastructure-as-a-Service IT Strategy Recommendations ....................................................... 50

  Resilient IT Strategy Recommendations .................................................................................... 53

  SaaS/ PaaS IT Strategy Recommendations .................................................................................. 55

Administrative and Core Services ..................................................................................................... 58

  Academic Administration IT Strategy Recommendations ......................................................... 58

  Business Systems IT Strategy Recommendations .................................................................... 62

  Facilities IT Strategy Recommendations ..................................................................................... 64

  Public Safety IT Strategy Recommendations ............................................................................... 66

  Research Enterprise IT Strategy Recommendations ................................................................. 69

  Web Strategy IT Strategy Recommendations ............................................................................... 72
Appendices .................................................................................................................................................. 77
Appendix 1: Governance Structure ..................................................................................................... 77
Appendix 2: Feedback and Follow-up ................................................................................................. 79
Appendix 3: Contributors to the Plan ................................................................................................. 80
Appendix 4: References ....................................................................................................................... 86
Appendix 5: FY13 Costs and Funding Sources for IT Services .......................................................... 87
Appendix 6: Estimated Costs to Implement the FY14-15 Strategic Plan ........................................... 88
Executive Summary

IT is partnering with Yale leadership and the community to develop a plan that furthers the University’s mission to create, preserve, and disseminate knowledge, and to attract and retain the best and brightest students, faculty, and researchers. We are contributing to these efforts through the use of a governance model that facilitates decision-making, and by implementing a dynamic and inclusive planning process with regular opportunities for feedback and communication. This strategic alignment benefits the University through a shared understanding of where we want to go and how we plan to get there; the ability to make better-informed choices; an improved ability to plan for future changes, such as regulatory and environmental changes; and clearer accountability for achieving goals that support the strategy and mission.

The partnership also brings effective stewardship of limited resources by allowing IT to align resources with the most valuable activities that support the University’s vision. IT resources (staff and funding) at Yale are highly dispersed, often resulting in distributed and isolated decision-making about IT investments. The new governance and collaboration framework is broadening participation and improving transparency in technology investments and decision-making, improving integration, and leveraging limited funding most effectively.

We thank the many faculty members, staff, and students who contributed energy and enthusiasm to the development of these strategies, and who will assist with the prioritization of this plan. Not surprisingly, the needs that were identified shared many common objectives that illuminate where Yale should focus energy, keeping these topics at the forefront of our priorities. They include:

- Improved collaboration, communication, and elucidation of the services available
- Improved data access and data integration among systems
- Data governance and stewardship
- The ability to innovate, accelerate, and deliver solutions with agility
- The need to maintain a secure, robust, and compliant environment

Over the past decades, IT has matured to become a core function of higher education, but recently several “disruptors” have emerged that require us to innovate, evolve, and adapt. These trends are shaping community expectations, institutional reputation, and even compliance. These new opportunities threaten existing operating and process models; they are less about automation and process improvement and more about changing the nature of the way we think about technology’s role in higher education.

Information technology is still critical to the administrative functions of the University, but it is increasingly part of the fabric of how we teach, learn, build communities, and communicate. In the section on New Trends and Emerging Technologies, we explore a few of these topics, such as “bring your own device/technology” (BYOD/T); rapid growth in mobile computing, including tablets, smartphones, and e-textbooks; massive open online courses (MOOCs); social media, communities, and the shift of focus to the user experience; cloud computing; and “big data.”
The technology landscape around us continues to evolve rapidly, offering ever-improving user experiences, ubiquitous access, and ever-available cloud-based tools. Our community is already using these services and expects the same of our services. While IT aspires to provide a modern and user-friendly experience, we are limited by our current technology landscape, which comprises many large, complex, and highly independent systems. These systems use a plethora of standards, frameworks, and architectures, held together with point-to-point integrations. As mentioned in the themes from the plan, governance (especially around data) is lacking, which makes improving the integrations—and therefore the user experience—significantly more difficult. In addition, the user experience is distributed and sometimes confusing, frustrating, and inefficient. The complexity and diversity of our technologies result in high maintenance and resource costs that in turn constrain our ability and bandwidth to implement new technologies.

The demand for IT projects continues to grow, partly due to better processes for documenting the demand from the Yale community. The demand for centrally funded IT projects for FY14 was $72.1 million. Nearly half of this demand (48%) was requests for foundational technology or projects to mitigate risk or address compliance requirements. A significant portion of this foundational demand (18% of total demand and 47% of available portfolio funding) represented large maintenance activities such as life-cycle replacements for infrastructure and large application upgrades.

In recognition of the fiscal challenges faced by the University, the ITS budget for FY14 remains essentially flat. Savings from retired services offset the increased support costs resulting from projects and new services implemented in FY13. Continued adoption of cloud computing will ultimately result in lower operating costs.

Over the past decade we have leveraged capital funding to deliver new IT functionality, but have not budgeted the ongoing operating costs necessary to maintain the new services. As a result, approximately 94 percent of IT centralized resources and funding is required to provide routine services and to maintain existing systems, leaving insufficient resources to accomplish the objectives set forth in this plan. Implementation of this plan will require an infusion of additional funding to address the backlog of demand for foundational technologies. Moreover, it will require that ITS retire non-essential services to create capacity for high value activities.

As the financial climate improves through FY15-6 and we are able to make sound arguments that demonstrate the value of investments in IT, we anticipate additional funding will become available.

IT will continue to partner with Yale leadership and the community to support the University’s mission, and effectively steward Yale’s limited resources. We will continue to leverage new technologies to address opportunities and challenges that affect the University’s ability to achieve its goals. In short, IT is a part of the fabric of the University community and we are committed to its advancement and support.
FY14–16 Information Technology Strategic Plan

IT Vision, Mission, Values, and Principles

VISION
We strive to be recognized globally as the leading technology organization across universities, through rock-solid services, innovation, technology leadership, and community satisfaction.

MISSION
Our mission is to deliver the highest level of service possible to students, faculty, and staff, and to demonstrate technology leadership that furthers the University’s mission.

VALUES
We aspire to five core values that underlie all information-technology activities at Yale: respect, service, leadership, transparency, and fiscal responsibility.

PRINCIPLES
We aim to deliver technology services with an underpinning set of six principles: community satisfaction, technology leadership, staff development, fiscal management, and rock-solid services. Using these areas of focus, we guide technology decision-making and service delivery for the Yale community of faculty, staff, and students.

Community Satisfaction
We deliver our services with consideration of the users, the Yale community, not solely from only a technological point of view. When we select technology and offer services, usability and accessibility is a priority. We inform and involve the community in our decision-making processes.

Technology Leadership
As technology leaders, we leverage new and emerging technology trends; implement architecture that embraces standards, interoperability, and extensibility; and base decisions on well-defined, relevant metrics. We promote innovation and creativity to find solutions that delight the community and support the University’s goals. We communicate transparently, and invite all those who represent broad perspectives to share knowledge and information through communities of practice.

Staff Development
We invest in training and development of the technology staff and the wider community to enhance technical and non-technical skills and growth, and create frameworks to enable and foster communication and collaboration throughout the organization.

Fiscal Management
Our investment decisions reflect careful evaluation of the University’s strategic goals; expected benefits and outcomes, costs, and risks; and technical and data architectural impact and fit. Whenever possible, we leverage standard technologies and processes, and work to eliminate duplicative processes and technologies. We strive for transparency, predictability, and simplicity in our costs as represented in charges and assessments.

Rock-Solid Services
We provide services that meet or exceed community expectations. We deliver effective and efficient computing and communications infrastructure, services, and support for Yale’s teaching and learning, research, public service, and administrative programs.
Scope of Challenge

New Trends and Emerging Technologies in Higher Education

The technology landscape around us continues to evolve rapidly, offering ever-improving user experiences, ubiquitous access, and ever-available cloud-based tools. Information Technology is increasingly woven into the fabric of how we teach, learn, build communities and communicate. Our community expects technology they use in their activities at Yale to function and feel like systems found across the web; to understand who they are in the context of what they are doing; to allow them to configure and build independent of the IT organization; to be a useful, integrated social component; and, to function effectively on smart phones and tablets.

Gartner’s hype cycles, in balance with the technology needs of our community, help us understand which applications and what infrastructure we may need in the future. These Hype Cycles offer a snapshot of the relative maturity of technologies, IT methodologies and management disciplines. The cycle highlights overhyped areas, estimates how long technologies and trends will take to reach maturity, and helps organizations decide when to adopt. The Gartner Hype Cycle provides useful analysis to inform whether or not we are investing in technology opportunities at the most appropriate time to meet the needs of our community.

*2013 Gartner Hype Cycle for Higher Education*

*Highlights illustrate areas that are currently implemented or are under development.*
Yale is exploring a multitude of new opportunities, most somehow connected to the evolving cloud landscape. Two of our working groups focused specifically on adopting trends in software-as-a-service and infrastructure-as-a-service. We expect the following technologies to significantly impact our community.

**Bring Your Own Device/Technology (BYOD/T)**

Students, faculty, and staff have long been purchasing their own devices and using them on campus networks, however the exponential growth of those devices has tested our network and other support systems. As an example, on one particular day the number of unique devices connected to the campus network exceeded 38,000. Campuses are required to support personal devices and technologies for the community, regardless of whether the institution has changed its policies or support models accordingly.

Gartner, a leading information technology research and advisory firm, recommends a coherent approach to securing mobile BYOD across all University facilities regardless of location, to include five basic security policies: password lock codes, lock when idle, complex passwords, remote wipe capability, and device encryption. Campus policies should be modified to prohibit institutional data being downloaded to unprotected devices. Student activity should be limited to public-access networks designated for that purpose (Chuang & Harris, 2012).

At Yale, we have taken steps to clarify our campus IT Appropriate-Use Policy to ensure that individuals are aware of their responsibility for the security of institutional information regardless of whether a device is personal or owned by Yale.

**Mobile Devices**

Mobile devices are changing the interaction platform for consuming content, and this is especially true in the context of teaching and learning. There are two ways students use technology in a classroom environment: passive, where personal devices are allowed, but not required; or active, where course design is dependent upon and requires access from a mobile device. Devices in the classroom can be disruptive if the instructor is not guiding the learning with the device interaction in mind.

The proliferation of e-textbooks is also changing the face of higher education. Tablets, with their large, high-definition screens, and touch capabilities, are already a mature platform for the delivery of textbooks and other printed materials, and are preferred by many students. Tablets can hold thousands of books, are considerably more cost-effective, lighter, and more portable than an equivalent number of textbooks. For many students, searching, referencing, and citing in a digital format is now easier than working with hardcopy books. Tablets also provide access to the internet, enabling instant cross-referencing and the synthesis of ideas and readings, as well as sharing in Google+ and other social networks.

Students report that using a tablet facilitates greater participation in class as it allows them to easily share ideas with peers and encourages “active input from groups.” Students express a great desire to change the traditional classroom environment, and the novelty of the tablet provides a deviation from the normal routine of a class. Students who learn visually praise tablets because they become more involved in learning and the devices give them hands-on experience with course material (Rossing, Miller, Cecil, & Stamper, 2012).
At Yale, ITS supports a growing number of mobile and tablet initiatives as educators find creative ways to integrate these technologies in their diverse areas of study. We offer class sets of iPads that faculty apply to use for a semester and integrate in creative ways. For instance, Yale students in Maria Moreno’s Introduction to Model Systems in Biological Research course view live images of animal and plant specimens that are broadcast wirelessly to multiple iPads from a shared digital microscope, as well as projected on a screen at the front of the classroom. Yale students have taken ITS supported iPads into the field for entomology courses. The Writing Center leveraged iPads to allow students to interact and participate in radio media broadcast seminars.

**Massive Open Online Courses (MOOCs)**

The U.S. Consumer Financial Protection Bureau estimates student loan debt in America at more than $1 trillion. Higher-education institutions have acknowledged this overwhelming cost and started seeking and nurturing alternate educational methods. This demand for less expensive education has spurred many high-ranking universities to offer massive open online courses (MOOCs) (Ripley, 2012). Continuous multiple choice questions help to engage students, with pop-ups acknowledging correct answers. “Humans like immediate feedback, which is one reason we like games.” (Ripley, 2012, para. 22) The ability to fast-forward and rewind also helps students learn on their own terms. MOOCs are perfect for “self-motivated and already fairly well-educated [students].” (Ripley, 2012, para. 55)

The American Council on Education (ACE) has begun to review some of these MOOCs for possible college accreditation, which may allow some students to graduate more quickly by taking self-guided courses concurrent with their in-class lectures. MOOCs may also become the new generation of AP courses, allowing high-school students to get a head start on college (Young, 2012).

**Social Media**

Higher education should take heed that 46 million Americans check their social media accounts every day, and that one out of every five minutes spent online is spent on a social network. Students utilize social networking for discussions with peers, often using Facebook or Google+ to talk about course-related topics (Kirschner, 2012). Educators are coming to realize the very broad implications of social media, including its potential value in distance learning. For example, in the spring of 2012, the Yale Broadcast and Media Center recorded and posted online videos of a Yale College Seminar called Philanthropy in Action. Students were able to converse with speakers across the globe on Livestream, and could follow the discussions on Twitter.

**Cloud Technology**

Cloud technology has opened up new opportunities for teaching as well. Budget constraints and small class sizes can make individual purchases of software impractical, even when the need is obvious, such as in computer-related courses. Software subscriptions delivered in the cloud as e-services are able to provide software and associated data via a web browser or a thin client, relieving the user of the burden of hardware and software installation and management. A case in point is Adobe’s Creative Cloud, which provides access to 24 popular graphic design and editing tools at a relatively low monthly subscription rate. Such simplified solutions not only allow students to focus more on the actual coursework, but also enriches their overall experience (Kourik & Wang, 2012).
Cloud learning management systems (LMS Cloud) enhance student-student and student-faculty interactions. The high use of precursor technology (e.g., Blackboard) demonstrates the demand for these services (Lowendahl, 2012). Cloud LMS can free up technical resources for innovation and integration of the service. New implementations of the LMS can be rapidly deployed and provide access to social and mobile options (Carvalho, Areal, & Silva, 2011). Lecture capture-and-retrieval tools are starting to be integrated into these platforms. Though they cannot replace actual face-to-face teaching, the benefits are many, including “review, improved retention, convenience, and a new option for students to make up planned or unplanned absences.” (Lowendahl, 2012)

**Big Data**

As defined by Gartner Research, big data is "high volume, velocity and/or variety information assets that demand cost-effective, innovative forms of information processing that enable enhanced insight, decision-making, and process automation." (Lapkin, 2012) “Big data” may be a hyped-up term, but the impacts of big data are being felt everywhere, not just in higher education. The volumes of structured and unstructured information we collect continue to grow exponentially, doubling in the span of months. These data range from email to research data sets, and if studied in appropriate ways could create knowledge and connections never before possible.

Our challenge is to organize and make sense of these data to open up new avenues of research, to explore and transform the teaching and learning experience, and to improve the decision-making of University leadership. With proper planning, we will see the coming together of data and integration governance, infrastructure, and applications to capture, organize, and store the “big data” and the analytical methods and tools required to attain those insights.
Where We Are Today in IT at Yale

In FY13 the Central IT Operating Budget was $110 million and the Central IT Project Capital Budget was $22 million. The following chart illustrates how FY13 costs aligned with program areas and related IT services. Ready-to-Serve (RTS) activities include delivery of common services and routine maintenance. RTS Projects include periodic life-cycle upgrades and replacement projects; these projects “keep the lights on” for existing service/systems. Other projects are projects that deliver new services or improve existing services.

Central IT is funded predominantly from General Appropriations (GA) allocations with additional revenue from Internal Services and Billing.

GA Allocation 60.4%
Internal Service income 19.6%
Billing from the FTE rate and telecommunications 13.0%
Funding Allocation 5.9%
Other income 1.1%

Appendix 5 provides additional detail indicating these fund sources relate to the specific services provided by Central IT.
Recognizing the fiscal challenges faced by the University, the ITS operating budget for FY14 is on target at $120.1 million. The projects that were completed in FY13 resulted in about $4 million of incremental recurring costs. Savings from retired services, productivity improvements, and interest and amortization decreases offset the incremental costs by $1 million. We requested additional funding in FY14 to improve our Teaching and Learning services and received approval for an increase of $1 million, resulting in a final operating budget of $121.5 million.

Continued adoption of cloud computing will ultimately result in lower operating costs. However, while cloud solutions will reduce the need for capital expenditure, we will see an increase in project-related operating expenses. Projects historically have required capital investments, causing project costs to be paid from operating expenses over five years through interest and amortization expenses. Cloud-based computing solutions typically require less capital investment, as the services are purchased on an annual basis with no capital outlay. Assuming no overall growth in project spend, we will see an inversion of project capital, with the ratio of capital to operating funding moving from 75:25 closer to 50:50. The operating portion of the project budget grew from $8 million in FY11 to $12 million in FY13, and could approach $15 million by FY15.

The increased operating expenses are partly transient, while new cloud-based support costs run in parallel with support costs for existing systems, and interest and amortization on the retired system. This usually occurs for a period of one to two years before the net benefits are realized. For example, overall ERP maintenance will nearly double the FY13 expenditures, approaching $10 million, while the Oracle ERP and new Workday ERP are operating in parallel. As the Oracle ERP is retired, those costs are expected to be comparable to prior costs, albeit delivering a higher level of service and system capability. Overall, these changes will require a net increase in operating expenses through FY16, before becoming cash-flow positive beginning in FY17, when reductions in interest and amortization resulting from lower capital investments offset the increasing project operating expenses.
Nearly 94 percent of centralized IT resources and funding are required to provide routine services to the community and to maintain the complex and diverse systems that we support today, constraining our ability to satisfy new needs beyond what we can accomplish with the project portfolio funding. Historically IT resources (staff and funding) have been dispersed, which resulted in independent and sometimes duplicative solutions, that lacked common standards, and which are now difficult to integrate, and costly to maintain. We have not collected or communicated information about the total end-to-end costs of implementing and supporting technologies, so we have made investment decisions without understanding the true costs. Over the past two years we have made significant progress to raise visibility and awareness, but we must continue to understand the end-to-end costs of IT support in order to improve efficiency, reduce costs, and improve decision-making.

We continue to see a growing demand for IT projects, due in part to better processes for documenting the demand from the Yale community. Total demand for IT projects increased from $57 million in FY13 to $83 million in FY14. We are also nearing the end of life for many of the large IT investments that were made in the past. We are currently replacing our fundraising technology, Enterprise Resource Planning (ERP) solution and identity management solution. In the next several years we will need to decide the future of our Learning Management System, Student Information Systems, and capital construction and renovation system (to name a few). Large life cycle replacement needs such as these, will consume the majority of the project budget and limit our ability to respond to the broader needs identified in this plan, unless we are able to increase our investments in IT for the next several years. The estimated costs to implement this plan, and to address the upcoming lifecycle upgrades is approximately $215.5 million. The Central IT Project Budget, including additional infusions of $5 million and 10 million in FY15 and FY16 respectively, is anticipated to total $106.5 million (including capital and operating funds).

### Estimated Costs to Implement Strategic Plan

<table>
<thead>
<tr>
<th>Category</th>
<th>FY14 Allocation ($)</th>
<th>FY15 Total Demand ($)</th>
<th>FY16 Total Demand ($)</th>
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<tr>
<td>Administrative &amp; Core Services</td>
<td>$50</td>
<td>$100</td>
<td>$150</td>
</tr>
<tr>
<td>IT Foundations</td>
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<td>$40</td>
<td>$60</td>
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<tr>
<td>Ready to Serve (RTS)</td>
<td>$10</td>
<td>$20</td>
<td>$30</td>
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<tr>
<td>Teaching, Learning, Research</td>
<td>$5</td>
<td>$10</td>
<td>$15</td>
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See Appendix 6 for additional detail about the estimated costs for each of the detailed recommendations within the three year plan.
In spite of a significant backlog of demand, satisfaction with IT services has increased from 50 to 79 percent over the past two years. These gains can be attributed to the following key strategies:

- Engaging the community to identify whether services are meeting current needs
- Improving core foundational technologies that are not meeting community needs
- Creating a collaborative framework for making decisions and for communicating those decisions
- Implementing best practices in service management to measure and continually improve our services
FY14–16 IT Strategy

Although community satisfaction has improved dramatically over the past two years, our objective is to increase community satisfaction with IT to more than 90 percent by 2015.

The Yale Information Systems Technology Needs and Recommended Strategies, contained in this plan, identify the goals and objectives we need to achieve as an organization to deliver on the expectations of our community. The top five common strategies are:

- Expand data governance and stewardship
- Improve collaboration, communication, and elucidation of the services available
- Improve data access and data integration among systems
- Find the ability to innovate, accelerate, and deliver solutions with agility
- Maintain a secure, robust, and compliant environment

In order to achieve as much of this plan as possible, within the constraints of our budget, we need to increase the capacity of our staff to work on new projects and technologies by driving down operating costs, minimizing time and effort spent improving costly independent systems, and delivering technology services that are cost-effective and efficient on an ongoing basis.

We will gain these efficiencies through continued implementation of best practices in service management. We have developed a baseline budget that aligns the IT budget with the services we provide, and provides greater visibility about the current costs associated with these services. We have established metrics to measure the ongoing actual costs for routine services and maintenance upgrades (allowing comparison to the original baseline). We have also established metrics for service quality and community satisfaction. Service owners will engage with the community to develop plans to drive down operating costs while maintaining community satisfaction, leveraging the metrics and our collaboration model to continuously improve the quality and value of our services.

To support these goals, we have identified the following set of specific objectives for FY14-16:

- Achieve 90 percent community satisfaction by 2015
- Cultural change through 100 percent adoption of Infrastructure Technology Infrastructure Library (ITIL) and the Service Framework by 2015
- All core technologies have a clear roadmap by FY15
- Overall RTS capacity needs are reduced to 80 percent by FY16
- Contribute 5 percent productivity to ITS and Yale every year
- Increase IT workplace commitment scores to over 75 percent
- Deliver 100 percent of the approved portfolio annually

We will also propose a new assessment model based upon common services that aims to decrease overall costs for basic services. For common services, we will base charges on standard service levels rather than usage. Other services that require nonstandard, superior service levels will be based upon consumption.
Yale Information Technology Needs and Recommended Strategies

This word cloud represents the top 50 words used in the 19 recommended strategy reports submitted by the focus area working groups.

The strategic planning process kicked off in December 2012 with the formation of 19 working groups with membership across the Yale community. The working groups created draft recommendations that conveyed the goals, objectives, and strategies related to three specific technology client need areas that are critical to support achieving the University mission:

- Teaching, Learning, and Research
- IT Foundations
- Administrative and Core Services

Between December and February, the group members worked together to identify the IT needs of their specific area and to recommend strategies to achieve these needs. These drafts were vetted with the Yale community during late February and March. In April, the groups reconvened to review the community's feedback and finalize their recommended strategies.

These recommendations act as a guide to select specific projects which will allow us to achieve the stated objectives within operational and fiscal constraints.
## Teaching, Learning, Research

<table>
<thead>
<tr>
<th>Service Area</th>
<th>Lead</th>
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</thead>
<tbody>
<tr>
<td>Information &amp; Digital Asset Management</td>
<td>Michael Dula, Chief Technology Officer, Library</td>
</tr>
<tr>
<td>Research Technologies</td>
<td>Edward Kairiss, Acting Deputy CIO and Senior Director, Academic IT Solutions</td>
</tr>
<tr>
<td>Teaching &amp; Learning With Technology</td>
<td>Lucas Swineford, Director, Broadcast &amp; Digital Media Center, Digital Dissemination</td>
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## IT Foundations

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<tr>
<th>Service Area</th>
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<tbody>
<tr>
<td>Cloud File Backup &amp; Synchronization</td>
<td>John Coleman, Director, ITS Core Services</td>
</tr>
<tr>
<td>Data &amp; Integration Services</td>
<td>Russ Battista, Director, Enterprise Technology Architecture, ITS Solutions Design</td>
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<tr>
<td>Desktop Virtualization</td>
<td>Philip Rinehart, Associate Director, ITS Desktop Engineering</td>
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<td>Email</td>
<td>Robert Condon, IT Program Director, ITS Infrastructure Services</td>
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<td>Identity &amp; Access Management</td>
<td>Josh Nabozny</td>
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<tr>
<td>Information Security &amp; Risk Management</td>
<td>Richard Mikelinich, Chief Information Security Officer, ITS</td>
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<tr>
<td>Information Technology Service Management</td>
<td>Adriene Radcliffe, Director, Governance, Service Management, &amp; e-Services</td>
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<tr>
<td>Infrastructure-as-a-Service</td>
<td>John Coleman, Director, ITS Core Services</td>
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<tr>
<td>Resilient IT</td>
<td>Susan Kelley, Senior Director, ITS Infrastructure Services</td>
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<tr>
<td>SaaS/ PaaS</td>
<td>Colleen Whelan, Manager, ITS SaaS Practices</td>
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## Administrative and Core Services

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<th>Service Area</th>
<th>Lead</th>
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<tr>
<td>Academic Administration</td>
<td>Vijay Menta, Director, Client Lead Team, Academic Administration</td>
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<td>Business Systems</td>
<td>Marc Ulan, Associate CIO, Business Systems</td>
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<tr>
<td>Facilities</td>
<td>Barbara Haberman, Manager, Application Systems, ITS Shared Solutions</td>
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<tr>
<td>Public Safety</td>
<td>David Boyd, IT Director, University Public Safety</td>
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<tr>
<td>Research Enterprise</td>
<td>Joyce Lush, Director, ITS Client Team for Research Enterprise</td>
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<td>Web Strategy</td>
<td>Jane Livingston, Associate CIO, Campus Community Technologies</td>
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Teaching, Learning, Research

Information & Digital Asset Management IT Strategy Recommendations

Goals

Create an information and digital asset environment that provides support for creators of information (researchers, teachers, scholars, students, even automated systems), managers and stewards of information (project owners, laboratories, libraries, archives, museums, administrators), and users of information (all of the above and more, at Yale and beyond). This has system, policy, and financial implications for storage infrastructure, tools for managing workflow and processes, indexing and discovery systems, and emerging technologies.

Objectives

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</table>
8. Support established and emerging technologies and standards for information management, dissemination and preservation. | X | X | X

9. Create policies and infrastructure to support management and retention of institutional and personal data on University systems. | X | X |

10. Address collaborative information landscape. | X | X |

**Recommended Strategies**

1. **Provide support for research data throughout its lifecycle: collection, management, curation, access, and preservation and re-use**
   A white paper has been drafted by Yale University Library and ITS based on participation in the E-Science Institute, sponsored by the Association of Research Libraries, Duraspace, and the Digital Library Federation. That paper (available at [http://guides.library.yale.edu/escienceinstitute](http://guides.library.yale.edu/escienceinstitute)) will provide a valuable starting point for addressing this issue. A strategy for supporting research data at Yale will need to address storage; policy; grant compliance, outreach and coordination with faculty; tools for data lifecycle management; and consultation help for faculty on specialized topics such as grant compliance, metadata, and preservation. Support for data preservation will address faculty problems with accessing data on obsolete platforms. Other Enterprise systems such as workflow tools and the Identity Management project will be part of the support ecosystem. While the white paper addresses some immediate steps that can be taken to improve support and analyze our current state versus our peers, a robust program for data management support may require additional staffing and resources at YUL and ITS.

2. **Address long-term A/V delivery, storage, and preservation needs**
   As with research data, a project should be undertaken to address long term audio-video capture, archiving, and preservation needs. This includes lectures, guest lectures, performances, student recitals, and conference proceedings. The first step is to understand what is being captured now in a multitude of systems. As with research data, this has implications for policy, storage, lifecycle management, and metadata capture.

3. **Assess existing systems for digital asset management across Yale (Library, YDC2, Filenet, etc.), and compare with University needs and standards**
   Initially, this is a project to assess systems and perform a gap analysis. As with storage, we would then be able to provide a menu of existing service options to information owners/stewards. We need to identify the assets that are within the purview of the university, categorize by purpose (e.g., teaching, research) or format (image, AV, publication, data, document, email, website) or some other scheme and identify the issues that need to be addressed (ownership, stewardship, legal requirements, preservation needs, storage requirements, access, metadata). Where systems are not currently in production to address these needs, new projects may need to be initiated.

4. **Provide transparent, dynamic information about data storage options, whether centrally supplied, cloud-based, consortial, or other vendor solutions**
Large storage arrays are already in place within ITS, the Library, the professional schools, and no doubt other islands within the university. What is needed is both a menu of options and a transparent pricing model so the most appropriate and cost-effective option can be selected for a given project. Identify types of storage needed for different digital assets: e.g., working storage, fast access storage, off-line storage, long-term preservation storage, etc. Determine which of these types are/should be centrally supported by ITS. Determine which are best served by other models (decentralized, cloud-based, consortial, recommended vendors, etc.). The current laissez-faire approach means that people find individual solutions that may not be in the long-term interest of the university. We need to communicate a clear cost model that is kept up to date, then create storage solutions to support as many of these use cases as is feasible. In addition to providing information, we need to build workflow tools to support and automate the information ingest process as much as possible. There is a large community of stakeholders: e.g., faculty, Library, Museums, lab informatics experts, Yale affiliates.

5. **Establish a process to clarify University positions on policies affecting ownership and access to the University’s digital resources and scholarly output**
   Working with University Counsel, the Office of the Provost, the Deans, and faculty representatives, establish a process and a set of policies to guide the digital publication, access, discovery, and preservation of Yale research data, scholarly publications including student work (ETD’s etc.), and other digital assets. Yale has a policy to promote open access to cultural heritage materials; we need a policy that addresses a wider scope of materials from scholarly publications to research data.

6. **Support efforts to make Yale’s information resources more readily discoverable and usable—internally, including within Yale’s classrooms, and to the external world**
   In order to make the information assets of Yale useful, we must make them both discoverable and capable of being integrated with other systems. This involves a number of issues: indexing, metadata, and discovery platforms; integration between island systems; reporting tools and standards; integration with classroom systems; and communicating a menu of digitization options on campus for converting analog materials. For all types of information, we need to determine the system of record and promulgate from it.

7. **Develop an academic computing strategy that supports faculty needs to manage their highly miscellaneous and individual digital asset portfolios**
   Portfolio of standards and tools. Menu that faculty can choose from. Help with capturing metadata for items that are destined for a permanent repository, using items that are drawn from one of the existing repositories, and managing items that are ad hoc collections used for pedagogical or research purposes.

8. **Support established and emerging technologies and standards for information management, dissemination, and preservation**
   Examples include mobile access to information and applications, support for linked data and semantic web development, data visualization and augmented realities, and the data required to support 3-D printing of objects. Pilot projects should be supported (e.g., funded) and scaled up when successful.
9. **Create policies and infrastructure to support management and retention of institutional and personal data on University systems**
   Need policies for management and retention of administrative and personal data on University systems. Communicate clear understanding of legal requirements, outside agency requirements, Yale requirements, local optional requirements. We also need clear guidelines for preserving student information, e.g., in Classes.

10. **Address collaborative information landscape**
    Joint projects by students and faculty and researchers across institutions are increasingly the norm. There are also consortial endeavors for digital preservation (e.g., the Digital Preservation Network), and discipline-specific and format-specific repositories (e.g., Arxiv, PubMed, Hathi Trust). How do these fit into our ecosystem? How do we make them part of a Yale Discovery system? Improved interoperability and standards will help support collaborative efforts, but we also need to understand this landscape better.
Research Technologies IT Strategy Recommendations

Goal
Support the technology-enabled research environment at Yale, which promotes collaboration, innovation and productivity, and facilitates the exploration and adoption of new research tools.

Objectives

<table>
<thead>
<tr>
<th>Objective</th>
<th>Timeframe</th>
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<tbody>
<tr>
<td>1. Develop coordinated leadership in Research Technologies among ITS, IT partners, and central administration</td>
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<tr>
<td>2. Develop a communication and outreach effort targeted to the research community regarding services ITS currently offers researchers</td>
<td>X</td>
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<tr>
<td>3. Engage researchers, ITS Partners and ITS resources regularly to determine if current needs are being met and highlight emerging needs</td>
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<tr>
<td>4. Develop and promote the Research Storage Solution (RSS)</td>
<td>X</td>
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<tr>
<td>5. Develop, formalize and implement an institutional strategy for research data management across Yale</td>
<td>X X</td>
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<tr>
<td>6. Develop a phased approach to the establishment of a cohesive tiered-storage environment that will allow Yale researchers to mix and match storage allocation, levels of performance, redundancy, backup, throughput, and access to computational equipment</td>
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<tr>
<td>7. Develop and implement training and consultation programs for large-scale data management and data analysis</td>
<td>X</td>
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<tr>
<td>8. Develop and implement an institutional data repository to enable researchers to deposit primary datasets of ongoing value and to stage datasets for deposit in disciplinary repositories</td>
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Recommended Strategies

1. Develop coordinated leadership in Research Technologies among ITS, IT partners, and central administration

Within the ITS Operating Model, the Research Technologies Committee will engage the campus-wide community in identifying, prioritizing, and championing new research IT initiatives. As per its charter, this group will:

- Champion proposed projects and services for the Research Technologies program
• Identify new opportunities and strategic directions in research technologies
• Focus on specific funding opportunities
• Respond to emerging research technologies that may require support
• Develop and formalize an institutional strategy for research data management across Yale, working with partners
• Develop a standard list of services that currently exist related to data management, computing, transfer of research data from one institution to another when new faculty members come on board, and other research support activities and use this to increase awareness and coordinate services across YUL, ITS, and other units with research support responsibilities.

2. Develop a communication and outreach effort targeted to the research community regarding services ITS currently offers researchers

The Director of Research IT will ensure that the catalog of Research IT services is continuously updated and the ITS website contains accurate descriptions of ITS-supported technologies and services of value to the Research Community. The Director will partner with leadership in Libraries, professional schools, and centers to communicate all available services and resources to the entire campus community, through websites, workshops, and staff training to provide them with knowledge and access to Research IT tools and resources.

3. Engage researchers, ITS Partners and ITS resources regularly to determine if current needs are being met and highlight emerging needs

Develop a detailed, domain-specific annual survey targeted at research IT users to measure their satisfaction with current services, identify gaps in those services, and anticipate emerging research areas and initiatives that will require new resources and technologies. Empower IT and Library staff to continuously engage researchers within their areas of support, and develop partnerships with research labs, groups and centers. Use these engagements to monitor service delivery, community satisfaction, and emerging needs.

4. Develop and promote the Research Storage Solution (RSS)

Assemble a cross-functional team to review RSS architecture, performance and usage profile, and mature the service to increase its value to the research community.

• Develop a set of recommendations for improvements in the service.
• Develop a roadmap for RSS growth.
• Launch an outreach and support plan that can be implemented with existing resources.
• Design enhancements to support management of data sets that are supported by the Research Storage Solution.
• Investigate data management workflow tools and technologies that streamline workflow and metadata capture from data generation through analysis and long-term storage.
5. Develop, formalize and implement an institutional strategy for research data management across Yale
   - Develop a standard list of services that currently exist related to data management, computing, and other research support activities and use this to increase awareness and coordinate service across YUL, ITS, and other units with research support responsibilities.
   - Develop Digital Repository Services that would allow researchers to easily store and manage research data outputs, to publish their datasets for online access at a stable web address and reference these datasets from publications, and be integrated into services for the preservation of the data.
   - Carry out Domain Specific Data Assessments to investigate specific research centers, communities of practice, and specific academic disciplines to determine their data management, data sharing, and data curation requirements.
   - Develop Research Data Curation Services and Tools to support collaboration and data sharing among researchers during the research process, and to promote publishing or archiving data and high-quality metadata to discipline-specific data centers or knowledge-sharing databases, and/or to Yale’s own digital preservation repository.

6. Develop a phased approach to the establishment of a cohesive tiered-storage environment that will allow Yale researchers to mix and match storage allocation, levels of performance, redundancy, backup, throughput, and access to computational equipment.¹

   Identify the staff, infrastructure, and funding resources to implement a multi-year initiative to
   - Evaluate the suitability of the existing RSS as an anchor within an hierarchical storage architecture;
   - Assess the suitability of public and private cloud storage and other leading edge storage technologies as part of long-term solutions for research data management and institutional stewardship of research data.

7. Develop and implement training and consultation programs for large-scale data management and data analysis.²

   Both programs should take steps to encourage interdisciplinary collaboration and cooperation among those generating research data and those with expertise in data management and analysis.
   - For data management, a joint ITS-Library program should focus on effective tools for basic file and database manipulation, and on data curation concepts (e.g., data lifecycle, data sharing, etc.).
   - For data analysis, the program should focus on statistical and computational techniques for large-scale data analysis. This program should include a practicum offered to graduate students, postdoctoral associates, and researchers modeled on courses with a computational or informatics focus.

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8. Develop and implement an institutional data repository to enable researchers to deposit primary datasets of ongoing value and to stage datasets for deposit in disciplinary repositories.¹

- Continue the pilot, started by ODAI, of an institutional repository for publications. To complement this effort, provide one FTE (Program Director) to establish an institutional data repository to enable researchers to share datasets with the public or with other specific researchers and to stage datasets for deposit in disciplinary repositories.
- Appoint a faculty committee to assess the impact of data sharing and reuse on research, publication, peer review, and tenure review.

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Teaching & Learning with Technology IT Strategy Recommendations

Technology is transforming multiple aspects of teaching and learning. One likely outcome is an evolution toward a more diffuse environment where collaboration and communication are more critical to the process than ever before. IT organizations of tomorrow will need accelerate toward a model that prizes partnership across the institution to support solutions that advance pedagogy and academic vision.

Goals

Help to enable an academic environment that fosters collaboration, innovation and scholarship and facilitates the exploration and adoption of new tools that support pedagogy, academic vision and learning.

Objectives

<table>
<thead>
<tr>
<th>COLLABORATION</th>
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<tbody>
<tr>
<td>1. Catalogue the technological solutions and technology support services</td>
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<td>faculty members and students are currently using and where operational</td>
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<td>leadership rests for each solution and service</td>
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<td>2. Determine if there are core teaching and learning services that should</td>
<td>FY14 X</td>
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<td>be offered and supported across the institution and not be restricted by</td>
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<td>School boundaries</td>
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<td>3. Solidify communication across the institution for colleagues with shared</td>
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<td>interests</td>
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<td>4. Keep University leadership informed regarding current and emerging</td>
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<td>technology-related education initiatives</td>
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<th>INNOVATION</th>
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<tr>
<td>5. Evaluate and, if necessary, adapt to latest trends around virtual learning</td>
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<td>environments</td>
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<td>6. Create a framework for faculty to apply analytics toward the evaluation</td>
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<td>of learning in various environments</td>
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<td>7. Support current and future distance learning and open education initiatives</td>
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<td>SCHOLARSHIP</td>
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<tr>
<td>8. Support faculty members who wish to gain additional knowledge of best practices for teaching with technology</td>
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<tr>
<td>9. Support digital scholarship and information technology literacy</td>
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<th>SUPPORT FOR TOOLS</th>
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<tr>
<td>10. In close collaboration with faculty and other staff colleagues outside of the ITS organization, design on campus learning environments that utilize technology for the enhancement of teaching and learning</td>
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<tr>
<td>11. In close collaboration with the Resource Office on Disabilities, ensure that new educational technologies being adapted or installed throughout the University are accessible to all teachers and learners.</td>
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**Recommended Strategies**

**COLLABORATION**

1. **Catalogue the technological solutions and technology support services faculty members and students are currently using and where operational leadership rests for each solution and service**
   
   Launch a University-wide effort to inventory the technological solutions and technology support services currently being used on campus for teaching and learning. As part of this objective, we should work with the Faculty Technology Committee to identify faculty meetings where we can openly discuss the challenges they have had with technology, the gaps they need/want to close, and their long-term vision for teaching with technology.

2. **Determine if there are core teaching and learning services that should be offered and supported across the institution and not be restricted by School boundaries**
   
   We should determine the areas (if any) around which it makes sense for the Professional Schools and others on campus to use a shared model. It is important the Professional Schools drive this conversation so that the specific areas can be identified by school and not "forced" upon anyone. In order to accomplish this objective, a technology council comprised of members of Yale College, the Graduate School of Arts and Sciences, all 12 professional schools and central administration should be created. This council should meet frequently for an initial period of 6 months to make a primary set of recommendations based on existing tools and services. The members can then decide how to handle ongoing deliberations to evaluate new tools and services.
3. **Solidify communication across the institution for colleagues with shared interests**
   We should create sustainable communities of practice across campus for Faculty, Students, Teaching & Learning Staff, and Communication efforts. There must be institutional support for these communities, including a budget that can be tapped to provide resources and incentives. There should also be a person(s) who is given the formal responsibility to manage these communities. It should not be assumed that management and leadership for each of these communities would lay within the current ITS organization. An important component of this objective will be to catalogue and evaluate the programs (ex. Lux Talks) and tools we use to showcase educational innovation. We should also look at websites, blogs, and other forms of media distribution to help tell stories of innovation.

4. **Keep University leadership informed regarding current and emerging technology-related education initiatives**
   Hold bi-annual meetings with the Deans & Directors. These meetings will feature campus technology leaders, those within and outside ITS, discussing current and emerging technology-related education initiatives.

**INNOVATION**

5. **Evaluate and, if necessary, adapt to latest trends around virtual learning environments**
   One growing trend is seeing movement from the traditional LMS to loose and variable constellations of learning platforms and tools (e.g. web conferencing and video conferencing platforms). Some examples of what other areas are impacted by this trend include support for the “bring your own device” movement, the creation of “communities of learners,” and the importance for identity management to underpin all of it. A small group comprised of colleagues from inside ITS and outside of it should be created to establish a framework for evaluating trends and making recommendations to the appropriate leadership/committees to obtain funding when necessary.

6. **Create a framework for faculty to apply analytics for the evaluation of learning in various environments**
   First, we should identify if there is existing expertise on campus to lead this effort. If not, it should be determined whether this objective should be integrated into the preceding objective.

7. **Support current and future distance learning and open education initiatives**
   ITS should work to support the leadership of the Office of Digital Dissemination on these initiatives and collaborate closely with it.
SCHOLARSHIP

8. **Support faculty members who wish to gain additional knowledge of best practices for teaching with technology**
   The Yale Teaching Center can play a significant role in this by developing components that create opportunities for faculty to enhance their teaching through the use of instructional technology solutions. This program might benefit from the development of online learning modules for faculty members new to teaching at a distance over the internet. The Yale Teaching Center should call on others across the institution as needed to support this effort and continue to serve as the nexus for the conversation on exploring and implementing innovative teaching methodologies at Yale.

9. **Support digital scholarship and information technology literacy**
   Enhance support for digital scholarly projects by introducing applications for managing, and interacting with data. Examples include applications for creating digital archives, media galleries, online exhibitions, timelines, maps and other forms of data visualization. Establish tiered services for hosting digital scholarly projects making it easy for faculty and students to compare and request server environment and storage options. Building on strong record of successful collaboration, ITS and the Libraries will continue to work hand in hand to provide consultation and support for digital scholarly projects. Efforts should be made to catalog, and create finding aids for digital scholarly projects to improve access to the work happening at Yale.

SUPPORT NEW TOOLS

10. **In close collaboration with faculty and other staff colleagues outside of the ITS organization, design on campus learning environments that utilize technology for the enhancement of teaching and learning**
    The group created to evaluate trends around virtual learning environments should also work with faculty to determine what tools, resources and services are needed to meet expectations for most teaching needs. This group should make recommendations to the appropriate leadership/committees to obtain funding when necessary. This objective might include video broadcast tools for including virtual participation, lecture capture systems, smartboards, projection, annotation systems, etc. This is another area that must be driven by need and academic vision rather than technology.

11. **In close collaboration with the Resource Office on Disabilities, ensure that new educational technologies being adapted or installed throughout the University are accessible to all teachers and learners.**
    Decisions made to incorporate technologies that advance teaching and learning must consider how to facilitate individual accommodations for all students with disabilities.
IT Foundations

Cloud File Backup & Synchronization IT Strategy Recommendations

**Goals**

Align Yale's endpoint backup and endpoint file sharing services to take advantage of mature cloud based offerings to further Yale's academic, administrative and research mission.

**Objectives**

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<th>Timeframe</th>
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<td>2. Assess the first year of box.com</td>
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<td>3. Deploy a box.com like service that meets the requirements of 3-lock data</td>
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<td>4. Develop lifecycle management processes and tools for box.com</td>
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<td>5. Sponsor development of integration of Box@Yale with other ITS services</td>
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<tr>
<td>6. Communicate recommendations on the use of supported cloud storage -- Box, Google, Microsoft Office 365</td>
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<td>7. Identify new opportunities: expected convergence of sync and backup, secure file transfer, file storage, other backup</td>
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**Recommended Strategies**

1. **Select and deploy an endpoint backup replacement that is user-friendly and easier to maintain**
   Tivoli Storage Manager (TSM) backup services are expensive to maintain and user feedback is negative. Hosted/cloud backup services are mature and cost effective and, we expect, easier to support than TSM. ITS will embark on a vendor selection project with input from stakeholders across the University, select and deploy the replacement system, and begin volume migrations in FY14. ITS will complete the migration of endpoint backups and decommission TSM as an endpoint solution in FY15.

2. **Assess the first year of box.com**
   ITS will review and analyze the first year of the Box@Yale service to identify opportunities for improvement. We will survey use by the Yale community via end user surveys and metrics from
Box@Yale and ServiceNow, review security incidents, review box.com’s roadmap, and review third-party apps for possible inclusion in the Box@Yale service.

3. **Deploy a box.com like service that meets the requirements of 3-lock data**
   ITS and clients have identified a need to share 3-lock data easily. ITS would like to extend box.com services to users handling covered data; but, there are both technical and legal obstacles to using 3-lock data in box.com at this time (Spring 2013).

   We will develop requirements with ITS Information Security and other stakeholders. Our presumptive first choice is box.com. We will review alternative services if necessary.

4. **Develop lifecycle management processes and tools for box.com**
   ITS requires tools and procedures for lifecycle management of box.com accounts and data, including self-service migration to free lifetime box.com accounts for graduating students.

5. **Sponsor development of integration of Box@Yale with other ITS services**
   ITS will encourage and sponsor develop of integrations between box.com and other services on campus. Activities may include an IdeaScale campaign and development grants.

6. **Communicate recommendations on the use of supported cloud storage -- Box, Google, Microsoft Office 365**
   The cloud storage landscape is confusing to end users and results in inefficiencies. ITS will develop clear recommendations and communicate them to our clients.

7. **Identify new opportunities: expected convergence of sync and backup, secure file transfer, file storage, other backup**
   File storage and backup technologies’ feature sets are converging, and we anticipate that single solutions will emerge that meet both needs at the enterprise level. ITS will continually evaluate vendor offerings to identify opportunities for new services and consolidation or realignment of existing services.
Data & Integration Services IT Strategy Recommendations

Yale is entering a technology era full of new opportunities and new challenges. Informed by the technology available in the consumer marketplace, students, faculty, researchers and staff have become increasingly demanding, expecting the ability to readily access complex data that is presented in easily understandable, user friendly formats. Furthermore, Yale is in the midst of adopting and implementing new cloud-based enterprise systems, which rely heavily on rapid and effective data and system integration. In order to effectively manage this rapid rate of change, the current technology landscape must evolve, improve, and become more adaptive.

At the center of an effective integration strategy is strong data management. Data is one of Yale’s most important non-human assets and a properly executed integration strategy should ensure consistency, security, and quality appropriate for a world-class university. Fortunately, there are many technologies, processes, and models that can facilitate rapid response and evolution to meet these needs.

A comprehensive data and system integration strategy addresses and enables both system and data connectivity and interoperability across any technology environment, including web, mobile, and cloud. Using common data management practices, data will be protected and secured across the entire enterprise through the management of certified and approved access channels. Shared data services which access data in a common manner, not only provide consistency of results, but can also reduce the maintenance costs and overhead of the entire systems environment.

Goals

Develop and execute an enterprise-wide data and system integration strategy enabling all Yale constituents (students, faculty, researchers, and staff) to safely, accurately, and securely access and transmit critical data across all environments and technology platforms according to their schedule and needs. The end goal is to:

- Achieve high quality and repeatable results
- Provide broad access to data across the Yale Community
- Ensure data is accessed in a secure, controlled and consistent manner
- Enable data stewards / data owners to manage and control data to ensure appropriate level of access, quality, and accuracy
- Employ the appropriate level of technology and data controls that provide guaranteed and secure results while maintaining a user friendly approach across all platforms (web, cloud, mobile)

Objectives

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<th>Timeframe</th>
<th>FY14</th>
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<tbody>
<tr>
<td>Establish baseline metrics to understand current requirements and define future state integration environment</td>
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<tr>
<td>Collaborate with Yale community to solicit input, define and evolve</td>
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### Objectives

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<td>requirements, and gain buy-in</td>
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<tr>
<td>Establish common, secure, and robust access methods for data retrieval and synchronization</td>
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<tr>
<td>Ensure systems and platforms throughout the community can easily leverage and consume new data access methods</td>
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<tr>
<td>Ensure compliance to gain early traction and evolve model to be more effective over time</td>
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<tr>
<td>Define and implement standard technology stewardship model (foundation for stewardship model)</td>
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<tr>
<td>Incorporate data management and stewardship practices (foundation for stewardship model)</td>
<td>X</td>
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<td>Align organization to deliver results in a consistent, timely, and effective manner</td>
<td>X X X</td>
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<tr>
<td>Implement comprehensive data stewardship program</td>
<td>X X</td>
</tr>
<tr>
<td>Further define and implement technology stewardship and architecture program, incorporating metrics to define success</td>
<td>X X</td>
</tr>
<tr>
<td>Establish framework for guaranteed quality and repeatable delivery</td>
<td>X X</td>
</tr>
</tbody>
</table>

### Recommended Strategies

1. **Establish baseline metrics to understand current requirements and define future state integration environment**

   Assess and document current state processes and access methods. Determine validity (through collaboration with community representatives) of current requirements and define future state. Establish process and commitment to maintain currency of documentation. Publish results to community.

2. **Collaborate with Yale community to solicit input, define and evolve requirements, and gain buy-in**

   Inform, educate, and engage representatives across the functional user community and determine their perspective on important requirements.
3. **Establish common, secure, and robust access methods for data retrieval and synchronization**

   Establish standards for accessing and synchronizing data. Minimize non-standard processes and redundant copies of data. Analyze current state processes to prioritize highest demand services. Define build and deployment processes. Create environment where data services and documentation is discoverable and available to the Yale community.

   Establish standards for archived data retrieval, sensitive data access, and data retention policies.

4. **Ensure systems and platforms throughout the community can easily leverage and consume new data access methods**

   Establish common architecture methods and principles. Provide guidance to assist developers with implementation.

5. **Ensure compliance to gain early traction and evolve model to be more effective over time**

   Implement a simple and scalable governance model. Define and implement a services management program within a Service Oriented Architecture (SOA) model.

   Establish internal continuous improvement processes to ensure data is accessed in a secure, controlled, and consistent manner. This will enable guaranteed outcomes and maintain lowered cost of maintenance.

   Incorporate standard measures and Key Performance Indicators (KPIs) for all processes.

   Establish integration roadmap to evolve basic practices initiated in the short term.

6. **Define and implement standard technology stewardship model (foundation for stewardship model)**

   Integrate newer technologies where appropriate. Leverage those organizations that have done this before to drive best practices in this area. Establish foundational technical build skills and capabilities within the organization. Establish standard framework to select new vendors and technologies.

   Establish metrics around throughput and usage monitoring.

7. **Incorporate data management and stewardship practices (foundation for stewardship model)**

   Determine domain stewards to begin discussion around best practices. Define data storage (e.g. cloud) and sensitive data access requirements (i.e. FERPA, HIPAA, PCI, etc.). Ensure integrity and security of data as well as compliance with all standards. Establish data quality, control, and content management practices.

8. **Align organization to deliver results in a consistent, timely, and effective manner**

   Engage senior leadership across the University to incorporate enterprise philosophy into day to day practices. Establish training requirements and future plans.

   Establish a model to move from alignment to effectiveness to deliver expected results where community data integration needs are served consistently. Evolve to a change-ready organization that can readily adapt to dynamic requirements.
Implement standard training program to onboard new resources and evolve the skills of the current staff.

9. **Implement comprehensive data stewardship program**
   All data sources (e.g. Student, HR, Alumni, etc) should have designated steward(s) who are responsible for definition, quality control, documentation, and authorization of use for the content of the data domain. This is typically not managed by technical personnel and is a critical component in support of Yale’s mission. In addition to Data Stewardship, technology platforms must be managed and promoted to align and support the data access management strategy. An effective strategy in this area will serve to consolidate and reduce maintenance costs. We recommend considering short-term outcomes to drive a more comprehensive plan across the Yale enterprise/community and then evolve our processes into a more mature execution model.

10. **Further define and implement technology stewardship and architecture program, incorporating metrics to define success**
    Take advantage of existing technologies, processes, and models available in the consumer marketplace that facilitate rapid response and evolution to meet the needs of the students, faculty, researchers, and staff.

11. **Establish framework for guaranteed quality and repeatable delivery**
    Further drive and improve process to minimize nonstandard behaviors to align with the prescribed approach to access critical data.
Desktop Virtualization IT Strategy Recommendations

Virtual Desktop Infrastructure (VDI) is at the beginning stage of investigation at Yale University. This technology is a method to deliver a computing desktop in the “cloud”. Many departments have interest, but no department is currently offering a solution that addresses all of the key requirements for a service. Benefits may include the ability to increase security, reduce desktop hardware costs, and simplify computer management.

In FY14, the focus for VDI should be around three potential limitations for VDI: user data, configuration data and application data. For VDI to be successful for our stakeholders, combinations of these areas are required to satisfy business needs. A key element in this strategy is that the VDI service must implement concurrency rather than a one-to-one desktop mapping to achieve cost neutrality. In tandem with this work, use cases should be modeled and defined to ensure business and technical requirements are met. After this work is complete, in the FY14-FY15 timeframe, vendors would be engaged to understand their offerings, and how they might be best used at Yale.

**Goal**

Develop a virtual desktop environment service that allows for delivery of a desktop computing experience through a cloud-based solution to facilitate teaching, learning, research, administrative and “bring your own technology” initiatives.

**Objectives**

<table>
<thead>
<tr>
<th>Objective</th>
<th>Timeframe</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Form a working team (key stakeholders, Endpoint Engineering) that will analyze and develop the strategy to potentially offer a VDI service</td>
<td>FY14</td>
</tr>
<tr>
<td>2. Analyze and develop an application-on-demand service to deliver key applications to support a virtual desktop service</td>
<td>FY15</td>
</tr>
<tr>
<td>3. Analyze and develop a user experience service to deliver user settings and configurations to support a virtual desktop service</td>
<td>FY16</td>
</tr>
<tr>
<td>4. Analyze the Yale services required to provide ubiquitous access to user data</td>
<td></td>
</tr>
<tr>
<td>5. Working with key stakeholders, model use cases and pilot them to determine the viability of virtual desktops and determine the lowest common denominator to deliver the service</td>
<td></td>
</tr>
<tr>
<td>6. Based on use cases, analyze and propose a service design package for delivering virtual desktops. This work will include the development of a cost model, and a security analysis of VDI</td>
<td></td>
</tr>
</tbody>
</table>

**Recommended Strategies**
1. **Form a working team (key stakeholders, Endpoint Engineering) that will analyze and develop the strategy to potentially offer a VDI service**

   VDI is being examined in many areas of the University. To successfully offer a VDI service, this team should provide governance in achieving this goal.

2. **Analyze and develop an application-on-demand service to deliver key applications to support a virtual desktop service**

   To offer a VDI service that does not increase cost for Yale, the first area that must be addressed is the ability to have applications travel with the user(s). This technology is commonly referred to as application virtualization. The user would be able to access the application(s) from any location as defined by the supporting service. To achieve this objective, a review of the current technologies, cost impact, and their applications will be done.

3. **Analyze and develop a user experience service to deliver user settings and configurations to support a virtual desktop service**

   This objective is also required to deliver settings for the user as they log in to the VDI infrastructure. This technology is commonly referred to as user experience virtualization. To achieve this objective, a review of the current technologies, cost impact, and their applications will be done.

4. **Analyze the Yale services required to provide ubiquitous access to user data**

   This objective is required so that a user has access to their data as they login to multiple sessions. Many solutions are evolving at Yale (e.g., Box.com, personal CFS); this objective would require an evaluation of what solution would fit this need and provide the recommendation.

5. **Working with key stakeholders, model use cases and pilot them to determine the viability of virtual desktops and determine a common set minimum requirements to deliver the service**

   A key part of delivering a VDI service is using a single gold master image. An analysis of the use cases is required to determine what should be included in this gold master. Each department has unique requirements, but all would need to agree on the “core” requirements. This objective could be achieved with the working group.

6. **Based on use cases, analyze and propose a service design package for delivering virtual desktops**

   This objective would only be started once the vendor landscape and potential costs are understood. A service design package defines all of the requirements, roles and responsibilities, and any other requirements for a VDI service. This work will include the development of a cost model and a security analysis of VDI.
**Email IT Strategy Recommendations**

Our email strategy goes beyond completing the migrations from our local IMAP email services to cloud-hosted solutions. Our strategy acknowledges that email is not just a standalone service, and that it needs to be part of an overall collaboration strategy. Solutions in the collaborative space are very dynamic. Therefore, rather than being overly prescriptive on what tools to use our strategy should allow us to: keep abreast of latest developments; envision how new combinations of technologies could be applied; and identify key gaps that must be filled in order to take advantage of new opportunities.

The recent rollout of Box Net exemplifies the principles above: This vendor supplied cloud based solution was relatively easy and inexpensive to implement; it provided more than just storage capabilities as it also provided easy to use collaboration features; all faculty, students, and staff were automatically granted access to this tool.

**Goal**

Leverage market developments to provide a continually improving set of cloud-based email, calendaring, and collaboration services that will help faculty, students, and staff, to work in a more effective and unified manner.

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Timeframe</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Move all local email mailboxes to cloud-based services and decommision the on-premise IMAP and Exchange-based email services.</td>
<td>FY14: X, FY15, FY16:</td>
</tr>
</tbody>
</table>
**Objectives**

<table>
<thead>
<tr>
<th>Objective</th>
<th>Timeframe</th>
</tr>
</thead>
<tbody>
<tr>
<td>10. Implement an encrypted email service</td>
<td>FY14 X</td>
</tr>
<tr>
<td>11. In order to assist faculty, staff, and students in deciding which of</td>
<td>X X X</td>
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<tr>
<td>the available collaboration tools may best meet their needs, provide</td>
<td></td>
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<tr>
<td>on an annual basis an updated summary of the tools, including the</td>
<td></td>
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<tr>
<td>strengths and weakness of tools with similar capabilities.</td>
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</table>

**Recommended Strategies**

1. **Move all local email mailboxes to cloud-based services**
   a. Yale currently supports multiple email systems and cannot migrate all students, faculty, and staff to Google's hosted email system, EliApps, due to regulatory requirements. Microsoft's hosted email system, Office 365, became available in 2012 and Microsoft appears willing to address the compliance issues that restrict our use of EliApps. An evaluation of Office 365 is underway and will be completed by late summer, 2013.
   b. Based on this evaluation we will determine an initial strategy of which populations can/will use which of Yale’s cloud-based email services: EliApps or Office 365
   c. In Fy14 all local email mailboxes will be migrated to one of these two cloud-based email services:
   d. Some local email infrastructure will still be required (e.g. mail relays, spam management, etc.).
   e. It is possible that end users could have email accounts on one service, EliApps or Office 365, and also have collaboration tool accounts on the other service
   f. Decommission the on-premise IMAP and Exchange-based email services
      i. Pantheon and Med.Mail are the IMAP email services, and we plan to have many of the accounts on those services migrated to either YaleConnect or EliApps by the end of FY13.
      ii. Decommissioning of the local Exchange-based email service, YaleConnect, assumes that either EliApps or Office 365 will meet the needs of all Yale populations. A pilot evaluation of Office 365 is scheduled to start in the spring of 2013 and be completed by late summer.
      iii. The feasibility of migrating all local Exchange accounts to the cloud based Office 365 depends on the results of the Office 365 pilot program
      iv. If Office 365 meets all of the needs of YaleConnect users we would expect to be substantially complete with their migration by the end of FY14, though there is the potential that a small population of YaleConnect users would not have completed their move

2. **Provide an alternative to the on-premise Pantheon-based collaboration services, and decommission those services**
   a. These services include login servers, Pine, file storage, personal web pages
   b. These services may be replaced by cloud-based services other than EliApps and Office 365 (e.g., Box Net may be used to replace Pantheon’s file storage, etc.)
   c. Care should be taken to ensure that the replacement services match or exceed the current functionality and easy of use of the current Pantheon-based services.
3. **Implement lifetime email addresses**
   a. Students have a relationship with Yale that lasts a long time
   b. We will work with Yale College and the Graduate and Professional schools to determine how best to offer lifetime email addresses for their students.
   c. We would like to begin issuing lifetime email addresses for those graduating in the spring of 2014.
   d. Assumes that such accounts will be on one of the cloud-based email services, though not necessarily all lifetime accounts on a single service
   e. Will require a review of legal and policy issues
   f. Will require a technical review to determine whether the population size of email accounts, over time, will raise any conflicts
   g. May require adjustment to our licensing agreements with our cloud-based email providers
   h. Review technical, policy, and legal issues for lifetime Yale email accounts for Alumni in FY15
   i. Provide an opt-in capability for all Alumni for lifetime Yale email accounts in FY16

4. **Simplify provisioning policies in order to enable faster rollout of new collaboration tools**
   a. Enabling new features within EliApps has frequently required changes to our provisioning tools and/or provisioning processes
   b. The desire to turn on additional features in either EliApps, Office 365, or other cloud-based collaboration services will only increase over time
   c. Policies that affect provisioning should be reviewed to determine the feasibility of granting access to more tools for all members of the Yale population
   d. This review is especially timely given the implementation of the Identity and Access Management program

5. **Complete transition of all service requests for access to email, calendaring, and collaboration tools to the new IAM/eService environments**
   a. Convert existing processes to utilize IAM
   b. Identify email and collaboration services and how they are provisioned in FY13 as part of the Start replacement project, eService

6. **Standardize on a single, sustainable mail list technology and decommission all other on-premise services of this type.**
   a. There are multiple approaches currently in use (e.g., Panlist, Mail Man, application-specific solutions, etc.)
   b. Some mail list services are based all or in part on obsolete technology
   c. Individuals, groups, and applications use mail lists or mail list-type functionality
d. The conversion effort will require coordination across a large number of stakeholders and end users.

e. Begin conversion of accounts and services that reference the alternative solutions, and decommission all other on-premise services of this type once those conversions are completed.

7. **Implement a unified telephone messaging solution**
   a. Analyze options
      i. Lock in pricing for the A3 service level option for Office 365 which provide access to Microsoft’s Unified Messaging System
      ii. Evaluate UMS vs. other options
   b. Develop a recommendation for a unified telephone messaging solution. Implement this recommendation in the following year.
   c. Implement the recommended unified telephone messaging solution in FY15.

8. **Eliminate client-based email tools**
   a. The use of client-based email tools contributes to the level of effort required by end users to adhere to best practices in order to ensure a consistent and dependable level of performance.
   b. As a first step, Yale should stipulate that at most, only two client-based email tools, should be used to simplify the effort in mastering the issues that affect email performance.
   c. There are functional gaps that inhibit the conversion to and wide-spread use of web-based email tools (e.g., there is no way to import address books into Outlook Web Access, there are functional gaps in these tools, etc.). Elimination of client-based tools is dependent on vendors closing these gaps.
   d. Though there would likely be better a performance experience using web-based email tools, the effort to convince the current population of end users to adopt this type of new tool will be significant.

9. **Provide an opt-in capability for collaboration tool access to individuals outside of the Yale population (e.g. allow faculty outside of Yale to use our collaboration environment)**
   a. Faculty frequently collaborates with others outside of Yale.
   b. Productivity gains from a collaboration suite should be expanded to the broadest population that is practical.
   c. The provisioning process should be as simple as possible, hopefully self-service.

10. **Implement an encrypted email service**
    a. Confirm the need for this type of service.
    b. Providing a solution is dependent on retirement of all email services except for Office 365 and EliApps. Optimally, it would best to be on a single email service (see objective #10 above). The
worst case scenario would be to implement this with the two cloud based email services, though even that would present some challenges.

c. Evaluate options and recommend an existing or new service
d. Implement the new service

11. In order to assist faculty, staff, and students in deciding which of the available collaboration tools may best meet their needs, provide on an annual basis an updated summary of the tools, including the strengths and weaknesses of tools with similar capabilities.

a. Developments in the market will continue at a fast pace.
b. The suite of collaboration tools implemented at Yale will continue on a fast pace as well.
c. The summary of the tools that are available should be revisited each year. These Summaries should be made readily available to the Yale population and provide a means for capturing their comments.
d. In general this regular re-assessment should be viewed as providing assistance to faculty, staff, and students in their decisions as to which tools best meet their needs rather than a required migration to any alternative tool.
e. This review should include updates to the ITS web site documentation for these tools, including instructions for configuring various devices that reflect the most recent versions of the tools and devices.
f. Ensure that TAs and Graduate Assistants are apprised of each year’s developments in order to help inform faculty the possibilities that new functionality might provide to assist academic activities.
g. Due to the constraints listed in objective #1 above, Yale now has a bifurcated environment strategy: Many students have been migrated to Eliapps, while most faculty and staff, depending on their needs and compliance concerns, will be split across EliApps and Office 365. However, we believe that convergence toward a common email and calendaring platform would be ideal. Therefore in FY15 we will determine if a single email service is achievable. If a single service is feasible we will prepare recommendations for migrating all email accounts to that service no later than FY16.
Identity & Access Management IT Strategy Recommendations

**Goal**

Establish Identity and Access Management (IAM) as a core Yale business service, providing stable, reliable and reusable Identity technologies and authoritative Identity sources, supported by an expert and experienced Identity delivery organization.

**Objectives**

<table>
<thead>
<tr>
<th>Timeframe</th>
<th>FY14</th>
<th>FY15</th>
<th>FY16</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Complete the implementation/ modernization of Yale’s IAM environment utilizing commercial off the shelf software where feasible:</td>
<td>X</td>
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</tr>
<tr>
<td>1.1. Enterprise Directory</td>
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<td>1.2. Provisioning</td>
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<td>1.3. Role Management</td>
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<tr>
<td>1.4. Access Certification/ Attestation</td>
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<tr>
<td>1.5. Access/Federation Management</td>
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<tr>
<td>2. Develop and Mature IAM Governance</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>3. Develop transition plans to move applications onto new IAM platform and implement</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>4. Decommission IDM technology</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td>5. Develop and deliver an IAM Awareness &amp; Communication Program</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>6. Develop, Capture, Report IAM Metrics</td>
<td>X</td>
<td>X</td>
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</tbody>
</table>

**Recommended Strategies**

1. **Deliver new technology to support transformation of the IAM architecture/ Platform**

   Provide an integrated provisioning, role management, authentication and authorization environment with clearly identified authoritative sources, appropriate governance processes, efficient access control mechanisms and a secure, compliant environment that meets the needs and privacy requirements of the University supported by a maintainable and cost effective structure.

   A new IAM technology platform is foundational to all the new initiatives at the University. Without this foundation we will not be able to bring on new technology in an efficient, effective and seamless way. Expanded use of computing, platform and application services hosted “in the cloud” requires extending IAM services and controls beyond campus boundaries.
2. IAM Governance

Currently there is no IAM Governance at the University. IAM governance will align institutional needs for IAM services with the policies, standards and priorities mechanisms established for operation and oversight of the program. Governance will also establish a forum and processes for adjudicating critical decisions. The engagement of IAM stakeholders in governance and working groups will be established to marshal the collective energy, creativity and knowledge to move the IAM program forward.

IAM policies and standards are critical to the improvement of the IAM program and required to establish authority and rules for the IAM program. The two primary precursors to developing policies and standards are a governance structure and a policy framework with associated policy management processes.

There will be an IAM Executive Committee, IAM Advisory Committee and an Identity Data Stewardship Program to help move the IAM program forward.

3. Develop transition plans to move applications onto new IAM platform and implement

Joint planning will be performed with the ITS leadership team to coordinate technology/application transition planning for transitioning applications to the new IAM platform.

4. Decommission IDM technology

Meeting Yale’s goals for reducing the cost and administrative burden of highly customized IT environments requires decommissioning Yale’s current IDM architecture, which is customized, complex and costly, and standing up a new IAM architecture and platform leveraging Commercial Off The Shelf products where feasible. Joint planning will be performed with the ITS leadership team to coordinate technology/application transition planning for the decommissioning of IDM technology.

5. IAM Awareness & Communication Program

Develop/ implement an IAM Awareness & Communication Program to facilitate program implementation. Highlight IAM’s relationship to and facilitation of Yale’s overall business, information technology and information security objectives.

6. Develop, Capture, Report IAM Metrics

Currently there are no IAM metrics and measurements. With a new IAM platform we will be able to have metrics to quantify the benefits and demonstrate the value of Yale’s IAM services in key areas such as security efficiency, security effectiveness and IAM program performance.
Information Security & Risk Management IT Strategy Recommendations

Yale University recognizes that information is a key asset and that the way information is managed, controlled and protected has a significant impact on the quality of delivered information services. Information assets must be protected from unauthorized use, disclosure, modification, damage and loss. Additionally, information assets must be available when needed, particularly during emergencies.

The dynamic and open nature of the University’s computing environment makes it difficult to manage and secure. Many departments operate their own systems and applications. In addition, the University has not fully developed or enforced standards or guidelines to reduce the risks commonly associated with such dynamic computing environments. We traditionally utilize administrative controls which are not foolproof.

Goals

Through the use of strategic initiatives and mission oriented processes, protect the confidentiality and integrity of information collected, stored, processed, transmitted or otherwise communicated by University owned, loaned, leased or controlled processes and systems, so that the infrastructure, networks, systems and information are available to authorized persons when required. University information will be maintained in compliant, secure settings wherein access can be reliably provided to users.

Information security as it relates specifically to the objective of identity and access management (IAM) is covered within the scope of the IAM IT strategy recommendations and not listed here.

Objectives

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Timeframe</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>FY14</td>
</tr>
<tr>
<td>1. Implement systems governance to gain a better understanding of risks and to improve mitigation decision making</td>
<td>X</td>
</tr>
<tr>
<td>2. Plan a set of projects that mitigate current identified risks.</td>
<td>X</td>
</tr>
<tr>
<td>3. Secure critical infrastructure and services with perpetual monitoring and assessment activities such as:</td>
<td></td>
</tr>
<tr>
<td>a. Host Vulnerability Scans</td>
<td>X</td>
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<tr>
<td>b. Web Vulnerability Scans</td>
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<tr>
<td>c. NetFlow Monitoring</td>
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<tr>
<td>d. Application Risk Assessments</td>
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<tr>
<td>e. System Design Reviews</td>
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<tr>
<td>4. Implement an Information Security and Policy committee to increase awareness and proactively assess risks with a diverse group of University representatives.</td>
<td>X</td>
</tr>
</tbody>
</table>
FY14–16 Information Technology Strategic Plan
Information Security & Risk Management IT Strategy Recommendations

**Objectives**

<table>
<thead>
<tr>
<th>Objective</th>
<th>Timeframe</th>
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</thead>
<tbody>
<tr>
<td>5. Awareness activities will be performed to keep the University community informed about security practices, threats and compliance matters.</td>
<td>FY14: X</td>
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<tr>
<td></td>
<td>FY15: X</td>
</tr>
<tr>
<td></td>
<td>FY16: X</td>
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</tbody>
</table>

**Recommended Strategies**

1. **Implement systems governance to gain a better understanding of risks to improve mitigation decision making**
   Classify all assets with criticality and confidentiality ratings to achieve a state of risk situational awareness. This new consciousness will enable risk-based decisions so Yale can use its resources in the most effective way possible to reduce risks to systems assets and networks at Yale.

2. **Plan a set of projects that mitigate current identified risks.**
   Initiatives that support this objective will help Yale reduce the likelihood of data loss/disclosure of confidential and sensitive data.
   - Reduce risk by eliminating items identified in the ISO Risk Register
   - Implement a framework for policy, standards and guidelines

3. **Secure critical infrastructure and services**
   Initiatives that support this objective will support a defense in depth architecture and provide increased security of critical University services. Many of these initiatives and supporting projects are required to be in place according to federal regulations, state laws and industry requirements. Examples include: HIPAA, GLBA, FERPA and PCI.
   - Network and system security architecture redesign
   - Host Vulnerability Scans
   - Web Vulnerability Scans
   - NetFlow Monitoring
   - Application Risk Assessments
   - System Design Reviews
   - Identity and Access Management (See recommendations of the Identity and Access Management working group)

4. **Implement an Information Security and Policy committee to increase awareness and proactively assess risks with a diverse group of University representatives.**
   Initiatives that support this objective will increase awareness for Yale data stewards of security risks, help them to identify controls to reduce those risks, and to understand what risks remain after any identified controls have been implemented.
5. **Awareness activities will be performed to keep the University community informed about security practices, threats and compliance matters.**
   a. Externally hosted security training is being purchased for the University.
   b. ISO is appearing at grand rounds meetings for every clinical department in YSM in FY13 and FY14.
   c. An information security newsletter will be broadcast to the community.
Information Technology Service Management IT Strategy Recommendations

A primary goal of the ITS organization is to provide rock-solid services to our world-class community. IT Service Management (ITSM) is a proven and effective framework for helping IT organizations become more service-oriented with an emphasis on customer satisfaction.

The Service Management organization delivers this framework by implementing a set of processes known as Information Technology Infrastructure Library (ITIL), mapping those processes to appropriate tools and developing a system of measurement and metrics for reporting on the health of services and processes.

In order to effectively manage ITIL processes with a service orientation, we have developed and will mature a governance structure that includes a Process Owners Board (to mature ITIL processes) and a Service Owners Board (to increase customer satisfaction of IT services).

Service Management also includes the Knowledge Management discipline that is responsible for capturing, storing, and sharing organizational knowledge. Our goal is to develop a holistic Knowledge Management process that improves organizational efficiency by reducing the need to rediscover knowledge and use this knowledge to support the other ITIL processes with a focus on consistent handling of issues or requests and providing a consistent and positive customer experience.

Additionally, the Service Management program supports organizational transformation through its ongoing investment of staff education in ITIL, thereby ensuring a high level of competence in, and shared understanding of, service management principles. This will increase organizational efficiency in transforming our organization into one that has a service orientation and is focused on customer satisfaction of those services.

Goals

Improve the level of service provided by the ITS organization by continuing to implement the IT Service Management (ITSM) framework, including the development of a holistic knowledge management process.

Objectives

<table>
<thead>
<tr>
<th>Objective</th>
<th>Timeframe</th>
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</thead>
<tbody>
<tr>
<td>FY14</td>
<td>FY15</td>
</tr>
<tr>
<td>1. Establish and maintain staff ITIL expertise to support organizational transformation.</td>
<td>X</td>
</tr>
<tr>
<td>2. Continue to make the IT Service Management platform (ServiceNow) universally available to those who support and manage IT services.</td>
<td>X</td>
</tr>
<tr>
<td>3. Maintain and extend Service Management processes and ServiceNow platform capabilities to meet the evolving needs of IT service delivery.</td>
<td>X</td>
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</tbody>
</table>
Objectives

<table>
<thead>
<tr>
<th>Timeframe</th>
<th>FY14</th>
<th>FY15</th>
<th>FY16</th>
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</thead>
<tbody>
<tr>
<td>4. Create knowledge management roles, responsibilities and workflow and extend cross-platform data integration to meet the needs of service providers and end users alike.</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td>5. Establish and mature a Service Management governance model that enables Service Lifecycle management and Process maturity though Continual Service Improvement.</td>
<td>X</td>
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</tbody>
</table>

Recommended Strategies

1. Establish and maintain staff ITIL expertise to support organizational transformation.

The ITIL framework encompasses a series of best practice processes and functions that IT organizations must embrace for effective service delivery. Without such a framework, teams typically work in silos, employ multiple tools, use disparate terminology, and variable processes for managing services.

By investing in ITIL training for the organization, we establish a common nomenclature and develop a shared understanding of service management processes. This shared understanding helps to build more efficient operations with robust metrics and reporting capabilities which lead to improved service delivery and increased customer satisfaction.

The strategy for training is to maintain 90% of our staff with ITIL Foundations certification, and have IT leaders attain intermediate and advanced certifications in various ITIL phases most closely aligned to their organizational function. We will continue education through a community of ITIL practitioners to reinforce concepts, share practices, and nurture the discipline.

2. Continue to make the IT Service Management platform (ServiceNow) universally available to those who support and manage IT services.

Service and process metrics become increasingly valuable when applied across all IT functions. Our strategy is to continue to onboard IT groups throughout the university to more fully leverage the platform and provide university-wide metrics on services and processes. This creates a single catalog of service performance metrics, key performance indicators and critical success factors, and allows all IT support providers to provide a better and seamless customer experience for the university community.
3. **Maintain and extend Service Management processes and ServiceNow platform capabilities to meet the evolving needs of IT service delivery.**

   Our ITIL framework is still in a nascent stage. A mature ITIL environment includes processes from all ITIL phases (Service Strategy, Service Design, Service Transition, Service Operations and Continual Service Improvement). The Service Management program has developed a roadmap to introduce relevant ITIL processes and mature existing processes supported by the platform today. This will ensure necessary support for the diverse scope of services that IT provides to the university community.

   The ServiceNow platform is native mobile-web enabled, and also has a mobile specific interface that can be configured. The platform will be available in a mobile format for our field service staff, such as desktop support and event services. Our strategy will be to partner with those practitioners to understand their desired user experience scenario, and to select the implementation that best suits those needs.

4. **Create knowledge management roles, responsibilities and workflow and extend cross-platform data integration to meet the needs of service providers and end users alike.**

   There are many disparate knowledge repositories throughout the organization including project sites, wikis, local databases and file stores with various kinds of IT service information. This data is not universally available to all the teams providing support for IT services or the end users. A comprehensive knowledge process and a unified repository, supported by roles, responsibilities and workflow, would allow us to share knowledge about our services with one another and enable future customer self-service.

5. **Establish and mature a Service Management governance model that enables Service Lifecycle management and Process maturity though Continual Service Improvement.**

   There are currently no standard models of measurement that we apply to services in order to gauge customer satisfaction, financial health, or service performance. This requires adequate governance, including creation of a Service Board that is comprised of service owners and those who oversee portfolios of services, to establish these models for all IT services. Similarly, a Process Owner group will periodically measure our organizational process maturity and ensure adherence to the ITIL framework. Both groups will identify and implement improvement projects as needed.
Infrastructure-as-a-Service IT Strategy Recommendations

Goals

Utilize Infrastructure as a Service (IAAS) in Yale’s enhanced private cloud and in a public cloud provider to further Yale’s academic, administrative and research mission.

Objectives

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Timeframe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lay the groundwork for Yale to take advantage of unique features and realize potential cost savings at Amazon Web Service</td>
<td>FY14</td>
</tr>
<tr>
<td>Address the need for self-service provisioning of virtual machines</td>
<td>FY15</td>
</tr>
<tr>
<td>Increase visibility of cost vs. use to clients of the Yale VMware private cloud</td>
<td>FY16</td>
</tr>
<tr>
<td>Facilitate internal cost planning for infrastructure services</td>
<td></td>
</tr>
<tr>
<td>Meet client demand for lower-cost virtual machines, where professional system management is not a requirement</td>
<td></td>
</tr>
<tr>
<td>Address demand for common configurations of infrastructure services</td>
<td></td>
</tr>
<tr>
<td>Meet need for governance and guidance about which services belong in public vs private infrastructure</td>
<td></td>
</tr>
<tr>
<td>Leverage new public IAAS presence to meet current business continuity/disaster recovery needs and prepare for the business continuity/disaster recovery needs of cloud only services.</td>
<td></td>
</tr>
<tr>
<td>Support and drive innovative academic, administrative and research uses of IAAS</td>
<td></td>
</tr>
</tbody>
</table>

Recommended Strategies

1. Lay the groundwork for Yale to take advantage of unique features and realize potential cost savings at Amazon Web Services

In FY14, ITS will attempt to secure an Enterprise Agreement with Amazon. We will purchase and implement tools that allow us to provide consolidated billing at AWS that integrates with Yale’s own billing systems. We will also select the first production enterprise service to launch at AWS and deploy it in FY14.
2. **Address the need for self-service provisioning of virtual machines**
   
   ITS has identified a need for self-service provisioning of virtual machines in both the VMware private cloud and at a public cloud provider. ITS will select a vendor (or vendors) for self-service portals to front VMware and Amazon Web Services and deploy during FY14.

   Self-service for infrastructure components at Amazon Web Services demands integration with Yale authentication, authorization and billing systems; ITS will select a vendor for this service and deploy it during FY14.

3. **Increase visibility of cost vs use to clients of the Yale VMware private cloud**
   
   To allow for more direct cost comparisons with Yale-managed Amazon Web Services and other externally hosted IAAS providers, ITS will implement chargeback/showback features in the Yale VMware cloud and develop a subsidy/penalty plan.

4. **Facilitate internal cost planning for infrastructure services**
   
   ITS will provide accurate cost information for capacity planning and budgeting, as well as comparisons with public IAAS providers’ costs. This may require purchasing and/or deploying tools for tracking underlying infrastructure costs.

5. **Meet client demand for lower-cost virtual machines, where professional system management is not a requirement**
   
   ITS has identified an immediate need for unmanaged virtual machines in VMware. We will deliver a lower-cost tier of unmanaged VMs in Yale’s private cloud for users who do not need professional system administration. This service will be available before the self-service portals; we expect this service to be subsumed by the portals.

6. **Address demand for common configurations of infrastructure services**
   
   We will extend our set of common configurations of virtual machines to meet the needs of known typical client use cases, providing Yale-branded infrastructure stacks to internal ITS clients as well as external clients.

7. **Meet need for governance and guidance about which services belong in public vs private infrastructure**
   
   Yale clients, including and especially ITS itself, will need clear guidance to determine which infrastructure deployment model is best suited to a particular service. We will develop a workflow and governance to guide that decision making process.
8. **Leverage new public IAAS presence to meet business continuity/disaster recovery needs and prepare for the business continuity/disaster recovery needs of cloud only services.**

Review, assess and leverage the impact of Yale’s new public cloud presence on business continuity/disaster recovery for both on-premise and off-premise services.

9. **Drive innovative academic, administrative and research uses of IAAS**

Activities may include:

a. Case studies

b. Sponsored development

c. Offering grants of staff and IAAS compute resources for student or faculty use

d. User groups
Resilient IT Strategy Recommendations

Goal
Establish a Resilient IT program to direct investment, planning and testing activities related to resilient IT and business continuity; for mission critical services provide highly available infrastructure with documented, reviewed and tested architecture and recovery plans.

Objectives

<table>
<thead>
<tr>
<th>To direct investment, planning and testing activities related to resilient IT and business continuity:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Establish a formal Resilient IT program including University governance</td>
</tr>
<tr>
<td>2. Reconcile IT resiliency strategy with University BC strategy and planning</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>To improve availability of mission critical services:</th>
</tr>
</thead>
<tbody>
<tr>
<td>3. Improve our recoverability in the event of the loss of a single data center</td>
</tr>
<tr>
<td>4. Develop a strategy that will leverage and improve the resiliency of high impact infrastructure services (e.g. virtual machine infrastructure and shared storage)</td>
</tr>
<tr>
<td>5. Emphasize replicated storage and snapshots in lieu of tape backups</td>
</tr>
<tr>
<td>6. Improve resiliency of <a href="http://www.yale.edu">www.yale.edu</a></td>
</tr>
<tr>
<td>7. Improve backup architecture, processes and recovery capabilities</td>
</tr>
<tr>
<td>8. Improve inter-data center network and fiber</td>
</tr>
</tbody>
</table>

Recommended Strategies

1. To direct investment, planning and testing activities so that they align with University priorities, **establish a formal Resilient IT program with University governance** and
2. **Reconcile strategy with University business continuity strategy and planning:**
   - Review Resilient IT strategy and tactics with OGC, Audit and Risk Management
   - Explore options for Resilient IT program structure and governance
   - Implement approved comprehensive Resilient IT program
   - Manage ongoing governance process
   - Assign accountability and resources; define roles
   - Align with and inform business continuity planning; linkage to budget planning
   - Establish resilience as part of ongoing project management and service introduction processes
3. **Improve recoverability in the event of the loss of a single data center**

   Today we are lacking critical documentation and process to enable a rapid transition to another data center in the event of a complete data center outage. The strategies we will use to improve recoverability are:
   - Confirm formal process for locating non-production equipment in alternate data center; review of vmware pool locations; review of current equipment location.
   - Establish resilient vital records repository, review documentation and identify gaps, document as needed, review recovery procedures across teams.
   - Prioritize order of infrastructure and service recovery. Establish preliminary RTO and RPO objectives for top 100 services.
   - Draft internal DR plan and objectives for initial DR test; conduct tabletop exercise; perform data center failover and failback exercise.
   - Improve inter-data center network single points of failure; mesh replacement.

4. **Develop a strategy to leverage and improve resiliency of high impact infrastructure**

   As virtual servers are shared storage are an ever-increasing percentage of our infrastructure, focus resiliency efforts where improvements will have broadest impact
   - Purchase and implement VMWare Site Recovery Mgr (SRM) to improve ability to prioritize recovery and implement workflow in recovery process.
   - Expand storage capacity to accommodate DR test copy -- if done, remove??
   - Accelerate remaining migration of physical to virtual servers wherever feasible.
   - Implement load balancing Local Traffic Mgr (LTM) and Global Traffic Manager (GTM)
   - Research 3rd party hosting of VMWare, complete business case

5. **Emphasize replicated storage and snapshots in lieu of tape backups**

   To improve recovery point and recovery time objectives use replicated storage and snapshots in lieu of tape backups whenever reasonable.
   - Implement NetApp snap vault functionality.
   - Consider offsite replication.

6. **Improve resiliency of www.yale.edu, reflecting the importance of Yale’s web front door begin always available**

   - Design high availability technical architecture for www.yale.edu and implement

7. **Improve backup architecture, processes and recovery capabilities**: recognizing the importance of improved recovery time and recovery point objectives

8. **Improve inter-data center network and fiber as a foundational step to overall improved high availability**
SaaS/ PaaS IT Strategy Recommendations

SaaS/PaaS solutions offer Yale a multitude of benefits including but not limited to regular and predictable software upgrades and roadmaps, subscription licensing models that support lower total cost of ownership, quickly scalable bandwidth, improved implementation timelines, increased ownership and configuration capabilities for non-technical staff, and natively collaborative and mobile applications and platforms.

Goals

Develop a vision and service delivery roadmap that positions Yale to leverage Software-as-a-Service (SaaS) and Platform-as-a-Service (PaaS) solutions to advance the University mission and functions and realize total cost of ownership savings and improved timelines for technology solution implementation.

Objectives

<table>
<thead>
<tr>
<th>In support of defining an Enterprise SaaS/PaaS vision</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Develop and mature a common understanding throughout the University about what SaaS/PaaS solutions are, how they are currently employed to carry out the University’s mission, and ways to increase their adoption at Yale.</td>
</tr>
<tr>
<td>2. Define University Governance guidelines for SaaS/PaaS implementation.</td>
</tr>
<tr>
<td>3. Create Organizational Change impact assessments and staff development needs to inform an enterprise SaaS/PaaS vision.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>In support of creating a service delivery roadmap that accelerates the introduction of and reduces the total cost of ownership for SaaS/PaaS services to the Yale community</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. Establish a SaaS/PaaS Center of Excellence that develops, publishes, and promotes industry wide SaaS/PaaS best practices throughout Yale.</td>
</tr>
<tr>
<td>5. Develop and mature SaaS/PaaS solution selection criteria identifying benefits and risks to inform IT Partners, departments, and units seeking a new application or technology solution.</td>
</tr>
<tr>
<td>6. Identify and refine SaaS/PaaS successful delivery metrics for adoption at Yale.</td>
</tr>
<tr>
<td>7. Reduce the total cost of ownership and decrease the implementation and integration timelines of application delivery.</td>
</tr>
</tbody>
</table>
**Recommended Strategies**

**In support of defining an Enterprise SaaS/PaaS vision**

1. **Develop and mature a common understanding throughout the University about what SaaS/PaaS solutions are, how they are currently employed to carry out the University’s mission, and ways to increase their adoption at Yale**
   
   Expand membership of SaaS/PaaS Strategic Plan Working Group to include IT Partners and additional key university staff to create and publish a common set of definitions and informational aids related to SaaS/PaaS technologies. Generate frequent communications regarding the Enterprise SaaS/PaaS Vision.

2. **Define University Governance guidelines for SaaS/PaaS implementation**
   
   Governance topics should include but are not limited: approval of strategic and operational SaaS/PaaS initiatives, roles and responsibilities of SaaS/PaaS administrators, and application management, etc.

3. **Create Organizational Change impact assessments and staff development needs to inform an enterprise SaaS/PaaS vision**
   
   Evaluate SaaS/PaaS solutions being mindful of the effect on the University community, including staff development opportunities, training needs, and organizational impact.

**In support of creating a service delivery roadmap that accelerates the introduction of and reduces the total cost of ownership for SaaS/PaaS services to the Yale community.**

4. **Establish a SaaS/PaaS Center of Excellence that develops, publishes, and promotes industry wide SaaS/PaaS best practices throughout Yale**
   
   Further enable the ITS Solutions Design and SaaS/PaaS Practices team to collaborate with external and internal partners on defining a SaaS/PaaS roadmap. Support the development of SaaS/PaaS Community of Practice.

5. **Develop and mature SaaS/PaaS solution selection criteria identifying benefits and risks to inform IT Partners, departments, and units seeking a new application or technology solution**
   
   Create a series of help guides for the selection, procurement, implementation, and support of SaaS/PaaS software solutions. Evaluate the ITS Portfolio of Projects for potential use of SaaS/PaaS technologies. Identify and clarify opportunities for SaaS/PaaS use in transformative as well as tactical technology solutions.

6. **Identify and refine SaaS/PaaS successful delivery metrics for adoption at Yale**
   
   Gather baseline metrics (where available) to recommend relevant and measurable successful delivery criteria for SaaS/PaaS offerings.
7. **Reduce the total cost of ownership and decrease the implementation and integration timelines of application delivery**
   Establish preferred pricing agreements with selected solution vendors. Redefine the service delivery and application support models as applicable to SaaS/PaaS solutions in support of streamlined support and blended support from ITS and the functional group. Identify and develop standardized apps that can be quickly deployed and configured with moderate effort to enable self-service deployment, configuration, and ongoing ownership by non-technical staff.
Administrative and Core Services

Academic Administration IT Strategy Recommendations
Academic Administration Working Group members believe that technology plays a pivotal role in shaping how Yale University is perceived by prospective applicants, students, faculty, staff, alumni and donors.

Goals
The goals for Academic Administration are to:

- Establish Information Technology Services (ITS) as the technology leader in the academic administration space by implementing creative and cutting edge solutions.
- Implement and develop integrated and reliable technical solutions that satisfy prospective applicants, students, faculty, staff, alumni, parents, and donors and facilitate the collaboration, innovation, communication, and efficiency between these communities.
- Ensure that solutions are developed and maintained in a cost effective manner while meeting both immediate and long term needs.

Objectives

<table>
<thead>
<tr>
<th>Objectives</th>
<th>FY 14</th>
<th>FY 15</th>
<th>FY 16</th>
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</thead>
<tbody>
<tr>
<td>Establish Information Technology Services (ITS) as the technology leader in the academic administration space by implementing creative and cutting edge solutions.</td>
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<tr>
<td>1. Stay abreast of technology trends and opportunities</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td>2. Adapt to ITS technology standards for application development</td>
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<tr>
<td>Implement and develop integrated &amp; reliable technical solutions that satisfy prospective applicants, students, faculty, staff, alumni, parents, &amp; donors &amp; facilitate the collaboration, innovation, communication, and efficiency between these communities.</td>
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<tr>
<td>3. Eliminate community perception of “confusing administrative applications“</td>
<td>X</td>
<td>X</td>
<td></td>
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<tr>
<td>4. Look for opportunities to streamline processes, integrate standalone solutions, or automate manual processes</td>
<td>X</td>
<td>X</td>
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<tr>
<td>5. Improve the efficiency and integration of applications and processes by making student data readily available in a user friendly format</td>
<td>X</td>
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<tr>
<td>Establish periodic training programs to improve the skills set of</td>
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<tr>
<td>6. Implement an annual planning process that anticipates future needs as the University and external environment changes</td>
<td>X</td>
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**Objectives**

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<th>employees</th>
<th>FY14</th>
<th>FY15</th>
<th>FY16</th>
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</thead>
<tbody>
<tr>
<td>8. Measure and monitor both short and long term needs and costs</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td>9. Decommission old applications that no longer provide value to the Yale community</td>
<td>X</td>
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</table>

**Strategies**

**Objectives for Goal 1**

1. Stay abreast of technology trends and opportunities
2. Adapt to ITS technology standards for application development

Changes in technology occur constantly and rapidly. As advances in software and hardware move forward, we must be cognizant of the possibility that modifying and changing our systems to take advantage of newer methods and applications may enhance our productivity overall.

To stay abreast of changes in technology, a concerted effort should be made by ITS to understand and evaluate new technology offerings and opportunities, and to adopt technology standards for the development of applications. ITS will need to encourage staff to become efficient and proficient in these technologies. Finally, standards need to evolve as new products and methods enter the marketplace.

**Strategies to Achieve the Objectives for Goal 1**

- Conduct regular reviews of existing applications based on current technology standards
- Regularly review technology standards established by ITS and keep them relevant
- Measure the reduction in choices of programming languages used for development
- Implement a technology training program for staff development and growth
- Encourage staff to research, develop and provide creative ideas that enhance existing and future administrative systems

**Objectives for Goal 2**

3. Eliminate community perception of “confusing administrative applications“
4. Look for opportunities to streamline processes, integrate standalone solutions, or automate manual processes
5. Improve the efficiency and integration of applications and processes by making student data readily available in a user friendly format

Communication, collaboration, efficiency, sustainability, high return on investment and most importantly anticipating the future technology needs in the academic administration space are important in engaging

Yale Information Technology Services

Office of the CIO | 59
and captivating our important constituent groups. The satisfaction of these groups is important in our 3-Year strategy because positive perspectives and experiences with our academic systems will engage our clients. Improving customer satisfaction aligns well with ITS vision and emphasizing its importance in our 3-Year strategic plan will help augment that goal.

At Yale, there are many administrative applications that students, faculty and staff are required to use for their everyday work. Many of these applications have disparate user interfaces, overlapping functionality, and lack adequate integration to one another. Consolidating applications where overlapping functionality exists, aggregating disparate applications into a single platform, and building applications with a consistent user interface should be a primary focus for new applications that are developed. This will remove artificial boundaries among the applications, making the user experience more straightforward, consistent and efficient. Furthermore, consolidation of systems would produce collaboration, promote efficiency, and provide stability with a higher return on the University's investment.

It is important that ITS partner with functional owners and provide the needed technical support for evaluating current manual processes and automating these processes, where appropriate.

ITS alone cannot satisfy or meet the current demand for technology support and improvement. There should be strong encouragement for development outside ITS, engaging companies and organizations that can help us meet our demands in the academic administration space. This use of external entities to help us with our future development and implementation needs should be structured and monitored. The technology standards that guide our development activities in-house need to also encompass and include these external organizations.

To encourage proper execution of activities not conducted or managed by ITS, it is essential that ITS develop and mandate the use of appropriate user friendly web services for data consumption and dissemination to and from Banner, the canonical source of student data.

**Strategies to Achieve the Objectives for Goal 2**

- Develop a framework and platform to “house” various administrative applications and lessen the “confusion” for users
- Measure constituent satisfaction in 2014 as baseline and again in 2016
- Eliminate redundant systems and measure the reduction in the number of applications due to consolidation and decommissioning
- Utilize Service Oriented Architecture where appropriate to promote efficiency, reduce duplication and improve auditability of data accessibility
- Always look for additional uses and users that may benefit from new solutions
- Develop the governance and security rules for processes that people employ to share documents and work related data
- Develop the governance and security rules for web services implementation
- Partner with functional process owners to evaluate the current manual processes and explore automating or integrating where appropriate
Objectives to support Goal 3

6. Implement an annual planning process that anticipates future needs as the University and external environment changes
7. Establish periodic training programs to improve the skills set of employees
8. Measure and monitor both short and long term needs and costs
9. Decommission old applications that no longer provide value to the Yale community

Annual assessments of existing systems will provide useful input regarding the value, cost and effectiveness of applications used by our constituents. Feedback from these regular reviews will help us adjust our portfolio of systems to better serve the academic community.

The availability of subject matter and technical experts has been somewhat limited within and outside ITS. This has impeded the execution of high value projects. To counter this deficiency, increased staff levels and cross-training should be a high priority. Although this has implications on budgets, in the long run this will facilitate more effective and rapid development of critical systems improvements.

It is important to address the lifecycle assessment of applications and aggressively decommission out-of-date systems. As part of this endeavor to identify obsolete systems, ITS can provide usage statistics and technology assessment to the functional owners to help them determine priorities for replacement.

Strategies to Achieve the Objective for Goal 3

✓ Perform life cycle assessments every year to identify the current state of applications, future expectations and the gap between the two
✓ Provide a list of all applications and their usage statistics for functional owners to help them decide if certain applications should be considered for decommissioning
✓ Ensure that a technology solution adds value
✓ Create and establish a dynamic training program to address staffing trends
✓ Develop self-service training tools when appropriate
✓ Analyze the time and budget constraints for implementation of training programs
✓ Ensure that training, documentation and on-going support are part of the implementation of new systems and changes to existing systems
✓ When aligning staff needs for new systems, consider the complete system life cycle
✓ Consider conducting cost benefit analysis on new technology implementations and when decommissioning old applications
✓ Measure maintenance costs in 2014 as baseline and again in 2016
Business Systems IT Strategy Recommendations

In 2012, in collaboration with stakeholders across the University, Yale identified a tool, “Workday”, that supported the finance and business operations, faculty administration services, and human resources business processes. Implementing a single shared tool to support multiple business systems allows for significant and sustainable improvements to technology and a more strategic use of Yale resources.

Goals

For Finance and Business Operations, Faculty Administration Services, and Human Resources, complete the modernization of major administrative applications with the minimal number of platforms required to meet critical requirements and invest in business process design that is positioned to take optimal advantage of new systems such that Yale:

- Simplify and standardize processes
- Make it easy to get work done and harder to make mistakes
- Minimize administrative overhead for faculty, end users, and central process owners
- Lower operating costs and improve effectiveness
- Establish an accurate, trusted and timely reporting environment
- Leverage cloud based solutions to achieve technology goals
- Optimize support for alternate work devices such as mobile devices and tablets for administrative processes

Objectives

<table>
<thead>
<tr>
<th>Timeframe</th>
<th>FY14</th>
<th>FY15</th>
<th>FY16</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Implement standardized comprehensive financial management processes, tools and applications to streamline and automate manual administrative processes</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>2. Streamline processes and automate administration of faculty lifecycle events and reduce reliance on hardcopy</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>3. Streamline managerial tasks, eliminate paperwork and simplify and standardize HR processes</td>
<td>X</td>
<td>X</td>
<td></td>
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</tbody>
</table>

Recommended Strategies

1. Implement standardized comprehensive Financial Management processes, tools and applications to streamline and automate manual administrative processes

Deliver Technology to support Finance and Business Operations Business objectives. This will include extending and improving University budgeting capabilities, and increasing the use of technology in areas such as Capital Planning and Capital Management.
Provide support for University Financial Planning and Budgeting objectives through the implementation of Workday.

Partner with Workday to complete the Workday Finance product capability for a Tier 1 research institution.

Deploy Workday cloud based services for Finance and Business Operations. Augment where Workday gaps exist.

2. **Streamline process and automate administration of faculty lifecycle events and reduce reliance on hardcopy**

   Improve Technology for OFAS (Office of Faculty Administration Services) in support of the faculty lifecycle. Improvements are planned through the implementation of Workday which will provide faculty lifecycle technology solutions with a cloud based service approach.

   Partner with Workday to complete the Workday product capability for a Tier 1 research institution.

   Deploy Workday cloud based services to support faculty lifecycle events.

   Augment where Workday gaps exist.

3. **Streamline managerial tasks, elimination of paperwork and simplify and standardize Human Resources (HR) processes**

   Improve Technology for HR Operations through the implementation of WorkDay, which will provide HR related services in areas of Human Capital Management (HCM) and Payroll.

   Deploy Workday cloud based services for HCM and Payroll.
Facilities IT Strategy Recommendations

**Goals**

Continue to utilize newer technologies and solutions to improve productivity and accountability of Facilities personnel, improve customer service, and foster the quicker completion of projects. Also, continue to enable technologies that support Facilities’ efforts to reduce energy use and improve energy efficiency.

**Objectives**

<table>
<thead>
<tr>
<th>Objective</th>
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</tr>
</thead>
<tbody>
<tr>
<td>1. Continue the deployment of the Mobile Work Force and Mobile Manager applications to Physical Plant, and to additional Facilities units, including Grounds Maintenance, Custodial, Fire Code Compliance, and others as feasible</td>
<td>X</td>
</tr>
<tr>
<td>2. Continue the deployment and support of ECAP and other tools and technologies required to support Facilities’ energy reduction initiatives</td>
<td>X</td>
</tr>
<tr>
<td>3. Support ITS’ project to implement WorkDay, ensuring Facilities’ business requirements are satisfied and there are no interruptions in business services</td>
<td>X</td>
</tr>
<tr>
<td>4. Identify opportunities for the replacement or augmentation of PCS with the implementation of a professional project/construction management system such as Primavera, e-Builder, or similar. Begin efforts to initiate the replacement/augmentation project</td>
<td></td>
</tr>
<tr>
<td>5. Identify opportunities for the replacement of SharePoint for a more user friendly, robust, and automated solution</td>
<td>X</td>
</tr>
</tbody>
</table>

**Recommended Strategies**

1. Continue the deployment of the Mobile Work Force and Mobile Manager applications to Physical Plant, and to additional Facilities units, including Grounds Maintenance, Custodial, Fire Code Compliance, and others as feasible

Continue close collaboration efforts with Facilities management to identify the appropriate groups, personnel, and timing for the continued deployment of the Mobile Work Force and Mobile Manager applications.
2. **Continue the deployment and support of ECAP and other tools and technologies required to support Facilities’ energy reduction initiatives**

   Work closely with Facilities Utilities and Engineering management and staff to continue and expand the utilization of ECAP. This includes migrating to a more robust and user-friendly web-based version, and the development of custom reporting tools necessary to support energy use analysis and decision making.

3. **Support ITS’ project to implement WorkDay, ensuring Facilities’ business requirements are satisfied and there are no interruptions in business services**

   Work closely with the WorkDay project team to ensure that the project does not negatively impact Facilities’ interfaces, applications, and systems. Ensure that all milestones and project deliverables are met, with no Facilities business interruptions.

4. **Identify opportunities for the replacement or augmentation of PCS with the implementation of a professional project/construction management system such as Primavera, e-Builder, or similar. Begin efforts to initiate the replacement/augmentation project**

   Work closely with Facilities management and staff to define deficiencies, obstacles, and problems with the current PCS system. Also define the business requirements, must-haves and nice-to-haves, for a new system. Identify potential vendors and their packages, and provide them with an RFP developed with Facilities. Work closely with the vendor and Facilities management during the selection process and the implementation.

5. **Identify opportunities for the replacement of SharePoint for a more user friendly, robust, and automated solution**

   Work closely with Facilities management and staff to define deficiencies, obstacles, and problems with the current SharePoint solution. Define the business requirements, must-haves and nice-to-haves, for a new solution. Identify potential solutions, including internal ITS solutions, to meet Facilities’ needs. Work closely with the chosen vendor’s solution (including ITS’) and Facilities to implement the solution.
Public Safety IT Strategy Recommendations

**Goals**

For administrative functions that support public safety, deliver sustainable improvements and additions to technology that enhance the safety of the university community, decrease operating costs and increase efficiency and effectiveness.

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Timeframe</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Drive the replacement of the University’s access control systems (ACS) while increasing the Security department’s ACS management efficiencies and decreasing overall cost of ownership</td>
<td>FY14</td>
</tr>
<tr>
<td>2. Working with ITS, fully integrate security systems to take advantage of new IDM systems to manage the entire lifecycle of identities with regard to physical access</td>
<td></td>
</tr>
<tr>
<td>3. Provide effective and responsive reporting, analysis and data management capabilities that enable Public Safety leadership to easily make data-driven decisions which would include the move to an intelligence-led policing paradigm</td>
<td></td>
</tr>
<tr>
<td>4. Manage the move to mobile technology in the public safety arena in order to take advantage of reduced purchase and maintenance costs and more widely distributed access to real-time data</td>
<td></td>
</tr>
<tr>
<td>5. Merge security technologies into a single holistic interface to mitigate the university’s exposure to security risks</td>
<td></td>
</tr>
<tr>
<td>6. Reduce the time to initiate the university’s emergency management notification systems</td>
<td></td>
</tr>
</tbody>
</table>

**Recommended Strategies**

1. **Drive the replacement of the University’s access control systems (ACS) while increasing the Security department’s ACS management efficiencies and decreasing overall cost of ownership**

Yale’s largest Access Control System (ACS), Picture Perfect, which secures most of the central campus and medical school, is being discontinued by the manufacturer. We have contracted the services of a security consultant to research and recommend the best ACS on the market for Yale University that is capable of growing to match the anticipated growth of the university’s needs for the next 20 years. Some required ACS features include a full featured calendar for scheduling temporary and permanent door and card access privileges, self-service online access request with workflow that will enable automated access changes and new badging and advanced card security technology that will streamline credentialing, authentication, visitor management, mobility and near field
communications. We will have the desired vendor identified and vetted by the end of FY13 and will then embark on a multiyear project to implement the new system and sunset Picture Perfect.

2. **Working with ITS, fully integrate Yale’s public safety systems to take advantage of new Identity Management System (IDM) to manage the entire lifecycle of identities**

   Implementation of Yale’s new IDM system and integration with the physical access systems will bring unprecedented advancement in identity lifecycle management. This initiative will allow us to move to a sustainable platform of integration with a single reliable source of identities alleviating the overhead of maintaining multiple custom interfaces to several data sources with questionable data. IDM’s capabilities will allow us to provide a single reliable source for controlling on-boarding/off-boarding of Yale community members to physical access systems. In addition, detailed provisioning of access for new identities (or their changing roles), including removing of access will be rapidly pushed out from the IDM to reduce institutional risk. Business rules will establish what access and functions should be assigned (and revoked) based on roles using data originating from a single authoritative source. This will greatly reduce the amount of manual processes required today. We will replace all existing interfaces from access control systems to disparate data sources with connectors to Yale’s new IDM during the implementation of the new ACS. We will also use ServiceNow to enable self-service access management for validated authorizers.

3. **Provide effective and responsive reporting, analysis and data management capabilities that enable Public Safety leadership to easily make data-driven decisions which would include the move to an intelligence-led policing paradigm**

   Data from disparate sources, both inside and outside of the University, need to be combined, analyzed and presented for effective decision-making. Local, state, and federal crime data will be collected and considered in light of University Police, Security, and Facilities information. Data-driven decisions will be most effective when information regarding physical structures, lighting and weather are combined with historical crime data. When and where crimes have occurred should be considered in unison with the environmental conditions, staffing levels, and the capabilities of staff to react and be proactive as the first step toward an intelligence-led policing program.

   We will produce visual analytics using Tableau business intelligence software. The analytics reports produced will be delivered across a variety of platforms including, but not limited to, web browser, tablet, smart-phone, and in-car MDT.

4. **Manage the move to mobile technology in the public safety arena in order to take advantage of reduced purchase and maintenance costs and more widely distributed access to real-time data**

   With the continued introduction of new inexpensive mobile devices such as tablets and handheld devices, the university needs to move the delivery of data to all law enforcement staff using those devices. This move will increase officer safety by giving him/her real-time access to Yale PD’s crime
records as well as federal and state crime databases. The total cost of ownership will be greatly reduced due to the much lower cost to purchase and the near elimination of costly annual maintenance contacts. We will evaluate and test low cost tablets to replace mobile data terminals in the police cruisers. Further we will develop and execute a plan to deliver secure crime data to handheld devices for foot, bicycle and motorcycle patrols.

5. **Merge security technologies into a single holistic interface to mitigate the university’s exposure to security risks**

Yale Security Central Alarm Station staff has a need for greater situational awareness and actionable intelligence during security incidents. Multiple sensor vendors and stand-alone software products make it difficult to achieve this goal presently. A physical security information system (PSIM) or successor network-based technology would simplify event reporting, connect appropriate entities, and equip responders with actionable real-time intelligence while enforcing departmental policies and procedures. We will develop and implement a plan to merge information from disparate security technologies for enhanced responses to security incidents. We will start this project by identifying and evaluating current off-the-shelf PSIM and successor network-based solutions. We will then vet the vendor of the desired solution then plan and execute implementation of the application.

6. **Reduce the time to initiate the university’s emergency management notification systems**

Yale has multiple emergency notification systems that operators must access and manipulate separately to issue alerts. This process wastes precious time and compromises campus safety to varying degrees dependent upon the severity of the emergency event. A unified solution encompassing all avenues of communication in a single interface is needed to mitigate intuitional risk, including the ability to deliver notifications over the network to employee’s workstations. Reliability and supervision of all components is required to ensure flawless operation at all times, especially after long periods of inactivity. We will research available best-of-breed solutions that connect and activate multiple emergency notification systems. We will then develop a plan to implement a solution. Also, we will work with Data Network Operations to implement network notifications to workstations.
Research Enterprise IT Strategy Recommendations

**Goals**
For administrative functions that support research, deliver sustainable improvements to technology that reduce faculty administrative burden, improve operating efficiency, and facilitate compliance. Units included are Office of Research Administration (ORA), Environmental Health and Safety (EHS), and Office of Cooperative Research (OCR).

**Objectives**

<table>
<thead>
<tr>
<th>Timeframe</th>
<th>FY14</th>
<th>FY15</th>
<th>FY16</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Establish high-performing teams for delivery and support of technology</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>2. Incorporate appropriate support for the conduct of research in all improvements to University technology</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>3. Respond to changes in external compliance regulations and internal policies, to facilitate remaining in compliance</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>4. Provide continuous improvement and evolution of key applications in close collaboration with functional areas, as needed to reduce faculty administrative burden, improve operating efficiency, or facilitate compliance</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>5. Provide effective and responsive reporting, analysis and data management capabilities</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>6. Unit specific objectives are:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Deliver technology to support transformation of Office of Research Administration (ORA) units</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>b. Improve technology to manage Yale’s environmental health &amp; safety risks</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. Ensure that faculty, staff, and external entities have access to information related to Technology Transfer</td>
<td></td>
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</tbody>
</table>

**Recommended Strategies**

1. **Establish high-performing teams for delivery and support of technology**

   We need to develop ITS and functional staff for productive and efficient delivery and support of technology. Areas of focus are identifying and resolving resource gaps for ITS and functional areas, establishing effective partnerships between ITS and functional areas, and achieving the right mix of Yale-badged and external resources.
2. **Incorporate appropriate support for the conduct of research in all improvements to University technology**
Lobby with ITS and functional leadership to institute effective governance structures which ensure that IT projects and other activities consider the conduct of research at the University. Serve as active participants and as leaders for these governance structures.

3. **Respond to changes in external compliance regulations and internal policies, to facilitate remaining in compliance**
While specifics are not known, we anticipate that changes in regulations will require a significant investment in technology each year. We will request capital funding each year and reserve resources to ensure that we have funding and people to address compliance needs as they emerge.

4. **Provide continuous improvement and evolution of key applications in close collaboration with functional areas, as needed to reduce faculty administrative burden, improve operating efficiency, or facilitate compliance**
We anticipate that transformational change in technology and business process will be followed by a period of adjustment and evolution that is needed to fully capture and solidify benefits. We plan one to 2 years of continuous improvement activity following introduction of new technology. ITS currently allocates funding and resources to this type of activity through the capital project prioritization process. We will work to fund and staff these activities through operational processes, as that governance provides a better match to the work activities.

5. **Provide effective and responsive reporting, analysis and data management capabilities**
The transformation of business processes and introduction of new technology that is being done in the Research Enterprise area change the nature of the information available and the nature of how that information is used. We anticipate that requirements for reporting and analysis will evolve over the next several years. Therefore, we will focus on data quality, data integration, analytical capability for power users, and basic standardized reporting for others, with the expectation that functional areas will generate advanced reports as they are required. Work done by ITS in maturing data integration technology at Yale will be implemented as appropriate. As reporting requirements mature, we will invest in more robust standardized reports.

6.a **Deliver technology to support transformation of Office of Research Administration (ORA) units**
A new technology platform is a key component of transformation of business process and organization for ORA compliance units. An emphasis will be placed upon faculty experience as a major factor in overall efficiency and in ensuring compliance. Several aging and outdated systems will be retired. Cloud solutions will be considered, as well as use of mobile devices.
6.b Improve technology to manage Yale’s environmental health & safety risks

Expand the functionality of EHS Integrator (a holistic software solution for research, environmental and occupational safety) to allow the use of EHS data for risk reduction and compliance, meet federal and state requirements, and improve the efficiency and effectiveness of EHS operations. Provide supervisors and investigators with visibility to EHS authorizations, training status, and other safety-related information for their staff and facilities. Continue to improve integration with other University systems to expand the view of safety-related data for the EHS Integrator user. The EHS IT team will work with external vendors on development of EHS Integrator and implementation of third-party systems as appropriate.

6.c Ensure that faculty, staff, and external entities have access to information related to Technology Transfer

The current focus is on strengthening foundational capabilities within the Office of Cooperative Research (OCR). A term position is being created to professionalize management of information systems and to recommend approaches for expanding visibility to information for staff, inventors, and other stakeholders. This position will have a key role in developing a long-term plan to leverage technology to meet OCR’s objectives.
Web Strategy IT Strategy Recommendations

**Goals**

Provide the Yale Community with solid, integrated, discoverable and reusable online services and environments, taking advantage of emerging technologies to improve the experience of those who interact or transact with Yale online.

**Objectives**

<table>
<thead>
<tr>
<th>Objective</th>
<th>Timeframe</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FY14</td>
</tr>
<tr>
<td>1. Provide Yale Community with support for its web publishing and communications needs to sustain the Yale public and internal web presence(s), ensuring that services are cost-effective and that the clients understand the total “cost of ownership.”</td>
<td>X</td>
</tr>
<tr>
<td>2. Improve decision-making and ensure ongoing collaboration</td>
<td>X</td>
</tr>
<tr>
<td>3. Evaluate a broader enterprise content ecosystem</td>
<td>X</td>
</tr>
<tr>
<td>4. Identify, implement, communicate and maintain standards for application security, branding consistency, accessibility and compliance</td>
<td>X</td>
</tr>
<tr>
<td>5. Create a more consolidate environments to improve search-ability and reusability of content</td>
<td>X</td>
</tr>
<tr>
<td>6. Establish standards and processes for quality assurance, audit, and migration of outdated content and infrastructure</td>
<td>X</td>
</tr>
<tr>
<td>7. Improve search functions across systems and services to ensure discoverability of assets, documents and content.</td>
<td>X</td>
</tr>
<tr>
<td>8. Enable multichannel delivery and reuse of content to various devices and formats (e.g., ebooks, mobile, websites, search, social)</td>
<td></td>
</tr>
<tr>
<td>9. Provide the ability to conduct online financial transactions</td>
<td>X</td>
</tr>
<tr>
<td>10. Act on Yale community needs for campus-wide solutions such as event scheduling and integrated calendaring solution, campus-wide analytics and reporting services, video streaming and storage</td>
<td>X</td>
</tr>
</tbody>
</table>
Recommended Strategies

1. **Provide Yale Community with support for its web publishing and communications needs to sustain the Yale public and internal web presence(s), ensuring that services are cost-effective and that the clients understand the total “cost of ownership.”**

   In order to provide sustainable support and development for web publishing and communications needs at Yale, create a central group that can provide expertise for developing high quality, usable and accessible online experiences for the Yale community, both public and internal. These services must be cost-effective and the community should begin to understand that web presences are not static, but require an ongoing commitment to the content that serves as the primary way that the public and our current, potential and former faculty, students and staff interact with Yale.

   There are challenges with such an undertaking as Yale’s departments’ and organizations’ funding range wildly. In the past, and currently, Yale communities that can contribute more resources have invested more in their online presences, while those whose resources were limited have generally used part-time, student or other resources to create and maintain their web presences on the cheap. This range of investments shows on Yale websites, creating an inconsistent user-experience.

   While funding a group such as this could be a challenge, we believe that providing services evenly to the community is an essential undertaking. These services should include content strategy, usability, accessibility and use standards and best practices to improve the overall Yale online experience.

2. **Improve decision-making and ensure ongoing collaboration**

   Our second recommendation is to propose and create a formal web governance group as well as a community of practice to ensure ongoing collaboration, improve decision-making and encourage broad adoption of standards. The governance group should represent the community at large and have representation from major stakeholders. Their charge should be to address issues of regulatory compliance, to create and communicate standards and recommend and set direction for the Yale online experience.
3. **Evaluate a broader enterprise content ecosystem**

We recommend that Yale assess the web ecosystem to understand the complex and interactive needs across campus for document management, web content management, and digital asset management, for capturing, managing, storing, preserving and delivering content to and from a broad range of target and source systems. If the assessment finds that an enterprise content management system would be useful, then we recommend that Yale identify, select, implement and support an ECM to serve the institutional needs of the community based on the assessment. This system may co-exist with other lighter weight solutions to create a broader enterprise ecosystem for managing content for a variety of purposes but especially organized into the themes: capture, manage, store, preserve and deliver.

**CAPTURE**

The group believes that the Yale web ecosystem will continue to grow and change and capturing information through technologies such as OCR, and other types of intelligent character recognition to digitize and capture artifacts, forms and content from a variety of sources should be a part of this strategy. This section of the recommendation overlaps with the Digital Asset and Information management group recommendation and we reiterate the importance of that recommendation here.

**MANAGE**

4. **Identify, implement, communicate and maintain standards for application security, branding consistency, accessibility and compliance**

The governance group should identify, implement, communicate and maintain standards for application security, branding consistency, mobile interaction, accessibility and regulatory compliance. All of these issues are equally important to the Yale online experience and currently no such set of standards exists.

5. **Create a more consolidated environment to improve searchability and reusability of content**

The current Yale online ecosystem functions largely as an archipelago—a loosely confederated group of islands that often maintain separate and redundant sources of the same information that should be shared and re-used. This group recommends that we create and build robust methods for integrating and interacting with Yale institutional data in a reusable/repeatable way across applications and systems. Currently, another working group is working on recommendations for service oriented architecture and this group wants to reinforce that recommendation. Once established, the web governance group could help communicate best practices and publish a grid for web developers across campus to more easily discover where to go (or to whom) for particular information integrations.
6. **Establish standards and processes for quality assurance, audit, and migration of outdated content / infrastructure**

Yale manages much content on old applications and web servers. This group recommends that, beginning in fiscal year 14, ITS begin prioritizing and migrating web content from Elsinore, Research and other sources to a target content management system. In addition, we also recommend that Yale begin a regular audit of web content for quality assurance such as currency and appropriateness of content, broken links, accessibility of old and new content, sustainability, and migration to and from newer platforms and technologies.

**STORE AND PRESERVE**

Preserve content based on Yale community needs, definitions of business requirements, government, and governance policies. Also see Digital Asset and Information Management and Research Technologies working group recommendations.

**DELIVER**

7. **Improve search functions across systems and services to ensure discoverability of assets, documents and content**

Yale's web ecosystem is distributed and fragmented which impacts the discoverability of content, assets and documents. We recommend that Yale identify, select, and implement a search solution to include semantic discoverability (publishing content for consumption by search and semantic engines) and faceted search that will serve needs across systems and services to ensure discoverability of assets, documents and content. Improving search and discoverability campus wide will necessarily require some governance around what kinds of applications, servers, and data sources are searched, and this decision-making should be handled by the new governance committee.

8. **Enable multichannel delivery and reuse of content to various devices and formats (e.g., ebooks, mobile, websites, search, social)**

Related, but not the same as search is to identify, select, implement and support services that will deliver and enable the reuse of content based on recommendation engines and taxonomies to multiple channels of devices and formats including websites, books, social communities, mobile, search and online books. This sort of multichannel delivery system will also require governance and oversight including integration and taxonomy decisions.

9. **Provide the ability to conduct online financial transactions**

Many organizations at Yale need to offer the ability to conduct online financial transactions. Currently each organization that has such a need must figure out how to accomplish it independently. We recommend that Yale identify, select, implement and support services to enable compliant online transactions (point of sale for eCommerce) and communicate those standards and services broadly.
10. Act on Yale community needs for campus-wide solutions such as event scheduling and integrated calendaring solution, campus-wide analytics and reporting services, video streaming and storage

The need for online solutions regularly crosses university divisions and departments. In our recent assessments, we discovered that many groups desire campus-wide solutions for services such as event scheduling and integrated calendaring as well as tools to support analytics and reporting, and video streaming and storage. Identifying, selecting, implementing, and supporting any one of these services requires an individual initiative; our recommendation is that these initiatives be prioritized in the coming three years. Integrating services such as these with enterprise web solutions would also be essential. Such initiatives would require broad participation and engagement from across the community.
Appendices

Appendix 1: Governance Structure

Over the past year, we have developed a governance structure that enables communication and transparency and brings members of our community together to guide our strategy and decisions. We envision active participation and committee membership from all corners of the campus community including faculty, staff, students, and alumni. The governance framework is mostly in place, and we are planning the remaining topical "special interest" committees.

Our first priority over the past year has been standing up the committees that guide the investments for the annual capital portfolio. The committees are also responsible for the assessment of input from the Yale community through analysis of feedback and metrics. The Strategic Technology Committees base their decision-making on community needs, legal and compliance requirements, financial constraints, and alignment with the university mission and strategy, and they will help to set priorities around the implementation of the plan and will guide future changes to the plan.

For further information about the progress and work of the Technology Strategic Committees, visit http://its.yale.edu/about/collaboration-and-governance/committees.

About the existing committees:
ITS Advisory Committee (ITSAC) - ITSAC has overall responsibility for advice on institutional IT policy and service issues. This committee meets periodically to provide advice to the Provost and Yale's Chief Information Officer on Yale’s information technology policies, strategies, priorities and services.

Technology Initiatives Committee (TIC) - Comprising functional and technology leaders from across campus and ITS, this group discusses IT operations, opportunities, strategies, and innovational directions. The TIC will review and propose a comprehensive technology portfolio including teaching, learning, research, and administration to the University Officers. The TIC provides strategic oversight for the IT strategic and operating plans and the Technology Operating Committee (TOC).

Technology Operating Committee (TOC) - Comprising ITS Staff and representatives from the IT Partners, this group oversees projects, programs, budgets, external spending, and holds overall accountability for the day-to-day management of the IT portfolio of projects.

ITS Research Technologies Committee - The objective of this group is to advance the research mission of the University. The committee guides strategy, direction and decision-making in the use and support of research technologies such as High Performance Computing and big data.

ITS Information Security & Policy Committee – This group guides strategy, direction and decision-making to advance the mission of the University through information security technologies, assurance, policies, compliance, and risk management. The committee provides a team of trusted advisors with whom ITS leadership partners in creating a secure, highly functional IT environment at Yale. The committee works in tandem with the University HIPAA Privacy and Security Committee, which oversees HIPAA compliance for the University.

ITS Finance, HR, and Payroll Committee - This group guides strategy, direction, and decision-making in the use and support of finance, human resources, and payroll technologies. Specifically, this committee serves as a team of trusted advisors with whom ITS leadership partners in Yale’s transition from its current systems to a new cloud-based HR, payroll, and finance systems.

Technology Architecture Committee (TAC) - Comprising technology leaders from across campus, this group meets monthly to consider technology architectural standards. The committee applies an enterprise-wide perspective to business, application, data, and infrastructure architecture domains, and sponsors adherence to architectural standards across the portfolio of major technology initiatives.
Appendix 2: Feedback and Follow-up

We invite you to share your thoughts about this strategic plan. Listening to the needs of our community is essential to the planning of the diverse technologies we will offer.

To learn more about strategy planning at Yale ITS, please visit:
http://its.yale.edu/about/strategic-planning

You can comment on the strategic plan by sending an email to the strategy-planning team at:
technology@yale.edu

Faculty can contact the ITS Advisory Committee (ITSAC), which represents the faculty and administrator perspective on the direction of IT at Yale:
http://its.yale.edu/about/collaboration-and-governance/committees/its-advisory-committee-itsac

Students can reach us through the Student Technology Collaborative:
http://its.yale.edu/centers/student-technology-collaborative-stc
Appendix 3: Contributors to the Plan

Thank you to the members of the Yale Community who generously gave their time, knowledge, and insights to help us produce this plan. The contributors listed below provided oversight; led or served on one of the nineteen working groups; or in some capacity informed the shaping of the strategic plan.

ITS Strategic Planning Team
Daniel Powell, Strategic Business Analyst, Strategy and Portfolio Management, ITS-OCIO
Faith Brown, Director, Strategy and Portfolio Management, ITS-OCIO
Jane Livingston, Associate CIO, Campus Community Technologies, ITS
Russell Sharp, Executive CIO, ITS-OCIO
Susan West, Associate Director, Strategic Communications, ITS-OCIO

Communications Team
Bob Liu, Communications and Web Team, ITS-OCIO
Chris Kilbourne, ITS Website Manager, ITS-OCIO
Dave Broggi, Communications and Web Team, ITS-OCIO
Janet Jeddry, Communications Officer, FBO Change Leadership and Communications
Roger Ngim, Associate Director, Communications and Marketing, ITS-OCIO

Working Group Members (*Indicates Working Group Lead)

- **Teaching, Learning, Research**
  - Information & Digital Asset Management Working Group
    - Michael Dula*, Chief Technology Officer, Library
    - Charles Greenberg, Research Services Librarian, Cushing/Whitney Medical Library
    - Daniel Griffin, Manager, Instructional Technology Services, School of Law
    - David Hirsch, Director, Academic IT Strategy, ITS Academic IT Operations
    - Larry Gall, Head of Computer Systems, Entomology Informatics Manager, Peabody Museum
    - Limor Peer, Associate Director for Research/ISPS, General Administration and Grants
    - Meg Bellinger, Director Office of Digital Assets & Infrastructure, Yale Digital Collections Center (YCD2)
    - Michelle Hudson, Science and Social Science Data Librarian, Center for Science & Social Science Information
    - Pam Patterson, Academic Technologist, ITS Digital Humanities

- **Research Technologies Working Group**
  - Robert Dietz, Media Services Manager, School of Management
  - Sandy Bouton, Director, Systems Administration, ITS Infrastructure Services
  - Thomas Raich, Director, Information Technology, Art Gallery
  - Ed Kairiss*, Senior Director, ITS Academic Services
  - Craig Henry, Client Support Specialist, ITS Faculty Support Program
  - El Lolis, Senior IT Project Manager, ITS Academic IT Operations
  - Jill Parchuck, Director Science & Social Science and Co-Director for Science and Social Science Information, Center for Science & Social Science Information
  - Joe Paolillo, Associate CIO, ITS Health & Medicine
  - Joyce Lush, Director, Client Lead Team, Research Enterprise
  - Matthew Jerviss, Systems Programmer, School of Management
FY14–16 Information Technology Strategic Plan

Paul Gluhosky, Manager, IT, ITSSOL Academic Project Development
Robert Chang, Manager, Faculty of Arts & Sciences IT Support Program
Themba Flowers, Manager, IT, ITS Social Science Research Services

Teaching & Learning With Technology Working Group
Lucas Swineford*, Director, Broadcast & Digital Media Center
Alan Usas , Director IT & CIO, School of Management
Daniel Griffin , Manager, Instructional Technology Services, School of Law
David Hirsch, Director, Academic IT Strategy, ITS Academic IT Operations
Ekaterina Ginzburg, Instructional Technologies Specialist, School of Nursing
Emily Horning, Director of Undergraduate Research and Outreach, Library
John Graves, Technical Lead, ITS Academic Project Development
Ken Panko, Director, Center for Media & Instructional Innovation, ITS Academic IT Solutions
Mark Lazenby, Assistant Professor, School of Nursing
Michael Schwartz, Associate Dean for Curriculum, School of Medicine, Office of Education and Neurobiology
Michael Yaffe, Associate Dean, School of Music
Nelleke Van Deusen-Scholl, Director Center for Language Study; Professor (Adj) Linguistics, Center for Language Study
Paul Draghi, Director of Information Technology & Lecturer & Research Scholar, School of Forestry and Environmental Science
Randall Rode , Director, Information Technology, School of Drama
Richard Collins, Online Course Prog Mgr, Yale Summer Session
William Rando, Assistant Dean Graduate School; Director Teaching Center, Academic Administration

IT Foundations
Cloud File Backup & Synchronization Working Group
John Coleman*, Director, ITS Core Services
Jessica Greer, Senior Systems Administrator, ITS Core Services
Mike Caplin, Senior Operating Systems Programmer, ITS Core Services
Stephen Baraquin , Manager, IT, School of Law
Susan Kelley, Senior Director, ITS Infrastructure Services

Data & Integration Services Working Group
Russ Battista*, Director, Enterprise Technology Architecture, ITS Solutions Design
Brendan Turnbull, Tech Lead/Systems Programmer, School of Management
Dan Kefford, Senior Solution Architect, ITS Solution Design
Jennifer Lia, Budget Coordinator, School of Law
John Jibilian, Associate CIO, ITS Solution Design
Karen Colburn-Murphy, Director, IT Planning and Coordination, Yale College
Kathleen Broderick, Director, Business Intelligence, ITS
Cheryl Boeher, Manager, ITS Infrastructure
Pam Miller, Senior Solution Architect, ITS Solutions Design
Syed Alli, Systems Programmer, IT, School of Law

Desktop Virtualization Working Group
Philip Rinehart*, Associate Director, ITS Desktop Engineering
Fred Ferrie, Client Services/ Systems Administrator, School of Management
Jeff Capuano, Senior Director, Campus Technology Services
Joe Paolillo, Associate CIO, ITS Health & Medicine
John Zito, Manager, User Support Services, School of Law
Julio Valdes, Technical Lead, ITS Production Systems
Lauren Kerrigan, Associate Director, Health and Med IT Operations
Kevin Glick, Head of Digital Information Systems & Univ Archives
Bryan Little, Systems Programmer, Yale Health Plan
Robert Kaczowka, Systems Programmer, Yale Health Plan
Kim Gaddy, Director Information System & Decision Support, Patient Financial Services, School of Medicine
Themba Flowers, Manager, IT, ITS Social Science Research Services
Email Working Group
Bob Condon*, IT Program Director, ITS Infrastructure Services
Adam Bray, Assistant Manager, Student Technology Collaborative
Jeff Capuano, Senior Director, Campus Technology Services
John Coleman, Director, ITS Core Services
John Zito, Manager, User Support Services, School of Law
Loriann Seluga, Associate Director, CTS Student Technology Collaborative
Michael Dinice, Applications Systems Specialist, Service Desk
Robert Chang, Manager, Faculty of Arts & Sciences IT Support Program
Susan Kelley, Senior Director, ITS Infrastructure Services

Identity & Access Management Working Group
Josh Nabozny*, Information Security Office, ITS
Elizabeth Burnell, Director, Identity & Access Management

Information Security & Risk Management Working Group
Rich Mikelinich*, Chief Information Security Officer, ITS

Information Technology Service Management Working Group
Adriene Radcliffe*, Director, IT Service Management, ITS Management Services
Bill West, Systems Programmer, Production Services
Chloe Turnbull, Business and Process Analyst, ITS Management Services
Dorothy Ortale, Knowledge Manager, ITS Management Services
Lou Tiseo, Director, Data Center Services
Paul DiBello, Director, Client Lead Team, ITS AYA & Development
Ricardo Chavira, Associate Director, Service Management, ITS Management Services
Rick Smith, Director, Metrics and Quality Assurance, ITS Management Services

Infrastructure-as-a-Service Working Group
John Coleman*, Director, ITS Core Services
Camden Fisher, Technical Lead, ITS Production Services
Colleen Whelan, Manager, ITS SaaS Practices
Gail Barnett, Manager, Library IT, Systems, Library
Gary Leydon, Associate Director for Tech Services, Teaching and Learning Center, YSM Student Affairs
Jessica Greer, Senior Systems Administrator, ITS Core Services
Paul Gluhosky, Manager, IT, ITSSOL Academic Project Development
Stephen Baraquin, Manager, IT, School of Law
Susan Kelley, Senior Director, ITS Infrastructure Services

Resilient IT Working Group
Susan Kelley*, Senior Director, ITS Infrastructure Services
Bob Condon, IT Program Director, ITS Infrastructure Services
Cheryl Boeher, Manager, ITS Infrastructure Services
David Galassi, Director, Net Services, ITS Data Network Operation
John Coleman, Director, ITS Core Services
Lou Tiseo, Director, Data Center Services
Paul Gluhosky, Manager, IT, ITSSOL Academic Project Development
Sandy Bouton, Director, Systems Administration, ITS Infrastructure Services
Stephanie Scungio, Associate Director, Portfolio and Operations, ITS Academic IT Operations
Stephen Baraquin, Manager, IT, School of Law

SaaS/ PaaS Working Group
Colleen Whelan*, Director, ITS SaaS/PaaS Practices
Daniel (DJ) Martin, Technical Program Lead, ITS SaaS/PaaS Practices
Daryl Brereton, Associate IT Director, School of Drama
David DeMichele, Software Engineer, ITS SaaS/PaaS Practices
Gary Leydon, Associate Director for Tech Services, Teaching and Learning Center, YSM Student Affairs
John Coleman, Director, ITS Core Services
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<td>Rod Ares, Business Systems Analyst, YSM Student Affairs</td>
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<td>Nancy Creel-Gross, Senior Director, Operations, Human Resources</td>
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<td>Shauna King, Vice President, Finance and Business Operations</td>
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<td>Barbara Haberman*, Manager, Application Systems, ITS Shared Solutions</td>
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<td>Tom Undercuffler, Director, Facilities Information Systems, Facilities</td>
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<td>Bill Horowitz, Sr. Programmer/Analyst, University Public Safety</td>
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<td>Glenn Hasiotis, Programmer/Analyst, University Public Safety</td>
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<td>Jim Hackett, Programmer/Analyst, University Public Safety</td>
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<td>Rich Guerriero, Technical Lead, University Public Safety</td>
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<td>Bob Davis, Director, Research Enterprise Operations, Research Administration</td>
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<td>Denny Kalenzaga, Director, Finance &amp; Administration, Academic Services Cooperative Research</td>
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<td>Ed Kairiss, Senior Director, ITS Academic Services</td>
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<tr>
<td>Jim Macy, Director &amp; Professor, Comparative Medicine, School of Medicine</td>
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<td>Peter Reinhardt, Director, Environmental Health &amp; Safety, Provost's Office</td>
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<td>Regina McDonald, Administrator, Animal Resources Center and Comparative Medicine, School of Medicine</td>
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<td>Stephanie Perry, Business Manager, Environmental Health &amp; Safety, Provost's Office</td>
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<tr>
<td>Andrea MacAdam, Director for Interactive Media &amp; Strategy, Public Affairs</td>
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<tr>
<td>Clayton &quot;Andrew&quot; Predmore, Manager, Web Operations, Yale University Library</td>
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<tr>
<td>Darice Corey, Director of Web Operations, Yale College</td>
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<td>Ed Kairiss, Senior Director, ITS Academic Services</td>
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<td>Elizabeth Stauderman, Chief of Communications,</td>
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We would like to thank the following for their participation informing the working groups, whether through direct questions from the group members or through the open commenting period on their drafts:

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<td>Gary Leydon, Associate Director for Tech Services, Teaching and Learning Center, YSM</td>
<td>Linda Faust, Project manager, ITS Shared Solutions</td>
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<td>Janet Conroy, Director of Communications &amp; Public Affairs, Law School</td>
<td>Louis King, Digital Information Architect, YWC Digital Assets &amp; Infrastructure</td>
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<td>Jay Fusco, Director Central &amp; Enterprise Content Management, ITS Shared Solutions</td>
<td>Lucas Swineford, Director, Broadcast &amp; Digital Media Center, Digital Dissemination</td>
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<td>Jeffrey Campbell, Manager, Technical Analysis, ITS Shared Solutions</td>
<td>Meg Bellinger, Director Office of Digital Assets &amp; Infrastructure, Yale Digital Collections Center (YDC2)</td>
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<td>John Coleman, Director, ITS Core Services</td>
<td>Michael Dula, Chief Technology Officer, Library Central Systems</td>
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<td>John Mayes, Associate VP &amp; Chief Procurement Officer, Purchasing</td>
<td>Randall Rode, Director, Information Technology, School of Drama</td>
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<td>Jon Ingersoll, Manager for Application Development, IT, School of Management</td>
<td>Sarah Stevens-Morling, Manager, Online Communications &amp; Print Advertising, School of Drama</td>
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<td>Josh Nabozny, Information Security Office, ITS</td>
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<td>Susan Monsen, Chief Technology Officer, School of Law</td>
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<td>Ken Panko, Director, Center for Media &amp; Instructional Innovation, ITS Academic IT Solutions</td>
<td>Thomas Raich, Director, Information Technology, Art Gallery</td>
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<tr>
<td>Lec Maj, Head of Information Technology, Yale Center for British Art</td>
<td>Vincent Massaro, Senior Digital Officer: Senior Web Developer/Producer, Interactive Team, Public Affairs</td>
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<td>Lena Parker, Director, YSM Web Group, School of Medicine</td>
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<td>Michael DellaBianca, Director, YSS Access Management &amp; Client Services</td>
<td>Michael Felberbaum, Dir Contribution Processing Dev</td>
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<tr>
<td>Stephen DellaPorta, Professor, Biology</td>
<td>Michael Fischer, Prof Computer Science, Meagan Fitzpatrick (2014), Graduate School of Arts &amp; Science, David Gabriel, Asst Professor, Comparative Literature</td>
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<td>John Bollier, Associate VP, Facilities</td>
<td>Michael DellaBianca, Director, YSS Access Management &amp; Client Services</td>
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<td>Maria Bouffard, Director of Emergency Management, Vice President’s Office</td>
<td>Michael Felberbaum, Dir Contribution Processing Dev</td>
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<td>Cyndi Breault, Associate Director for Finance and Administration, School of Law</td>
<td>Michael Fischer, Prof Computer Science, Meagan Fitzpatrick (2014), Graduate School of Arts &amp; Science, David Gabriel, Asst Professor, Comparative Literature</td>
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<td>Paul Cohen, Asst Prof Pathology</td>
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</table>
Brandon Gassaway (2017), Graduate School of Arts & Science
Susan Gibbons, Librarian, University Libraries
Bridget Gillich, Administrator, School of Management
Sheila Gillooly Greene, Web Editor, Yale College Dean’s Office
Steven Girvin, Deputy Provost for Science & Technology, ex officio member
Anton Glenbovitch, ITSSSG Shared Solutions
William Goetzmann, Professor, School of Management
Carmine Granucci, Dir Information Tech & Asst Dir of Finance
Abby Grow, Assistant Manager, IT, School of Law
Ronnell Higgins, Chief of Police, Yale University Police Department
Martha Highsmith, Associate Vice President of Yale University, Vice President’s Office
George Hines, Director of Security Systems, Security
Greg Huber, Political Science, Chair, ITSAC
Derek Hunt, Associate Director, IT, School of Management
Yuhong Huo, Database Administrator, IT, School of Management
Sohrab Ismail-Beigi, Assoc Prof Applied Physics & Physics
Matthew Jacobson, Professor, History
John Kaufhold, Director Finance & Administration, Facilities
Bill Kelly, Professor, Anthropology
Ruth Koizim, Sr Lectror French
Donna Lee, Systems Programmer, IT, School of Law
Jennifer Lia, Budget Coordinator, School of Law
Janet Lindner, Associate Vice President, Administration
Bryan Little, Systems Programmer, Yale Health Plan
Michael Lotstein, Records Services Archivist, University Archives,
Lawrence Manley, William R Kenan Jr Prof English; Dir Division of Humanities
Sue McDonald, Director, Finance & Administration, Law School
James McKay, ITSMSR Business Analysis
Members of the Student Technology Collaborative
Members of the Yale College Council

Thomas Morse, Assoc Rsrch Scientist Neurobiology
Connor Moseley (2014), Berkeley College
Tim O’Connor, Associate Provost for Science and Technology, ex officio member
Judy Offut, Associate Director, Information Systems, Human Resources
Mingxing Ouyang, Assoc Rsrch Scientist Int Med Cardiology
Glen Pelligrinelli, Financial Analyst, School of Law
Andrew Quintman, Asst Prof Religious Studies
Lawrence Rizzolo, Assoc Prof Anatomy & Experimental Surg and Ophthalmology
Dorothy Robinson, Vice Pres & General Counsel, Office of the General Counsel
Harold Rose, Senior Associate General Counsel, Office of the General Counsel
Sal Rubano, Director, Enterprise Risk Management
Jed Rubenfeld, Professor, Law
Holly Rushmeier, Prof Computer Science; Chn Computer Science,
Paul Singer (2016), Jonathan Edwards College
David Skelly, Assoc Dean for Research, Forestry & Environmental Studies
Richard Sleight, Assoc Dean Graduate School
Daniel Spakowicz (2013), Graduate School of Arts & Science
Vinod Srihari, Assoc Prof Psychiatry
Sumithra Sudhir, Programmer/Analyst, IT, School of Management
J Lloyd Suttle, Deputy Provost for Academic Resources, ex officio member
Hans Teja (2013), School of Management
Jackie Tucker, Senior Director, Business Solutions and Analysis
Rebecca Udler, Senior Associate Director, Student & Academic Services, School of Management
Gunter Paul Wagner, Alison Richard Prof Ecology/Evolutionary Biology
Robin Whittemore, Assoc Prof School of Nursing
Ken Wieler, Deputy Director, IT, School of Management
Brian Wolson, Associate CIO, ITS Shared Solutions
Tonie Young, Application Support/Dev Specialist, School of Management
Jing Zhang, Computer Spec Y-NH Teachers Inst
Appendix 4: References


Lowendahl, J. (2012). *IT market clock for higher education.* Gartner, Inc.


Appendix 5: FY13 Costs and Funding Sources for IT Services

<table>
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<tr>
<th>Program Area</th>
<th>IT Services</th>
<th>Operating Cost</th>
<th>Gift &amp; Endowment Income</th>
<th>Other Income</th>
<th>Internal Service Income</th>
<th>ITS PFR Billing</th>
<th>Telecom Infrastructure Bundle</th>
<th>Total Income</th>
<th>GA Allocation</th>
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1 IT Services include Backup, Data Ctr, Desktop Engineering, Email, Identity & Access Mgmt, ITS Systems & Infrastructure, Production Svcs, Quality Center, Sans Practices and Univ. IT Systems

2 Telecommunications & Networks include Telephone and Data Installations, cellular phones including long distance usage, pagers, lines, phone sets, phone rentals and call centers

3 Tier 1 Support Services include Campus Tech Pr Operations, DSP Faculty & Staff Support, Media Services, Service Desk, Student Technology Collaboratives

In addition to these funds which supported IT operations, the FY13 capital budget for projects was $22 million.
## Appendix 6: Estimated Costs to Implement the FY14-15 Strategic Plan

<table>
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<th>Program Area (Strategic Plan)</th>
<th>Program Name (Portfolio)</th>
<th>Technology Areas of Focus (Strategy Working Groups)</th>
<th>FY14 Allocation ($)</th>
<th>FY15 Total Demand ($)</th>
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<td>Foundational Technologies</td>
<td>Cloud File Backup &amp; Synchronization</td>
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<td>Data and Integration Services</td>
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<td>Desktop Virtualization</td>
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<td>Resilient IT</td>
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</table>

FY14 Allocations include only the projects that were allocated funds during the FY14 Project Portfolio planning cycle. Much of the work that was recommended in Year 1 of the strategic plan (FY14) was consequently postponed and is now reflected in the FY15 Total Demand column.