

PENNSTATE



# Penn State

## Information Technology Strategic Plan

~~June~~ July 2013

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# I. Executive Summary

This is Penn State's first ~~university~~ University-wide strategic plan for IT ~~Information Technology~~. ~~strategic plan~~.—It incorporates input from hundreds of students, faculty, and staff obtained through a year-long process to explore the ~~indispensible~~ indispensable role technology plays in all aspects of the ~~university's~~ University's mission.—As requested by Penn State's Core Council review, the plan considers how to maximize the strategic value of Penn State's nearly \$250 million annual investment in technology and sets priorities for new investment.—It addresses ~~known~~ gaps in technology capacity and proposes multi-year initiatives to expand support for research and teaching and enhance outreach and operations.—It improves coordination across the Penn State IT community, optimizes the use of resources, supports innovation, and makes essential technologies more widely and consistently available to all units.

## Strategic Directions

The IT strategies respond to ~~many significant~~ the external opportunities and challenges facing Penn State ~~and as well as~~ broader changes in how technology is used by faculty, students, and staff. Implementing the plan supports the ~~university's~~ University's response to the changing competitive landscape in online learning and enables an increases in online enrollments and a broader adoption of new pedagogical models.—The plan improves the ~~university's~~ University's competitiveness for research awards and aligns the research technology infrastructure with shifts in funding ~~agency~~ priorities towards data and computer-intensive, interdisciplinary research.—The IT strategies align Penn State technology with its administrative strategies to promote shared services, data-driven decision-making, and more agile processes.—Finally, the plan embraces major changes in how individuals use technology by supporting mobility, collaboration, content creation, and virtualization of services.

The plan emphasizes four strategic priorities, each with its own goals:

- **Enable Learning**—Use technology to extend ~~PSU's~~ Penn State's market and student base and diversify access to educational programs.
- **Support Research and Innovation**—Be a leader in research computing by expanding capability and capacity.
- **Modernize Administrative Systems and Services**—Simplify, automate, and enhance administrative services to students, faculty, and staff.
- **Sustain IT Effectiveness**—Improve IT efficiency and effectiveness through consolidation and standardization, multi-sourcing, and shared services without hindering innovation.

The four priorities are supported by two enabling strategies:

- Create and foster enterprise IT governance, effective funding practices, and portfolio management to optimize value for investment.
- Build an agile, future-looking workforce equipped to provide, manage, and use technology effectively.

## Enable Learning

The strategic plan shifts the University's focus from the outdated idea of nurturing the adoption of instructional technology to one that encourages the ~~enabling~~ broad use of a variety of technologies in diverse settings. Additional instructional designers will support faculty members' exploration of pedagogical innovations aided by technology and enable the development of more online and hybrid courses.—Increasing investment in technology in classrooms and learning spaces will enable new forms of pedagogy and student engagement.—Capturing and analyzing increasing amounts of data

will support assessment of the efficacy of pedagogical and technological innovations and will support efforts to personalize learning experiences.—Explicitly linking research and assessment to technology adoption will improve outcomes and position Penn State to be a leader in instructional technology.

### Support Research and Innovation

Penn State is falling behind its peers ~~and competitors~~ in research computing capacity and capability. This is a particularly ~~consequential~~ **serious** deficit as research grows more data-intensive and research computing is more relevant to more disciplines. Penn State must ~~invest to~~ close this gap ~~in order to~~ sustain its position among leading research universities. To foster innovation and discovery, the ~~university~~ University will make research software, computing capacity, modern data centers, data storage, and support transparent, accessible, and abundant. Increased investment in advanced research computing and data capabilities, as well as additional research computing specialists, will provide the infrastructure required by leading edge, computationally intensive research.—Better coordination among IT support organizations will facilitate discovery and access to basic and advanced research support. A faculty director for research computing, reporting to the ~~Vice vice~~ Provost ~~provost~~ for **Research**, will oversee advanced research computing services and work in conjunction with ITS and ~~college~~ Penn State IT groups to establish policies and services that are sensitive to the needs of the research community.—Through IT governance, faculty will ~~be~~ direct the future priorities for expanding research computing support and advocating for increased investment.

### Modernize Administrative Systems and Services

~~Over~~ During the next five years, Penn State will begin to transform all of its major support processes and systems to provide more agile and efficient services, eliminate silos of data that hinder decision-making, and deploy more cost-effective technology ~~that is more cost-effective to sustain~~. New student information, human resource management, financial and research support systems and processes will streamline administrative services and make them more accessible to highly mobile, online constituents.—New, more adaptable technology will ~~be more adaptable and will~~ facilitate more agile and responsive services.—Improved integration, guided by supporting an overall architecture, will enable improved access to data and greater integration of services.—Advanced reporting and analytical tools will help model decisions, optimize the use of resources, ~~or and~~ design predictive models that improve student success.—For system and process change to be successful, organizations and culture will need to change as well, adapting their.—~~P~~ processes ~~will need to become more consistent and aligned with to~~ the leading practices available in packaged software. Building or customizing systems will be a last resort undertaken only to meet truly unique, strategic needs. In doing so, individuals will develop new skills to effectively use and manage technology. Active governance will be required to set priorities, manage change and establish the principles that will guide this multi-year effort.

### Sustain IT Effectiveness

IT effectiveness has three foci: adopting cross-industry best practices to manage technology, achieving greater efficiencies by consolidating duplicative IT ~~solutions~~ procedures in areas where it will not hinder ~~differentiation is not critical to~~ strategy or innovation, and investing in the core technical infrastructure required to sustain the research, teaching, and outreach mission. Penn State has already taken significant steps to improve IT effectiveness, but.—~~T~~ this plan substantially accelerates efforts to improve the quality, consistency and cost-effectiveness of a wide variety of IT services. Changes to the processes and practices the University uses to manage its technologies and services will make it easier to find and access existing IT services and will improve the University's capacity to deliver new ~~solutions~~ ones.—The creation of additional core services, like the network, will provide more consistent and efficient technologies across units in areas where needs are similar ~~and~~

~~duplication of effort inefficient.~~— Collective and collaborative management ~~of more distributed~~ technology solutions that have previously been managed in isolation, ~~such as (e.g., electronic commerce technologies.)~~ will improve service quality and minimize redundanciest efforts.

### **IT Governance**

Effective IT governance must be participative and decisive. Governance committees should set or adopt strategies, establish goals, create frameworks to empower and guide decision-making, and monitor results.— Leaders should implement strategies, facilitate decision-making and solicit the input of stakeholders. Penn State's IT governance should consist of three domain-specific governance bodies: ~~(research, instruction, and enterprise administrative systems.)~~ all accountable to an ~~E~~xecutive ~~B~~oard. Additional cross-organizational groups, led by the Information Technology Leadership Council (ITLC), ~~and~~ focused on IT operational coordination, should complement the governance committees.

### **Agile, Future-Oriented Workforce**

~~The foundation of the plan is the IT workforce.~~— Innovative hiring strategies, extensive, ~~and~~ continual retraining, better defined career paths, clear performance objectives and accountability, and lower barriers to collaboration across units will result in a workforce ~~that is able to deliver the solutions~~ students, faculty, and staff require.— The plan also calls for increased support and professional development for all faculty and staff to improve capacity ~~to and~~ more effectively use available technology.

## II. Introduction

Recent advances in information technology are inextricably linked to Penn State's most important strategies and initiatives.—Sustaining the University's position as a leading global research ~~university institution~~ requires technology able to support computationally intensive and team-based research, ~~manipulate and store~~manage increasingly large data sets, and share research ~~outcomes~~results.—Technology, when integrated in face-to-face and online education, increases access, improves learning outcomes, and supports innovative pedagogical models. New technology-based educational delivery models may redefine the economics, competitive contours, and enrollment patterns of higher education.—Rising expectations and ~~resource~~funding constraints drive the University to adopt mobile, online and automated services to increase operational productivity, create a more consistent user experience, and facilitate work ~~ing anywhere, at anytimeany time,~~anywhere.—Better technology is necessary, but not sufficient, for excellence.—It must be accompanied by improved IT services and organizational capacity ~~to effectively apply to~~in all areas of the University's mission.

This is Penn State's first comprehensive University-wide IT strategic plan.—At the direction of the Core Council, ~~the this strategic~~ plan was developed through a year-long consultative process (insert hyperlink to one- to two- page description of the methodology) that broadly engaged the University community.—This plan synthesizes the work of seven planning committees and draws input from focus groups and surveys ~~that engaged~~of students, faculty, and staff across Penn State. Its implementation will assure that Penn State has the technologies it requires to sustain and enhance its position among leading universities.—It builds on the findings of the 2011 IT ~~a~~Assessment and increases the effectiveness of the University's \$250 million annual IT investment. ~~It also and positions~~ resources to support strategic priorities in research and teaching and. ~~Concurrently, it creates efficiencies through shared services and improved management of core technologies to free up time and money to invest locally in teaching and research innovation to support innovation in teaching and research.~~ It recommends overhauls to the processes and systems that deliver services to students, ~~manages~~finances and personnel, and provides data required to model and assess complex strategic decisions.—It builds on considerable momentum within the IT community to reduce duplication, integrate services, and expand the capacity of IT staff to support the effective use of technology.—It makes ~~commonly used~~ technologies more widely available at consistent levels of quality across all units of the University.

~~Undergirding~~Supporting the plan are recommendations to establish well-defined IT governance, which will to set priorities, create accountability, and engage faculty and budget executives more effectively in IT planning.—Implementation will require changes to how ~~the costs of~~ IT funds are allocated, ~~to thereby~~removeing artificial barriers to collaboration, and ~~reduce incentives for encouraging~~ units to optimize incentives only after considering the locally without regard for the impacts on other units.—Finally, Penn State must continue to sustain a technology foundation that supports the services it offers and accommodates the personal technologies that students, faculty, and staff bring to campus.

### Alignment

The next few years will see new University leadership develop new institutional strategies. The Penn State IT plan is a bridge between *Priorities for Excellence*, and what will come next.—Its recommendations address immediate needs and ensure progress towards lasting institutional goals in research, learning, efficiency, and sustainability.



- **Research**—To sustain and enhance the University's position among leading research universities, institutions will require increased research computing capabilities.—The plan calls for every researcher to have access to a more robust set of baseline services, including research networks, data storage and preservation, server hosting, and collaboration tools.—Investment in expanded staff and technology capabilities will help attract and retain the best faculty and enhance the capability and competitiveness of research programs in data- and computationally intensive fields.—~~Recommended~~ These changes to the structure and governance of research computing will elevate its research computing's importance and insure its continued alignment with research needs.
- **Learning**—At its core, the plan recognizes that the use of technology in instruction is an integral component of most courses and programs.—The plan advances an integrated approach to learning supported by technology, that encompasses the needs of the World Campus, as well as other colleges' niche online programs offered by colleges, and individual faculty seeking to improve individual their own courses. The plan recommends developing new designs for learning spaces that are better linked to evolving pedagogical models.—It expands instructional design capacity and creates a Penn State IT Learning Council to foster collaboration and innovation, increase the number of online and hybrid courses, and sustain consistent quality, and design for universal access.—It lays the groundwork for increased use of such learning technologies as digital content, and mobile devices and other learning technologies.—Finally, it makes more explicit connections between educational research, instructional technologies, and faculty development programs to focus the institution on pedagogical and technological innovations that promote deep learning.
- **Efficiency and Effectiveness**—The Penn State IT plan promotes efficiency and effectiveness in multiple ways.—The first is a multi-year, multi-part strategy to introduce new cost-effective and easily adapted processes and technologies to students services, human resources, finance, research administration, and advancement that are more cost-effective to operate and more easily adapted to changing circumstances. The second strategy is to increase the efficiency and effectiveness of IT services.—The plan clarifies and expands the number of core or shared services that provide University-wide solutions to common IT needs.—It consolidates or improves the coordination of important technologies that meet specialized needs or are used by some, but not all, units.—It strengthens service management processes and staff development to provide higher quality, more efficiently managed, transparent services to the campus community.—Finally, it recommends systemic changes to funding and governance to remove internally imposed barriers to collaboration that fuel duplication and inefficiency.
- **Outreach Community Involvement**—A key part focus of Penn State's tripartite three-part land-grant mission is education and research for people outside the traditional classroom and laboratory. This mission of service is accomplished through such areas of the university University such as continuing education, the World Campus, Penn State Extension, and Penn State Outreach. While a specific subcommittee was not charged to study the services area, Penn State IT recognizes it is recognized that many elements of the learning and research sections of the plan have direct impact on Penn State's service mission. The successful application of advanced technologies will serve to improve the delivery of educational programs, help reduce costs, and expand access to audiences while fostering improved programmatic partnerships among the service areas and the campuses.

- **Sustainability**—The IT plan advances the University's sustainability goals and strategies in several areas. ~~It accelerates the consolidation of such overlapping or overly distributed IT services such as server hosting to reduce energy consumption, improve service and reliability, and limit waste.~~ It calls for more consistent, objective analyses of the total cost of deploying and operating potential technology projects and services to find solutions that are designed and sourced in ways that meet requirements at the lowest possible total cost. Longer-term, ~~the capabilities~~ the implications of the IT plan ~~creates for the University~~ will have an even greater impact on sustainability. Online learning and services will reduce the need for individuals to travel and will optimize the use of physical space. Smarter building systems and scheduling software will reduce energy ~~utilization~~ use and defer the need to create new spaces.

## Principles

—The Penn State IT plan accelerates the University's substantial progress toward a new operating model characterized by collaboration, trust, and a focus on ~~enabling the effective utilization~~ use of technology. It prepares the University to make several important shifts: ~~including moving from building administrative solutions to buying and integrating software already on the market solutions;~~ consolidating overlapping capabilities that ~~are do not meeting truly unique needs or are vital to innovation;~~ making more extensive use of technologies organized and operated "above the campus" through shared service partnerships; and creating a decisive, inclusive IT governance system. All of the changes ~~called for~~ suggested in the plan require substantial trust and collaborative implementation efforts that transcend organizational units and stakeholder groups. New governance structures, metrics, and transparency will continue to build a unified culture for IT at Penn State IT, one. ~~This culture is typified by the IT principles~~ (insert link to full IT Principles), developed by the University's IT Leadership Council (ITLC) in September 2012, which guide this plan:

1. We will align IT resources and plans with the University's Strategic Plan.
2. We are committed to responsible stewardship of human, financial, and environmental resources.
3. We will make our systems and services accessible.
4. We are committed to collaboration and open communication across all units.
5. We will encourage innovation.
6. We will actively develop and support our staff.
7. We will maximize value and reduce cost through collaborative processes for sourcing and ~~high utilization~~ use of enterprise services.
8. We will identify risks, implement proactive security measures, and be consistent with policy and law.

## Case for Action

—The current state is unsustainable, and the cost of failing to act on this plan is high. Research computing, data support capabilities, and overall IT investment lag behind peer institutions and threaten Penn State's competitive positioning. Without expansion, the institution's data center capacity is insufficient to provide secure, resilient hosting for research servers and to meet the needs of the University's administrative operations. Network capacity must continue to be upgraded to support the needs of the research community and the physical and virtual classroom.



Many colleges, and most campuses, lack sufficient instructional design capabilities to support the growing faculty interest ~~of faculty~~ and the increasing student expectation ~~of students~~ that technology be effectively integrated into the University's educational programs.—Computer-based testing facilities have insufficient capacity,—classroom technology is not supported by sustainable funding, and the infrastructure on campuses and in classrooms is not prepared to meet the challenges of expanded use of digital instructional materials and mobile devices.—There are not enough ~~In~~incentive structures and ~~available time are insufficient~~ to encourage more faculty to take risks to explore innovative pedagogical models.—Few units have defined processes to forecast and prioritize course redesign opportunities.—~~Important d~~Data about about students' online engagement with course materials, faculty, and one another are difficult to access and analyze, which would help Penn State IT better ~~to understand the learning process or and~~ provide students with feedback about ways to improve their success.

Major administrative systems lack required capabilities and have become increasingly costly to sustain.—A legacy of brittle processes and such brittle/fragile, homegrown technologies as (IBIS and, ISIS,) coupled with impending staff retirements, are driving up risk and cost.—The lack of a comprehensive human resource system impedes service, inhibits analysis, and increases the cost of compliance.—Student services, human resources, finance, and research administration ~~processes and~~ structures need to be rethought to ~~eliminate omit unnecessary~~ inconsistencies across units, consolidate and share expertise, and improve productivity.—~~Over reliance on e~~Costly, insecure, and, at times, inaccurate shadow record-keeping systems created to compensate for short-comings in enterprise solutions need to be eliminated.

The absence of consistent, coordinated solutions for multiple technologies is inefficient and undermines broad strategic objectives.—Work has begun on a process to consolidate email solutions, server hosting, and create a single ticketing system to report and track IT problems.—This still leaves many overlapping and unmet needs.—Progress must continue to reduce duplication of effort and improve such services such as wireless networks, data storage, identity and access management, and the maintenance of software solutions used by many units.

Finally, the University must compete to recruit, develop, and retain a talented IT workforce. Present practices are falling short in a number of areas.—Units work independently to recruit staff and cannot easily share applicant pools.—Organizational structures are too rigid to share ~~IT~~ expertise to advance institutional priorities and provide professional development opportunities.—Compensation levels are not sufficient to recruit and retain a skilled technical workforce. Unit budgets for training are too small to provide IT staff members ~~sufficient~~ access to required professional development.—Job families are too broad and career paths too limited to accommodate the diverse skill sets engaged in technology management and support.

## **Plan Structure**

This plan presents the goals, strategies, and implementation enablers that will guide Penn State IT for the next five years.—Goals and strategies are organized around four broad themes: enable learning, support research and innovation, modernize enterprise services, and sustain effective IT, while recommendations to restructure IT governance and funding practices ~~Supporting the four themes are r~~Recommendations to restructure IT governance and funding practices to enable the plan. ~~D.~~

Detailed implementation roadmaps and resource forecasts are under development and will be presented separately.

### III. Goals and Strategies

The goals and strategies presented in this section emerge from recommendations developed by seven planning committees.—Each planning committee examined a particular technology domain, such as (e.g., teaching and learning) or crosscutting such management issues such as (e.g., IT funding, and their g).—Committee reports present a detailed discussion of the strategies and implementation considerations [\(insert link to reports\)](#).

#### **Theme 1: Enable Learning**

The learning technology needs of students and faculty are quite dynamic.—The challenge has shifted from nurturing adoption to supporting a broad and growing use of a variety of learning technologies ~~in diverse settings~~.—The strategies supporting Theme 1 will expand the use of ~~learning technologies~~ to promote ~~deep~~ learning online and in-person.—They will create more flexible ~~and scalable~~ models to ~~seed and support the~~ adoption of technologies that scale beyond a single unit but are not necessary ~~or appropriate as~~ University-wide solutions.—They increase the use of learner analytics by making data more accessible.—The strategies recognize ~~that~~ the instructional design community must expand and collaborate as a distinct community with its own ~~shared~~ values, priorities, and expertise, while maintaining deep ties to the broader IT community. Finally, the plan recommends sustained efforts to scale the infrastructure and services required to support more online and hybrid courses, at a consistently high-quality and, accessible online experience level for students, and then leverage such innovative delivery models ~~such as~~ MOOCs, where they make sense pedagogically.

#### **Goals**

In the next five years, Penn State will:

- —Increase the number of online and hybrid courses.
- Use technology to improve learning in the classroom.
- Improve support for students to learn the technologies unique to their discipline or degree program.
- Improve learning through a ~~broadening~~ adoption of new pedagogical models.
- Reduce the cost and improve the effectiveness of instructional materials.
- Continuously improve students' satisfaction with their online learning experience.

#### **Strategies**

##### **1. Create a coordinated learning strategy supported by technology.**

In the next five years, technology will become a supporting element of learning in nearly all courses. It is insufficient to associate online learning only with the World Campus. MOOCs, online courses, college-delivered online programs, hybrid courses, flipped classrooms, and digitized instructional materials will be a routine part of students' ~~learning experience and core expectations~~. Penn State must align its culture, policies, and support structures to accommodate this fast-emerging reality without reducing quality or constraining innovation.—Colleges and campuses should devise mechanisms to create capacity and incentives for faculty to experiment with learning technologies, restructure courses to leverage new pedagogical models, and share the outcomes with their colleagues.—As a result, F ~~faculty~~ development programs and instructional technology training must become more integrated.—Colleges should also ~~improved their~~ approaches to course redesign ~~should be established~~ to increase productivity, maintain standards of quality and consistency, and ~~design-develop~~ courses for accessibility without sacrificing flexibility to choose the right content and tools to meet learning objectives. Improved ~~coordination of strategizing~~ among academic units and

methods within the instructional design community ~~improve will better integrate efforts to leverage use~~ content across pedagogical models and platforms.

## **2. Expand instructional design capabilities and capacity.**

To create more online and hybrid courses and improve the integration of technology in face-to-face courses requires additional instructional design support in all units.—Faculty have limited time to research new technologies, identify new content, and redesign courses.—~~So~~Thus, ~~their~~ productivity is ~~greatly~~ enhanced when Penn State can support them with trained instructional designers ~~with who~~ have knowledge of the disciplines and the faculty they support. Embedded instructional designers build relationships with faculty that encourage innovation and ~~develop~~ expertise in the instructional technologies and content most valuable to a particular discipline. All colleges and campuses should ~~develop create~~ staffing plans that ~~allow for enable them to create more~~ instructional designers ~~capacity~~ to work with their faculty.—The University should develop improved job classifications and career paths that recognize instructional designers' ~~the differential~~ roles and qualifications ~~of instructional designers~~.

Efforts to coordinate, develop, and support the instructional design community should ~~increase establish~~.—~~A~~a council of instructional designers ~~should be established~~ to bring together a ~~the~~ variety of existing committees, ~~to enable~~ the instructional design community to interact with one another and with ~~leading faculty adopters of learning technologies~~.—The leadership cCouncil should design the standards and values of the learning technology community, share successful practices, and promote professional development ~~opportunities~~.—It should participate in the ITLC to maintain an effective dialogue between IT leaders and the instructional community.—ITS should continue to support instructional designers by seeding new innovations, supporting technologies used across the majority of Penn State, providing research and data about effective practice, and lending resources to large-scale course redesign efforts.

## **3. Advance the use of research, data, and assessment to improve pedagogy supported by learning technology.**

Research should be fully integrated into decisions made about pedagogical innovation, adoption of instructional technology, and the design of learning spaces.—Penn State should seek opportunities to foster applied research in technology-enabled instruction and seek recognition for advancing the body of knowledge in the field.—The University should provide increased internal grant programs, recognize faculty who research pedagogical innovations at Penn State, and expand expertise in assessment. A laboratory classroom should be developed to experiment with innovative uses of space and pilot new learning technologies.

The University should ~~be among the leaders in~~ higher education in the development and use of learner analytics. Data captured in ANGEL and other learning technologies should be ~~made more~~ readily available to support longitudinal research, and a Analytical models and views of data should be developed to enable faculty and students to monitor their performance in a course.—Proposed ~~F~~faculty development sessions ~~should be developed to would~~ support the use of data and analytics in pedagogical improvement strategies.—The University should seek partnerships with corporations or consortiums to develop improved learner analytics systems.

## **4. Create innovative learning spaces driven by pedagogy and able to support the growing array of devices and content that faculty and students will use in their courses.**

Penn State should accelerate recent progress made by the University Classroom Ccommittee on Instructional Facilities to drive learning space design ~~the design of learning spaces~~ from the

perspective of the faculty who will teach in them. Faculty, instructional technology leaders, and Office of Physical Plant should work collaboratively to develop standard designs for a variety of classroom types that are tied to ~~different~~ such pedagogical models (~~e.g., as~~ flipped lecture classes ~~and~~ seminars). All learning spaces should include ~~highly~~ capable and reliable wireless networks that enable faculty and students to use a variety of personal or ~~university~~ University-owned devices to access, share, and manipulate content. More, and more varied, types of learning spaces are required, including additional collaborative spaces for group work, reconfigurable rooms that support lecture, collaborative projects, and discussion, and spaces that can concurrently support students participating in person and online. Additional capacity is required for secure e-testing facilities. In general, more computer labs should become specialized facilities to support curricular materials or pedagogical methods that cannot be virtualized or accessed in collaboration spaces. At the same time that new spaces are created, life-cycle funding is required to secure the ability to refresh the technology in existing spaces at four- to five-year intervals. Finally, the implementation of new scheduling software, integrated with the replacement for ~~the student information system~~ ISIS (student information system), should create more sophisticated scheduling and room assignment capabilities to match faculty preferences and pedagogical methods, the course, ~~pedagogical method~~, and the room's design.

#### **5. Support expanded use of digital curricular materials and student-created content.**

The continued evolution of physical learning spaces must be accompanied by the expansion of virtual learning resources. Penn State should ~~seed~~ create and support the expanded use of such digital curricular materials ~~such as accessible e-texts~~ as a means to reduce the cost of curricular materials and introduce more interactive content. Networks, accessibility services, user support services, security, and identity management capabilities must ~~plan to~~ keep pace with the expanded use of ~~a variety of~~ devices to interact with increasingly rich media content. Penn State should decide whether to continue using ANGEL as its learning management system, and if not, create a new long-term strategy to replace it. ~~Developments in learning management systems should continue to be monitored and a long-term strategy decided to sustain or replace Angel as the core of the learning technology environment.~~ Specialized software should continue to be made available over the network, in addition to fixed labs, to support the online learner.

A repository strategy is required to organize and store student- and faculty-created digital content. Faculty repositories should support the discovery and reuse of learning objects that can be shared across courses. Students should be provided a University electronic portfolio or the ability to share access to their personal portfolio to create repositories of their created content. Portfolios will support assessment, provide a mechanism for students to demonstrate their capabilities to future employers or graduate schools, and share materials with collaborators.

#### Priorities for Action

- Establish an Instructional Design Council
- Assess capacity and build collaborative staffing plans for instructional designers
- Create a laboratory classroom
- Improve course redesign processes and align them with college and campus priorities
- Develop a research agenda and assessment strategy for instructional technology
- Expand device requirements to more majors and increase e-text adoption





## Theme 2: Support Research and Innovation<sup>1</sup>

Theme 2 summarizes the recommendations developed by the faculty members of the Research IT Strategic Planning Committee. The full Statement of the Committee [\(insert hyperlink\)](#) contains additional important details to support the case for action and implementation of these goals and strategies.

Research computing is the life and blood of present-day research in many fields. Penn State's research productivity has risen impressively during the last-past two decades, supported by dramatic increases in external funding. However, Penn State's research computing infrastructure has failed to keep pace with its growth in research. In both administrative structure and funding our **Advanced Research, Computing, and Data Enterprise (ARCADE)**<sup>2</sup> now lags behind such comparable research universities schools as the universities of as (e.g., Minnesota, Wisconsin, Maryland, and Illinois and Purdue University, Illinois). Penn State's upward trajectory as a major research university is dependent on having adequate provisioning of advanced and baseline research computing capacity and capability. Fortunately, addressing the crisis in ARCADE requires only relatively modest steps at this stage, and taking them will allow us to fundamentally transform the system. Doing so will pay huge dividends in the coming years.

### Goals

In the next five years, Penn State will:

- Create forward-looking capabilities, organizational models, and policies that enhance Penn State's position as a top research university.
- Adopt a faculty-driven governance and organizational model to establish research computing plans and priorities.
- Provide greater access to appropriate computing and data resources for all researchers.

### Strategies

#### 1. Create a cultural shift in philosophy regarding research computing.

Penn State should instill a philosophy of abundance, whereby in which ARCADE is made highly visible to the research community and its benefits made are available to all researchers through transparent and easily accessed processes. Further, policies and practices surrounding ARCADE must be grounded in an appreciation that the most innovative research requires embracing rather than avoiding risk. There is a "long-tail" of research computing at Penn State: although a small number of researchers use high-performance computing facilities intensively, a large number of researchers use smaller (often local) facilities. So, Bbasic and customized ARCADE needs to be readily available across all parts of the University, including the physical sciences, engineering, the social sciences, and arts and humanities. And Bbecause research computing is central to the Uuniversity's tripartite-three-part mission, support for ARCADE must be implemented at all levels, rather than through a few high-end centralized facilities, and faculty experts should play a key role in Penn State's ARCADE planning and oversight to ensure that policies and practices are at the cutting edge and serve to advance—rather than limit—the research productivity and achievements of Penn State faculty and students.

<sup>1</sup> This section presents an excerpt from the statement on research computing authored by the faculty on the research planning committee with the support of the IT staff members.

<sup>2</sup> "ARCADE" has been employed here as a temporary placeholder, pending further discussion of what constitutes an effective acronym. We have used the term as though the holistic enterprise it represents currently exists. Obviously it does not yet do so, but we believe that it urgently needs to be a reality.

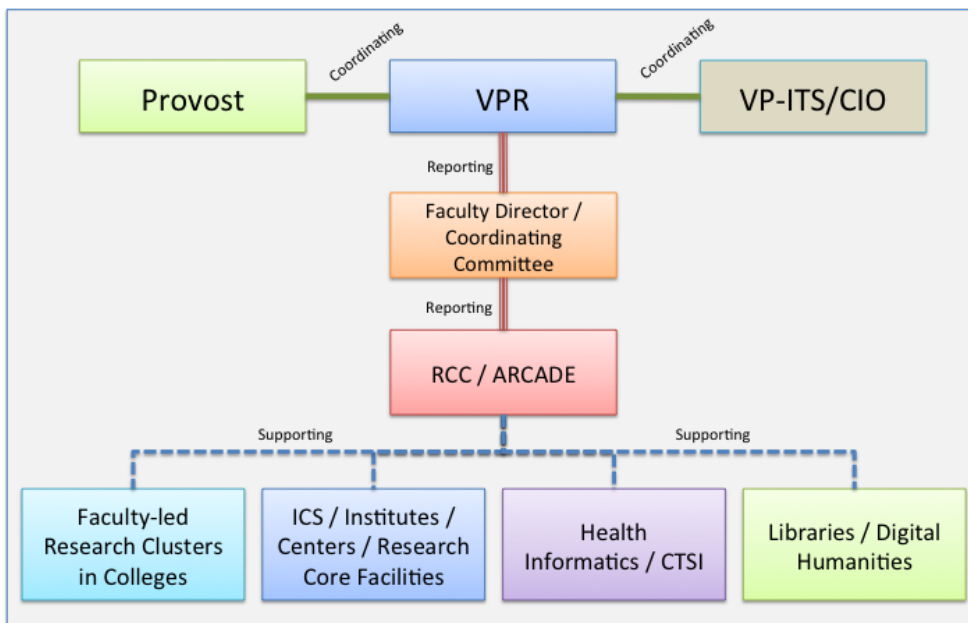


**2. Restructure the organizations that support research computing and institute a faculty-led governance model.**

2.

To increase the visibility and importance of ARCADE and to promote research excellence there should be a highly placed senior university official with dedicated personnel whose jobs are to ask, “How can ARCADE at Penn State better serve the needs of our research community?” Having explored alternative models, we recommend the appointment of a This faculty ARCADE Director-director-, who will reports directly to the Vice pPresident for Research.<sup>3</sup> The Director should be advised by a faculty-led governance committee, the (Research Computing Board,) that is appointed by the Vice-vice President-president for Research, Vice-vice Provost provost for IT (VPIT), and Academic-the academic Deansdeans. Working within the broader IT governance structure- recommended in the Strategic Enablers section, (see Strategic Enablers), the committee should be given the responsibility and authority to make policy and resource allocation decisions about ARCADE.- In addition to overseeing advanced research computing support, the Director-director would work in partnership with ITS leaders and, campus and college IT directors to improve local facilities and support for research. As noted, researchers depend on an ecosystem of local, shared, and central support services and facilities.- It is vital that the new organizational model strengthen coordination across IT units.

### Potential Model for Penn State ARCADE



**3. Significantly increase investment in research computing and data enterprise capabilities.**

The development of additional research computing capabilities, data capacity, and improved integration of appropriate research computing is required at all levels of complexity (from desktops to

<sup>3</sup> The ITS staff on the committee agreed that it was appropriate to abstain from endorsement of specific recommendations for revisions of organizational structure, but will wholeheartedly support the implementation of the full set of recommendations if adopted by Penn State's senior leadership.

servers) and across all organizational constructs, from (individuals to schools and centers).—The committee'sA significant gap between Penn State's annual \$2.5 million central funds support of these initiatives, when compared to the \$6 million from and the level of investment at Wisconsin and the \$10 million in support at Minnesota, shows a significant gap. peers, such as Wisconsin (\$6 million) and Minnesota (\$10 million) benchmarking of structural models and level of investment in ARCADE revealed aPlagues Penn State significant gap between Penn State's annual support from central funds (\$2.5 million) and the level of investment at peers, such as Wisconsin (\$6 million) and Minnesota (\$10 million). Increased investment will support hiring additional research computing support staff, acquiring and maintaining additional computational and data storage capacity, and expanding the availability of research-specific software. Increased funding creates opportunities to extend support to unfunded researchers to seed new areas of exploration and to enable more student use of research computing infrastructure in education.

#### **4. Improve services, expand organizational capacity, and align policies with the needs of the research community.**

\_\_\_\_\_ Detailed improvements to services and staffing should be designed in detail by the research computing board, the ARCADE director, and IT leaders.—Critical to future success is establishing tight communications between researchers and IT leaders to create services that are responsive to their unique needs of research.—The future requires a greater degree of nimbleness, with structures and groups prepared to incorporate new hardware, software, or models quickly. Improvement opportunities and specific recommendations of additional hardware, and software are discussed in Appendix D (hyperlink) of the Committee's report.—In summary, the strategic plan offers the following guidance to inform future improvement planscalls for:

- **New Policies**

- Security policies are variously interpreted through the uUniversity, leading to confusion. Penn State IT should Pprovide better means to address information security risks and implement policies without constraining the flexibility, technical diversity, and agility required for research computing. A necessary and appropriate concern for security should not prevent research and slow productivity. Discussions have shown that security policies are variously interpreted through the university, leading to confusion.
- IT should Wwork to coordinate support policies across units. Faculty in one unit sometimes find that faculty in another unit have access to resources and are subject to more flexible policies.
- Clarify IT should also clarify policies on the use of, and facilitate access to, such commercially offered tools as Dropbox, Google Drive, and Amazon AWS when they are easier than Penn State solutions and would not place classified data or personal ly identifiable information at risk (e.g., Dropbox, Google Drive, Amazon AWS).

- **Supporting Personnel**

- Penn State should Rrecognize that the skills required to provide research IT support and daily computing support are different, and therefore they require different personnel with specialized training, distinct career paths, and appropriate compensation structures.
- Such IT support of aAdvanced research IT support such as the development ofing specialized computational applications or large scale data management may be best facilitated by Ph.D.'sPh.D. s and field experts working with IT specialists.
- A greater iInvestment in permanent research support staffing, as opposed to shorter-term grant funded staffing, which can help build a greater pool of expertise and stability in staffing, is also needed.

- **Better Coordination and Communication**

- Penn State should Ccreate a r“Research oOmbudsman” and research IT on-boarding procedures for new faculty.—New faculty have noted that it takes many units to set up access to specialized needs,; as there is no one-stop shop for obtaining what they need, and; finding out where necessary resources are located is excessively difficult.
- There are similar concerns for existing faculty.—Some faculty have voiced a need for it should also establish “research consultants” who could help who could help existing them faculty navigate the range of services and systems in place.
- Penn State should Ddevelop a central website or other tool to advertise and clarify what and where different advanced computing servers are on campus.—Specialized or emerging areas may require a more focused approach, such as (e.g., the development of a “Ddigital Humanities-humanities Ttoolkit”).

- **General Service Improvement Priorities**

- Penn State IT should Pprovide access to national and local advanced computing assets for the training of to train graduate students, research support staff, and faculty.
- Penn State should also Aallow ubiquitous, easily accessible, wireless and, guest access to internetInternet resources.
- IT should Pprovide stronger support for all research platforms and operating systems, including (Windows- and, Apple-based systems as well asMac, Unix and Linux).
- The University should Ppursue ways to consolidate, coordinate, and negotiate software licensing for advanced /research computing.
- Penn State should Eexpand support to faculty in preparing data management plans.

### Priorities for Action

- Create and fund detailed plans to expand research computing and data cyber-infrastructure capacity and capabilities.
- Recognize the need to invest in ARCADE on a scale comparable to peer institutions.
- Appoint a faculty director for ARCADE reporting to the VP vice presidentprovost for Research.
- Form a Research Computing Board, the (ARCADE steering committee,) consisting of 9-nine to 12-twelve faculty and several IT leaders.

### Theme 3: Modernize Enterprise Systems and Services

The ~~university~~ University faces a unique and substantial opportunity to redefine how it manages itself. ~~Over~~ During the next five years, Penn State should transform processes and systems to provide more agile and efficient services, eliminate ~~sites excesses~~ data that hinder decision-making, and deploy ~~more current, cost-effective~~ technology that is more cost-effective to sustain. ~~Changes to the business process change~~ must drive changes to systems and technologies—~~n~~. New technologies should not be layered on outdated and ineffective business processes. Systems modernization is occurring within a changing technology landscape. ~~New solution~~ delivery options, such as software as a service, are introducing new cost and operating models for enterprise technologies. Systems are becoming more interoperable, increasing the potential for a “best of breed” strategy that mixes solutions from multiple vendors without introducing unsustainable operating and maintenance costs.

The urgency to begin is great. ~~Students, faculty, and staff expect more mobile, online services current that present systems cannot deliver.~~ ~~Current~~ The systems lack the configurability to adapt to new service models ~~such as (e.g., shared services) or and to~~ policy and process changes without significant time and cost. ~~Access to data is difficult and insufficient to model decisions, optimize the use of resources, or design predictive models that improve student success.~~ Institutional risk is growing as custom-developed systems age and the staff members who support them approach retirement.

#### Goals

In the next five to seven years, Penn State will:

- Deploy agile, cost-effective, and integrated administrative systems.
- Implement more consistent, efficient, and accessible enterprise administrative services.
- Minimize time spent by faculty, students, and staff on administrative tasks.
- Enable processes and data to support new strategic directions such as online learning, global research, and educational partnerships.
- Provide services that are increasingly available anytime, anywhere, and from many devices.

#### Strategies

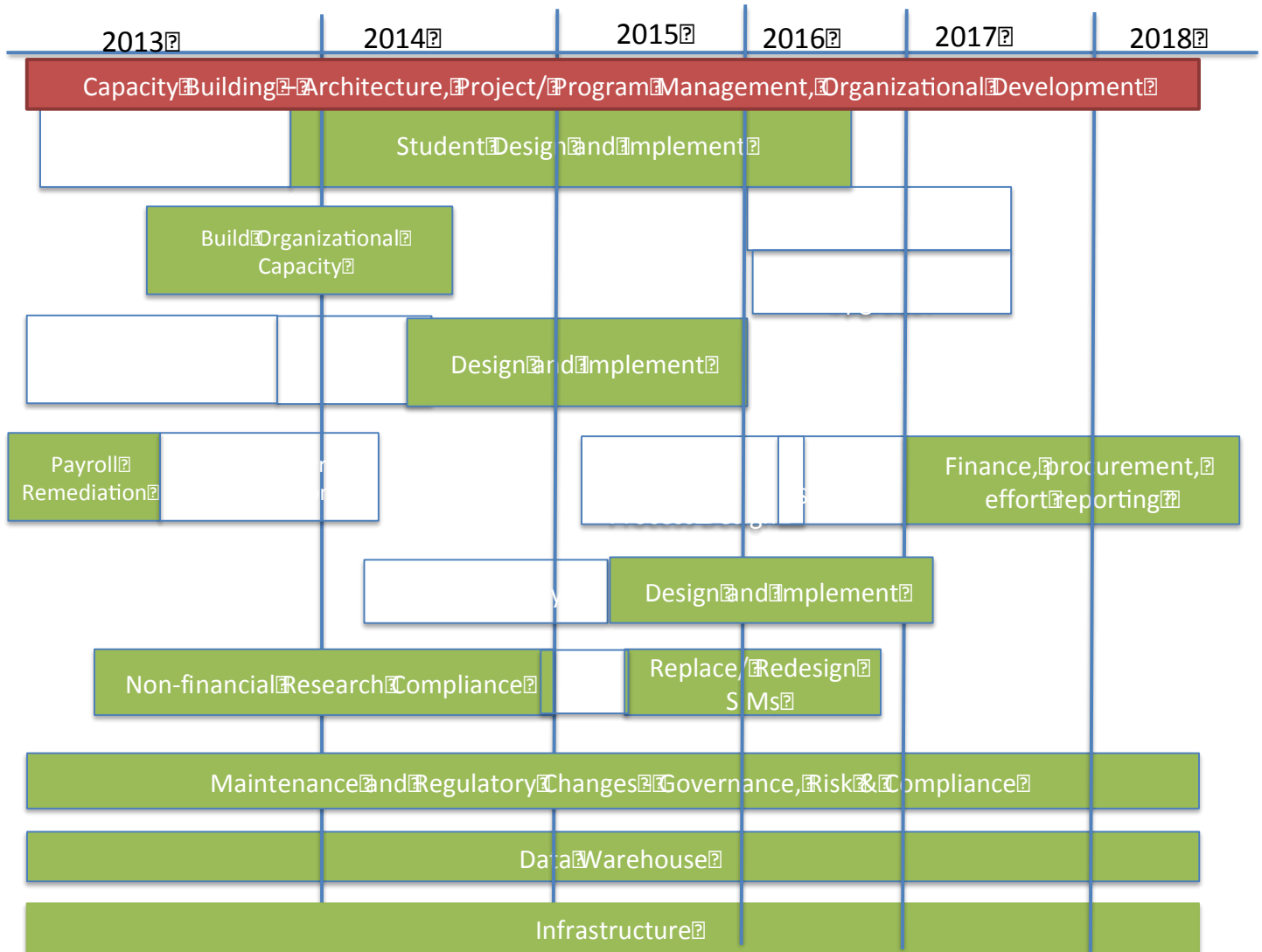
***1. Implement new enterprise processes and systems, expand reporting and analytics, and align the supporting technology infrastructure—(databases, middleware, operating systems, hosting environments)—to facilitate the implementation and effective integration of solutions.***

1.

Process and systems modernization requires a multi-year, multi-phase effort. ~~Over~~ During the next five to seven years, Penn State must create the capacity to successfully plan and execute multiple implementations of new systems, redesigned processes, and restructured organizations. ~~The high-level sequencing and pace of systems replacement should follow the timeline below. New needs or newly designated enterprise systems should be integrated into the master timeline as necessary.~~

In addition to sustaining momentum on the ~~already initiated~~ current project to replace ISIS, Penn State must create the capabilities required to plan and manage the overall modernization program. ~~Penn State~~ The University should create and implement a governance structure for enterprise systems to ~~coordinate the execution of these major projects and to provide on-going mechanisms to establish shared priorities, resolve significant conflicts in data management or business process designs, and sponsor organizational changes to maximize the benefits of investments in new technology.~~ This new governance structure should also adopt clear standards to guide the selection

of new solutionsequipment—should the University, (e.g., build or vs. buy new software, should it consider, best of breed or vs. single vendor solutions—) and achieve integrated processes and systems. In addition, shared project resources, such as project managers, process analysts, and enterprise architects must be established to provide the superstructure to support multiple projects. Hiring and retraining plans are required in both ITS and administrative units to accelerate the development of the skills to implement and manage revised processes, data structures, and systems. The high-level sequencing and pace of systems replacement should follow the timeline below. New needs or newly designated enterprise systems should be integrated into the master timeline as necessary.



## 2. **Adopt principles and architectural standards to guide the design, selection, and implementation of the University's new administrative environment.**

At Penn State, an enterprise system includes any information systems that capture institutional data, support the delivery of widely required or centrally provided services, and maintain compliance with internal and external regulations as an enterprise system.—Within the universityUniversity, enterprise systems include, but are not limited to, programs designed to manage student information, human resource management, advancement, alumni relations, finance, pre- and post-award research administration, business intelligence or (analytics), and constituent-relationship management. Additional widely used specialized solutions, such as facilities management



technologies, asset management systems, and physical security technologies, should also be managed as enterprise systems and services. Enterprise systems should be selected, implemented, and operated under the direction of an integrated governance structure and should adhere to a core set of design principles ([draft principles hyperlink](#)) that enable inter-operability, support efficiency and improve service to constituents.—In addition to adopting common principles, Penn State should:

- **Adopt an overall enterprise architecture—including technology standards—to guide the selection and implementation of enterprise software solutions.**—The architecture should build on this strategic plan to establish the goals of the systems modernization process, establish a detailed replacement strategy, and articulate standards to guide the selection of software products. Standards should improve the security and inter-operability of enterprise systems and maximize the value of enterprise data. Enterprise architects are needed to ~~provide the capacity to~~ evaluate the feasibility and cost of integrating new solutions with existing technologies as they are modernized.—Architects will support administrative and IT leaders to adapt the overall system, process, and data modernization strategy as needs and options change. Enterprise architects, working with IT governance committees, should recognize and analyze emerging needs for new enterprise solutions and develop plans for their integration into the enterprise architecture.
- **Buy and not build solutions.** The decision to custom develop a new solution or redevelop a solution maintained by a third party should have a ~~very~~ high hurdle that does not allow exceptions to ~~gradually~~ creep back into the enterprise systems at the University.—Custom development may be appropriate if the University's requirements are extremely unique, an adequate solution is not available in the marketplace, or it is strategically important to the University to create a unique solution.—The decision to develop or modify should be made deliberatively and supported by a compelling justification. Even in these instances, the University should seek partners to co-develop and support the maintenance of the solution ~~in order to~~ share risk and cost.
- **Enable greater tolerance for best of breed solutions.** ~~With respect to selecting best of breed systems or a single vendor, t~~The ability to integrate with other systems, operating cost, and benefits to be gained from improved software capability must all be weighed when selecting between best-of-breed systems or single-vendor options.—Single-vendor solutions may make sense within each family of processes—(e.g., student systems, finance, and human resource HR systems, for example), ~~but~~and each area may wish to determine what is best for their needs. ~~An important caveat is that~~But a wide diversity of separate systems could become too costly to maintain. Governance processes and decision structures will be required to review and balance the trade-offs.

### **3. Foster data-driven decision-making and analytics through improved tools, training, and data governance practices.**

3.

Penn State has already begun to invest in improved reporting and analytics through a data warehouse initiative.—With each system replacement project, the University should extend its capacity to capture additional data about a variety of measures including student engagement, staff development, service productivity, and costs.—Architectural standards should favor the selection of technologies that facilitate integration and data exchange without the development of expensive—to maintain interfaces. Penn State's preferred direction should be one that establishes single, authoritative source systems that make data accessible for analysis or integration without copying and storing duplicate copies of data in multiple, often less secure, places.



Current and future Projects ~~currently underway, as well as those that are planned,~~ will make it easier to combine data from such different source systems as ~~(e.g., space management and research, or student and finance.)~~ for analysis.—An overarching technical analytics ~~technical~~ strategy should be developed to inform the replacement of individual administrative systems solutions and create a technology infrastructure of data sources and tools that supports integration and analysis. To fully realize the benefits of this increased functionality will require additional staff capabilities and improved data management practices. Penn State should create a system of data stewardship, including specific role description for data stewards who would be responsible for promulgating a shared understanding of “institutional data,” and ~~and use these stewards to devise and grant access to data them based on institutional roles requests. These data stewards should be responsible for promulgating a shared understanding of “institutional data”.~~ Having an data expert in place who can point to the right data, or help prevent units from misinterpreting the data fields that they are using would be highly ~~extremely~~ beneficial. ~~for the institution.~~

**4. *Create the organizational capacity to implement large-scale change projects, support new technologies, and optimize their use.***

An overarching structure should be created to lead ~~the~~ Penn State IT's modernization effort.—It could take the form of a senior leader for transformation reporting to the Executive ~~executive~~ Vice vice President ~~president~~ and/or the Senior ~~senior~~ Vice vice President ~~president~~ for Finance and Business and the Vice ~~vice~~ Provost provost ~~of for~~ Information Technology, and/or a program office comprised of the leaders of multiple process and software implementation efforts.—The coordinating structure could house a shared project infrastructure for such activities ~~such as~~ enterprise architecture design, project management, communications, and training, and could establish methodologies and tools to improve implementation capacity. The senior leader for transformation would be a visible champion for the changes in process, practice, policy, structure, and skills ~~that are~~ required to derive benefit from investment in new processes and technologies. The role would work in conjunction with other administrative and IT leaders to implement the design principles and architecture that will define the new administrative services and processes. Whatever form the institution decides upon, this overarching structure should involve the creation of a “change czar” who is responsible for ensuring and reporting on organizational support for these impending changes.

Investment and support isare required for IT and non-IT areas to restructure their staffing and skill mix. Non-IT areas need capacity to support process and system configuration, develop reports and data analysis, participate in ongoing system maintenance, and provide user support.—New hybrid technology and functional roles will be needed in many of the University offices. IT analysts and application developers will require retraining to support a shift from custom-developed to ~~vended~~ commercial or open-source products.—New expertise in software development tools, systems integration, data architecture, and analytical tools is required. Changes in job classifications, career paths, and professional development programs will be necessary to facilitate the overall organizational change. Building new skills and deploying staff to implement new solutions while maintaining the existing processes and technologies will be a substantial challenge.—It requires careful planning, resources to augment existing staff during peaks in workload, and governance to balance the competing priorities of building the new and maintaining the current solutions.

### Priorities for Action

- Approve the overall modernization timeline.
- Implement project governance for ISIS replacement.
- Develop a capacity plan to sustain two concurrent implementations over five to seven years.
- Implement broader IT governance.
- Develop enterprise architecture and create a mechanism to evaluate proposals to acquire, build, or modify enterprise systems.
- Proceed with ISIS replacement project and initial requirements analysis for human resource information system.
- Develop a detailed technology strategy for analytics.
- Design and implement a new data steward model.

## Theme 4: Sustain IT Effectiveness

—Since the completion of the IT Assessment in 2011 ([insert link](#)), Penn State has taken significant steps to improve IT effectiveness.—This plan substantially accelerates these efforts through a four-part strategy.—First are improvements to the processes and practices the University uses to manage its technologies and services.—Second is the creation of additional core services to provide more consistent and efficient technologies across units without duplication of effort.—Third are strategies to provide collective and collaborative management of [previously isolated](#) technology solutions that have previously been managed in isolation.—Fourth are strategies to support the IT workforce.—The ideas represented in Theme 4 draw extensively on the work of the IT Services, University Services, and IT Operational Effectiveness Planning Committees ([hyperlinks to their full reports](#)).

### Goals

In the next five years, Penn State will:

- Improve the quality and cost effectiveness of IT services.
- Increase student, faculty, and staff satisfaction with IT services.
- Provide consistent access to core technologies and services to all faculty, students, and staff.
- Recruit, retain, and develop an IT workforce that has the skills and resources required to implement, manage, and support the use of technology in teaching, research, and operations.
- Create a unifying culture across IT at Penn State that facilitates trust, collaboration, transparency, and accountability.

### Strategies

#### 1. Improve and expand service management.

Penn State IT should ~~turn a strong focus to on~~ improved service management, ~~beginning~~. This ~~should begin~~ with the creation of a service portfolio and shared service catalog, ~~which we~~. The ~~catalogue~~ should provide **a range of information**; including: a defined customer base for each service; high-level metrics information; standardized information on locating services, information, and support; information on service level objectives and expectations; lifecycle guidelines for all services; and a portfolio management ~~review~~ that can be used by executives and IT departments. This catalogue could serve as the single jumping off point for [Penn State](#) IT services, ~~and~~ be searchable based on the user's interest or role.

—The service portfolio should be planned for expansion from the outset.—It might begin with a focus on core services (see [strategy Strategy 3](#)) and expand to include [such](#) specialized services ~~such as~~ research computing or unit services offered uniquely by a college or campus.—It is particularly important that the portfolio include services that have previously been treated in an isolated or ad-hoc manner, ~~as~~.—The University Services planning committee inventoried many technologies and services ([insert hyperlink to list](#)) that require stronger coordination, upgrading, or consolidation of effort.

—An improved approach to service management should also include ~~the designation of~~ a service management consultant ~~who is~~ familiar with all IT services and ~~who~~ can help users and IT personnel determine what is available. This person should work in conjunction with communications and marketing to ensure ~~that~~ the community knows what is available to ~~them~~ ~~it~~ and how to use the catalogue. Both the service portfolio and the service consultant are supportive of recommendations discussed in Theme 2 to improve communication of available services.

—Finally, services should have defined life-cycles and consistent processes to evaluate requirements at their initiation, monitor service levels and costs during their operation, and transition them to retirement when no longer necessary or well ~~utilized~~used.—Managing services throughout their life-cycle requires active joint decision-making between primary providers and users of a service supported by active IT governance.

## **2. Expand portfolio and project management capacity to more effectively prioritize, implement, and increase the value of technology investments.**

An expanded project management office should provide improved tools to plan and manage projects, train staff in project management methods, and track the University's most significant IT projects.—It should provide analysis and support to IT governance groups in setting priorities and monitoring the University's major project portfolio. Staff in the project management office should be available to consult with units as they plan and manage small and moderate-size projects and provide direct management of high-risk, ~~high-complexity~~ efforts.—The project management office should identify professional development needs, recommend qualifications and performance standards, and provide methodologies and tools to IT project managers hired by other units. Finally, the office should ~~play a coordinating role to promote~~ the sharing of staff across organizational boundaries to provide ~~needed~~ resources to projects and valuable professional development opportunities to individuals.

## **3. Expand the availability and adoption of core Penn State IT services provided by a coordinated or single source, adopted by most, and paid for collectively.**

Adopting additional core services (previously referred to as “common good services”) will reduce unnecessary duplication of effort, provide faculty and students with consistent technology experiences, and enable IT units to focus resources on unique needs. Core services will focus on technologies needed and used in relatively similar ways by the majority of units. Core services should not limit innovation, especially in teaching and research. Penn State should adopt a consistent approach to evaluating, selecting, and operating core services consistent with a well-understood definition ([insert hyperlink](#)). ~~Funding models must support The establishment of a~~ additional core services ~~must be supported by changes to funding models to facilitate their implementation and governance structures to commit the University to their adoption.~~—Core services should be made available through the service portfolio outlined below (Theme 4, Strategy 1) and sourced to the organization (internal or external) that can most effectively provide it.—Core services should not imply uniformity or devolution of performance to the lowest common need across units; ~~instead,~~—~~T~~ tiers of service should be available to reflect ~~the different ial scale and~~ needs of units.—Metrics should be implemented to monitor the performance of core services, promote accountability, and provide data to continually evaluate and improve performance.

### **Potential Core Services**

- |  |   |
|--|---|
| <ul style="list-style-type: none"> <li>• Email systems (underway)</li> <li>• Expanding online professional development capabilities, including, learning management system, training access, and tracking capabilities for completed trainings</li> <li>• Web hosting</li> <li>• Developing consistent auxiliary services systems and technologies across the campuses</li> <li>• Data storage and back-up</li> <li>• Wireless networking</li> <li>• Wired local networks</li> </ul> | <ul style="list-style-type: none"> <li>• Server virtualization and collocation (underway)</li> <li>• High-capacity research networking</li> <li>• Physical and building security and access (for additional information see University Services report)</li> <li>• Facilities management and maintenance systems (see University Services report)</li> <li>• Unified communications—converged capabilities of voice, data, and video communications</li> <li>• Administrative desktop virtualization</li> <li>• Expansion of remote access to lab images</li> </ul> |
|--|---|

#### **4. Support the strategic plan with a robust, reliable, and secure technology infrastructure.**

The full and final approval of investment in expanded data center capacity is a critical element of provisioning the infrastructure required to support future IT strategies. Similar commitments are recommended to upgrade networks to support the eventual introduction of 10-gig capacity to research labs and the deployment of virtual networks for research. Likewise, sustainable, scalable funding and technology solutions are required to keep pace with demand for data storage, especially large research data sets, and a virtual server infrastructure. These solutions should continue to evolve to be adopted as internal cloud services and/or such candidates to for sourcing to external private clouds as the (e.g., above campus services – hyperlink to IT Services Report describing cloud strategy).

Penn State's technology should expand mobility and access. Greater use of mobile devices and cloud computing should be encouraged within thoughtfully specified boundaries to protect information and preserve support service levels. Consistent support processes and policies should be established to accommodate the use of faculty members' and students' personally owned devices, referred to as (BYOD). Mobile devices should be used widely as a primary platform for accessing electronic and physical services as well as demonstrating identity. Wireless networks, mobile friendly administrative and academic systems, mobile device-oriented user support services, and improved user awareness of mobile device security practices will be critical enablers of a mobile device strategy. Additionally, the University should move aggressively to pilot and then fully deploy virtual desktops for staff.

#### **5. Improve staff recruitment, retention, and performance management practices for Penn State IT at Penn State.**

—The successful implementation of the plan requires improved staff development and management practices. IT units require funding and support from budget executives and human resources to expand professional development, provide market competitive compensation, implement proactive performance management and offer more varied career paths aligned with the IT strategic plan. Processes, policies and management culture should enable staff to work on strategic IT projects outside their its unit to contribute unique skillsets or gain valuable experience while advancing a shared institutional goal. Penn State's IT and HR-human resource leaders should work collaboratively to understand root causes of staff turnover and improve retention through improved professional growth opportunities and competitive compensation levels. IT leaders need to raise performance expectations and increase accountability for all IT staff. For recruiting, better central systems and shared recruiting services are needed to help determine from where to recruit from and with whom to ~~to~~ share applicant pools. Stronger partnerships with feeder institutions will help build a diverse pipeline of qualified candidates, while. Strategic use of contract labor will help to bridge temporary gaps in skills or provide time for the university-University to develop deeper concentrations of skills within the existing workforce.

—Multiple elements of the strategic plan require IT staff to acquire new skills or shift into new areas of responsibility. Some may require new roles that combine IT skills with non-IT skill sets such as process or data analysts, media specialists, or instructional technologists. These changes necessitate new or more flexible job profiles and career paths. IT professional development practices must be extensively overhauled. At a base level, Penn State IT at Penn State needs a funding model and a commitment to time to ensure IT staff in all units can continue to receive critical

professional development. ITS Training Services should assume responsibility for coordinating, administering, and marketing most IT trainings. A staff-focused learning management system should be implemented as a component of the new Human Resource Information System.

#### Priorities for Action

- Adopt definition of core services and prioritize their expansion.
- Develop a phased implementation plan and begin work on service portfolio.
- Assess and revise IT staff classification structure and career paths.
- Perform a training needs analysis to support the strategic plan.
- Expand project management office capacity.
- Seek approval and full funding to increase data center capacity and expand networking and data storage support for research.



## IIIIV. Strategic Enablers

The implementation of the IT plan will not succeed without strong IT governance and effective IT funding practices. The credibility and value of the plan hinges ~~s significantly~~ on getting both right. ~~These two strategic enablers were prominent in the discussions of each of the planning committees.~~ Improvements are required to enable Penn State to manage IT more effectively, make technology more widely and consistently available, and bring focused investment to strategic priorities. Governance recommendations are based on designs developed during the IT assessment and improved by ITLC.—A joint committee of budget, finance, and IT leaders ~~empaneled~~ empanelled ~~during the who worked on the~~ IT planning process have developed IT funding these recommendations.

### *IT Governance*

Penn State needs IT ~~Governance~~ governance structures and processes to establish major investment priorities, achieve greater coordination and consolidation of IT services, promote accountability and transparency, and provide sponsorship for strategic change.—Multiple aspects of the plan are interdependent on effective governance.

- The organizational realignment of research computing services is based on a faculty-driven governance model integrated in overall IT governance.
- Enterprise systems require governance to oversee integrated processes, data and shared technologies, as well as provide leadership for individual process and system replacement projects.
  - Overall governance is required to establish investment budgets, prioritize replacement projects, ~~oversee the implementation of~~ an enterprise architecture, and sponsor the redesign of processes and organizational structures.
  - Individual project governance is required to approve complex process and policy changes, control modifications to purchased software, oversee project risk-management practices, and resolve decisions that may disadvantage one part of the organization over another.
- Instructional technology strategies envision the creation of a Learning Council to bring together the instructional design community to share successful practices, influence other IT governance bodies, and recommend new projects and initiatives.
- Core services require governance to approve their designation, establish service level objectives and cost parameters, and commit the organization to adoption.
- Incentives for collaboration and adoption of effective IT practices requires governance to establish which IT services should be funded collectively and which should be at the discretion of individual units.

Decisions made by individual units should be informed by the frameworks and structures established by shared IT governance. Many aspects of the strategic plan require action at the unit level to adopt a University-wide solution, discontinue investment in a departmental service that is no longer necessary, or restructure to move resources to unit-specific needs such as instructional design or research computing support.—Governance structures are required to bring these issues to the attention of budget executives across Penn State.

## Recommended Design

Effective IT governance must be participative and decisive. The scale of Penn State drives the need for structured governance, but also creates risks of decision-making paralyzed by excessive consultation or impossible efforts to find perfect solutions.—IT governance processes ~~can't~~ can ~~not~~cannot replace the responsibilities of leaders to act.—Governance committees should set or adopt strategies, establish goals, create frameworks to empower and guide decision-making, and monitor results.—Leaders should implement strategies, facilitate decision-making, and solicit the input of stakeholders.

Penn State's IT governance should consist of three domain-specific governance bodies accountable to an executive board. Led by the ITLC, A~~additional~~ cross-organizational groups, ~~led by the~~ Information Technology Leadership Council (ITLC), focused on ~~IT~~ operational coordination should complement the governance committees. Finally, project specific governance structures will provide leadership for ~~university~~ University-wide efforts to deploy new technology, processes, and practices. Each of the components of governance ~~are~~ is described below:

The **Executive Board** is the senior IT governance committee.—Its composition should include the ~~Executive~~ executive ~~Vice vice~~ President ~~president~~ and ~~Provost~~ provost, ~~the Senior~~ senior ~~Vice vice~~ President ~~president~~ for Finance and Business, ~~the Vice vice~~ Provost ~~provost~~ for Information Technology (VPIT), ~~the Vice vice~~ President ~~president~~ for Research, the ~~Dean~~ dean of the University Libraries, the ~~Chair~~ chair of the ITLC, the University Budget Officer, and rotating representation from one dean, one chancellor, and the faculty.—Its ~~decision rights and~~ responsibilities include approving the IT strategic plan, approving and prioritizing major IT capital projects, designating new core services and associated funding mechanisms, and approving the implementation of information technology, access and security policies.—In addition, the ~~Board~~ board monitors the implementation of the strategic plan, advises the VPIT on major decisions, and guides budget executives to align unit IT investments and practices with institutional IT strategy.

The **Research Computing Board** is comprised of faculty and IT leaders appointed by the ~~Vice vice~~ Provost ~~provost~~ for Research in consultation with the ~~Executive~~ executive ~~Vice vice~~ President ~~president~~, the ~~Faculty~~ faculty ~~Director~~ director for Research Computing and Data (a new position proposed in the strategic plan) and ~~the Vice vice~~ Provost ~~provost~~ for Information Technology. The board's ~~decision rights and~~ responsibilities include approving research computing strategies, and prioritizing projects and investments in research computing capabilities.—It advises the ~~Faculty~~ faculty ~~Director~~ director for Research Computing and Data and IT leaders on the design of services and the development of policy.—It recommends to the Executive Board significant capital projects, policy changes, and changes to operating budgets to improve support for research.

The **Instructional Technology Board** is comprised of faculty, IT leaders and representative leaders from the instructional design council.—Its members are appointed by the ~~Executive~~ executive ~~Vice vice~~ President ~~president~~ in consultation with the ~~Vice vice~~ Provost ~~provost~~ for Information Technology.—The ~~Board's~~ board's ~~decision rights and~~ responsibilities include prioritizing ~~university~~ University-wide investments in instructional technology, defining common values and principles to ~~guide development of~~ online learning experiences, establishing technical, design, and quality standards for online learning, and promoting the adoption of best practices.—It recommends pilot projects to ~~seed~~ start new pedagogical innovations, proposes research to evaluate new pedagogical models, and advises IT and ~~OPP~~ the Office of Physical Plant on the design of learning

spaces. The Instructional Technology Board recommends to the Executive Board significant capital projects, policy changes, and changes to operating budgets to improve support for learning with technology.

The **Enterprise Systems Board**<sup>4</sup> is comprised of the senior leaders of administrative services, including the Corporate Controller, Human Resources, the Budget Office, Research Administration, Development, the Registrar, Financial Aid, Student Accounts, Admissions, the Graduate School, and appropriate IT leaders.—The Board is appointed by the Executive Vice President, the Senior Vice President for F&B Finance and Business, and the Vice Provost for Information Technology.—Its decision rights and responsibilities include approving the principles and standards that define the University's enterprise architecture, reviewing and recommending architectural exceptions to meet unique business requirements, devising the optimal strategy and sequencing to directing replacement of major systems, and coordinating the timing of significant upgrade projects.—The Board devises policies to improve the consistency and use enterprise data.—It recommends significant capital projects to the Executive Board, and recommends options to resolve significant resource conflicts between enterprise system replacement or upgrade projects and other institutional initiatives.

### Operational Coordination and Communities of Practice

Once strategies and priorities are have been set, four operational committees and the ITLC help coordinate their implementation. The ITLC and the ITLC Board provide a forum to plan and collaborate on initiatives to implement IT policies, improve IT services, develop the IT workforce, and improve IT management practices.—The ITLC maintains connections to IT governance bodies to assure its practices are aligned with and responsive to the needs of the research, instruction, and administrative communities.—The ITLC is supported by several standing operating committees appointed by the Vice Provost for Information Technology in consultation with the ITLC Board.

- The **IT Resources Committee** improves staff recruitment, retention, and development and recommends changes in IT funding practices to promote efficiency and effectiveness.
- The **IT Infrastructure Committee** develops standards to inform technology selection decisions, recommends the adoption of emerging infrastructure technologies or sourcing strategies, and develops long-range infrastructure plans.
- The **IT Security Committee** formulates IT policy recommendations to the VPIT, and the Executive Board and advises the ITLC on approved policy the implementation of approved policies.
- The **IT Operational Effectiveness Committee** oversees the implementation of shared tools and processes that improve technology and services the management of technologies and services.—This committee also oversees the design and implementation of service management processes and metrics.

### Communities of Practice

Operational coordination and collaboration is also supported by communities of practice organized around solutions or roles with university-wide implications.—For example, the IT Strategic

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<sup>4</sup> Operational coordination of on-going systems maintenance and enhancement projects will be achieved through sub-committees focused on particular such systems and processes as finance, (e.g., finance) working in consultation with ITS leadership.

Plan suggests the formation of a Council of Instructional Designers.—As a community of practice, this group would discuss common issues, share successful practices, and make recommendations to the ITLC and the Instructional Technology Board.—Similarly, the IT Strategic Plan identifies opportunities to create stakeholder groups around particular ~~solution families~~ areas of concern, such as building management systems, e-commerce, and ~~CRM~~ customer relationship management.—Each of these ~~solution~~ areas may ~~be~~ house a community with a defined leader to facilitate discussion of common needs and interests.—Communities of practice will form when needed and disband when no longer necessary with the support and approval of the ITLC Board or one of the IT Governance Boards.

### **Project Governance**

—~~Very~~ Large projects that implement changes to technology, processes, and practices require dedicated project governance.—For example, enterprise system modernization projects, such as ISIS replacement, will have unique governance needs.—These projects require delegation of significant authority to a project director and implementation team to make the many operational decisions required to manage large, multi-year improvement projects.—In most cases, project managers and directors will be advised by a project steering committee consisting of the leaders of the units most directly impacted by the implementation and representatives of the constituents who will be impacted by new process, service and technology designs.—The IT ~~Governance~~ governance ~~Boards~~ boards ~~won't~~ will not be able to ~~provide direction to~~ each implementation project or ~~to~~ offer the speed of decision-making required to keep a ~~project~~ implementation on time and budget.—They will address issues that arise from the implementation project that have the potential to constrain future implementation projects or require balancing issues that impact multiple systems and processes. The Enterprise Systems Board will also evaluate and recommend to the Executive Board any changes that would alter the overall strategy, timeline and phasing of the system modernization plan.

### **Authority and Accountability of the Vice Provost for IT**

As the senior University administrator for ~~information~~ Information Technology, the ~~Vice vice Provost~~ provost and his staff are responsible for the overall coordination of the IT decision-making process.—In addition, the ~~Vice vice Provost~~ provost is the senior advisor to the ~~President~~ president, the ~~Provost~~ provost, the ~~Senior Vice President F&B~~ for Finance and Budget, the ~~Deans~~ deans, and the ~~Chancellors~~ chancellors, and as such, is expected to evaluate and offer advice on decisions that reach their level.—The position is responsible for overseeing the implementation of the University strategic plan, IT policies, and architectural standards.—It is the ~~Vice vice Provost's~~ provost's responsibility to stop and bring to the attention of the appropriate budget executive or governance body any IT decision that is substantially inconsistent with approved strategy or policy and request that it be further justified or reconsidered.—Likewise, the ~~Vice vice Provost~~ provost is accountable for monitoring how policy and strategy is are being implemented across IT at Penn State to minimize any negative impact on productivity, efficiency, and the achievement of Penn State's academic strategy.

### **Office of the Vice Provost for IT**

The Office of the Vice Provost for Information Technology provides staff support to governance committees and planning tools and advice to all budget executives on unit-level IT decisions.—It coordinates functions spread across IT at Penn State and includes strategic planning and

| assessment, program and project management (PMO)<sup>5</sup>, enterprise architecture, communications, and IT policy.

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<sup>5</sup> ~~If an overall leaders for systems and business process change is appointed, reporting to the executive vice president~~ EVP [EVP — this needs spelled out. Not sure what it is.] and Senior senior Vice vice President president (p.18), the PMO should be a joint report to the change leader and the VPIT.

## IT Funding

Current IT funding practices are ad-hoc, and the method for allocating funds to the providers or consumers of a service is frequently misaligned with the type of service or desired behavior of prospective adopters. ~~For example:~~

Examples are numerous.

- Highly decentralized funding and control for many services across units make it difficult to create or foster the adoption of core or shared services even when they are more cost-effective.
- Many departments lack sufficient financial and human resources allocated to IT to fund the transition to new core or shared services and sustain legacy solutions through their replacement.
- Most IT leaders and budget executives are not provided information necessary to forecast and plan for future IT costs.
- Current processes and practices do not reserve funds to sustain or replace technologies that have already been implemented as they age.
- There is no consistent practice in the development of IT investment requests and cost projections. ~~Methods, assumptions about cost drivers, and varying experience of project planners make it difficult for budget executives to fully anticipate the full-total costs of their units' IT decisions.~~

Improvements to IT funding are designed with five goals in mind:

1. Define the optimal, appropriate, and efficient use of primary sources of funding for technology, including the management of the student technology fee, general budget allocations, auxiliary operations, and direct and indirect cost recovery on research grants.
2. Adopt funding models and cost allocation methods to drive the targeted behaviors for a service.
3. Create better tools to categorize, manage, and track IT spending within the ~~university~~ University and give decision makers access to meaningful information.
4. Create sustainable models of funding that promote the adoption and use of IT collaboration on services while ensuring transparency and accountability.
5. Improve efficiency through more effective resource planning and funding allocation methods that minimize unnecessary duplication of services and anticipate the life-cycle costs of technologies and services.

The following changes, ~~which are discussed in greater detail below,~~ are recommended to support the implementation of the IT plan:

- ~~• Develop funding models to drive desired behavior for a service~~
- ~~• Align funding and cost allocation practices with the university capital and operating budget.~~
- ~~• Optimize the effective and appropriate use of IT funding sources~~
- ~~• Improve the capacity to track and report IT costs~~

### ***Develop funding models to drive desired behavior for a service.***

Presently, Penn State lacks consistent practices for allocating funding ~~to the provider or consumer of a service.~~ ~~Fragmented funding spread across many budgets makes it difficult to create and sustain a shared service.~~ ~~Likewise, there are few incentives to commit to collaborative services and discontinue departmental services.~~ ~~Conversely, there are often gaps in available funding within department IT budgets to operate unique services or promote innovation and adoption of new services.~~ ~~ideas.~~ ~~Penn State should migrate-adopt~~ to a more consistent approach. Broadly speaking, two main concepts should guide this change:

1. Services that everyone is required to use will be funded centrally.



2. Services that units choose to use must be paid for or cost shared with the units.

The decision to fund a service centrally implies that a budget is allocated and implemented by the unit responsible for providing the service to the institution.—That budget may be created either by designating already available University funds to this purpose or by raising the money via a charge to all unit budgets.—In contrast, ~~Concept two22~~ Concept 222 allocates funding to units that consume the service, which would ~~Consuming units use these funds~~ money to provide the service themselves or procure it from an ~~internal or external~~ service provider.

***Additionally, the approach to allocating funding to operate a service should be aligned with the definition and characteristics of a service as illustrated in this ~~service~~-funding matrix.***

### Service Funding Matrix

Type of Service	Examples	Target Behaviors	Optimal Funding Model
<del>Compliance/Physical security</del> <u>Security/ Life Safety/Risk Mitigation</u>	<ul style="list-style-type: none"> <li>Critical skills training for IT staff</li> <li>Payroll system</li> <li>Video surveillance cameras</li> <li>Access controls</li> </ul>	<ul style="list-style-type: none"> <li>Near complete adoption-</li> <li>No variability due to <del>differential</del>-<u>differing</u> priorities or funding levels-</li> <li>Sufficient funding to mitigate risk</li> <li>Maximize compliance</li> </ul>	<ul style="list-style-type: none"> <li>University funded, costs not allocated to individual units-</li> </ul>
Core-Service	<ul style="list-style-type: none"> <li>Wireless networks</li> <li>Server hosting</li> <li>Storage</li> <li>E-mail</li> <li>Data centers</li> <li>Voice communications</li> </ul>	<ul style="list-style-type: none"> <li>Substantial adoption.</li> <li>Disincentive to duplicate the service-</li> <li>Consistent baseline experience for all.</li> <li>Leverage economies of scale-</li> <li>Sufficient funding to meet service level objectives.</li> <li>Sufficient funding to start-up a service that will attract “customers”-</li> <li>Scalable funding as use grows-</li> </ul>	<ul style="list-style-type: none"> <li>University and unit funded-</li> <li>University funds costs of service start-up and portions of on-going costs-</li> <li>Units charged for some share of costs based on size (e.g., headcount, budget size) and for the differential cost of a premium service (if applicable)-</li> <li>All units charged regardless of whether they use the service-</li> </ul>
<del>Metered- &amp; and</del> <u>Differentiated Services</u>	<ul style="list-style-type: none"> <li><del>Metered Printing</del>-<u>printing</u></li> <li>Discipline specific instructional software</li> <li>Online ticket sales for events and performances</li> </ul>	<ul style="list-style-type: none"> <li>Allocate service or capacity based on need</li> <li>Discourage waste</li> <li>Growth in demand enables growth in capacity</li> <li>Sufficient funding to meet service level objectives</li> <li>Multiple providers spur innovation and meet <del>differentiated</del> needs-</li> </ul>	<ul style="list-style-type: none"> <li>All costs charged to units using the service based on metric of consumption-</li> <li>University may invest to seed the creation of new service or support transition costs-</li> </ul>
Emerging	<ul style="list-style-type: none"> <li>iPad pilot for teaching and learning</li> </ul>	<ul style="list-style-type: none"> <li>Encourage focused experimentation</li> <li>Sustain multiple approaches</li> <li>Encourage use</li> </ul>	<ul style="list-style-type: none"> <li><del>Funded by university</del> <u>University</u> or division sponsoring the innovation</li> <li><del>No cost to early adopters-</del></li> </ul>

***Align funding and cost allocation practices with the ~~university~~ University capital and operating budgets.***

The implementation of the IT strategic plan requires new capital investment as well as on-going funding ~~for to replace~~ replacement of existing technologies as they age.—The implementation of the strategic plan should include the development of a five-year financial plan that forecasts required capital budget allocations and the implications of new services for IT operating budgets. Forecasts should inform the establishment of IT capital investment budgets and the allocation of unit operating budgets.—The Executive Board should allocate available University capital investment in IT and have the opportunity to advocate for increased investment by the University and individual budget units. In addition, the approach to allocating the costs of core IT services to units should follow whatever method Penn State employs as part of the redesign of the budget process, which is currently under review.

***Optimize the effective and appropriate use of IT funding sources.***

There are relatively few options for funding technology investments and operations.—To make best use of these funding streams, the committee recommends that Penn State:

- Establish a committee to recommend the future uses of the student technology fee and establish efficient mechanisms to identify, ~~substantiate~~, and propose future rate changes to the Board of Trustees.—Technological changes such as “bring your own devices,” virtualization of labs and classrooms, and the ubiquitous need for wireless make it difficult to identify technologies that are solely for the benefit or use of students.—Conversely, students benefit substantially from a broad set of ~~university~~ University technologies and services, including student information systems, classroom technology, instructional design support, and learning management systems.—In light of these changes and convergences, the future use of the technology fee should be regularly examined.
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- Develop a common set of principles for all budget executives to use for IT funding and costing decisions.—These principles complement the overarching IT principles adopted by the ITLC and should be defined in consultation with this group.—These common principles should include a commitment to track and develop funding plans to predict the future ~~for the future~~ cost to replace already implemented technologies, evaluate the full life-cycle costs of a proposed IT project with consistent templates and tools, and to maintain transparency.
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- Facilitate a ~~more~~ consistent approach to IT cost projections by developing and using, on an institution-wide basis, an IT costing methodology and checklist. The funding committee has developed an initial framework that should be refined during implementation. [\(hyperlink\)](#)
- —
- Define and adopt best practices and tools on the use of funding from general, auxiliary, research funds, and sponsored awards, developing an IT cost pool ~~for IT~~. IT budgets should anticipate ~~that~~ sponsored awards will be less available to fund core infrastructure essential to research.—Research computing should be available and costs measured in a manner that maximizes the ability of researchers to use sponsored awards to acquire IT services.
- —
- Bundle allocated IT costs into a single chargeback tied to a metric ~~of unit size~~ such as a unit's head count.—Maintain transparency by providing an annual analysis of the IT costs that comprise the bundled rate.—Use IT governance groups to review and approve changes to the bundled rate.

***Improve the capacity to track and report IT costs.***

The IT assessment was a labor-intensive, manual analysis of the ~~university's~~ University's total expenditures on technology. ~~In order to~~ To provide more accuracy and transparency, ~~the committee~~ makes the following recommendations the University should:

- Design and implement more discrete expenditure codes to facilitate a more detailed understanding of non-~~personnel~~ IT expenditures.
- ~~Develop~~ Develop standard definitions of IT cost metrics to be ~~employed~~ used by units benchmarking costs with the IT Operation Effectiveness Committee ~~in concert with the work of the IT Operational Effectiveness committee.~~
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