FY17 Information Technology Planning Document

Prepared for

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Northwestern
INFORMATION TECHNOLOGY

Contents

Introduction and Overview of Key Trends

FY16 was another year of change for the delivery of Information Technology (IT) services at Northwestern. Driven by the goal to improve the delivery of services, there were changes in technology, process, and people in all areas of IT: in areas of core missions of the University (teaching and learning, and research), in the administrative systems and services that enable the day-to-day operations of the University, and in the infrastructure that underlies it all (both the technological infrastructure and the human support infrastructure).

IT Drivers of Change

Many of the changes occurring at Northwestern are driven by IT industry trends (e.g., the growth of cloud computing, consumerization of IT, information security, big data, data science and analytics, the Internet of Things, mobility, globalization, and social media). While each of these impacts the delivery of IT services at Northwestern, four will be highlighted here: cloud computing, big data / analytics, information security, and mobility.

Cloud Computing

One of the most impactful IT trends is the growth and maturation of cloud computing. The presence of cloud computing has been visible in every area: in the product selection processes for larger administrative systems (the Library, Facilities Management, Research Administration); in our course management platform for teaching and learning, and in its new surrounding applications; in collaborative file sharing services; and in interest in doing genomics research in the cloud. Ensuring that these expanding cloud offerings are appropriately integrated into our portfolio – from user experience, technological, security, and business process perspectives -- is critical. A big step was taken with the signing of enterprise agreements such as Amazon Web Services and Box storage, which will enable advances in provisioning speed, matching functional requirements with the provisioned infrastructure, having more compute and storage capacity and capabilities, and improving the customer experience of our services.

Big Data / Analytics

Another set of trends that continues to drive changes in IT services at Northwestern are the trends of digitization, big data, and analytics. The desire for better analytic capability is growing everywhere, and Northwestern is no exception. This desire drives the need for finding new ways to collect data, and to access existing data; and sometimes the desire itself is driven by new sources of data that provide new opportunities for insight.

In teaching and learning, for instance, the deployment of the Canvas learning management system has encouraged the use of digital content in courses. This, along with the data Canvas captures as a matter of course, has facilitated and expanded the set of data that is available on learning outcomes. Additionally, the cloud-based architecture of Canvas and its separate analytic platform based on Amazon Web Services provide a rich and extendable analytic foundation. This environment is now being explored and integrated with additional data sets to make this type of analysis – still new to Northwestern – possible on an ongoing basis

The desire for data-driven decision-making is also underlying a shift in how we position our core systems of record within our strategy for administrative systems application development. For years, these transactional systems were seen as the development environments for extending the ways business units access the valuable data they contain. Instead, we are now looking to access their data via new user interfaces and applications, built outside of these systems and connected to the systems of record by reusable web services. This new approach (as demonstrated by the forthcoming research portal) will enable faster development times and improved user experiences, both of which will help unlock the higher-level value of the data that has been mired within these systems due to poor user interfaces,

database architectures optimized for transaction processing rather than analytic exploration, and long development timelines.

Information Security

The security of the University's systems, and individual and institutional data, has always been a high priority, with ongoing risk assessments and remediation. However, the nature of this landscape is one of continuing evolution and escalation, with new threats, new technologies, and new areas of attention appearing each year. FY16 was a particularly active year for Northwestern in this area, with multiple new initiatives started on different aspects of information security (e.g., database encryption, improved email and network protection, more powerful server and network monitoring, expanded vulnerability assessments, and improved end-user security). Many of these initiatives will continue in FY17 with a particular focus on end-user security, the security of research information, and identity management. They will be joined by the deployment of newer data access monitoring tools that have become widely used by the financial and online retail sectors but are still relatively new within higher education.

Mobility

Mobility is no longer just an add on, or a convenience; it is a core component of the IT landscape. However, just as we do not have a "cloud first" strategy, neither do we have a "mobile first" strategy, and the areas of the University that have specifically made the development of mobile applications a high priority are growing but still limited. On the other hand, we are seeing a growth in vendors' ability to deliver robust mobile access as part of their core functionality (e.g., Canvas, Blue Jeans and Skype video conferencing), and there is a continuing commitment at the University to maintaining an infrastructure that supports mobility. For example, the University's wireless network will continue to be expanded and strengthened; the ability of online services to be delivered "reflexively" (i.e., where the user interface automatically adjusts to the size of the device on which it is being accessed) remains a strong priority; reusable web services, which mobile applications depend on to access data from larger systems of record, will continue to be developed; and a vendor's ability to exceptionally deliver services via smaller mobile devices is seen as a strong benefit in product selection.

Improving Service Delivery

The sections above provide examples of how technology is driving and enabling changes in the delivery of services at Northwestern. The opportunities provided by these technological shifts are significant, even transformative in some cases, but the successful delivery of services is a result of a blend of three ingredients – technology, people, and process, and these technological opportunities also bring significant organizational challenges along with them. Continuing to improve our organizational capability is critical.

Planning and Agility

New opportunities and needs surface every day, and being able to pivot effectively in the face of change is critical. Without a base alignment on priorities – having a strong shared sense of priorities about what is *most* important – the attractiveness of new opportunities can lead to debilitating levels of misalignment.

At Northwestern, IT Governance is one of the most visible means of aligning on priorities and being able to move in coordination towards priorities. In FY16, the alignment and mobilizing roles of IT Governance were evident in all functional areas. The Infrastructure Advisory Committee (IAC) provided a forum for input, alignment, and motivating a continuity of effort in information security and cloud computing. The Administrative Systems Advisory Committee (ASAC) continued to mature the process for identifying and prioritizing administrative systems work, with improved integration across administrative systems' technical and business teams in defining project scopes and dependencies, and with an improved process for aligning on project priorities. The Educational Technology Advisory Committee (ETAC) pushed for improvements in the visibility of learning innovations at the University,

guided the expansion of the Canvas ecosystem via the addition of critical third party apps, and advocated for prioritization of early learning analytics projects with faculty. And a new institutional connection was forged with the Research Deans Council to provide ongoing input that will help compliment and provide synergy to the growing number of grassroots partnerships in the research community and the ongoing support and guidance that a central administrative committee provides for the University's large-scale research computing infrastructure. All of these efforts will continue in FY17.

Another important but less obvious way that planning is being done differently to improve agility is Northwestern IT's ongoing effort to change how work is done internally. Instead of committing teams to a set of projects with detailed commitments of work over a period of months, more work is being done with an Agile work methodology, where work is planned and done in two-week bursts with deeper connections to the project's business partners. This approach, which is most notably spreading through the administrative systems development teams, enables an improved ability to pivot: to new priorities as they are identified within the project, or to different projects altogether.

Partnership and Engagement

Engagement with the University community is a basic principle for Northwestern IT. IT governance and the continuing expansion of the Agile methodology are examples of how partnership and engagement operationalize that principle on a daily basis and improve productivity. In some areas, engagement has taken on a new urgency in its role as a strategic imperative. For example, in research computing, the growth in the range of platforms available for computational research, and the growth in the percentage of researchers using some aspect of computational research for their work, make it impossible for central IT to effectively provide support by itself to all who need assistance. The only way central support can be scaled to meet these expanding needs is for Northwestern IT to find new approaches to enabling research via partnerships with faculty, post-docs, PhD students, and School IT units. Similarly, as teaching and learning incorporates more elements of online digital content, central IT needs to effectively enable their use by creating more synergies with other IT teams and by helping to foster new peer-to-peer connections within the teaching and learning community itself. To this end, Northwestern IT is emphasizing new forms of engagement and partnership in both of these areas to supplement our traditional role of providing technical support for central computing platforms.

This emphasis on partnership and engagement is also present in other areas: in the continued emergence of federated approaches to administrative systems (e.g., McCormick and Weinberg's coordinated effort on faculty administrative systems); in a heightened emphasis on a collaborative approach to improving our information security; in a collaborative exploration of new options for cloud-based infrastructure; and in a collective look at transforming how we provide support for our endpoint devices (laptops, desktops, and tablets). Some of the new partnerships forged in the past year have bridged historical gaps within Northwestern IT itself, creating improved service opportunities. For example, Academic & Research Technology (A&RT) is partnering with teams from Enterprise Reporting and Analytics, the Project Management Office, and Facilities, Finance, and Research Administration to build the Research Portal. The Distributed Support Services team is also collaborating more closely with A&RT to provide support for conference room technology.

Organizational Capacity

Taking on so much change presents real challenges to our organizational capacity. For instance, new technologies demand new skill sets, examples of which can be seen in every functional area. The administrative systems development teams have been focused for decades solely on supporting the primary systems of record; pivoting to doing development work outside of these systems, rather than inside of them, requires new skills and a new understanding of how the pieces all fit together. Even more difficult is pivoting to new cloud environments such as Amazon Web Services. These new environments are powerful and offer compelling new functionality, but they are still rapidly evolving; learning how to work within their framework is not like learning a new programming language with

multiple training options available, or learning how to integrate a new storage array with extensive vendor documentation and support. It is much more exploratory trial-and-error as one learns what is available, how to find new pieces, and how to fit it together – all while it is continually changing.

These new challenges do not / will not affect Northwestern IT alone. Ultimately they will affect the entire Northwestern community. For instance, moving to the cloud requires learning new approaches to procurement, vendor management, and business continuity planning (to name just a few). Migrating to new methods of administrative applications development and data access from outside of the core enterprise systems requires new approaches to aligning development environments within the University, as well as improved processes for vetting requests for access to data. Putting University request forms online requires standardization of processes across units that have never had to be concerned with how things were done outside of their units, and putting processes online may make them so easy that they have unintended consequences that will have policy considerations (e.g., making it easier for a student to request a change in his/her major may unintentionally affect the availability of popular courses that are only open to people in that major).

These new opportunities for service delivery offer compelling options, but they challenge our existing skill sets and the way we work. Similarly, partnership and engagement, while critically important to aligning a decentralized institution and scaling our support and response, also requires time, particularly as new institutional methodologies and relationships are being formed, and organizational skills that have not been institutionally incented up to now are learned and mastered.

All of these changes in how we work and how we provide services to the Northwestern community will ultimately return overall savings and are worth the short-term costs. Having a broader shared vision on how to do work, and on which work is chosen, eliminates friction and noise in the process, creates room for agility and productivity, and allows us to focus on the truly transformational work that elevates the University above its peers. Having all IT units finding synergies through interaction and collaboration not only increases our overall bandwidth, but it makes a large organization feel smaller and creates a more connected and fulfilling workplace.

Document Structure

The five sections that follow this introduction focus on the four areas for which we have IT Governance bodies – teaching and learning technology, research computing, administrative systems, and infrastructure – plus one section on information security. Each section gives a basic overview of what was accomplished in FY16, what is forthcoming in FY17, and some of the challenges and opportunities in that area.

In addition to this document, there is an accompanying document that details the project roadmaps (the projects completed in FY16 and the projects planned for FY17) for each functional area covered in this document.

Both of these documents are posted, along with planning documents from previous years, on the Northwestern VPIT/CIO's website.

Educational Technology

Over the past three years, Northwestern has had an accelerated level of engagement with the use of technology in teaching and learning. This is evidenced by the increased and broader use of teaching and learning technology with the introduction of the Canvas learning platform, the integration of many new tools into this platform (social media, analytics, etc.), the growth of blending learning, the expanding scope of the Educational Technology Advisory Committee (ETAC) and faculty working groups in the online and educational technology areas, the Provost Digital/Online Projects Initiative, the launch of the Digital Learning website, and the launching of over two dozen MOOC's. Many of these initiatives

complement Northwestern's commitment to its traditional strength of in-person teaching and learning, supplementing the classroom experience with blended learning environments. Others are offered as fully online courses (e.g. graduate professional programs).

Expanding around the Canvas Foundation

Following FY15's migration from Blackboard to Canvas, attention shifted from the Canvas start-up phase to a Build-on-Canvas phase. This second phase focused on more extensive uses of the innovative functionality already within Canvas, and on extending Canvas' core capabilities with the integration of learning apps (e.g., for videoconferencing, discussion, file sharing, social media).

This new focus of engagement involved a continuing partnership with distributed IT units in supporting faculty's use of technology in the classroom. It also resulted in multiple new points of engagement with faculty, including three new faculty learning communities, the release of Northwestern's Digital Learning website, and a day-long event (TEACHx) that showcased innovation in teaching and learning across the University.

The Use of Video

Mirroring the continuing explosion of online uses for video, much attention was also devoted to using video in teaching and learning at Northwestern. Examples included the launch of the first One-Button Video studio in the library for video recording by faculty and students, and pilots of different media management applications (MyMediaSite, Zaption, and Arc, which is a new media management tool by Canvas's vendor, Instructure).

Classroom Design

Classroom design specialists from Northwestern IT and Facilities Management worked during FY16 to design much-improved classroom spaces in Kresge Hall, which re-opens in September 2016. The new suite of learning spaces in Kresge includes an active learning classroom that will support a variety of classroom practices, including small team project work and multiple team presentations.

Learning Analytics

Interest in new approaches to teaching and learning and efforts to sustain a broadened diversity within the student body, have kept the ability to have good data on learning outcomes high on the priority list. Concentrated effort was spent in FY16 in learning analytics pilots with Northwestern faculty, and this has led to the creation of initial technological and information architectures around Canvas to support sustained analytics efforts with our learning communities. The launch of multiple learning analytics projects has also led to the creation of an *ad hoc* working group to identify new policy issues regarding data privacy and long-term use of these analytical capacities.

A Look Ahead: FY17

All of the foregoing initiatives will continue in FY17, with newly launched faculty engagement opportunities maturing, and continuing efforts to extend the learning management platform's capabilities and use. This will include investigating the easy use of video in learning and teaching, bringing the use of learning analytics into a production mode, supporting expanded activities with social media (Yellowdig), piloting closer integration of Microsoft cloud productivity services (Office, calendaring, email) into Canvas, and beginning a study of digital portfolio services for students.

Also on the agenda for FY17 are an expanded office footprint in Chicago for Northwestern IT classroom support staff (which will enable expanded support of classroom technology services and thorough support of special events in Chicago), and discussions about the future development of an expanded faculty service point in the Jacobs Center for the support of innovative teaching efforts.

One of Northwestern IT's closest partners in this area is the Searle Center for Advancing Learning and Teaching. With the Center's new leadership in place, all of these topics – technology, support models,

services, and approaches to physical spaces – will benefit in FY17 from the added perspectives brought to the partnership.

Research Technology

The Technological Context around Research

These are challenging times for researchers and those who support them. As Northwestern continues to successfully drive towards its aspirational goals for expanding its production of impactful research, the increasing complexities and requirements for conducting and supporting research remain unabated:

- The growth of computational research – along with the use of modeling, simulation, data analytics, and visualization – continues to deepen in its traditional locales, and continues to grow in the areas where its presence is more recent (e.g., the arts and the humanities).

- Reduction in the cost and effort required to capture, create, and store data has led to a significant increase in the amount and types of data being collected, which increases the need for effective data management tools, platforms, skills, and strategies.

- The growing practice of data science requires rethinking strategies around collaboration and support in order to support increasingly cross-disciplinary efforts.

- Growing regulations for the management and publication of research data place additional pressures on our faculty to ensure the security, preservation, and accessibility of the results of federally funded research, and the changing information security landscape continues to increase the risk of exposure of sensitive data, regulated data, and intellectual property. In the face of these twin pressures, a coordinated enterprise response becomes more important going forward.

- The growing sets of regulations and the increasing competition to acquire research funding greatly increase the need for integrated, easy-to-use administrative tools and platforms.

- The exploration of cloud-based or regional and national facilities is a necessary component of every research university's IT portfolio. When there is alignment, they are a great option for scaling and augmenting campus resources. However, using these specialized remote resources often requires learning new computing environments and data management methods (i.e., they come with hidden support costs for all parties).

What We've Just Accomplished: FY16

All of these factors combine to accelerate the need for services, support, training, education, and consulting. Within this context, Northwestern IT's goal is to be a leader and key partner in the provision of a leading-edge environment for research. In FY16, we made continuing strides forward in each of the areas listed above, with notable accomplishments in our shared infrastructure for research computing (historical high levels of participation within high performance computing, growth of the research network, and the provision of a secure shared service for research data storage), and in our continued partnerships within the research community (with faculty, graduate students and post-docs, the Library, Schools, the Office for Research) to provide multiple opportunities for research skills training and engagement.

As part of our changing relationship with the research community: we partnered with the Office for Research to add new resources to help integrate researchers and their equipment into the University infrastructure; we established an institutional connection with the Council of Research Deans; we partnered with Feinberg to add a new position to support genomics researchers leveraging high

performance computing services; and we began to organize a more coordinated approach to information security for research data, led by a cross-University working group of IT leaders,. We also partnered with the Office for Research to do a discovery assessment of information security practices within research centers.

Looking Ahead: FY17

In FY17 we will continue these infrastructure and engagement efforts, with particular emphasis on providing enterprise paths to cloud alternatives to supplement our on-premise shared services (building on the enterprise agreement signed with Amazon Web Services). We will continue to improve our information security posture with regard to research data (e.g., providing templates and consulting services to help faculty set up their research environment for working with legally restricted data, addressing the latest data security standards, and improving our security offerings to faculty for their personal computing and lab environments). And we will continue to reduce the administrative overhead associated with research (e.g., continuing releases of the Research Portal, replacing or re-implementing the University's sponsored research pre-award proposal management system, and projects related to other areas such the animal control system, IRB, and Conflict of Interest).

Administrative Systems

The administrative systems area continues to be the focus of much activity, with progress on many fronts: _people_ (more aggregation of teams, realignment of resources, and the creation of an associate vice president (AVP) position for administrative systems); _process_ (increased use of Agile development practices, integrated portfolio planning, and standard IT controls best practices, and _technology_ (Amazon Web Service development, systems monitoring, database encryption, and targeted technology planning activities).

Enterprise Systems

All of these efforts are part of a commitment to create a holistic approach to the systems that underlie the University's business services. This approach: views these systems as enablers of the University mission and related activities; adjusts our approach to maintenance and innovation within each system so that it is based on the system's ability to differentiate the University from its peers; pivots towards cloud-based architectures to take advantage of their benefits; and builds an environment that supports a collective approach to the development of solutions.

The core of our administrative system portfolio is made up of three large, on-premise PeopleSoft transactional systems that have been heavily customized over the years. These systems are slow to change, and their level of functional innovation lags far behind cloud-based systems. Implementing new releases of software requires significant periods of system down time and lengthy development and testing time. With the upcoming end-of-life of the PeopleSoft platform, activities are underway to determine the next generation of these critical applications. Last year we began our path to this inevitable migration with an assessment of the PeopleSoft cloud-based software and its alignment with our current systems. That assessment resulted in a decision to do one last round of software upgrades to our on-premise systems to take the opportunity to remove customizations that will prove burdensome when migrations to the cloud occur, increase our use of new features, and stabilize the infrastructure. These upgrades (Human Resources and Financials are upgrading in FY17, and Student and will follow in FY18) will give us a stable base for the near-term future, so we can shift our resources to preparing for the larger transition.

In addition to these core enterprise platforms, there are also a variety of other critical administrative systems. These other systems (e.g., in facilities management, research administration, alumni support, and student support) have been the focus of upgrades, planning, enhancements, and development

process improvements to ensure reliability and sufficient support for our customer base. Many of the teams supporting these applications have shifted to Agile development techniques focused on releasing smaller changes more frequently and using new technologies provided by key cloud providers (e.g., Amazon Web Services).

More of this development work is starting to happen <u>outside</u> of the core systems, rather than <u>within</u> them. Of particular note is the release of the initial Research Portal application, which has been a top business priority and a good proving ground for the future state of Administrative Systems. This application utilizes the Amazon development environment and rapid development techniques to build a new User Interface that presents a personalized view of each user's data, integrated from multiple sources in an easy-to-use manner. Because the application gathers the data from the Enterprise Data Warehouse (via web services and presents it via a new interface), it is not bound to the limitations of these larger transaction-oriented systems of record. This new approach narrows the role of these important ERP systems, returns a better user experience, and provides more value from the data within them. We are also seeing the benefits of developing outside of these larger systems, as multiple new smaller systems are being integrated with the systems of record in Human Resources, Alumni Relations, and Student.

Enabling Technologies

To further realize the full value of the data inside these transactional systems, continued focus will be placed on the development of our "enabling technologies" in FY17. Next steps in the Identity and Access Management program will include the extension of Multi-factor Authentication deployments to core systems, implementation of the new core identity management platform, and incremental improvements in existing services. The enterprise web services architecture will also have monitoring, error handling, and infrastructure improvements implemented in FY17. These changes will increase the reliability of the web services and reduce the turnaround time for error handling.

Continuing to improve our infrastructure for, and our use of, web services will also benefit the emphasis on improving administrative services that was begun in FY16. As this initiative evolves, we anticipate interest will grow in providing more online self-service or paperless options, and more automatic, real-time, behind-the-scenes cross-system updates. The shift to online business processes will be assisted by the enterprise license for OnBase that was purchased this year, but to achieve its full potential, the momentum to move business processes online is highly dependent on having reusable web services in place and surrounded by business processes that make it easy for appropriate developers to get access to the web services.

Organizational Capacity

The success of providing access in this way to the data within these transactional systems also highlights one of our larger organizational capacity issues. The IT teams supporting these ERP systems have been built over decades with skill sets necessary to maintain and develop <u>within</u> these systems. Ultimately, after we migrate to the cloud, the need for many of these legacy skill sets will be greatly reduced, and the people and positions can migrate to newer, more flexible skill sets. However, transforming the skills of our central IT team will be a multi-year process, and there is need now for this newer type of development work so we can more rapidly build surrounding applications with better service delivery features <u>outside</u> these systems.

At this point, a number of the distributed IT teams have the capability to do this type of development work to complement the work being done at the center. However, to realize the full value of this potential on an enterprise level, multiple improvements are still needed. New skill sets need to be expanded in the center so we can assume the ongoing maintenance of these systems when they migrate in as shared services, and partner more effectively with distributed development efforts. In addition, the application development practices in the distributed teams need to be better aligned with what is needed to scale the applications as shared systems at the center, and the development practices in the

distributed units need to be better aligned with each other so cross-team development can be done (as the possibility of the McCormick and Weinberg College collaboration on faculty-related systems is demonstrating).

Reporting and Analytics

Improved service delivery in the administrative area is closely tied to our ability to provide robust reporting and analytics capabilities. Many functional areas have data marts in our enterprise data warehouse, and an initiative to standardize the tools used to maintain them was begun in FY16 to enable operational efficiencies, and it will be finished in FY17. However, the data in the marts is not easily available outside the warehouse (or sometimes across data marts due to the lack of shared master data elements), and while the analytic platform (IBM's Cognos) is extremely powerful, it is not easy for non-power users, and it has been difficult to grow the distribution of reporting capabilities.

In FY17 a roadmap will be developed to modernize the hardware, software, and data structures that support the integration and distribution of enterprise data. The first steps down this road have already begun. New web services are making enterprise data available to developers, while the implementation of Tableau Server will allow business people to create sophisticated analyses and visualizations using enterprise data integrated with local data sources. A centralized dictionary of administrative data definitions was piloted in FY16, and will expand in FY17.

Information Security

The Information Security Landscape
During last year's planning process, information security was identified as a priority area and received substantial investment for FY16. The wisdom of that decision has been reinforced by continuing announcements of breaches from government agencies (including the IRS and the Office of Personnel Management, where 22 million federal government employee records, including millions of people with high-security access, were exposed), healthcare organizations, private companies, and educational institutions. We also were reminded that it's not just Personal Health Information or Personally Identifying Information that need to be protected; the exposure of intellectual property also made the news again (the breach at Penn State's Engineering School), as did breaches where the release of internal communications was extremely damaging. And finally, we saw the methods of attack continuing to evolve. For example, ransomware became more prevalent: once installed on an unsuspecting user's computer, ransomware encrypts and prevents access to the data on the computer until an actual ransom is paid to the perpetrator. In the face of this escalating threat landscape, regulators' responses to reported breaches continued to evolve. Investigations no longer look narrowly at the specific point of a breach; instead, they increasingly look across the enterprise, expecting to see standard security controls consistently in place across the enterprise.

Core Strategic Principles
To maintain its positive information security profile, the University's information security program is standards-based, and has on-going assessments, both internal and external, to insure adherence to the program's tenets. Yet, in order to keep pace with the constantly evolving and escalating landscape, each year we must get better at what we do, implementing new technologies and new services, and improving and expanding what we already offer. This past year was filled with significant new activity, bringing advancements in all areas of information security. For example: additional monitoring services were deployed; the scope of our log aggregators was expanded to enable efficient analysis of voluminous sets of network and access logs when compromises or threats are detected; expansion of the University's vulnerability scanning service continued; the ability to individually encrypt any email an end user is sending has been expanded from Feinberg to the whole University; and while the core

enterprise databases have been surrounded by layers of security for years, the underlying databases themselves were encrypted this year.

All of this work is built on three overarching principles:

1. In order to respond to the continual change in threats and opportunities for defense and risk mitigation, our goal is continual improvement rather than perfection. Our goal is to make our security posture demonstrably better each year.

2. To accomplish our first goal, we want to strive to "make it easy for people to do the right thing" rather than marshalling forces to compel adherence to policies and guidelines, or simply relying on their good citizenship to do the right thing (though an improved year-round communications plan will be an important aspect of our increased attention to this topic).

3. We are adopting an integrated enterprise approach to information security, focused on building improved security practices into the institutional fabric as a whole rather than doing individualized, add-on solutions in a variety of situations, and focused on improving our ability to coordinate efforts in order to raise the bar across the University as a whole.

Primary Areas of Emphasis

In this context, three areas in particular were targeted as high priority in FY16, and they will continue to be emphasized in FY17: research information security, improved threat detection, and end-user security.

Research Information Security

The threat landscape for higher education is targeted not only against regulated Personally Identifiable Information (PII) and Personal Health Information (PHI), but also intellectual property. In discussions during FY15, people highlighted the fact that unlike most people at the University, many research centers and individual faculty are not connected to school IT teams for their day-to-day support. As a result, their information security practices and needs are less well known. During FY16, Northwestern IT partnered with the Office for Research to design a discovery survey to learn more about research centers' information security practices and needs. Twelve centers participated in the survey during the summer, and the results will be used by the centers, Northwestern IT, and the Office for Research to help target the assistance most needed by these centers, and to inform the other efforts underway to help identify and improve secure IT services for our faculty and their research.

In parallel, a CIO-led working group with representatives from Feinberg, Weinberg, McCormick, Kellogg, SoC, and Northwestern IT have been working on methods to identify vulnerabilities associated with research information security, and to enable joint efforts by Northwestern IT and the local IT teams to work effectively with the schools' faculty and administration to address security gaps and needs in an ongoing, sustainable manner.

Improved Threat Detection

As methods of attack continue to evolve, we will need to continually adjust the tools and platforms we use to mitigate the risks associated with these changing threats. While traditional security measures are still essential, the new landscape demands more sophisticated tools (known as Advanced Threat Detection tools) and new approaches to security. One of these new approaches is multi-factor authentication (MFA), which requires a verifying response from end users when logging into or changing features of their accounts. Another approach is the monitoring of the ways individual end users typically access their accounts (e.g., from already known computers, or from around the same locale) and requiring verification from them if their account is accessed in atypical ways. By wrapping monitoring and real-time verifications from account owners around the data, these new approaches expand the security focus from the device to the data, and pivot from relying on upfront prevention to improving speed of detection and response. Banks and credit card companies have led the way in these

efforts, and they are spreading through the commercial sector and higher education. At Northwestern, multi-factor authentication will be expanded from its initial application in FASIS to the other core administrative systems in this calendar year, and some of these new data loss prevention and advanced threat detection mechanisms will be deployed during FY17.

End-User Device Security

While the new approaches are increasingly important and are beginning to be deployed, it does not mean that we can lose sight of the importance of traditional approaches to security – at the data center layer, the network layer, or the end-user layer. The end-user layer is particularly important because it is harder to control, and most breaches begin with a breach of a personal computer (not a server) inside the organization. Our efforts in this area need to be improved on multiple levels.

In the spring of this year, the Infrastructure Advisory Committee formed a working group to look more closely at how security at this layer is managed at the University. They will be recommending an enterprise path for improving that security and making the management of it more efficient. The path will include an emphasis on shared services and coordinated effort to replace the individually isolated approaches that have been such a large part of Northwestern's approach to information security thus far. One of the first visible signs of this new path will be a coordinated effort to get all Northwestern-owned desktops and laptops encrypted.

IT Infrastructure

[NOTE: This section mirrors the breadth of responsibilities assumed by the Infrastructure Advisory Committee. It covers two areas of infrastructure, each with its own section:

1. the overarching IT Infrastructure components such as data centers, networking, and service platforms (servers and storage), with the addition of communication and collaboration services (voice, email, calendaring, web conferencing, etc.);

2. the infrastructure of support processes that makes it possible for our community to easily consume our IT services, including the management of personal devices (i.e., endpoint management), and IT service management (e.g., handling and processing service requests, building service catalogs, tracking and managing configurations).]

The Overarching IT Infrastructure

The focus in infrastructure has remained unchanged for the last several years: maintain a robust, stable, and secure infrastructure that is able to meet the needs of the University while improving our ability to integrate cloud-based systems and infrastructure into our on-premise infrastructure at scale rather than as extended one-off's, and to improve our agility, particularly in responding to security vulnerabilities and regular maintenance. Within this context, there have been multiple transformative sets of work that began in FY16 and will continue into FY17.

A Growing Emphasis on The Cloud

During FY16, multiple proofs of concept, and some production-level projects, were launched to help flesh out the gestalt of cloud services. Enterprise licenses were executed for Amazon Web Services (AWS) and Microsoft's Azure, and integrating the AWS environment with our on-premise infrastructure was a focus for the spring and summer quarters. AWS is getting the most attention initially because of the robustness of its functionality, with several aspects of research support leading the way: a pilot for providing a research computing environment in AWS will be completed in FY17, and the Research Portal (see above, p.8) is being built in AWS.

A cloud-based infrastructure has enormous potential. As we move to it, we will gain, for instance, access to robust and quickly evolving environments, to the potential for limiting the current pace of expanding our on-premise facilities, and to point-in-time agility in deployment (e.g., being able to add more servers at times of peak demand, duplicate a research environment when a new grant is received, turn down test and development environments at night when developers are not using the systems, automate many currently manual maintenance tasks, and know at any moment the health of all of our systems). However, making this transition is challenging. The advantage of being "quickly evolving" is also a downside when you are first trying to learn what is available, required, or optimal. There are no comprehensive manuals or course series that will give you what you need to know in a neatly contained presentation, and there are learning curves on all fronts: data management, system integration, the management of cloud providers, financial operations, and legal variations. However, the industry trend and undeniable advantages are clear, and as more experience and knowledge is gained via these proofs of concept and "snow plow" projects (i.e., trailblazing projects that explore new ways of delivering services and consequently involve additional work uncovering obstacles and clearing paths for those who follow), more services will be shifting there.

Storage

Another area of transformative focus is storage, which, in the era of big data and ongoing digitization of assets, is a perennial focus of attention. After deploying the Research Data Storage Service in FY15 – which housed 250TB of data at the end of its first year, and now houses an additional 200TB – attention has turned to archive/preservation storage. Northwestern IT has been working with the Northwestern University Library this year to help with their analysis of, and preparation of recommendations for, this type of storage. The working group's recommendations are expected in the fall quarter.

More Granular Control over Access to IT Services

Driven by the Feinberg School of Medicine's desire to be more granular in controlling access to sensitive data, Northwestern IT has partnered with them throughout FY16 to identify, architect, and deploy an infrastructure that will permit different modes of access to email depending on who is requesting the access, their location at the time of request, and the device from which the request is being made. This approach breaks totally new ground for Northwestern, requiring the introduction of new technology platforms and new functionalities for technology already deployed at the University, and expanding the capability of information security systems to alter the means of data access depending on the security profile of the access method. Deployment of this service is scheduled for early fall.

Improved Threat Response Agility

The quest to be more agile in our information security posture has driven several other initiatives that are focused on being able to know, at all times, what our assets are and who owns them. With over 2,500 servers in the data center, and an even larger number of pieces of software running on them, this is not a trivial task. To further improve our security posture we are currently installing a Qualys Guard agent on all servers in the datacenters that are maintained by Northwestern IT so we will have up-to-the-minute data on assets and ownership. Once this service is stabilized and a sustainable set of processes has been wrapped around it, we will be expanding it to the other servers in the data centers to further improve the University's security posture.

Communications Projects: New Voice Platform and Improved Cellular Reception

In addition to these sets of work, there are several large multi-year communications projects in process that will begin rollouts in FY17. After initial vetting of vendor RFP responses, and pilots with each of the two finalists, a new voice platform will be chosen in the fall to replace our current end-of-life voice platform with a more flexible platform that provides better support for a more mobile workforce. The quality of phone service is also being addressed by ongoing work to improve cellular service on campus. After two failed attempts to gain carrier buy-in to carrier-agnostic distributed antenna systems (DAS), a new approach is being undertaken which leverages the carriers' expansion and upgrading of their

infrastructure on/near campus to take advantage of new technologies that have better penetration inside buildings. These upgrades will occur over the course of the first six months of FY17, and they will be supplemented where needed and where strategically important by upgrades and limited expansion of the DAS that currently serves a variety of locations on campus.

The Support Infrastructure

Support in a Decentralized Institution

Prioritizing the integration of support is particularly important in a decentralized environment where services span the areas of responsibility of multiple support organizations. For example, a FASIS service is deployed on NUIT-managed servers, delivered over the NUIT-managed network, accessed via an endpoint device that is primarily supported by distributed IT units, and supported by an HR help desk.

Similarly, the integration of support is particularly important in a time when we are looking for ways to reduce duplications in our IT infrastructure and realize the benefits of delivering services via shared platforms. To be successful in this effort, it is important to demonstrate that the basic levels of end-user support can be delivered effectively from central IT. These processes need to be responsive and smooth even as their scale increases, and the central organization needs to demonstrate awareness of its existing service levels and their alignment with the needs of its community.

People and Process Changes

As such, user support has been a major area of focus during FY16 with changes in personnel, processes and technology. New senior-level hires were made in Northwestern Technology Support Services (TSS), and other job positions were rewritten or added. TSS's Distributed Support Services team (DSS, the team that provides desktop support for Northwestern IT and many central administrative units) renewed their focus on improving their daily support processes and the structured communications with their clients, tightening up internal processes and improving their interaction with other parts of Northwestern IT to smooth service delivery when support responsibilities overlap. Improving the collection of service delivery metrics, and using them to drive business process improvements through benchmarking and metric reporting improvements, will be a priority for FY17. External consultants have been engaged to review TSS's Service Management maturity levels and to provide improvement recommendations.

Improved Access to Information about Services and Support

One of TSS's highest priorities is improving the presentation of support materials on the Northwestern IT website. Much content is available on this site, but much of it is outdated, hard to find (with multiple content repositories being used), or hard to consume when found. The primary organizing framework for presenting this material is the Service Catalog, and considerable work was done during FY16 to restructure this catalog, revising its focus, improving the definition of its categories, and updating the services included in it. This process will continue in FY17 along with the selection and deployment of a new, unified Knowledge Management platform. The integration of this new platform into the Northwestern IT website will be part of a larger overhaul of the Northwestern IT website that will also improve the usability of its content and bring it into alignment with the University's new marketing framework.

The Development of Shared Services

Being able to provide end-user support services reliably from the center of the University support network is an important goal due to the need to improve the University's overall IT security posture and the desire to reduce duplicative services. Progress was made on multiple fronts in this area during FY16: an endpoint management platform was deployed for managing Apple devices (Casper), including the management of hard drive encryption within the native Mac operating system; a corollary encryption service was deployed for managing the native encryption of Windows devices; and beginning work was

done on "de-bundling" the endpoint management services that Northwestern IT provides to its desktop support customers as part of a full-service packaged support offering.

Instead of continuing to require the subscription to this full-service package in order to get these services (e.g., asset tracking and management, software image development, software packaging for easier deployment, automated patching of known software vulnerabilities, personal computer backup) from Northwestern IT, a leading priority for FY17 will be creating the business and support models to enable the provision of these back office services as part of a no-chargeback partnership option for schools and units with their own desk-side IT support teams.

Reducing the fragmentation of the support model for University administrative systems continued in another area in FY16 with the transition into the University's IT Support Center of Tier I support for Learn@Northwestern and the Alumni Relations and Development systems. This trend will continue in FY17 with the transitioning of Tier I support for the Student system and for Office for Research systems.

Consolidating the number of Personal Computing Models at the University
FY17 will also be a year in which we begin to work on reducing the variety of different models of computers that are ordered at the University. Over the past eight years, much good work has gone into improving the contracts for personal computing device purchasing options in the University's preferred vendor contracts with Dell, CDW, and Apple. This work has resulted in improved availabilities, warranties, pricing, order turnaround time, and service options. However, as these devices become more commodified, the belief is that further concentration of the University's buying power will drive additional efficiencies and price improvements, and improve the University's security posture by making support processes more scalable, all without impacting the work experience of the vast majority of people at the University.