



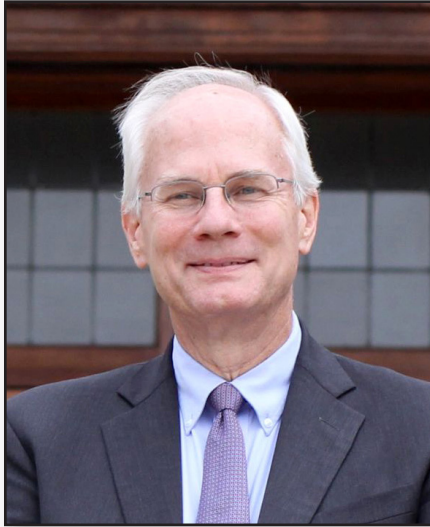
# Division of Information Technology Annual Report - Fiscal Year 2018



INFORMATION TECHNOLOGY  
VIRGINIA TECH™

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# ■ LETTER FROM VICE PRESIDENT & CIO SCOTT MIDKIFF



I am pleased to present the Division of Information Technology annual report for fiscal year 2018 (FY 2018). We continue to grow in our role as consultant and broker for the services, support, and infrastructure required by the university. Given the ever-changing nature of technology, we intend to be agile, yet compliant, with the enterprise-level stability and security required. A theme running throughout our year's endeavors is continual improvement and unification of services, processes, and service portals, creating better outcomes for university constituents at all levels. As we improve services we make it easier for individuals to navigate the university's IT environment, connecting with resources and expertise that helps them achieve their goals for learning, teaching, and professional endeavor.

Information technology has never been more important to major research universities, including Virginia Tech. Properly conceived and applied, information technology presents exciting opportunities for Virginia Tech to achieve new levels of effectiveness and transformation in its teaching, research, and outreach missions. Keeping an unswerving commitment to improving our services at the fore, I am proud of our achievements and commitment to serve our colleagues across the university.

Vice President  
for Information  
Technology &  
Chief Information  
Officer

Advanced Research  
Computing (ARC)

Collaborative  
Computing Solutions  
(CCS)

Enterprise Systems  
(ES)

IT Experience &  
Engagement  
(ITEE)

IT Security Office  
(ITSO)

Network Infrastructure  
& Services  
(NI&S)

Secure Identity  
Services (SIS)

Technology-enhanced  
Learning and Online  
Strategies (TLOS)



# ■ INTRODUCTION

The Division of Information Technology provides and supports core technology services that are essential to the successful functioning of the university. These include ongoing services, innovations to existing services, and a select number of new services that add functionality or build on existing capabilities. The current strategic plan provides guidance and direction for our service portfolio through 2018. Our annual report for FY 2018 provides an opportunity to review and reflect on the outcomes of the past year, to assess the effectiveness of the division in adapting to meet the university's needs, and to provide actionable insights that support the ongoing work and continued development of the Division of Information Technology.

This report is organized by the division's "pillars," which were introduced in the 2012-2018 Division of IT Strategic Plan, and upon which we in the division have focused our priorities. It is also informed by current visioning efforts including Beyond Boundaries and our own internal initiative to develop a new strategic plan for our organization. The first four of our seven pillars originated from language contained in *A Plan for a New Horizon*, the university's current strategic plan:

- Pillar 1:**    ----    Enabling Networked Learning in the Networked University
- Pillar 2:**    ----    Providing Competitive Advantage through Sustainable Advanced Cyberinfrastructure and Collaboration
- Pillar 3:**    ----    Leveraging Information Technology to Distinguish the Virginia Tech Experience
- Pillar 4:**    ----    Advancing Information Technology for Enterprise Effectiveness

The final three pillars focus on ways that the Division of Information Technology supports the work of the first four pillars.

- Pillar 5:**    ----    Ensuring the Security and Resilience of Information Technology Resources
- Pillar 6:**    ----    Improving Communication with Customers and Partners
- Pillar 7:**    ----    Strengthening the Information Technology Organization

Within this structure, we will describe a portion of our outcomes achieved over the past year. In the interest of brevity, we have selected only the highlights for inclusion, and have kept our accounts concise. We invite reviewers to contact our leadership for additional information on the items included within.

### Enabling networked learning in the networked university

Virginia Tech's foremost mission will always be to educate students, an ongoing endeavor that necessitates many parallel capabilities. In addition to having professors and instructors who are equipped to teach their subjects, the university needs facilities that are prepared to host the media that conveys course content and enables participation, the capacity to innovate and explore new means of engaging with students, and robust systems of asynchronous communication and collaboration that enable students and educators to connect from any location around the world.

The Division of Information Technology's commitment to learning is a central component of this strategic support. In FY 2018 we have continued to ensure that instructors around the university understand the IT tools and services at their disposal. In addition to focusing on the creation and management of special spaces for integrated technologies, we have strengthened the ability of instructors to test and adopt new techniques that utilize digital multimedia in the classroom and in our distance learning environments.

In these ways, the division continues to demonstrate its commitment to delivering technologies that allow faculty to enable and enhance teaching and learning in both physical and virtual spaces.

#### **Advancing professional development and structured support**

By offering professional development and technology training, the Division of Information Technology continues to play a strong role in the development of digital fluency among faculty, staff, and students. In FY 2018, the number of program participants in Networked

Learning Initiatives courses (NLI), part of Technology-enhanced Learning and Online Strategies (TLOS) increased from 1,405 in the previous academic year to 1,761; the number of NLI sessions increased from 465 to 568; and the total number of session hours increased from 13,884 to 17,101.

With a focus on program development, course development, and assessment across the range of teaching modalities, the division undertook a redesign process that resulted in the development of 75 new online courses. In FY 2018, 60 courses were designed or redesigned, including four complete online graduate degree or certificate programs. A shift in the business model allowed Learning Experience Design (LED, also within TLOS) to separate faculty credentialing from the submission of developed courses for quality assurance review, allowing for course development within colleges, departments and programs with in-house support and funding. Through this approach, 100 faculty members earned credentials through cohort, boot camp, and six-week sessions.

The InnovationSpace was re-envisioned as the TLOS Innovation and Outreach Studio (I/O Studio), a faculty-facing hub that lends equipment and supports research and development projects on emerging technologies for teaching and learning. The I/O Studio team provides resources to faculty to facilitate design/thought exercises, collaborate on sandbox projects, provide agile project management, assist with applications for Innovation in Learning grants applications, and advise on 4-VA grant applications. The studio is reservable and stocked with both analog and digital tools including, but not limited to, whiteboards, butcher paper, and other tools designed to support ideation and research.

## Defining an institutional approach to online learning

In FY 2018, the division addressed the task set in *A Plan for a New Horizon* to “develop an appropriate infrastructure for e-learning” to encompass a defined institutional approach to online learning. We increased the availability of video conferencing and digital content management services from 5,000 to approximately 40,000 users through an effort led by TLOS called Video for Instruction (VFI).

The VFI program was developed as a means to coordinate efforts on several projects that improve or establish services for videoconferencing, video streaming, video recording, and video content management. The VFI program greatly improved the quality and efficiency of these services by coordinating needs assessment, contract negotiations and licensing, configuration of services, and customer service strategy across a diverse group of stakeholders and project participants within TLOS, the division, and our partner departments.

New contracts with Zoom and Kaltura increased the capacity for video conferencing and content management services to accommodate all Virginia Tech users, instead of just a subset of the population. As a result, all faculty, staff, and students now have access to video conferencing tools and unlimited storage for video content. As these tools become more widely used, we will monitor both adoption rates and types of usage.

By expanding the availability of and support for new synchronous and asynchronous enterprise-level digital video and multimedia capabilities, the division has significantly increased Virginia Tech’s infrastructure for e-learning connectivity. Potential uses of this technology can now extend to web conferencing, classes, meetings, ad-hoc collaborations, and other events without limits.

## Creating technology-infused spaces

In FY 2018 we took steps to create financially sustainable technology-infused spaces at Virginia Tech by working with partners to design and promote utilization of specialized locations customized for optimal connectivity and flexibility across our Blacksburg campus. In common areas including residence halls, study areas, lecture spaces, and featured venues, we have offered connectivity and tools that enable a broad range of university activities.

In tandem with these efforts, TLOS took the lead with groups across campus in creating an interdisciplinary collaboration studio where faculty can propose and pursue “sandbox projects”—short-term, hypothesis-driven experiments that apply emerging technologies in physical and virtual learning environments. Supported by full-time TLOS staff and a team of undergraduate Student Innovation Fellows, these sandbox projects are a key part of TLOS’s innovation pipeline, offering a structured methodology for testing and scaling-up new learning technologies.

### Sustainable, advanced cyber infrastructure and collaboration

To advance research and discovery at Virginia Tech, high performance computing (HPC) resources and services remain among the university's key priorities. The Division of Information Technology has further expanded its commitment to the enhancement of our research infrastructure, providing the services and capabilities needed to support innovation at every level of our global research university.

The university's "Focus on Function" approach highlights three domains: improving our support for large high-impact projects, enhancing faculty resources for proposals and post-award project management, and strengthening our innovation ecosystem. The division's central high performance computing systems (HPC) and support structures are evolving as part of those initiatives. The division is making significant investments in software and researcher support by aligning and embedding our computational scientists as active participants in transdisciplinary Destination Areas and collaborative research throughout the Virginia Tech enterprise. We are also enhancing access and availability of specialized HPC computing and visualization services to Virginia Tech researchers throughout the commonwealth.

#### **Expanding accelerated computing and deep learning capabilities**

As data sets grow in size and number and increases in computer processor speed level out, alternate means for modeling and computing are becoming more important. Deep learning as a modeling platform is quickly becoming the first method people choose to convert data to knowledge. Deep learning is extremely computationally intensive as it strives to allow one to codify feature

discovery, model creation, and optimization in an automated fashion, utilizing computers to "learn" from data. To give an idea of scale, typical datasets can be terabytes in size with model parameters being in the 100's of millions range. Accelerators are necessary in many disciplines outside of deep learning, including chemistry, physics, biology, and medicine.

While processor speed increases have slowed, our need for computing power has not. To keep pace, computer architectures have developed to parallelize operations where possible. Beginning in 2017, Advanced Research Computing (ARC), in cooperation with Network Infrastructure & Services (NI&S) and Collaborative Computing Solutions (CCS), increased investments in accelerated platforms for generalized computing and deep learning—specifically through purchases of approximately 100 server nodes containing GPUs (graphical processing units). Huckleberry, our newest HPC cluster, is specifically designed to support emerging deep learning research activities. Augmenting our existing clusters, NewRiver and Cascades, has added more than 80 compute nodes. The availability of these resources means more capacity to accomplish more research in less time.

#### **Providing computing and visualization resources, support, and leadership to advance computational research**

The Hypercube immersive projection room (part of the Visionarium) had a 98.1 percent uptime in 2018, with operating system and software upgrades resulting in less than seven days of unavailability. Users were able to remain in constant engagement with the university's central HPC software stack; software installs were



Additional computing clusters enhanced capacity for research at Virginia Tech.

generally rapid with many taking less than a day. A few larger packages with more complex dependency issues were known to take between one and two months.

### **Collaborating with computational science and engineering-driven research centers to accelerate scientific discovery**

Funded research at scale is a community effort. To increase the number and variety of successful grant submissions and subsequent performance on awards, ARC has worked to develop active collaborations and relationships with principal investigators across Virginia Tech.

Virginia Tech's centralized HPC and Visualization facilities are used by all Destination Areas, Strategic Growth Areas, and colleges across campus. ARC is actively participating in grants across all Destination Areas.



ARC's Visualization Team hosted over 34 workshops, including visualization lab visits.

College and department use is widespread, with the Colleges of Engineering and Science leading among our user base. There are active efforts to increase users in non-traditional areas such as entomology, economics, arts, and humanities. To facilitate growth in these areas, ARC has invested in hiring computational scientists skilled in diverse scientific disciplines such as engineering, physics, math, chemistry, and biology, several of whom have expertise in deep learning and modeling.

To further solidify ARC as a hub for HPC, ARC has pushed to grow our investment computing program by 10 percent each year. The investment computing program is a mechanism for principal investigators and departments to purchase computing resources, host them in ARC, and seamlessly integrate their dedicated resources with the larger set offered through ARC. The investment computing program has been well received by faculty, and requests are increasing with an expectation that the program will grow as desired. Several near-term improvements are underway to allow university researchers to maintain groundbreaking research through access to these cutting-edge facilities.

### **Offering computational training programs to encourage development of knowledge, skills, and techniques suited to the needs of university researchers**

In FY 2018, ARC offered a total of 34 courses of Networked Learning Initiatives (NLI) courses and alternative educational programs such as hackathons and workshops, covering a diverse array of visualization and HPC topics. Additionally, the university's HPC experts taught programming or



analysis-related courses and provided guest lectures for undergraduate and graduate programs in Computer Science, Electrical and Computer Engineering, and Computational Modeling and Data Analytics, among others.

ARC members presented multiple tutorials and workshops in addition to supporting outreach programs at local middle and high schools and nationwide conferences with more than 200 attendees each. In deep learning alone, ARC hosted several multi-day workshops to increase the knowledge base in deep learning and raise awareness of HPC resources at Virginia Tech. Additionally, members of ARC gave presentations at conferences to increase our visibility on topics such as *Machine Learning with TensorFlow and Keras*, *Deep Learning Applications in Image Analysis*, and *Automated Machine Learning*.

To broaden the scope, the Visualization Team hosted multiple lab visits that discussed the nature of data and the techniques and technologies required to process and visualize it. ARC also hosted the BrainIAK hackathon in conjunction with the Fralin Biomedical Research Institute at Virginia Tech Carilion (formerly known as the Virginia Tech Carilion Research Institute). All of these activities were aimed at raising interest and understanding within the community.

### **Innovating tailored resources for cybersecurity education for the university and the commonwealth**

In an effort to close the cybersecurity skills gap, the Virginia Cyber Range has worked to support cybersecurity education in high schools and colleges throughout the Commonwealth of Virginia.

Over FY 2018, Cyber Range cloud architects and application developers have drastically updated and improved the Cyber Range software, making it possible for instructors to provision network infrastructure that enables students to complete hands-on labs and exercises in controlled and isolated network environments. This virtual infrastructure supports cybersecurity education within the College of Engineering's departments of Computer Science and Electrical and Computer Engineering, as well as the Business Information Technology program within the Pamplin College of Business.

The Virginia Cyber Range hosts infrastructure for cybersecurity competitions across the state and maintains a repository of courseware to support cybersecurity courses at the K-12 and post-secondary level. Introduced early in the 2018 academic year, the repository has seen over 2,500 courseware downloads by 313 cybersecurity educators across Virginia. This year, the Virginia Cyber Range exercise area went from supporting 250 users (students and faculty) to supporting over two thousand, and we expect that number to continue to climb.

Outreach efforts in FY 2018 that have supported cybersecurity education include weekly virtual lessons covering introductory cybersecurity topics, summer bootcamps for teachers of cybersecurity courses in Virginia high schools, and organization of the inaugural Virginia Cybersecurity Education Conference, an annual event planned for August 2018. The Virginia Cyber Range also leads an executive committee made up of educators from 12 colleges and universities, working together to provide a model for cooperation between higher education institutions throughout the commonwealth.

### **Supporting restricted research at Virginia Tech**

In January 2018, the federal government outlined new compliance regulations for researchers developing or working on projects containing controlled unclassified information (CUI), using an approach developed by the Department of Defense. These regulations are designed to increase data security compliance across the board to achieve a common control standard.

In December 2017, the Office of Export and Secure Research Compliance and the Division of IT's Collaborative Computing Solutions unit launched a new Secure Research Environment to support Virginia Tech in meeting these new compliance requirements. This environment provides a convenient and compliant service for researchers to onboard into a computing space where they can focus on their research efforts with the assurance that data security standards are in compliance with the federal government's needs.

### **Renewing local multipoint distribution service licenses**

The Local Multipoint Distribution Service (LMDS) is a fixed broadband wireless access service that operates in licensed frequencies between 27.5 and 31.3 GHz. Virginia Tech first acquired the licenses in 1998 to serve a large portion of Southwest Virginia and adjacent areas in North Carolina and Tennessee. Renewal of the 10-year license requires Virginia Tech to prove that the licenses met FCC "substantial service" requirements.

During the ten years since Virginia Tech acquired the licenses, much of the original LMDS equipment has been replaced by other technologies. However, it was still important to retain these licenses. In response to that need, NI&S developed partnerships to find new

uses for the available LMDS spectrum and designed and installed four LMDS point-to-point links across the area. These deployments were sufficient to ensure Virginia Tech maintained the licenses for another ten years and simultaneously addressed some broadband connectivity needs in Southwest Virginia.

### **Linking Virginia Tech's high-speed research network and the VT Transportation Institute**

Under a grant from the National Science Foundation, NI&S constructed the new VT-Rnet (short for "research network"). This network provides 10 Gbps connections to researchers and direct, high-data rate access to campus HPC and storage systems. VT-Rnet also provides high-data rate access to external computational and data resources via the the Advanced Scientific Collaboration Environment and DMZ and, subsequently, Internet2. This new capability transforms the scope and scale of research in a variety of areas requiring high-speed and/or large-volume data transfers. To date, tangible results have been obtained in areas including digital libraries, genomics, biomedical imaging, bioinformatics, transportation, wireless communications, and visualization.

Delivering the 10 Gbps VT-Rnet connection to the Virginia Tech Transportation Institute (VTTI) required fiber to be installed to their data center which is located several miles off campus. Through a partnership with the Town of Blacksburg, VTTI, and the Division of IT, NI&S constructed an underground pathway from the intersection of Research Center Drive and US 460 to a new meet point adjacent to Federal Mogul. Grant-funded fiber was installed in the new pathways connecting the Andrews Information Systems Building and VTTI.

### Leveraging information technology to distinguish the Virginia Tech experience

Pillar 3 challenges the Division of Information Technology to apply technology in ways that enhance and improve the Virginia Tech experience. The challenge is to move continually towards offering resources that are easy to use, fast, and consistent. In partnership with other university units, we work to ensure that both physical and virtual spaces are infused with technologies that enhance learning, research, outreach, and administration. Most notably for students, we seek to provide unparalleled support for the technological aspects of daily life in a learning community, independent of geographical location, with a goal to facilitate full participation and collaboration.

Creating these experiences requires collaboration with university partners to build the underlying infrastructure to support sustainable technology-infused spaces and provide tools for a broad set of university activities.

#### Supporting technology-infused spaces

Technology-infused spaces merge collaboration tools and audiovisual technology with physical spaces, expanding virtual spaces to enrich the learning experience, adding flexibility for distance and non-traditional learners, and providing the full advantages of interconnecting resources and people.

In FY 2018, the division took many steps to create financially sustainable, technology-infused spaces at Virginia Tech, working with partners to design and promote utilization of specialized physical spaces across campus. Enhancing the wireless network in the common areas of residence halls, study areas, and featured venues increased the ability to maintain stable connectivity for all types of

university activities. Selecting Zoom for video conferencing allowed every student and employee to virtually connect for everything from large group meetings to one-on-one conversations.

In response to university-wide strategic directives, Technology-enhanced Learning and Online Strategies (TLOS) transitioned responsibility for student-facing digital literacy efforts to the University Libraries. The InnovationSpace was re-envisioned as the Innovation and Outreach Studio (I/O Studio), a faculty-facing hub for facilitating and supporting research and development projects on emerging technologies for teaching and learning.

FY 2018 was a transition year for TLOS's I/O Studio with significant time and energy dedicated to winding down old services and establishing new ones. In its first year of operation under the new model, the I/O Studio team renovated the physical studio space, developed processes and metrics for facilitating sandbox projects, and cultivated relationships with potential faculty partners. Under the new model, TLOS sponsored six sandbox projects in the spring of 2018.

The I/O Studio hired an initial cohort of 12 Student Innovation Fellows and planned more than a dozen faculty sandbox projects for completion in fall 2018. TLOS faculty and staff are engaged in multiple Destination Areas and are working closely with the Calhoun Discovery Program in the Honors College.



The I/O Studio supports faculty research of emerging educational technologies

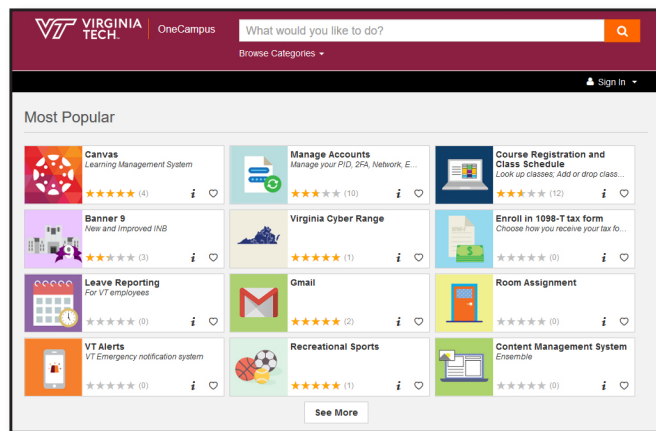
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### Improving the user experience for finding and using university services

To improve the experience of locating and accessing university services for all university constituents, Enterprise Systems (ES) led a collaborative initiative with University Relations and IT Experience & Engagement (ITEE) to replace the legacy myVT portal with OneCampus, a software as a service discovery application with Google-like search capability and an app-store interface.

The Division of IT achieved significant efficiency increases by replacing myVT with OneCampus. ES analyzed services provided within myVT and created comparable services in OneCampus, decommissioning myVT in November 2017. A soft rollout of OneCampus service began during summer 2017 new student orientation.

Utilizing OneCampus as the universal “app locator,” also made it easier for campus users to access Banner 9 administrative functionality during the transition to new Banner apps.

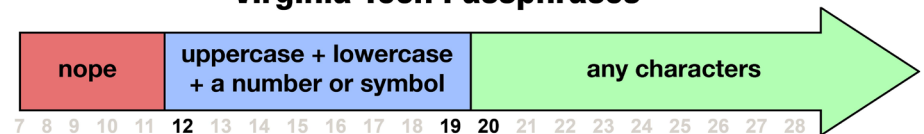


OneCampus

### Streamlining onboarding and account provisioning for new students and employees

During FY 2018, G Suite for Education was moved behind the login service for all users, enabling access with a VT Username and 2-Factor Authentication. It also became possible to have the VT Username and Hokies ID both set to the same password. New password complexity requirements were implemented that shifted passwords to passphrases of 20 characters or longer. These longer passphrases are more secure and can be easier to remember. Additionally, options for new VT Usernames have been extended from 8 to 16 characters, allowing a wider variety of possible options for incoming students and employees.

#### Virginia Tech Passphrases



- passphrases > passwords
- length is better than symbols
- use four or more words
- spaces are allowed
- minimum of 12 characters
- consider using a password manager
- see [www.it.vt.edu/accounts](http://www.it.vt.edu/accounts) for details

#### Sample passphrases:

Lily Lavender Emmeline Hermione  
The Dawgs play on Saturday.  
Hhcc1rejoice  
Toget#erforever  
Be a rainbow in someone's cloud.

This graphic helped the VT community understand the new rules for passphrases

Security and onboarding efficiency was also enhanced by the creation of a new application called OnBoard, which allows new students and employees to have all Virginia Tech online accounts created through one process, instead of having to go through multiple processes to set up VT Usernames, Hokies, Google, and Network Accounts. At creation, VT Username and Hokies ID password are the same and new network passwords are automatically generated and accessible in



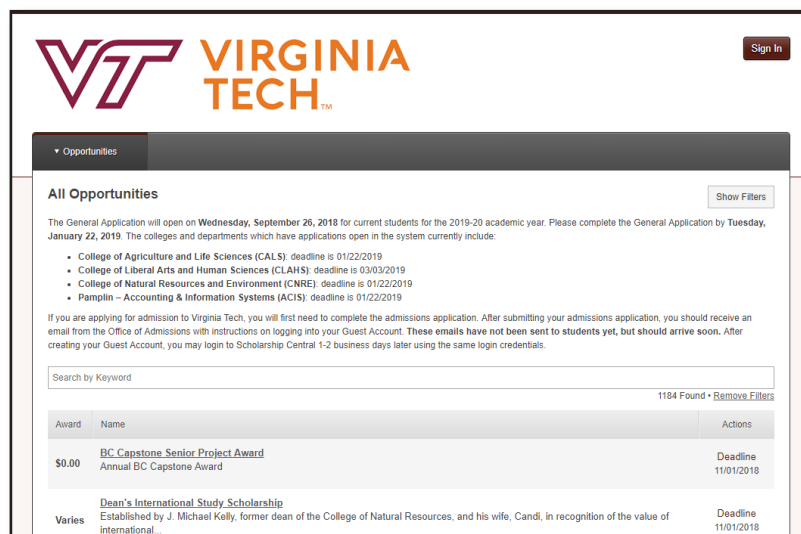
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Account Manager. This change greatly simplifies the experience for new users and lends to a positive first impression of IT at Virginia Tech.

### Transforming technology services for the university's students, employees, alumni, and parents

In August 2017, University Scholarships and Financial Aid, in partnership with ES and the Division of IT as a whole, implemented AcademicWorks, an application designed to centralize Virginia Tech's scholarship process and to increase the visibility of scholarship opportunities for incoming and current Virginia Tech students.

Utilizing student application data, the system matches qualifying students to scholarship opportunities, allowing Virginia Tech to offer more scholarships earlier in the application process and attract top talent to the university. This system also provides students with crucial information as they evaluate their options for pursuing higher education and promotes institutional effectiveness through better visibility, increased matching, and improved utilization of available scholarship funds.



AcademicWorks simplifies the scholarship application process for current and prospective Virginia Tech students.

To improve the experience for Virginia Tech residential students, ES worked with Housing and Residence Life to implement a new housing management system called StarRez. The new system is a cloud-based solution offering roommate matching, swipe check-in, residence hall activities, and many other features.

The Sunapsis International Student system was implemented through a collaboration between ES and several university offices including the Graduate School, the Cranwell International Center, and Virginia Tech Human Resources. This system empowers international students to maintain legal immigration status and supports Virginia Tech federal regulatory compliance.

### Seeking opportunities for continuous improvement of the user experience

In FY 2018, ITEE continued its long-term development and training efforts to improve the user experience for those needing computer support and IT services at Virginia Tech. This initiative, which began in 2014, requires gaining a clear understanding of Division of IT services, developing better documentation for services, and simultaneously working to reduce information silos and improve cross-disciplinary effectiveness.

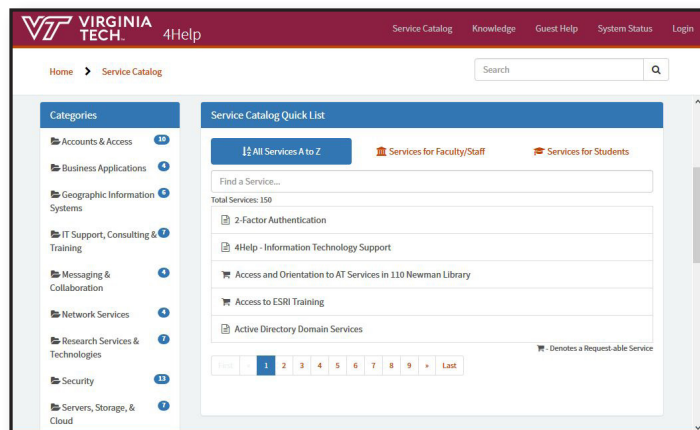
In 2018, 4Help (4help.vt.edu) was solidified as the central location, or "Service Portal," for users to access the IT Service Catalog, view Knowledge Base articles, and request support from the Help Desk, enabling a more unified user experience. The legacy site, computing.vt.edu, was decommissioned as part of this effort. Content housed

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at the former sites was reviewed for relevance, consolidated, and migrated or archived. The project also eliminated numerous disparate web pages for individual IT services, which had created confusion for users.

Thanks to the work of many throughout the Division of IT, 67 Service Catalog entries were directly requestable at the beginning of FY 2018. By the end of FY 2018, 81 items were directly requestable from the catalog, a 21 percent increase. The increase in available requestable items means that more IT services are easier to find and access than ever before.

This effort also greatly reduced the need for paper forms, streamlining workflows and making it easier to track progress and assign work. ITEE reviews the quality of entries and seeks to continuously improve items within the Service Catalog. This progress will continue for the foreseeable future as we strive for full representation of all Division of IT services, making them requestable wherever feasible.



The 4Help Service Catalog improves the user experience for faculty, staff, and students in need of computer support.

Additionally, a feedback button was added to every user-facing page on [4help.vt.edu](http://4help.vt.edu), making it easier for users to share information on

their experience with the portal and identify any challenges they encounter.

To further improve user satisfaction with the 4Help Service Portal, an online card sorting study was conducted to evaluate the information architecture of the Service Catalog. Quality assurance analysis was conducted on all requestable services created in FY 2018. Incident emails were redesigned to improve user satisfaction and provide clearer communication. New icons were designed for all catalog items, services, and main categories. Team members researched best practices to improve the relevance of search results, including conducting an analysis of user search queries to better understand terminology used by colleagues across the institution.

The above processes have provided the Division of IT with a much better understanding of portal usability and are informing a project to make continuing improvements to the portal based on feedback received. We also made significant improvements to our quality assurance processes and rubric in FY 2018, increasing quality and consistency of items within the Service Catalog.

### Evolving the experience for incoming Virginia Tech students

Incoming student support has been a key focus area for the user support team for over a decade. Significant evolution of the program, particularly over the past two years, has enabled a better, more consistent support and orientation experience for new students arriving on campus.

Continuous improvement plays a key role in this support area. FY 2018 saw several significant improvements: VirtualBox was adapted

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as a solution over other options for Windows virtual environments, reducing the time needed to assist each new student by approximately 30 minutes per support request. 4Help hired and trained students over the summer with the understanding that they would continue employment at the during the school year. Student consultants were also cross-trained to handle surge call volume at the Help Desk. At new student orientation, each student received a free bag with information on general computing topics at Virginia Tech, along with 4Help's contact information. To meet the needs of Virginia Tech's largest freshman class yet, with over 7,000 students, 4Help also offered multiple, in-depth presentation sessions informing students and parents of what they needed to know about IT at Virginia Tech.

### **Providing wireless support for events and surge capacity**

Network Infrastructure and Services (NI&S) often receives requests for wireless network access in locations without any service (e.g. the Drillfield) to support campus events. In an effort to accommodate these requests and support the university, NI&S invested in wireless Rapid Deployment Kits. These kits can be transported and installed on short notice to provide wireless network services. During FY 2018, NI&S deployed these kits in support of the Virginia Tech Relay4Life, drone testing activities, and April 16th Memorial events.

NI&S also provided support for VTHacks, a student-run annual event where students from area colleges and universities come together to create software solutions over the course of 36 hours. NI&S provided expanded wireless internet services and support for the event. NI&S has provided this service to VTHacks since 2015.

### **Providing network enhancements for the VTCSOM Roanoke campus (Riverside 1 & 2)**

To extend the "VT Experience" to the campus of the Virginia Tech Carilion School of Medicine (VTCSOM) and the Fralin Biomedical Research Institute at VTC in Roanoke, NI&S replaced all of the network equipment in the Riverside 2 building to match current NI&S standards for technology, reliability, and features. To support the growth of this campus, NI&S now oversees the management and operation of all network services for Virginia Tech affiliates in Roanoke, including voice, ethernet, and wireless support. To accomplish this goal by the end of FY 2018, NI&S installed two distribution switches, one aggregation router with 10Gbps interfaces, 29 ethernet switches with 1Gbps interfaces, and 147 wireless access points. In addition, all network service documentation and circuit information has been reconciled with our internal business applications, and customer support functions have been transferred to NI&S personnel. With these changes in place, all Virginia Tech services on the VTCSOM campus are identical to those provided on the Blacksburg campus.

Telephone services in the Riverside 1 and 2 buildings were also brought into the Virginia Tech Unified Communications (UC) System. A new media gateway was installed in Riverside 1. Three media gateways were taken over at Riverside 2, reconfigured and brought into the Virginia Tech UC system. Approximately 375 telephones were migrated into the system.



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### **Advancing connectivity for Virginia Cooperative Extension and AREC offices**

Virginia Cooperative Extension Offices and Virginia Tech Agricultural Research & Extension Centers (AREC) in Accomack County, Winchester, Eastern Shore, Harrisonburg, and Greenville/Emporia were brought into the Virginia Tech UC system, providing these locations with 5-digit dialing to campus extensions as well as reducing long distance charges by routing calls over trunk facilities in Blacksburg. NI&S also provided consultation and design to support extending Eduroam service to 135 remote sites, creating near ubiquitous access at ARECs, 4-H Centers, and Cooperative Extension offices throughout the commonwealth.

### **Outfitting Virginia Tech baseball facilities with new outdoor WiFi capabilities**

The ballpark at English Field underwent a major renovation in 2017. NI&S designed and installed the network electronics to provide pervasive WiFi coverage indoors and out. The ballpark is the first facility at Virginia Tech to have WiFi service for all outdoor seating. During the opening game against the University of Louisville, the wireless network served more than 620 devices and transferred over 22 gigabytes of data. The network not only provides WiFi service to fans, but also provides critical connectivity needed for game day operations including network access for ticket scanners.



Hotel Roanoke and Conference Center

### **Hotel Roanoke (anyRoam) WiFi services**

In May 2018 the Hotel Roanoke and Conference Center became an Eduroam service provider, allowing Eduroam participants, including Virginia Tech students, faculty, and staff to connect seamlessly to Virginia Tech's WiFi service when at the hotel. The Hotel Roanoke is the first and only non-university conference center in the United States to offer the Eduroam service.



English Field at Atlantic Union Bank Park



### Advancing Information Technology for Enterprise Effectiveness

Responding to the needs of our administrative partners across the university, the division's provision, maintenance, and innovation of administrative and support services play a key role in the success of the university, both now and into the future. The Division of IT is committed to building and maintaining tools that work across the enterprise to provide the appropriate technology capabilities for the university's diverse administrative needs. The Division of IT delivers a portfolio of higher education applications to enable these capabilities for employees, students, alumni, and the Hokie community as they apply to, work within, matriculate from, give back to, and otherwise interact with the university. We strive to meet these needs efficiently and with a commitment to thoughtful innovation and successful, effective administration.

The Division of IT is dedicated to improving the university's access to and use of institutional data. The division partners with units across the institution to analyze business processes and promote continuous process improvement for university administrative services. These partnerships and collaborative relationships are central to the division's success in advancing enterprise effectiveness.

#### **Positioning Virginia Tech's enterprise resource planning system for the future**

In order to manage many of the critical business processes of the university and services to university constituents, Virginia Tech utilizes Ellucian Banner for enterprise resource planning (ERP). In FY 2018, Enterprise Systems (ES) collaborated with university leadership and administrative offices to plan, execute, and deploy an upgrade that revitalized the Banner ERP to provide an improved

user interface, modernize the technology, and position Virginia Tech for the future. The new Banner 9 interface incorporates a responsive design, enabling enhanced support options for tablets and mobile devices. Included in this multi-year project was a commitment to reducing custom modifications to the Banner platform by evaluating Virginia Tech's business processes and then deprecating more than 130 system modifications that were no longer needed. This change has significantly reduced the complexity of system maintenance and will facilitate interworking between business units going forward.

ES collaborated with Ellucian to allow the system modifications required by Virginia Tech to be translated to the new technology in a native fashion. The modern Banner 9 administrative pages technology has extensibility and configuration features that enable customization without modifications to the underlying software. The Banner 9 architecture also includes the Ellucian Ethos platform, a foundational component for advancing data analytics and third party product integrations. Banner 9 enables Virginia Tech to modernize our ERP environment, to analyze and reassess university business processes within current ERP functionality, and to continue to align our applications with university best practice implementations into the future.

#### **Facilitating the addition of the Virginia Tech Carilion School of Medicine as Virginia Tech's ninth college**

Virginia Tech recently expanded its commitment to the health sciences with the addition of the Virginia Tech Carilion School of Medicine (VTC SOM) as the university's ninth college. In preparation for this growth, ES successfully partnered with university

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stakeholders during FY 2018 to establish the various administrative functions needed to integrate VTCSOM into Virginia Tech's academic, human resources, and financial milieu. These functions include human resource processes, admissions processes, access to the course catalog and timetable of VTCSOM classes, academic histories, and transcripts. Effective collaboration between the Division of IT, university stakeholders, and Carilion leadership resulted in a successful and timely integration of VTCSOM, with the full functionality required for Virginia Tech's newest college.

### Supporting Virginia Tech's strategic goal to increase efficiency of administrative processes

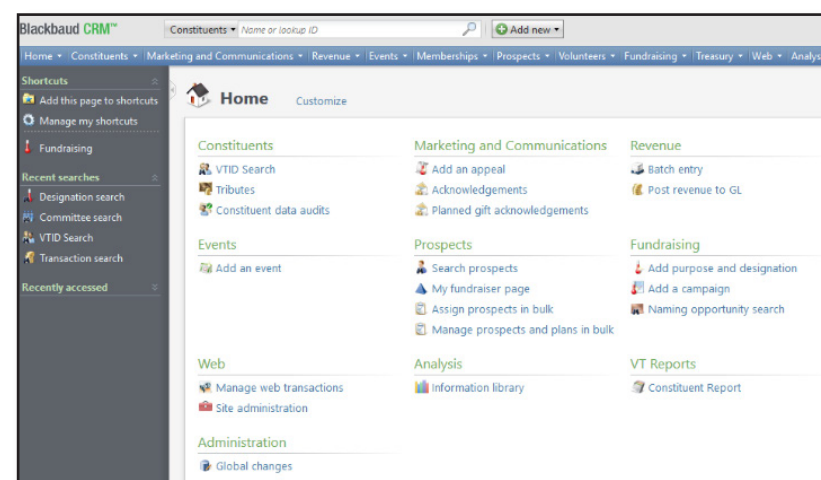
The Virginia Tech Division of Human Resources coordinated with ES to implement the Equifax salary verification system, simplifying and expediting the process of employment verification for new and continuing employees. The new system saves personnel time and provides a better experience for university employees.

ES also enhanced Virginia Tech's in-house leave system to provide processing and management of paid overtime, saving personnel time in handling overtime processes, and reducing complexity and errors in payroll transactions. Human Resources is deploying this functionality to the campus in a phased implementation.

### Providing new capabilities to support the university's strategic objectives of increasing and diversifying our funding sources

During FY 2018, ES worked with the Division of Advancement to successfully complete a multi-year project to implement the Blackbaud Customer Relationship Management (CRM) system,

which was designed and configured specifically to support the future direction of the Advancement division's services. The system combines online applications, actionable prospect research, and analytics with multi-channel direct marketing in one platform to enable an integrated view of the constituent experience across the organization. In addition to Blackbaud, a variety of other new Advancement-related applications were implemented, including an improved user interface for online giving to Virginia Tech, support for crowdfunding opportunities, and the Paciolan Advantage system for integrating donations to athletics with athletic ticketing.



The Blackbaud CRM system provides a single platform for University Advancement to manage marketing activities.

### Seeking opportunities to achieve or enable administrative efficiencies and partnerships

In FY 2018, the Information Technology Experience and Engagement (ITEE) team provided system administration for an increased number of campus partnerships focused on IT support. The department of Mining and Materials Engineering, Virginia

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Tech Carilion School of Medicine, the Virginia Maryland College of Veterinary Medicine, the Graduate School, and the Office of the Vice President for Research and Innovation all entered collaborative partnerships with the Division of IT to leverage the division's primary support and IT service management platform, known as ServiceNow. In total, there were 12 defined partnerships for incident management at the end of the fiscal year.

These partnerships enable organizations to improve the support experience for their users and allow participating teams to easily share and analyze data, try new processes, explore new services, and improve efficiency by not having to secure, socialize, and maintain their own systems. This approach to platform sharing has resulted in greater collaboration and partnership between the division and distributed IT groups in the colleges, institutes, and administrative areas across Virginia Tech. ITEE will continue to expand and evolve this approach over the coming years.

### **Advancing internal collaboration for greater efficiency and cost savings**

As a result of two new approaches, ITEE was able to reduce software licensing fees by over \$34,000 over the course of 2018. Through a collaborative project with Network Infrastructure and Services (NI&S), the Division of IT transitioned from using XpressConnect (a software utility that configured client machines to connect to wireless networks) to a free, open source solution called EduroamCAT.

ITEE also sought to modify licensing agreements with Symantec Antivirus. Due to licensing changes, students could no longer be covered under the existing contract. Instead of seeking to resolve this

with Symantec, ITEE reviewed market offerings in conjunction with the IT Security Office and others to determine whether viable market alternatives were available. Based on this research, the Division of IT was able to recommend multiple options for student antivirus protection that no longer required maintaining the Symantec coverage. Because FY 2018's savings resulted from a unique set of circumstances, this level of cost savings may not be feasible in most years; ITEE will continue to seek opportunities to reduce costs and generate efficiencies for our organization moving forward.

ITEE also engaged in several high-impact collaborations that brought new functionality and streamlined operations for groups across the university. One of these projects was a partnership with Secure Identity Services (SIS) to enable authorized partners outside the division to offer VT Username (formerly PID) password resets to their faculty, staff, and students. ITEE and SIS also worked together to streamline access to a user lookup tool employed by IT personnel and the Division of Human Resources and began working with distributed IT personnel to develop a support model designed to meet their specialized needs.

### **Creating a new annunciator channel for VT Alerts**

VT Alerts was designed to allow use of several communication channels simultaneously. The newest channel is the Annunciator channel, which enables text-to-speech conversion and makes it possible for building-wide audio devices, like fire alarms, to be used for audio notifications. The new devices utilize the same protocols currently used for standard public safety messages, but have a greatly increased range, since audio notifications can reach more people, over a wider area, than visual boards. Central infrastructure was deployed and eight buildings were enabled to receive audio based VT Alerts notifications.

### **Innovating a new message board channel for VT Alerts**

As part of the VT Alerts service, NI&S supports a total of 586 public safety message boards, which are nearing end of life. In close collaboration with internal and external partners, the next generation of boards has been identified and the application portfolio has been expanded to allow use of the new technology format. As part of the project, a new support application was developed to enable support teams to operate, administer, manage, and provision old and new message boards from a single location. These innovations are preparing the university to utilize the next generation message boards to provide visual alert notifications to the campus community.

### **Adding a back-up interface for VT Alerts**

VT Alerts supports both on-premise and off-premise components to allow multiple communication channels to be utilized for emergency notifications. In addition to a cloud interface, a new local interface for on-premise channels has been designed, evaluated, and deployed. This new interface allows university stakeholders access to on-premise VT Alerts channels, in case of a network edge connectivity loss or if the cloud interface is unavailable. This further increases the reliability of the system by allowing an additional means of notifying the university community in the event of an emergency.

### **Designing and installing telecommunications infrastructure at the Emergency Operations Center**

A new Emergency Operations Center (EOC) was built within the university's public safety building to centralize the command, control, and coordination necessary to manage incident response. NI&S worked closely with Virginia Tech Emergency Management to design and install telecommunications infrastructure necessary to assist in maintaining critical operations.

### **Expanding Virginia Tech's security camera footprint**

Expanding the university's security camera infrastructure to meet the increase in the university's square footage, as well as replacing existing equipment at the end of life were both identified as high priorities by university stakeholders, including members of Virginia Tech Emergency Management, the Virginia Tech Police Department (VTPD), and the Division of Operations.

During the infrastructure refreshment project, all central server components providing user access, monitoring, recording, and reporting functionality were replaced with new physical infrastructure and virtual application components. A new storage array was also deployed, increasing the available storage capacity of the system by 40 percent. This storage expansion was implemented on schedule, allowing the successful deployment of more than 100 new security cameras across the university.

The VTPD identified the need to allow for map-based selection of security camera video to enable first responders to view live video of specific locations. NI&S proposed and implemented a new software solution which utilizes GIS map layers unifying security



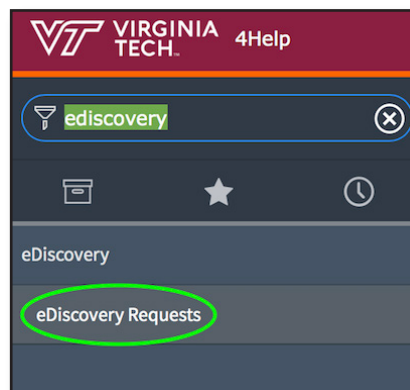
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video data with campus data maps, including emergency phone (blue light phone) locations and traffic conditions. The new solution revolutionizes the accessibility of the system, enabling immediate access to security camera video on a multi-layered university map.

### Enhancing eDiscovery services

The eDiscovery service enables IT support teams to identify, collect, and produce electronically stored information in response to a request related to a lawsuit or authorized investigation. This includes, but is not limited to, emails, documents, presentations, databases, voicemail, audio and video files, social media, and web data. During the past year, this service was transitioned from the legacy Digital Data Request System to the new ServiceNow portfolio.

Project members evaluated current processes, consulted with both internal and external customers, and operationalized several service components through close customer feedback and collaboration. The redesigned eDiscovery service includes a standardized data custodian interview format and standardizes communication with University Legal Counsel and university stakeholders. A new custom eDiscovery application based on ServiceNow was developed and deployed. The new application greatly improves request completion times by automating the request coordination between multiple support groups in the division.



Requesting Data from the eDiscovery Team

### Security and resilience of information technology resources

Information technology has become critical to the operation of the university's teaching, research, and outreach missions. The Division of IT remains committed to maintaining a strong and proactive cybersecurity posture, as well as a robust and resilient infrastructure, to minimize disruptions to our information technology services.

The university's overall cyber defense strategy is divided into six industry standard phases:

- Preparation - steps taken by the Division of IT before an incident occurs.
- Detection - the tools, software, and systems in place that can detect cyber attacks in a timely manner.
- Containment - steps taken to contain an attack once it is detected. These measures limit the spread and impact of an attack to internal and external resources.
- Eradication - steps taken to eliminate and remove the malicious software and unauthorized access or control of university technology resources.
- Recovery - steps taken should university data be compromised.
- Followup - steps taken to review the performance of the previous five steps to measure their effectiveness in responding to an incident.

As new cyber threats continue to mount, the need for continuous hardening, monitoring, and intervention, as well as preventive outreach, education, and networking continue to be of paramount importance. The Division of IT has focused major efforts in these areas in FY 2018.

In addition, new and ongoing services such as the container-based development solution Docker Trusted Registry and Life Cycle Management, which takes a proactive approach to network infrastructure upgrades, allow university stakeholders to conduct complex business operations and research with confidence.

#### Expanding cybersecurity outreach

Educating the university community on ways to protect themselves and their data from unauthorized access or modification remains a top priority within the university as well as for the Division of IT. In addition to providing online security awareness training to 5000 users, the IT Security Office (ITSO) raised the university's cybersecurity awareness by providing training sessions to four departments; at three IT symposium events; and at both fall and spring graduate teaching assistant orientations, reaching an additional 1150 students and employees.

In collaboration with IT Experience & Engagement, ITSO also participated in Gobblerfest and Staff Appreciation Day activities to raise awareness of cybersecurity topics, and ways to stay safe online. ITSO also hosts a security course offered through the SANS Institute that enables IT professionals throughout the university to improve their technical security skills and update their knowledge of IT security topics and threats. The 2018 SANS training event was attended by over 70 Virginia Tech employees as well as participants from a number of universities, community colleges, and state governments. These events raise awareness of the importance of proactive cybersecurity within the university and other organizations.

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ITSO staff members presented at the following conferences or events: the Educause Security Professionals Conference and other Educause events; the VASCAN (Virginia Alliance for Secure Computing and Networking) Conference; the Ohio State Cybersecurity Symposium; two Council of Independent Colleges of Virginia panel events; the Gartner/Evanta Chief Information Security Officer (CISO) Symposium; the Harris Corporation Security Awareness program; the Mid-Atlantic Banner User Group Conference; the Common Solutions Group Meeting; the Roanoke Institute for Internal Auditors Chapter Meeting; the NYSERNET Conference; the Smart City Security Workshop; at meetings held at the Southwest Virginia Higher Education Center and Stafford High School; and at Gen Cyber.

Other outreach events included monthly participation on the VASCAN steering committee and hosting both the annual VASCAN Conference and the United States Cyber Challenge Eastern Regional Cyber Camp. Participating in or leading these outreach efforts assisted ITSO in fulfilling its outreach mission, and allowed us to learn from others. In addition, ITSO designs the curriculum for the U.S. Cyber Challenge summer camps. These efforts uphold Virginia Tech's reputation as a leader in cybersecurity.

ITSO also advances cybersecurity education through teaching and learning activities. The university Chief IT Security Officer teaches ECE 5585 and ECE 4560, while his deputy teaches ECE 5586. ITSO provides a cybersecurity lab for undergraduate and graduate students to participate in cybersecurity research using real data, and ITSO staff have provided guest lectures in other ECE courses as well as in ACIS and STAT, serving a total of 174 students in these classes. ITSO members are on the university Integrated Security Destination Stakeholders and Curriculum committees.

### Enhancing continuous monitoring capabilities

FY 2018 saw gains in the division's abilities to detect, contain, eradicate and recover from cyber attacks aimed at the university. The Centralized Logging Service (CLS) fulfilled a Cyber Security Task force recommendation to increase ITSO's ability to analyze how attacks take place by aggregating log data from servers and security tools across the university network into a single location that can be more easily monitored and searched during computer security incident response activities. The CLS helps the security team determine whether sensitive data has been stolen and how to limit the extent of an attack. This year, ITSO replaced older network security monitoring systems with the Zeek Network Security Monitoring System (<https://www.bro.org/zeek.html>). This tool monitors university network traffic on our border with the internet, looking for malicious network intrusion attempts and allowing ITSO to quickly detect and respond.

The Restricted Local Area Network (RLAN) provides additional monitoring and active response to systems that manage the university's business processes, such as financial transactions, personnel data, and sensitive data. Proactive system vulnerability assessment using the Rapid7 Platform allows university IT staff to deal with potential weaknesses in their systems. The DNS Restricted Policy Zone Firewall (DNS RPZ) provides a way to disrupt communications between compromised systems and hackers trying to access those systems. A total of 824 tickets were recorded, with 261 coming from 4Help and 563 from the Security Operations Center (SOC). These tickets represent the ongoing network security monitoring efforts of the SOC.

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Over the past year, ITSO also performed a total of 137 vulnerability scans and prevented more than 200,000 attempts to communicate with a hacker command and control machine.

Ticket submission continues to increase as ServiceNow becomes more integrated with SOC processes, and the number of vulnerability scans will also increase as we expand scanning capabilities into departmental network enclaves and cloud environments. ITSO has also implemented a 24x7 automated SOC process that Virginia Tech departments may opt into in order to receive alerts 24x7, 365 days a year. In FY 2018, ITSO developed the Hands-Off ITSO Scanning Tool (HOIST), FireEye Incident Notification Tool (FEINT), and the Credential Reset Incident Tool (CRIT) to automate trouble ticket reporting tasks.

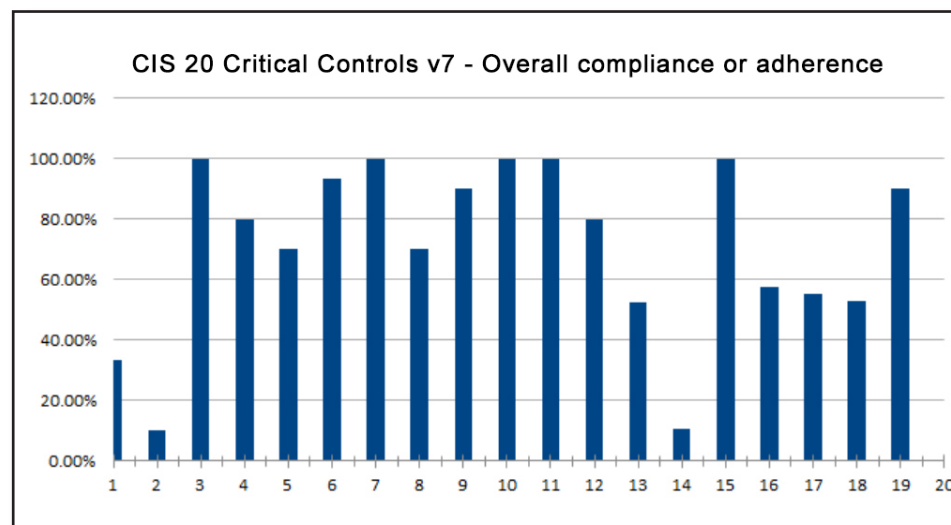
ITSO is continually improving the division's effectiveness in identifying and mitigating threats against Virginia Tech resources, making us better able to relentlessly pursue increased automation, leverage Agile and cloud resources, and simplify operational tasks in order to magnify the impact of our security efforts.

### **Providing Virginia Tech data trustees and custodians with the tools and knowledge to ensure the privacy and integrity of sensitive university data.**

ITSO, working with the Executive Director of IT Policy and Strategic Engagement, developed and published new "Data Steward Role Guidelines" ([https://it.vt.edu/content/dam/it\\_vt\\_edu/policies/Guidelines\\_for\\_Data\\_Stewards.pdf](https://it.vt.edu/content/dam/it_vt_edu/policies/Guidelines_for_Data_Stewards.pdf)) in October 2017. This guidance to data stewards covers the expectations and responsibilities of the role. As the demand for data analytics capabilities increases across the university, effective management of university administrative data is key to the university's success in these endeavors. The vice president

for each administrative area (typically in the role of "data trustee") designates Data Steward(s) to champion and facilitate the quality, appropriate use, and access restrictions for the data that are generated and administered within their domains.

ITSO also created new data classifications of 'low, moderate, and high' risk to replace the previous 'public, limited, and restricted' categories. This revision was published in policy 7100, Administration Data Management and Access Policy. In support of this change, ITSO developed and published the Risk Classifications Standard, Standard for High-Risk Digital Data Protection, and the Minimum Security Standard. The Minimum Security Standard outlines the baseline IT security standards that need to be implemented for low, moderate, and high-risk endpoints, servers, and applications.



The results of the gap analysis allow the ITSO to prioritize efforts in implementing the 20 critical controls and show progress made since the 2016 gap analysis. <https://www.cisecurity.org/controls/>



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The creation of the Standard for High Risk Digital Data Protection allowed the division to combine the previous Standard for Social Security Numbers and Standard for Storing and Transmitting Personally Identifiable Information into a single new standard. Additionally, ITSO updated its 20 critical control methodology and mapped the minimum security standard to the critical controls. ITSO, along with the Associate Director of University Security Initiatives, published the Logging Standard, which documents what types of events need to be logged and sent to the centralized logging service (CLS).

The completion of this documentation provides the university a common set of terms to use when talking about data and provides the basis for security requirements to protect the confidentiality, integrity, and availability of each class of data. These documents and all other IT policies and standards will continue to be reviewed to ensure consistency with current organizational structures and best practices.

In 2018, ITSO also performed its second gap analysis of the 20 Critical Security Controls within the Division of IT. The 20 Critical Security Controls are defined by the Center for Internet Security (<https://www.cisecurity.org/controls/>) and provide a framework and set of best practices for managing network security operations.

### **Initiating new cyberattack mitigation services**

During FY 2018, Virginia Tech subscribed to a cloud-based Distributed Denial of Service (DDoS) Mitigation Service offered by Internet2. The service protects Virginia Tech's on-premises application servers and network resources against large coordinated DDoS attacks. Internet2 offers the service as a hybrid solution where attack detection and attack signaling is done by the subscriber

(Virginia Tech), and mitigation is done by Internet2. Attack signaling is currently implemented on Virginia Tech edge routers, and attack detection/analysis is done manually. In the near future, with the help of a flow collection tool and a route server, both attack detection and signaling processes will be automated.

### **Enabling software containerization services**

The Division of IT recognized the need to provide a service to allow use of packaged software in standardized units for software development and deployment. A container is a standard unit of software that bundles code so that an application can convert quickly and reliably from one computing environment to another. A container image is a lightweight package of software that includes everything needed to run an application: code, runtime, system tools, system libraries and settings.

Containers as a Service (CaaS) provides container-based virtualization, in which container engines, orchestration, and the underlying compute resources are all delivered to users as a single service. With CaaS, users can create and manage containers using provider tools or a web portal interface. Within the spectrum of cloud computing services, CaaS falls between Infrastructure as a Service (IaaS) and Platform as a Service (PaaS). The basic resource for CaaS is a container, rather than a virtual machine (used in PaaS environments), or a bare metal hardware host system (used to support IaaS environments).

Network Infrastructure & Services (NI&S), in collaboration with staff from Enterprise Systems (ES) and the Chief Technology Architect's office, as well as staff in the Division of Student Affairs, the College of Agriculture and Life Sciences, and the Office of the

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VP for Research and Innovation, designed and created the Docker Trusted Registry (DTR) service allowing continuous integration and continuous delivery processes to build, ship, and run IT users' applications. The DTR has a web based user interface that allows authorized users to browse Docker images and detailed information about each image. The DTR scans each layer and aggregates the results to provide a complete picture of the container, verifying this information against a vulnerability database.

In addition to the DTR service, NI&S now serves in the role of cluster administrator, providing a Docker "Swarm" for developers to deploy images. This service currently supports users from across the division, in preparation for additional expansion.

### **Provisioning technology support for the airport runway expansion**

The extension of the Virginia Tech-Montgomery County Executive Airport runway required NI&S to relocate the primary copper and fiber connections to campus. A new concrete-encased conduit pathway, including multiple utility vaults, was constructed under the soon-to-be completed runway. New cabling, serving as the primary information transport to the Virginia Tech campus from Andrews Information Systems Building (AISB), was installed in the new duct bank. During this project, NI&S also constructed a new pathway into AISB enhancing the resilience of the physical network with diverse cable entrances into the building.

### **Managing the network equipment life cycle**

The Life Cycle Management (LCM) project is an annual initiative to refresh wired and wireless network hardware across the university. NI&S and the Office of Budget and Financial Planning collaborated to develop an investment strategy for refreshing network equipment on a scheduled life cycle. The 2017-18 LCM project upgraded 7,152 ports to support 1Gbps wired ethernet service in 70 buildings. The project replaced 492 wireless access points and added an additional 199 in 39 buildings. The wireless access points support 802.11ax (the latest wireless standard). The completion of the 2017 wireless LCM project ensured that all campus wireless access points support the latest standard.

### Improving communications with customers and partners

Sharing information effectively is what makes it possible to make the leap from capacity to achievement, from possibilities to positive outcomes. In the Division of IT we strive to offer communication that is service-oriented, tailored to the users' needs, and both technically accurate and timely. We seek to build relationships with key constituent groups, including students, faculty, and distributed IT personnel. Through these efforts, we aim to increase understanding, preparedness, and adoption of our tools and services; to create new opportunities for partnership and collaboration; and to stay connected and engaged as the university's needs continue to evolve.

#### Improving outreach and communications to the university community

In FY 2018, the Division of IT worked to share key messages for communication campaigns that included the promulgation of new password rules, changes in VT Username length, changes to the network password, the completion of the Canvas implementation project, the final implementation of 2-Factor Authentication for all university constituents, the launch of OneCampus, the Banner 9 transition, the launch of Zoom and Kaltura, the changes in Symantec Antivirus licensing, and the renewed enforcement of software license review policies.

In addition, publicity was shared related to the addition of the Huckleberry HPC cluster, and the exponential growth of course offerings and utilization of the Virginia Cyber Range. These efforts were aided by the addition of new communications personnel in Technology-enhanced Learning and Online Strategies (TLOS) and the Virginia Cyber Range, which has expanded communications capacity for new initiatives and ongoing efforts in those units.

Event-based outreach and engagement is another important component of the division's communications strategy for campus and the region. The Departmental Computing Support Symposium, hosted by the division in the spring and fall, brought together members of the division and IT professionals from other departments to share information about new and ongoing IT initiatives. The division's major spring diversity event brought together members of the local community, including K-12 students, for a showing of "Hidden Figures," introduced by Industrial & Systems Engineering Ph.D. candidate TeAirra Brown, and followed by tours of campus STEM facilities in the College of Science, College of Engineering, and the Division of IT.

IT Experience & Engagement (ITEE) and the IT Security Office (ITSO) worked together to promote awareness of IT security issues as well as the availability of OneCampus to over 1,000 Virginia Tech staff members and more than 8,000 students at Staff Appreciation Day and GobblerFest, respectively. The Student Programs group in ITEE provided timely IT information for newly admitted students as part of the New Student Orientation outreach effort, and a cadre of volunteers from across the division facilitated several summer camp engagement offerings designed to get K-12 students thinking about life after high school, and the possibility of making Virginia Tech a part of their plans for the future.

The division also continued to evolve procedures for sharing information during service outages through the Major IT Service Issue process (MITSI). MITSI describes procedures to follow for communication and responses to division leadership, the distributed IT community, and the full university community during outages, depending on their impact, severity, and duration.





In cooperation with the Division of Advancement, Division of IT communications staff supported the transition to new, approved logos for all units and provided feedback on site accessibility and design considerations that were useful in connecting University Relations staff with accessibility experts in TLOS, in support of the university's new web templates.



Example of an FY 2018 ACCS Presentation given by Division of IT team member Joyce Landreth in partnership with colleagues from University of Richmond and University of Virginia

A total of 18 IT professionals from Virginia Tech shared their knowledge on a variety of technical topics with our university colleagues from around the state at the annual Association of

Collegiate Computing Services of Virginia (ACCS) Conference in March 2018. ACCS is a significant conference for the Division of IT, providing major opportunities for networking, recruitment, and information sharing for IT professionals within the state. Our ties to ACCS are strengthened by the participation of an ITEE team member on the ACCS board, a key advocacy resource that helps ensure that topics of interest to Virginia Tech are covered at the conference.



A few photos from our FY 18 K-12 STEM outreach events.



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The division significantly expanded efforts in K-12 engagement during FY 2018, offering several STEM workshops, tours, and enrichment activities throughout the year. These efforts have resulted in beneficial new partnerships with colleges and departments across campus, and have advanced the goal of diversity and inclusion in STEM and IT. These events are a new area of emphasis for the division, and efforts are underway to develop a unified plan for K-12 outreach, including defined guidance for employee participation in these efforts, and plans to sustain these efforts into the future.

### **Developing and implementing a plan to actively engage our communities**

The division began working to develop and implement a portfolio of strategies and processes to actively listen to, seek input from, and build awareness of people, protocols, and units outside the IT organization. In FY 2018, this included having each unit within the Division review current utilization of advisory and stakeholder groups to identify gaps, refine roles, and update or create charters. The division began work to address identified gaps and establish sustainable, effective lines of communication.

Outcomes from this work in FY 2018 included the redesign and relaunch of the dormant Computing and Communications Resources Committee as the **IT Service and Systems Committee**, reporting to the Commission on University Support. The approved charge for this committee now enables it to make recommendations for the effective offering and utilization of university information technology services and systems, and to recommend policies that relate to the governance of these services and systems. The committee's scope of concern includes all information technology services and systems related to instruction, research, outreach, and administration at the university.

The committee organizes into subcommittees to address specific aspects of information technology services and to report to the committee. Each subcommittee will be chaired by a member of the Division of IT with other members being assigned or volunteering based on interest or knowledge of subject matter area.

This university-level governance structure and scope improvement has been complemented by efforts at the unit level to more broadly engage and seek input and guidance from colleagues across the institution. A notable achievement in this space was the successful formation and launch of a new Enterprise Systems advisory group, which has provided valuable consulting and advice in support of the Banner 9 effort across the university.

The division has evaluated and improved interactive communication with multiple segments of the university, and has established plans to engage particular audiences based on the strategic needs of each group. From here, ongoing and active participation in university strategic planning and Master Plan activities will focus on understanding constituent IT needs. Additionally, we have increased focus on service discoverability through the ServiceNow and OneCampus platforms.

### **Seeking opportunities to continuously improve and change how Virginia Tech delivers services to enhance the university's ability to move Beyond Boundaries**

The Division of IT has worked to improve transparency, discoverability, and reportability of IT services across the university, and successfully deployed OneCampus as a mobile capable, customizable discovery tool for users with differing needs. All of this was part of a roadmap of potential service needs which is directly



informed by the university's initiatives, our user communities, and best practices.

Additionally, the division significantly increased its promotion of accessible technology methodologies and support, offering several new ways to learn and connect with the accessible technologies group within TLOS. A weekly brown bag seminar was opened to the university community, and an accessibility liaisons group was formed to build a network of champions for accessible design. Accessible Technologies also supported University Relations as they worked to develop new university web templates that were significantly more accessible (the Ensemble One Theme).

### Promoting awareness of IT project management policies and processes

Additionally, the division redesigned the [Standard for Information Technology Project Management](#) to include new and alternative methodologies and processes for management of IT projects. [Policy 7210, Information Technology Project Management](#), was revised and put into practice. A redesigned decision support tool, the [project scorecard](#), was created to aid project managers in assessing the risk and complexity of a project. All elements have been released and updated, and several awareness communications and use training have been conducted across campus.

Moving forward, the division will continue to monitor and refine the project management program elements.

### Developing new services that meet identified gaps in our service portfolio

In January 2018, Collaborative Computing Solutions (CCS) released a new consultation service to help researchers explore and define their cloud data and computing needs, and connect them with available programs and resources to meet those needs at Virginia Tech. These consultations bring together expertise from researchers, the Division of Research, and the Division of IT to help researchers understand their options fully. In support of university research, this program assists in validating data compliance agreements and documents required for grant initiation, and connects researchers with university partners that govern university and individual compliance of data sharing agreements, terms of grants and contracts, laws and regulations, university policies, etc.

This year, the division also added data risk and compliance callouts to relevant entries in the IT Service Catalog. These callouts help users easily identify the types of data that can be shared or stored in specific environments, based on data security standards published by the ITSO. These standards are now available for commonly used file storage and collaboration solutions including Google Suite for Education, Office 365, and Slack.

Through CCS, the division developed four Networked Learning Initiatives courses to improve understanding and utilization of online collaboration spaces at the university. These courses include online collaboration using the Microsoft Teams, Google Suite for Education, and Slack platforms, and an overview course exploring the difference between online collaborative spaces and intranets.

### **Delivering key presentations to peer and advocacy groups**

The Network Engineering and Operations program has successfully developed and incorporated network automation into its operational functions. This effort was shared with an Internet2 Working Group at the University of Michigan in June 2018 (presented by Lee Whittaker), initiating additional inquiries and information requests from peers.

NI&S collaborated with the Virginia Tech Office of Emergency Management for two presentations on campus safety and security to the Common Solutions Group in the Fall of 2017. The first presentation focused on the gains that become possible through direct stakeholder engagement and the formation of a single support team that brings IT experts into long-term collaboration with public safety units. This allows all technical support activities to be coordinated through a single group, providing dedicated personnel, and reducing response times dramatically.

The second presentation covered technical efforts in the creation of Virginia Tech's new message board and annunciator channels, as well as improvements to the university's emergency notification system, VT Alerts. The presentation included information on advanced monitoring tools, life cycle planning for the service, ways to increase redundancy for each component, and the importance of testing and monitoring to detect and resolve issues before they impact the service.

### **Providing leadership and support for the Mid-Atlantic Research Infrastructure Alliance (MARIA)**

The Division of IT provided engineering and operational support to the Mid-Atlantic Research Infrastructure Alliance (MARIA) to deliver high performance wide-area network services linking

regional research universities and federal laboratories to national and international research networks. A major accomplishment was an upgrade of fiber networks in the state in partnership with Mid-Atlantic Broadband Communities Corporation (MBC) to provide increased reliability with optical diversity for critical paths. Through active participation at the national level with technical support to the Quilt Commodity Internet Service RFP process, Virginia Tech reduced the cost for commodity internet service to participating MARIA members by 50%, while increasing the capacity of those services.

Virginia Tech successfully renegotiated terms for colocation and related services for the Mid-Atlantic Research and Education Exchange (MREX) located in Ashburn, Virginia which has yielded cost benefits to MARIA and other MREX participants for several years.

The university also provided support to the Virginia Department of Education's new K-12 Learning Infrastructure Program Working Group including new connectivity to Internet2 for a pilot group of schools and development of related technology plans for network access for K-12 schools statewide. Additionally, the installation of an aggregation switch enabled data transfer capacity upgrades for several MARIA members including the University of Virginia, George Mason University, and Virginia Commonwealth University. The new switch delivered a ten-fold increase in capacity to the MREX, reaching 100Gbps for these universities (Virginia Tech achieved 100Gbps in 2016).

### Strengthening the Information Technology organization

We seek to build a strong and thriving IT organization at Virginia Tech, a division that is resilient, adaptable, intelligently resourced, and committed to doing the work needed to enable the university to achieve its missions. To build such an organization, it is necessary to commit to continuous improvement, fearless exploration of perceived gaps, and sustained efforts to support and develop a welcoming, diverse, and empowered workforce.



Broad cross-division engagement on major projects and initiatives increases the likelihood of success, and helps identify potential issues that smaller teams might not have flagged.

#### Promoting a culture of openness, professional development, and information sharing within the Division of IT

The past year was a time of significant advances in the division's strategies for employee engagement and retention, with the rollout of

two new initiatives to benefit employees - the Employee Recognition Program and the Leadership Development Program (LDP), both emerging from the division's Human Resources (HR) office. The first of these is an officially recognized award program for employees, with three types of awards available, a rolling peer nomination and selection process, and two annual events focused on recognizing employee achievement. The second initiative, the Leadership Development Program, is a yearlong cohort-based leadership mentoring program specifically for IT professionals, which seeks to develop soft skills and offer opportunities for networking, professional development, and relationship building. Both programs had a successful start, and continue to build awareness and participation.

A third HR initiative sought to assess needs and gauge the current status of employee engagement and satisfaction with the workplace climate across the Division of IT through the use of a survey. Several units worked with the HR office to expand and disseminate the second round of the IT workplace climate survey, which built on the initial survey conducted in Spring of 2017. The 2018 workplace climate survey was conducted in May-June 2018. Across the division, 43 percent of employees responded, marking a 10 percent improvement over the first cycle. Responses gathered from the first cycle also led to several improvements across the organization.

Among these improvements was the launch of a multi-year effort to improve internal communication and collaboration across our nine units. Combining the results from workplace climate surveys, interviews with division leaders, and perspectives from members of our communications team, a vision for improved internal communication is taking shape that seeks to serve our



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employees' interest need for deeper and more consistent sharing of useful and actionable information, process guides, and status and tracking reports. The exploration has resulted in a plan that includes development of a new intranet site for division employees, strategic and structured use of chat and online collaboration platforms, increased sharing of information on projects and initiatives, and new methods for requesting communications support.

The Division of IT continued to benefit from the combined efforts of a communications team dedicated to advancing communication across the organization. The IT Communications Team led internal communications initiatives including the coordination of a unified digital signage platform to allow joint administration and sharing of sign content, greater coordination of social media platforms for service management and information sharing, and advising the launch of our new workplace collaboration platform, Slack. The IT Communications Team will continue to evolve towards increased cooperation and shared responsibilities for its members.

### **Fostering a diverse and inclusive community by developing these competencies in our workforce**

This year, the division established new mechanisms to support diversity and inclusion in unit recruiting efforts and hiring practices. This included the formation of a new Diversity Committee with representation from each unit within the division. Committee members are all trained Diversity Advocates, and in addition to their service on the committee, provide capacity to support the Division of IT's requirement (implemented in FY 2018) that a Diversity Advocate participate on the search committee for all full-time positions.

After the second round of workplace climate surveys, an analysis of the findings was used to develop an action plan that included a number of diversity and inclusion-centered activities and considerations. This plan will be implemented in FY 2019.

As part of the Leadership Development Program, knowledge partners both internal and external to the Division of IT were asked to facilitate targeted learning experiences for LDP participants. This helped to meet the overall learning objectives of the program, adding modules on problem solving and decision making, strategy in action, and the value of broadening community. The overall success of the initial year of LDP bodes well for its growth and evolution in coming years.