

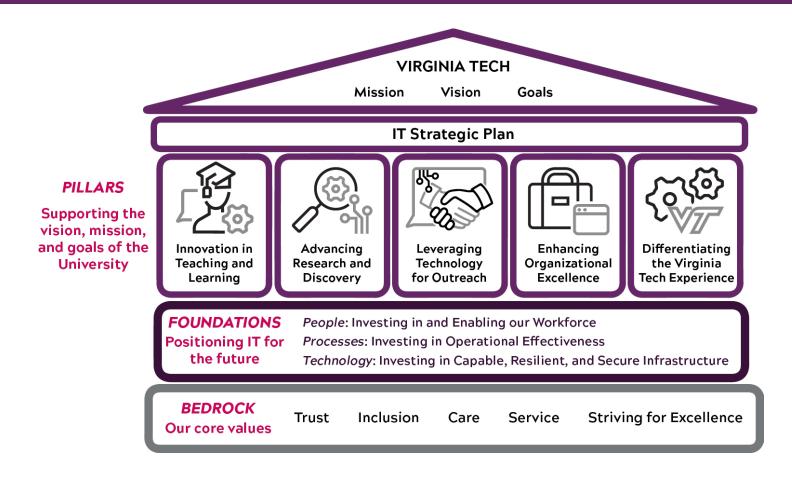
# Division of Information Technology

Annual Report Fiscal Year **2021** 



#### **TABLE OF CONTENTS**

Letter from Vice President for Information Technology & CIO Scott Midkiff	1
Fiscal Year 2021 Financial Summary	3
Innovation in Teaching and Learning	4
Advancing Research and Discovery	18
Leveraging Technology for Outreach	23
Enhancing Organizational Excellence	30
Differentiating the VT Experience	43
People (Investing in and Enabling our Workforce)	51
Processes (Investing in Operational Excellence)	54



#### LETTER FROM VICE PRESIDENT FOR IT & CIO

I am pleased and honored to introduce the Division of Information Technology annual report for the 2020-2021 fiscal year! Across the world, the nation, and Virginia Tech, FY 2021 was dominated by the COVID-19 pandemic. The academic, research, and administrative enterprises of Virginia Tech were all significantly impacted by public health measures in response to COVID-19, economic changes due to the pandemic and other factors, and unrest and change driven by a renewed focus on social justice.



Scott F. Midkiff, Vice President for Information Technology & CIO

The employees of the Division of IT responded to these changes with expertise, energy, and dedication. We transitioned support for emergency remote teaching from the quick reactive measures of March 2020 to a comprehensive program that was sustained across the 2020-2021 academic year. We significantly improved the university's support for accessibility to learning materials for all students through consulting, training, and tools. We provided Wi-Fi to new locations so students could study and socialize outdoors. We met increased demands for connectivity and IT security for the university's remote and onsite workforce. We managed data and provided dashboards for key metrics related to COVID-19 cases and vaccination status. These are just a few examples of the great work done by many across the Division of IT to support the university during the COVID-19 pandemic.

While meeting these new needs, the Division of IT's "normal" work and responsibilities did not diminish during FY 2021. Division of IT employees continued to provide the many core services that are critical to the operation of the university and to meeting Virginia Tech's mission for teaching and learning and for research and innovation. We continued to push forward with our IT strategic and operational plans during FY 2021. At the end of FY 2021, we also positioned Virginia Tech for a comprehensive IT assessment and IT security review which, in turn, lays the foundation for the university's ongoing IT Transformation Program.

I am proud of the contributions and achievements of the employees of the Division of IT for reliably and effectively operating our systems and providing core services, doing special work

in response to the COVID-19 pandemic, and enabling the future through execution of the strategic and operational plans. This annual report provides a summary of part of this large body of work in the context of the five pillars of our Division of IT Strategic Plan: Innovation in Teaching and Learning; Advancing Research and Discovery; Leveraging Technology for Outreach; Enhancing Organizational Excellence; and Differentiating the Virginia Tech Experience. The report also summarizes our advances in the key foundational areas of People and Processes.

Thank you for your interest in the work of Virginia Tech's Division of IT. I hope that you will join me in my appreciation of the service and dedication of Division of IT employees in supporting the university and the university community.

Scott F. Midkiff, Ph.D.

Vice President for Information Technology & Chief Information Officer

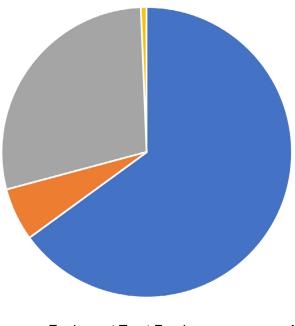
#### Fiscal Year 2021 Financial Summary

The financial summary below provides an overview of the total budgeted funds and expenditures for the Division of IT during FY 2021 (July 1, 2020 - June 30, 2021).

#### Vice President for Information Technology Financial Summary, Fiscal Year 2021

	Total Budget	Total Expenditures
Education and General Funds	\$53,160,811	\$43,808,064
Equipment Trust Funds	\$3,829,249	\$3,953,955
Auxiliary Operations	\$21,292,010	\$19,268,285
Sponsored Grants and Contracts	\$1,641,610	\$404,811
Continuing Education / IDDL Funds	\$253,308	\$1,746
Overhead Funds	\$1,888,206	1
Other Sources	\$249,910	\$256,516
Total	\$82,315,104	\$67,693,377

#### Fiscal Year 2021 Expenditures



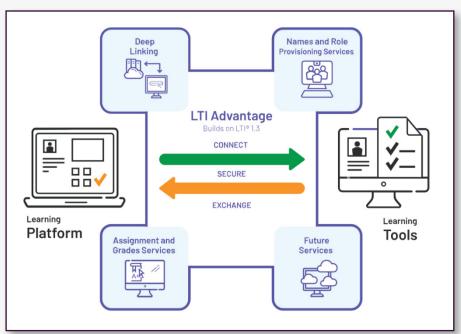
- Education and General Funds
- Equipment Trust Funds
- Auxiliary Operations

- Sponsored Grants and Contracts
- Continuing Education/IDDL FundsOverhead Funds

#### Learning Tools that transform the hybrid classroom

Technology-enhanced Learning and Online Strategies' commitment to innovation in teaching and learning includes the periodic analysis of Canvas tools and faculty-driven requests for new features. When considering requests, TLOS focuses on extending functionality and promoting Canvas as the central learning hub for Virginia Tech courses. LTIs (Learning Tools Interoperability standards) provide a standardized way of integrating learning tools with Canvas. In FY 2021, the growing collection of Canvas tools and feature updates served to enhance the hybrid classroom experience.

Many Virginia Tech
courses rely on computer
labs for in-class
instruction or homework.
With physical computer
labs closed due to
COVID-19 restrictions,
and many students
attending classes
remotely, providing a
cloud-based computer
lab option became a
priority. After examining
several options, TLOS
and Virginia Tech



Learning Tools Interoperability (LTI) seamlessly integrates learning tools into the Canvas platform, allowing instructors to utilize a variety of tools and methods while providing an optimal student learning experience.

selected <u>Apporto</u>, a cloud-based virtual lab service that allows access to a variety of software options with a consistent virtual desktop experience for all users.

Apporto includes monitoring, backup, patching, and other software and hardware maintenance. Virtual desktops can include both free and paid software applications

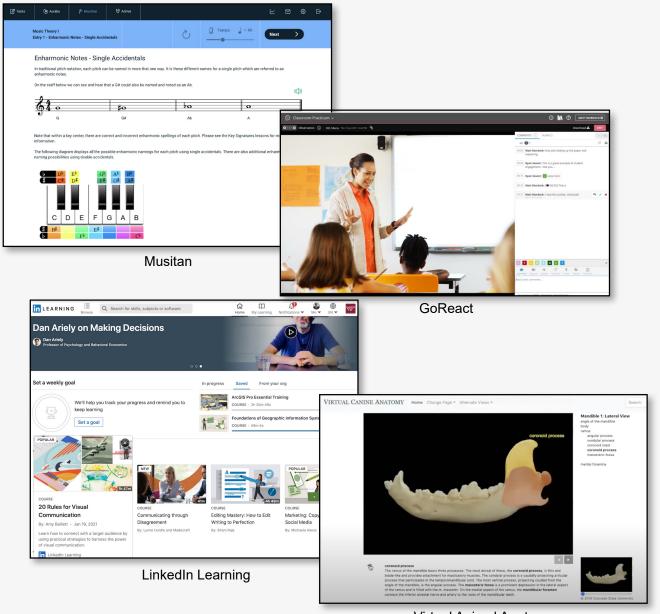
that have been approved for use at Virginia Tech and licensed by the university, department, or instructor. Available software includes SPSS, MATLAB, ArcMap, JMP Pro, ArcGIS Pro, and AutoCAD, with support for Windows and Linux virtualization. Collaborative features such as screen sharing, remote desktop capabilities, and user profile persistence produce an experience similar to using an in-person lab. This service was available at no charge during FY 2021 was considered.

In addition to Apporto, most of the other LTIs added during FY2021 offered specialized course support:

- <u>Auralia/Musition</u> allows band, orchestra, and choir students to complete their homework and assignments while faculty track completion, give feedback, and assign grades.
- GoReact delivers online video feedback, developing performance-based skills in a variety of disciplines.
- <u>Labflow</u> supports students as they attend labs, collect data, and write reports
  while also providing lab management, grading support, and teaching and
  learning analytics for instructors.
- <u>LinkedIn Learning LTI</u> provides easy authentication and allows video content to be assigned and graded within Canvas.
- New Quizzes is an assessment engine that integrates with Canvas and new features such as setting student quiz accommodations for a whole course, shuffling question answers, printing quizzes, requiring a waiting period between attempts, and using stimulus, ordering, and hot-spot question types.
- <u>Virtual Animal Anatomy</u> is an online program that provides canine, equine, feline, and bovine anatomy lessons for the Virginia-Maryland College of Veterinary Medicine.

Other LTIs added prior to FY 2021 support the hybrid classroom by creating opportunities for enhanced learning, collaboration, and testing. Continued support for Zoom and Kaltura with associated captioning services produces visual assets that are shown to enhance learning outcomes. Discussion tools like Piazza allow

students to ask and answer questions and increase engagement. Proctoring options provided by Respondus give students the ability to complete quizzes and exams while maintaining physical distancing.



Virtual Animal Anatomy

Learning Tools Interoperability (LTI) seamlessly integrates learning tools into the Canvas platform, allowing instructors to utilize a variety of tools and methods while providing an optimal student learning experience.

#### Enhanced data analytics capabilities provide new insight into the benefits of learning technologies

Progress continues on the data analytics collaboration between Enterprise Systems (ES) and TLOS. An environment to consolidate and visualize data is in place at the **University DataCommons**, a web-based application intended to provide strategic insights for decision makers throughout the university, helping the university make informed decisions using commonly defined data.

The dashboards developed share reports on employee and graduate student participation in Professional Development Network (PDN) and LinkedIn Learning courses as well as universitywide Zoom usage, with visualizations that can be customized to show single-year or multi-year data. Kaltura data has also been loaded into the system with data visualizations coming in FY 2022. Work has also begun to allow visualization of course evaluation data.

This project helped the Learning Systems team provide PDN transcripts within the PageUp learning management system. Employees can now see their PDN transcript in the same location they find records of other training and professional development activities.

These data analytics contribute to information technology decision-making, facilitating a deeper understanding of how students and employees are using university-provided tools and services.

#### Providing specialized training and education to serve university missions

One of the most easily identifiable ways that the Division of IT support the university's missions is by sharing our expertise with university employees, as well as with our colleagues and counterparts nationwide. We provide a wide variety of training opportunities and educational content, from guest lectures and whole university courses to targeted workshops, conferences, and professional development offerings. While the pandemic limited many of our usual conference interactions, the division remained active, delivering presentations and workshops at high-profile symposia at the state and national level.

In FY 2021, Division of IT personnel provided course content for Computer Science, Electrical and Computer Engineering, Math, Computer Modeling and Data Analytics, and Biological Systems Engineering courses, as well as for the Masters in Information Technology.

Additionally, division personnel provided extensive professional development offerings in a wide variety of areas, including digital accessibility and inclusion, advanced research computing, collaboration platforms including Google Workspace and Microsoft, service management using ServiceNow, IT security, and the IT major incident process. Many of the offerings included video tutorials or asynchronous learning options. The division also provided specific outreach to students during New Student Orientation.

The Vice President's office also hosted two online symposia for IT professionals across the university to expand connections and awareness of new service offerings, upcoming changes, and opportunities for collaboration. Known as the Departmental Computing Support Symposium, this long-running series has become a primary touchpoint for IT employees working all over the university. During the pandemic, as some options for networking and connection were curtailed, participation in this symposium grew by 15 precent.

## Bug Bounty Program provides hands-on practice for students while bolstering the university's cybersecurity efforts

Virginia Tech's IT Security Office (ITSO) employs multiple tactics to protect the university's cyberinfrastructure. These include "red teaming:" actively looking for vulnerabilities much like a

hacker would, and then repairing any issues before bad actors can exploit them. In March 2021, the ITSO established the Bug Bounty Program, which invites Virginia Tech students and staff to test for vulnerabilities, or "bugs" in select university domains in exchange for a cash reward for any issues found. This innovative new program not only helps the ITSO to expand the university's cybersecurity efforts, but also provides an opportunity for interested Virginia Tech students to hone their red teaming skills, which are highly sought after in the cybersecurity field. By the end of the spring 2021 semester, the program had 40 registered participants. With their help, the ITSO was able to correct several vulnerabilities.



Daniel Schoenbach, a computer science and mathematics major, was among the first Bug Bounty participants to identify and report a vulnerability to the IT Security Office.

#### Moving into new offices during a pandemic

TLOS completed the renovation of University Mall, Suite 21 and moved in during November 2021. TLOS' new home includes a variety of collaboration spaces, a professional development classroom, a formal conference room, a break room/kitchen, and a DIY video production studio. The newly renovated suite has built-in perimeter offices with modular walls forming the interior offices.

As part of the move, most of the space TLOS had occupied in Torgersen Hall transitioned to Computer Science.

Accessible Technologies' offices remained



The entrance to the TLOS suite features a large collaboration space with a variety of seating options.

in 2020 Torgersen Hall to remain close to the Services for Students with Disabilities office and the students and faculty they serve.

### Helping departments and degree programs offer online or flexible learning models

Selecting programs eligible for conversion to online or flexible learning modalities relies on TLOS' partnerships with the Provost's Office and academic deans, prioritizing programs based on university strategic needs. In FY 2021, TLOS partnered with four programs — Computer Science, Agricultural Economics, the online MBA, and the online MPA — to provide instructional design services as these programs expand their online and flexible curricula.

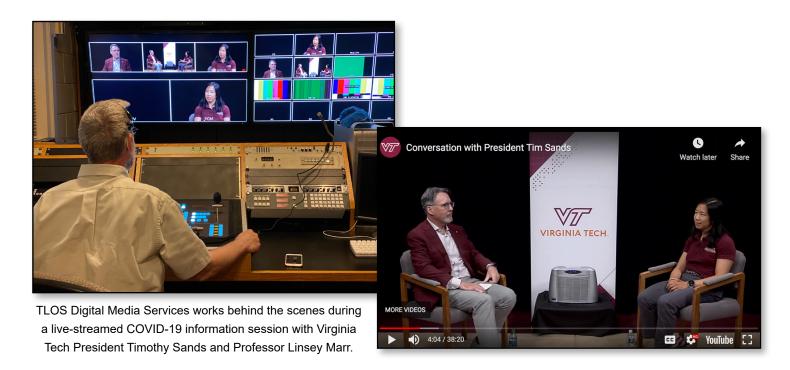
Instructional designers tailored their services to these programs to address specific needs and help each program meet its unique goals. Services ranged from customized professional development to full-production services. For example, one customized professional development approach provided consultations and training focused on tools, templates, and techniques to create predominantly synchronous courses. While, a full production approach emphasized TLOS instructional designers and media producers developing learning objects, including production-quality videos.

Another step in the course conversion process is reviewing courses to assure their quality. TLOS worked with partners to create a quality assurance (QA) checklist and recruit and prepare faculty volunteers for a peer review QA process. The QA peer review program by these faculty volunteers is expected to begin in the third quarter of FY 2022.

In addition to the focused department and degree program efforts, TLOS learning technologies specialists and instructional designers conducted 798 individual consultations with faculty — a 30 percent increase over the last fiscal year, made possible by permanently adopting the COVID response service model that made more TLOS employees available to meet with faculty. Consultations provided assistance with Canvas (35 percent), Zoom (27 percent), Kaltura (20 percent), and general course design (15 percent).

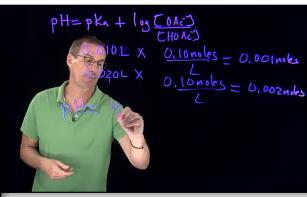
#### Educational video projects bring learning to life

TLOS' Digital Media Services (DMS) team completed 109 educational video projects in FY 2021. Many of these video assets were incorporated into Canvas courses and the degree program modules. In addition, DMS produced 24 projects for non-course-related purposes and supported six university livestream Zoom events such as President Sands' town hall broadcast.





Human Resources at Virginia Tech is partnering with TLOS to produce a series of Human Resource related roundtable discussions.



Matt Eick from the School of Plant and Environmental Science runs equations on a TLOS light board during an instructional video.

# Award programs and grants foster innovation in the classroom and beyond

TLOS offers several <u>partnership opportunities</u> to strengthen teaching and learning using technology. Sandbox Projects support the research and development of emerging learning technologies. Seed grants, curricular redesign grants, and competitive research grants are available through the <u>Innovation in Learning</u> and <u>4-VA</u> award programs. The transition to department and program-based funding partnerships, coupled with TLOS' increased focus on operational work related to COVID-19, hampered FY 2021 sandbox efforts. As a result of these changes, the TLOS

innovation pipeline model is being analyzed and refined to formalize the process for proposing, conducting, and assessing future sandbox projects.

TLOS worked with the Provost's Office to award 4-VA funds to departments and programs that were focused on developing flexible online learning experiences. Awards went to the College of Engineering for the development of the MEng degree in Computer Science & Applications or Computer Engineering as part of the <a href="Tech Talent Pipeline">Tech Talent Pipeline</a> initiative, as well as to the Housing Camp, Transdisciplinary Modules, and



TLOS is helping to foster innovation and cultivate talent in Virginia through its management of grant programs such as 4-VA.

Transdisciplinary Teaching Fellows projects. Of the 26 awards granted, 100 percent of recipients submitted midpoint and/or final reports.

#### Accessibility certification programs continue growth

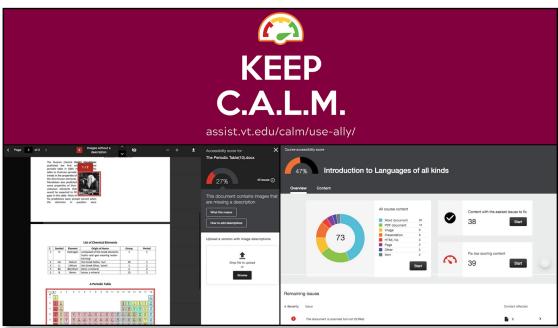
TLOS' Accessible Technologies group established the Accessibility Professional Certification

Grant Program in the fall of 2018. Grant recipients develop expertise as they earn the International Association of Accessibility Professionals (IAAP) Certified Professional in Accessibility Core

Competencies (CPACC) or the Web Accessibility Specialist (WAS) credential. In both tracks, grant recipients receive membership in the IAAP, online exam prep training, and a waiver of exam fees, as well as weekly access to certified accessibility professionals who can answer questions and demonstrate assistive technologies. Since the program began, 66 Virginia Tech employees have earned the CPACC certification and 16 completed the WAS certification. Beginning in fall 2020, the program was expanded to allow community members to participate in the exam prep portion of the program, including those from other higher education institutions and K-12 schools. The fall 2020 CPACC cohort was also the first to use an exam prep curriculum developed in-house by Virginia Tech faculty. In addition, Accessible Technologies developed micro-badges for both the CPACC and WAS cohorts to acknowledge efforts and participation.

### C.A.L.M. campaign highlights Ally tool for more accessible learning materials

The FY 2021 Choose
Accessible Learning
Materials (C.A.L.M.)
campaign theme was
Use Ally. Blackboard
Ally is an external tool
integrated into Canvas
to support accessibility
and universal design.
Ally scans uploaded
instructor content within
Canvas and offers ways
to improve document



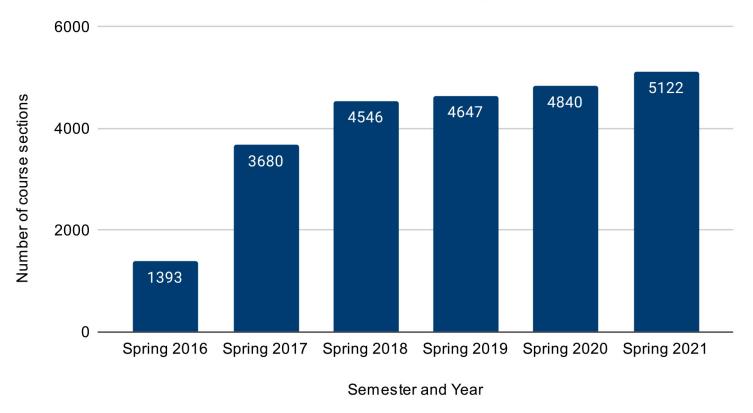
accessibility. Students can use Ally to download alternate formats of documents that best suit personalized learning.

In addition, captioning services were expanded to include free professional captions for an increased number of pre-recorded videos. Captioning video content improves student outcomes and user engagement by making video content accessible to a greater number of users and in a greater variety of situations.

### Teaching and Learning Technology in FY 2021: by the Numbers Canvas remains an essential tool for teaching and learning

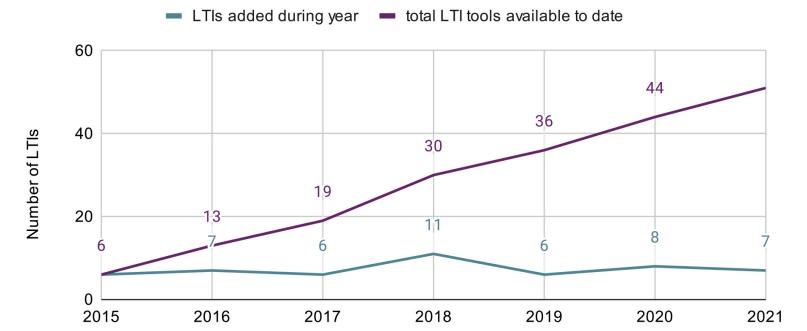
Utilization of Canvas has steadily increased since the learning management system's adoption in 2015, and topped 5,000 active course sections for the first time in FY 2021. TLOS also added another five LTI tools for during the 2021 calendar year, such as Apporto and LinkedIn Learning.





### Learning Tools Interoperability (LTI) available in Canvas

Number of tools added yearly and cumulative LTIs available

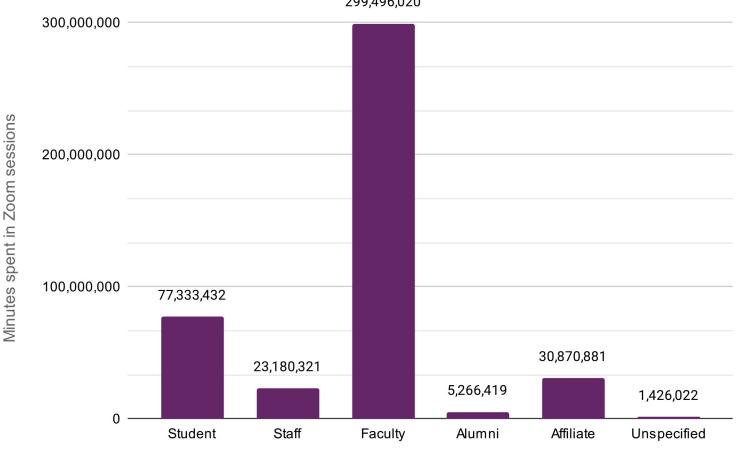


Calendar Year

#### Zoom becomes a fixture in learning and working at Virginia Tech

Zoom usage increased exponentially in FY 2021 compared to previous years. In FY 2019, TLOS recorded only 2.3 million minutes spent on Zoom by members of the Virginia Tech community and their affiliates. In FY 2020, usage increased to more than 62 million minutes. During FY 2021, 437,573,095 minutes were spent on Zoom, a seven-fold increase. The graph below breaks down FY 2021 usage by classification.

### Zoom usage by members of the Virginia Tech community: FY 2021



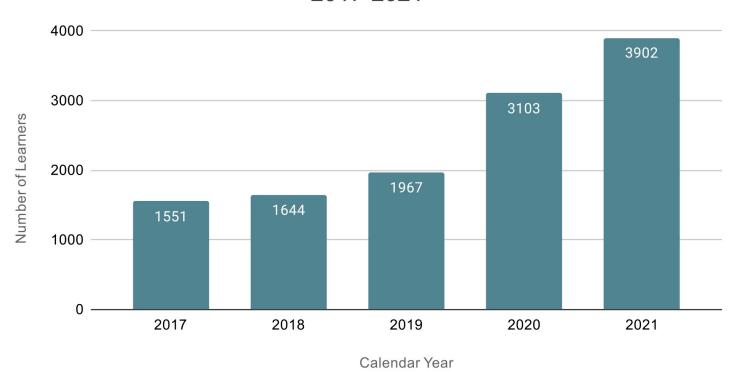
Classification

#### Professional Development Network (PDN) participation remains strong as in-person and hybrid workshop opportunities return

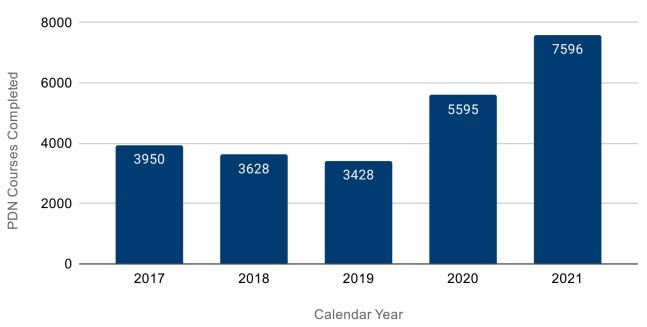
TLOS Professional Development Network (PDN) hosted 865 workshops in FY 2021 with 3,902 faculty, staff, and graduate students attending at least one workshop. Featured topics include outreach and engagement, inclusive pedagogy, assessment, teaching and learning, and research. TLOS hosts in-person workshops in one of <u>four classrooms</u>, with a virtual attendance option for most workshops.

Learners looking for self-paced courses have access to the <u>TLOS On-Demand website</u> as well as <u>LinkedIn Learning</u>, which offers more than 17,000 on-demand courses and learning paths designed to help users gain new skills and knowledge. Virginia Tech employees and students viewed 27,685 hours of video and completed 16,484 courses in FY 2021. Popular course topics covered teamwork, leadership, remote work, creativity and innovation, and software tutorials.

### Professional Development Network (PDN) Learners per Year, 2017-2021



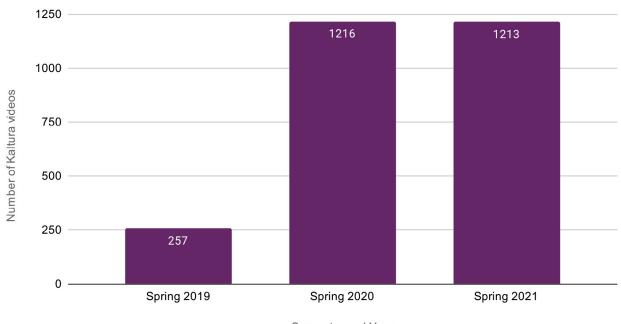
#### Professional Development Network (PDN) Total Courses Completed per Year



#### Kaltura bridges gap between in-person and remote learning

During FY 2021, there was a sustained level of video usage in Canvas courses as compared to FY 2020. However, the total number of course videos increased significantly, from around 17,000 in spring 2020 to more than 28,700 in spring 2021. As we return to more in-person learning, we expect this trend to level off; however, we do expect for videos to remain a popular component of courses.





#### PILLAR 2 - ADVANCING RESEARCH AND DISCOVERY



### Advancing Virginia Tech's research landscape by expanding high-performance computing resources

A key goal of the Division of IT's Advanced Research Computing unit (ARC) is to maximize research productivity at Virginia Tech through interdisciplinary collaborations that connect researchers to new opportunities in computing and data-driven research. As the research needs of the Virginia Tech community evolve, ARC is expanding its capabilities for high-performance computing (HPC), both in terms of compute capacity and expertise.

Significant expansion began when the research computing team from the Fralin Life Sciences Institute joined ARC at the end of FY 2020. ARC gained a team of highly experienced systems engineers, as well as access to an additional state-of-the-art data center in Steger Hall on the main Blacksburg campus. The merger positioned ARC to support an expanded HPC infrastructure and to serve a greater number of researchers.

During FY 2021, ARC brought two new HPC clusters online, beginning with the central processing unit, or CPU cluster, TinkerCliffs, in October 2020. The <u>largest</u> and <u>fastest computing cluster</u> in Virginia Tech history to date, TinkerCliffs replaced BlueRidge as ARC's flagship computing resource, with nearly 6 times the computing power of its predecessor. Housed in the Steger Hall data center, the 332-node

cluster has the capacity to accommodate multiple research projects with relative ease, even those involving very large and complex calculations, simulations, and models. TinkerCliffs is also the pilot cluster on which investigators can utilize ARC's cost center model — a program that helps ARC reinvest in its infrastructure while providing enhanced services to grant-funded research projects. Using this program, researchers can purchase dedicated space and compute capabilities above ARC's standard level of service, adding these costs to grants and contracts.

ARC also added a new graphical processing unit (GPU) cluster in January 2021. Named Infer, this cluster serves as an all-purpose resource that is especially useful for researchers who are making their first forays into GPU-enabled computations. The cluster provides 18 Intel Skylake nodes, each equipped with an Nvidia T4 GPU. The name "Infer" alludes to the artificial intelligence and machine learning inference capabilities of the T4 GPUs derived from the "tensor cores" on these devices. In spring 2021, ARC transferred 40

"Since the installation of BlueRidge in 2013, the demand for HPC resources at Virginia Tech has consistently increased. TinkerCliffs is a true 'workhorse' cluster that will provide the computing capacity for our users to advance their research, which in turn will strengthen their ability to secure external funding in a competitive research environment."

— Terry Herdman, Associate Vice President for Research Computing

v100 nodes, each with two Nvidia P100 GPUs, from an older ARC system that will be decommissioned, expanding Infer's capabilities while making efficient use of existing resources.

By bringing these two clusters online, and expanding personnel resources, ARC has increased its capacity to support research initiatives across Virginia Tech, helping to advance the university's research mission while exemplifying the Division of IT's core value of striving for excellence.

#### Investment Computing Program provides shared HPC infrastructure

ARC's Investment Computing Program leverages a coordinated approach to high-performance computing across the university through department-level and faculty investment in Virginia Tech's centralized HPC infrastructure. The Investment Computing Program allows departments and faculty to purchase priority access to ARC's systems for one to five years, which provides them enhanced services and resources for long-term project needs. This program is complemented by the cost center, which allows researchers to purchase short-term priority queue access, additional compute space, or both, to facilitate meeting deadlines. In FY 2021, with the commissioning of TinkerCliffs, ARC enabled researchers to add cost center compute costs to grants and contracts. Together, the Investment Computing Program and cost center provide a sustainable business model that encourages investment in HPC across the university while ensuring that ARC can continue to provide free access to its computing resources for the majority of Virginia Tech users.

#### Expanding opportunities for cloud services at Virginia Tech

Collaborative Computing Solutions (CCS) worked with Information Technology Procurement and Licensing Solutions (ITPALS) to expand Virginia Tech's cloud platform services to include Google Cloud Platform (GCP) in addition to Microsoft Azure and Amazon Web Service (AWS). With this addition, faculty and staff are now able to choose from and request access to three cloud platforms for their research and data management needs, all of which are compliant to handle high-risk data such as PII, FERPA-protected, and ePHI data. This change expands the opportunities for teaching, administration, and research at Virginia Tech.

### Elevating innovation in research through interdisciplinary collaboration and technical GIS support

By providing data storage, application development, and hosting services to faculty researchers and graduate students, our Enterprice GIS team acts as a direct participant in discovery and functions as a force multiplier. Having the expertise of GIS specialists on their research team gives researchers a competitive edge in securing grant funding while allowing them to focus on their specific subject matter.

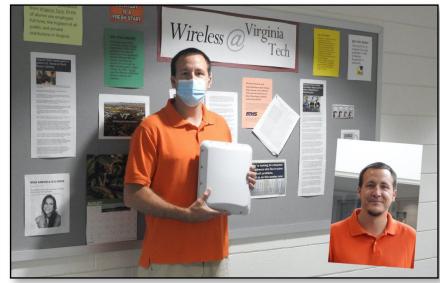
Recent projects in this area include a partnership with the department of <u>Forest Resources and Environmental Conservation</u>, with whom the GIS team developed a method of integrating a

dynamic web map of forest canopy imagery with the commercial crowdsourcing provider AWS Mechanical Turk to determine how well humans perform compared to computers at the task of identifying trees on an aerial photo. Another is a long-running collaboration with the **Sustainable Water Infrastructure Management (SWIM) Center** in Civil and Environmental Engineering to develop the **PipelD**<sup>2</sup> database, a national resource that enables water utilities to load data into a single secure system, transform the data into a standard data model, and then run engineering models to predict asset failure and plan for replacement. Thirdly, Enterprise GIS partnered with faculty from Agricultural and Applied Economics, and collaborators from Clark University, to develop an integration between the ArcGIS interactive mapping platform and Qualtrics (survey platform), to enable a novel method for tracking and recording the areas of an online map viewed by its users in real time. These areas of interest were then fed into econometric models as predictors of a person's willingness to pay for an environmental policy intervention. A paper on this topic is currently under editorial review by the Proceedings of the National Academy of Sciences.

The Enterprise GIS team's contributions to research projects such as these provide important support to our research community, and contributes innovative solutions that positively impact society and the environment.

### Citizens Broadband Radio Service licenses expand research opportunities

In summer 2020, the Virginia Tech
Foundation acquired eight priority
access licenses (PALs) for the newly
available <u>Citizens Broadband Radio</u>
<u>Service (CBRS)</u> from the Federal
Communications Commission (FCC).
These licenses, located in what is
known as the 'innovation band' of radio
frequencies, provide researchers with
space to conduct research in such areas
as wireless communications, cyberphysical systems, telehealth, smart
farming, and smart cities, even allowing
them to build their own private 4G or 5G
networks to conduct their work.



Virginia Tech's acquisition of Citizens Broadband Radio Service licenses enables innovation in various technologies and configurations, including private LTE(4G) and (5G) testbeds, such as this in Durham Hall on the Virginia Tech Campus.

The Division of IT administers these licenses, four of which are located in Montgomery County, and four of which are located in Craig County. In addition, the Division of IT was granted a Program Experimental License by the FCC, which establishes an "umbrella" over the main campus in Blacksburg that allows individual experimental radio licenses to be granted in a significantly streamlined manner.

The licenses are currently being utilized by faculty and student researchers in the College of Engineering as well as the <u>Commonwealth Cyber Initiative</u>. Moving forward, the Division of IT anticipates that these licenses could be utilized to provide advanced communications services in underserved areas in southwest Virginia, in addition to being used to advance research in disciplines ranging from agriculture to healthcare.

#### PILLAR 3 - LEVERAGING TECHNOLOGY FOR OUTREACH



### 'Bring Your Own Brain' fosters community discourse around neurodivergence, disability, and technology

As stated in our core value of *Inclusion*, the Division of IT is committed to sustaining a culture of inclusion based on diversity, involvement, accessibility, and empowerment. Since 2016, the division has hosted public diversity events to foster a culture of inclusion within division, and to encourage discourse surrounding issues of inclusion and diversity at the university in support of Virginia Tech's **strategic priority** to elevate *Ut Prosim* by increasing cultural competency and ensuring a welcoming, affirming, safe, and accessible campus climate.

In April of 2021, the IT Diversity Committee presented <u>Bring Your Own Brain:</u> <u>Celebrating Neurodiversity in STEM careers</u>, a live online panel discussion exploring neurodiversity in the STEM workforce from the perspective of five neurodivergent individuals in various stages of their careers. Our panelists, moderated by Carolyn P. Phillips of Georgia Tech, engaged in frank and thoughtful discourse on issues including accessibility, invisible disability, race and disability, and stereotyping of neurodivergence in academia and the workplace.

Originally scheduled for spring of 2020, the event was postponed for one year due to COVID-19 restrictions, and held as a webinar. This change offered unexpected benefits. The virtual format was preferred by our five panelists, who were able to join us remotely from Massachusetts, Georgia, Indiana, and Illinois, as well as Virginia Tech. Additionally, we were able to broaden our outreach, opening the event to those in the New River Valley area and beyond. As a result the event drew more than 200 participants — half were Virginia Tech students and employees, and the other half were individuals from all over the country.

As with previous diversity events, the Division of IT received support from several other university groups to plan and produce this event. These included the Office for Inclusion and Diversity, the Virginia Tech Center for Autism Research, the College of Science, the Disability Alliance at Virginia Tech, and Human Resources Talent Development. Collaborating with these groups ensured we were able to provide a top quality event, while also strengthening the connection between the Division of IT and the university groups we serve.

## Cyber Range helps Virginia cybersecurity educators connect and stay current through virtual events

In addition to providing the digital environment and resources for Virginia educators to empower their students with cybersecurity skills and knowledge, the Cyber Range provides opportunities each year for cybersecurity educators to engage in professional development and networking. During FY 2021, the <a href="Cyber Range">Cyber Range</a> hosted two events of note: the Virginia Cybersecurity Education Conference in July 2020, and GenCyber Camp in June 2021. Both of these events were held virtually due to ongoing pandemic restrictions.

Celebrating its third year in 2020, the <u>Virginia Cybersecurity Education Conference</u>

(VACyberEduCon) is an annual conference that brings together educators and students from Virginia's high schools, community colleges, and universities, as well as industry professionals, to learn about new cybersecurity teaching tools, share ideas, and participate in hands-on workshops with the goal to support and enhance cybersecurity education in Virginia. Over 250 participants attended the all-virtual event, which carried the theme "leveling up the next generation"

of cybersecurity professionals" and included workshops, breakout sessions, birds of a feather meetings, and a virtual happy hour.

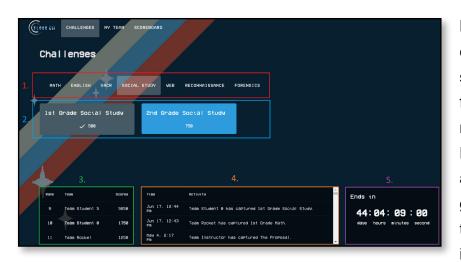
At the end of the fiscal year, in June 2021, the Cyber Range hosted GenCyber camp, a virtual cybersecurity bootcamp for secondary school teachers. Focused on helping teachers prepare for the upcoming school year's cybersecurity curriculum, the bootcamp included hands-on exercises, lab exercises, and help from teaching



The Cyber Range team successfully transitioned to an all-virtual event just weeks before the 2020 CyberEduCon was scheduled to kick off.

assistants in topics ranging from cryptography and network security, to cybersecurity careers, to how to create lesson plans and pacing guides. A total of 55 teachers attended the two-week-long virtual program.

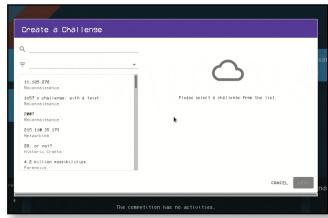
### CloudCTF platform gamifies cybersecurity learning for students of all ages



Learning technical cybersecurity concepts can be daunting for anyone, especially students who are relatively new to the field. To make learning cybersecurity more accessible and more fun, the Cyber Range developed the CloudCTF platform, an online Jeopardy-style capture-the-flag game that allows individuals and teams to earn points for answering questions in a variety of cybersecurity categories.

Designed simply so that it can be utilized in a variety of settings, CloudCTF runs in a safe and secure environment in the cloud, and can be provisioned from the Exercise Area of the Virginia Cyber Range in a matter of seconds. Teachers can tap into CloudCTF's extensive library of pre-set challenges to quickly set up a game for their students, or design and save customized challenges to best suit their students' skill level.

Since its debut in July 2020, CloudCTF has been used by instructors and students across Virginia and beyond for CTF competitions, labs, student practice, and more. The Cyber Range has also hosted four national-level CTF events, giving hundreds of individuals hands-on opportunities to learn new skills in a gamified environment.



CloudCTF adds an element of fun and friendly competition to cybersecurity education

#### K-12 STEM outreach continues through pandemic

Despite ongoing restrictions on gathering in large groups, the division's commitment to engage pre-college students with activities that raise interest in technology-related careers remained strong, and division units and personnel delivered several virtualized STEM and cybersecurity events throughout the 2020-21 academic year. In collaboration with the Virginia Tech Institute for Creativity, Arts, and Technology (ICAT), the Cyber Range provided an online hacking and cyberdefense demonstration to rural junior high school students through the



The Virginia Cyber Range's Thomas Weeks led the session "What is Cybersecurity?" during the VT Science Festival in October 2020, which was held virtually due to COVID-19 restrictions.

Virginia Tech Science Festival. The Cyber Range also spearheaded a "Defense Against the Dark Arts" cybersecurity event, collaborating with the Roanoke-Blacksburg Technology Council and the Roanoke InfoSec Exchange (RISE) to offer a forum and demonstration led by a panel of cybersecurity experts.

#### Improving digital accessibility within the Cyber Range

When public schools across the nation shifted to online learning in March 2020, the Cyber Range saw increased demand as cybersecurity teachers worked to provide virtual environments to replace the physical computer labs that students could no longer access. At the same time, students with disabilities who had received assistance in the classroom with the Cyber Range's web-based

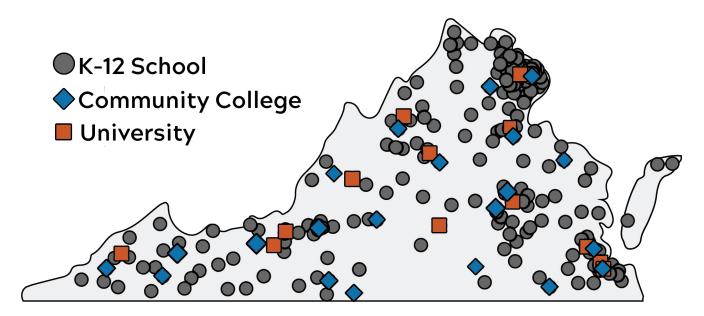
software now found themselves without that support. While the Virginia Cyber Range had built basic accessibility features into its tools and programs such as alternative text and semantic structure, even these measures proved insuficient to provide accessibility for all Cyber Range users.

In response, the Cyber Range completed a third-party accessibility assessment of its web site, courseware repository, exercise area, and knowledge base, working with the vendor to make the necessary improvements to meet the World Wide Web Consortium's (W3C) Web Content Accessibility Guidelines (WCAG). In FY 2021, the Cyber Range achieved this goal, and a Vendor Product Accessibility Template (VPAT), which shows compliance with WCAG, was issued to the group in accordance with Web Content Accessibility Guidelines, version 2.1a.

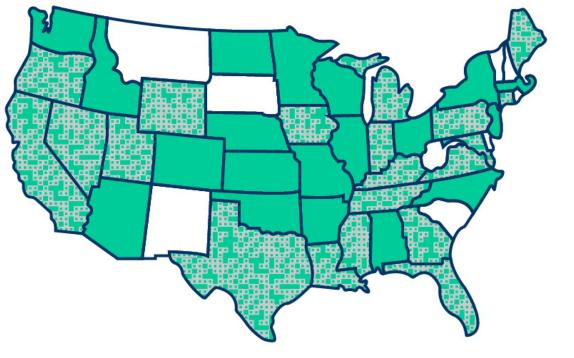
In addition, the Cyber Range worked closely with Technology-enhanced Learning and Online Strategies, receiving grants to train and certify a Cyber Range developer as a Web Accessibility Specialist (WAS) and a courseware team tember as a Certified Professional in Accessibility Core Competencies (CPACC) through the International Association for Accessibility Professionals (IAAP). Through these efforts, the Cyber Range made significant improvements in the user experience for Cyber Range users of all abilities.

#### VA and US Cyber Range Coverage Maps

### Virginia Cyber Range Users, FY 2021



#### US Cyber Range Reach, FY 2021





States with new users in FY 2021



States with existing users in FY 2021

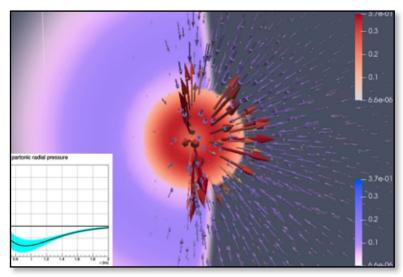


No Cyber Range users yet

#### Advanced Research Computing faculty provide support awardwinning graduate research

In addition to providing high-performance computing support for Virginia Tech, Advanced Research Computing faculty seek out opportunities to collaborate with students and researchers in support of their mission to "cultivate advanced computing infrastructure as a platform for collaboration and to help secure the position of Virginia Tech as a leader in education, innovation, and research."

During FY 2021, ARC Visualization Director Nicholas Polys advised and co-authored research papers for graduate students who went on to present at the 2020 International



Nic Polys presented a paper on his collaborative work with the Jefferson National Lab titled "Nuclear Femtography on the Web with X3D" to an international audience at the 2020 Web3D conference.

Conference on 3D Web Technology (Web3D). Polys and Computer Science graduate student

#### PILLAR 3

Yanshen Sun received the Best Paper Award for their work on Web-based 3D rendering techniques for large point clouds, titled "Scalability of X3D4 Point Properties: Benchmarks on WWW Performance."

Polys also presented his own full paper about his collaborative work with the Jefferson National Lab titled "Nuclear Femtography on the Web with X3D," and won first place in the Humanoid-Animation Video Music Competition for his X3D video with original music titled, **Fire in the Sky**, Additionally, ARC Visionarium intern and Computer Science graduate student Jooyoung Whang presented his paper "DeepCinema: Adding Depth with X3D Image-Based Rendering" at the Web 3D conference.

### Mapping behind the scenes and beyond boundaries to position Virginia Tech for the future

The Division of IT's Enterprise GIS team provides services to faculty, students, and departments that are crucial to the success of both Virginia Tech's academic mission and university operations. During FY 2021, Enterprise GIS accomplished much to enhance the organization by lowering barriers for access to GIS technologies, and allowing facilitating use of university research, teaching and outreach.

#### Connecting students and researchers to state-of-the-art software

Students at Virginia Tech who use GIS require specialized software, namely ESRI ArcGIS Pro. When COVID-19 pandemic restrictions took effect in March 2020, students who had relied on campus computer labs to access ArcGIS Pro no longer had that option. Enterprise GIS quickly took action to develop a cloud-based virtual software solution that allowed students to use ArcGIS Pro from a web browser. Built on Amazon Web Services (AWS) AppStream, the service could be scaled to meet demand, and its processing nodes could be scaled to improve processing speed for more compute-intensive use cases. This solution served a number of students through most of 2020, until a more generalized and robust cloud virtual desktop service, Apporto, was made available by Technology-enhanced Learning and Online Strategies (TLOS). While most students now use Apporto to access ArcGIS Pro, the initial work done by Enterprise GIS to implement remote software access had an impact beyond Virginia Tech. Through its membership in the ESRI Innovation Program, Enterprise GIS used this experience to provide guidance to peer institutions who also faced a rapid transition to remote learning and research.

A new niche emerging in the GIS field is localized remote sensing from unmanned aerial systems (i.e, drones). Using specialized mission planning software, drones can be programmed to fly a regular, overlapping pattern across an area of interest. Photos taken during the automated flight can then be assembled, like a puzzle, into a seamless map. The photogrammetric processes needed to create the orthomosaic outputs require specialized software. However, purchasing software capable of meeting precise research requirements for positional accuracy and configurability

#### ENHANCING THE WHOLE UNIVERSITY

can be prohibitively expensive for individuals. To meet the needs of our researchers in a cost-effective manner, Enterprise GIS deployed an instance of WebODM, a leading open-source drone processing package, which is <u>now available as a free service</u> to the Virginia Tech community through the IT Service Catalog.

#### **Enhancing university operations through innovative GIS applications**

In addition to supporting Virginia Tech's academic missions, Enterprise GIS enhances the administrative operations of the university by "spatially-enabling" datasets so that they can be visualized on a map. This can be a transformative capability for data-driven decisionmaking, as maps are an intuitive way to interact with data. During FY 2021, Enterprise GIS worked with several departments to implement mechanisms to map and analyze data in real time. One example is a collaborative project with the Virginia Tech Office of Emergency Management (VTEM) to improve awareness and response capabilities in emergency situations.

Enterprise GIS built a software integration that links geospatial data into VTEM's dashboard, providing the ability to sync data between systems so that emergency planners have accurate, up-to-the-minute information during rapidly evolving situations. In addition, Enterprise GIS worked with Virginia Tech's Facilities Operations and VT Electric Service teams to integrate a real-time telemetry system to monitor the condition of utilities and buried infrastructure, allowing utility assets to be visualized on a map.



New, automated GameDay GIS mapping capabilities are helping Virginia Tech Emergency Management enhance its safety plans for Hokie football games.

Additionally, Enterprise GIS upgraded the customized GameDay GIS mapping products it supplies to VTEM for home football games, replacing manually-produced print maps with a user-initiated automated cartography web service. This upgrade

ensures that VTEM has access to the most up-to-date maps for its work managing safety at the university's most highly-attended events.

Looking to the future, we anticipate that the need for complex systems integrations in the administrative space will only increase, and that the geospatial research component across all fields of academic inquiry will continue to accelerate. Demand for GIS mapping capabilities, and the customized programming, infrastructure, and expertise to support them, will continue to grow. Enterprise GIS is positioned to be ready to handle the technical challenges, allowing our researchers to focus on their subject matter and our administrative personnel to focus on their core missions.

# New Cloud Strategy Working Group sets forth Virginia Tech's first strategic recommendations for cloud computing

Over the past decade, Virginia Tech has increasingly looked to cloud-based technology solutions to satisfy mission-critical university needs in domains as varied as admissions, human resources, research compliance, and purchasing. Recognizing that the cloud will only play a greater role in administrative and academic functions into the future, the Division of IT established a **Cloud Strategy Working Group** in fall 2019. This group, of 23 faculty and staff representing all units within the division was charged with assessing the university's current climate regarding cloud computing, and developing strategic recommendations. These recommendations would provide a guiding framework for the division and the university in making effective and intentional use of cloud-based technologies in support of the IT Strategic Plan.

During summer 2020, the group conducted in-depth interviews with faculty and staff across campus who were known to have utilized cloud computing for teaching, research, or outreach within recent years. These interviewsaimed to identify core needs in the area of cloud computing infrastructure, support, and awareness. The group drafted initial <a href="Strategic Recommendations for Cloud">Strategic Recommendations for Cloud</a>
<a href="Computing">Computing</a>, as well as <a href="Recommended Standards and Practices for Cloud Computing">Recommended Standards and Practices for Cloud Computing</a>, which were released to the university community in spring 2021.

The university community was invited to provide input and help shape the strategy moving forward, so that collectively, the Division of IT and Virginia Tech can establish responsible, sustainable cloud computing practices that enable innovation in research, enriched learning experiences for students, and efficient technology support for the university.

#### Increasing protection of sensitive information

Collaborative Computing Solutions (CCS) enabled the Data Loss Prevention (DLP) policy for Virginia Tech's Microsoft 365 (M365) environment. In Exchange Online, the policy will detect what appears to be sensitive information (social security, debit, and credit card numbers) as the email is being written and caution users regarding sharing this information with others. The warning message in the email helps users protect sensitive information from being released to unintended audiences. Enabling the DLP policy is a simple measure that has the potential to stop inadvertent data compromises at the university.

### Google Workspace Program evaluates impact of vendor service changes on Virginia Tech and best path forward

On February 16, 2021, Google announced several changes to their educationally-focused G Suite for Education (now Google Workspace for Education) productivity suite. These changes are expected to affect Virginia Tech's instance of the product, and the announcement introduced questions and challenges around how faculty, staff, students, alumni, and retirees will utilize the service suite in the future. In response, the Division of IT launched the **Google Workspace Program** to evaluate the potential effects of changes to Google service offerings and licensing and implement a plan for the university to address these changes. Virginia Tech will benefit from this program as it evaluates both how Virginia Tech is using Google services and Google's new licensing model to determine a plan to address the changes with minimal service disruptions or loss of data access.

#### Improving security and scalability of email infrastructure

With the successful completion of a multi-year effort to move Virginia Tech's email solution to the cloud, email is no longer routed through on-premise servers. Instead, university email is routed through Google cloud infrastructure. This service change provided significant benefits including service reliability, resilience, scalability, attack mitigation, and anti-spam/phishing improvements. It also freed up local resource time by eliminating the upkeep of a significant number of on-premise servers, allowing them to focus on other priorities such as support for the university, maintenance of other essential systems, and implementing innovative ideas and technologies. The project was deployed in multiple phases while simultaneously maintaining full email service functionality for end users during the transition period.

## Data lake enables new analytics capabilities across university systems

In recent years, the Division of IT has led numerous projects focused on providing data storage and management services that are dynamic and scalable for the university's growing and changing business needs. Key among these is a project led by Enterprise Systems (ES) to establish a data lake service for Virginia Tech. This project aims to improve the usability of administrative data gathered across multiple levels of the university by providing greater flexibility in how different types of data can be integrated and analyzed. With the technical foundation for the data lake established during the 2020 fiscal year, ES shifted its focus towards making technological improvements to the data lake structure and initiating integrations with university systems.

For example, during FY 2021, Enterprise Systems and TLOS embarked on a joint effort to import dataform TLOS managed apps, such as Kaltura, Canvas, and Zoom, into the data lake, building a repeatable framework that allows data from these apps to be combined with other datasets to help drive an understanding of how students and employees are using the tools we offer. This framework is being utilized by <u>University Data Commons (UDC)</u>, which sources data from the data lake. As work progresses on the data lake service, ES continues to add new data sources and to make enhancements in areas of data access and service support.

#### Modernizing the university's human resources data domain

In close collaboration with Virginia Tech Human Resources, Enterprise Systems' Database and Application Administration team (DBAA) created new data models, reports, and analytics to support changing needs surrounding the new telework agreement system, compensation analysis, and employee budgets. In addition, DBAA expanded analytics capabilities to allow distributed human resources teams greater access to the specific data needed to help them solve their unique problems, while also providing centralized guidance for data utilization.

This project is advancing data-informed decision-making by enabling timely, accurate, streamlined access to data to all members of the university community and promoting effective usage of data visualization and data reporting tools.

# Robotic Process Automation provides significant efficiency improvements for the Virginia Tech finance division

In partnership with the university's finance division, the Division of IT completed the implementation of tools for Robotic Process Automation (RPA), a software technology that makes it easy to build, deploy, and manage software robots (bots) that emulate human actions interacting with digital systems and software. Once in place, these bots are used to perform a range of defined actions, such as system navigation, keystrokes, and data identification and extraction. In practice, RPA allows the finance team to automate a number of essential, yet repetitive tasks, such as verifying figures and querying databases. RPA has already provided significant operational efficiencies for the Accounts Payable group, and will continue to help the finance division more effectively contribute to the university's missions.

## University Data Governance Council enhances reporting and data analytics capabilities, enables informed decision-making

The <u>University Data Governance Council (UDGC)</u> was established in August of 2020 as part of Virginia Tech's initiative to enhance its reporting and data analytics capabilities, optimize utilization of institutional data, and enable informed decision-making. Chaired by Vice President for IT and CIO Scott Midkiff, the UDGC provides strategic guidance to the university's data management and analytics efforts by endorsing policies and practices that affect the production, quality, usability, and security of administrative data used throughout the university. Within the council are three working groups, each focused on one of the following three areas of data governance: data access, risk, and compliance; metadata and data dictionary; and data literacy, training, and tools.

During its first year, the UDGC completed or made significant progress on a number of deliverables. The group took inventories of both existing data-related policies and metadata practices and data dictionaries; conducted a gap analysis to identify areas where current data policy is lacking; published a simplified version of the Administrative Data Management Standard; conducting a survey of Virginia Tech data stewards; and drafted a <u>Guide to Data Protection for Data Trustees and Stewards</u>, which codifies consistent data access requirements and request processes and identifies needs for new or modified policies, standards and guidelines. The UDGC will use these deliverables to identify and assess options to move toward more cohesive and consistent data governance at Virginia Tech.

## Expanding cybersecurity awareness training opportunities for faculty and staff

Protecting the university's cyberinfrastructure against threats such as ransomware and theft is critical to its operations, its research mission, and the safety of our community. With a significantly greater number of students and employees accessing university systems remotely due to COVID-19 precautions, the need for robust security has increased substantially over the last year. The IT Security Office (ITSO) implemented a number of measures during FY 2021 to help defend Virginia Tech's technology resources against cyber attacks, educate the community about identifying and avoiding potential threats, and mitigate cybersecurity issues swiftly and effectively.

One area of focus was expanding IT security awareness and knowledge of best practices among university faculty and staff. The ITSO integrated its flagship course for basic cybersecurity awareness, the SANS Securing the Human awareness training program, into the university's PageUp system, making it available to all Virginia Tech employees as an on-demand course. In addition, the ITSO created a new supplemental security training course focused on phishing and other security issues specific to Virginia Tech, and provided email phishing exercises to all Division of IT employees to test and improve phishing awareness among our division.

In addition to training, the ITSO improved access to cybersecurity training and consulting through 4Help and the IT Service Catalog, adding a new requestable item for individuals and departments to request a Security Architecture Consultation for any new IT application, database, network or system project. ITSO staff also contributed several new articles to the 4Help Knowledge Base to provide updated information on security practices such as using SSH keys in Linux and Windows and best practices for custom web application design.

# New tools enhance the IT Security Office's vulnerability testing capabilities

In FY 2021, the ITSO further bolstered technical capabilities to thwart would-be attackers. The ITSO worked with ITPALS to secure the approval of BurpSuite, a software package that allows web developers to scan their code to identify security issues including injection attacks, broken authentication and access controls, as well as other types of misconfiguration. Using BurpSuite, the ITSO's Red Team group can test vulnerabilities in the university's cyber infrastructure more efficiently.

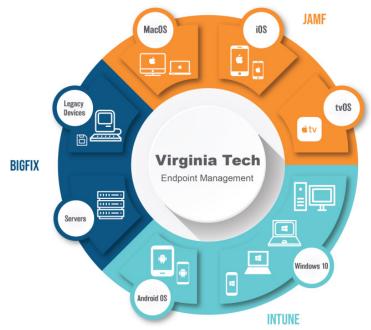
The ITSO also worked with students in the IT Security Lab to facilitate ongoing research into Virginia Tech's open-source threat intelligence capabilities.

The ITSO expanded their team in FY 2021, adding two new full-time employees in the Risk Management and Assessment areas. This afforded the ITSO increased capacity to conduct necessary reviews of Cloud Vendor Assessment tools and Vulnerability Assessment and Management tools, to ensure that the security tools we use continue to meet the changing needs of Virginia Tech. The ITSO also secured funding to hire additional student interns, who are helping to build integrated security dashboards from a variety of data sources.

### Enhancing security of university-owned devices with Unified Endpoint Management

Unified Endpoint Management (UEM) allows the Division of IT to consistently and securely manage university-owned devices such as laptops, desktop computers, lab computers, phones, and tablets, helping to prevent and quickly address potential vulnerabilities and other problems.

The division completed review, procurement, and piloting of endpoint management solutions, and launched UEM as an operational service in July 2020. The endpoint solutions JAMF (for Apple devices) and BigFix patch management for all devices are



Unified Endpoint Management provides an efficient and scalable solution to manage security of a broad range of devices.

now available university-wide through the <u>IT Service Catalog</u>. Currently, over 2,000 university-owned devices are managed using JAMF, and over 11,000 using BigFix. A third solution, InTune, is currently under licensing review and is expected to become available for UEM of Microsoft devices during the next fiscal year.

The successful implementation of the UEM has resulted from a multi-year collaborative effort, by ITEE, the ITSO, ITPALS, and CCS, as well as departmental IT professionals across the university.

# Partnering with the College of Liberal Arts and Human Sciences to mitigate identified security and automation concerns

Virginia Tech departments are periodically audited to ensure their IT systems, processes, and practices are sufficient in terms of security and efficiency. When the College of Liberal Arts and Human Sciences (CLAHS) received a report from the audit office that many areas in their IT operations were not in compliance, IT Experience and Engagement (ITEE) played a leading role in helping CLAHS to make improvements in critical areas and elevate their security status. With support from the university's <a href="Business and Management Systems">Business and Management Systems</a> group, members of ITEE, including the Faculty and Staff Technology Resources (FASTR) team, which specializes in providing desktop support to faculty and staff in the Division of IT, developed a task force to assist the CLAHS chief technology officer with several initiatives. These included:

- Helping CLAHS develop an IT budget to purchase critical software to bolster security;
- Assisting the college in acquiring licenses for JAMF endpoint management and Bomgar remote desktop solutions and providing training in these solutions;
- Setting up an instance of ServiceNow for CLAHS IT to manage incidents; and,
- Creating BigFix self-installers for Macs and providing critical support in applying BigFix to devices college-wide.

In addition, ITEE and the IT Security Office partnered with CLAHS IT personnel on the initial development and pilot of a university-wide Administrative Rights Standard, which aims to ensure that administrative rights on faculty and staff computers are only extended when necessary. The pilot, which began in June 2021, extended into the summer term, and the standard is expected to be implemented university-wide during FY 2022.

# MicroStrategy upgrade provides more efficient, powerful data analysis and reporting capabilities

MicroStrategy, a business intelligence platform offering analytics and data visualization capabilities, is the primary tool used by Virginia Tech for reporting and analytics across the majority of data domains. During FY 2021, Enterprise Systems facilitated a major upgrade to MicroStrategy software and hardware which resulted in significant improvement in the efficiency of data reporting and management. This upgrade allows Virginia Tech to scale analytics services to new platforms,

including mobile and third party reporting tools, to help centralize data analytics as more domains are added throughout the university. At the same time, it allows the university to decentralize data ownership so that the stewards of each domain have greater control to publish and distribute data to their partners without relying on a centralized team to complete the process.

#### New Customer Portal improves user experience for NI&S customers

The NI&S Customer Portal provides a modern, consolidated and consistent user experience for users provisioning and managing NI&S services. The project's scope included a refactor and refresh of existing NI&S web applications, and the addition of new and improved functions. A key concept of the project is Agile development, which involves users and adds transparency to the project through biweekly sprint reviews for a large and open audience.

The first version of the portal was deployed in January 2021 on Amazon Web Services (AWS) infrastructure. In late March, the development team completed a migration of the Customer Portal to the university's Common Platform, becoming the anchor tenant of that system. Applications added to the Customer Portal since its release include:

- Request for Estimate
- Network Query
- Organizational Wireless Device Manager
- DHCP Exclusions
- Communications and Network Liaison lists

- IP Assignment information
- E911 Location Reconciliation
- Invoice Viewer
- Service Inventory
- Call Detail and Cellular records

Significant work was completed for a DNS records manager application that was released to a limited internal audience for review.

Campus Cable TV upgrades provide access to a broader range of

programming

Virginia Tech's new on-campus cable television programming lineup provided by Apogee has 100 high definition channels. Available in public areas including residence hall lounges and used by departments across campus, this cable service better aligns with customer needs, which have changed drastically with the explosive increase in subscription video services. A live streaming service, including access to all offered channels, storage, pause, rewind and fast-forward capabilities, is set to become available in spring 2021.



NI&S completed cable TV upgrades that allow students more options for programming in common areas on the Virginia Tech campus.

# NI&S announces a new time and cost saving business model

A new NI&S business model, encompassing all of the unit's business lines, was announced during FY 2021. This new model will be more people-centric, providing departments with the level of connectivity necessary for their entire staff, rather than charging on a per-connection basis. This approach provides more predictability for both NI&S and departments, and reduces administrative overhead associated with billing, accounting, and service request. As a result, employees will be able to connect to phone and computing networks and become productive more easily. NI&S aims to begin the move to this new business model during FY 2022-23.

# Network infrastructure installations improve wireless capabilities across Virginia Tech campuses

During FY 2021, the NI&S Network Infrastructure Installation (NII) team installed over 10,000 feet of fiber, plus numerous additional devices and infrastructure to expand campus networks at Virginia Tech. A significant amount of effort was directed toward IT infrastructure installation in the <u>Creativity</u> and <u>Innovation District - Living Learning Community</u>, a 230,000 square foot residence hall including creative studios, study spaces, and an auditorium, which opened in Fall 2021. In addition,

the NII team's efforts expanded 10-gigabit distribution and user access to 1-gigabit services and improved the wireless capabilities of multiple buildings on the Blacksburg and Roanoke campuses.

The NII team completed this work successfully amidst the challenges set forth by the COVID-19 pandemic, taking the necessary precautions to continue this important on-site work while the university was operating under essential operations status.



NI&S worked throughout FY 2021 to install cable and network infrastructure for the new state-of-the-art Creativity and Innovation District Living Learning Community on the Blacksburg campus.

#### Installation Statistics July 1, 2020 to June 30, 2021

Item Type	Quantity
25 pair cable	8,093 feet
CAT6A Ethernet Cable	13,216 feet
CAT6 Ethernet Cable	392,044 feet
COAX Cable	90,281 feet
Fiber	10,237 feet
Conduit	10,063 feet
Wall jacks	4,462 each
Ethernet Switches	131 each
Wireless Access Point	498 each

### WiFi upgrades help Virginia Tech connect safely during pandemic

To facilitate physical distancing during an ongoing pandemic, NI&S increased outdoor wireless availability on Virginia Tech campuses, expanding access to both the eduroam or VirginiaTech guest networks in Blacksburg, Roanoke, and the Greater Washington D.C., metro area.

By the end of FY 2021, outdoor spaces adjacent to the following buildings were equipped with WiFi:

- Burchard Hall
- Classroom Building
- Goodwin Hall
- Squires Student Center
- Henderson Hall
- Davidson Hall

- Seitz Hall
- Sandy Hall
- Peddrew-Yates Hall
- Derring Hall
- Bishop-Favrao Hall
- Dietrick Hall

In many locations, tents were erected to provide shelter and comfort. Students, employees, and visitors were encouraged to use these areas to study and socialize while safely distanced, to help prevent the spread of COVID-19.



The Outdoor Gathering Spaces and Approximate WiFi Ranges map captures the estimated coverage areas of outdoor WiFi installations on the Blacksburg campus.

#### PILLAR 5 - DIFFERENTIATING THE VT EXPERIENCE



### Enhancing the student experience – from applicant to graduate – through academic enterprise support

Over the course of their college career, students navigate dozens of processes, from the initial application, to enrollment and course registration, to filing for graduation. When these processes are set up to be accessible and easy to use for the student, as well as efficient and effective for the university, this reduces barriers and facilitates student success.

In FY 2021, the Division of IT's Enterprise Systems (ES) unit implemented a number of improvements and upgrades to the university's academic and business enterprise software applications designed to enhance students' experiences throughout their academic careers.

#### Paving a smooth path to application and enrollment

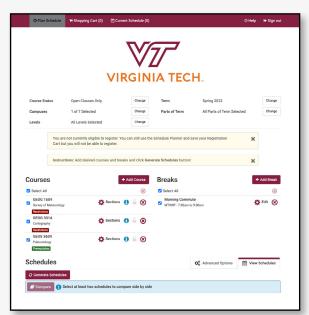
The CommonApp online application portal allows prospective students to explore and apply to any of up to 900 colleges and universities using a single application process. During FY 2021, ES implemented the CommonApp for Virginia Tech, allowing first-year and transfer students to easily apply for undergraduate admission. In addition, CommonApp has been integrated with Slate, the university's

Customer Relationship Management (CRM) tool used to manage applicants and enrollment decisions, and Banner, which is used to manage student information at Virginia Tech.

Once a student applies through the CommonApp, their application is loaded automatically into Slate, where they can use the new Slate portal, which was also implemented in FY 2021, to view their application and status, and access financial aid details. These integrations not only allow prospective students to continue engaging with Virginia Tech as they await admission decisions, but also facilitate the admissions process for the Office of Undergraduate Admission, allowing the admissions office to easily access and view applications on Banner via Slate.

#### Minimizing stress and maximizing efficiency during course registration

The "Drop/Add" period, during which students can register for the upcoming courses, can induce anxiety as students attempt to organize and optimize their schedules to meet curriculum requirements and fit in with home, work, and extracurricular obligations. During FY 2021, ES implemented several tools to assist with this process, including CollegeScheduler, a web-based class scheduling system that students can use to build their desired course schedules in an easy-to-use drag-and-drop format. Because CollegeScheduler is integrated with Banner, students can register directly from the app



CollegeScheduler uses a simple interface to help students plan their course schedules around their busy lives.

when Drop/Add opens. In April 2021, ES implemented another Banner-integrated app, ConnectOnce, which allows users to integrate information about their course catalog and class rosters with products and services from the educational content provider Follett. Using ConnectOnce, students can review and purchase books for their upcoming courses during the course registration process, resulting in significant time savings.

Drop/add can not only be stressful for students, the high level of activity places significant demands on Virginia Tech's online admistration systems. During FY 2021, ES initiated a project to improve the stability of pre-registration and registration applications to handle increased volume during the drop/add process.

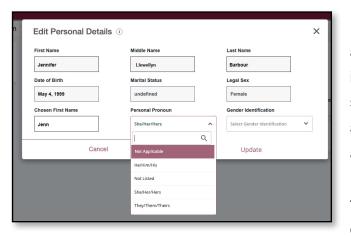
These improvements exemplify the Division of IT and Enterprise Systems' ongoing commitment to provide innovative solutions



Enterprise Systems' Academic Applications team implemented a number of upgrades and new software integrations designed to help make new and existing Hokies' student experience positive.

for academic applications that enhance the student experience while also improving efficiency for the university's business processes. Looking ahead to FY 2022 and beyond, ES is working on several additional projects, including implementation of an eTranscripts application that will allow for secure transmission of official electronic transcripts, an automated waitlist program that will instantly notify students on a course waitlist when a spot opens up, and an upgrade to the current course catalog management system.

## New personal information fields in Banner allow students to affirm personal identity across university record systems



For many Virginia Tech students, personal pronouns, and gender identity, are fundamental to their sense of identity. Feedback from students during a recent new student orientation session indicated a strong desire among students to have the option to document these aspects of their identity in the university's record systems. In response, the University Registrar and the Office for Equity and Accessibility conducted a survey and established a campus-wide working group with a goal to

provide students a <u>means to indicate chosen names</u>, gender identity, and personal pronouns, and display, report on, and provide this information to third-party applications.

The Business Application and Integrations Services and Academic Applications teams from Enterprise Systems were called upon by this working group to help implement the addition of three new fields in Banner: personal pronouns, gender identity, and chosen first name. These optional new fields <a href="became available">became available</a> to students and employees in spring 2020. With this change, personal pronouns and chosen names are displayed on HokieSPA faculty course rosters and to academic advisers, allowing a student to enter a class or advising relationship with the instructor/adviser already aware of their chosen identifiers.

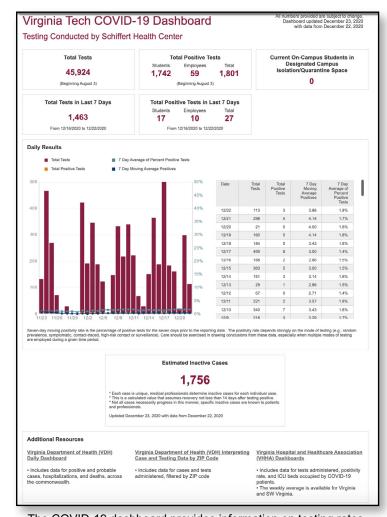


The addition of personal pronoun, gender identification, and chosen name fields to Banner's student and employee information reflects Virginia Tech's commitment to its Principles of Community.

While adding three fields to a form is on its surface a small change, the impact it has made in helping to create an inclusive, welcoming environment for Virginia Tech students has been significant.

### COVID-19 dashboard helps Virginia Tech make informed public health decisions during a pandemic

In summer 2020, Virginia Tech was preparing for socially distanced in-person fall semester in the midst of the COVID-19 pandemic. University officials needed a way to accurately and efficiently track testing and disease cases on the Virginia Tech campus, in order to monitor the positivity rate and to detect any potential outbreaks that might necessitate a change in operations. In early August, ES and Network Infrastructure and Services (NI&S) embarked on a collaborative effort to build and launch a public-facing dashboard to track COVID-19 cases before students returned to campus. In just 11 days groups from ES and NI&S created and proposed several prototypes,



The COVID-19 dashboard provides information on testing rates, positivity rates, number of infections, and other data, updated daily, to inform students, employees, and the public how COVID-19 is currently affecting the university community. This example shows data from December 22, 2020, at the height of the pandemic in Virginia.

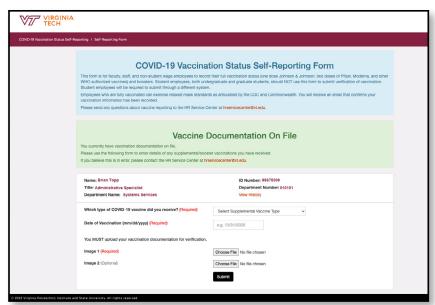
addressed needs for security, database configuration, and licensing, and launched a <u>working version</u> <u>of the dashboard on the VT Ready site</u>.

Over the course of the semester, ES groups continued to modify and improve the dashboard based on user feedback and the evolving needs of the community, adding data features such as positivity rate and estimated inactive (recovered) cases. Having access to timely, accurate data helped Virginia Tech officials make informed decisions regarding restrictions throughout the semester, and helped the university community make informed decisions about their personal risk level. Along with consistent enforcement of public health measures, this dashboard helped the university achieve an overall successful return to in-person activity during Fall 2020.

## Employee vaccine reporting and testing process helps Virginia Tech prepare for in-person fall 2021 semester

With vaccines available to all adults by summer 2021, Virginia Tech implemented a vaccine requirement for students, and strongly encouraged employee vaccination to enable a fully in-person fall semester.

ES worked to implement an online vaccination self-reporting system, along with a process to record routine mandatory testing for employees who had not yet been vaccinated by the initial reporting deadline of August 15. Building the self-reporting system involved multiple employee and administrative applications, as well as multiple integrations with vendor testing tools, operational reports, and analytical dashboards.



The vaccine reporting form allowed students and employees to securely self-report their vaccination status, helping the university plan for the fall 2021 semester.

## Improving knowledge and skills for collaboration through engagement

Collaborative Computing Solutions (CCS) partnered with Microsoft and Google to develop and deliver a series of information sessions designed to maximize benefits of collaboration tools for faculty, staff, and students at Virginia Tech. Through this partnership, three summer events were scheduled: the Microsoft Campus Update Event, a Microsoft Data Center Day, and the VT Google Day Event. These events showcased how each of these industry leaders use their specific toolsets to support modern collaboration workflows. In addition to knowledge transfer, the VT community members also benefited through direct interaction with global partners developing, implementing, and delivering top-level enterprise systems.

### Increasing operational efficiency through Exchange Online student self-service

CCS increased both operational efficiency and customer satisfaction through a project that enabled all students to receive Exchange Online (EO) mailboxes. Previously, EO mailboxes had to be requested by departments for individual students, such as student employees and graduate assistants. Going forward, students who wish to have them will have the ability to self-provision EO mailboxes for their Hokies accounts using <a href="#ADadmin">ADadmin</a> and to manage their email routing between EO and Gmail.



CCS's work to allow students to self-provision mailboxes saves time and effort for students needing access to Exchange Online services.

This change eliminated prior manual steps required by departments to provide their students with EO mailboxes, streamlined overall email support efforts, and reduced the complexity of VT email services. Once a student enables their EO mailbox, the mailbox will remain available as long as the student remains active at Virginia Tech.

### Providing a Common Platform for production applications

The Common Platform Initiative, which is building a single organizational unit to provide application technology infrastructure and shared services for development teams, expanded its offerings to both the Division of IT and the university IT community during FY 2021. The Common Platform team

completed initial testing of the platform and met its goals in December 2020. This phase successfully illustrated the platform's benefits through demonstrations and pilot deployments of production-ready, low-risk applications.

The Common Platform Initiative team also incorporated the findings and analysis of the Cloud Strategy Working group, as well as feedback from the pilot and demonstration, to refine the aims of the initiative. Use of the platform will continue to expand, meeting a broad set of needs for both the division and the university IT community.

#### Continuity of service efforts during pandemic

The Division of IT has been at the forefront of the university's efforts to provide continuity of services both for students and employees since the beginning of the COVID-19 pandemic in March 2020. The IT Experience and Engagement unit (ITEE) played an integral role in the successful transition from all-remote learning to an in-person Fall 2020 semester while protecting the health and safety of their employees. Procuring the software licenses for Information Center staff to work remotely enabled ITEE to set up a tech support model that allowed agents to provide effective support to students during



ITEE worked swiftly to help ensure students had the technology equipment and support they needed when Virginia Tech classes were being held remotely.

the busy August move-in and new student orientation periods without coming on site. Additionally, ITEE worked with the Dean of Students office to facilitate a loaner laptop initiative for students who were in need of a computer that would allow them to complete coursework at home. To best serve Virginia Tech employees, ITEE collaborated with the IT Communications Team to develop a <u>guide to</u> working remotely.

### Creating a consistent, reliable IT support experience across Virginia Tech's campuses

With facilities in seven Northern Virginia locations, and the new <u>Innovation Campus</u> in Alexandria under development, Virginia Tech's presence in the Northern Virginia/Washington D.C. area continues to expand. As such, the need to provide more robust services to campuses in this region, including greater alignment of their operational practices with those of other university units, has become

apparent. Towards this goal, IT Experience and Engagement (ITEE) assisted in implementing ServiceNow as a common IT support platform, and training IT teams at several Northern Virginia locations, during FY 2021.

The ServiceNow platform is currently used by all units in the Division of IT and several departmental IT teams on the Blacksburg campus to track incidents, provide services, and share information. By adopting ServiceNow for incident management, IT teams in the Northern Virginia/Washington D.C. area can take advantage of a common platform for IT Service Management and work more closely with units at other Virginia



Tech campus locations. Both the National Capital Region and Northern Virginia Center teams are slated to begin using ServiceNow for incident management in July 2021. These teams will now be able to transfer incidents between teams across Virginia Tech campuses to provide effective support to users regardless of physical location. Having a common platform also promotes more effective communication among the university's IT support teams and ultimately allows us to provide more efficient, high-quality service to students, employees, and stakeholders.

#### **Operational Excellence Program**

The Operational Excellence Program was initiated as part of continuous improvement efforts on the Division of IT HR team. Its focus is on People, Processes, Performance, and Technology. Several changes have been implemented in each of these areas. In addition to team training related to professional development and emotional intelligence, the team's efforts in refining the use of ServiceNow and implementing business agility have improved team morale and service delivery.

The efforts during this year included the following:

- Implemented Scrum to drive business agility goals and objectives
- · Built internal processing guides and streamlined business processes
- Mapped pipelines for how work comes to IT Human Resources and developed standards for processing work and requests (including user requests, internal requests, and project tasks)
- Complete revision of the IT Human Resources ServiceNow Catalog with the goal of connecting users with any help or information needed (including built in workflows for each request type)
- Initiated a process improvement process via Scrum Retrospectives

These changes have improved team communication and collaboration, creating a fully integrated, self-organized team focused on transparency, inspection, improvement, and ensures that team members have the skills and information needed to perform their work. All request types known as of October 2020 are accounted for in ServiceNow workflows. Since January 2021, process improvements and new request types have been identified and entered. Team effectiveness is now measured using ServiceNow metrics, showing major improvements in the number of tasks carried out each week due to shortened duration times.

### IT employee engagement survey and action plan

As part of our work to foster a culture of employee engagement committed to attracting, retaining, and developing skilled IT talent, the division began in 2017 to conduct a continuous assessment of the organizational climate through a confidential bi-annual employee feedback survey. The survey identifies organizational practices that influence employee engagement and overall employee satisfaction. Survey data is used to inform current initiatives and develop new initiatives to improve the workplace. The IT Connect continuous feedback model and the IT Leadership Development Program are both resulting initiatives.

In the fall of 2020, we shifted to an annual survey that focused on employee engagement. A collaborative team from IT Human Resources and ITEE to develop and disseminate the survey, which included a pulse survey to collect data regarding the impacts of our transition to remote work and preferences for future working modalities. After the survey closed, the team analyzed the data and presented the results via online dashboards, facilitating open and targeted demonstrations and question and answer sessions to assist with interpreting the results and action planning.

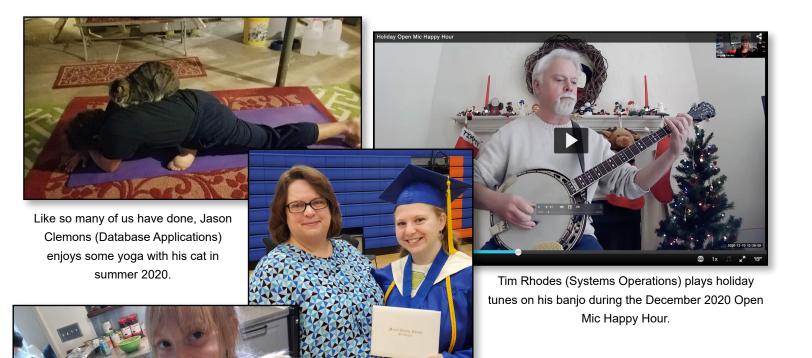
## Online activities for division employees provided a sense of community during height of COVID restrictions

While Virginia Tech resumed in-person classes during the 2020-21 academic year, the Division of IT workforce remained largely remote as the pandemic raged and vaccines were not yet widely available. Providing avenues to connect was important to help employees feel engaged and to foster a sense of community. Since gathering in person was not possible, we looked for creative ways to connect online, using the same collaborative tools that the Division of IT manages and offers to the university for learning and working.

Throughout the year, Division of IT employees took to the #it-friendsandfamily Slack channel to share moments and milestones that normally would have been topics of conversation in the office break room. In addition, Zoom, Slack, and other online methods of collaboration provided a way for employees who had always worked remotely, or who rarely had a chance to come to campus to interact with colleagues, to participate in the conversation.

During summer 2020, the IT Advisory Council hosted weekly Zoom lunch hours, which had no agenda except to allow colleagues to chat. In lieu of the division's holiday reception in December 2020, a committee comprised of staff from the IT Communications Office, IT Human Resources, and the senior leadership team planned and hosted a <u>series of online events</u>. These included an Open Mic Happy Hour, during which several employees showcased their musical and poetry talents via Zoom, a team trivia competition, also via Zoom, and photo contests inviting folks to share holiday pictures on the #it-friendsandfamily Slack channel. The Commonwealth of Virginia Campaign team also took their annual fundraising activity online, hosting a Zoom bingo that granted game winners a donation towards the charity of their choice.

While a return to in-person activities will be welcome as the pandemic wanes, these online methods will remain a part of the division's event-planning strategy.



Bethany Elmore (Finance Applications) celebrates her youngest child's high school graduation in 2020.

Baking was a popular pastime during the early pandemic days. Richard Quintin shared this photo of his child making cinnamon rolls.



Angela Correa (IT Communications) snapped a photo of her kids taking a hike during an at-home school day.

The CVC Bingo tournament allowed employees to exploit some of Zoom's funner features.

### Data Analytics Community of Practice drives best practices for datadriven solutions

In FY 2021 Enterprise Systems made significant advances in promoting data analytics and reporting for departmental needs across the institution, forming a Data Analytics Community of Practice (CoP) in partnership with the divisions of Human Resources and Finance. The primary goal of this CoP is to help drive common best practices and develop centralized analytics solutions to help those using analytics in their work help answer complex questions as effectively as possible. Consisting of nearly 50 employees throughout the university whose primary role involves data analytics, the CoP provides training opportunities, helps group members to build relationships across the university, and facilitates access to data across different domains. In doing so, the CoP helps to prioritize the work done by the centralized data analytics team.

### ITEE expands FASTR support for Division of IT personnel

The Faculty and Staff Technology Resources (FASTR) group within ITEE provides desktop support and maintenance for Division of IT employees whose units have opted in. During FY 2021, FASTR made significant strides to expand their service portfolio, extend coverage to serve more employees across the division, and implement robust remote desktop support solutions.

FASTR expanded its portfolio of desktop support services to provide a broader, more consistent model of support across the division. These include new computer setup with a standard operating system/image that includes unified endpoint management (JAMF or Intune), Microsoft Office, VPN, and encryption. FASTR will also configure the computer's email client, set up domain accounts, and implement administrative rights as appropriate. Other services include upgrades of operating systems and supported software, set-up and maintenance of backups, computer troubleshooting and repairs, printer management, and training for end users. These services are available by request through the <a href="Service Catalog">Service Catalog</a>. FASTR continues to add to its service portfolio, with future enhancements expected to include laptop selection/receiving and IT asset management.

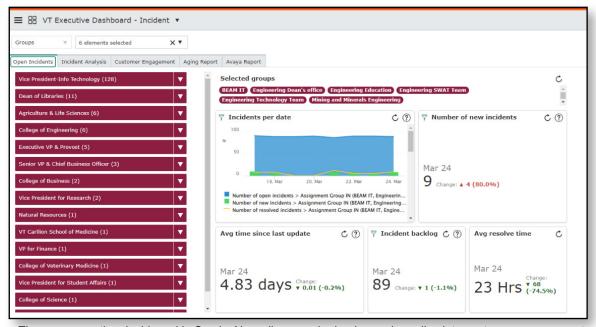
In addition, FASTR onboarded three additional IT groups during FY 2021 — Secure Identity Services, IT Human Resources, and Administration and Planning, bringing the total number of employees supported to over 228. More units are slated to onboard with FASTR in the coming year, further improving desktop support services for our employees.

# Executive dashboard allows Division of IT leadership to gain, deeper insights into user experience

At the request of senior leadership, ITEE developed a new Executive Dashboard in ServiceNow. Enables division leadership to gain greater insight into user experience trends and enables a deep-dive view into critical data over time. The dashboard comprises five key areas:

- Open incidents for each area, including visibility into all partner incident statistics;
- Incident analysis, including incidents by type, average age of open incidents, and first call resolution rate;
- Customer engagement statistics, including survey responses and satisfaction scores;
- Detailed aging report for all areas by state; and,
- A view into Avaya call center data.

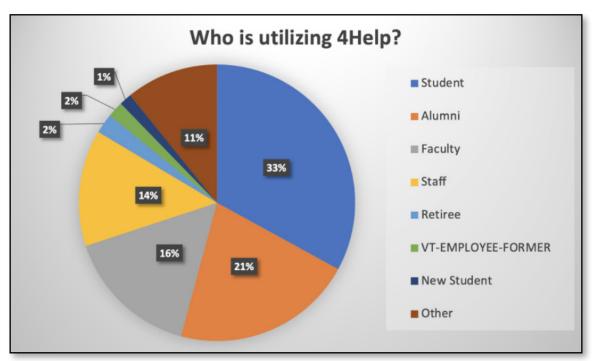
By utilizing ServiceNow Performance Analytics, an integrated application designed for reporting and analyzing IT service performance and quality, ITEE was able to create this comprehensive and responsive dashboard and to allow the division to monitor performance and measure user satisfaction more effectively than before.

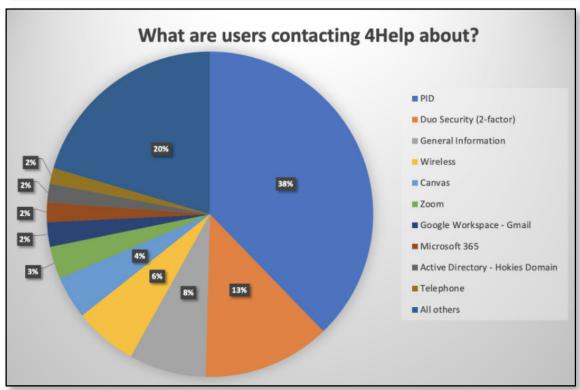


The new executive dashboard in ServiceNow allows senior leaders a deep dive into customer engagement and incident trends in their area of service.

### **4Help User Support Statistics, FY 2021**

Each year, the user support agents at 4Help provides technical support to thousands of members of the Virginia Tech community who request assistance from everything from password resets to network issues in campus buildings and more. The graphics below provide a snapshot of the





#### **User satisfaction survey**

After a 4Help incident is resolved, a user experience survey is offered to each user. Survey questions seek to gain an understanding of the user's perspective on the customer service provided, the overall process, and whether they felt their issue was resolved. Results of individual questions are averaged to generate an overall user satisfaction result.

ITEE User Survey Data, FY 2021		
Total surveys taken	2287	
Percent incidents resolved in < 1 day	95.15%	
Percent of users who said their issue was resolved	94.35%	
How would you rate your experience with the person(s) who resolved your issue?	4.81 (out of 5)	
How would you rate your satisfaction with the process of getting your issue resolved?	4.66 (out of 5)	
Total Satisfaction Score	4.74 (out of 5)	

# Automated testing and performance monitoring capabilities reduce testing time for Secure Identity Services applications

Traditionally, application testing has been performed manually, after writing the code for an application. If errors are found, the development team must go back and address the errors, and repeat the testing process. Not only can this method be time consuming, but also results in important information about the application's required behavior being buried within layers of documentation produced during the development-testing cycles. During FY 2021, Secure Identity Services (SIS) implemented automated testing tools to integrate Behavior-Driven Development (BDD) into its system development processes.

Using BDD, testing is conducted prior to and throughout the development process, using automated tests that guide developers in writing code. Instead of writing code first, an automated test is created based on the required behavior of each aspect of the application being developed, and code is then written to satisfy that test before moving forward. As soon as the code passes a test, those changes

can be moved into production. Using BDD reduces the time it takes for SIS developers to make necessary changes to applications, while also establishing a baseline set of tests that provide a single source of reference to confirm an application's required behavior. The automated tests can also be run rapidly on multiple operating systems and via multiple browsers using third-party testing platforms, which provide SIS with excellent coverage when testing applications.

This report covers many of the Division of IT's most impactful efforts during the 2021 Fiscal Year. We're sure we missed some! We hope you have found this report useful in building your understanding of what we are about and how we strive to be of service to Virginia Tech.

If you have questions, or would like more information on the topics covered within this report, please contact IT Communications via email (<a href="mailto:it.communications@vt.edu">it.communications@vt.edu</a>). Thank you.



Office of the Vice President for Information Technology MC 0169 755 University City Boulevard Blacksburg, Virginia 24060 vpit@vt.edu | (540) 231-4227

