



Information Technology Annual Activities Report 2010-2011

**Office of the Vice President for
information Technology**
www.it.vt.edu

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Information Technology serves the university community and the citizens of the Commonwealth of Virginia by applying and integrating information resources to enhance and support teaching and learning; participate in, support, and enhance research; foster outreach, develop partnerships with communities and promote the capabilities of advanced networking and communications; and provide, secure, and maintain university systems.

This annual report of activities presents highlights of the year for the entire organization, and reports from each of the major organizations within Information Technology. Vice President Erv Blythe is assisted by the leadership of these groups, an experienced cadre of professionals:

Administration and Planning	Jeb Stewart, Chief of Staff and Deputy CIO
Advanced Research Computing	Terry Herdman, Associate Vice President
Converged Technologies for Security, Safety, and Resilience	Brenda van Gelder, Executive Director
Enterprise Systems	Deborah Fulton, Associate Vice President
Learning Technologies	Anne H. Moore, Associate Vice President
Network Infrastructure and Services	William C. Dougherty, Executive Director
Secure Enterprise Technology Initiatives	Mary Dunker, Director
Information Technology Security Office	Randy Marchany, Information Technology Security Officer
Strategic Initiatives	Jeff Crowder, Executive Director
Strategic Partnerships	Hud Croasdale
Chief Technology Architect	Carl Harris, Director

Featured projects

Strategic goals in the current environment include maintaining the security of the university's network, computing, and data resources; facilitating research into and using high performance research computing and networks; and fostering organizational agility to meet changing needs and demands.

Security

Protecting the institution's data resources presents dynamic and evolving challenges, many that related to how we human beings use our systems. Information Technology deployed several new functions this year that assist people using technology to maintain secure computing environments. Vigilance relating to the technical security of networks and systems continues to guide daily work as well.

Password change project

The vice president required that all enterprise passwords be changed this year and annually thereafter. Changing passwords means that they will comply with stronger complexity rules, now, and as rules may change in the future. The Information Technology Security Office provided leadership and the responsibility for publicity. Many other units created notification and reminder tools, or modified systems to enforce the password expiration and complexity attributes. These include Security Enterprise Technology Initiatives; Converged Technologies for Security, Safety, and Resilience; and Enterprise Systems.

Account recovery options project

Account recovery options present a new ability for employees and students to self-manage resetting forgotten passwords. Self-service is both more convenient and more secure, since no person needs to know even a temporary password, other than the account-holder. The methods chosen improve on older, less secure means of challenge-response or secret questions by using one-time passwords sent to a pre-registered telephone via text or voice. Account-holders may also use OpenID in previously registered accounts with Google or Yahoo. Account recovery options facilitate the password change mandate, whether for long-used but forgotten passwords, or for newly changed—and forgotten—passwords.

Intrusion detection systems and malware discovery

Information Technology Security Office and Network Infrastructure and Services deployed an intrusion detection system in core switching centers to monitor patterns in network traffic, identify attacks, and gather metrics about attack types and sources. Data from this system give daily evidence of malicious network traffic.

In a related effort, a pilot project this year analyzed outgoing data streams for suspicious traffic, particularly traffic that may indicate a breach of sensitive data. These discovery tools allowed rapid remediation.

High performance research

High performance networking

Continuing a project started last year together with the Virginia Tech Foundation, Network Infrastructure and Services completed construction of a private optical network linking key strategic resources in northern Virginia including the Northern Virginia Center in Falls Church and the new Virginia Tech Research Center-Arlington. Capacity and functionality exceeds the early expectations, with the network providing virtually unlimited capacity. The initial commitment for at least 10 gigabits per second tying the research center to the hub node in McLean for access to Internet2, NLR, federal nets, the main campus, Internet, and other networks. That capacity is now expected to be an aggregate 400 gigabits per second of initial capacity, scalable up from there. The system's rich capabilities integrate the most advanced Ethernet switching services over a dense mode wave division multiplexing layer. As a result, we will be able to offer extremely high capacity services precisely tailored to meet the unique requirements of individual researchers with only marginal incremental cost. The

system will be fully redundant with diverse fiber paths and automatic failover capabilities for individual services so it will be extremely robust. Effectively on-net for all the national and international high performance research networks, the center will be as well-connected as any research facility in the world.

Also coming to fruition this year is the fiber project funded by a Broadband Technologies Opportunity Program grant in 2010 to the Virginia Tech Foundation. The project extends Virginia's open-access, fiber-optic backbone into the central Appalachian region of the state. On contract to the VTF, NI&S teams designed the project. With the grant in hand, this year's work has overseen the construction, with a "go live" expected during the coming fiscal year. The new path adds 108 miles of fiber, beginning at Bedford and stretching through neighboring counties to Virginia Tech.

High performance computing

The Athena GPGPU cluster was new this year. The graphics processing units and large RAM memory footprint complement the other research computing machines managed by Network Infrastructure and Services and by Advanced Research Computing units.

Even newer is the HokieSpeed research computing system. HokieSpeed uses both CPUs and GPU (graphics processing units). It was implemented successfully despite a very tight time constraints. The staff of Information Technology Acquisitions ensured that the procurements were expedited; NI&S staff members ensured receiving and inventory control of the new components, as well as installation. Administrative and Planning Facilities staff oversaw the appropriateness of the infrastructure—power, cooling, space; NI&S also worked through system and network administration to facilitate successful operation. An NSF instrumentation grant awarded to principal investigators from engineering and the sciences provided acquisition funding. Once their initial research program is complete, Advanced Research Computing will facilitate general research use of the system.

Teaching and learning

The completion of the university transition from the Blackboard course management system to the community-source Sakai learning management system this year was a happy anti-climax! Years of work by Learning Technology to ensure that the locally branded *Scholar* system met the needs of the Virginia Tech community, to demonstrate and train community members on the system, and to provide both technical and person guidance to instructors making the transition—all these years of work ended quietly in December with the shut-down of the legacy Blackboard system.

The community-source system allows Virginia Tech more direct control in creating and enhancing features as well as timeliness in fixing problems.

Virginia Tech technology entrepreneurial initiatives

In January 2011, the VT Technology Services & Operations Corporation came into being, after the concept was approved by the board of visitors the preceding August. The corporation exists for the benefit of Virginia Tech, with a focus on developing emerging technologies that advance the goals of the university in scientific research, clinical research and education, and instruction. The corporation may also provide services related to the use and operation of emerging and advanced technologies. The corporation will manage strategic emerging technologies and services with the potential to scale beyond serving only Virginia Tech; with the potential to attract external private partners; or with the potential to spin out as independent entities. While separate from the university, the corporation holds an affiliation agreement with Virginia Tech.

Activities of the corporation will focus on high performance computing, communications, and information technology capabilities where products and services critical for the strength and competitiveness of the university's research and education programs are not yet commercially available. Examples of such efforts range through cyber security initiatives, command and control centers, communications infrastructure, data analytics, and mobile applications development.

VT Technology Assets, LLC, was also established in January 2011 as a subsidiary of the Virginia Tech Foundation (VTF). Assets are managed under contract by Information Technology with VTF oversight. The LMDS licenses are held by the LLC, along with the foundation's interest in National LambdaRail and various usages rights to fiber optic networks.

Financial summary

During fiscal 2011, the organizational units of Information Technology were provided resources totaling \$57,132,824 in support of university academic, research, administrative, and outreach goals.

Source of funds

E&G	\$31,426,036
Equipment Trust Fund	2,777,386
Auxiliary operations	20,232,882
Sponsored grants and contracts	1,785,194
Continuing Education	79,169
Overhead	669,140
Other sources	163,017
Total	<u>\$57,132,824</u>

Use of funds

The organization expended educational and general funds support for academic, research, and administrative activities totaling \$18,709,130. Network Infrastructure Services provided network, video, computing and other infrastructure services of approximately \$8,135,972. Learning Technologies system support totaled \$4,503,585.

The Telecommunications Network Auxiliary expended \$15,710,460 in network infrastructure and communications support, and the Student Software Sales auxiliary expended \$ 1,386,725 in support of software sales to students.

Advanced Research Computing

Advanced Research Computing (ARC) promotes the university's research computing capacity, including visualization and visual computing. Key priorities for the year address shared memory machines, cluster computing, visualization and visual computing systems, along with increasing the awareness of the services available to university researchers.

Infrastructure

Shared memory

A top priority for Advanced Research Computing is addressing the shared memory machines, which are in heavy use but have an expired maintenance contract. A proactive strategy suggests planning a near-term replacement. Progress on this priority during the year included the acquisition of a new SGI UV system. The new system has 42 blades, 84 sockets, and 504 cores (2.66Ghz CPUs) with 2.68TB of memory. The system will be online and available to researchers early in the coming fiscal year.

Cluster computing

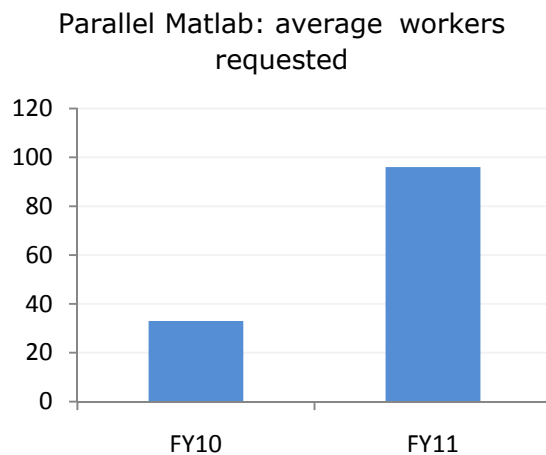
We are evaluating options for the next large-scale cluster computational system, an updated technology akin to System X. We continue to identify and consolidate requirements from across the user community. While there is clear consensus that a System X replacement must be a priority, the architecture and procurement strategy is still to be determined. This item continues as a primary goal for 2012.

Utilization of our cluster systems over the year shows some interesting trends. First, the new Athena system has a growing user base as faculty try new programming idioms (e.g. CUDA) and new visualization paradigms. This is a promising trend that bodes well for Virginia Tech users to harness the full power of this machine (and other architectures like it, such as HokieSpeed).

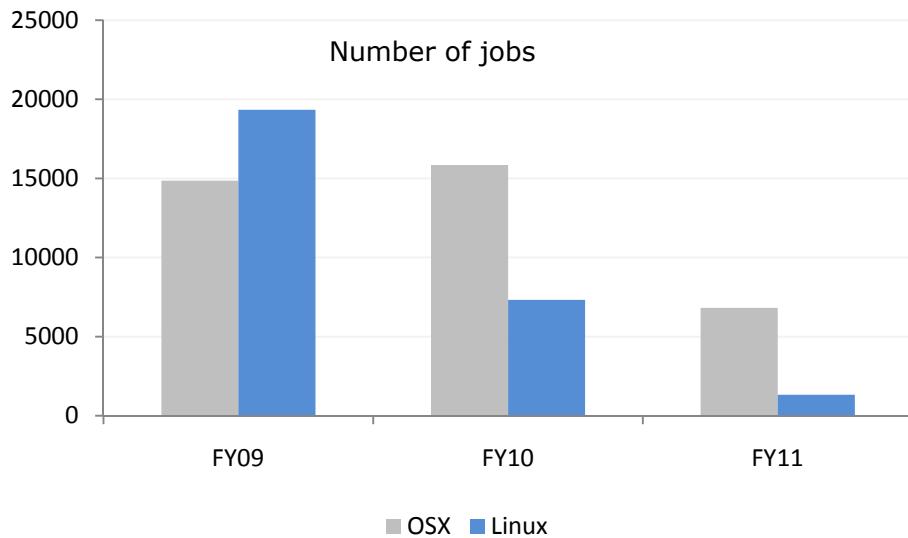
The Appro GPU Cluster is a cluster system with GPUs and large RAM memory footprint. There are 42 quad-socket, octa-core nodes (1344 cores) with 64 GB RAM each (12.4 TFLOP peak). Across sixteen of the nodes there are 32 FERMI GPUs from nVidia. This cluster is an innovative addition to ARC's computing portfolio. In terms of number of cores and TFlops, it is larger and faster than System X. In addition, each node has significantly more RAM. Athena also provides a strong initial platform for VT users in visualizing large datasets and doing general computing on the GPU. These architectures, languages, and capabilities are similar to those we will see in the forthcoming HokieSpeed. This was the first full year of use for Athena.

Type of use	Jobs run	Number of users	Average CPU per job	Aver hours requested per job	Average hours used per job
General cluster computing	19704	42	133	418.9	25.8
GPU processing	4789	20	108	13.8	1.5

Secondly, our new Parallel Matlab workers on Ithaca are staying busy. This suggests that many faculty members have existing Matlab code and that client installation hurdles can be overcome.



Third, we can see that System X utilization is dropping. We attribute this the fact that new faculty are less inclined to learn on an old system and existing users are sending their larger jobs elsewhere such as the clusters on TeraGrid and the National Center for Computational Sciences (NCCS).



Visual computing

This year, we brought our production visualization facilities back into leadership class. A new, reconfigurable set of displays and immersive visualization equipment was brought online in Torgersen Hall in the newly-named 'Visionarium Lab'. The original CAVE is now a state-of-the-art VisCube with wireless tracking and passive stereo. Unique views of 3D models and data can be experienced with a variety of display form factors and resolutions. The upgrade is significant and puts the university's immersive facility back in the top academic installations in the country for resolution, brightness and contrast. For more, see <https://snoid.sv.vt.edu/visionarium/>.

2009-2010	GPU memory bandwidth: 304 GB/sec; Millions triangles/second: 1293; Pixels: 18,668,640
2010-2011	GPU memory bandwidth: 1612.6 GB/sec; Millions triangles/second: 3684; Pixels: 85,720,160

These figures do not include the remote rendering capacity of Athena.

Education and training

To increase the visibility of and communication about advanced research computing resources, we sought to improve the quantity and quality of the presentation of ARC resources—online, in on-campus presentations, and other training sessions. This goal continues for next year. Since advanced research computing users come from all across campus, we diversified our offerings this year to provide more specificity on visualization skills and more introductory material for using research computing systems.

In August 2010, we hosted a three-day intensive, hands-on High-Performance Computing (HPC) Boot Camp, which taught parallel programming and visualization skills to more than 48 attendees. In addition, we offered two short courses through the Faculty Development Institute, four hours each, in the fall. The courses are “Scientific Visualization with Advanced Research Computing Resources” and “3D Modeling and Animation for the Web.” In the spring, we offered the full track (12 hours), “Deep Media for Research and Education,” and the short course “Introduction to HPC at Virginia Tech.” We also expanded the HPC Boot Camp materials and tutorials, including the documentation for the new Athena system and remote visualization.

Outreach

ARC organized a successful booth at Supercomputing 2010 in New Orleans. In a partnership with the University of Virginia, Virginia Tech produced an exhibit booth on the Supercomputing show floor, showcasing the capabilities and applications of our computational science and research. In addition, ARC faculty members are also leading members of several organizations with broad impacts across industry and academia such as the HPC User Forum, the Coalition for Academic SuperComputing and the Web3D Consortium.

Support services/personnel

Among the challenges and opportunities for research computing at Virginia Tech is staffing. Peer universities have established HPC centers with six to 12 full-time staff members. Successful research computing cyber infrastructure includes three crucial elements: hardware, software, and support services—people. For effective and sustainable resources at Virginia Tech, we continue our efforts to establish an annual budget for research computing and visualization.

In achieve the programmatic goals, ARC must have an expert research computing staff. We have worked to develop a plan for personnel, organization, and hiring to scale up advanced research computing staff and support. The university HPC Investment Committee has recognized staffing and organization as a priority, and recommended ten support positions to serve researchers across campus. We continue to scope and define these positions to reflect the needs expressed by the faculty and the resources available. The positions include several levels and skill sets, including computational specialists, systems analysts, and system administrators.

Through the upgrades to resolution, brightness, and contrast in the Visionarium, this year saw significant adoption of Athena and the Visionarium by faculty members in departments as diverse as computer science, geosciences, architecture, building and construction, mechanical engineering. In addition, several undergraduate classes visited the facility and several graduate classes used the lab space and equipment as a basis for projects.

Research

The Visual Computing Group made several important strides in both pilot and funded research projects. Our initial work with Center for Geospatial Information Technology (CGIT) to develop the n-dimensional city models has culminated in the large

collaboration *3D Blacksburg*. 3D Blacksburg is an open, standards-based set of data products representing our town and campus including terrain, images, and buildings. From safety and security to town planning, from wayfinding to friend-finding, the open data and models of 3D Blacksburg provide a platform for further synergies. Included in this effort is a pathway for School of Visual Arts' tools to feed immersive environments. For example, the new Center for the Arts building was virtually added to an immersive version of 3D Blacksburg. The coming year will publish more layers and details. For more, see www.vt.edu/spotlight/innovation/2011-03-28-3d/3d-blacksburg.html.



Our work with CGIT to build interactive geospatial visualization systems was the subject of a recent, peer-reviewed paper—Dan Tilden, Ankit Singh, Nicholas F. Polys, and Peter Sforza. 2011. Multimedia mashups for mirror worlds. In *Proceedings of the 16th International Conference on 3D Web Technology (Web3D '11)*. ACM, New York, NY, USA, 155-164.

Our international leadership in standards development is bearing out in **volume rendering** and **medical imaging**. Our volume rendering component is now a part of Extensible 3D (X3D) Version 3.3 and currently under public comment. One area of future work may be the specification and support of tetra or hexahedral meshes in X3D. This work would open up an exciting area for new standards-based visualization techniques of finite-element simulation or interactive haptic rendering. A sample of research is found in the paper—Ullrich, S., T. Kuhlen, N. F. Polys, D. Evestedt, M. Aratow, and N. W. John, "Quantizing the Void: Extending Web3D for Space-Filling Haptic Meshes", *Medicine Meets Virtual Reality (MMVR)*, vol. 163, Newport Beach CA, USA, IOS Press, pp. 670-676, February, 2011.

The National Science Foundation-funded effort to integrate structural simulation in the **design education of undergraduate architects** progressed significantly in its second year. This year we implemented a rich design client and simulation server for our Structure and Form Analysis System (SAFAS). We piloted the online curriculum with classes (via website and Scholar); in the coming year, the tool also be used in classes at Hampton University and the University of Illinois. Also funded in this period is the National Science Foundation's **National Center for eDesign** where Virginia Tech is

the lead institution of an industry university cooperative research center (IUCRC) in information technology-enabled engineering and design. Other member schools are Carnegie Mellon University, the University of Massachusetts-Amherst, the University of Central Florida, the University of Buffalo, and Brigham Young University.

Advanced Research Computing continues to leverage its visual computing capabilities into basic research in computer science and **perception**. Another sample of research is Polys, N., D. Bowman, and C. North, "The Role of Depth and Gestalt Cues in Information-Rich Virtual Environments", *International Journal of Human-Computer Studies*, vol. 69, 2011. We worked with the Institute for Critical Technology and Applied Science's Center for Naval Systems and the Virginia Tech Applied Research Corporation in the development of several significant proposals. There seems a healthy demand for research in this area, and we continue to build and refine winning teams.

Goals for 2012

To maintain and expand HPC hardware infrastructure, bring the HokieSpeed system into production and develop an achievable strategy for a new large-scale cluster as a System X replacement

To build the HPC support team, hire, train, and organize new staff

To foster multi-user collaboration services, deploy a standards-based visualization platform for the online sharing of 3D models, animations, and worlds such as simulation results

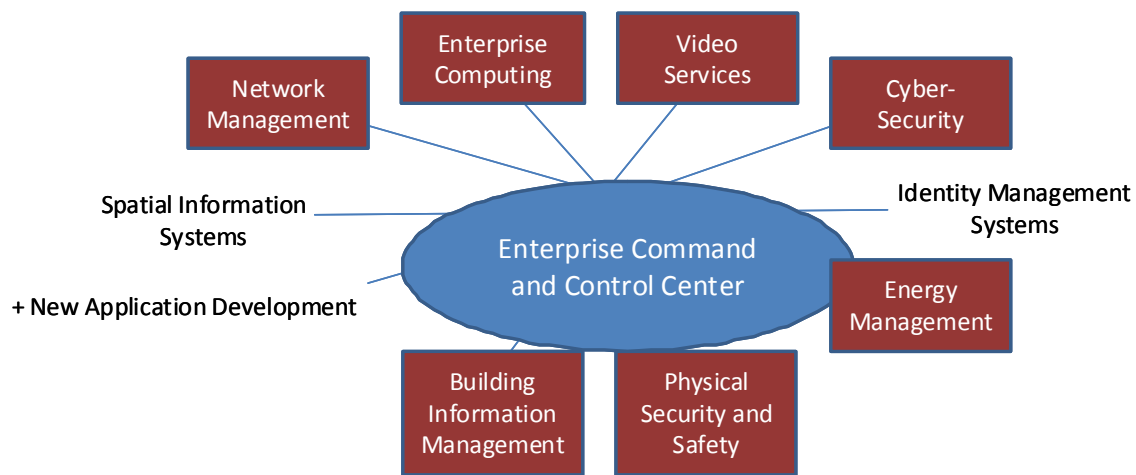
Converged Technologies for Security, Safety and Resilience

Converged Technologies for Security, Safety and Resilience (CTSSR) is responsible for coordinating, integrating, and developing advancements within the IT organization on strategic initiatives that involve the intersection of information technology security and physical security activities, campus safety, and community/regional resilience. (See the full mission statement at www.it.vt.edu/organization/ctssr.html.)

Converged Technologies oversees continuity of operations and disaster recovery activities, and includes the following units:

- Converged Technologies
- eCorridors
- Virginia Tech Geospatial Information Sciences (VTGIS)
 - Center for Geospatial Information Technology (CGIT)
 - Enterprise GIS
- Identity Management Services (IMS)
- Blacksburg Electronic Village (BEV)

During the year, Converged Technologies participated with staff reporting to the vice president for administrative services—police, emergency management, student services, and others—in beginning the early planning stages of a 24/7 unified command and control call and dispatch center. This new facility will incorporate existing functions of the Network Operations Center, police dispatch and walk-ins, security video monitoring, enterprise computing, and cyber security. It will also incorporate the functions of building information management, identity management, and energy management. The security and safety aspects of the new unified command and control center are being developed in partnership with L3 STRATIS/ERIS to develop and implement a situational awareness platform that incorporates geospatial data for interior and exterior building views and will integrate data streams from sensors and other sources to create a common operation picture for building managers, emergency responders and facilities operations.



Virginia Tech’s operations center is moving toward incorporating building information management, physical security and safety, and energy management.

With Network Services and Infrastructure and the Virginia Tech Police, Converged Technologies completed the police mobile data terminal project, described in the Network Infrastructure and Services section. A third major initiative of Converged Technologies was to do a complete update of the continuity of operations plan for Information Technology and the associated risk assessment, disaster recovery plan, and emergency action plans.

eCorridors

An Information Technology outreach unit, eCorridors works to facilitate and promote the ability for every person, organization, and community in Virginia and beyond to have the capability, at a reasonable cost, to produce and access high volume information and services in the networked world. It works to advance broadband policy and access, as well as economic development and community resilience activities throughout the region and beyond.

Speed testing

As a partner in the Virginia state broadband mapping initiative, funded by the National Telecommunications and Information Administration, eCorridors is responsible for the collection of consumer side Internet performance data from residential, business, and community anchor institutions. In November 2010, the eCorridors program launched a new portal and enhanced Internet speed testing application called Accelerate Virginia. From January through March, we designed a custom speed testing application for the Agriculture, Human and Natural Resources Information Technology unit to conduct a speed testing campaign of all their remote offices. In all, 114 of the 133 (85.71%) remote connections were tested. eCorridors worked to update the version of the K-12 Internet speed testing application, releasing it in July 2011. It allows administrators at elementary, middle, and high schools to test Internet connection speeds and report their findings back to the Virginia Secretary of Technology's office. So far, 310 (16.88%) Virginia public schools out of 1837 have tested their connections. We also engaged with fifteen counties to initiate localized Internet speed testing campaigns, resulting in more than 4000 new Virginia data points

Virginia Broadband Advisory Council

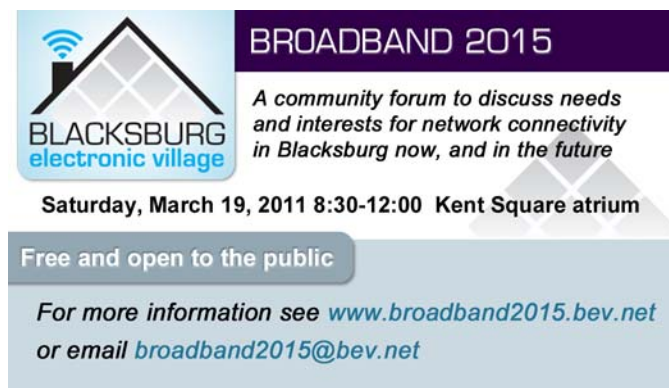
In May 2011, the staff of eCorridors assisted the Center for Innovative Technology in coordinating the regular meeting of the Virginia Broadband Advisory Council held in the Corporate Research Center.

Google Fiber for Communities

In February 2010, Google announced the Google Fiber for Communities project in which Google declared their intent to build and test ultra-high speed broadband networks in a small number of trial locations across the country. Google invited all U.S. municipalities interested in having their communities serve as a trial location to respond. Virginia Tech and the Town of Blacksburg submitted a joint application named "FutureForward Blacksburg."

As part of the town's submission the director of eCorridors and Blacksburg Electronic Village, Brenda van Gelder, worked with others in Information Technology to gather and document extensive data about Blacksburg required for the application. Virginia Tech Geospatial Information Sciences (VTGIS) prepared a video that illustrates a number of applications that citizens, students, government officials, and businesses in the town would be able to use if a gigabit Ethernet were available. The video features Virginia Tech's President Charles W. Steger. Rick Boucher, then Virginia Representative and chair of the U.S. Federal Communications Commission's technology and Internet subcommittee, also provided a video in support of Blacksburg as a location for Google's project (<http://www.youtube.com/user/eCorridors>).

We submitted the "FutureForward Blacksburg" response on March 26, 2010. Google announced the selection of Kansas City, Missouri, in March 2011. Although Blacksburg was not selected, the momentum, interest, and collaborations generated by the process led to other joint actions in support of the Blacksburg Broadband Vision 2010, which envisions an operational Gigabit network available to all citizens of Blacksburg by 2015.



The poster features a logo on the left with a house icon and a Wi-Fi symbol, labeled "BLACKSBURG electronic village". To the right, a purple banner reads "BROADBAND 2015". Below this, text describes the forum as a community forum for discussing network connectivity needs. The event details are: "Saturday, March 19, 2011 8:30-12:00 Kent Square atrium". A grey box states "Free and open to the public". At the bottom, contact information is provided: "For more information see www.broadband2015.bev.net or email broadband2015@bev.net".

BROADBAND 2015

A community forum to discuss needs and interests for network connectivity in Blacksburg now, and in the future

Saturday, March 19, 2011 8:30-12:00 Kent Square atrium

Free and open to the public

For more information see www.broadband2015.bev.net or email broadband2015@bev.net

Broadband 2015

On March 19, 2011, the Blacksburg Electronic Village, Inc., and the Town of Blacksburg co-sponsored a community forum entitled "Broadband 2015." The purpose of the event was to create awareness in the community about opportunities and needs with regard to high speed Internet connectivity to homes and businesses, and to discuss Blacksburg's vision for

developing an advanced communications network infrastructure. The forum brought together more than 80 participants, including the mayor, town council members, numerous residents, and members of the business community. The recorded audio files of the forum are available at <http://www.blacksburg.gov/Index.aspx?page=513> (search keyword Broadband 2015).

Center for Geospatial Information Technology

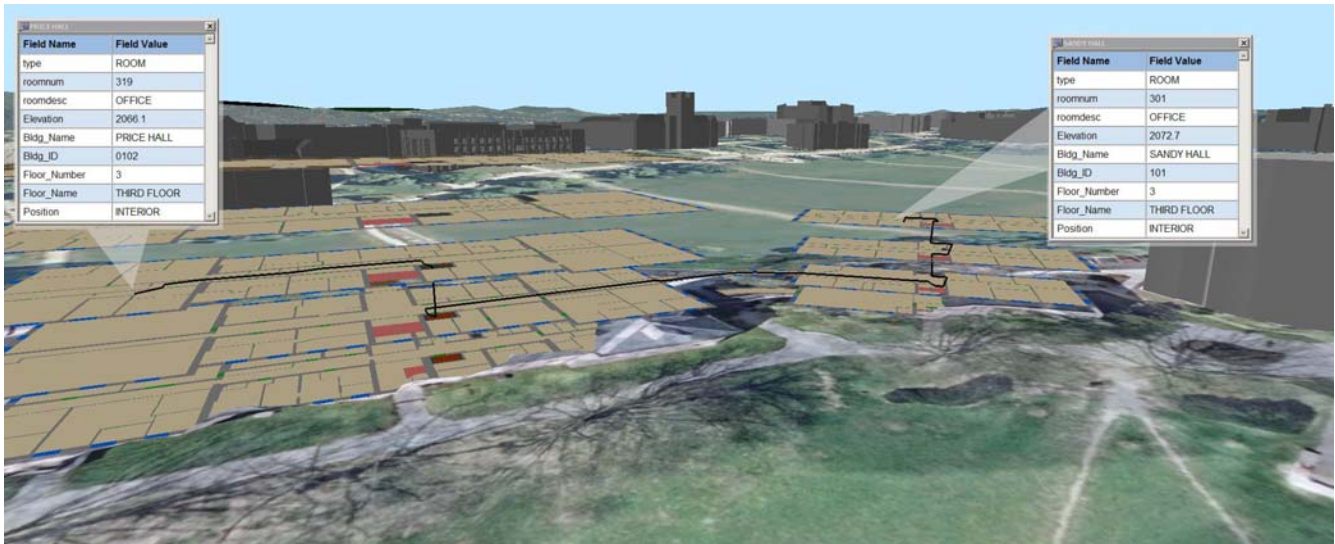
The Center for Geospatial Information Technology (CGIT) is an interdisciplinary university research center, and part of Virginia Tech Geospatial Information Sciences reporting to the executive director of Converged Technologies for Security, Safety and Resilience. The CGIT faculty and its students engage in high quality, applied geospatial information research in safety and security, 3D GIS, spatial modeling and simulation, and community resilience. In addition to external sponsored research, CGIT has adopted a living lab concept and strategy to facilitate cross domain research-to-operations outcomes for operational and administrative geospatial priorities at Virginia Tech.

Research initiative: open source data analysis using Twitter feeds

A research project in open source geospatial data from social networks resulted in the development of a semi-automated work flow and software to harvest user-specified terms from a defined area of interest from the Twitter.com Web services. We initially developed a modified version of the Archivist software for storing tweets. In the latter stages of the project, we used a Python script that runs a key word and area of interest query directly on the Twitter API Web services. For example, nearly 3000 tweets containing the term 'broadband' were collected via a query for the geographical region of the state of Virginia during November 2010. Aggregating and organizing open source information from sources such as Twitter provides useful insights for many problems, including social research, market analysis, and situational awareness.

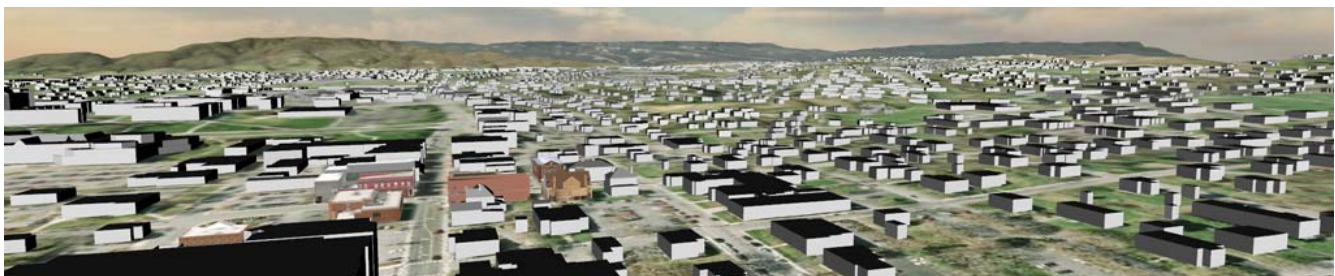
Interior space GIS: a foundation for campus-wide planning and management

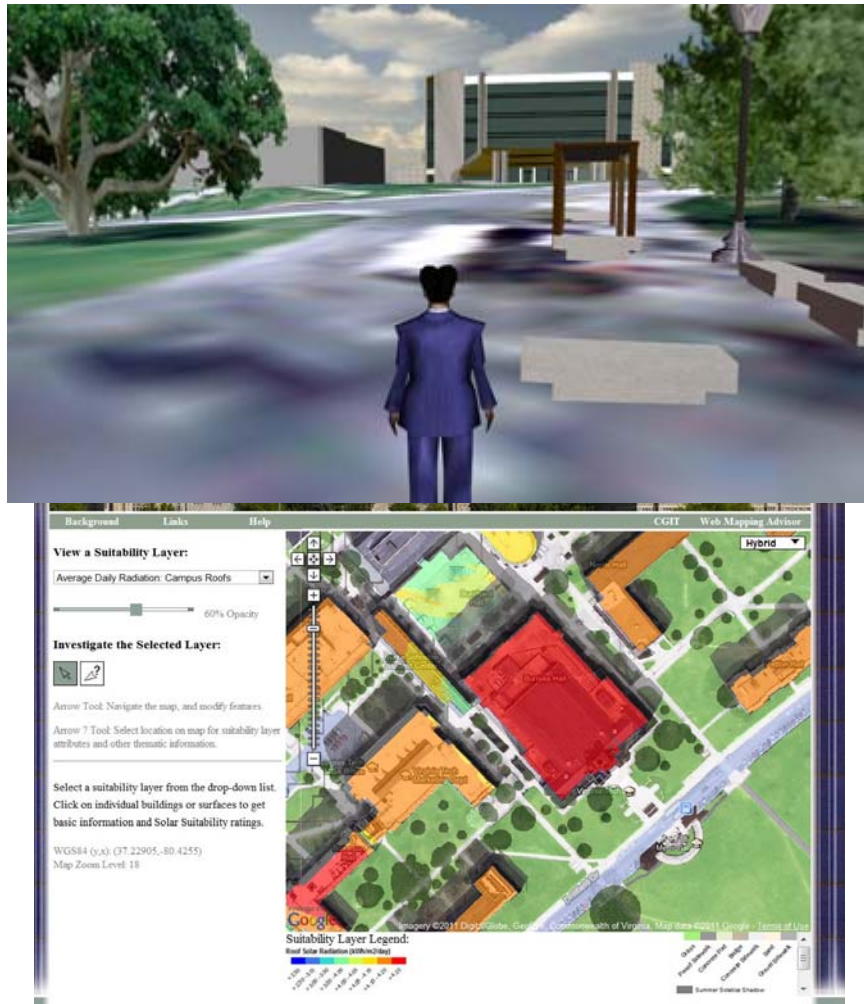
VTGIS is integrating building floor plans into an enterprise GIS to improve campus planning and management. Although Virginia Tech has maintained separate mapping of interior and exterior features for many years, the completion of this project will mark the first time the campus has combined these in a unified viewing environment. By updating the format of the interior space mapping and placing it in a geospatial context, new modes of interaction, analysis, and visualization will be possible. Examples of ways the interior space GIS may be used include space accounting and management, fixed asset and hazardous substance mapping, precise E-911 response and situational awareness, wayfinding and evacuation routing, visualization of campus populations by day and time, and links to other documentation stored in the digital plans library or work order management system. The interior space GIS will be a generalized depiction of interior spaces based on existing floor plans. As building information model files become available for newly constructed buildings, and interior space surveys improve the mapping of existing buildings, the accuracy of interior space GIS will improve.



3D Blacksburg

The 3D Blacksburg Collaborative develops, curates, and serves 3D GIS, building, terrain, sensor, and community information through interactive, Web-based spatially enabled virtual environments. The 3D Blacksburg faculty and students are working to organize open, standards-based resources for online geospatial visualization and seed the demand for a new modality of presence and participation. The 3D Blacksburg Collaborative develops and curates a multi-dimensional city model of the Town of Blacksburg and its surroundings and is participating in the W3C and the Open Geospatial Consortium—OGC—coordinated 3D Portrayal Interoperability Experiment, or “3D-PIE.” This spatial data infrastructure supports several interactive geospatial information and visualization services including building models and terrain, and a broad array of content overlays. Citizens, scientists, and scholars can use these resources for many applications including planning and community and economic development. A new Web portal for 3D Blacksburg, launched in April 2011, can be found at <http://www.3dBlacksburg.org/>.





Enterprise GIS

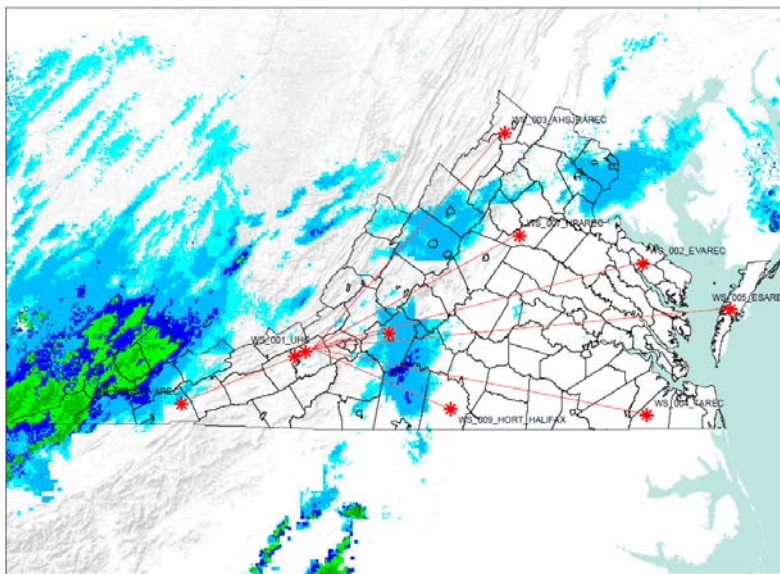
The Enterprise GIS unit of the Geospatial Information Sciences division is a key component of Virginia Tech's spatial data infrastructure, providing GIS data hosting, systems integration support, and Web application development services to both academic and administrative units of Virginia Tech. Enterprise GIS supports the university's strategic objectives by lowering barriers to the use of advanced geospatial technologies in research, teaching, outreach, emergency response, facility operations, and campus planning.

Partnering with BEV for Web application development

Due to the increasing popularity of the Web as a platform for interaction with GIS data, the ability to design and maintain efficient, scalable Web mapping applications has risen to prominence as a key component of Enterprise GIS's service portfolio. In 2011, Enterprise GIS and the Blacksburg Electronic Village (BEV), an internationally recognized outreach unit of Information Technology, began a long-term collaboration to enable BEV's considerable depth of expertise in Web application administration and hosting to be leveraged for Web-based GIS projects. This partnership enhances Enterprise GIS's ability to deliver robust, complex Web applications to client departments, and aligns with CTSSR's executive director's long-term vision for BEV to become more engaged in the geospatial arena.

Mesonet: Integrating and disseminating weather data

For many years, Virginia Tech's College of Agriculture and Life Sciences has maintained a network of weather stations at the Agricultural Research and Experiment Stations, research farms, and other sites across the commonwealth. Enterprise GIS recognized that the output of these stations is fundamentally spatial information, and developed a systems integration strategy to automatically feed the daily observations into the central GIS database, making it available for researchers in multiple academic disciplines. In addition, researchers from other institutions have come to recognize the unique asset Virginia Tech possesses in having its own weather station network, and in 2011 Enterprise GIS developed a Web-based data extraction tool that enables research collaborators of Virginia Tech faculty members at other universities to access the entire time series of meteorological observations for use in their own models.



MEASURES: Quantifying ecosystem services

With the prominence of the issue of climate change, researchers have devoted considerable attention to quantifying the “ecosystem services” provided by natural environments. In particular, researchers in the department of Forest Resources and Environmental Conservation have developed a tool called MEASURES to estimate the amount of carbon that a healthy forest can sequester, as well as the nutrients and sediment that it can prevent from entering the watershed, enabling landowners to accurately assess the hidden costs of harvesting that resource. Working with the Center for Geospatial Information Technology, Enterprise GIS integrated the MEASURES tool into a Web application platform called InForest, developed by the Virginia Department of Forestry and the Timmons Group. This tool enables forest landowners to delineate a tract of land, run the MEASURES tool from a Web interface, and receive a report of the ecosystem services that piece of land provides. Additionally, Enterprise GIS has entered into an agreement to migrate the hosting of the entire InForest application to Virginia Tech, allowing the MEASURES tool and its Web interface to evolve together as our researchers’ understanding of this important problem continues to improve.



Identity Management Services

Identity Management Services (IMS) is the production office responsible for electronic identity and access management at Virginia Tech. Identity management is becoming increasingly integral to Converged Technologies in the areas of safety and security due to its essential role in electronic access, network security, and maintenance of identities for campus personnel and students. IMS provides policies, procedures, and support for secure access to information resources to complement teaching, learning, research, and outreach, and to support administrative operations.

- IMS currently manages the lifecycle of approximately 742,000 electronic identities at Virginia Tech.
- IMS has defined 44 different affiliations that describe the type of association that an electronic identity has with Virginia Tech.
- IMS has resolved approximately 6600 trouble tickets regarding access issues from July 2010 until the present.

Projects undertaken or brought to completion this year enhance secure identity management.

Self-service password reset

IMS personnel led a project team for the development of a set of self-service password reset tools. The project includes development of the infrastructure, processes, and procedures. With the launch of the self-service PID password reset tool on June 1, 2011, the first phase of the project ended. The service utilizes leading-edge technologies to provide users with several convenient and secure methods for resetting their own passwords. A user may choose to have

a single-use, limited-time code sent to their cell phone via a text message. The user may also choose to receive the code on a cell or landline phone via a voice message. Another option would be for the user to pre-register an existing Google or Yahoo account for use in authenticating to the service. To date, approximately 40,000 users have enabled their self-service PID password reset options.

Future deliverables of the project will be a Banner/Oracle password reset tool slated for April 2012 and a Hokies password reset tool scheduled for June 2012.

Banner Enterprise Identity Services (BEIS)

The IMS director is leading a project team for integrating Sungard Higher Education's (SGHE) BEIS product into Virginia Tech's current identity management infrastructure. One deliverable will be a single sign-on environment—via the Central Authentication Service—for SGHE's Internet Native Banner, Self-Service Banner, Travel and Expense, Workflow, and Document Management products. A second important deliverable will be automated provisioning and deprovisioning of users across Virginia Tech's SGHE products. Work has begun to define events triggering provisioning and deprovisioning, necessary role and authorization information, and structuring of messages for communication among the products.

Required password change initiative

IMS served on the technical team to implement the required password change of all PID, Oracle, and Hokies passwords by July 2011. IMS collaborated with the Middleware team to expire approximately 158,000 PID passwords. IMS led the effort for Oracle passwords. We modified password management processes to use newer controls and functionality available in Oracle 11g. We migrated all users into new Oracle profiles to enforce password complexity rules and password expiration.

Virginia Tech affiliates

As more processes move to an online environment, more individuals require secure login credentials. IMS works with groups across the university to ensure secure identity management provides these credentials.

We are working to address the needs for university departments and services to provide appropriate electronic access to non-Virginia Tech researchers collaborating with university personnel, to visiting scholars, and to vendors participating in active projects on the Virginia Tech campus.

“P-85” identities. With the Office of Human Resources, IMS is developing appropriate categories for the large number of affiliates entered into the identity management system via Human Resources' P-85 form (Request for Unpaid Faculty Affiliation with VT Academic Department). IMS will create affiliations to define the resulting categories in order to allow providers of electronic services to make appropriate access decisions. IMS and HR met with the Research Division, including the Office of Export and Secure Research Compliance; the Insurance and Risk Management Office, the Police Department, and others to gather requirements related to the identities associated with the HR P-85 form.

Carilion. The director of IMS serves as member of the Virginia Tech/Carilion working group that includes representatives from the Office of the Provost, Legal Counsel, the Office of the Controller, the Research Division, and others to assess the electronic access needs of Carilion faculty and staff members and students and to provision incoming students and employees.

The Virginia College of Osteopathic Medicine (VCOM). IMS continues to support VCOM via the in-house developed workflow, load, and update identity management processes. As incoming classes are admitted, IMS works with VCOM to update VCOM affiliations and student class levels.

Enterprise Systems

Enterprise Systems develops, coordinates, and manages application software systems that provide critical information services for university constituents. It facilitates an enterprise-wide view of university applications while ensuring that these systems effectively balance information technology, university functionality, and security and compliance.

Enterprise Systems (ES) consists of five units focused on different aspects of the mission. **Application Information Systems (AIS)** serves as the central resource responsible for acquisition, development, and maintenance of the university's core administrative systems. To provide these services AIS is divided into teams for Advancement, Human Resources, Student Systems, and Finance. **Information Warehousing and Access (IWA)** is responsible for the design, development, and implementation of the Virginia Tech Enterprise Data Warehouse. The data warehouse currently contains finance, human resource, and student data. IWA services also include the development of dashboards, parameter-driven reports, and training programs for ad-hoc query access. **Database and Application Administration (DBAA)** provides the necessary controls, oversight, performance monitoring, and 24x7 on-call responses for application administration, database administration, Web hosting, and filebox services. **Integration and Portal Services (IPS)** provides information technology support in the areas of portal administration, integration processes, the Banner General module and processes, Web user interfaces, and Enterprise Directory interfaces. **Document Management Systems (DMS)** provides enterprise technology services for document management, Web content management, wiki services, and workflow, as well as software development and support for the Office of Information Technology Acquisitions.

Enterprise System has set goals and objectives. Accomplishments for the year are organized according to these goals. The goals are to

1. provide new enterprise systems, technologies, and applications that expand and broaden services and functionality in support of the missions of the university;
2. expand the functionality, usefulness, and usage of production enterprise systems;
3. sustain and support university enterprise-level applications to ensure long-term viability of the university applications and systems;
4. promote best practices that enable the Enterprise Systems organization to effectively manage the development and ongoing support of enterprise applications.

Expand functionality through new systems

Goal 1 is to “provide new enterprise systems, technologies, and applications that expand and broaden services and functionality in support of the missions of the university.” This year, ES completed several projects that expanded functionality, and engaged in planning for more.

Employee performance management system. An objective for the year was to develop and implement phase two of an employee performance management system that automates the university annual performance evaluation processes. Features of the successfully implemented Phase 2 of the performance management system include routing enhancements, multi-Web page evaluations, timeout warnings, expanded search functionality, status updates, and email functionality.

Banner Enterprise Identity Management Services (BEIS). The objective was to implement BEIS, the foundation for tighter integration across all Banner applications. This integration results in better account management and improved usability. We installed the infrastructure components in the Banner environment. The project is now progressing to implementation of the functionality for production Banner users, with integration and testing in the development environment. The new Banner Travel and Expense system requires deployment of BEIS.

Travel and Expense system. ES’ objective was to develop a plan for the implementation of the Travel and Expense system and to begin implementation. This year’s progress included purchase of the system and the creation of project plans for the initial phases of implementation. We completed gathering functional specifications, and are planning a pilot for the coming fiscal year.

Leave, time, and attendance system. We worked towards the objective of preparing a needs analysis and proposal for a leave, time, and attendance system. ES participated in a feasibility study for a leave system. The next steps are for university management to decide on a plan.

Research administration system. The objective was to participate in implementation planning and activities for the research administrative system that was selected in the procurement process. The committee evaluating responses to the request for proposals worked from the fall through the spring. The committee determined that none of the systems provides a comprehensive solution that would meet all Virginia Tech requirements. Enterprise Systems provided technical assessments of each of the vendor systems. The committee determined that a blended solution of vendor products, open source solutions, and university-developed solutions will be required to meet our needs. Analysis and recommendations for these solutions are now under consideration.

Faculty activities system. “Participate in implementation of Digital Measures Activity Insight system” was another objective in the area of new systems for expanded functionality.

Activity Insight will provide the university faculty and administration with a secure, reliable system for recording, tracking, and reporting faculty activities in the areas of scholarship, service, and teaching, and will provide a consistent means for generating annual faculty activity reports. The Office of the Provost continued implementation of the system this year. Enterprise Systems assisted by loading faculty and schedule data for selected pilot departments into the Electronic Faculty Activity Reporting System—VT EFARS— application. VT EFARS is Virginia Tech’s implementation of the Digital Measures’ Activity Insight software.

Police Department. An objective was to provide support for the Virginia Tech Police Department in working with Information Technology to facilitate converged security initiatives. Throughout the year, we provided support for several initiatives, including encrypted email communications for Microsoft Outlook 2010 clients and the evaluation and implementation of an open source application that securely wipes computer hard drives of all data before submission to Surplus Property.

Course evaluations. IWA worked on the object of developing a new data mart for course evaluation data that retrieves data from the Scholar system, archives it, and provides reports to instructors and administrators. The data warehouse team worked in collaboration with Learning Technologies and the Office of Academic Assessment to analyze business processes and reporting requirements. Activities included the design and creation of the data mart, and developing end-user reports according to the specifications provided by Academic Assessment. The system was successfully deployed and used by campus departments at the end of the 2011 spring term.

Ad hoc query application. The objective to evaluate, acquire, and implement a new open source ad hoc query application to support an expanded data warehouse user base led to the selection of JasperSoft Business Intelligence Suite. ES evaluated open source ad hoc business intelligence applications before selecting JasperSoft. The new tool was initially deployed to provide reporting and analysis for the new course evaluation data mart. Usage will be expanded across all data marts in the data warehouse.

Student conduct tracking. An objective for the year was to develop and implement a student conduct tracking system for the Office of Student Conduct to replace the legacy PAVE system. Enterprise Systems developed and implemented a new student conduct tracking system to process information about conduct infractions. The system provides a less-costly and more secure replacement for a vendor system. Data from the PAVE system was converted and the system went into production in June.

Online giving form. The objective was to develop and deploy a new online giving page for the Virginia Tech Carilion School of Medicine and Research Institute. The March implementation used the unique branding of the new public private partnership between Carilion and Virginia Tech and provided information about the partnership. This page enables giving specifically to the VT Carilion School of Medicine and Research Institute and then provides a “thank you” that is tailored to their fundraising goals and contacts.

Password security projects. The ES goal was to develop a new Account Manager application in support of Account Recovery Options project and the password change project. Integration and Portal Services developed Account Manager to allow users to reset their own

online accounts passwords, while mitigating risks involved in exposing self-service password reset functionality. The application interface provides access to the multiple secure recovery options (verified third-party authentication services or a one-time password delivered by text message or a voice call to your phone). Account Manager is also now the location for changing PID passwords, unifying password functions into this one location.

Expand the functionality of production systems

Goal 2 and its first related objective focus on expanding “the functionality, usefulness, and usage of production enterprise systems.” Enhancements to existing systems occurred throughout the areas of ES support.

Human resources. We made improvements in the efficiency and usability of the labor redistribution functionality. A java applet now aids departments in calculating labor redistribution funding percentages that occur in the middle of a pay period. Enterprise Systems continues to work with SGHE on identifying problems and performance issues with this software and recommending improvements. We also completed several significant changes to the compensation processes—enabling the VRS Plan 1 employees to receive a 5% pay increase; modifying programs to change from an employer paid deduction to an employee-paid VRS deduction; and facilitating the payment of a bonus to salaried employees and graduate assistants (December 1 paychecks). ES enhanced the leave system by combining all compensatory leave into one leave balance and setting up an expiration process for all compensatory leave types. The enhancement enables automatic expiration of unused compensatory leave after one year.

Development. Enterprise Systems provided end-of-campaign support for the university’s Comprehensive Campaign, including freezing data and creating reports.

Finance. In conjunction with Department of Taxation, we implemented a debt setoff system, reducing the university’s dependence on the state’s accounting system—CARS. We also assisted the Financial Reporting section of the Controller's Office in compiling the data needed to complete the Higher Education Research and Development Survey (HERD). The HERD survey takes the place of the Survey of Research and Development Expenditures.

Research. Enterprise Systems provided several reporting enhancements for the Office of Sponsored Programs (OSP) to meet regulatory requirements and to improve budget analysis. A newly designed reporting system supports OSP in fulfilling the new training requirements for the responsible conduct of research. We aligned date information in the sponsored research data mart with the budget submission process to allow more accurate analysis.

Student and financial aid. We modified the student data mart to facilitate effective utilization with course evaluation reporting. Additional data includes section attributes and teaching load instructor data. Enterprise Systems developed a program to post federal American Recovery and Reinvestment Act—ARRA—Tuition Mitigation Scholarship awards to students enrolled in summer sessions. We also implemented Web-based rejection letters for graduate applicants. Plans are for the same type of notification for acceptance letters for

graduate applicants. Enterprise Systems expanded the course registration process to include the ability to capture student acknowledgment of the arrest disclosure policy at time of registration.

A second objective is to expand the usage of enterprise systems through improvements in application interfaces and user interfaces and through user training.

One improvement is the Enterprise Systems-developed Hokie Mobile for the Android mobile phone environment. Since Android now has the largest share of the mobile marketplace, Virginia Tech’s mobile app needed to be available in this market in addition to the original deployment to the iPhone marketplace.

User training includes the 67 staff members trained by the data warehouse team on ad hoc query-building and dashboard navigation across various data warehouse subject areas. This training used Oracle’s Enterprise Performance Management Suite, and we have begun training for the JasperSoft Business Intelligence Suite.

Ensure long-term viability

Goal 3 is to “sustain and support university enterprise-level applications to ensure long-term viability of the university applications and systems.” A related objective is to **implement software upgrades and patches** to maintain software support and promote application security. The list below demonstrates the upgrades completed this year to support this objective.

FY11 Enterprise Systems upgrades

Product	Application	Version
Atlassian	Jira	4.3
Atlassian	Confluence	3.5.2
EMC	AppXtender	6.5
IBM InfoSphere	DataStage version	
MicroFocus	Cobol	5
Oracle DBMS	Oracle – Data Warehouse	
Oracle DBMS	Oracle - Banner	11.2.0.1
Oracle DBMS	Oracle - VT Foundation	11.2.0.1
Oracle DBMS	Oracle - Scholar	
Oracle Hyperion	Oracle EPM	
Oracle	SQR	9.3.1
redLantern	DARS	3.5.9.1
SciQuest	SelectSite (HokieMart)	10.2, 10.3, 11.1
SGHE Banner	Accounts Receivable	8.1, 8.1.1
SGHE Banner	Advancement	8.2, 8.3, 8.3.1

SGHE Banner	Advancement Self-Service	8.3, 8.4, 8.4.1
SGHE Banner	Banner Document Mgt.	8.3
SGHE Banner	BEIS	8.1.3
SGHE Banner	eInvoice	8.4
SGHE Banner	Employee Self-Service	8.3, 8.4, 8.4.1
SGHE Banner	Finance	8.4
SGHE Banner	Finance Self-Service	8.3
SGHE Banner	Financial Aid	8.8, 8.10, 8.11
SGHE Banner	Financial Aid Self-Service	8.8, 8.10, 8.11
SGHE Banner	General	8.3
SGHE Banner	General Web	8.3
SGHE Banner	INAS	8.8, 8.10, 8.11
SGHE Banner	Payroll	8.3, 8.4, 8.4.1
SGHE Banner	Position Control	8.3
SGHE Banner	Student	8.1, 8.2, 8.3
SGHE Banner	Student Self-Service	8.1, 8.2, 8.3
SGHE Banner	Faculty Self-Service	8.1, 8.2, 8.3
SGHE Banner	Travel & Expense	8.1, 8.2, 8.3
SGHE Banner	Web Tailor	8.3, 8.4
SGHE Banner	Workflow	8.0.1

Another objective is to provide **efficient and effective operational support** for enterprise systems as needed for maintaining system integrity. We modified the quality checks on the accounts receivable data mart to use parallel processing, improving nightly run times, and enabling full verification with each load. ES also modified fund/org security on the Finance and accounts receivable data marts, resulting in performance improvements for queries and reports.

As part of Virginia Tech’s participation in the SGHE Community Source Initiative, Enterprise Systems contributed an employee self-service page for veterans classification. SGHE Community Source has accepted this ES-developed page and moved it into baseline Banner. By moving this Web page from a locally developed page to a SGHE baseline release, we reduced the local maintenance required.

Technology. The objective to promote new and evolving efficiencies in the technology architecture for delivery and provisioning of enterprise applications was addressed by virtualization and cloud-sourcing. We moved several databases to the virtual environment, and deployed virtualized servers supporting the enterprise Web environment. Financial aid student need analysis was moved from installation on local servers to a cloud-based software-as-a-service system on a SGHE site (Federal Methodology Need Analysis) for more responsive and accurate response service to students and resource savings for the university.

To “implement improvements in **development methodologies** including integration strategies, code reuse, object oriented design, and Web development architecture” is another related objective. The Java development teams adopted Apache's Maven product to serve as a

central repository for use in building and managing Java-based projects. A Finance Web Service enhanced Banner Finance integration. Initial use will be by OSP for electronic project authorization notices.

The focus of another objective is our own responsibility to data security: “Promote and ensure **security of data** within enterprise systems applications.” Activities relevant to this object include upgraded the workstations of the AIS Finance team from Windows XP SP3 to Windows 7 and from Microsoft Office 2007 to Microsoft Office 2010.

ES also participated in initiatives to improve security of enterprise applications and systems. We identified the seven covered personally identifiable information data elements¹ across all Banner modules and then encrypted in the production Oracle databases. Enterprise Systems conducted a review and assessment of usage of these data in reports, processes, and related processes, and eliminated these PII data as much as possible. We removed these data from the data warehouse whenever possible. Enterprise Systems also worked with Nelnet to switch hashing algorithms from MD5 to SHA-256.

Best practices

Goal 4 is to “promote best practices that enable the Enterprise Systems organization to effectively manage the development and ongoing support of enterprise applications.” One objective is to consolidate processes across Enterprise Systems and implement a **standardized process for tracking issues** and operational support activities across all Enterprise Systems’ units. This year, we centralized the service request process and applied a consistent process for classifying, approving, scheduling, and executing tasks. To facilitate effective processing, we developed and implemented a new workflow for approving requests for operational initiatives and project work.

Another objective is to “encourage and support employee training and **professional development** to enable effective adoption and ongoing support of technologies and systems required for enterprise systems applications.” Professional development activities this year include:

- Several employees attended SANS training and earned the GIAC Web Application Penetration Tester (GWAPT) certification.
- Several members of the data warehousing staff completed training sessions sponsored by JasperSoft to facilitate administration and deployment of this new business intelligence tool.

In addition, ES staff members serve in leadership capacities on **SGHE** advisory boards to provide feedback and guidance on SGHE products and initiatives: the SGHE community source team, the SGHE Pillar Strategic Planning group, and the SGHE Human Resources

¹ Standard for Storing and Transmitting Personally Identifying Information, www.it.vt.edu/publications/pdf/3_PIIStandardFinal13June-signed.pdf

Customer Advisory Board. ES staff members participate in the advisory panel for the database conversions required to support the new Banner user interface. Staff members attended the SungardHE Users Conference (Summit), the Mid-Atlantic Banner Users Groups (MABUG), and the large school consortium annual meeting.

IWA staff members provide leadership to the Higher Education Data Warehousing Forum, with team members serving on the board, attending the annual conference, and participating in a panel discussion to share our successes in business intelligence.

The objective to “implement more formal **change management process** that creates a portfolio of requests for prioritization, resource utilization, and categorization of effort” was addressed through the purchase and implementation of a project and portfolio management solution August 2010. We began tracking requests for new work and managing projects and operational initiatives in TeamDynamix (TD) in April 2011. In June, we completed training for process of managing resources in TeamDynamix as the first step in addressing resource management using the TD system.

The best practices goal includes this year’s objective to “**reorganize** Enterprise Systems to meet evolving commitments and address staffing reductions.” In the fall, the team working on Advancement was re-organized and divided into two distinct teams: Enterprise Systems AIS –Advancement and Development Information Systems, and Development Information Systems. The Development Information Systems team remained in the Gateway Building assigned to the Development organization and the AIS Advancement team relocated to the Andrews Information Systems Building and is assigned to Enterprise Systems. The purposes of the reorganization were to clarify division of responsibilities, physical locations, organizational homes, and organizational policies and cultures for each team. The reorganization into two teams has resulted in better communications, improved employee morale, and increased productivity for both teams.

Goals and objectives for 2012

Our goals and objectives for 2012 provide both continuity and new challenges. Each goal’s objectives follow.

Goal 1: Provide new enterprise systems, technologies, and applications that expand and broaden services and functionality in support of the missions of the university.

- Implement the SGHE Travel and Expense module for a pilot group of departments.
- Complete the Banner Enterprise Identity Services (BEIS) implementation project that will enable CAS authentication for various components of the production Banner software environment and provide provisioning mechanisms for the Travel and Expense system.
- Provide technical resources and expertise on the project teams for phase one components for research administration.

Goal 2: Expand the functionality, usefulness, and usage of production enterprise systems.

- Create a design plan and implementation strategy for the next generation of an enterprise portal.
- Move Banner production application software environment to virtualized environment and separate the application and database server environments.

Goal 3: Sustain and support university enterprise-level applications to ensure long-term viability of the university applications and systems.

- Perform upgrades to enterprise applications in September and November of 2011.

Goal 4: Promote best practices that enable the Enterprise Systems organization to effectively manage the development and ongoing support of enterprise applications.

- Enhance and expand the usage of TeamDynamix to provide better analysis of risks, benefits, and resource requirements for operational initiatives and for project requests.

Information Technology Acquisitions

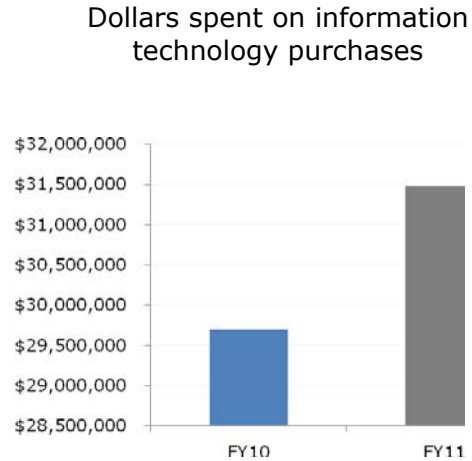
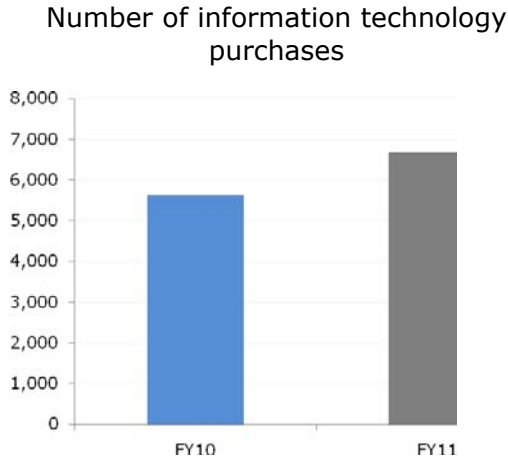
The mission of Information Technology Acquisitions (ITA) is twofold. First, ITA seeks to acquire technology goods and services for the university using best value concepts. Second, ITA makes every effort to acquire and distribute relevant software to the university community at the best possible terms. Three major operational entities carry out the mission: Computer Purchasing, Software Distribution (Departmental and Student) and Contract Management, Licensing, and Billing.

Computer Purchasing

Computer Purchasing manages university-wide information technology procurement. The office fulfills information technology requirements for computers, software, systems, storage, maintenance, service, and negotiation of end-user licenses and other agreements. The office establishes new competitive contracts, utilizes existing internal and external contracts, and solicits competitive quotes, bids, and proposals to achieve the most effective and efficient procurement process, meet end-user requirements, and assure compliance with university and state policies and procedures and legal requirements.

Increasingly, systems based in information technology are the foundation of education, research, and business solutions. These solutions are usually very complex and may include modular components and hosted solutions. Security and legal considerations are critical for Computer Purchasing. Key security considerations include secure Web-based logon, userid and password security and control, system access control, data integrity, personal identifiers, and multi-system interface. Legal agreements for software licenses, maintenance, and orders are involved in nearly all purchases, and assuring legal soundness and compliance is essential.

Expenditures on information technology procurements increased to \$31.5 million this year, up from \$29.7 million last year, and the number of purchases increased to 6,686 from 5,627, demonstrating the trend toward information technology-related solutions. The figures below compare this year's data to last year's, showing the dollar increase of \$1.7 million and number increase of 1,059.



To meet the growing demand efficiently and effectively, Computer Purchasing issues solicitations, negotiates and establishes new competitive contracts, and utilizes existing internal and external contracts. This year, several contracts were renewed or amended, and other solicitations are underway. Five newly awarded contracts included two with a cooperative clause that opens the contracts to other educational and governmental agencies. Expanded creation and use of cooperative contracts improve the state’s return on investment for procurement costs, allowing multiple agencies with overlapping requirements to share contracts at negotiated rates and to decrease the number of bid-, request-for-proposal-, or other procurement processes. The cooperative-use contracts included one for PKI certifications and one for video surveillance systems.

Additional purchases requiring the buyers’ expertise in Computer Purchasing were for research programs—centralized research hardware and data storage infrastructure for vast data collection, high-speed computational processing, and custom server components.

Process improvement achieved during the year included the implementation of the HokieMart punchout for Fujitsu. The punchout provides simplified, direct ordering by departments for mobile computers. We also undertook to expand the data repository for contract and license agreement electronic files, and added frequently used forms for ease of access.

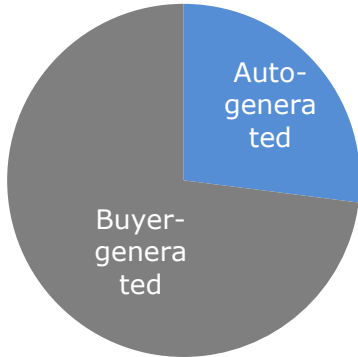
Computer Purchasing continues to solicit and award contracts and orders to small, woman-owned, and minority-owned businesses (SWAM). The information technology acquisitions area makes significant contributions to inclusion through competitive purchasing from SWAM vendors.

HokieMart completed its third full year as the university’s single point of entry for procurement. This system enables both Purchasing and Computer Purchasing to manage increased volume by allowing direct entry by university departments for smaller orders and for orders from existing contracts, as well as for inter-departmental orders, including orders to Software Distribution. Both the dollar amount and number of these “HokieMart auto-generated” orders increased this year. Buyers, in contrast, deploy their expertise for more complex, larger dollar orders and purchases not already on a contract. Analytical skills and legal and regulatory processes are more heavily mandated in higher dollar orders, and these require the buyer’s value-added knowledge, skills, and experience. Buyer-generated orders

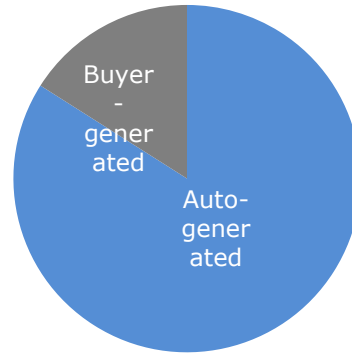
often require competitive bids or proposals, negotiation of legal agreement terms and conditions, or involve special processes.

Buyer-generated orders average \$32,477 while HokieMart auto-generated orders average \$1,425. Buyer-generated account for 73% of the total dollar value of this year's purchases, while HokieMart auto-generated orders account for the larger number of orders—84% of total volume.

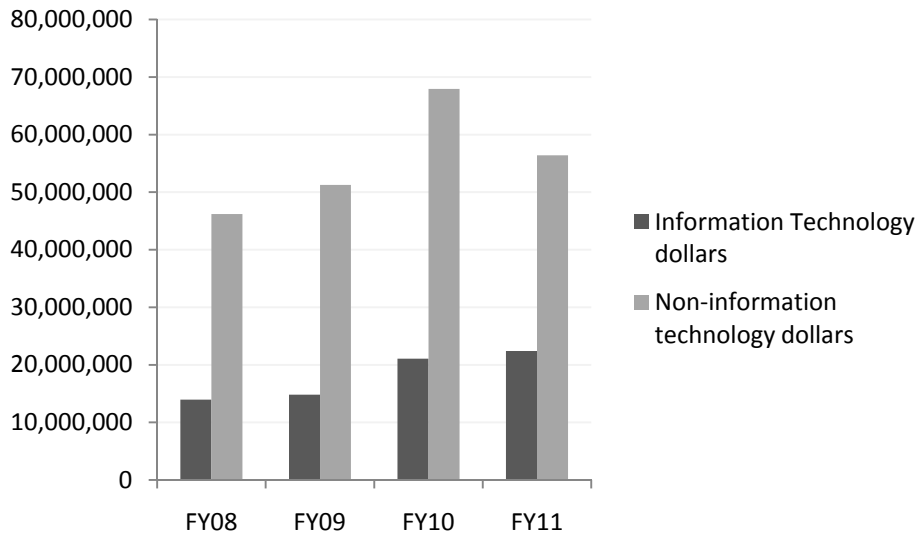
Dollars spent on information technology



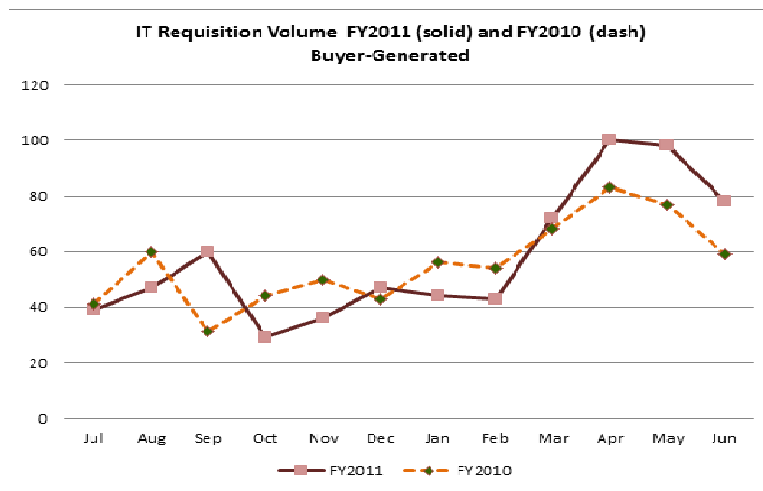
Number of information technology purchases



This year witnessed a shift toward information technology-related expenditures. Buyer-generated information technology order dollars increased, while non-information technology orders decreased. The chart below demonstrates the increase of \$1.3 million in buyer-generated dollars for information technology. The existing staff of two full-time buyers, one half-time buyer, and one support staff member manages this increased volume. Some key explanatory factors are complex software and hardware systems and expanded research requirements. In contrast, buyer-generated orders for non-information technology commodities *decreased* by \$11.5 million. These commodities include equipment, supplies, and services for scientific, medical, office, facilities, food services, and agriculture requirements, as well as travel and capital outlay for construction.



Each year has variation in peaks and valleys in receipt of requisitions, depending on needs. The graph shows the monthly volume of requisitions received by Computer Purchasing this year compared to last year. The spring peak was delayed compared to last year, influenced by the delayed release of the annual allotment of Higher Education Equipment Trust Fund monies, administered by the State Council of Higher Education for Virginia, and by budget uncertainty.



Departmental Software Distribution

Departmental Software Distribution is a part of the Software Distribution Office and is organized on a partial cost recovery basis. Departmental Software Distribution provides software at discounted prices, and occasionally at no cost to departments, with a limited number of titles available for individual purchase by faculty and staff members. Software distributed by Departmental Software Distribution includes software purchased through major contracts or site licenses (e.g., Adobe, Microsoft Select, Esri, Mathematica, and Campus

Agreement contracts) and any software we can obtain at quantity discounts for which there is a demand by departments. Departmental Software Distribution also offers a limited number of laptops for short-term lease to departments. Total recoveries include billings to other universities for their share of both the Virginia state-wide Esri and Mathematica education site licenses that we manage.

Departmental Software Distribution once again this year expanded its capabilities by serving as a resource for departments that were in need of specialized software but did not have the numbers to purchase the software at reduced rates. One of the most complicated projects that ITA successfully completed was the negotiation and management of a statewide Mathematica three-year contract. Wolfram Research approached Information Technology Acquisitions to lead a Virginia statewide contract to provide Mathematica to students, and to faculty and staff members at a number of public and private universities. The idea originated at the Virginia Software Summit by schools that had successfully worked with Virginia Tech on the Esri statewide contact.

Over the course of 8 months, ITA worked extensively with representatives from Wolfram sales and the Wolfram legal team to develop and redefine the terms of the contract. Upon approval from university legal counsel, ITA presented the document to the schools interested in joining the contract. After contract review, additional time was spent negotiating memorandum of understanding (MOU) terms with the 15 universities, accommodating the special needs of each school. Once the MOU was finalized, each university signed the three-year agreement. The MOU covered issues including technical support and site administration. ITA spent over a month overseeing the MOU execution. Upon execution of the contract and MOU, ITA was responsible for billing the individual schools for their portion of the site license fee. By the end of the fiscal year, three additional schools had initiated internal processes to join the consortium.

A Wolfram Research Academic License Agreement is now in place to provide three-year price protection for all the participants. In this—and all—purchases, the emphasis on competition and negotiation work towards best values. Some members of the consortium are able to afford the software, which may have previously been out of reach. Others experience cost reductions. Information Technology Acquisitions was able to negotiate an unlimited site license that included individual licensing systems and support for each school. We will continue to support the contract for the next three years and anticipate taking the lead when it is time to negotiate the renewal.

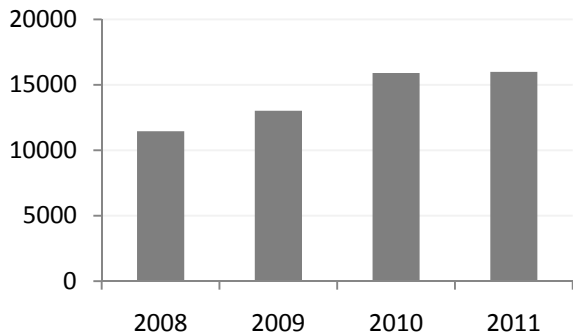
Another major accomplishment was the successful negotiation of the Identity Finder site license. A centrally supported site license for Identity Finder provides a cost-effective way for campus units and personnel to secure data on thousands of university desktops.

The Campus Agreement program expanded with the addition of eleven new departments. ITA manages the Campus Agreement program for 63 departments with a total count of 4346 individual users. The growth of the Campus Agreement program is just one example of departments discovering the benefits of ITA software management capabilities. ITA assumed the management of the statewide Mathematica contract and SimpleHelp this year. Each of these software applications had previously been managed by individual departments. Once ITA took over their administration, these applications became available to more members of the university community.

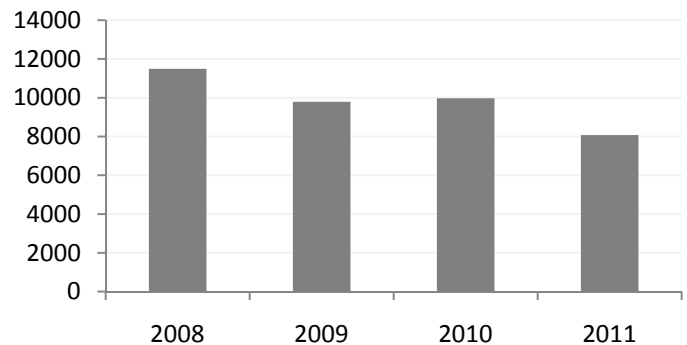
New software releases inevitably come with more challenges in managing the software. This year saw ten new product releases from Adobe; three new products from Microsoft including a new version of Office for the Macintosh; and new products or versions from Qualtrics, Rhino, Simapro, and Abaqus, PDF Annotator, Granta CES Edupak, Mathematica, LabVIEW, MapPoint, Dyknow, EndNote, Esri, SAS, Bentley, Matlab, Minitab, Visual Studio, Project, and Visio. Each product was tested and incorporated into our systems. As was the case last year, each new product release was tested on both 32-bit and 64-bit systems. The associated installation documentation became more complicated and more time consuming.

The following graphs show interdepartmental service requests and HokieMart orders processed. Sales billings to departments, including HokieMart orders, vary each year based on the mix of products purchased. In 2009, sales and products distributed declined slightly as departments anticipated budget cuts; more departments joined the Campus Agreement program, substituting for individual product purchases; the release of Windows 7 was anticipated; and more software titles were available on the download server. In 2010, new product releases from Adobe and Microsoft, additional Campus Agreement memberships, and the assumption of management of more university software products by ITA produced a sales increase of \$146,465 and an increase of overall software distributed of 7065 products. Sales of Microsoft products increased significantly in 2010 and new sales of ANSYS and Qualtrics extended the increase. In contrast, both sales and products distributed declined in the 2011 fiscal year, a result of sharp cuts in departmental budgets and the recency of purchases of Microsoft and Adobe new releases in 2010. Total sales fell by over \$40,000 and product distribution declined by over 1800 units.

Number of items distributed

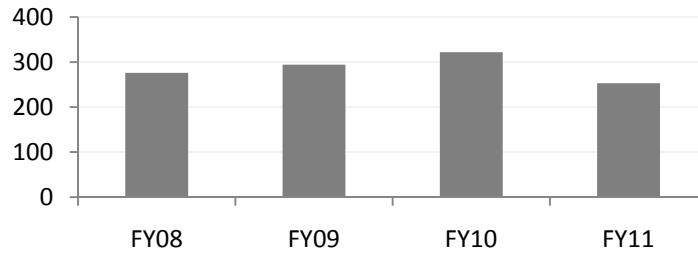


Department Software products distributed

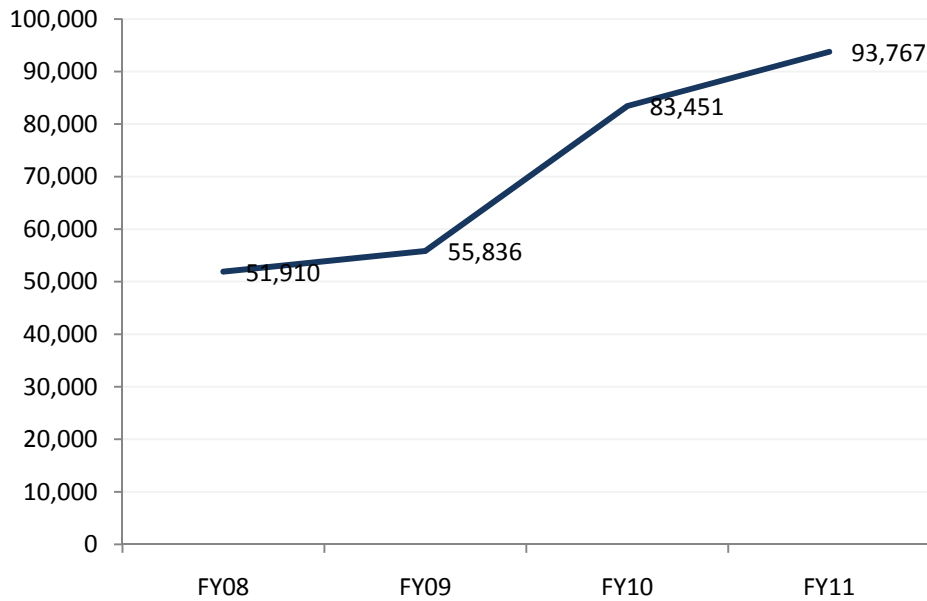


Introduction of new products generally tend to spur sales in the first year, while purchases may fall off the following year. The charts below indicate the number of new products introduced over the last four years as well as the number of connections to the software server. Individual products distributed include departmental licenses and additional CDs and DVDs purchased. Distribution numbers do not include site licenses distributed through the network software installation service. While there was a slight increase in new product offerings in 2009 over 2008, 2010 saw major new product releases from both Microsoft and Adobe—Microsoft’s new operating system Windows 7 and Office 2010, and Adobe’s update of the Creative Suites collection. With these 2010 updates, new product introductions declined in 2011.

Department Software new products introduced



Software server total connections



Software distributed by download increased this year over previous years. Several “staple” applications saw large download increases. Microsoft software covered by Campus Agreement accounts for the majority of the connections. We are currently serving 4309 faculty and staff members across the university. Other “staples” accounting for download increases include Matlab, JMP, LabVIEW, Chems sketch, Dyknow, Granta, ANSYS, and Simapro. New products also contributed to the increase. These included Identity Finder, Suse Linux, and several virtual machine applications. Other new products were added each year as ITA receives requests to manage specialized software through our server. This year, several software additions to the network server impacted the continuing rise in distribution, including new versions of JMP, PDF Annotator, Identity Finder, Mathematica, LabVIEW, MapPoint, SmartDraw, EndNote, Esri, Bentley, Matlab, Visual Studio, Project, Simapro, Visio, and WebDrive.

Student Software

Student Software Distribution is a part of the Software Distribution Office and is organized as an auxiliary. Student Software Distribution was originally organized to provide software for the engineering freshman software bundle. It now handles bundle requirements for six academic areas as well as the Microsoft Campus Agreement bundle for incoming undergraduates. Student Software also distributes software to other students, and to employees. Outside of bundled purchases, sales primarily involved Microsoft Office and Adobe releases. Student Software only handles software that is specifically requested to support an academic program, such as the freshman engineering bundle; or is only available as an add-on to a current university contract. Additionally, the software must be obtained for students at a price that is significantly lower than is otherwise available.

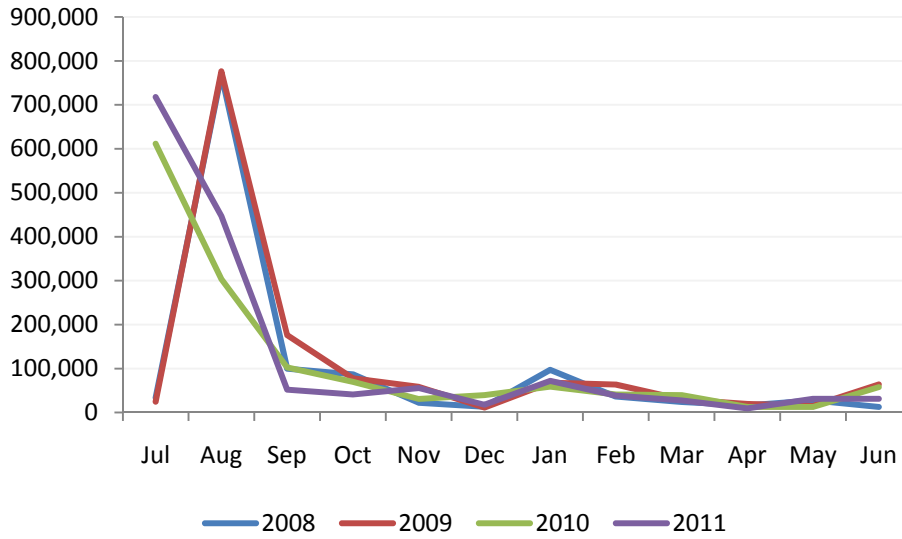
In April 2009, the Vice President and Dean for Undergraduate Education required a new Microsoft Campus Agreement software bundle for incoming undergraduates. Freshman and transfer undergraduate students were required to purchase a Microsoft desktop software bundle that includes Microsoft Office, operating system upgrades, and core CALs¹. Successful implementation of this new initiative required detailed planning and cooperation among many departments across campus. At the end of 2009 New Student Orientation, the university coordination committee expressed satisfaction with the program. The communication plan, convenient location, knowledgeable staff, and the collaborative efforts of the committee proved instrumental in making the new undergraduate software requirement a positive experience for our incoming students and their parents.

Since the implementation of the incoming undergraduate bundle at the end of the 2009 fiscal year, ITA has become a permanent member of the university's orientation team. This committee is composed of members from academic and support areas. Our participation with the committee keeps us abreast of current academic trends and issues in education that may affect the software chosen for distribution to the university. Additionally, we provide assistance and guidance when software related concerns or questions arise. Planning and collaboration among the membership has led to innovative ways to solve problems that cross academic, administrative, and support areas and has allowed ITA to be on the forefront of the development of solutions.

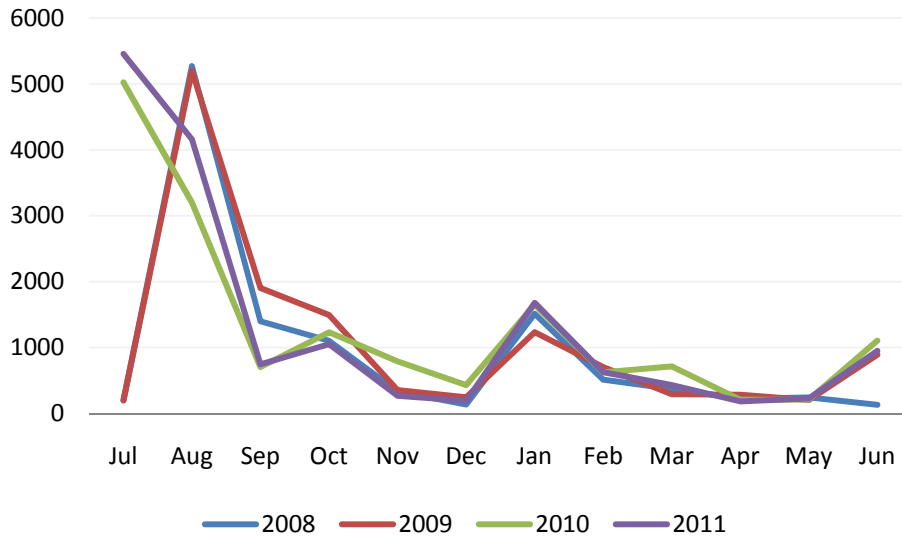
With the incoming undergraduate bundle in place, billing changed dramatically from 2009. This year and in 2010, ITA crafted a simple informational email message and sent it to the 6300-plus incoming students to explain the requirement and billing process. July became the new peak for sales and distribution, replacing the former move-in peak time in August.

¹ A CAL is a client access license essential to connecting to Microsoft server software.

Student Software dollars by month



Student Software number of sales by month



Downloads and virtual mounts as methods to distributed software have grown. We now offer 114 software titles encompassing more than 963 GB on the network software server. The significant increase seen since 2009 is due in large part to the implementation of the incoming undergraduate software bundle and to the addition of new software applications to the ITA server.

We continue to invest in new hardware and software to stay ahead of this demand. In the first quarter of the 2009 fiscal year, ITA looked at server usage to plan for expansion of software distributed via our download servers. At that time, we saw the potential for significant increases. Ongoing improvements to assure continuity of service in the event of extremely high server usage enabled ITA to handle the implementation of the Microsoft Campus Agreement bundle for incoming undergraduates, despite the extremely short implementation

timeline. Going forward, we continue to look at usage patterns and examine the priorities of the academic areas that we serve in order to plan investments in service delivery.

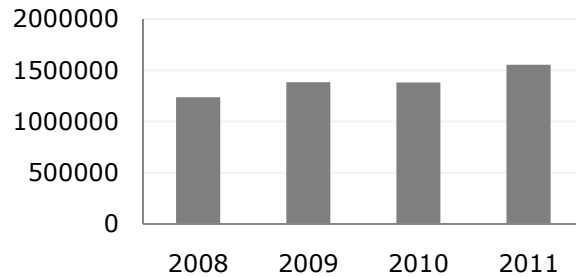
In 2009, ITA moved to a site license with Mathworks to provide Matlab to incoming engineering students. This new and different licensing methodology, total academic headcount (TAH), required extensive planning, testing, and research. We distributed more than 9200 licenses with few problems. In the summer of 2009, we renewed the TAH contract and were required to do more planning and research to make sure that students could continue to utilize Matlab. The project involved working with Mathworks to ensure a smooth transition in providing new licenses to end users without disruption to current license holders. This new contract has also been more cost effective for both ITA and for students. At that time, Mathworks also changed their licensing mechanism used to provide licenses to faculty and staff members. Administering this license requires intensive work, but we have full license accountability so there is less concern with software piracy or license misuse. The extra work involved helped keep costs down for the end-users. In the fall of 2009, additional toolboxes were added to the concurrent Matlab license that serves faculty and staff members. For the first time, this addition allowed faculty and staff to have access to the same tools that are included on the student TAH license.

Last year brought about several new product releases that affected overall sales and distribution totals. Microsoft released both a new operating system, Windows 7, and the new Office 2010 software suite. Adobe released new versions of Creative Suites, Photoshop, Web Premium, and Dreamweaver. Other new product releases that affected sales and distribution practices included PDF Annotator, SAS, Matlab, LabVIEW, Esri ArcEditor, Granta, and Visio.

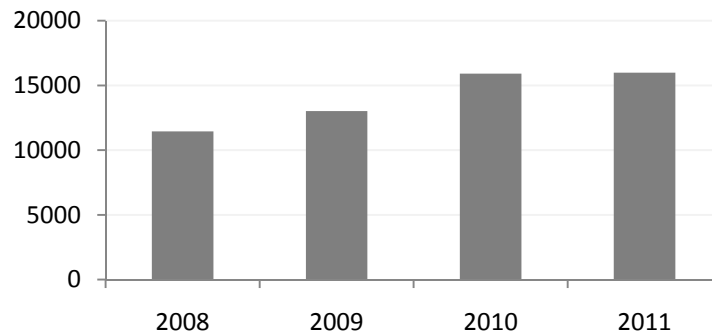
In 2010, ITA successfully provided an installation and support program on Torgersen Bridge. A follow-on program, the Software Assistance and Education Center (SAEC) began operation this year. On November 1, 2010, and continuing through May 13, 2011, this joint initiative between Information Technology Acquisitions and University Computer Support provided on-site technical software support and offered educational seminars to eligible students and employees. The SAEC's blended service model provided more than 200 individual services including providing assistance to individuals who obtained software from the Software Distribution office, and assisting in the installation of Windows on an Apple computer. ITA is a valuable resource to departments in need of product negotiation with vendors. Products such as ANSYS, Granta, Rhino, and Simapro were acquired at a price discounted from the original quote.

Increases in both total sales and total products for 2011 over results from several factors. The introduction of the incoming undergraduate software bundle boosted sales, as did increases for existing products such as Auralog, and the acquisition of new products such as Windows 7, Rhino, and Granta. Adobe's 20% price increase on their new Creative Suites line accounts for some of the increase in dollar sales. An unexpected increase in sales of the College of Engineering software bundle resulted from the college accepting more than 300 students over their initial estimates.

Student Software total sales dollars



Student Software total items distributed



Contract Management, Licensing, and Billing

The Contract Management, Licensing, and Billing section manages the contracts and licenses used for distributing software to the university and the commonwealth. New releases and additional software acquisitions drive much of the work generated by this part of the ITA organization.

Virginia Tech continues to hold the statewide contract for Esri GIS² software. The contract now includes sixteen public as well as private universities in the commonwealth. Each university on the contract saves from \$10,000-\$15,000 over previous yearly renewals by taking advantage of the statewide contract. Esri has continued to offer more products and complimentary software to students that attend schools that are part of the contract. ITA works closely with the Enterprise GIS Research and Development Administration group as well as the Virginia Geospatial Extension Program to further software training and usage throughout Virginia. Extensive support is provided to the Virginia Community College System's effort to provide software and training to twenty-three community colleges.

ITA teamed up with Wolfram this year to organize a statewide contract for Mathematica. We have provided contact information and extensive guidance to the sales team at Wolfram to aid them with the startup. ITA will manage the contract. This contract includes both public and private universities.

² Geographic information systems

This part of the ITA organization handles billing for both Student Software and Departmental Software. It also manages most of the technical aspects related to software distribution. Ongoing work includes developing software distribution methods. Students and faculty members are able to access software via direct download of ISO images, as well as through the creation of virtual mounted drives. Although many vendors are offering product downloading directly from their websites, ITA uses methods to make local downloads more efficient by providing custom builds that reduce the file size. Custom builds are also prepared as network shares to provide a more streamlined installation. The detailed documentation we provide facilitates straightforward software installations for faculty and staff members and for students. The unit also acts as a liaison to departments regarding access to software and services specified in contracts such as Microsoft download products and volume license keys. We create and managing license codes, including the yearly Matlab activation keys; we manage license servers for Lab View, ANSYS, and Esri ArcGIS; we access license manager hosted by MathWorks and Minitab to generate license files; and we troubleshoot software installation and activation problems.

The contract management team works to ensure that all end users are aware of contact requirements and regulations. We work with each software vendor to take advantage of licensing controls offered by the vendor to ensure control of the software within the constraints of the contract.

The demand for license server management continues to increase. ITA works directly with the Document Management Systems group to provide campus-wide license servers for Esri, Matlab, Ansys, Abaqus, and Labview. License server administration often requires extensive testing and setup to ensure availability to the correct end users. With ITA assuming license server management, departments are able to focus on core competencies by relieving them of the burden of managing complex license requirements.

ITA has also assumed more support for various software installations and activation issues. As software is more secured against piracy, more installation issues occur. Due to the methods that ITA uses to keep the software “locked down,” more support for the end-user is required.

This year the Contract Management, Licensing, and Billing section of ITA negotiating the state-wide Mathematica license, Campus Agreement renewals, creating and testing of builds for ANSYS, SAS, Matlab, JMP, Granta, Mathematica, EndNote, LabVIEW, SPSS, SimpleHelp, and WebDrive.

Information Technology Security Office

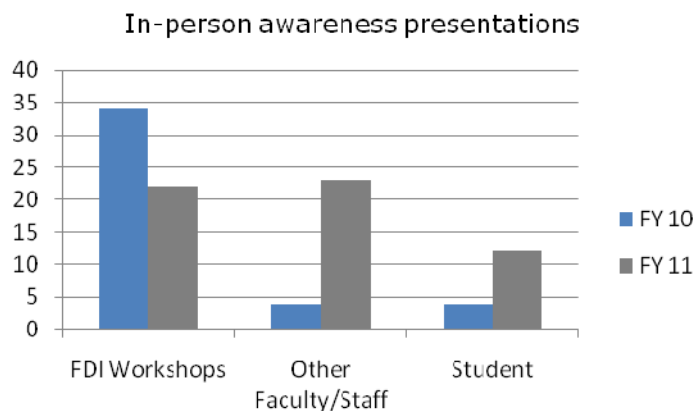
The Information Technology Security Office provides technology tools and services, education, awareness training, and guidance necessary for all Virginia Tech users to work towards a safe and secure information technology environment for teaching, learning, research, outreach, and the conduct of university business.

Awareness and training

Making users aware of cyber issues and providing training remains one of the most effective ways of protecting Virginia Tech's data and systems. The ITSO continued to conduct traditional face-to-face presentations as well as seek opportunities to reach larger audiences through online learning. Goals for the year included providing more awareness training to faculty and staff, increasing online awareness, opportunities, and increasing outreach opportunities.

Faculty and staff awareness

The IT Security Office collaborates with Learning Technologies to present cyber awareness training to participants in the Faculty Development Institute (FDI). While the number of FDI presentations decreased slightly, the IT Security Office was able to increase faculty and staff participation levels by reaching new areas such as University Organizational and Professional Development, HR Partners, and several of the university's colleges and schools. The increased effort resulted in a 38% increase in faculty and staff participation from last year.

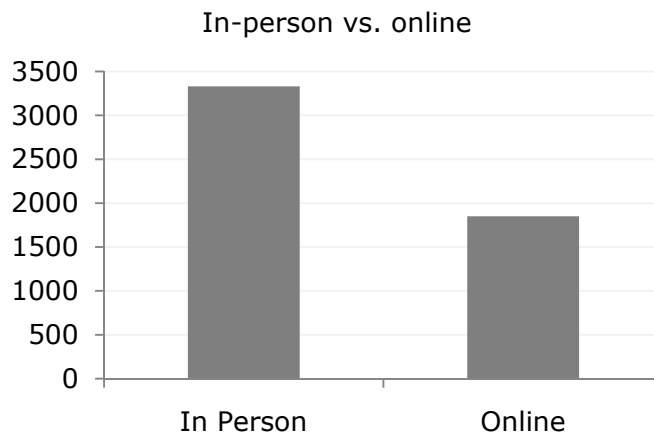


Online awareness training

A goal for the year was to offer online awareness training. We delivered a Gramm Leach Bliley Act awareness module to the Bursar's Office early in the year. Those enrolled in the course learned the importance of protecting Virginia Tech's nonpublic personal financial information.

The office also began offering access to SANS Institute's "Securing the Human" online cyber awareness training course in February 2011. "Securing the Human" training delivers a current and relevant cyber awareness message on issues from phishing, social engineering, and even compliance issues with FERPA and HIPAA.

The training also provides an assessment of the participants' understanding of cyber-related issues. The training was well received, with enrollment over 1800 faculty and staff members. Online awareness training represents the fastest growing segment of awareness education.



Advanced cyber security training

The IT Security Office facilitated two training sessions for the university's technical community. A course delivered by AppTrust gave Web developers a chance to gain the skills necessary to develop secure Web applications. A 6-day course, SANS-EDU SEC 542 Web Penetration and Ethical Hacking, gave attendees the knowledge needed to develop and secure Web applications. Attendance was high for both courses, drawing from the university and from the across the United States and Canada.

Student awareness training

The IT Security Office presented cyber-awareness messages to students. Presentations were given as part of some student orientations along with guest lectures for classes. . This year, we reached more than 2300 students.

Additional awareness efforts

Other notable awareness efforts include the following:

- Distributed awareness materials to students at Gobblerfest
- “Tech Fundamentals” orientation handout and the “Welcome Back” of the Collegiate Times
- Developed an FDI track “IT Security and Policies at Virginia Tech: What do I really need to know? “
- Developed a subdomain website dedicated to awareness (awareness.security.vt.edu)
- Executed publicity campaign for the Password Change Project
- Distributed awareness materials and advertised awareness messages as part of National Cyber Security Awareness Month.

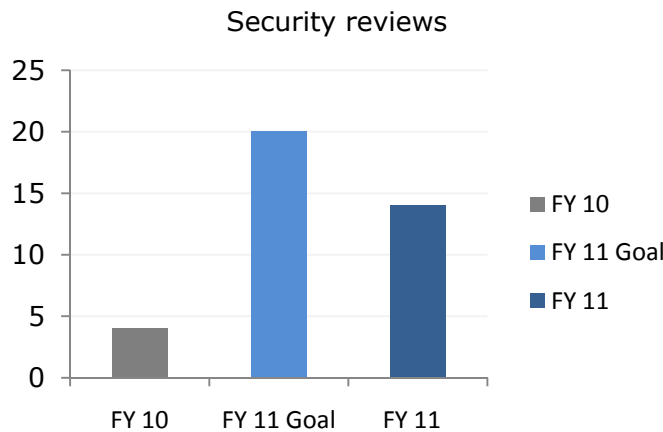
Opportunities

We believe that we made progress in reaching the faculty and the staff as well as students, but that we can reach more by increasing audience sizes and by refining our messages. The following goals have been set for next year:

- Increase the number of outreach presentations made to the community
- Double participation in online awareness training
- Create and employ a campaign to raise awareness of the importance of protecting Virginia Tech’s sensitive data

Security reviews

Security reviews are a service offered by the IT Security Office to help departments discover potential cyber-security problems that could result in sensitive data disclosures, illegal usage, and related problems. We had set a goal of 20 security reviews for the year, but had only completed or engaged in 17 security reviews, although some of the reviews covered multiple departments.



Security reviews consistently discovered issues that could result in data and system compromises. The issues discovered violated both University Policy 7010 and the Standard

for Securing and Transmitting Personally Identifiable Information. Some of these issues included the following:

- Improper storage and transmission of personally identifying data elements
- Improperly configured firewalls
- Obsolete or unpatched operating systems
- Obsolete or unpatched client software
- Lack of antivirus software or antivirus scanning
- Vulnerable Web applications
- Improper backup procedures
- Improper physical security of information technology assets

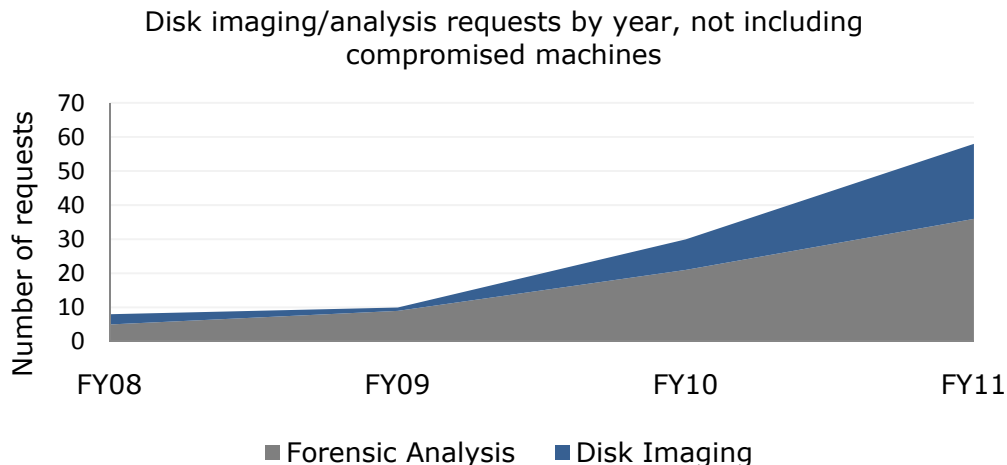
Opportunities

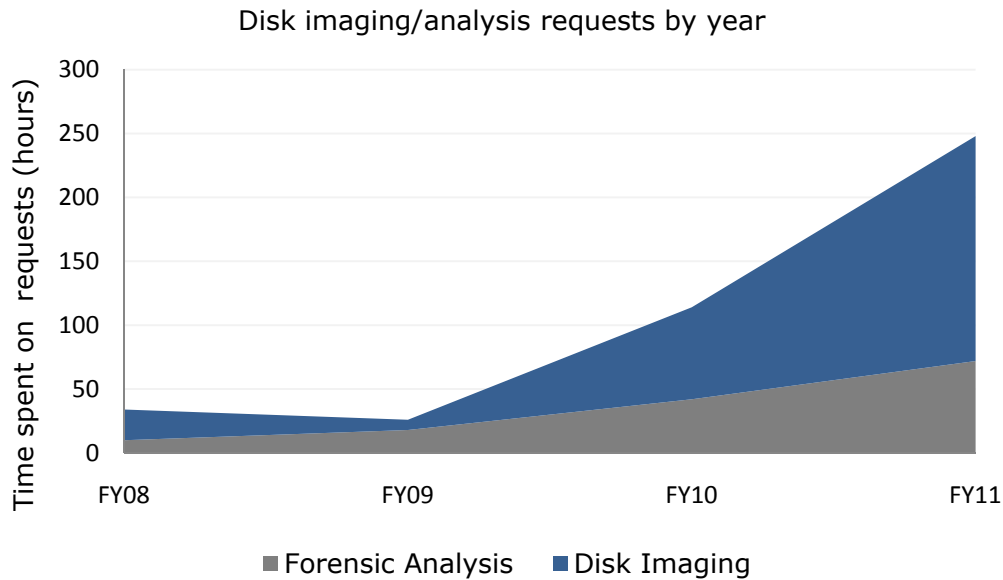
We believe that security reviews are a proactive way to protect data and systems. To improve the overall quality and increase efficiency of security reviews, the office will

- continue to pursue reviews in areas of high inherent risk;
- develop a system for collecting metrics;
- commit to reducing security review performance times;
- improve documentation;
- perform 20 security reviews in the coming year.

Forensic work

The IT Security Office saw a continuing rise in demand for disk imaging and forensic analysis. We undertake these activities at the request of University Legal Counsel, Internal Audit, and Human Resources. We also perform forensic activities on compromised machines that contain sensitive data. While imaging and forensic analysis requests increased as a result in compromised machines, 55% of the requests were for human resource issues.





Intrusion detection and compromised machines

We completed the project to deploy an open source intrusion detection system (IDS) using multiple sensors. Data collected from this system and other vendor products used for evaluation quickly give daily evidence of thousands of malicious network traffic alerts. A serious threat from malware immediately emerged and had a significant impact on the workload for the office.

We worked with departmental information technology staffs to remove 198 compromised machines from the network. Compromised machines with personally identifying information required hours of analysis to determine the likelihood of data exposure. Compromised machines with information-stealing malware resulted in several university departments sending over 2000 data breach notifications to individuals.

Opportunities

To manage the serious threats from sophisticated malware, we are seeking improvements in early detection and quick mitigation of issues. To meet the challenge, the IT Security Office is committed to improving all areas of compromised machine detection and mitigation. To make these improvements, we have set the following goals for the coming year:

- Improve our ability to detect malicious traffic
- Reduce infection-to-remediation time with improved notification and response processes
- Create or obtain tools to better analyze malicious network traffic

Other activities

Password Change Project

The Information Technology Security Office led a project initiated in September 2010 to ensure that all Hokies, all PID, and all production Oracle instance passwords were changed at least once before July 1, 2011. As project leader, the IT Security Officer worked closely with Identity Management Services (IMS), Secure Enterprise Technology Initiatives (SETI), Enterprise Systems (ES), and 4HELP to coordinate the Password Change Project. The project also required that passwords meet a new standard minimum strength. Work completed by IMS, SETI, and ES allowed for on-time project completion. This project affected over 200,000 PID accounts, 5000 Hokies and 3000 Oracle account users.

Securing sensitive data

The IT Security Office continued its focus on securing data. A big part of securing data is identifying its location. We obtained and distributed Identity Finder software with the help of Information Technology Acquisitions. Identity Finder's ability to search for data elements such Social Security numbers and credit card numbers with a user-friendly interface quickly became a valuable asset in the search and securing of sensitive data elements. With the use of Identity Finder software along with Virginia Tech's own FIND_SSNs software, the university now has a set of tools that can help find legacy data no matter where it is stored.

Security Operations Center (SOC)

We developed a Web application that combines several security tools into one interface for departmental support personnel to gain insight into their systems. The Security Operations Center (SOC) dashboard allows technical support personnel to see real time IDS alerts and Netscan data for machines that fall within relevant IP ranges. The SOC application also allows support personnel to contact the IT Security Office for scanning and follow-on consultation. The SOC application will also serve as a framework for the future integration of security tools and information to be shared with departmental information technology support personnel.

IT Security Lab

The IT Security Lab serves as a test bed for production-oriented hardware and software security systems under the direction of the IT Security Office and provides a teaching hospital environment for undergraduate and graduate students. Key goals for the lab were increase virtualization of its systems, increase student involvement in the development and maintenance of security tools and applications, and increase funding opportunities for research. We feel that these goals were met and fostered an environment that has led to ground breaking research into IPv6 security.

Cover-VT

In the previous fiscal year, the lab developed a visualization framework that combines IDS data and mapping information provided by Enterprise GIS Research and Administration Development. Students in the lab maintain the project and research ways to enhance the use of geospatial data.

SAIC Gift

Science Applications International Corporation provided a gift of \$30,000 to be used to further the mission of the lab. This generous gift has allowed the purchase of equipment and funding for student wage positions to conduct research on projects associated with the lab.

Teaching hospital

The IT Security Lab delivers hands-on classwork in a teaching hospital environment for ECE4560 and ECE5984 where over 90 students learned information technology audit techniques and vulnerability mitigation. Master's and doctoral students researched areas of IPv6, visualization of cyber threats, and mobile device security with exciting work in IPv6 security emerging.

MT6D research

The Moving Target Internet Protocol version 6 Defense (MT6D) is being developed in the Information Technology Security lab by Matthew Dunlop, Stephen Groat, and William Urbanski under the advisement of Randy Marchany and Joseph Tront. MT6D provides a technique for hosts to communicate over the network while constantly rotating their network addresses. The objective of this research is to protect hosts from targeted network attacks, preserve the privacy of communicating hosts, and allow hosts to communicate anonymously over the network. A few strengths of MT6D are that it is transparent to users; it can operate regardless of the host operating system; and hosts do not need to negotiate with each other in order to use it. One of the unique features of MT6D is that it can rotate addresses even in the middle of a network communication without losing or renegotiating the communication. MT6D is now in the functional prototype stage and has successfully demonstrated its ability to pass numerous forms of network traffic to include streaming video and voice-over-IP traffic.

MT6D has received numerous accolades. MT6D was awarded first place poster and \$500 at the GSA Research Symposium. It was awarded third place and \$2500 at the 2010 National Security Innovation Competition in Colorado Springs. MT6D caught the attention of a major corporation who donated a \$30,000 gift to assure its continued development. MT6D is also a key component of two government research proposals. It has a patent pending. In November of this year, MT6D will appear in the IEEE Military Communications Conference (MILCOM).

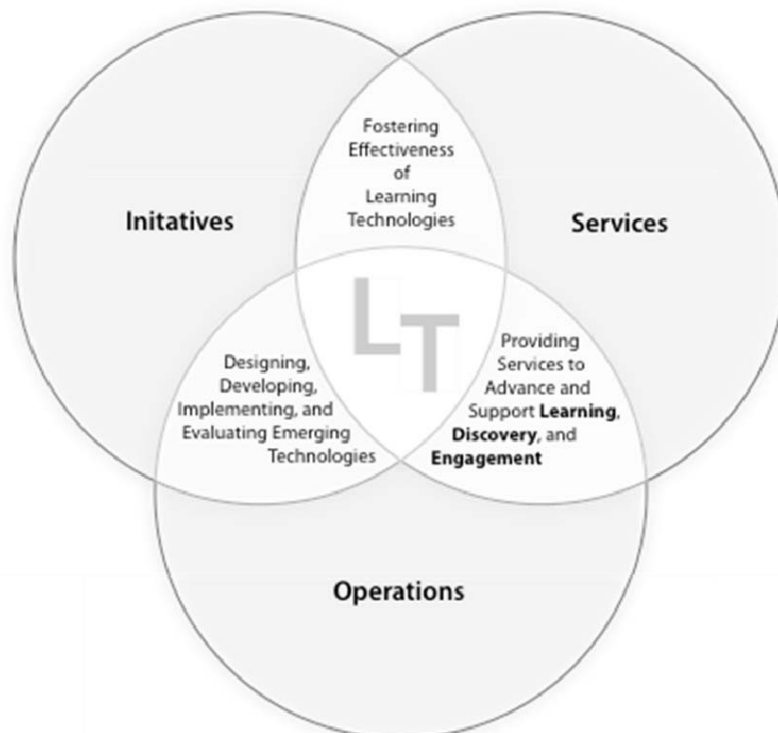
Opportunities

The lab's goal is to continue to increase cyber-security research and provide a hands-on learning environment. Next year's objectives are to seek outside funding opportunities, and seek ways to involve students in the development of security tools and applications.

Learning Technologies

Learning Technologies provides a learning infrastructure actively designed to meet modern needs for integrating technology across content areas. We seek to create and support robust environments for learning, discovery, and engagement for faculty, staff, and students that are grounded in sound principles of learning, and in a thorough knowledge of integrating technology for effectiveness and efficiency of effort,

- through comprehensive development programs and training activities in the appropriate use of emerging technologies;
- through systematic application of appropriate resources to designing, developing, implementing, and evaluating technology-assisted instruction;
- by providing highly responsive services that advance and support network-assisted teaching, research, and outreach.



Aims for the coming year and spheres of operation

Selected hallmarks

Leadership support for the Task Force on Instructional Technology. In the fall of 2010, Erv Blythe, vice president for information technology and chief information officer, and Daniel Wubah, vice president and dean for undergraduate education, charged an eighteen-member Task Force on Instructional Technology with developing a vision of the best uses of instructional technology at Virginia Tech in the next decade and beyond. Co-chaired by Anne H. Moore and Peter Doolittle, the task force met between January and May 2011, hearing presentations and engaging in discussions about the future for instructional technology at large. In particular, the task force sought to envision what Virginia Tech might look like in 2020 in order to realize the possibilities for instructional technology to benefit learning.

The interactive report of the Task Force on Instructional Technology, *Invent The Future: VT 2020*, is available: <http://blogs.is.vt.edu/inventthefuture2020/>. A wealth of information resides on the interactive site that may serve as a resource for thinking, discussion, planning, and action. This website is a dynamic outcome of the task force's work and, by design, allows anyone to join the conversation and ongoing activities.

Transition to Scholar. The multi-year effort to transition from Blackboard to Scholar ended this year. Blackboard was shutdown in December and Scholar became the only university-sanctioned course management system.

Scholar SPOT Survey System. In partnership with the Office of Academic Assessment, Learning Technologies successfully deployed the new Scholar SPOT Survey System for end-of-semester course evaluations. The College of Natural Resources and the College of Engineering used the system this year. Additional colleges plan to use this system in 2011-12.

Discovery Commons launch. The research repository opened as a public access portal for viewing project findings and collections of significant data associated with faculty and departments at Virginia Tech. The American Civil War Newspapers project became operational with the completion of the first newspaper, the Macon Daily Telegraph, available for public access and online viewing. Other major projects are in development for the repository.

ePortfolio Innovation Committee (EPIC). EPIC's mission is to define the use of ePortfolios for a general undergraduate population. Initiated in May 2010, twenty faculty members serve on this committee representing all undergraduate colleges. The committee's work will eventually include defining recommendations for moving forward with a general ePortfolio requirement for undergraduates.

4-VA partnership. 4-VA is a Commonwealth of Virginia program that provided general funds to George Mason University, the University of Virginia, Virginia Tech, and James Madison University. In a public-private partnership between those institutions and Cisco, each institution is installing Cisco TelePresence facilities to promote shared learning across campuses. Programs in development address the STEM fields in science, technology, engineering, and mathematics, along with foreign languages, research initiatives, and more.

Leadership beyond campus. Learning Technologies staff members actively participate in national and international organizations committed to enhanced learning through technology. We serve as board members, reviewers, and editors. These organizations include the following:

Association of Active, Experiential, and Evidence-Based Learning (AEEBL)	institutional representative and regional conference sponsor members
CAMPUS TECHNOLOGY Advisory Board	institutional representative board member
EDUCAUSE Center for Applied Research (ECAR)	co-director and faculty officer and institutional representative
EDUCAUSE Learning Initiative (ELI)	review editors
EDUCAUSE Learning Technology Leadership Institute	editorial board
Electronic Campus of Virginia (ECVA)	institutional representatives
International Journal of ePortfolios	institutional representative board member
Journal of Interactive Technology and Pedagogy	board member
Learning Technologies Advisory Committee at SCHE	member
Learning Technology Consortium (LTC)	board member
New Media Center Consortium (NMC)	board member
National Institute for Technology and Liberal Education (NITLE)	representative
Pearson Strategic Advisory Board	institutional representative
ResearchChannel	
Redesign Alliance	
Sakai – institutional	
WICHE Cooperative for Educational Technology (WCET)	

Operations

The operations teams within Learning Technologies provide production support, documentation, quality assurance, maintenance, and application development for several enterprise-level systems. Those managed by Online Learning and Collaboration Systems (OLCS) are Scholar, including ePortfolios; the legacy course evaluation system; ElementK; and DyKnow. Together, the development and systems administration teams that work on these systems provide practical and innovative technologies for university-wide use. The Discovery Commons Research Repository, managed by Digital Imaging and Archiving, provides university-wide resources for the development, distribution, and stewardship of digital research assets.

Major systems supported

The operations teams are responsible for several significant production systems. For general information on the two operations teams noted above see www.emd.vt.edu/ and www.olcs.lt.edu/.

Blackboard. The university’s previous course management system was officially decommissioned in December 2010 after over a decade of production use. It was replaced with the Scholar system.

Course evaluation data mart. This data mart, managed by Information Warehousing and Access (IWA), is the first Virginia Tech data warehouse to use open-source JasperSoft software for reporting. We completed this joint project with IWA as a sub-project in ramping up the Scholar SPOT Survey System (see below and <https://webapps.es.vt.edu/jasper/login.html>).

Discovery Commons Research Repository. Discovery Commons creates a location for digitizing and preserving collections associated with research and providing access to the collections. It is hosted and managed by Database and Application Administration in Enterprise Systems. This group provides server support for data integrity and security, with storage and backup provided by Network Infrastructure and Services. The repository application consists of VITAL, the institutional repository solution designed by VTLS, Inc., and built on Fedora Commons Repository Software, an open source solution for the development of digital object repositories. Digital Imaging and Archiving, the repository-working group, manages site development and content acquisition. (<https://dcr.emd.vt.edu/vital/access/manager/Index>)

Dyknow (Vision). Dyknow is a Web-based tool used to foster interaction through collaborative note-taking, student response tools, content replay and more. Our support for this tool is in conjunction with a partnership with the College of Engineering. (www.dyknow.com)

ElementK. This suite of online e-learning and print courses is available for use by university faculty and staff members for professional development. (www.elementk.com)

FDI Tracking System. The tracking system is used to manage program participant activity, workshop registration, webpages, and computer selection, delivery, and inventory. Improvements made this year include changes to the administrative portion of the website that have streamlined several administrative processes.

Legacy course evaluation. The course evaluation software was developed from software provided by Columbia University and is currently used by colleges wanting to do online evaluations that have not yet moved to the Scholar-based evaluation system. (<https://courseeval.cc.vt.edu/login/>)

Scholar. This course management system is based on the open source Sakai Project (www.sakaiproject.org), a project started in 2004 and used by hundreds of universities worldwide. We are active members of the open-source community that maintains Sakai, participating in conferences and development activities year-round. Scholar is an integrated system made up of many tools that combine to support learning, teaching, and collaboration for faculty and students. ePortfolio tools are part of the Scholar system. (<https://scholar.vt.edu>)

Scholar SPOT Survey System. This tool facilitates administration of end-of-semester course evaluations. It is based upon a Sakai tool named the “Course Evaluation System” and has modest adoption by the open source community, with active development by approximately five universities. (<http://eval.scholar.vt.edu>)

Key initiatives completed

Each of the systems required some work by the operations teams this year. The most critical initiatives are highlighted below.

The multi-year effort to transition from Blackboard to Scholar was completed this year after Blackboard was shutdown in December 2010 and Scholar became our only university-sanctioned course management system. Use of Scholar increased this past year because of this change.

Courses using Scholar by semester

Semester	Number of courses
Fall 2009	1781
Fall 2010	3906
Spring 2010	2182
Spring 2011	3889

We upgraded Scholar from version 2.6.2 to 2.7.1 in May 2011, introducing several hundred bug fixes, enhancements, and performance improvements, along with a few new tools. For more details, see <http://help.scholar.vt.edu/Upgrade/index.html>.

Scholar SPOT Survey System. In partnership with the Office of Academic Assessment, we successfully deployed the new Scholar SPOT Survey System for end of semester course evaluations. It was used by the College of Natural Resources and the College of Engineering this year. Additional colleges will move to this system next year. A course evaluation datamart supports the reporting needs of departmental administrators and deans for data from this new system. From a small pilot of 30 courses and about 700 student responses in Spring semester 2010, there were 1000 courses and over 19,000 responses in Spring semester 2011. Response rates have been quite strong.

Semester	College(s)	Total number of requests sent to students	Number of student responses	Response rate
Fall 2010	CNRE	5046	3987	79%
Spring 2011	CNRE, COE	26130	19166	73%

Discovery Commons. The research repository was successfully launched as a public access portal for viewing project findings and collections of significant data associated with faculty and departments at Virginia Tech. The American Civil War Newspapers project became operational with the completion of the first newspaper, the Macon Daily Telegraph, which is available for public access and online viewing.

Support of departmental goals

Operations teams strive for continuous improvement, taking input from those who use these technologies. For example, this spring, we completed a survey of both students and faculty members who use Scholar. Key findings garnered from the survey data included the need for

a stable and high performing system, interest in using Scholar on mobile devices, interest in adding new tools to the system (such as an iClicker interface), and dozens of specific tool suggestions, all of which drove specific changes introduced in Scholar for the 2.7.1 upgrade. Regular self-assessment and outside assessment of our offerings allows us to learn, grow, and improve regularly. Furthermore, these ideas will help us prepare for future maintenance releases and larger upgrades.

Additionally, we've regularly surveyed faculty and students each semester following use of the new Scholar SPOT survey system. We found that students prefer this method for taking surveys. The statement that was presented to approximately 2500 students in the College of Engineering in spring term 2011 was, "I prefer filling out this evaluation form on-line rather than filling out the paper-and-pencil form in class." Their responses were 83% positive.

Response	Percentage
Strongly disagree	6.76%
Disagree	5.23%
Somewhat disagree	5.10%
Somewhat agree	12.93%
Agree	25.64%
Strongly agree	44.43%

We expect substantial growth in the use of this system for end of semester surveys this coming year, with all colleges coming online by Spring Semester 2012.

Learning Technologies' application development and systems support teams provide the technical capabilities to enhance, maintain, and scale-up our systems. The Scholar/Sakai platform has been the focus of these teams. OLCS continues to build expertise in quality assurance, improving our skills to ensure high quality Scholar releases. Responding to trouble tickets opened by faculty members and students remains another important function of OLCS. We have continued relationships with other universities around the globe that use Sakai as their main learning management system—critically important relationships when running community-/open-source software.

A major goal for the research repository is adding value to digital materials represented. Quality is a high priority, and we take action to prevent poor quality content from entering the repository. One example was the set of slides scanned for silvaculture research during the past fiscal year. Due to various duplication processes, the slides were a mixture of film types duplicated inconsistently. To achieve adequate color rendering, the slides were digitized multiple times. The research sponsor then was able to select the correct color rendering for each image based on personal knowledge of the experimental site.

In addition to quality assurance work, the digital imaging group works directly with faculty members and departments to evaluate existing data collections so that searching and exploration is possible within specific disciplines and across fields of interest to users of all levels. Over the past year, this work included an extensive analysis for the graduate theses and dissertations project that revealed disparities related to the graduate research record. Further analysis planned for the coming year will complete preparation for constructing a master inventory for this research collection.

Initiatives

ePortfolio Initiatives

ePortfolio Initiatives fosters effective uses of learning technologies by increasing adoption and focus on the pedagogical uses of ePortfolios. Second, we participate in designing, developing, implementing and evaluating emerging technologies related to ePortfolios. Third, our unit provides services to advance and support learning, discovery, and engagement.

Effective uses of learning technologies. ePortfolio Initiatives fosters effective uses of ePortfolio pedagogy. This year's activities include continuing as a significant and central component of the evolving First-Year Experiences program, the quality enhancement plan for our SACS accreditation effort. In 2010-2011, we engaged with six different programs, covering more than 1000 students, in using ePortfolios to encourage students to gather artifacts and to reflect upon problem solving, inquiry, and integrative learning. We have begun working with twelve additional programs, working with an estimated 2500 students. All undergraduate colleges are represented. ePortfolios continue to be an important part of both assessment and of encouraging an integrated, intentional approach to learning within these first-year experiences.

In addition, more programs have adopted an ePortfolio approach, including graduate engineering programs such as aerospace and ocean engineering and mechanical engineering, and the five-year clinical veterinary medical program. An increase in general adoption for all students reflects the "open enrollment" ePortfolio site, now with more than 2100 users and more than 1900 ePortfolio presentations. Many programs introduce this site to their students for their general, personal ePortfolio platform. Other undergraduate programs continue to work with us to customize our tools for their assessment and learning needs. Extra-curricular programs, such as the residence life programs and the SERVE Living Community, extend the curricular program use.

Finally, a major initiative to increase effective uses of ePortfolios at Virginia Tech is the creation of the ePortfolio Innovation Committee—EPIC, whose mission is to define the use of ePortfolios for a general undergraduate population. Twenty faculty members compose this year-long committee, representing all undergraduate colleges. It was initiated in May 2010, and will eventually define the recommendations for moving forward with a general ePortfolio requirement for undergraduates.

Designing, developing, implementing and evaluating. The ePortfolio Initiatives group participates in designing, developing, implementing, and evaluating emerging ePortfolio technologies. With the addition of the assistant director of ePortfolio development, we participate even more extensively in the Sakai Open-Source Portfolio community. We are actively participating in the vision and design for the next generation of Sakai software (termed the "Sakai Open Academic Environment"), and we are currently improving the reporting capabilities for the OSP tools within Sakai.

Members of the group participate in national and international ePortfolio communities. As this professional field coalesces, our participation ensures Virginia Tech a prominent role within it. Our largest contribution is to the Association of Active, Experiential, and Evidence-Based Learning (AAEEBL). Virginia Tech will host a regional conference at in November 2011. We have been the regular producers of the AAEEBL Learner Newsletter, and we are active review editors for the new International Journal of ePortfolios. We also have done webchats and conference presentations for the ePortfolio Action Committee, Campus Technologies, EDUCAUSE, and other regional groups. We are participating in a FIPSIE-funded national project with 20 other institutions engaged in ePortfolio development through the Connect-to-Learning grant, sponsored by La Guardia Community College and AAEEBL. Finally, we have made consultation calls or connections with more than a dozen other universities around the country in the past year who are seeking an understanding of ePortfolio scale-up and who see Virginia Tech as a successful model.

Services to advance and support learning, discovery, and engagement. ePortfolio Initiatives has offered a dozen workshops through the Faculty Development Institute. We are active participants in “Camp QEP,” a training course for the faculty members involved in the first-year experiences programs (FYE) that focus on understanding the new pedagogical approaches encouraged by the FYE. We have regular and ongoing consultation with existing and new programs, and we continue to do training efforts in the classrooms for students, as well as working in conjunction with InnovationSpace to provide direct service to students at the university. At the end of the 2011 academic year, we also made connections with University Libraries personnel as they to incorporate ePortfolio approaches to their own educational and training agenda for students.

Overall, our third year of the ePortfolio Initiatives has seen a deepening use of ePortfolios on campus. We have seen a growth in the number of programs and students using the technologies and engaging with the reflective pedagogies implied by ePortfolios. We have seen programs mature that have been working with us for several years, and we have seen many new programs begin their road to adoption. We have begun moving from a grass-roots pilot to an institutional initiative, clearly becoming a noticeable institutional imperative for us to engage with this learning technology.

Faculty Development Institute

The mission of the Faculty Development Institute (FDI) is to inspire a flourishing community of learning at Virginia Tech by encouraging the faculty’s integration of information and communication technologies into teaching, research, and service. The campus-wide demand for FDI offerings is fed not only by requirements connected with the computer replacement cycle but also by a growing awareness that digital technologies, especially those relevant to networked, interactive computing, are rapidly proliferating and growing in importance. FDI strives to help faculty members engage with these rapid changes within the context of their work at a 21st-century university, and thereby benefit themselves, their students, their institution, and society. FDI also strives to model active, learner-centered pedagogy in the curriculum it shares with the university community. Thus FDI’s objectives are closely aligned with other technology-enriched learning initiatives in the division of Learning Technologies, particularly the Graduate Education Development Institute, the Center for Innovation in Learning, and the ePortfolio initiative.

During the spring and summer of 2011, 466 faculty members participated in short courses and workshops associated with receiving a computer and software. Approximately 7400 such participants have participated since 1993. Thousands of other participants have come in their “off years” to benefit from new learning opportunities. This year, FDI strengthened the program’s value to the faculty by providing a wider range of content, including topics that support the university’s renewed emphasis on research excellence. Our curriculum also helped support continued large-scale deployment of Scholar and ePortfolio. Total participation decreased this year, unfortunately, dropping from 6,067 in 2009-2010 to 4,776 in 2010-2011. Personnel changes within FDI led to fewer courses offered, and the successful rollout of Scholar decreased demand for Scholar-specific training sessions. New offerings under the “imprint” of the Center for Innovation in Learning will increase the range and depth of courses available to faculty and staff members, and to graduate students during 2011-2012.

FDI has begun to leverage online affordances to increase both ease of access and overall participation in our curriculum. In 2010-2011, 21% of the FDI classes were conducted online through Adobe Connect, accounting for about 15% of the total participants. The use of Adobe Connect, or similar online products, was virtually non-existent with past FDI classes.

Short course breakdown by semester

Term	Total short courses & workshops	Total participants	Online courses	Online participants
Fall 2010	209	1,528	40	193
Spring 2011	292	2,690	64	472
Summer 2011	69	558	17	78
Totals	570	4,776	121	743

The FDI staff meets regularly with faculty members and deans from all colleges to gather feedback for our program, and participants provide suggestions for future FDI workshops. This information has enabled us to ensure our offerings continue to stay relevant and timely, allowing us to continue to contribute to the diversification and growth of Virginia Tech’s applications of technology in research and instruction.

FDI also partners extensively with InnovationSpace and other Learning Technologies groups, and in 2011-2012 those partnerships will grow. We will also partner with the University Libraries more frequently going forward. National/international linkages include the New Media Consortium, EDUCAUSE, the EDUCAUSE Learning Initiative, the National Institute for Technology and Liberal Education, and the *Journal of Interactive Technology and Pedagogy* (the FDI director sits on their editorial board).

FDI track offerings

New Faculty: Community and Computing
 Teaching with a Tablet PC to Engage Students in the Learning Process
 Improving Instruction using Scholar
 Improving Instruction using Scholar—Advanced Topics and Technology Use
 Planning, Developing, and Delivering Online Instruction
 Improving Online Instruction—Strategies, Pedagogy and Best Practices for Advanced
 Online Instructors
 Innovations—Exploring Emerging Learning Technologies
 Faculty Inquiry Group: Teaching Contemporary Students to be Actively Engaged
 Learners
 IT Security and Policies at Virginia Tech: What do I really need to know?
 Collaborative Creativity: Fueling the Future
 Community of Practice: Librarians at Virginia Tech
 An Introduction to MATLAB and Statistical Methods
 NVC Track—Improving Instruction using Scholar—Strategies, Pedagogy and Best
 Practices
 Visualization and Research Computing: Deep Media for Research and Education
 Statistical Data Exploration, ANOVA, and Regression using JMP
 Advanced Statistics—Design and Analysis of Experiments using JMP
 Geographic Information Systems: Fundamentals, Analysis and Web-based Mapping
 Life Cycle of a Sponsored Project: Research Administration Fundamentals
 The New Age of Interdisciplinary Projects—Designing, Proposing and Managing
 Interdisciplinary Research
 What is YOUR Track?—Design Your Own Development Experience
 Strategies for Inclusive Teaching and Mentoring

Faculty development classroom usage summary

Torgersen classrooms	FDI sessions	VT class meetings	Meetings/other workshops	Total number of events
1120, 3060, 3080	499	190	409	1098
Other rooms	78			

Summary of FDI computer distribution, spring/summer 2011

	Apple	Dell	Fujitsu	Hp	Totals	Percentage
Desktops	34	51	0	5	90	19%
Laptops	193	100	0	12	305	64%
Tablets	0	0	80	0	80	17%
Totals	227	151	80	17	475	
Percentage	48%	32%	17%	3%		

FDI has developed solid partnerships across campus and with outside vendors to provide a significant number of workshops that bear no out of pocket costs and fit well into the current scalability of our classroom availability and registration system. These partnerships provide close to 40% of the classes offered by FDI and over 10% of our summer tracks. Since these classes tend to be part of the missions of the partnering entities, this is certainly a sustainable strategy for the short-term and most likely for the long-term as well. Below is a breakdown of the main partnerships and the number of courses in 2010/2011:

University unit	Short courses	Tracks
Division of Research	81	2
Branding	37	0
University Libraries	15	1
Institute for Distance and Distributed Learning	29	2
GIS	21	1
LISA	27	0
IT Security Office	4	1
Diversity	0	1
Visualization	11	1
Total	225	9

Corporate Partner	Short courses	Tracks
MathWorks (MatLAB and Simulink)	3	1
SAS (JMP)	2	2
National Instruments (LabVIEW)	3	0
COMSOL (Multiphysics)	0	0
Autodesk Inventor	2	0
Total	10	3

Vendors who provide computer hardware for FDI take part in a hardware showcase each year. Participating faculty members can see the new line of computer options available to them and make a more informed computer selection. Vendors include Dell, Apple, Fujitsu and HP.

The Graduate Education Development Institute

Engaging graduate student instructors in the process of discovering and defining their pedagogical praxis is another important programmatic focus within Learning Technologies. During this past academic year, the Graduate Education Development Institute (GEDI) continued to support Learning Technologies' mission of advancing learning, discovery, and engagement by providing graduate students opportunities to explore technology-enriched active learning. The GEDI program provided professional development curriculum within multidisciplinary learning communities of peer colleagues to complement the mentoring offered at the department level.

As part of our ongoing collaborative efforts with the Graduate School, the GEDI Fellows taught over 250 graduate students throughout the fall semester in Phase II workshops for the Graduate School's GTA Orientation course, GRAD 5004. The director also co-taught a GTA workshop on ethical dilemmas to 60 students. Over the AY 2010-11, 102 graduate students enrolled in the semester-long GEDI graduate seminars, with the primary enrollment occurring in two sections of the GRAD 5114 course, "Pedagogical Practices in Contemporary Contexts." In addition, seven students enrolled in the Advanced Practicum course in the spring, and two graduate students did independent studies with the Director of the GEDI program. Assessment data for the GEDI pedagogy course continues to suggest that the semester-long graduate seminar plays a vital role in the professional development of graduate

teaching assistants at Virginia Tech. For example, entry data showed that most of the graduate students began the course without a clear understanding of how to define problem-based learning for a course they would teach; yet this year's exit data indicate that 94% are now either likely or very likely to incorporate case studies and problem-based learning into their curriculum. And, nearly two-thirds of participants indicated a new awareness of and interest in using collaborative 2.0 tools (including those in Scholar) within the courses they teach or will teach. GEDI participants also provided qualitative assessment exit data. Their feedback indicated that the contemporary pedagogy course is viewed as a site for "[d]eveloping our own perceptions of who we are as teachers" and for discovering that "[g]ood teaching is a fluid and mutual relationship between the student and the teacher so that knowledge creation and transmission happen on both sides." Many graduate students were excited to explore a teaching praxis that focuses on the learner: "I think that the focus on learner-centered teaching was the most useful aspect of this course. Society puts too much emphasis on grades and GPAs rather than concepts and learning. If we guide students through the learning process they are more likely to retain knowledge rather than just memorize it for a test." Graduate teaching assistants can also help to influence the direction of their departments, as suggested by the following comment: "I have greatly enjoyed this class . . . It has encouraged me [to] view teaching and [a] teaching framework in such a new and different light. I have actually encouraged my department to try to start to incorporate the development of an eportfolio for the undergraduates."

During the coming academic year, the GEDI program looks forward to exploring new collaborative efforts and ways to further other initiatives within Learning Technologies. One goal for GEDI is to discover common points of engagement with both the director of the ePortfolio initiative and the director of Faculty Development and Innovative Initiatives in Learning Technologies.

Services

Several Learning Technologies departments provide service to advance and support learning, discovery and engagement with a commitment to excellence. These departments are Computer-Integrated Learning Systems (CILS), Assistive Technologies (AT), CMS Training, Office of Technology for the Arts (OTA), Testing and Data Services (TDS), InnovationSpace (IS), and Technology Applications for Research and Collaboration.

These groups work collaboratively to foster the effective use of technologies and to design, develop, implement, and evaluate emerging technologies. In conjunction with the rest of Learning Technologies, these groups support and respond to the needs of the university. This diverse set of groups provides high-quality, extensive services to students, to faculty and staff members, and to the community, and supports more than 1000 computing stations throughout campus. The approach to service includes the highest quality and most reliable computer hardware and software in over 20 locations on campus maintained by CILS, IS, and AT.

In addition to providing equipment, the services group provides extensive support to the university community. AT provides assistive technologies (Braille services, screen readers,

audio readers) and training for end users and departments that are addressing disability accommodations. This support includes Web accessibility reporting, consulting and training. The CMS training department provides extensive training and support on the use of Ensemble to promote a powerful Web presence for Virginia Tech that is accessible and usable. This training is provided both through departments and in one-on-one settings. Over 70 new Ensemble sites have been created in partnership with the CMS training office. InnovationSpace provides access to equipment for checkout, including video and still cameras, audio recorders, iPads, lighting kits, and more. This service was supplemented by access to a lab that provides training and support through an expertly trained student and professional staff. Training and support are provided through FDI with presentations and courses being delivered by staff from CMS training, IS, TDS, OTA, and Technology Applications. SpaceCamp, offered through the InnovationSpace, continues to deliver student-led training on multimedia software, hardware, and best practices in film and video. CILS continues to support pay-for-print services and the president's conference room.

The services group continuously explores new projects supporting effective uses of learning technologies and services to advance and support learning, discovery, and engagement:

- CILS supported the full life-cycle of two SCALE-UP classrooms.
- Technology Applications for Research and Collaboration and the InnovationSpace have provided a virtual learning space and a virtual Graduate Life Center (GLC) within OpenSim.
- The OTA supported a 3D virtual center for the arts, a TelePresence partnership with Cisco and university partners across the state, and future directions for the Institute for Creativity, Arts, and Technology, and its physical presence in the Center for the Arts, now under construction.

The SCALE-UP classroom project—Student-Centered Active Learning Environment for Undergraduate Program—is a project of the College of Science to decrease failure rates science curricula. The classroom is carefully designed to facilitate interactions between students, and between students and instructors. A SCALE-UP classroom has an open space with large circular tables, each with three laptop computers. White boards and projectors display work in progress of the student groups, as the instructor walks through the room, facilitating student discovery. This specially designed classroom last fall that enabled highly collaborative, hands-on, interactive learning in what was traditionally a lecture-style class.

OpenLife is the locally hosted and branded version of OpenSim. Courses are now being delivered through this platform to support blended and online learning. This year's projects also included the inclusion of the virtual Graduate Life Center (GLC). Below are images from the OpenLife project with photography class and the GLC.



TelePresence is part of the **4VA Initiative**, a Commonwealth of Virginia program that has provided general funds to George Mason University, the University of Virginia, Virginia Tech, and James Madison University. In a public-private partnership between those institutions and Cisco, each institution is installing Cisco TelePresence facilities to promote shared learning across campuses. A smaller TelePresence facility has been installed in 314 Burruss Hall and a second TelePresence facility is still under construction in Torgersen Hall.

OTA continues to develop and facilitate trans-disciplinary and trans-organizational relationships to promote the Institute for Creativity, Arts and Technology. The institute is a major component of the Center for the Arts at Virginia Tech. The institute will provide an innovative platform to enrich learning environments. During the current building construction phases, OTA works to ensure the inclusion of both current technologies and the flexibility to grow with future technologies.

With support from OTA and other Information Technology personnel, Dane Webster (School of Visual Arts) and his students converted architects' renderings into an immersive, 3-D visualization of the center today, although opening is two years away.

The year's highlights from selected LT services include the following:

- Full Braille services with extensive support of teaching and learning through *ad hoc* requests and textbooks to Braille
- Full life cycle support of classroom transformation of the SCALE-UP classrooms, consultations with departments on learning-space redesign, and support of equipment updates with CILS, IS, and AT
- CILS's continued support and development of the PACE/PDM collaborative course with Dr. Jan Helge in Mechanical Engineering

- Support of research with AT providing services for Improving the Accessibility of Community Emergency Management Systems (ACEMS) and Spatial Touch Audio Annotator and Reader (STAAR) grant-funded projects
- Support of undergraduate research with Technology Applications Research and Development's Bill Plymale as the instructor for ECE 4994, providing students with access to the Pervasive Computing Lab
- Emerging technologies partnerships with various university stakeholders with the implementation of a blog platform, iPad loan initiative

The InnovationSpace continues to support multimedia technologies and pedagogical changes through its open lab, teaching and learning with technology classroom, equipment loans, and SpaceCamp student training sessions. This year there was a 3% increase over the last year's patron numbers with 15226 unique transactions. The most-used resources of the InnovationSpace resources were video work, graphics, and equipment loans. The demand for both multimedia software (Final Cut Pro, Illustrator, Photoshop, Dreamweaver) and hardware (video and still cameras, iPads, audio recording equipment) has influenced our growth to include more equipment for loans, repurposing of space in the lab and classroom to allow for overflow patrons, and an area where students can bring in their own laptops and still have access to our expert staff.

Network Infrastructure and Services

Network Infrastructure and Services (NI&S) administers the information technology infrastructure and related services, by

- operating highly available, reliable, and secure networks and computing systems;
 - researching, testing, and advancing emerging technologies;
 - disseminating information obtained through research and development;
 - engaging local, state, regional, and international communities as partners;
 - applying disciplined and conscientious fiscal practices.
- The departmental website is www.nis.vt.edu.

Involvement in instruction, outreach, and research

Rapid advances in technology and mobility are reflected in the constantly changing ways the university community must approach its work. Such change increases demand for, and expectations of, technology and infrastructure and the benefits they provide. New computing and communications methods continue to enhance the educational experience of students and the capabilities of faculty and staff, whether on-site or online. In response, NI&S seeks opportunities to innovate and improve programs that enhance Virginia Tech's reputation as a research university in an increasingly competitive, global, and digital environment.

Access to next-generation networks and services, including reliable and secure electronic communications and central computing facilities, continuous service monitoring, predictive capacity-planning, and e-discovery support for the university, is critical if Virginia Tech is to fulfill its mission.

Access and infrastructure

NI&S is a leader in advanced network services with an emphasis on promoting robust and integrated information technology strategies. The department participates in the deployment of wide-area, high-performance computing and communications networking to provide the university with direct access to high-speed, national and international, research networks and facilities. Linking various locations through high-speed networks enables the transfer of massive amounts of data and allows the visualization of results and remote access to specialized, scientific equipment.

Members of the university community expect and depend on efficient services made available through optimal use of up-to-date technology. Whether the infrastructure is used for teaching, learning, research, administration, or community service and engagement, Virginia Tech has access to gigabit Ethernet, wireless local area networks, wired and wireless voice communications, video and related services, broadcast-quality teleconferencing, and a cable television system. New, Internet-based applications like IP videoconferencing and high-definition video provide greatly improved quality and performance for distance learning programs. In all cases, essential technical, security, and help desk support are integral to daily infrastructure operations.

Planning has also been underway to allow the university community to take advantage of the convergence of various telecommunications technologies with a unified communications infrastructure to support future research and instructional needs and foster educational opportunities and economic development. This new information environment will replace much of the legacy network and telecommunications facilities while providing next-generation performance and flexibility. Based on a diverse, survivable, optical core, the enhanced network will provide the university with advanced networking capabilities, high-performance computing technologies, and a pervasive, leading-edge technology infrastructure to support the vision and mission of the university, well into the future.

The Business Model: building partnerships, recovering costs

NI&S collaborates with other Information Technology units to provide centralized network management and computing service support while emphasizing security and reliability. Through collaboration with academic programs and external partners, NI&S helps enhance the university's reputation in advanced network and computing research initiatives and learning environments.

NI&S is required to recover all operational costs as well as the expenses necessary to build, maintain, and continually upgrade the network. Constant improvements in operational efficiency, in addition to cost reductions, are necessary to keep pace with budget reductions and overhead costs imposed by the commonwealth and the university. The organization has always emphasized financial integrity and stability, administered a balanced budget, and ensured that financial resources are available for new technologies. NI&S is able to use a variety of funding mechanisms to fulfill its mission. Various units are supported from a combination of auxiliary, and education and general funds. Communications Network Services (CNS) can assume debt for capital expenditures related to infrastructure

development. However, the majority of NI&S funding comes from revenues associated with the sale of services. In addition, NI&S participates in funded sponsored projects and research in partnership with federal agencies and commercial entities.

Organization

Network Infrastructure and Services is organized into several units.

Strategic Initiatives

Strategic Initiatives (SI) directly supports Information Technology's executive administration in strategic programs and special projects. SI's goal is to enhance the quality and competitiveness of university research and instruction through advanced, broadband technology. SI provides leadership to several projects.

VT Technology Assets, LLC. In 2011, the Virginia Tech Foundation (VTF) created VT Technology Assets, LLC (VT-TA), a wholly owned subsidiary. The purpose of VT-TA is to hold strategic technology assets for the benefit of the university. VT-TA allows Virginia Tech to develop partnerships and expand the use of assets to increase their value to the university and to promote economic benefits for the commonwealth and the region. Assets currently held by VT-TA include over 3,000 miles of fiber-optic indefeasible rights of use, wireless spectrum licenses, an interest in National LambdaRail, metro-area network systems in the National Capital Region, advanced network security systems, and telepresence systems. SI manages the portfolio under contract to the Virginia Tech Foundation. NI&S will soon provide inventory management of the technology assets once a contract pending between VTF and the university is approved.

Mid-Atlantic Terascale Partnership. The Mid-Atlantic Terascale Partnership (MATP) connects regional research and education members to high-capacity and global networks, including National LambdaRail (NLR) and the Internet through an aggregation facility in McLean, Virginia. An SI representative serves as program director for MATP and as the mid-Atlantic administrative representative to NLR.

NetworkVirginia. The network promotes equitable access to broadband, particularly in rural communities, through colleges, schools, government offices, municipalities, and other public and private entities. NetworkVirginia reached over 1.4 million Virginians at its peak. Under subcontracts from Verizon and Sprint, Virginia Tech provides multiple services to NetworkVirginia and its customers.

Virginia open access fiber network. With leadership from Virginia Tech, the commonwealth began investing in open access, fiber infrastructure for rural areas in 2002 through the Tobacco Commission. The Mid-Atlantic Broadband Cooperative (www.mbc-va.com) and the LENOWISCO Planning District Commission (www.lenowisco.org/) constructed over 1,000 miles of fiber in Southside and Southwest Virginia. The Virginia Tech Foundation enabled significant expansion of this network with federal grant funding

extending the open access fiber network to Blacksburg with 12 strands of fiber allocated to VT Technology Assets, LLC. SI facilitates the projects, with significant investment from the Virginia Tech Foundation.

Local multipoint distribution service. Virginia Tech purchased regional local multipoint distribution service (LMDS) spectrum several years ago. SI is assisting with its deployment and integration with other networks through projects at the University of Virginia at Wise, the Institute for Advanced Learning and Research in Danville, and the City of Martinsville.

NatCap Dense wavelength division multiplexing (DWDM) network. Working closely with the VTF, the vice president for the National Capital Region (NatCap) and NI&S, SI led request for proposal procurement processes and contract negotiations to acquire a dark fiber ring and a high-performance DWDM/packet optical network system to link several strategic university assets in the northern Virginia area. The National Capital Area or, NatCap, network puts the new Virginia Tech Research Center—Arlington, Virginia, directly "on-net" with national and international research networks with world-leading bandwidth capacity. The network extends the same capability to the Northern Virginia Center in Falls Church, Virginia. Two NatCap nodes on the ring in McLean, Virginia, and Ashburn, Virginia, are collocation points providing direct access and exchange among virtually all national research and commodity networks. Through those facilities, Virginia Tech provides access to research and educational institutions and other community anchor institutions throughout the mid-Atlantic region.

Technology Innovation

Technology Innovation is composed of a team of NI&S engineers that collaborate with the Virginia Tech Office of the Chief Technology Architect to develop a strategic vision for the delivery of next-generation applications, technologies, and services for the university community. Team members recommend new technologies to be deployed and work with NI&S engineering groups to manage the integration of those technologies into the university's local and wide area communications environments. Team personnel conduct theoretical and practical research in network protocols, standards, services, methodologies, and best practices. The team acts as a liaison to research faculty in defining advanced network and application requirements to meet their needs.

Activities for Technology Innovation include the following:

- Conduct operational and theoretical knowledge transfer sessions in support of the NI&S's engineering and operations staff
- Consult with university, local, and regional groups on emergency communication initiatives
- Participate on the Information Technology High-Performance Computing and Networking Team, responsible for the development and operation of high-performance computing infrastructure in support of scientific research at Virginia Tech
- Represent Virginia Tech on technical committees and collaborative engineering staffs serving regional, national, and international high-performance network initiatives.

- Develop a vision of university’s technological direction and form strategies to achieve this vision
- Provide high-level consultation and develop innovative networking solutions

Network Security. Network Security registers and manages Internet protocol (IP) addresses and administers other activities critical to network security. Registry services used by every network-attached device (host) are essential for network reliability, availability, and security, and help maintain accountability for network activities. The Network Security staff provides consulting and engineering assistance in the areas of networking, security, and systems administration, as well as support for special applications.

IP address assignment. Every host (computer) on the Internet has an IP address. This unit manages the IP addresses assigned to Virginia Tech.

IP domain name service (DNS). DNS associates host names with IP addresses.

Dynamic host configuration protocol (DHCP) service. DHCP automatically configures network connections for registered hosts allowing those hosts to be moved among networks without manual reconfiguration by a system administrator.

Design and development. The Design and Development group develops systems and tools for efficient, effective, address registration and management.

Engineering Operations

Virginia Tech’s network serves the diverse and challenging needs of teachers, students, researchers, and administrators. Reliability and security are paramount concerns given Virginia Tech’s critical dependence on computers and the sensitive nature of the data they contain. Technology operations are highly dynamic and require planning and investment in technologies of tomorrow while operating and maintaining those of today.

Network Research and Development (Network R&D). Network R&D engineers collaborate with other NI&S engineering staff to identify new technologies and tools to support the evolving networking needs of the university. With high-level strategic direction provided by the Technology Innovation team, Network R&D researches, develops, and deploys new telecommunications technologies and services. Those enhancements are well-documented and fully integrated into the operations and management infrastructure. All operations and support employees are fully trained to manage the new technologies. Near-term new and upgraded services will address the increasing demand for converged technologies and facilitate implementation of distributed applications, mobile wireless networking, and pervasive computing. As required, Network R&D develops customized solutions to support unique research, academic, and administrative requirements, and provides technical support to the Virginia Tech community to ensure all network applications—including wireless—function optimally.

Activities for Network Research and Development include the following:

- Research, evaluate, and plan the integration of next generation solutions in network operations, configuration management, fault/performance management, and telecommunications security; and in collaboration with other NI&S engineering units, facilitate the deployment and configuration of these solutions and share knowledge and training for post-deployment management and troubleshooting
- Design, specify, and oversee the deployment of telecommunications systems and applications to deliver voice, data, and video services to the Virginia Tech community
- Research and select new telecommunications systems and applications to provide state-of-the-art voice, data, and video services to the university community
- Research, identify, and support development and transition of network and systems management tools to production
- Coordinate with other NI&S engineering teams to develop specifications and recommendations to support implementation of modifications and enhancements to ensure network performance is consistent with application requirements and user needs and expectations
- Consult with industry and user groups on multimedia and next-generation applications
- Provide support for network solutions for multi-disciplinary, funded research activities
- Promote the vision and use of information technology within the university and research community

Field Engineering (FE). FE plans, provisions, and provides structured telecommunications cable distribution systems (both inside and outside plant) designed to reliably and securely support Virginia Tech’s communications needs over the next 10 to 15 years. By working closely with Virginia Tech’s Office of Facilities Services, university architects, and project engineers, and through testing and evaluation of vendor products—often collaborating with vendors to customize systems to best meet the needs of the university, FE ensures the cabling systems, including pathways, spaces, advanced copper and fiber-optic cabling, cable management, terminations, and other related equipment meet or exceed all required capacities, specifications, and standards.

During construction and upgrades, FE helps assure work quality, proper documentation, smooth workflow, and employee efficiency and safety.

Video/Broadcast Services (VBS). VBS produces multimedia instructional materials, and manages and schedules—on a statewide level—the interactive videoconferencing network, electronic classrooms, and related systems required to deliver distance learning classes and materials to thousands of students. VBS offers live and on-demand streaming media services for classes, projects, and special events.

Network Engineering and Systems Support

Network Engineering (NE)

NE implements, manages, and operates the university’s data network. Team members utilize and manage new protocols, configure and utilize software, measure and analyze performance, continuously adjust network configurations, and improve processes. Achieving 99.9928%

network systems availability, NE staff members employ an array of software management, testing, and troubleshooting tools and systems.

NE works with other NI&S engineering teams to recommend and implement improvements to existing services and related infrastructure.

Network Engineering activities encompass four major areas:

Infrastructure planning and upgrades. Appropriate facilities, up-to-date cable plant, and continually upgraded network systems are essential elements of Virginia Tech's communications infrastructure. NE specifies and deploys the network equipment necessary to meet the growing needs and demands of research and academic computing. Standards-based solutions that support well-defined management options, security, serviceability, and feature sets that exceed current needs are chosen to meet future requirements. NE collaborates with other NI&S engineering groups to develop comprehensive plans to re-engineer pathways and building wiring to support the design and ongoing implementation of high-quality network architectures and upgrades.

Network services planning and implementation. NE collaborates with Network R&D to provide analysis and evaluation of proposed new systems and services, ensuring all required operational guidelines and procedures are well documented, and employees are properly trained before new services are integrated into production. NE provides network testing in preparation for new videoconferencing technologies being deployed on university networks.

Systems and applications integration, utilization, and administration. NE integrates, utilizes, configures, and manages a wide variety of hardware and software to efficiently and effectively operate and troubleshoot campus networks and related support systems and services. NE uses validated procedures, regular meetings, and an engineering change order process to maintain the integrity of the network and the services that depend on it.

Distance learning and cable television. NE's video engineers provide uplinks for the Virginia Satellite Educational Network for distance learning programs and they distribute commercial television programming via the university's cable television system. NE video engineers support the university by broadcasting special events for departments. The team emphasizes rapid response and close collaboration with commercial providers to maintain a high level of availability and to enhance services. The video engineers have upgraded the coax cable backbone system by installing a new fiber-optic backbone which improves the quality of the cable television programming provided to the university community. Residence halls have also been upgraded with fiber-optics which improve signal and picture quality. The conversion from coax to fiber-optics for the remaining classroom and administrative buildings began July 1, 2011, and will continue until the campus is completely upgraded to fiber. The anticipated project completion date is July, 2012. The fiber-optic upgrade is the initial step toward the goal of providing high-definition programming for the campus cable television systems.

E-Communications Services and Windows Administration Services (ECS-WAS)

The ECS-WAS team provides 99.97% or greater availability for all centralized messaging systems (email, including the recently launched Google email offering for alumni users;

instant messaging/chat services; mobile messaging; USENET news) and operating system and hardware administration support for all non-UNIX-based centralized services. The team maintains the university LISTSERV system and Virginia Tech UNIX/Linux mirror site. ECS-WAS staff respond to Internet abuse complaints, function as members of the Computer Incident Response Team, and provide e-discovery services in support of civil, criminal, and regulatory investigations.

Storage Management Team (SMT)

SMT provides highly available, self-managed storage and backup/archive facilities: (99.999% up-time for the period), administers the EMC Corporation Storage Area Network (SAN) for large, data-intensive applications (100% up-time), the high-performance storage for research applications (99.999% up-time for the period; IBM brand equipment), and the network-attached storage (NAS) devices (99.999% up-time for the period) that provide file-level storage for desktop/laptop users or departmental-level file-sharing.

Eighty percent of all storage is used for academic and research purposes. SMT participates in e-discovery efforts as the bulk of the data collected and preserved resides on storage and backup/archive equipment administered by SMT staff. SMT administers the central UNIX print server and provides back-end support to the university's LISTSERV system (100% up-time for the period). Next year, this team will deploy new storage systems to support research computing efforts and networked video surveillance camera data systems.

UNIX Administration Services

The UNIX Administration Services team supports UNIX/Linux-based hardware and operating systems for administrative applications (such as Banner and the enterprise Data Warehouse), instructional applications (such as Scholar/Sakai), and research applications (such as those running on System X, Silicon Graphics Incorporated [SGI], and IBM and Sun-based hosts). Standardization across all systems enables a small team to provide 99.9944% availability for over 300 non-research systems and more than 1,000 research systems (including the Apple MAC OS X-based System X, Sun Microsystems' Solaris-based systems, SGI IRIX and Linux-based systems, and the IBM iDataPlex cluster and other Power-based and Intel-based systems). The UNIX team provides systems administration support to twelve separate groups within Information Technology.

E-Discovery and Data Center

E-Discovery

The E-Discovery group provides support to University Legal Counsel. The bulk of centrally managed information technology resources are administered by members of this department. Remote collection of data from unit custodians is performed by members of Systems Support, though work can involve staff from the Information Technology Security Office, Switch Engineering, Network Administration, or personnel from university departments.

Data Center

The Data Center is located in the Andrews Information Systems Building in the Virginia Tech Corporate Research Center. Data Center management was created this year to coordinate all cross-departmental research and project-related activity, including monitoring electrical power and environmental systems, and ensuring adequate physical space and network resources are available. The emergency auxiliary site in Cassell Coliseum is managed with assistance from CNS Facilities Management. Coordination with other university information technology units ensures availability of needed telecommunications and storage network facilities. This area also prepares appropriate documentation, including project proposals and project management forms.

Special projects liaison

The special projects liaison provides administrative coordination among diverse entities involved in delivering telecommunications services to the university. Duties include the development of relationships with other government agencies and vendors, long-term planning, evaluation of new technologies and services, network design assistance, cost analysis, contract negotiation, communications with customers, and problem resolution.

The liaison is a key figure in coordination with external groups as well—NetworkVirginia, EDUCAUSE, the Net@EDU, Converged Communications Working Group, Internet2, QUILT Inc., and National Lambda Rail (NLR).

Systems Development and Administration

Systems Development and Administration (SDA) develops and maintains information systems, software applications, and related infrastructure for the NI&S organization. SDA includes the following teams and/or functions:

Software Development

The Software Development team builds and maintains software systems and Web applications to support all aspects of the complex NI&S organization including billing, accounts receivable, accounts payable, purchase order, budget, work order, service management, voice call detail records, network management, and equipment, materials, and cable plant inventory. Team members continue to develop and improve cola.cns.vt.edu, the organization's customer Web portal accessed by students, departments, and university guests. Development platforms include Oracle Forms, PL/SQL, Jasper Reports, BMC Remedy, Java, and many Java-related technologies. The Software Development team collaborates with the Chief Technology Architect on development of next-generation systems and VT Alerts, the university's emergency information distribution and feedback system.

UNIX System Administration

The UNIX System Administration team provides system and security administration for over 80 Solaris and Linux systems including database servers, application/Web servers, and network infrastructure systems that support all aspects of the organization and network.

Database Administration

Database and security administration for Oracle and PostgreSQL systems are provided by the Database Administration group. The team manages more than 15 Oracle instances and 15+ PostgreSQL instances for NI&S's administrative systems.

Windows Systems Administration and User Support

This team administers over 300 desktop systems, mobile computers, a classroom, and several Windows servers. They provide computing support to NI&S staff.

Computer Aided Design/Geographic Information System (CAD/GIS)

CAD/GIS documents Virginia Tech's network infrastructure. It uses computer aided design and geographic information systems tools to facilitate network management, perform troubleshooting, and strategic planning.

Voice and Mobile Technologies

Voice and Mobile Technologies (VMT), includes the Network Administration, NetworkVirginia, and Switch Engineering groups. VMT is responsible for planning and designing Virginia Tech's next-generation unified communications solution.

Network Administration

Network Administration, in collaboration with other NI&S units, coordinates record keeping, data analysis, and reporting necessary for accurate billing, fraud prevention, and audit compliance. Network Administration provides requisite assistance and information to university authorities and law enforcement.

NetworkVirginia

The NetworkVirginia group provides network administrative and problem resolution support to over a million NetworkVirginia customers—especially in rural and underserved communities. Service provisioning includes coordination with subcontractors Verizon and Sprint to provide the world's most advanced research network infrastructure for regional universities and laboratories. High-bandwidth, high availability network access is available to scientists, educators, economic developers, government, regulators, and businesses.

Unified communications system

Unified communications (UC) will provide a foundation for integration of real-time communications services like telephony, instant messaging, chat, and desktop videoconferencing with other non-real-time communications services such as email, voicemail, and fax. The planned UC system will enable the university community to access new and emerging communications technologies. Negotiations with vendors responding to a request for proposal for a next-generation unified communications system were concluded during the summer of 2011.

Switch Engineering (SE)

SE provides telephone and voice messaging services for the main campus and for university locations statewide. The university's main campus telephone system up-time was 99.946% for FY 2010-2011. SE oversees the emergency "blue light" telephones on the Blacksburg campus and supports law enforcement and service providers.

Revenue-based business planning and operations

Several business administration and operations units support the daily enterprise business activities and operations of NI&S.

Budget. The fiscal director is responsible for the fiscal integrity of the organization including budgeting and financial planning for all areas and performs financial analyses to determine growth potential, financing requirements, and project feasibility. The director also serves as a liaison with the university's financial areas.

Human Resources and Safety (HRS). This group provides support to managers, supervisors, and staff in the areas of recruiting, compensation, position classification, and leave reporting, and as NI&S' liaison to the university Office of Human Resources. HRS provides oversight to the department's safety officer, who is responsible for regulatory compliance, safety-related training, and assessment of workplace hazards, such as asbestos and lead.

Ordering and Provisioning (O&P). The O&P team facilitates and fulfills customer requests for telecommunications equipment and services. O&P provides planning assistance for major telecommunications projects including infrastructure planning for new building construction.

Business Services. The Business Services group processes accounts payable (including telecommunication vendor billing) and accounts receivable, provides payroll support, and operates the Student Network Services office.

Public Relations. The Public Relations team facilitates communication between NI&S and its customers and constituents. The Public Relations unit includes NI&S's reception services and the department's Web design, development, and documentation. The unit also processes Internet-based copyright infringement notifications in compliance with the Digital Millennium Copyright Act.

Project Management. Under the Commonwealth of Virginia's Restructured Higher Education Financial and Administrative Operations Act, the university has its own policy and standards for information technology project management. NI&S has organized a cadre to support project management within the organization.

Information Technology Support (ITS). ITS is composed of the Virginia Tech Operations Center (VTOC), University Computing Support (UCS), and the University Switchboard. ITS is a single point-of-contact for questions and issues relevant to centrally-provided computing and telecommunications services.

Virginia Tech Operations Center (VTOC). Comprising the Call Center and Network Operations, the VTOC provides 24 x 7 support for all central information technology applications and services, and network, campus television, and systems operations functions. The VTOC proactively monitors university information technology networks, systems, and services. The VTOC receives trouble calls and opens tickets to track and document the diagnosis, escalation, and resolution of reported problems.

University Computing Support (UCS). The UCS team comprises the Help Desk and the Content and Knowledge Management (CKM) groups. The Help Desk consultants resolve escalated problem tickets and serve as liaisons with other Virginia Tech information technology groups. CKM publishes and manages content for university Information Technology products and services, and maintains an extensive, publicly accessible, knowledge base, <http://answers.vt.edu>. CKM is responsible for www.computing.vt.edu, a one-stop computing resource site that describes many services and applications provided by Information Technology.

University Switchboard. The University Switchboard provides efficient, 24 hours each day, 7 days a week, directory information and operator assistance. Operators collect new listing information and ensure the Virginia Tech directory assistance database is accurate and reflects current information. A key component of Virginia Tech's emergency communication system during campus emergencies, switchboard operators function as a critical channel of VT Alerts, the university's emergency information distribution and feedback system.

Facilities Management. This group is responsible for ensuring that the CNS-managed facilities are highly reliable, robust, and secure. They research, specify, and recommend systems for new and improved facilities management and monitoring systems. The group schedules and performs required maintenance and repairs, and serves as the primary contact for telecommunications facilities issues.

Warehouse. The Warehouse is the receiving point for most of the inventory ordered by NI&S. Warehouse personnel ensure items are received as ordered, in an undamaged state, and are properly recorded in ATLAS, the department's inventory management system. Warehouse personnel are responsible for inventory control and for issuing inventory for the department's work orders and projects. The group works with the Controller's Office to ensure any incoming university fixed assets are accurately recorded.

Projects

Strategic Initiatives

Mid-Atlantic Terascale Partnership (MATP). MATP is a multi-state consortium of major research universities, federal agencies, and others gathered around high performance cyberinfrastructure. With the University of Virginia, Virginia Tech co-founded MATP and serves as the managing member.

NatCap. Virginia Tech owns and operates the National Capital Region Aggregation Facility (NatCap) with two nodes in McLean and Ashburn, Virginia. NatCap provides a network exchange and access point for research and education, and provides high efficiency/high performance access to all national and international research networks (Internet2, NLR, federal networks, etc), as well as commodity Internet services. NatCap delivered a 45% increase in Internet capacity to Virginia research universities over the previous period, with no increase in cost.

National Telecommunications and Information Administration Broadband Technologies Opportunities Program Fiber Grant. NI&S, with support from the university eCorridors program, submitted a successful grant proposal to the federal Broadband Technologies Opportunities Program (BTOP) resulting in a \$5.54 million award to the Virginia Tech Foundation (VTF). Use of this funding will extend Virginia open access fiber, operated by the Mid-Atlantic Broadband Cooperative (MBC), from Bedford to Blacksburg. [Click for more...](#)

NetworkVirginia. NetworkVirginia program delivers broadband services to rural and underserved communities throughout the state and provides the world's most advanced research network infrastructure for regional universities and laboratories.

Internet2. Since 1998, Virginia Tech has provided high performance access to Internet2 for member universities and K-20 participants in Virginia, Maryland, and the District of Columbia. Individuals using the Virginia Tech network automatically connect to Internet2 resources.

The Quilt. The Quilt provides a dynamic forum where leaders from throughout the advanced research and education network community build on the intellectual capital and best practices of network service providers worldwide. As a founding member of the Quilt, Virginia Tech represents the commonwealth via the NetworkVirginia, Mid-Atlantic Terascale Partnership, and NatCap programs. The university realizes deep volume discounts from the national aggregation of Internet capacity using Quilt contracts for commodity Internet service. [Click for more...](#)

National LambdaRail (NLR). Virginia Tech is a founding member of NLR—a high speed research network—that enables cutting-edge exploration and discovery in the biomedical,

engineering, network research, physics and many other disciplines at over 280 leading research institutions and federal agencies. The university provides aggregated access to NLR for research institutions in Virginia, Maryland, and the District Columbia.

National Capital Region

The Virginia Tech Research Center (VTRC) opened a major new research center in the Ballston area of the National Capital Region in the spring of 2011. Network Infrastructure and Services provided extensive and critical engineering design and consulting support to the VTRC and other facilities the National Capital Region to develop specifications for unified telecommunication services, network configuration, and advanced cabling infrastructure.



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The highly visible, state-of-the-art facility will advance Virginia Tech's research activities in a region that offers opportunities for partnerships with corporate research entities, and close proximity to government agencies and other public- and private-sector organizations.

NI&S acquired a dark fiber ring linking the VTRC's new research center to National Capital Region Aggregation Facility nodes in McLean and Ashburn, and to the Northern Virginia Center in Falls Church. The fiber ring includes designed-in resilience, such that if there is a failure or fiber cut at one point in the ring, network traffic is automatically routed in the other direction around the ring. Network Infrastructure and Services has negotiated a contract for a high-performance optical network system to light the fiber. A four-node, 40-channel dense wave division multiplexer (DWDM) system will be installed on the ring to provide multiple 10-gigabit and one-gigabit channels between sites. This network will provide the VTRC and the Northern Virginia Center with world-class research network connectivity and control over system costs during the next decade.

Virginia Tech/Carilion collaboration

Research conducted at the Virginia Tech Carilion Research Institute (VTCRI) bridges basic scientific inquiry at Virginia Tech with clinical expertise at the Carilion Clinic, yielding increased translational research opportunities for both. This relationship leverages Virginia Tech's world-class strength in basic sciences, bioinformatics, and engineering with Carilion Research Institute's highly experienced medical staff and rich history in medical education.



Network Infrastructure and Services met regularly and worked with the VTCRI to provide the VTCRI with email accounts, wireless network service, and voice communication service between the Blacksburg and Roanoke campuses. In December 2010, NI&S activated high-speed transport services between the two campuses. As a result, VTCRI has the same high-speed access to all network-based resources and services that are available to the Blacksburg campus. Similarly, VTCRI has the capability to benefit from access to national and international research networks. NI&S coordinates help desk and technical support with VTCRI's information technology staff. [Click for more...](#)

Support for university research and innovation

HokieSpeed

Network Infrastructure and Services' researchers and system administrators assisted the College of Engineering with the specification, construction, and testing of HokieSpeed—the newest supercomputer at Virginia Tech. HokieSpeed is funded by a two million dollar major research infrastructure grant from the National Science Foundation. The system is housed in the Data Center.

Building on knowledge derived from Virginia Tech's research into the application of graphics processing units to high-performance, green computing, HokieSpeed is expected to deliver significantly improved peak performance, power efficiency, and space efficiency in comparison to Virginia Tech's first cluster supercomputer, System X. System X was the fastest academic supercomputer in the world when built in 2003.

HokieSpeed aims to empower faculty, students, and staff across disciplines to tackle problems previously viewed as intractable or that required extremely time-consuming efforts and significant domain expertise to solve. [Click for more...](#)

Advanced networking

“Towards a Session Layer for the TCP/IP Protocol Suite—A Joint Research Project Between Virginia Tech and Juniper Networks”

Internet protocols were initially developed in an environment of scarce, expensive, shared resources. These protocols provide for the reliable and ordered delivery of data from one computer or device to another. From the perspective of running software, Internet address changes used to be exceptional circumstances requiring the intervention of a user and, often, a system administrator. Now, people frequently use one device on multiple networks or utilize several devices simultaneously to support one workflow. An example of this situation would be using a smartphone that provides Internet access over a cellular data network and/or the campus wireless network. The old model of an address change being a rare event has resulted in a mismatch between the dynamic communications capabilities needed to support today's prevailing usage patterns and the static network addressing ingrained in current protocols.

Juniper Networks has provided grants to Virginia Tech to collaborate on research toward the development of new functionalities, such as a TCP/IP Protocol Suite session layer. Such a mechanism will enable network conversations to migrate without interruption from one network to another in much the same way that cellular systems allow us to roam from one cell tower to another. [Click for more...](#)

Athena data analytics cluster

The Advanced Research Computing group deployed a data analytics cluster named Athena, which provides general-purpose computing on graphics processing units (GPGPU) obtained from Appro Super Computer Solutions. GPGPU accommodates extremely high-performance and high-precision mathematics using computer graphics processors.



As the first GPGPU-based cluster made available for general research use at the university, the cluster also served as a prototype for work connected with a National Science Foundation grant to the Department of Computer Science. The grant is funding the *HokieSpeed* (GPGPU) cluster now under development.

Athena has 42 compute nodes with 168 AMD processors/1344 processor cores and eight nVidiaTesla S2050 GPU Computing Systems providing 32 GPUs. Additional hardware has been purchased and deployed to provide dedicated resources to support the computational needs of the Virginia Department of Environmental Quality.

The Edward Via Virginia College of Osteopathic Medicine

The Edward Via Virginia College of Osteopathic Medicine ([VCOM](#)) is a post-baccalaureate, professional, medical college in Blacksburg, Virginia. It is a nonprofit, private corporation. The vision for the College is to provide healthcare for Southwest Virginia and the Appalachian region and to promote biomedical research with Virginia Tech. VCOM is located in Virginia Tech's Corporate Research Center.

Since 2001, VCOM has operated with a collaborative agreement with Virginia Tech. Information Technology has worked closely with VCOM over the last 10 years to provide

services, such as course management services and network connectivity, necessary to support their ever-changing and expanding environment. During the past year, NI&S worked with VCOM to design and implement a temporary network connection between their new Spartanburg, S.C., campus and their facility in the Virginia Tech Corporate Research Center. A new permanent service to interconnect their campuses via national research networks is being designed by NI&S engineering staff. VCOM's new facility in Spartanburg welcomes its first students in the fall of 2011.

Campus cabling infrastructure

For more than twenty years, Communications Network Services has provided leading-edge telecommunications services in support of the instructional, research, and outreach missions of Virginia Tech. Maintaining and advancing the university's stature as an information technology leader requires continual improvement of the university's cabling infrastructure. A comprehensive, multi-year, cabling upgrade is underway to improve infrastructure capacity and reliability in support of current and future telecommunication needs. To meet the immediate requirements of a next-generation unified communications system, improvements are being applied to building equipment rooms as well as to end-user connections. CNS also upgrades outside cable infrastructure and provides additional high-capacity, fiber-optic cable paths between buildings. The university's wireless networks are continually expanded and secured to address ongoing significant increases in demand. Designs for new and extensively renovated buildings include infrastructure to accommodate mobile network access throughout.

Core router connections. Over 200 campus buildings receive some combination of voice, data, wireless Wi-Fi, and/or cable television services via inside cable plant connected to the buildings' main equipment rooms. These equipment rooms are connected by outside, backbone cables to one or more of six campus cable/switch centers which are connected to one another via backbone ring copper and fiber-optic cables. During the last quarter of 2010, we completed an extensive network infrastructure upgrade, enabling the core routers in the switch centers to connect via 10 gigabits per second connections—a five-fold increase in bandwidth. This project results in immediate performance gains and provides capacity for future demands.

Campus network backbone. The six campus cable/switch centers connected via a cable ring that is being enhanced with additional fiber strands. Concurrent with fiber-optic cable installation, physically diverse cable pathways are being added to the switch centers, ensuring that damage to any single pathway does not sever connectivity to other core campus switch centers. Each center has multiple paths to every other center, providing multiple, redundant, communication paths in the event of an unexpected cable cut. The multi-year, two million dollar, network infrastructure upgrade helps ensure the university has a very high-capacity network core with high survivability to support fire and other alarms, unified communications, the cellular distributed antenna system, and research computing requirements. [Click for more...](#)



Ethernet-to-the-desktop bandwidth. The multi-year network infrastructure upgrade includes new network-edge distribution electronics, which are being added or replaced to improve connection resiliency, provide increased bandwidth, and to deploy the power-over-Ethernet (PoE) capability for IP telephones. These improvements allow provisioning of one gigabit per second Ethernet connectivity to the desktop. Upgrades are readily applied to campus buildings that have inside cabling capable of supporting high-speed Ethernet. However, some campus buildings will require cable plant improvements to support the equipment upgrades. This year, a complete cable upgrade has been designed and scheduled for the Carol M. Newman Library, which will yield significant performance improvements to the facility's wireless network service.

Cable/switch center facility upgrades. Related upgrades for the cable/switch centers are approaching completion and include replacement of backup generators and heating/air conditioning/ventilation systems, as well as the installation of new, uninterruptible power supply units. The state-of-the-art equipment is carefully selected to ensure physical security, power, and environmental requirements are fully met for each center and future technologies may be easily integrated. In anticipation of the Cassell Coliseum's cable/switch center's elevation to a fully functional, auxiliary data center and to support the new unified communications system, special upgrades are underway in that location to significantly increase the security, power, and network infrastructure.

Cable TV coax converted to fiber. CNS Video Engineering personnel in conjunction with CNS Field Engineering staff have planned and partially completed an upgrade to the television program delivery infrastructure on campus. The upgrade provides the foundation for improved content-delivery and allows for the removal of the copper coax infrastructure from building entrance conduits, which frees up valuable space for other network upgrade projects. Cable/switch center fiber-optic cables were terminated and associated fiber-optic components installed in most residence hall buildings in 2010, resulting in significant improvements in television programming signal quality. CNS is currently preparing for the next stage of the fiber-optic television cabling upgrade which will involve approximately 25 academic and administrative buildings served by the Burruss Hall switch center.

The new cable television distribution infrastructure will be fully capable of supporting digital or high-definition broadcasts via the campus network after replacement of source components and some edge switches within buildings. The new television-delivery system will provide HD broadcasts of local, over-the-air channels.

VT Alerts

Development efforts continued on VT Alerts, the university's emergency notification system. In September of 2010, NI&S provided the Virginia Tech Police and University Relations with the ability to send alerts for Virginia Tech locations other than the Blacksburg campus. Subscribers using [VT Phone Alerts](#) may elect to receive alerts targeted to university facilities in six key regions across Virginia—National Capital Region, Abingdon, Danville, Hampton Roads, Richmond, and Roanoke—as well as the Blacksburg campus.



NI&S continues to coordinate with the Office of Emergency Management to define new features and to help ensure satisfactory performance of the VT Alerts system in support of campus safety and security.

Emergency Management videos

Video/Broadcast Services (VBS) is currently developing instructional videos in cooperation with Virginia Tech's Office of Emergency Management. This program is funded by a grant from the U.S. Department of Education with a goal of preparing the entire campus community—faculty, staff, and students—for emergency situations by keeping them informed, prepared, and vigilant.

The program includes eight segments of five to 15 minutes in length and covers a variety of emergency preparedness topics including outdoor safety, women's self defense, alcohol education, evacuation procedures, and several others. In addition, the program provides information about the Virginia Tech Police Department, the Virginia Tech Rescue Squad, the Schiffert Health Center, and other campus health and safety organizations. VBS is involved in all aspects of the complex video production including script-writing, extensive preparation, execution, and post-production work.

The final deliverables will be available during the fall semester 2011 on the website of Office of Emergency Management, in at least four languages—English, French, Spanish, and Mandarin Chinese. The videos will be made available to other colleges and universities nationwide and will be discussed at national presentations on emergency preparedness.

Mobile computing for the Virginia Tech Police Department

Network Infrastructure and Services coordinated with the executive director of Converged Technologies for Security, Safety and Resilience, and the Virginia Tech Police Department (VTPD) to provide in-vehicle and hand-held mobile devices, referred to as mobile data terminals (MDTs). They were placed in service by the VTPD in October 2010. MDTs make

information available to officers on the road by providing access to the university's police dispatch center's records management system, and automated dispatch of patrol officers via the included computer aided dispatching database. Access to information stored in the Virginia Criminal Information Network and National Criminal Information Center databases is also available.

MDTs increase patrol officers' efficiency by allowing them to promptly communicate critical information and decrease the amount of time needed to complete reports by using in-vehicle data terminals. This results in an enhanced level of security officers' presence on campus. Gains in efficiency include having more detailed information promptly available about incidents to which they respond, including the proximity and availability of other officers. Supervisors have a quick view of where each officer is located at any point in time. Officers have immediate access to the history and photograph of an individual, expediting identification of an individual, and the ability to query information about drivers and vehicles while on site, eliminating the need to wait for a communication officer to relay information. Offices can share information without broadcasting over two-way radios. Finally, MDTs offer the ability for officers to spend more time in public view as a result of being able to check reports and email and complete forms in their cars.



NI&S engineers will assist with refreshing the MDT technology on a cycle of every two or three years. [Click for more...](#)

Network intrusion detection system

The Information Technology Security Office consulted with Network Infrastructure and Services research engineers to develop and deploy a distributed intrusion detection system (IDS). The IDS uses small, inexpensive sensors placed in each of CNS' core campus switching centers to monitor patterns in network traffic, identify attacks, and gather metrics about attack types and sources. The system uses signatures to match known attack patterns in malicious traffic, which correspond to known vulnerabilities in software and systems. Should a machine within the Virginia Tech community become compromised, the IDS system sends an automated trouble ticket to 4Help consultants.

The distributed IDS system was developed in-house, eliminating the need for expensive hardware maintenance contracts. The IT Security Office deployed and manages the sensors, while NI&S provides high-speed network connectivity, power, and equipment rack space.

The IDS devices are also available to NI&S for use as network sensors, providing the Virginia Tech Operations Center engineers and diagnosticians with an additional tool to identify and resolve network problems. The sensors monitor traffic without adding a significant additional load to the network infrastructure.

In-building cellular coverage/distributed antenna system

In-building cellular coverage on the Blacksburg campus varies widely, with areas where there is usable signal, to other locations where there is no service. Inadequate cellular coverage results primarily from the concrete-rebar-Hokie Stone-based construction used for most campus buildings. Coverage is also affected by radio frequency power that is emitted from microcell base stations and the placement and interoperability of the cellular services infrastructure belonging to carriers in this region. To increase the coverage, a campus and building-based distributed antenna system that is compatible with most of the local cellular services will be developed and deployed.

NI&S has begun a project that is expected to result in the implementation of a campus-wide, vendor-neutral, distributed antenna system (DAS) during the next 24 months. As initial steps towards the implementation of this solution, NI&S and its DAS partner have completed a campus-wide radio frequency survey and conducted interviews with interested cellular carriers.

Housing and Residence Life—special service offerings

Network Infrastructure and Services collaborates with Housing and Residence Life (HRL) to define their special telecommunications needs and provide services to meet them.

Premium sports programming. Premium cable television sports programming that was made available during the fall and spring semesters provides telecasts of NCAA college football and basketball, and NFL football games, to residence hall lounges. The premium sports programming encourages on-campus residents and their guests to socialize in public residence hall spaces.

Summer conference services. We provided Internet access and telephone services to thousands of HRL summer conference guests. Guests not directly affiliated with Virginia Tech live on campus while participating in sports camps or other special events sponsored by the university. While staying in residence halls, guests have access to the university's network, the Internet, and in-room phones.

WebMail system upgrade

In January 2011, a new WebMail service was deployed at Virginia Tech. The Internet message access protocol, or IMAP-compliant, WebMail system provides an updated email portal for students and employees. Code customizations and use of an open source product enabled the modification of the service to meet the constituents' needs while ensuring compatibility with Virginia Tech's email infrastructure.

Users are able to compose HTML email and will benefit from improved support for international character sets, which allow reading and writing in different languages. The upgrade has enhanced WebMail's functionality and performance with the addition of a Web server. Users will benefit from greater security of the service along with the installation of

recent, more secure releases of the Apache and PHP web server software. Anti-phishing security enhancements have also been incorporated.

Local multipoint distribution service

In 1998, Virginia Tech acquired the FCC licenses permitting deployment of high-speed local multipoint data service (LMDS) in the region. LMDS is beneficial for wireless backbone links and for alternate backup routes. The licensed areas cover about 16,000 square miles across most of Southwest Virginia and a small area in Tennessee. Current equipment supports speeds up to 400 Mbps over distances of a few miles with higher speeds anticipated for the future.

An important objective for acquiring LMDS service is to promote rural broadband infrastructure development. In November 2010, LMDS links were installed in Danville, Martinsville, and Wise County by university partners. Gamewood, Inc., an Internet service provider for the region, installed a primary backbone link in Danville between their network hub site and a shopping center to provide high-speed Internet service. The City of Martinsville installed an alternate path backbone link over a distance of about four miles between a site in downtown Martinsville and a Henry County node. The University of Virginia College at Wise installed three links on their campus to provide alternate backup routes in case of fiber-optic cable cuts. [Click for more...](#)

Capital and renovation projects

The Field Engineering group of CNS develops and installs telecommunications distribution systems—designed and maintained to support current and future university needs—for both inside and outside cable plant. FE works closely with project architects and engineers, as well as with University Planning, Design, and Construction staff during project development to ensure communications cable pathways and spaces meet all industry and university standards.

Ambler-Johnston Hall. Renovations to Ambler-Johnston Hall's east wing include a full deployment of the wireless network. Nearly 600 Ethernet connections were installed in the building, which will again be occupied by students in the fall of 2011. Renovation work has transitioned to the west wing of the building, which is scheduled to reopen for student occupancy in fall 2012.



Visitor and Undergraduate Admissions Center.

The new Visitor and Undergraduate Admissions Center has over 250 telecommunications connections, including wireless network and one gigabit-capable Ethernet service that were installed this year before the building's opening.



Infectious Disease Research Facility (IDRF). The IDRF will provide new laboratory space for the university's growing translational animal research program focused on infectious disease and immunology. CNS began installation of the inside cabling, which will initially accommodate over 360 telecommunications connections.

Center for the Arts. Under construction and scheduled to open in fall 2013, the Center for the Arts will include a 1,260-seat performance theatre, visual arts galleries, and the Institute for Creativity, Arts, and Technology. The institute will be a laboratory for innovation, where faculty and students—in coordination with partners from Virginia's school systems—will research, develop, and apply modules for learning in a collaborative, trans-disciplinary setting. CNS has provided engineering specifications toward the design of a very high-speed network infrastructure, which will include cable plant to support voice over IP telephone service and 10 gigabit Ethernet service.



Academic and Student Affairs Building. This building will include classrooms, the Services for Students with Disabilities office, and Student Affairs programming activities. Outside plant work includes installation of a communications duct system to tie into the university's steam tunnel cable-path grid. When completed, the building will have over 400 telecommunications connections.

ICTAS II. Occupied in January 2011, the Institute for Critical Technology and Applied Science II (ICTAS II) building encompasses over 42,000 square feet and is home to interdisciplinary research in a range of fields, including applied environmental biochemistry, nanobiology, and sustainable water. Field Engineering, with assistance from the NI&S Research and Development group, set up a Cat 6A cable test bed. Fluke Networks agreed to participate by demonstrating testing methods and sharing the test results. The products selected from the test bed were installed in the ICTAS II building, including cable plant to support 10 gigabit Ethernet service. ICTAS II has over 730 telecommunications connections.

Perry Street Parking Facility. The university's first multi-level parking facility, the Perry Street Parking Deck, provides 1,300 parking spaces. Parking Services maintains a satellite office on the ground level. CNS developed specifications for a facility network that includes

over 60 telecommunications connections to serve the office and to support a video surveillance system.

Internet copyright infringement complaints

The Digital Millennium Copyright Act ([DMCA](#), 1998) addresses the protection of copyrighted content that may be stored, played, copied, or transmitted in a digital format. The DMCA represents, in part, a legislative response to the proliferation of file-sharing or "peer-to-peer" software, which is a widely popular method for obtaining and sharing music and movies.

DMCA guidelines allow owners (or agents of owners) of copyrighted music, movies, photos, audio books, and software to contact Internet Service Providers (ISPs) to request prompt termination of illegal sharing of copyrighted material via their network resources. Virginia Tech promptly addresses cases of Internet-based copyright infringement complaints (ICICs) alleged to originate from its network. This year the volume of notices received was the highest for any academic year since copyright complaints were first received.

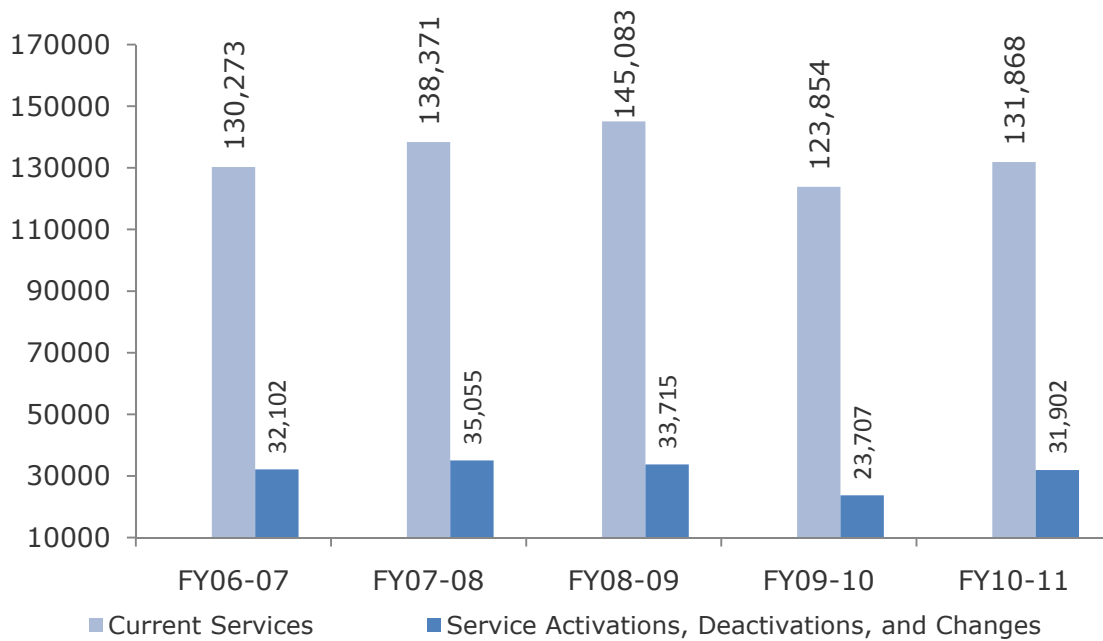
In addition to prompt response to complaint notices, NI&S Public Relations (PR) has conducted meetings with student groups to engage them in discussions on the topic of sharing copyrighted, digital creative works. PR continues to coordinate with the Office of Student Conduct to communicate with student groups prior to an infringement notice being received. Planning has also taken place during the past year to coordinate with EDUCAUSE affiliate "Future of Music Coalition" on development of a survey of file-sharing habits and perspectives of Virginia Tech students. Based on survey data, a public panel discussion, scheduled for the coming fall, will include both students and music industry representatives.

Metrics

Business Operations

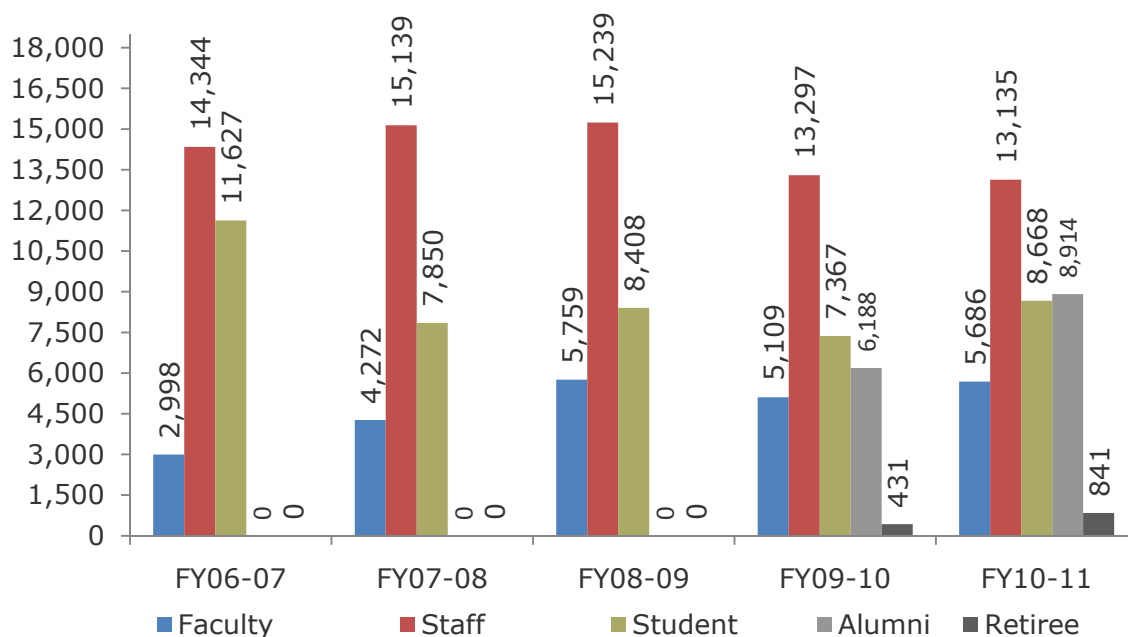
Services overview. The graph below depicts, by fiscal year, the number of current services billed to customers and the number of service activations, deactivations, and changes. The increase in the number of current active services is primarily due to wireless LAN/VPN service, requests from the Virginia Tech Transportation Institute for telemetry services, and cellular services, equipment, and accessories.

The number of NI&S service activations, deactivations, and changes increased by approximately 41% from last fiscal year. Such changes are typically a result of departmental moves to new or renovated office space and another department relocating to the vacated space.



Virginia Tech Operations Center

Tickets by caller affiliation. This graph depicts the distribution of the majority of the problem tickets received in the VTOC by caller affiliation. Alumni and retiree categories are listed only for the current and previous year. The number of tickets for alumni and retirees continue to increase, due to the Google Email for Alumni project and an increasing number of recent retirees.



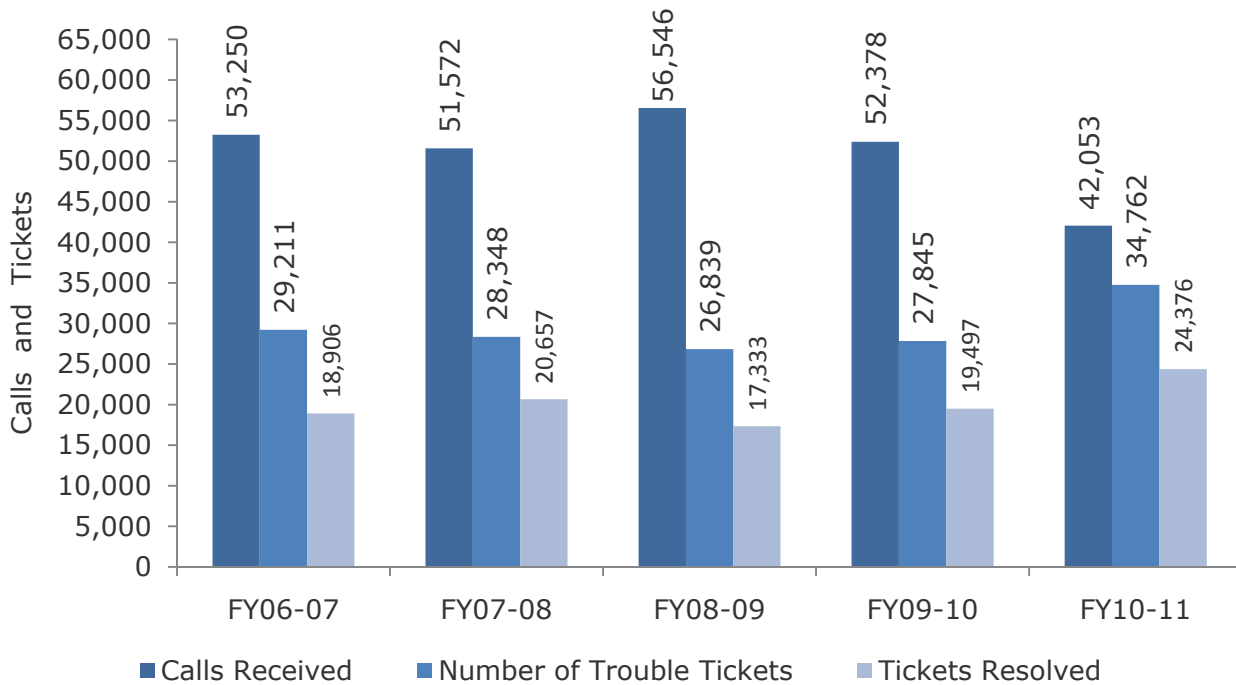
Total calls and trouble tickets. The graph below depicts calls received by the Virginia Tech Operations Center, the number of Remedy trouble tickets created, and the number of

trouble tickets resolved by the VTOC. The graph does not include support calls for Video/Broadcast Services.

VTOC technicians receive questions and trouble reports from constituents and provide information and technical assistance as required. VTOC creates and, if possible, resolves trouble tickets. If the problems cannot be resolved because of needs for additional data or technical expertise, the trouble tickets are escalated to the appropriate unit.

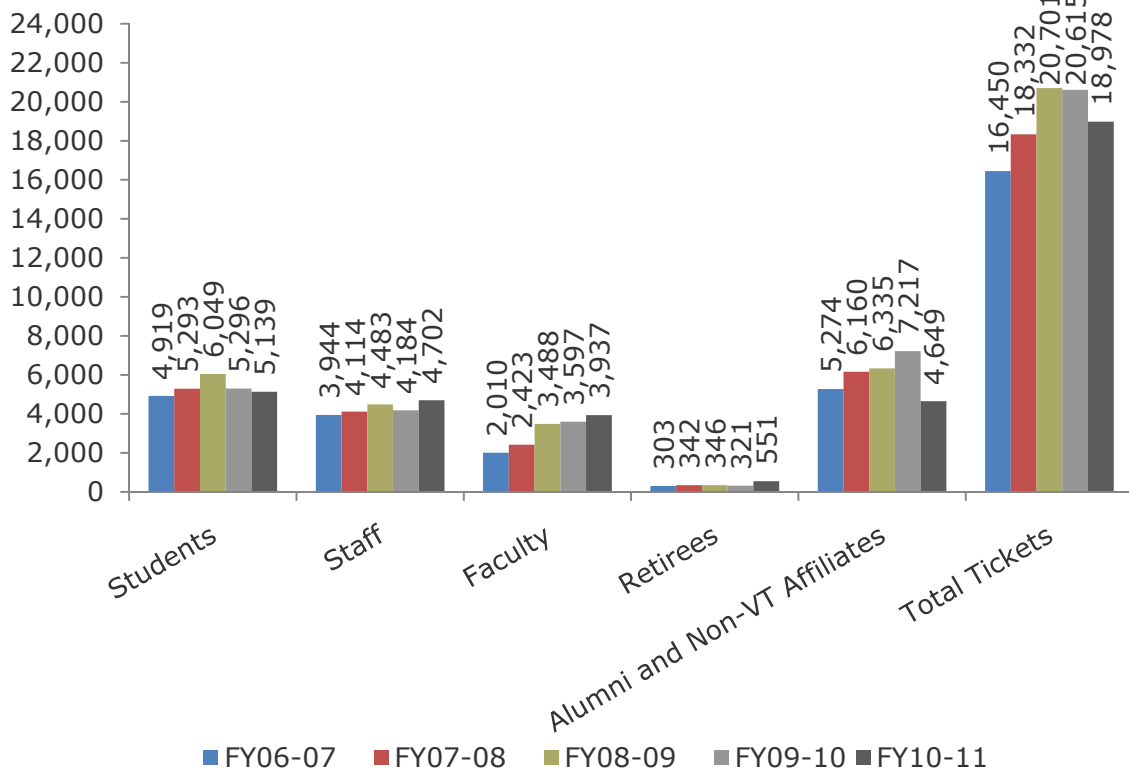
The number of calls received decreased by 20% and the number of trouble tickets increased by 25% over last year. The change in these statistics is attributed constituents' increased usage of the 4Help Web form to submit trouble tickets.

The 25% increase in number of tickets resolved is attributed to requests for password resets, and a continued emphasis on training which enabled the VTOC technicians to create and resolve trouble tickets without escalating them to other staff members.

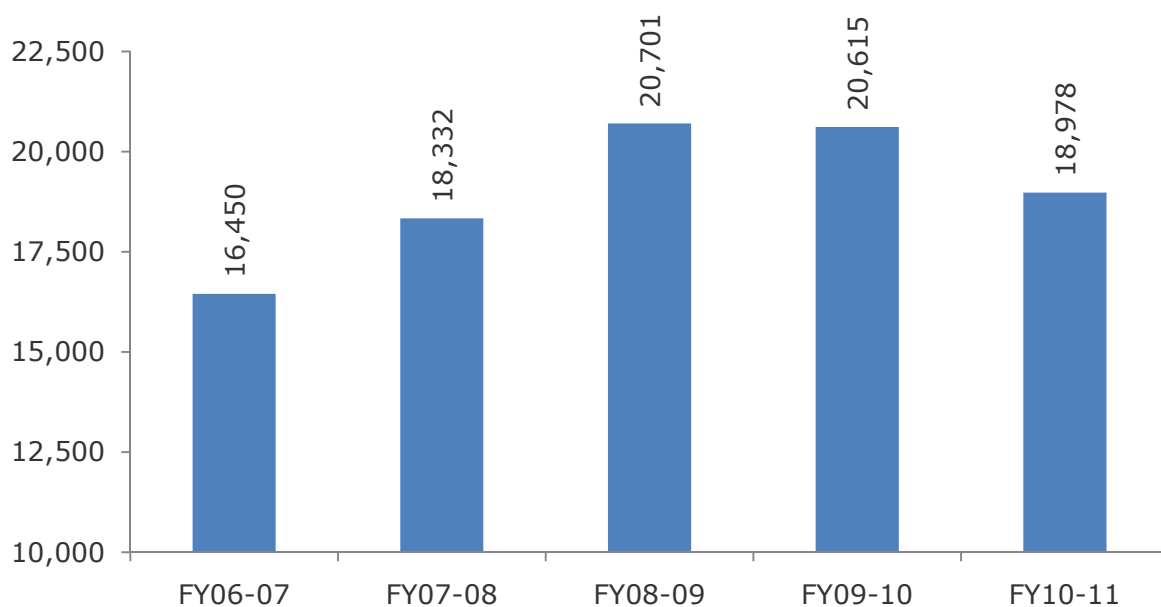


University Computing Support

Tickets by customer affiliation. The graph below depicts the distribution of trouble tickets based on callers' affiliations. Many callers have multiple Virginia Tech affiliations, so the current university relationship is recorded where possible. The distribution of tickets per constituent class this year was similar to last year, with the exception of a decrease in ticket counts from alumni and non-Virginia Tech affiliates. The decrease is due to Virginia Tech's completion of the implementation of the Google Email for Alumni Project.



4Help support tickets. This graph depicts the number of tickets opened by University Computing Support/4Help during the past five years. Two projects, Guest Access Management System and Google Email for Alumni, were introduced during FY09 and FY10, causing an increase in ticket counts. The 8% decrease this year is primarily attributed to concluding implementation of the Virginia Tech Google Email for Alumni project, and several improvements incorporated in the new Guest Access Management System (GAMS) now in use in the Offices of University Scholarships, Financial Aid, and Undergraduate Admissions.

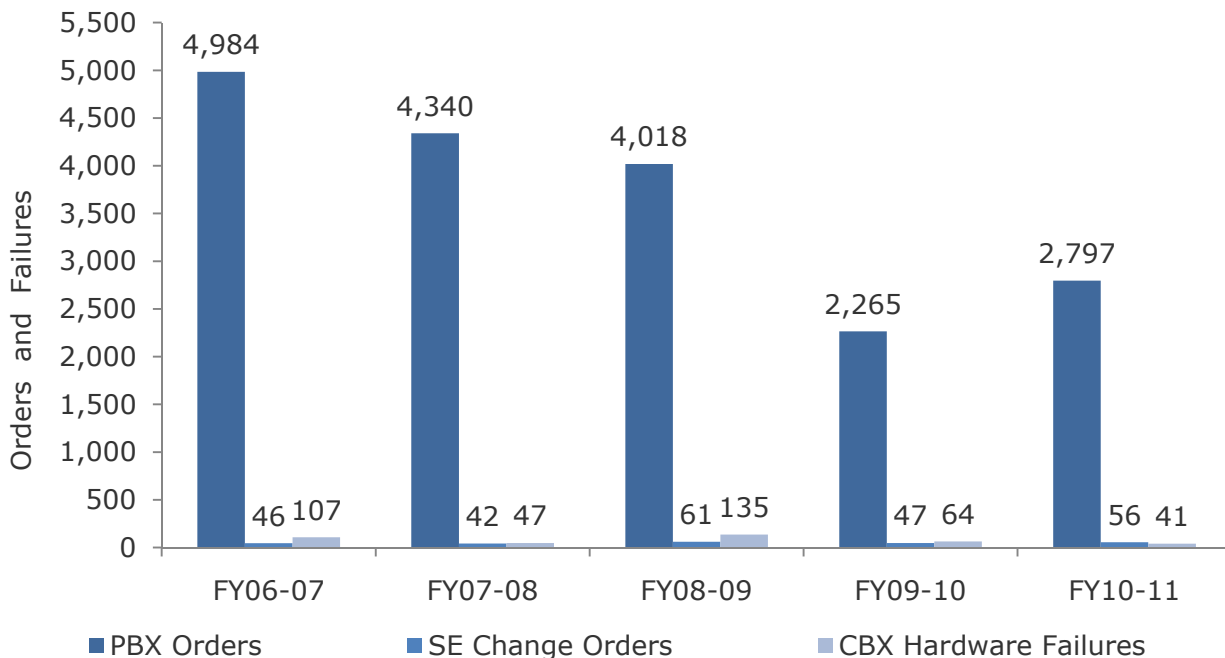


Switch Engineering

Orders and failures. The PBX order statistics depicted above represent the total number of move, add, and change orders for telephone or voice messaging services. This statistic tracks hardware, software, and cable plant activity that typically affect a single telephone user. The increase in PBX order activity this year is related to several projects including the Newman Library, East Ambler-Johnston Hall residential housing, and the new Virginia Tech Visitor's Center.

Switch Engineering (SE) change orders data represents changes to campus telephone or voice messaging systems' capacity or functionality. This statistic tracks hardware or software activity affecting large groups or *all* users of the telephone system.

The CBX hardware failures, which decreased by 36% compared to the prior period, represent the total number of electronic circuit packs replaced in response to service-impacting failures of the university's telephone system.



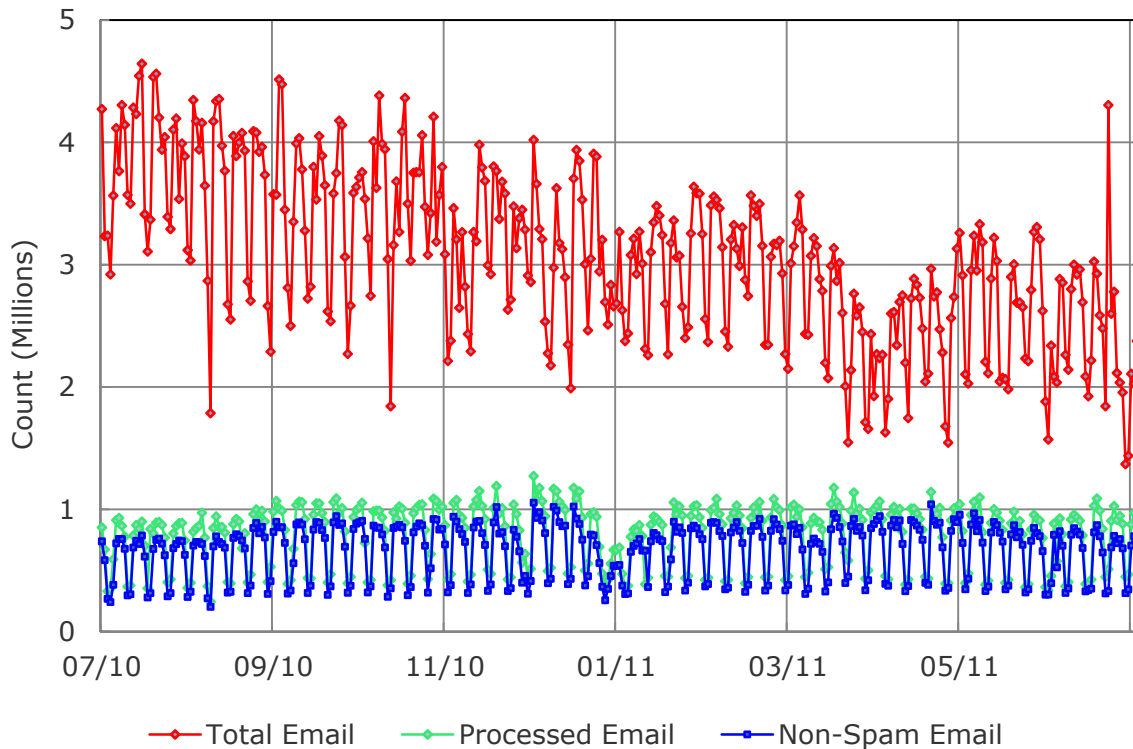
Network Engineering

Wireless LAN subscribers and coverage. Network Engineering continues to improve and expand wireless local area network (LAN) coverage. Wireless LAN service was made available this year in 23 additional buildings. As facility renovation projects continue to reshape campus, NE reconfigures the wireless networks to optimize coverage and capacity. Wireless utilization continues to grow as more faculty and staff members, students, and visitors to campus choose to use the wireless LAN for mobility and convenience.

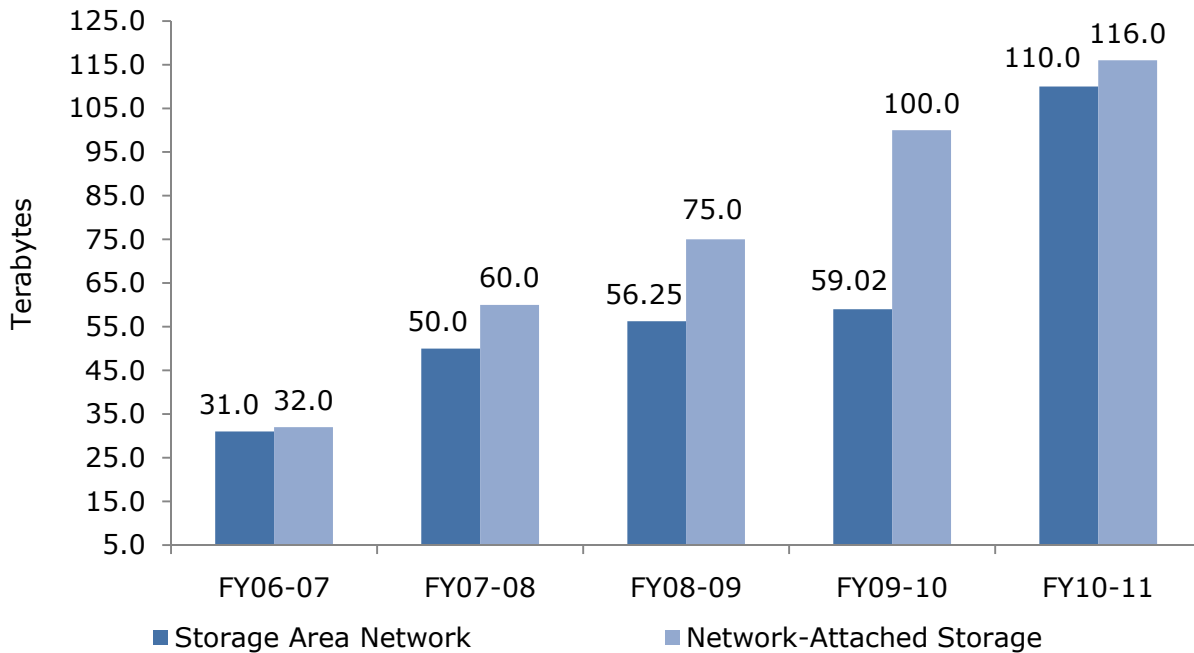
	FY07	FY08	FY09	FY10	FY11
Number of on-campus buildings with Wireless LAN Service	129	143	162	170	193
Total number of deployed wireless access points	1,248	1,359	1,769	1,898	1,978
Total number of Wireless LAN subscribers	26,358	29,885	32,089	35,995	36,012

Systems Support

Email flow. The graph below depicts the flow of email into the Virginia Tech domain from July 2010 to June 2011. The red line hovers between 1 and 5 million, representing all email messages received. The green line represents email messages actually processed through the system and not blocked or rejected due to viruses or suspected spam. The blue line represents email messages delivered and not tagged as potential spam.

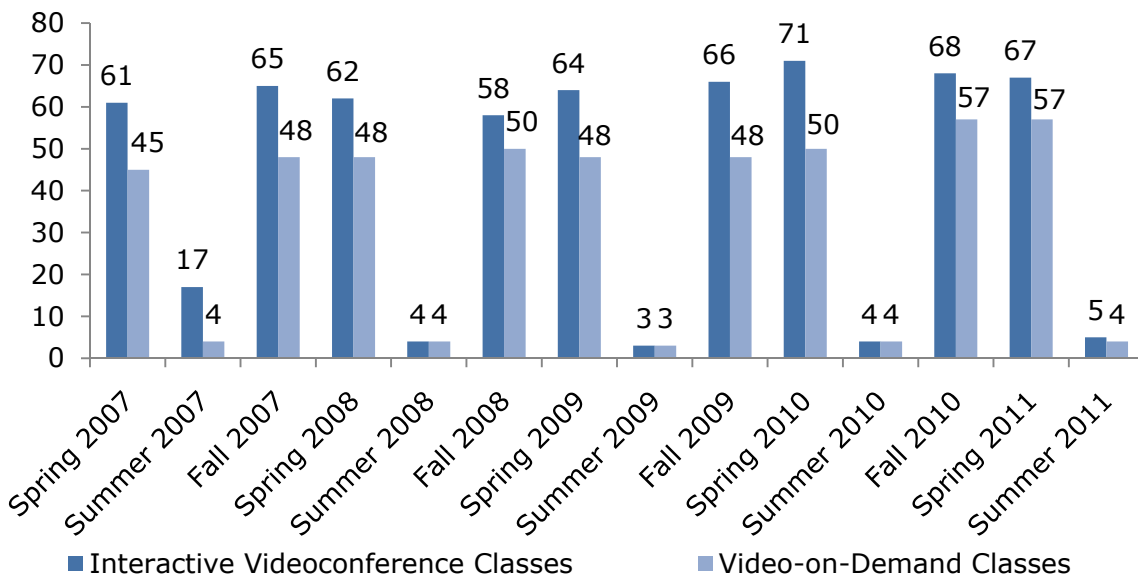


Network storage (terabyte). The increase in the capacity of the storage area network (SAN) and network-attached storage (NAS) this year supports Network Infrastructure and Services virtualization, Enterprise Systems database and application projects, CNS System Development and Administration projects, Learning Technologies, and departmental file sharing.

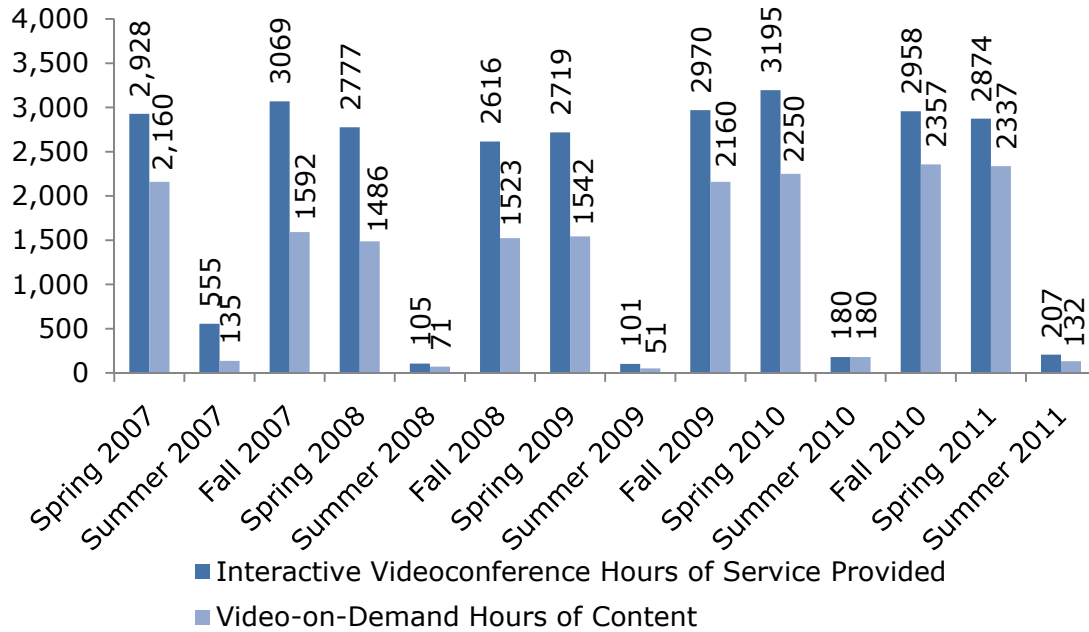


Video/Broadcast Services

Interactive videoconference and video-on-demand classes. The graph below depicts the total number of interactive videoconference classes and video-on-demand classes supported by Video/Broadcast Services. VBS maintains and operates Virginia Tech's 32 interactive videoconference (IVC) classrooms throughout the commonwealth. VBS coordinates the scheduling of on and off-campus IVC classrooms, provides video bridging services, and hosts class lectures as video-on-demand files.

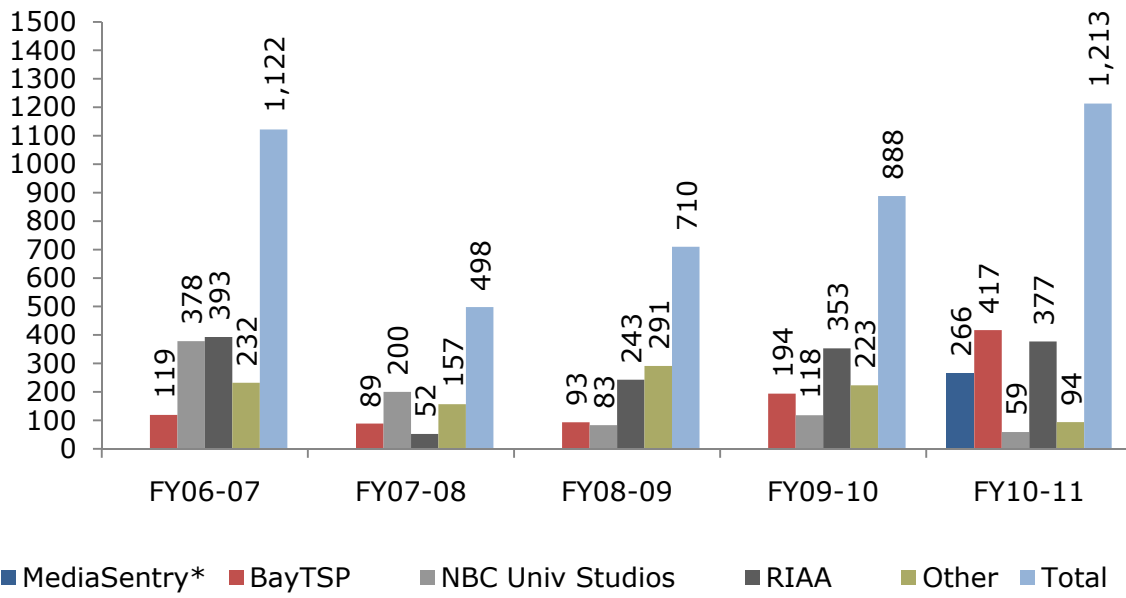


Interactive videoconference class and video-on-demand hours of content. The following graph depicts the total number of hours of videoconferencing service that VBS provided and the total hours of lecture material prepared and hosted as video-on-demand files. VBS' interactive videoconference classrooms have the capability to broadcast two separate channels of information simultaneously (dual video). VBS developed the process to capture and stream dual video content in a single video-on demand file. VBS continues to provide streaming and rich media support to the university using Real Media, QuickTime, and Flash streaming servers. VBS has increased its trans-coding processor capability in order to deliver all its streaming classes in the high-quality, high-definition H.264 video format.



Public Relations

Internet copyright infringement complaints. This year's volume was the highest for any academic year since copyright complaints were first received, reflecting a trend of significant growth since 2008. Over the period of 2006-2011, the principal originators of ICICs received by Virginia Tech have been BayTSP, the Entertainment Software Association, NBC Universal Studios, MediaSentry, and the Recording Industry Association of America—(RIAA). The RIAA temporarily suspended referrals to Virginia Tech in late April 2007 and resumed sending them in May 2008.



Secure Enterprise Technology Initiatives

The mission of Secure Enterprise Technology Initiatives (SETI) continues to focus on developing and supporting a secure infrastructure for computers, authentication, authorization, and digital identities. Fiscal year 2011 brought exciting and engaging activities for the SETI, described below. One change was better aligning unit names with missions and functions.

Former Name	New Name
e-Provisioning	Secure Information Exchange Services (SIES)
Middleware	Enterprise Middleware and Authentication Services (Middleware)
Microsoft Implementation Group	Microsoft: Secure Infrastructure Services (M:SIS)
Test and Deployment	Quality Assurance and Verification (QA&V)

Assessment

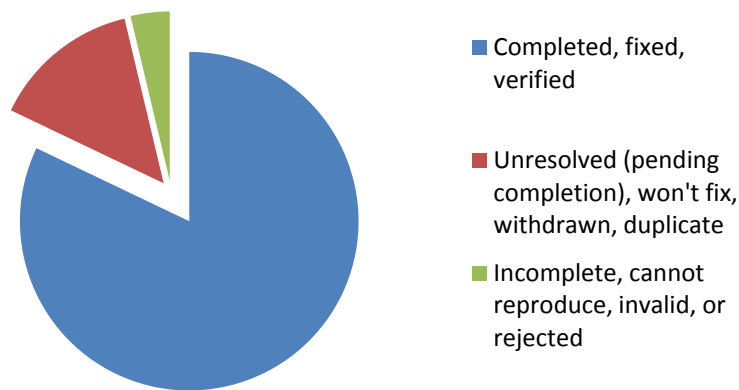
SETI established formal goals, objectives, and measurement criteria for the administrative quality assessment process. The goals are

1. to ensure that SETI's infrastructure services are stable, secure, and scalable—and increasingly “green,” with an objective of achieving stability and availability for production services;
2. to provide secure authentication solutions that enable application integration;
3. to ensure thorough testing prior to deployment.

Stability and availability of production services can be measured in uptime—the percentage of time a service is functioning properly and available to its users. This year, we developed tools for measuring uptime. Gathering data for the uptime measurement began June 1, 2011. Now that we have established tools to gather information, next year's data will cover the entire year. Target uptime was 99.9 percent, with the result that SETI production services surpassed the target uptime for the period measured.

Service	Percent uptime
Central Authentication System (CAS)	99.975
Shibboleth	99.975
Enterprise Directory LDAP	99.975
Directory Access Tool (DAT)	99.935
Public Key Infrastructure (EJBCA)	100.000
Hokies Active Directory and University Services Domains	100.000
Hokies Self-service	99.960
Virtual Dedicated Windows Server (VDWS) service	99.970

The target metric for testing was “less than 1 percent of Jira issues reported by or assigned to QA&V shall be resolved with codes of ‘Incomplete,’ ‘Cannot reproduce,’ ‘Invalid,’ or ‘Rejected.’” Since QA&V recorded testing issues in the Jira bug tracking system, data was available covering the entire period of July 1, 2010 through June 30, 2011. During this time, 3.6 percent of the 138 issues fell into the undesirable resolution category. A review of these issues should help the group improve processes for next year.



SETI activities

SETI was a key contributor to the Information Technology projects for self-service password reset—Account Recovery Options—and password change. Middleware developers contributed to both projects, building on the continuing support for the PID credential. M:SIS was critical to enabling the password change projects for Hokies accounts. QA&V conducted extensive testing for both projects.

Internal Audit reviewed SETI this year in a risk-based audit. The objective of the review was to contribute to the improvement of risk management and to evaluate the controls designed by management to mitigate those risks. The Virtual Dedicated Windows Service pilot developed by M:SIS garnered kudos for enabling effective and less costly server management. Overall, SETI received an excellent report from the audit.

Another major effort led by SETI is the issuance of server certificates that have broad trust. SIES provided development support and the certificates were ready to issue in March.

Enterprise Middleware and Authentication Services

Middleware support for the Account Recovery Options project and the password change project began with input in the planning and design phases, and continued through project execution. The Enterprise Directory, including Middleware-supported LDAP, forms the basis of the enterprise identity and account management system. Changes made to Middleware systems for these two projects included adding data to the LDAP, and to the DAT to benefit personnel who support account holders. Changes to the central authentication service enabled users to know when they needed to set their options and when their PID passwords had expired.

LDAP

Services are able to use the enterprise LDAP to make authorization decisions based on attributes associated with an authenticated user. Middleware added several attributes this year:

- *studentLevel* and *studentLevelCode* support allowing graduate students to enroll for eTokens;
- *accountRecoveryMaintenanceDate* supports account recovery options;
- *confidentialFlag* enables a directory-specific confidentiality setting.

To support the password change project, we exposed the existing attribute *passwordState*.

Changes support other needs and projects include a new affiliation denoting participants in the Language and Culture Institute—*vt-lci-affiliate*, and a modification to the access control list enabling emeritus faculty members to control their directory visibility.

Other activities related to LDAP included removing the little-used *finger.vt.edu* service, conducting research and testing for IPv6 support, and collecting and storing uptime data.

Directory Access Tool (DAT)

The Account Recovery Options project and the Password Change project required changes to the DAT to support management functions for account recovery and expose password attributes for the password change project. Additional email account attributes were exposed. An additional DAT change supports the expiration of individual membership in a group.

Central Authentication Service (CAS)

In addition to developing and deploying CAS 3.4.8 this year, Middleware made significant enhancements to CAS in support of other projects. We modified CAS to detect password expiration so that it could be the primary instrument for alerting users that their PID passwords are expired. Customizations for CAS login supported the Web flow for account

recovery options. Other changes dramatically improved user experience on mobile platforms, including iPhone, iPad, and Android devices. Finally, Middleware developed a high performance X.509 certificate revocation capability and contributed it to the open-source Jasig CAS project (www.jasig.org/cas/community). The ability to detect revoked certificates is a requirement for Virginia Tech's upcoming project to seek InCommon Silver certification.

Software development

Middleware software development included improved data validation on J2EE entities and user input, and updated password validation logic to support the password change project. Code was offered to the open source community to handle a variety of encrypted private key formats in vt-crypt library, to implement performance-minded password sequence checking for the vt-password library, and to support Shibboleth with many improvements to the vt-ldap library.

Other Middleware enhancements included support for unicode characters in the Banner replication stream (UTF-8), the addition of email account states, and improved logic of mail routing for local and out-sourced accounts.

Microsoft: Secure Infrastructure Services (M:SIS)

In support of the password change project, M:SIS researched the impact on account types, and sent proactive notices to users whose passwords would be expiring. M:SIS also received a clean bill of health from Internal Audit, and a commendation to the board of visitors for the VDWS offerings.

Hokies domain administration

M:SIS assisted the Office of Internal Audit with security and policy review of services and systems, making recommended changes to improve security of the Hokies domain. Developers began work to replace the current code base for provisioning, developed years ago by Identity Management Services (IMS), with M:SIS-developed applications to support timely de-provisioning of Hokies accounts.

To support the password change project, the group developed a system to email Hokies full users, Hokies account sponsors, and sponsored Hokies account holders and warn them of the need to change their password before automated yearly expiration. The email appears to have encouraged users to update their passwords, with fewer notices required at each notification, and with fewer than one-third of accounts experiencing password expiration and forced change.

	Number of people
1 st notice: 6/1	3656
2 nd notice: 6/15	2505
3 rd notice: 6/29	1598
Number of people's passwords expired	1111

M:SIS set up service accounts for the Business and Management Systems group to utilize the VT Active Directory “directory account change notification” for their SharePoint 2010 project for the Presidential Award site. M:SIS assisted with IMS de-provisioning of Hokies accounts and recovery of related storage space (MyStore).

Hokies Self-Service

M:SIS finished the first version of ADAdmin Web services, Web application and directory synchronization development, and began internal testing and code reviews. ADAdmin is a multi-year project to increase functionality and security of the active directory. Also, M:SIS began the upgrade to the existing Hokies Self-Service Web application to support new password requirements, including the extension of password length from 16 to 127.

Email/calendaring

M:SIS established a pilot project to support Microsoft Office 365 beta testing. The group set up Active Directory Federated Services to support single-sign on capability in beta. The Exchange team, M:SIS team, QA&V, and 4Help all received test accounts. We conducted research on available API function calls for developing new Web application extensions to existing infrastructure. M:SIS started synchronizing VT development active directory and Office 365 beta directory.

Virtualization

M:SIS has played a key role in planning a project to develop a virtualized secure desktop infrastructure to support PII/PCI compliance with Information Technology resources, working with Communications Network Services, the IT Security Office, and 4Help. Another potential project, “Virtualized Cloud Computing Environment,” is a proposal to the Virginia Tech Technology Services and Operations Corporation.

We finalized development for a VDWS+ cluster for Virtualized Dedicated Windows Servers to supplement current VDWS hosting infrastructure. This infrastructure used Windows 2008 R2 clustering technology, Dell networking and storage area network technology to bring high availability (99.99% uptime) to pay-for server rentals. VDWS/VDWS+ currently supports over 80 virtual guests. After working with the Office of the Controller, all payments for VDWS run through HokieMart.

VDWS virtual guest statistics

22 paying guests (non-IT)
59 non-paying\beta guests (internal to IT or in VDWS+
beta)
Utilizing 388 GB of RAM and 16 TB of storage
Emulating 90 CPUs and 55 network connections

Security

To meet the extended password complexity requirements for VT Active Directory and to support Windows 2008 R2 x64 architecture, the upgrade to the existing open-source DictionaryFilter project began. Testing began for Microsoft System Center Operations Manager to replace current homegrown reactive notification systems. M:SIS supported IT Security Office in deployment of Microsoft Active Directory Rights Management Services to support Digital Rights Management for Microsoft office documents. After testing the Global CA certificates for the SIES group, M:SIS rolled out utilization of Virginia Tech Certificate Authority wild-card certificates.

M:SIS continues to offer code to the open source community. (Statistics on downloads are from <http://opensource.w2k.vt.edu>.) The contribute applications continue to experience consistent levels of downloads from year to year. SelfService_v2.3 increased 14.3% this year over last, and VTwsus_v1.0 increased by nearly 20%.

Unique downloads

	FY10	FY11
Auth_ad_v1.4	193	202
Daisy_v2.2	3427	3460
DictionaryFilter_v2.1	780	815
Faith_v1.01	488	505
Ivy_v1b22	239	243
OUadmin_v1.0	155	162
Portinator_v1.0	191	193
SafetyNet_v1.0	673	679
SelfService_v2.3	560	640
VTwsus_v1.0	428	512
Win32_perms_v0.2	69	72

Secure Information Exchange Services (SIES)

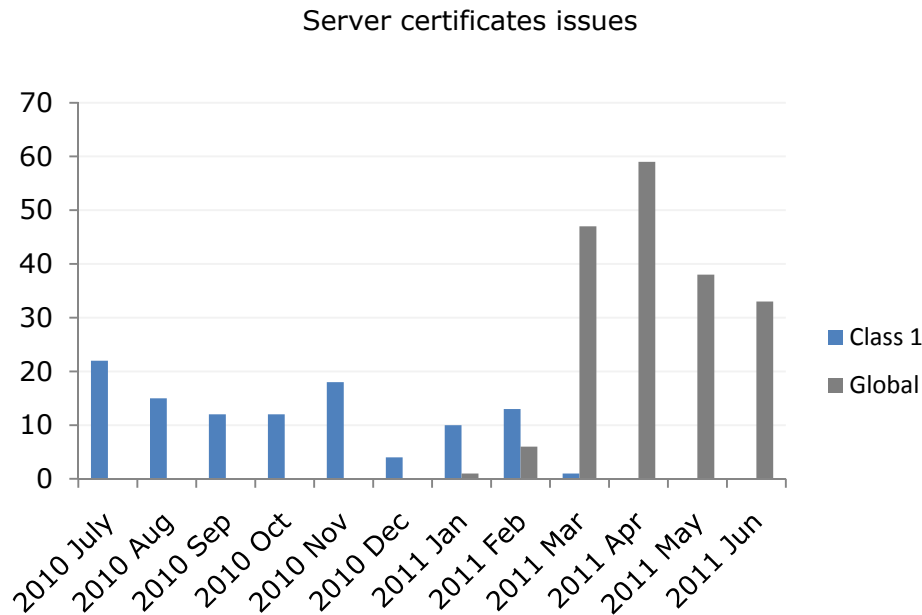
Significant accomplishments this year include the new globally trusted SSL certificates, ongoing work on the SoftPDC project, and continuing work to maintain and enhance existing functions.

Globally trusted SSL certificates

With the deployment of a globally trusted SSL digital certificate service, the Virginia Tech Certification Authority (VTCA) became a truly enterprise-level public key infrastructure (PKI) service.

Previously, the lack of global recognition or trust of the VTCA self-signed root certificate has prevented subscribers from using VTCA SSL certificates for securing their public facing Web applications. When a certificate is not trusted, the error message generated by a browser can lead to mistrust of the server or the source. To provide the missing trust, SIES implemented GlobalSign's root key signing solution. Certificates issued by the VTCA automatically inherit the trust associated with GlobalSign, making them transparently accepted by the majority of mainstream PKI-enabled applications. SIES deployed the globally trusted SSL certificate service in March 2011.

This achievement represents a significant milestone, since the ability to offer globally trusted SSL certificates is typically a service found only with the large commercial certificate vendors such as VeriSign or Thawte. On March 16, 2011, SIES rolled out a new VTCA digital certificate service to issue these Virginia Tech Global Server certificates at no cost to Virginia Tech users. For certificate subscribers, this relationship provides a major step forward in maintaining website security by providing functionally equivalent and trusted digital certificates without the expense of purchasing a commercial certificate. SIES recognizes the increasingly important role of the VTCA as a security solution, and works to ensure that the university can continue offering comprehensive, enterprise-wide, digital certificate services to the campus community. The graph below shows the higher numbers of certificates issued once the trust relationship was in place.



SoftPDC project

SIES continued work on the software requirement specification document for the SoftPDC project. Soft personal digital certificates (PDCs) are stored as files on a computer's hard drive or other storage media (flash drives, CDs) as opposed to PDCs that are generated onto a smart

device such as a smartcard or hardware token. The project is charged with developing and implementing a self service soft PDC Web application that will allow subscribers to manage the complete life cycle of their soft PDCs—key generation, private key escrow, certificate issuance, key revocation, renewal, and recovery options. Escrow is required because the planned soft PDCs will support encryption. The key escrow facility helps provide the assurance that the private keys needed to decrypt encrypted data will always be available to the individuals using soft PDCs. In June 2011, SIES completed development for a SoftPDC Web application prototype and has tentative plans for a production deployment of the SoftPDC service during the first quarter of 2012.

Token Administration System (TAS)

SIES completed the deployment of TAS v3.0 during August of 2010 followed by another deployment of TAS v3.1 in October 2010. TAS is an administrative application developed to support full lifecycle management of the personal digital certificates issued onto eToken USB smart devices. TAS v3.0 provided an updated application program interface using Web services to support integration with EJBCA as its backend certificate authority along with a simplified administrative interface. EJBCA is an open-source public key infrastructure certificate authority software package. The TAS v3.1 release provided an upgrade to allow the authorized issuance of PDCs to include graduate students.

EJBCA 4.0.1 upgrade

The ongoing software maintenance and support of EJBCA is critical for the successful operation of the Virginia Tech Certification Authority. EJBCA is the underlying certification authority application software used by the VTCA. To maintain EJBCA at current patch levels, SIES, in conjunction with Quality Assurance and Verification, is testing an EJBCA 4.0.1 upgrade. The deployment date will be in August 2011. In addition to providing several patches and upgrading to JBOSS 5.1 (J5EE application server platform), the EJBCA 4.0.1 release includes enhanced Web services that will provide functionality needed for the successful development and implementation of the SoftPDC service.

HSM high availability mode

With an increasing dependence on VTCA-branded digital certificates, it has become important to ensure high availability of VTCA certificate enrollment services. To address the service availability issue, SIES has configured dual hardware security modules (HSMs) that allow the VTCA to operate in a high availability mode. This solution reduces the probability of a VTCA service outage due to hardware failure.

SETI audit

In addition to working closely with Internal Audit to assist with the review of SETI, SIES served as the primary contact during the audit of the VTCA. As the infrastructure support group for the VTCA, SIES will continue to be heavily involved in its required annual audit.

Ongoing technical support

SIES provided ongoing technical support for its PKI Web services, Token Administration System, eToken RTE installers, and the VTCA PKI infrastructure including the VT Root, Class1 Server, Global Server, Middleware, and User CAs. SIES worked closely with the staff of Software Distribution in Information Technology Acquisitions to accommodate the requirements for issuance of PDCs onto eTokens and to provide training and support to their TAS administrators. In addition, SIES implemented a trouble ticket system based on BMC Remedy Action Request System (ARS). ARS allows trouble tickets received by 4Help to be forwarded to SIES staff members where the problems can be investigated, recorded, and resolved in a more efficient and timely manner.

Quality Assurance and Verification

SETI's QA&V is responsible for testing SETI services, including functions that integrate with systems supported by other Information Technology groups. QA&V provided testing support for the following main project areas this year:

- Password change
- Self-service password reset
- TAS 3.0
- eToken
- EJBCA
- the Global Sign VT root
- WSUS
- VDWS
- ED and CAS upgrades

Testing for areas outside SETI included:

- the eCorridors broadband speed test
- SAS and Mathematica network installations
- Identity Finder
- PIDGen
- VT Google mail
- browser testing and documentation review

Three testing issues that resulted in undesirable resolution codes occurred while testing using the Directory Access Tool, an essential tool with many different user roles. Generally, we test in the preproduction environment, but sometimes authorizations and refreshes to the underlying pre-production registry database are not in a predictable state. One instance resulted in reporting a Web service method failure to the wrong group outside SETI. This event was instructive, because a process needs to be developed for reporting and acting on issues across Jira projects and groups. The process will be created in the coming year. Another issue while testing TAS 3.0 could not be reproduced. The issue occurred while two

people were sharing a test machine that required each to log in with an eToken. Although the situation did not occur in the Student Network Services office, it was helpful to establish a dialog with them about their business processes.

Other work not tracked in Jira included meeting weekly with University Computing Support on a redesign of the computing.vt.edu website; participation in committees on scheduling and maintenance (SAMS), data quality, “cloud” email, and Enterprise Directory improvements. The QA&V staff members conducted a thorough review of the digital certificate acquisition process and made suggestions, provided password change statistics for the Call Center, and were enthusiastic participants in SETI’s internal audit. Finally, the group sent a dozen ancient test bed computers to surplus property (after performing low level formatting), and replaced them with more efficient netbooks and virtual machines.