

# Information Technology Annual Activities Report

2011-2012



*applying and integrating  
information resources to  
enhance and support  
teaching and learning,  
research and discovery,  
outreach and engagement*

*Office of the Vice President for  
Information Technology  
and Chief Information Officer*

***[www.it.vt.edu](http://www.it.vt.edu)***



 VirginiaTech





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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 leaders of these groups:

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

This annual report of activities begins with some highlighted activities, and includes reports from each major operational area.

## Highlights

The work of Information Technology includes large, multi-year projects, as well as shorter-term efforts that make a difference to the university community. The following is a mix of longer term and everyday efforts.

### Unified Communications program

Virginia Tech's communications have aged, and are not capable of providing the advanced technology services the university needs. The Unified Communications program, also known as "UC+3," is a group of four related projects that will provide high-quality communications services.

The project began in earnest this year, after many years of planning. In December, [Network Infrastructure and Services](#) announced the selection of IBM as the vendor of the new communications services. IBM's principal partner, Avaya, provides the unified communications software and equipment.

“With this contract in place, the Virginia Tech community can begin to look forward to a having well integrated, greatly improved communications services as part of our daily activities,” said William Dougherty, executive director of Network Infrastructure and Services. “We can look forward to a wide range of improvements, from caller ID and more robust conference and collaboration capabilities, to integrated voice, email, and fax messaging, and improved support for cell phones and other mobile devices.”

Significant preparatory work is underway in advance of installation of new, unified systems at each desktop. The four projects involved include construction of new telecommunications spaces to support the physical space, power, security, and cooling requirements; upgrading the copper and fiber-optic cabling to meet the current data-rate specifications required to support moderate or high-bandwidth applications; replacing outmoded equipment for the IP network at the core, aggregation, access and border layers of the network; and installing the software and equipment—including new desktop telephones—that will provide current-generation telephone, unified messaging, contact center, conferencing, mobility, and collaboration services.

This year, work in the preparatory phases increased in intensity, with new and upgraded physical spaces and cable upgrades accomplished in several locations. Intensive preparation was also in place for business model changes to begin the coming fiscal year, and for Discovery Centers to provide places for the university community to see and touch elements of the new system.

## Game Day GIS

Enterprise GIS piloted Game Day GIS, a GIS-driven Web application, in the fall of 2011. This geographic information enables the Office of Emergency Management and the Virginia Tech Police Department to maintain a higher level of situational awareness at home football games. They are able to track locations of reported incidents and police officers on an interactive map. The application was used at all six home football games and at spring commencement. Game Day GIS also creates a historical record of incident data that can be analyzed for remediation and forecasting.

## ePortfolio

Learning Technologies won the 2012 Teaching with Sakai Innovation Award for its use of [ePortfolios](#) in [First Year Experiences Pathways to Success](#) courses. Sakai is locally branded as “Scholar” at Virginia Tech.

The Pathways to Success program is designed to set first-year students on their own paths equipped with appropriate tools for exploration and discovery, and provide them with the curricular and co-curricular opportunities necessary to fully

engage as learners and ultimately as citizens. The Pathways to Success courses help students develop their problem solving, inquiry, and integration of learning skills. The Pathways to Success program currently serves around 2,000 students.

A community-source software application, Sakai draws on the expertise of educators and developers throughout the world. Virginia Tech has been a prominent contributor in the ePortfolio section.

## SAS site license

One of the many software programs used widely throughout the university is the statistical package, SAS. As with other software, unit costs are lower with higher volume purchases. This year, Information Technology Acquisitions successfully negotiated a site license for SAS software. The site license significantly lowers the cost to each individual user of the software, and also permits installation of SAS on more servers throughout the university, including the servers in Advanced Research Computing, an option that was cost prohibitive under the previous agreement.

## Financial summary

	<b>Total Expenditures</b>
Educational and General funds	\$33,068,536
Equipment Trust funds	4,364,826
Auxiliary operations	19,196,210
Sponsored grants and contracts	944,161
Continuing education funds	1,968
Overhead funds	31,091
Other sources	125,828
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Total	\$57,732,621





# Advanced Research Computing

Advanced Research Computing (ARC) advances the university's computational science and engineering research through advanced computing facility and user service. ARC is currently operating a wide spectrum of high performance computing and visualization resources that include multiple cluster systems, central storage systems, and visualization platforms.

## High performance computing infrastructure

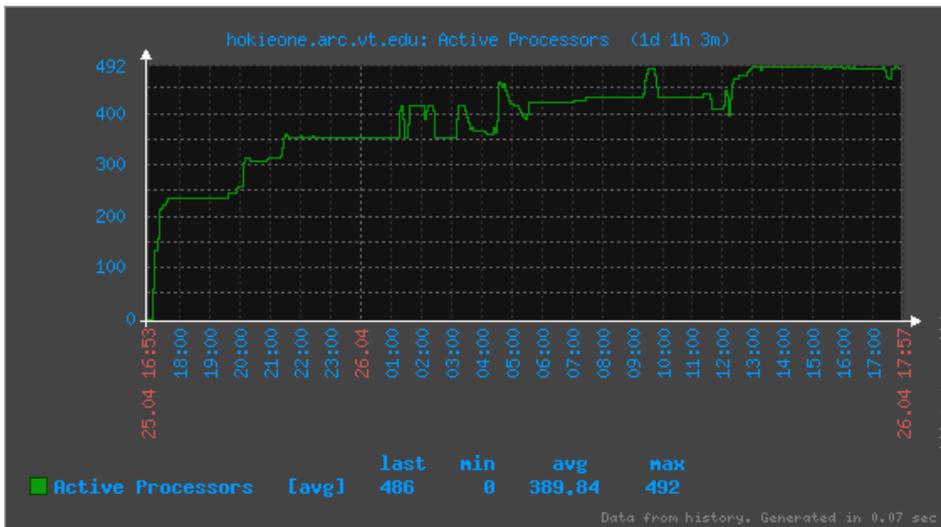
Below is the list of systems in operation and a brief description of each of the systems.

**HokieOne.** This shared-memory SGI UV system became available to Virginia Tech researchers in April 2012. HokieOne was a top priority in the system acquisition plan in year 2011 as the demand for shared-memory computing was high while old systems were not providing strong performance. The system has 504 2.66Ghz Intel Xeon Westmere cores (84 sockets on 42 blades) with 2.62TB of memory (5.3 GB/core), and utilizes Quad-Data-Rate (QDR) InfiniBand (IB) interconnection that has a throughput of 40Gb/sec per link.

**Athena.** Athena is a cluster system with GPUs and large memory. There are 42 quad-socket, AMD 2.3GHz Magny Cour octa-core nodes (1,344 cores) with 64 GB RAM each (12.4 TFLOP peak). Sixteen of the nodes also have access to 8 total nVidia S2050 Fermi (quad-core) GPU cards with 6GB of memory. These new GPUs support OpenGL and also single and double precision operations (96 TFLOP single precision peak). The nodes are connected via QDR IB interconnection and there are 40 TB of file storage attached to this device. This machine is intended for computation and visualization of large data sets. This is a unique machine with its large memory/node footprint, which is crucial for managing large time-series data and global/serial statistical operations. This system directly enables our computational scientists/engineers to tackle bigger problems.

**Ithaca.** An IBM iDataPlex system, Ithaca supports commercial software packages such as Matlab, Fluent, and other third-party software. Ithaca provides 672 cores (84 nodes) with a total peak performance of 6 TeraFLOPS. Each node has dual-socket quad-core 2.26 GHz Intel Nehalem processors. Ten nodes have 48 GB memory and the remaining nodes have 24 GB. Nodes are connected via QDR IB. Twelve of the nodes are dedicated to Matlab Distributed Computing Server, providing researchers with the ability to scale simulations up to 96 Parallel Matlab workers.

The figure below shows the spike of utilization rate of HokieOne right after regular maintenance period. Within 24hrs, the utilization rate reaches at almost 100%, a strong sign of a healthy computational science research community at Virginia Tech.



Usage metrics are also higher (table). Comparing the most recent quarterly usage statistics to usage in the same quarter in 2011 shows much higher—almost tripled—system usage this year.

General compute queue usage (CPU Hours)

System	May 2012 (CPU Hours)	May 2011 (CPU Hours)
Athena	740,928	217,816
Ithaca	584,093	216,083

Upcoming computing resources

ARC will be introducing two new large-scale computing systems in the coming months.

**HokieSpeed.** This new GPGPU cluster at Virginia Tech was acquired through funding from the National Science Foundation (NSF) Major Research Instrumentation (MRI)

program. It was ranked #96 and #11 on the Top500 and Green500 lists, respectively, in November 2011. The system contains 209 nodes, each equipped with dual six-core Intel 2.4GHz Westmere sockets and two nVidia M2050 448 core GPU cards, which gives 2,508 computing cores and 185,000 graphic cores. This heterogeneous cluster system will become open to grant PIs and Co-PIs in summer 2012. Prospective user groups across the nation are gearing up for the machine, and many large-scale computational simulations will be running on the system to solve grand-challenge scientific problems. In addition to the compute nodes, HokieSpeed has two dedicated visualization-nodes for high performance visualization. These nodes have four GPUs each, and are directly connected to eight 46-in, 3-D HD LED TVs-providing 14x4 ft<sup>2</sup> tiled display—for creating direct access of data from compute nodes to visualization resources.

**BlueRidge.** A new Linux cluster expected to be online in October 2012, BlueRidge will provide Virginia Tech researchers with their largest computing resource to date. The system has 318 nodes, each equipped with 16 cores (dual Intel Sandy Bridge chipset) and 64 GB of memory, for 5,088 cores and 20.3 TB of memory in all. It will also have five compute nodes with 128GB of memory and a RAID6 storage node with 48TB of disk space. Nodes are connected via QDR IB. Theoretical peak performance of the new system is approximately 100TFlops.

In addition, BlueRidge is configured for future expansion through the addition of Intel's many integrated core (MIC) accelerators. MIC architecture is considered a significant development in high-performance computing, with accelerated computing reminiscent of GPUs, but offering better compatibility with CPUs by preserving x86 programmability. In 2012-2013, ARC plans to increase the total number of nodes and install two MIC accelerators (Knight Corner) on each node.

## Storage

The old SGI storage system, Mobybits (80TB NFS system), has been retired after six years of service. ARC's new centralized data storage system offers two types of storage: general file systems and archiving. SGI's InfiniteStorage 16000 system provides 560TB of disk space (280TB of NFS and 280TB of GPFS) for users' daily usage. For archiving, a tape drive system with a total of 3PB of capacity became available by recent purchase of SGI InfiniteStorage Data Migration Facility (DMF). The DMF facility will archive ARC's central file system automatically without interfering with users' daily operation. On disk space, IBM's GPFS parallel file system offers high performance I/O over NFS.

Our last-generation supercomputers including System-X and SGI machines (Inferno, Cauldron) have been retired in May 2012 when the storage system migration was completed. All user data is now on the new storage system, and every ARC machine is connected to the new storage.

## Visual Computing

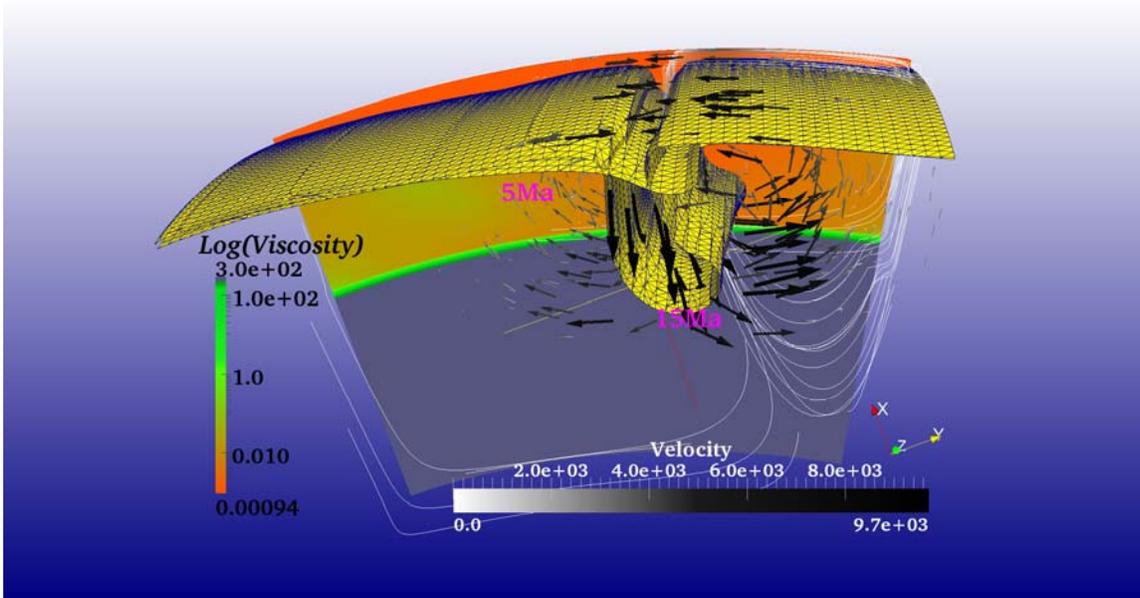
The **VT Visionarium** lab provides a full spectrum of immersive display venues for use by faculty and students across campus. The immersive virtual reality facility is driven almost entirely by open-source and open-standards software. The VisCube itself consists of three back-projected 10' x 10' walls and one floor where 1920x1920 passive stereo images (Infitec) are rendered. Each node in the rendering cluster is a dual quad-core Xeon processor with 16 GB RAM and two Quadro 5800 (4 GB each). Head and interface tracking is accomplished with a high-accuracy, low-latency ultrasound Intersense IS-900 tracking system (wireless). In addition, a MOOG motion platform is embedded into the floor of the VisCube and provides a 6-degree-of-freedom hydraulic floor frame that can be synchronized with the VisCube graphics system.



Structural analysis of a simulated building; Image: Patrick Shinpaugh, Felipe Bacim, Nicholas Polys

Numerous development and 3D graphics workstations are available in the lab including a 65 active stereo wall (Fakespace ROVR) with ultrasonic tracking, 65 monitors and a roll-able 52" multi-touch display. Across the spectrum of immersive platforms, the VT Visionarium provides 85,710,160 pixels, 3,684 million triangles-per-second and 21,760 GB/s of GPU memory bandwidth.

In the last year, remote, clustered rendering from the Athena and VisCube Clusters has been demonstrated and tested as both batch queued and online interactive sessions. After pilot testing, a web portal and Java WebStart client to access and schedule cluster visualizations is ready for friendly user deployment. In addition, we have implemented multi-user technologies to synchronously share X3D virtual environments and avatars in shared worlds such as a 3D Virginia Tech campus and the Center for the Arts building with live media streams such as webcam feeds. We are working to transition these technologies into a production environment to support collaborative 4D spaces for VT research and arts.



3D Navier-Stokes simulation of geologic subduction; Image: Tannistha Maiti, Nicholas Polys, Scott King.

## Research

ARC is innovating on several fronts where high-performance computation and visual analysis are critical requirements:

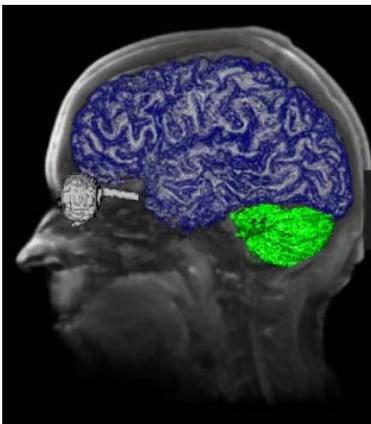
Information technology is continually enabling new tools and processes in engineering design: e-Design. We are co-principal investigators with faculty in the Department of Engineering Education on a National Science Foundation (NSF) Grant: "Industry-University Cooperative Research Center: e-Design Phase II Renewal" and "Center for e-Design: IT Enabled Design and Realization of Products and Systems". In the last year, this project has successfully added new academic sites, released a new website and member services, and held two Industry Advisory Board meetings. See: [www.center4edesign.org](http://www.center4edesign.org).

This NSF I/UCRC provides an excellent vehicle for the basic and applied research.

Our proposal (with the University of Massachusetts, Amherst) "Visual Interfaces for Engineering Innovation" was funded and executed as we developed an interactive 3D visualizer for ontologies and semantic networks. HPC simulations and their integration into product lifecycle management software is an emerging interest for the industrial membership. In addition, through the Center for e-Design, we are running a human factors study with CISCO on how to improve its telepresence platforms to support conceptual design in distributed teams.

Networks are a fundamental type of data in many disciplines and theories. We have pursued our research into the computational aspects of network analysis and real-time visualization. A sample of this research extended to mining biological networks databases can be found in Hossain, S. M., Akbar, M., and Polys, N. "Narratives in the Network: Interactive Methods for Mining Cell Signaling Networks" *Journal of Computational Biology* (2012).

Geospatial information systems and visual computing systems are converging as web-enabled services bring together more sensors and data for geo-referenced information fusion. In the last year, ARC has worked closely with faculty and CGIT to be lead contributors to the Open Geospatial Consortium's 3D Portrayal Interoperability Experiment (3D PIE), bringing novel Level-Of-Detail techniques to the *3D Blacksburg.org* prototype. As HTML-5 and native 3D rendering are now a reality on the web, we are pushing our research and educational content into new dimensions. Examples of this effort can be seen in Polys, N. "Publishing the Greatest Common Denominator" *Proceedings of the 1st International Workshop on Declarative 3D for the Web Architecture* (at WWW 2012).



MRI data set segmented and interactively presented with ISO X3D 3.3; Image: Andy Wood, Nicholas Polys

Volume data is generated and used in several domains: geophysics, medical imaging, and non-invasive sensing of objects as varied as bridges, fossils, and luggage. ARC faculty members have co-authored the new ISO international standard for reproducible volume rendering: Extensible 3D (X3D) Version 3.3. Also this year, Virginia Tech researchers used the VisCube to examine how immersive technologies such as screen surround, stereo and tracking effect user's performance on volume analysis tasks. This ARC-enabled research became a paper in the IEEE VR conference and was published as Laha, B. S., K., Schiffbauer, J.D., Bowman, D.A. "Effects of Immersion on Visual Analysis of Volume Data." *Visualization and Computer Graphics, IEEE Transactions on* 18(4): 597-606. (2012).

ARC computational scientists are leveraging HokieSpeed to test multi-scale

description of porous media and computational fluid dynamics algorithms, particularly lattice Boltzmann methods, targeted for hybrid supercomputing architectures. Three manuscripts are currently being prepared based on results obtained using this system.

In addition, ARC users have been maintained collaborative roles in a variety of research projects. These have included the following:

- Investigating the capacity to accelerate geophysical simulations using HokieSpeed's GPUs (with Geosciences)
- Parallelizing image processing tools used to analyze experimental fluid flows based on particle image velocimetry (the Advanced Experimental Thermofluid Research Laboratory—AETHER—Lab, Mechanical Engineering)
- Investigating the sensitivity and transferability of travel demand model disaggregate curves (Transportation Research Board)
- Automating visualization of temperature and thermal flow data for the Department of Energy, Energy Efficient Buildings Hub (with Mathematics)
- Organizing, analyzing, and automating the logging of watershed data; Teaching Research Experience for Undergraduates students (Stream Restoration, Education, and Management—StREAM—Lab, Biological Systems Engineering)
- Automating and streamlining the collection of Botswana public health data from text and hand-written formats (with Fisheries and Wildlife Science)

## User service, education and training

The HPC Investment Committee has recommended 10 HPC support positions to serve researchers at the university. In FY 2012, we successfully hired four of those ten. In October 2011, ARC hired a new deputy director of HPC, Byoung-Do ('BD') Kim, with experience from the Texas Advanced Computing Center (TACC) and National Center for Supercomputing Applications (NCSA). ARC also hired three computational scientists, Dr. James McClure, Dr. Gabriel Mateescu, and Justin Krometis, forming a stable of expertise to aid users in scaling and optimizing their code. We now have multi-tiered layers of user service by ARC: frontline help-desk staff for user ticket handling, and advanced user support and research collaborations with the computational scientists team. As a result, the number of unresolved help requests was cut by 50 percent in the first half of 2012 as compared with the same period in 2011. This reduction was achieved despite the deployment of HokieOne, the retirement of System X and the SGI Altix systems, and the transition to a new storage system during the first half of 2012.

In an effort to continue improving ARC's user service, ARC has launched a new website to better facilitate the use of research and visual computing clusters by faculty and students. The website features more complete and easier-to-access system documentation and interactive forms.

This year we continued successful offerings of user trainings and seminars, including 20 hours of short courses through the Faculty Development Institute (FDI) in spring 2012 on topics such as High-Performance Computing and Visualization, Parallel Programming, and Deep Media. We also organized a remote connection for VT users to attend HPC Bootcamp at the University of Virginia. ARC has also offered a series of guest lectures in a variety of courses, including the College of Science's Integrated Science Curriculum, to increase awareness of parallel computation among undergraduate students. With our new computational specialist expertise in-house, ARC has developed a new two-day HPC workshop for novice users teaching the basics of programming and running on HPC cluster systems. Going forward, this intensive workshop will be offered in addition to a practical programming series of short courses through FDI.

## Outreach

The booth of Virginia Tech and the University of Virginia at Supercomputing 2011 in Seattle was a great success showcasing Virginia Tech's computational science innovations. Numerous posters and papers were presented; in addition to the running 'Research Reel' that played in the booth, visitors could walk up and interact with real 3D research results through a gesture interface (e.g. Kinect). Other conferences where ARC had a strong presence (as organizers or presenters) include SIGGRAPH, Web3D, and SPIE Medical Imaging. These activities continue to demonstrate the university's international leadership in high performance computing and visualization research and their applications.

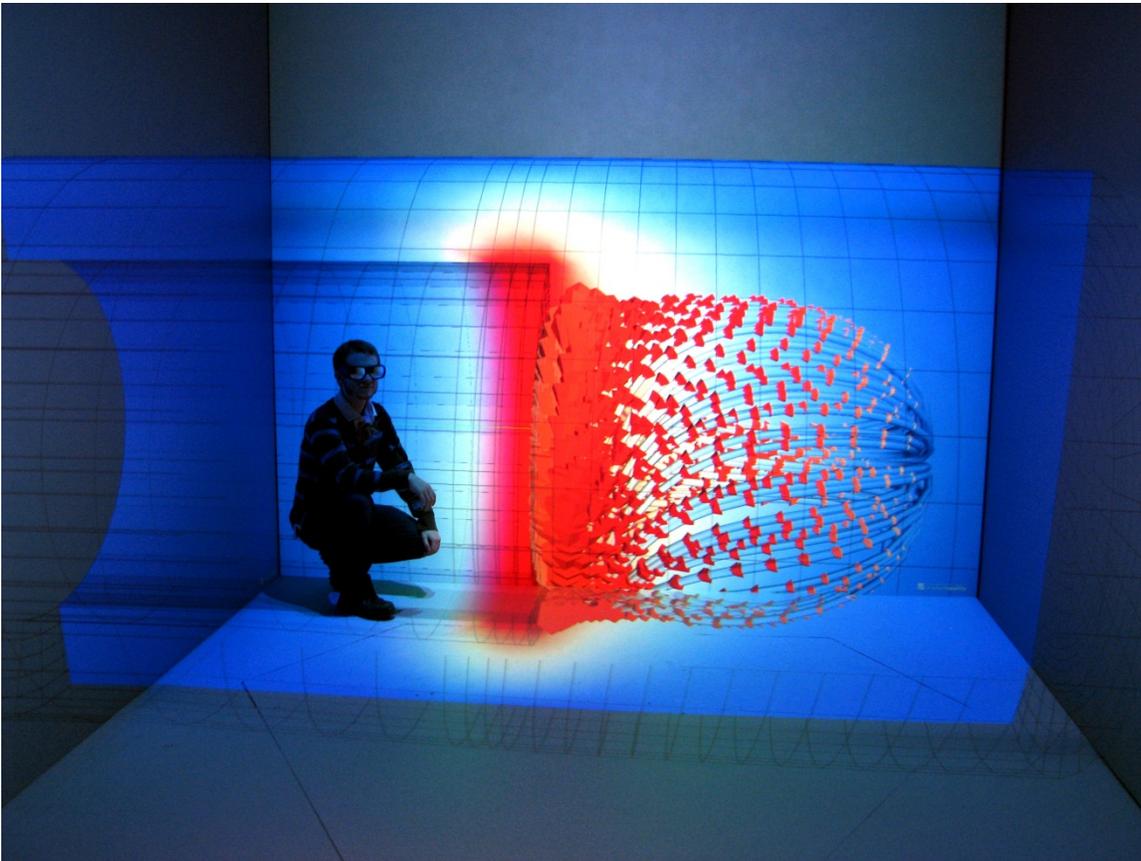
ARC faculty are also leading members of several organizations with broad impacts across industry and academia such as the HPC User Forum, the Coalition for Academic SuperComputing (CASC). Associate Vice President for Research Computing Terry L. Herdman is a member of the Sotera Defense Solutions team that was awarded the Chief Information Officer—Solutions and Partners 3 (CIO-SP3) indefinite delivery, indefinite quantity (IDIQ) contract issued by the National Institutes of Health (NIH). Dr. Nicholas Polys was also elected President of the Board of Directors for the Web3D Consortium ([www.web3d.org](http://www.web3d.org)) where Virginia Tech leads in international standards development with active projects and liaisons with: ISO, W3C, DICOM, OGC, Khronos, and IMS Global Learning Consortium.

## Goals for 2012-2013

- Develop an advanced HPC infrastructure
  - Deploy 2nd-phase expansion of the new Linux Cluster—BlueRidge
  - Implement a unified user environment and allocation management system for HPC resources, and offer HPC remote visualization service
- Standardize the user interface across all ARC resources to facilitate user

transitions to new systems

- Lower the barrier to entry for new users
- Minimize maintenance overhead by limiting customization required for deployment of new policies or solutions across systems.
- Continue to build Virginia Tech's HPC support team by hiring, training, and organizing new staff
- Continue to improve user service
- Develop multiple educational programs for faculty and students
  - Offer a two-day high-performance computing and visualization workshop, a series FDI classes, and a new program at NCR
  - Continue to work with graduate school and interested academic units to provide meaningful graduate-level programs
- Pursue new research areas to build data management solutions for large-scale distributed data, providing efficient access to, and sharing of, the broad range of data kinds (e.g. unstructured, semi-structured, and structured)



Immersive view of simulation results (a heated spinning disc); Image: Patrick Shinpaugh, Nicholas Polys





# Converged Technologies for Security, Safety, and Resilience

Converged Technologies for Security, Safety, and Resilience (CTSSR) was created by the Office of the Vice President for Information Technology in 2010, with a mission to develop and coordinate advancements on strategic initiatives that involve the intersection of information technology security, physical security, campus safety, and community/regional resilience. These activities often involve other university departments such as the Office of Emergency Management and the Virginia Tech Police Department, which are under the leadership of the VP for Administrative Services. For this reason, the Executive Director of CTSSR has a dotted-line reporting relationship to the Vice President for Administrative Services, and a solid line to the university Vice President for Information Technology and Chief Information Officer.

CTSSR serves as an advocate within Information Technology for technology infrastructure and resources that could be beneficial for campus police and emergency managers, and also provides outreach to communities in addressing information technology applications and processes for technology infrastructure development, public health and safety, and emergency planning. In addition, groups within CTSSR pursue and participate in research, development, education, and training related to our areas of expertise, which include converged technology tools and techniques, geospatial information systems (GIS), data analysis, applications development, and identity management.

CTSSR serves the university community by administering the university's continuity of operations and information technology risk assessment processes. In addition, the group advises the vice president and other administrators on federal and state policy issues affecting higher education in the areas of communications infrastructure, broadband Internet, networking, converged security, and geospatial data tools and processes.

CTSSR includes the following units:

- eCorridors (a technology outreach initiative)
- Virginia Tech Geospatial Information Sciences (VTGIS)
  - Center for Geospatial Information Technology (CGIT)
  - Enterprise Geographic Information Systems (Enterprise GIS)
- Identity Management Services (IMS)
- Blacksburg Electronic Village (BEV)

During the past year, CTSSR has completed several new initiatives that are central to the group's continued development. A strategic planning group consisting of key personnel within several CTSSR units was established to develop a long-range vision and associated goals. This Strategic Management Team meets on a monthly basis and ensures that our day-to-day tactical decisions are synergistic and aligned with the overall mission and vision.

**Communications manager.** During the last quarter of 2011, a search was conducted to hire a new full-time communications manager to focus attention on CTSSR- and Information Technology-related communications efforts. The search concluded with the hiring of Angela I. Correa, an experienced communications and public relations professional with long experience within the College of Agriculture. Ms. Correa has developed a comprehensive communications plan for all units within CTSSR, and is also providing continuing communications support for the multi-year Unified Communications project.

**Information technology risk assessments.** During the first quarter of 2012, CTSSR undertook a complete revision of university procedures for completing information technology risk assessments (ITRA; [www.it.vt.edu/organization/ctssr/risk\\_assessment/](http://www.it.vt.edu/organization/ctssr/risk_assessment/)). The new ITRA process offers departments a streamlined and easily understandable way to systematically review their information technology-related risks, and to develop plans to mitigate those risks in the event of system failure or other loss.

**Annual meeting.** During the second quarter of 2012, CTSSR hosted what is expected to be the first of many annual meetings to report on converged technology initiatives over the past year and brainstorm initiatives of interest to Information Technology and Administrative Services in the coming year. This year's meeting was held on June 27, 2012. Attendance at this meeting exceeded expectations, with more than 70 attendees from coming to the morning session, which featured presentations of five high-value projects developed with the collaboration of CTSSR personnel. The afternoon session engaged key Information Technology and Administrative Services personnel in a brainstorming session to identify existing challenges and opportunities related to data and physical security on campus. The results of the afternoon session have been captured in an outcomes report that will provide useful guidance for new CTSSR projects and initiatives in the 2012-2013 academic year.



*The CTSSR annual meeting drew over 70 participants from IT and VPAS.*

## eCorridors

The eCorridors technology outreach program benefits Virginia communities by increasing awareness of the benefits of advanced network infrastructure and applications, and enhancing inter-regional connectivity, based on the premise that communities with advanced fiber, wireless, and "next generation" Internet infrastructure will have a distinct competitive advantage over those that lag behind in these areas. eCorridors works with communities, private-sector, and municipal partners to encourage rapid development of advanced, fiber optic, wireless, and "next generation" Internet infrastructure across Virginia.

eCorridors continues to serve local, regional, and national organizations that request assistance with technology infrastructure issues such as broadband availability, pricing, and quality; and community utilization of networked applications and services. The program is in its third year of a partnership with Virginia's Center for Innovative Technology to develop the commonwealth's statewide map of broadband availability as part of the federally-funded State Broadband Initiative (SBI) project. Locally, members of the eCorridors program participate in the Blacksburg Broadband Task Force and the New River Valley Planning District Commission's technology infrastructure focus groups.

*Accelerate Virginia* continues to engage Virginia counties in Internet speed testing, with 7,700 Virginia residents testing their service to date. Accelerate Virginia has assisted local leaders with launching speed testing campaigns in 26 counties, and has been featured at several statewide meetings, including the Virginia chapter of the American Planning Association, the Virginia Municipal League, and the Virginia Broadband Council.



In September of 2011, Accelerate Virginia was awarded the Governor's Technology Award in the category "IT as an Economic Development Driver." This award recognizes the innovative use of technology to promote economic development.

**Vertical Assets project.** Adding wireless transmission equipment to an existing structure is cost effective for service providers, and also benefits private or public property managers. The Vertical Assets Inventory Toolkit ([www.ecorridors.vt.edu/verticalassets](http://www.ecorridors.vt.edu/verticalassets)) enables property owners and localities to identify structures or land that could serve as a site for installation of wireless communications equipment. The toolkit went live in spring of 2012, and already contains a total of 20,500 structures, towers, and other potential wireless transmission sites.

## Center for Geospatial Information Technology

The Center for Geospatial Information Technology (CGIT) is part of Virginia Tech Geospatial Information Sciences. CGIT stands ready to partner with university researchers, government agencies, and the private sector to research and develop advanced uses of geospatial technologies. Combined with Enterprise GIS, we offer a one-stop-shop solution for GIS data applications, access, storage and hosting. We are committed to performing high quality, applied geospatial information research in areas such as safety and security, health information technology, and community resilience.

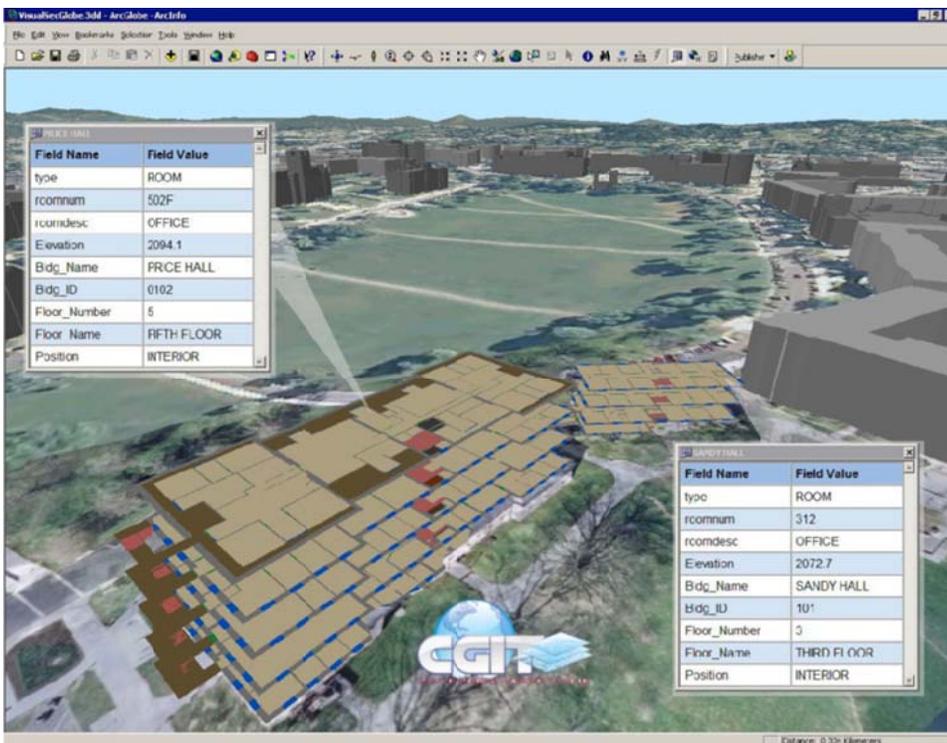
**High performance computing.** CGIT reached a milestone by connecting desktop GIS software and high performance computing resources. By implementing code that divides large raster datasets into manageable pieces, CGIT was able to link between ESRI's ArcGIS desktop software and one of the Virginia Tech high performance computing clusters. Now, CGIT GIS analysts who need to perform complex operations on large raster datasets can use this tool, which divides the raster into small pieces and sends the data to the high performance computing cluster, along

with instructions for what operations or computations the cluster should perform. The results are then collected and merged into a single raster dataset that the GIS analyst can use. Before this linkage, it was not possible for analysts to work with very large raster datasets, because the software simply could not manipulate such a massive amount of data.

In the future, similar parallelization logic could be used to take advantage of the multi-core graphical processing units that are present on many higher-end graphics cards in desktop computers, making this capability even easier to utilize, especially for those who may not have easy access to Virginia Tech's high performance computing cluster.

**Interior space/campus routing.** To improve administrative and planning capabilities, CGIT converted campus building floor plans from AutoCAD drawings into a GIS format to allow for easier color-coded mapping of room use, ownership, and other attributes. The new format aligns spatially with other campus mapping resources, so that interior building room information can more easily be combined with existing campus maps that show exterior features like sidewalks and underground utilities.

The primary user of the floor plan information will be Facilities Services, where it will assist in planning and maintenance of building uses all over campus. The routing application will also benefit Facilities Services, but ultimately will also be accessed by visitors, new students, and persons who rely on accessibility features such as wheelchair ramps and elevators.



*Detailed diagrams of Virginia Tech buildings are a resource for facility managers and the Virginia Tech police.*



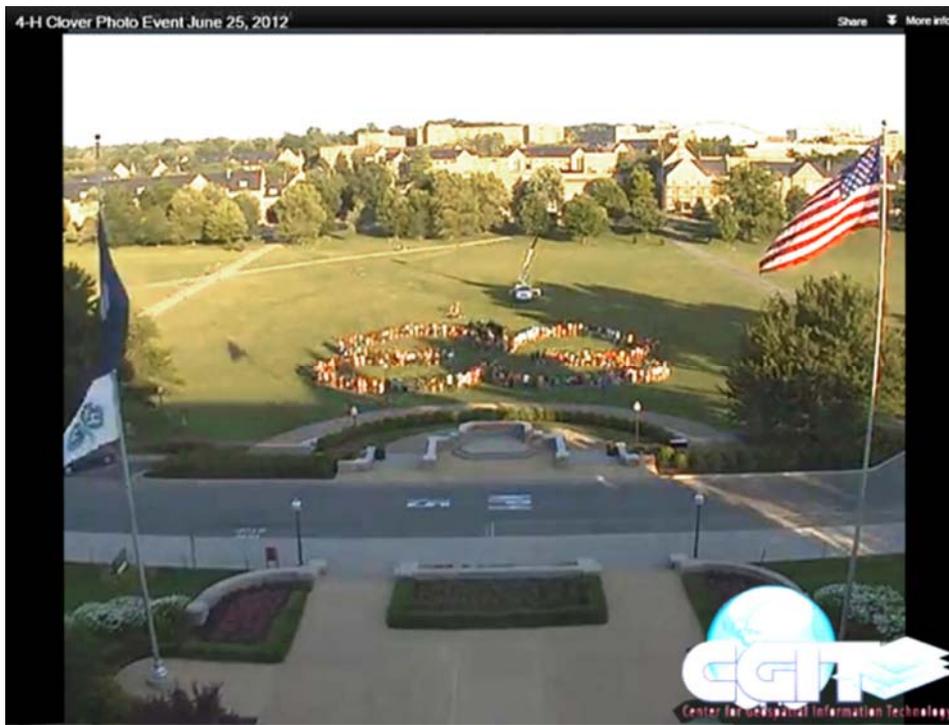
*Campus wayfinding tools offer a real benefit for people who are new to the campus, as well as for persons who rely on accessibility features to get from point A to point B.*

**Lane Stadium model.** CGIT developed a virtual 3D model of Lane Stadium based on the best-available floor plans and other geospatial data. The model aligns with the interior space GIS data described previously, allowing for potentially use in a future 3D situational awareness viewer. The result would give administrators a holistic view of the stadium, and may be combined with other geospatially-referenced information about activities or equipment within the stadium facility.

The model was not developed for the general public; its target audience would be operational users, or facility managers. However, it could also be generalized and streamlined for use in other 3D viewer environments, such as "3D Blacksburg," or popular 3D viewers like Google Earth.



**4-H Clover.** CGIT assisted the Virginia 4-H All Stars in the design and surveying of a large clover pattern on the drillfield, which was used to organize a group photo of more than 300 delegates from the Virginia 4-H Congress on June 25, 2012. See [www.youtube.com/watch?v=HGWlxPTe3Hw](http://www.youtube.com/watch?v=HGWlxPTe3Hw).



**Continuing research.** CGIT is continuing work on two multi-year projects. The first of these is a USDA study to improve grape and wine quality through the development of GIS-based site selection tools for potential wine growing areas. The tool will be part of a systems approach to improve production methods, product quality, and subsequent marketability of wines of an eastern United States provenance.

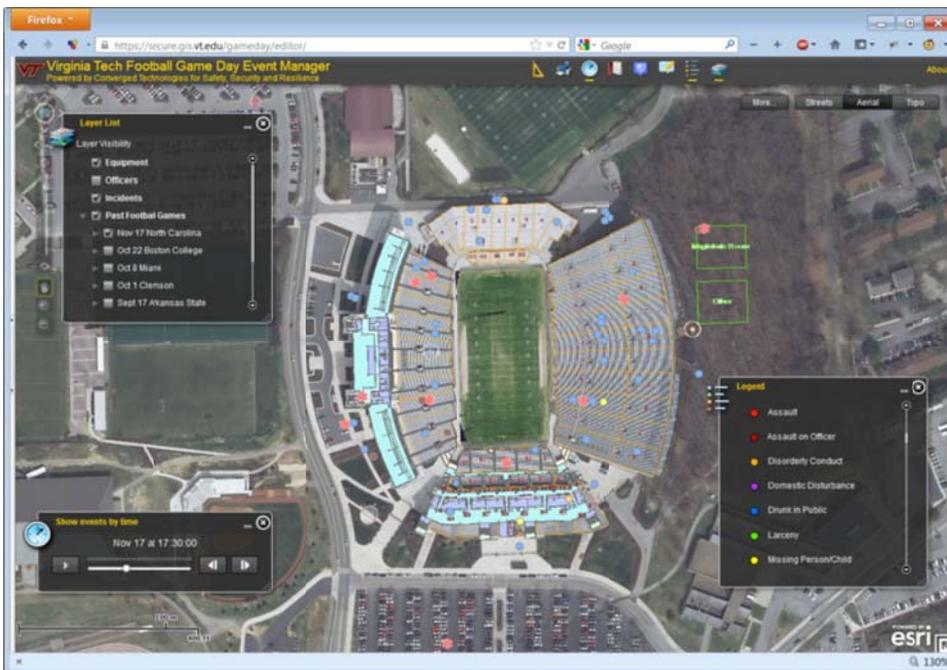
The second project is the National Telecommunications and Information Administration's (NTIA) State Broadband Initiative (SBI). This comprehensive program promotes the integration of broadband and information technology into state and local economies. Through CGIT, the SBI funds the work of Accelerate Virginia and Vertical Assets.

## Enterprise GIS

The Enterprise GIS unit is a key component of Virginia Tech's resources for spatial data management, providing GIS data hosting, systems integration support, and Web application development services to both academic and administrative units within the university. Enterprise GIS lowers barriers to the use of advanced geospatial technologies in research, teaching, outreach, emergency response, facility

operations, and campus planning. Enterprise GIS is supported in part through a long-term collaboration with the Blacksburg Electronic Village, an arrangement which significantly enhances Enterprise GIS's capacity in the area of Web application development and hosting.

**Game Day GIS.** In the fall of 2011, Enterprise GIS piloted a GIS-driven Web application, known as the Game Day GIS, which enabled the Office of Emergency Management (OEM) and the Virginia Tech Police Department (VTPD) to maintain a higher level of situational awareness at home football games by tracking the locations of reported incidents and police officers on an interactive map. This tool was requested by OEM director Mike Mulhare, who had found considerable value in the possibility of using GIS in this way after the successful execution of an earlier GIS prototype, built in collaboration with CGIT for the VT Emergency Operations Center's functional exercise in the summer of 2011. This high-profile application of GIS was used at all six home football games of the past season, as well as at Commencement and the Spring Game (though the latter was rained out). Beyond its immediate application as a situational awareness tool, Game Day GIS creates a historical record of incident data that can be continually analyzed in light of a number of variables of interest. VTPD has expressed interest in using the results of such analysis to inform the allocation of security resources and personnel at future football games and major events. Over time, the analysis and continual assessment of past events could lead to more efficient operations and cost savings. Enterprise GIS is currently working with VTPD and OEM to make improvements to the tool and prepare it for the next Virginia Tech football season.



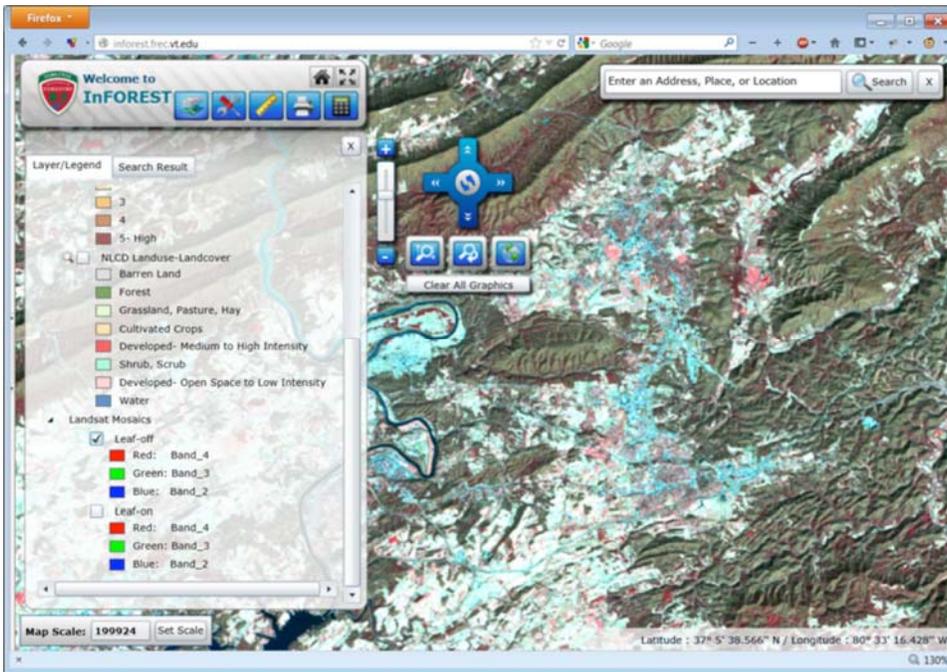
*The Game Day GIS app allows event managers and emergency personnel to zoom in on problem areas and key personnel, enabling better situational awareness in complex scenarios.*

**Geospatial Archive Resource and Data Exchange Network (GARDEN).** In 2011, Virginia Tech joined Virginia's Geospatial Archive Resource and Data Exchange Network (GARDEN). Through GARDEN, Virginia Tech serves as a "mirror" of the Virginia Geographic Information Network's (VGIN) data layers (which include, among other key "basemap" data layers, the aerial imagery flown through the Virginia Base

Mapping Program). By hosting a copy of these layers, university personnel have ready access for numerous applications in the academic mission, outreach efforts, and internal operations. This arrangement removes an external data dependency, alleviates the need to pay licensing fees, and offers improved performance. The Commonwealth of Virginia, via VGIN, benefits through the redundancy of having key data layers stored in multiple places, which allows universities to perform an archival function for older datasets, and enables each GARDEN institution to develop derived and value-added products that align with their strengths and research interests.

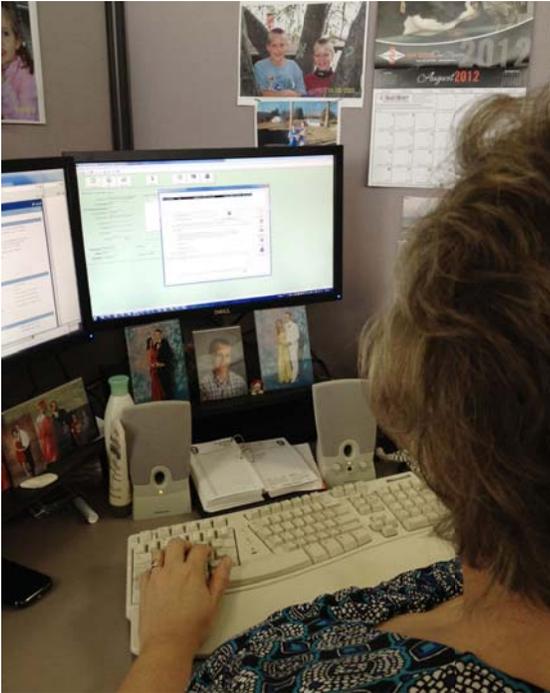


**InForest Web Application migration.** In collaboration with the Department of Forest Resources and Environmental Conservation (FREC), Enterprise GIS has been involved in a multi-year project to develop a Web-based platform to facilitate public access to analytical models that show the quantifiable benefits of different natural environments. This year, Enterprise GIS continued the work that originated with the MEASURES toolkit and assumed production hosting responsibilities for the InForest Web Application, a joint initiative of FREC, the Virginia Department of Forestry, and the Timmons Group. InForest is the public-facing user interface to the MEASURES suite of Ecosystem Service calculators developed within Virginia Tech's College of Natural Resources and Environment, which is also hosted on the Enterprise GIS infrastructure. With the move of the InForest Web presence to Enterprise GIS, the entire software stack for this project is now managed as a single, cohesive unit.



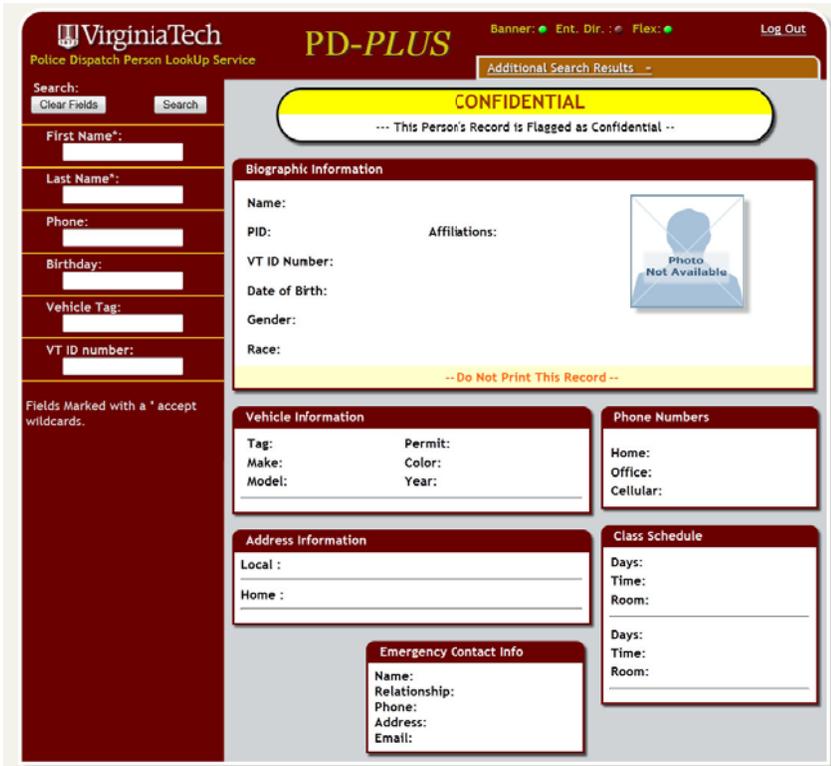
## Identity Management Services

Identity Management Services (IMS) is responsible for electronic identity and access management at Virginia Tech. IMS currently manages the lifecycle of approximately 700,000 electronic identities and has defined approximately 40 different affiliations that describe the type of association that an electronic identity has with Virginia Tech. In its role as a second-line customer service help desk, IMS annually resolves over 6000 trouble tickets regarding access issues.



*Most trouble tickets are resolved within 24 hours of entering the system.*

**PD PLUS.** A highlight for the Identity Management Services area this year was the development of an identity lookup application for the Virginia Tech Police Department. This application, PDPlus, allows a police dispatcher to enter a piece of identity information such as a name, Virginia Tech id number, or vehicle tag number, for an individual and pull up identity-related information for that individual. Previously, dispatchers needed to access several different systems separately in order to retrieve all the available identity information about a person. PDPlus utilizes sophisticated logic to query several different systems with the search criteria provided and produce a composite view of an individual on a single screen. The application should significantly reduce event response time by eliminating the need for the dispatcher to login to different systems and manually cross-reference individuals found on multiple systems.



*PD-Plus puts an end to time-consuming searches of multiple databases, enabling shorter response times and assisting VTPD in its mission to increase public safety.*

**Identity management planning.** The increasing importance of identity management to Virginia Tech was emphasized this year as the work of the university Identity Management Planning Committee drew to a close. The committee, led by Mike Mulhare, director of Emergency Management, was formed in early 2011. President Steger charged the group with the creation of a master plan to guide development of a comprehensive identity management and access control environment for Virginia Tech over the next five to ten years. The Director of Identity Management Services and the Executive Director of Converged Technologies for Security, Safety, and Resilience worked with others on the larger committee to produce a comprehensive assessment and recommendations for the identity management landscape at Virginia Tech.

## Blacksburg Electronic Village

The Blacksburg Electronic Village (BEV) provides specialized data management and infrastructure support for a variety of Information Technology projects. As part of its integration into the Converged Technologies for Security, Safety, and Resilience, BEV is in the process of transitioning its focus from external Internet access and Web hosting initiatives to the deployment and support of emerging Web technologies. BEV is an integral part of the day-to-day operations of the Enterprise GIS organization within CTSSR, augmenting the latter's proficiency in GIS with expertise in integration of geospatial tools into advanced Web applications, and providing systems administration support.

BEV has been a major contributor to a number of high-profile CTSSR initiatives, and is involved with collaborative efforts that include all units within CTSSR.

**Game Day GIS.** The highly-successful Game Day GIS application was made possible with BEV's assistance in the creation and maintenance of a secure Web hosting location, security hardening, and integration of authentication and authorization with the Central Authentication Service. Collaboration between BEV and Enterprise GIS also provided collaborative software development via BEV's revision control system, and data management support.

**Virginia Tech Hazard Mitigation Plan.** BEV has supported this CGIT initiative by designing and supporting a Web presence for the planning group. BEV created a site framework with a content management system for this project, enabling CGIT to upload information relevant to the Hazard Mitigation Committee, which includes participants from both CGIT and OEM. The site serves as the main portal for communication and decision-making amongst the committee and facilitators. The site allows the committee to review documents and give input, as well as to discuss, vote on, and prioritize goals, objectives, and action items.

**Broadband mapping and outreach support.** BEV has facilitated the ongoing efforts of eCorridors and CGIT to provide value-adding data products for the federally-funded statewide broadband Internet mapping program, known as SBI, by providing database and Web hosting for the Vertical Assets Inventory Toolkit. BEV's support enabled the toolkit database to efficiently scale to include the entire state, and ensured secure access to development and testing versions of the code base. BEV also hosts the Accelerate Virginia speed testing portal.

**VAES Weather Mesonet.** BEV has supported academic research by providing a Web presence and ongoing monitoring support to Enterprise GIS's effort to integrate the Virginia Agricultural Experiment Station's Weather Mesonet data feed from AHNR-IT into the ArcSDE database system. BEV hosts the site, and also provides data continuity monitoring to ensure that the researchers using the system, located at Virginia Tech and Penn State University, will have access to an uninterrupted time series of meteorological observations.

**Infrastructure updates.** During the 2011-2012 academic year, BEV upgraded numerous systems to provide enhanced support and reliability for all clients, both external and internal. These improvements included the following:

- Upgrading Web servers to a more recent version of PHP
- Upgrading the ModSecurity Web application firewall software
- Increasing the use of Apache Subversion centralized revision control system
- Upgrading our internal collaborative documentation website
- Continuing migration from physical to virtual machine operating platforms
- Converting to a dedicated MySQL database machine

**External initiatives.** BEV continues a long tradition of service to the local community, which began in the early 1990s with BEV's successful partnership with the town and the private sector, which connected the citizens of Blacksburg to the Internet. Today, BEV continues to offer a variety of Internet-based services to

Blacksburg citizens, civic groups, and non-profit organizations, maintaining systems that support a virtual community with deep roots in Blacksburg. BEV also provides outreach and assistance to other communities that are trying to develop healthy community networks.

## CTSSR by the numbers

These metrics cover the period July 2011-June 2012.

Students employed—26

Students mentored—63

Courses taught—24

Proposals submitted—13

New grants—six funded, for a total of \$413,683 in new grant funds

Presentations made, meetings hosted—76

Major meetings attended—15

Courses attended—9

Communities receiving assistance—30

Media coverage—27



# Enterprise Systems

Enterprise Systems develops, coordinates, and manages application software systems that provide critical information services for university constituents. Its role is to facilitate an enterprise-wide view of university applications while ensuring that these systems maintain an effective balance between information technology, university functionality, and security and compliance. Enterprise Systems collaborates with university constituents to encourage process transformation and to promote alignment of enterprise applications with university priorities.

The eight units of Enterprise Systems focus on different aspects of the mission:

**Advancement, Human Resources, Finance, and Student Systems** are four units within Enterprise Systems that support application subject areas. These four units are responsible for acquisition, development, and maintenance of the university's core administrative systems for their specific areas of subject matter expertise.

**Information Warehousing and Access** 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** provides the necessary controls, oversight, performance monitoring, and 24x7 on-call responses for application administration, database administration, Web hosting, and filebox services.

**Web Services and Development** provides information technology support in the areas of Web development, portal administration, integration processes, the Banner General Person module, and Enterprise Directory interfaces.

**Document Management Systems** 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.

Accomplishments for the year are organized in this report according to Enterprise Systems' goals:

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 and services

Goal 1 is to provide new enterprise systems, technologies, and applications that expand and broaden services and functionality of the mission of the university. This year Enterprise Systems completed several projects aimed at broadening the services available to the university and continues to expand upon these implementations.

**Banner Enterprise Identity Management Services (BEIS).** Single sign-on integration and CAS authentication using BEIS was implemented in Banner Workflow, Banner Document Management, Self-Service Banner, Internet Native Banner, and Travel and Expense. Enterprise Systems continues to work with Identity Management Services on the next phase of implementation to provide account provisioning. In addition, we are working with Ellucian, the vendor of the Banner system, to resolve performance issues that occur with the use of BEIS for authentication to Internet Native Banner.

**Research Administrative System.** Enterprise Systems partnered with the Vice President for Finance and Chief Financial Officer and the Vice President for Research to begin a Research Administration Program (RAP) that will consist of various projects for research administrative services using blended solutions of vendor products, the Kuali Coeus open-source system, and university-developed integration components. As the first project within the RAP, the university purchased and successfully implemented Cayuse 424 for proposal development and submission to Grants.gov.

**Travel and Expense Management.** An objective for the year was to implement the Travel and Expense Management (TEM) module for a pilot group of departments. The pilot was deployed in March 2012 and is currently being used in production by several central administrative departments, including Enterprise Systems. The next phase of the project will expand the pilot to academic departments. Enterprise Systems will add the functionality needed for that expansion. Enterprise Systems

worked with Ellucian to address performance concerns and, as a result, Ellucian has released a TEM patch that is planned for deployment later in 2012.

**Electronic I-9 system.** The TALX Electronic I-9 system is a cloud-based system for departmental entry of I-9 information. This system verifies an employee's right to work using the federal government's E-Verify system, a mandate from the governor of Virginia for all new hires. Enterprise Systems worked with the vendor to automatically upload access information and department changes and to download I-9 information to update Banner. We also worked with the vendor to implement a CAS login to the system.

**Leave, time, and attendance system.** In response to an audit of electronic timekeeping systems across the university, Enterprise Systems participated in an evaluation project for a leave, time, and attendance system which was initiated and completed this past year. This project resulted in the purchase of TimeClock Plus and the decision to implement the software as a central time clock system. The system will be implemented in phases with the ultimate objective to have this product used by all hourly employees. The deployment to the initial departments is planned for fall 2012.

**Advisor comment tracking system.** The objective was to develop and implement an advisor comment tracking system which would allow faculty advisors to record concerns with a students' academic progress. This system was successfully implemented and is used to facilitate early intervention by colleges and departments and to address a requirement of the Quality Enhancement Program for accreditation by the Southern Association of Colleges and Schools. The project sponsor is the Center for Academic Enrichment and Excellence Office.

**Student Perceptions of Teaching system Reporting and Analysis (SPOT).** The objective of this project is to provide reporting and analysis components for a centrally-supported, university-wide method for collecting student feedback regarding courses and instruction. Enterprise Systems partnered with Learning Technologies and with the Office of Assessment and Evaluation to model data and create reports of the SPOT data for supporting assessment and instructional development and evaluation.

Additional projects were initiated during the year.

**Online Giving Application.** Enterprise Systems is working with the University Development organization to create a new online giving application for University Development, the Hokie Club, and the VT-Carilion School of Medicine using this project as a proof of concept for Groovy/Grails technology. System design and development is continuing with deployment expected in fall 2012.

**Scholarships.** Work was initiated on the development of a system to more effectively and efficiently administer scholarships handled by the Office University Scholarships and Financial Aid. Enhancements to reporting for the colleges and departments will allow better management of scholarships that facilitates more effective distribution of funds. Ultimately, this effort will encompass the full scholarship processing cycle, including application processing, committee

nominations of possible recipients, verification of donor criteria, coordination with other aid received by the recipient, and award notification with donor information.

**College of Veterinary Medicine patient records.** This project will create a prototype site for doctors and administrators to view historical patient records in the College of Veterinary Medicine. The foundation for the project and the starting point for development is the mass digitization of patient records dating back to the opening of the hospital in 1981. The collection will preserve this information and provide searching capabilities and access to the material for veterinary medicine researchers.

**Department of Horticulture images.** The objective is to create a prototype site of sample metadata and images for the Department of Horticulture's course offering on Woody Landscape Plants. The project provides a valuable resource for the study of woody landscape plants by students on campus and across the Commonwealth of Virginia.

## Expand the functionality, usefulness, and usage of production systems

Work on Goal 2, enhancements to the functionality and usage of existing systems, occurred throughout the areas of Enterprise System support.

**myVT portal services.** Enterprise Systems began an assessment of the usage and direction of the portal. In working with a graduate research assistant, the GRA produced a formal paper on recommendations for content and structural design changes for myVT.

**Document Management Services.** We migrated existing Graduate School documents from Nolij to the Banner Document Management System and implemented a new document management application to store graduate student admissions and academic record documents. The Nolij system was decommissioned following the migration of Graduate School information.

**Content Management Services.** All sites that are launched via the Ensemble content management system were expanded to enable delivery of a mobile friendly version. Mobile detection is done by JavaScript and users on a mobile device are prompted to go to the mobile version of the site (generally m.[site name].vt.edu).

**Student services.** Processing of veteran's benefits for the Office of the Registrar was enhanced through a new Web process that enables students to apply for veteran's benefits and check the status of their applications. Additional data is now available for the Office of University Scholarships and Financial Aid to better address the award needs of veterans. Applicant and test score processing for Undergraduate Admissions, the Graduate School, and Veterinary Medicine admissions were

enhanced for greater integration to Banner and to facilitate addressing new requirements.

**Advancement services.** Enterprise Systems is continuing to participate with University Development in a post implementation analysis of the Banner Advancement system to evaluate Virginia Tech’s usage of the system and assess opportunities for more effective business processes and practices. In addition, we implemented a new bank reconciliation process for deposits for the Virginia Tech Foundation to streamline the business process and simplify bank reconciliation.

**Financial services.** In conjunction with Office of Sponsored Programs, Human Resources, and Controller’s Office, Enterprise Systems produced several reports and new processes to enhance administration of research including reports concerning responsible conduct of research (RCR) compliance and a snapshot-by-grant report for use by principal investigators and business managers. Enterprise Systems began analysis work for several enhancements to the Accounts Payable and Purchasing systems concerning handling discount codes from requisition through check processing and enhancements to the integration of purchase orders between HokieMart and Banner. Deployment of these enhancements is expected in the first half of 2013.

## Ensure long-term viability of the university applications and systems

Goal 3 is to sustain and support university enterprise level applications to ensure long term viability. Implementation of software upgrades and patches is an essential activity in achieving this objective to promote application security and maintain vendor support. The following list details the upgrades completed this year.

### FY12 Enterprise Systems upgrades

<b>Product</b>	<b>Application</b>	<b>Version</b>
Atlassian	JIRA	4.4, 5.0, 5.0.4
Atlassian	Confluence	3.5.2, 3.5.9, 4.2.2
EMC	AppXtender	6.50.124
Jaspersoft	Jaspersoft Server	4.5.1
LimeSurvey	LimeSurvey	1.91+ build 11379
Oracle DBMS	Banner, CMS, Data Warehouse, GIS, Learning Technologies, Registry, Scholar, Vatech, VT Foundation	11.2.0.3
Oracle Hyperion	Oracle EPM	11.1.1.4
Oracle WebLogic	Banner	11.1.1.4
SciQuest	SelectSite (HokieMart)	11.2, 11.3, 12.1
Ellucian Banner	Accounts Receivable	8.2, 8.3
Ellucian Banner	Advancement	8.3.2, 8.4, 8.4.1, 8.4.2

Ellucian Banner	Advancement Self-Service	8.4.2, 8.5, 8.5.1, 8.5.2
Ellucian Banner	BEIS	8.1.3, 8.1.4
Ellucian Banner	Employee Self-Service	8.4.1, 8.4, 8.5, 8.6.1, 8.6
Ellucian Banner	Finance	8.5, 8.6
Ellucian Banner	Finance Self-Service	8.4, 8.5
Ellucian Banner	Financial Aid	8.9, 8.9.1, 8.10, 8.11, 8.12, 8.13, 8.14
Ellucian Banner	Financial Aid Self-Service	8.9, 8.10, 8.12
Ellucian Banner	General	8.4, 8.4.2, 8.5
Ellucian Banner	General Web	8.4, 8.5
Ellucian Banner	Payroll	8.4, 8.5, 8.6.1, 8.6
Ellucian Banner	Position Control	8.4, 8.5, 8.6
Ellucian Banner	Student	8.4, 8.5, 8.5.1
Ellucian Banner	Student Self-Service	8.4, 8.5, 8.5.1
Ellucian Banner	Faculty Self-Service	8.4, 8.5
Ellucian Banner	Travel & Expense	8.1, 8.2, 8.3, 8.4, 8.4.0.3
Ellucian Banner	Web Tailor	8.4, 8.4.1, 8.5
Ellucian Banner	Workflow	4.4.2, 8.0.1

**Performance.** Enterprise Systems improved reliability and performance by separating the application and database server environments. Performance was further enhanced by migrating large databases such as Banner and Scholar to new hardware. Resource utilization was also enhanced through the migration of all smaller databases to a virtualized environment.

**Availability.** The overall availability and disaster preparedness for Scholar system was enhanced by creating a standby database.

**Application administration.** Administration of the Ensemble content management environment was improved through the implementation of local assets, which allows site specific customizations via CSS and JavaScript. In addition, a generic mailer script to verify form submissions was implemented and has also been adapted for managing campus notice submissions for the news community.

**Security.** Addressing our responsibilities for data and application security, we continued to review and enhance data protections. These efforts include providing a more secure method of delivering parent data to University Development, implementing access control lists on various Unix directories, reviewing nightly Finance feed logs for any historical personally identifying information, and reviewing all Advancement reports with a focus on those distributed externally. We worked with the University Controller to address audit requirements for expanded review of update access to critical objects in Banner systems and to provide periodic review of this access. Enterprise Systems began working with Secure Enterprise Technology Initiatives to implement Shibboleth authentication system within the research repository.

## Best practices

Goal 4 is to promote best practices that enable the Enterprise Systems organization to effectively manage the development and on-going support of enterprise applications.

**Governance tools.** One objective for this goal was to enhance and expand the usage of TeamDynamix to provide better analysis of risks, benefits, and resource requirements for operational initiatives and for project requests managed by Enterprise Systems. To accomplish this objective, we improved upon our initial use of TeamDynamix by adding more details to a new project request including benefits and risks to the institution.

**Organizational structure.** The Enterprise Systems organizational structure was adapted to address the impact of key personnel changes including retirements and loss of staff. The DBAA team was reorganized into three support teams to promote cross training and improve depth of support. We realigned our staff to create a Director of Application Architecture and Planning position with responsibilities for the planning and delivery of enterprise level services through standards and best practices. Several vacancies in the leadership team were filled and the organization has spent considerable efforts filling vacant positions both through promotions of existing staff to recognize their skills and expertise and through attracting new talent.

**Professional development.** 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 the following:

- Several members of Enterprise Systems attended SANS Certified Intrusion Analyst training;
- Members of the DBAA team attended Oracle WebLogic training;
- Staff completed the Virginia Tech Standard for Information Technology Project Management course.

In addition, staff members serve in leadership capacities on Ellucian advisory boards to provide feedback and guidance on the company's products and initiatives including. These include the community source team, the Pillar Strategic Planning group, and the Human Resources Customer Advisory Board. Staff members also participate in the advisory panel for the database conversions required to support the new Banner user interface. Staff members attended Ellucian Users Conference (Summit), Mid-Atlantic Banner Users Groups (MABUG), and the large school consortium annual meeting.

IWA staff members provided leadership to the Higher Education Data Warehousing Forum including serving on the board of the organization. IWA team members attended the annual conference and conducted a presentation on the Virginia Tech implementation of Jaspersoft and the course evaluation datamart.

# Goals and objectives for 2013

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

- Provide technical services and direction in support of the goals and deliverables defined by the Research Administration Program charter
- Provide planning for design and implementation of an enterprise-wide business intelligence platform
- Continue the development of a financial aid scholarship administration system
- Proceed with implementation of phase one of a leave, time and attendance system
- Implement the next phase of the travel and expense system implementation that will provide necessary functionality to support departmental deployment

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

- Modify purchasing systems to support the street address conversion project
- Complete development and deployment of redesigned online giving pages for Development gifts

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

- Advance the deployment of standby databases to other Virginia Tech campus sites to improve availability of systems
- Perform application and system upgrades to maintain vendor support requirements

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

- Develop plans and activities that increase the usage of Java related technologies and object oriented methodologies across the Enterprise Systems organization



# Information Technology Acquisitions

Information Technology Acquisitions (ITA) acquires and distributes information technology goods and services for the university using best value concepts. The unit is organized into three major operational entities—Computer Purchasing, Software Distribution (Departmental and Student), and Contract Management, Licensing, and Billing.

## Computer Purchasing

Computer Purchasing procures technology tools that enable the university to “Invent the Future.” The office is an integral component of the university’s mission to discover and disseminate knowledge, since education, research, outreach, and administration increasingly require solutions based in information technology.

Information technology solutions can be complex and may involve “cloud” or hosted solutions or may interface with existing systems. A process questionnaire guides departments in addressing relevant processes, including review of information technology security, interface with enterprise systems, control of sensitive data, impact on university networks, housing or monitoring of equipment, and physical safety.

Needs for hardware range from high-speed computing to vast data storage systems to desktop and mobile systems. Software needs range from complex administrative or research systems to widely-used student and departmental software to unique specialty tools. Hardware and software maintenance, customized solutions, consulting, and other services may also be required.

The staff of Computer Purchasing is composed of one half-time and two full-time buyers and one assistant. The procurement process involves issuing solicitations and orders, coordinating legal agreements, researching available cooperative contracts and sources, and negotiating contract awards to achieve efficiency and effectiveness. Through those processes, we meet end-user requirements while assuring compliance with university and state policies and procedures and legal requirements.

This year's accomplishments included new contracts and expansion or enhancements of existing relationships. We awarded five new contracts, including the first revenue-generating contract that has returned \$75,053 to date. In addition, 29 contracts were renewed or amended, and other solicitations continue in-process. We have emphasized using cooperative contracts wherever possible and appropriate. By allowing state agencies to purchase from contracts negotiated by Virginia Tech, total procurement costs are reduced, and the volume discounts can lead to better pricing. Among this year's contracts are several with important university-wide application, including email and research computing.

**Email.** Reduced cost, increased mailbox storage, and new capabilities were achieved through a new competitive, cooperative contract award to SADA Systems along with a Google agreement that allowed the university to begin to transition email to Google Apps for Education.

**Computer and data storage infrastructure.** Significant additions and replacements were made for centralized and research hardware and data storage infrastructure.

**Research support.** Several competitive procurements were completed to support research requirements for high-speed and high-volume computing, data storage, software, maintenance, and services.

### **Internal procedures**

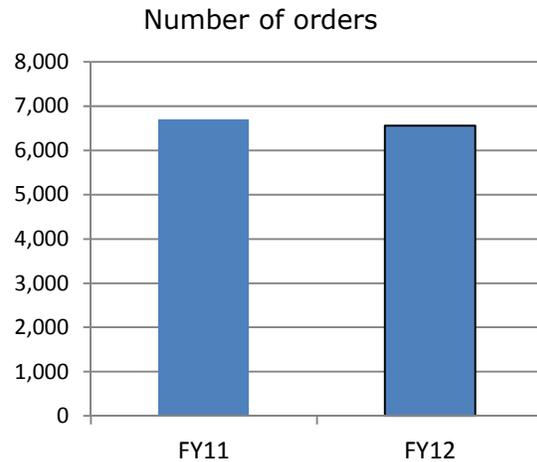
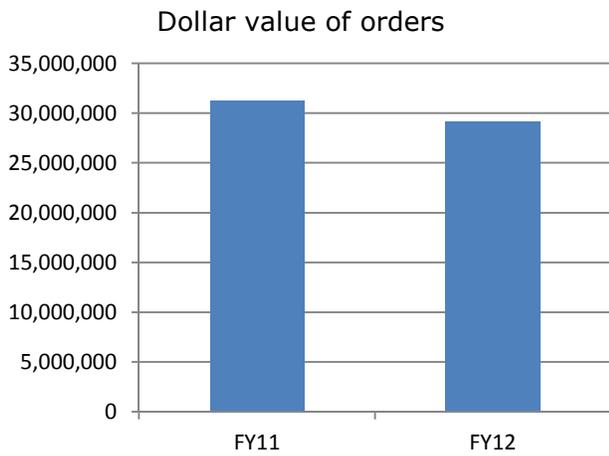
Computer Purchasing continues to solicit and award new contracts and orders to companies qualified as small, woman-owned, or minority-owned enterprises (SWAM). This competition provides strong pricing, quality service, and supplier diversity to strengthen our base of vendor sources.

HokieMart is the e-procurement system which allows Virginia Tech to provide one-stop shopping, reducing the time and effort entailed in the procurement process. "Punch-out" contract suppliers are linked to HokieMart through direct access to the suppliers' websites. These suppliers are familiar and have been preferred suppliers in the past. Departmental access continued to expand through punchout sites for higher-volume contract vendors. The Contract Manager module allows controlled access to contracts. Both allow orders to be generated automatically.

The data repository stores scanned contracts and license/service agreements. This year, we created a public view of the license/service agreements. As we continue to enhance the data repository, we can better expedite data research and increase e-document accessibility and transparency.

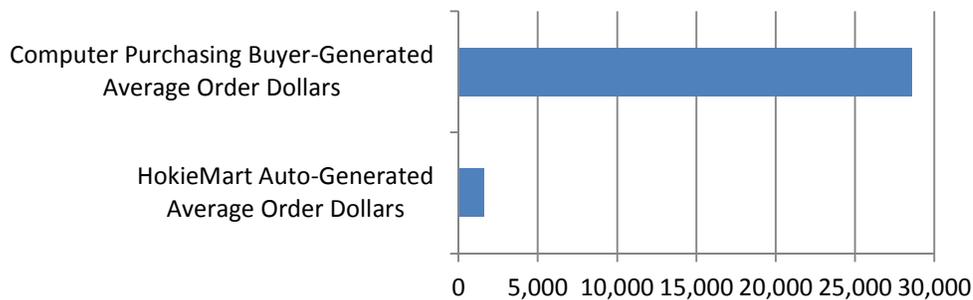
### **Operational metrics**

Despite the year's financial challenges, the university's investment in information technology remained strong. Information technology expenditures this year totaled \$29.1 million, for 6,697 orders.

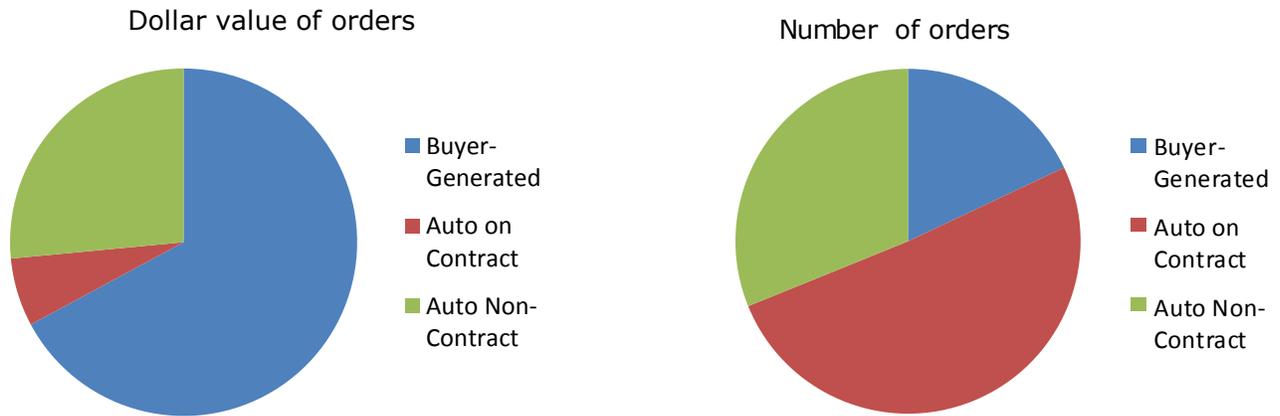


Both the self-service HokieMart system and the buyers of Computer Purchasing fill a specific, complementary niche. A buyer's knowledge, skills, and experience add value in the higher dollar orders that require analytical skills and dealing with legal and regulatory issues. HokieMart automatically generates small dollar purchases, some contract orders, and university internal vendor orders. The average information technology buyer-generated order is \$28,550 while auto-generated HokieMart orders are, on average, \$1,628.

Average dollar-value of orders

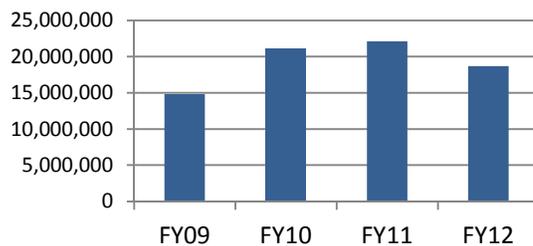


Orders managed by Computer Purchasing buyers account for 67% of total dollar value, and HokieMart auto-generated orders account for 82% of the total volume of orders. Since buyers issue contracts, and HokieMart Punchout and many other auto-generated orders are placed under those contracts, even auto-generated orders may involve buyers. The following graphs illustrate the significant differences in order dollars and volume, with Computer Purchasing buyers directly issuing two-thirds of the dollar value.



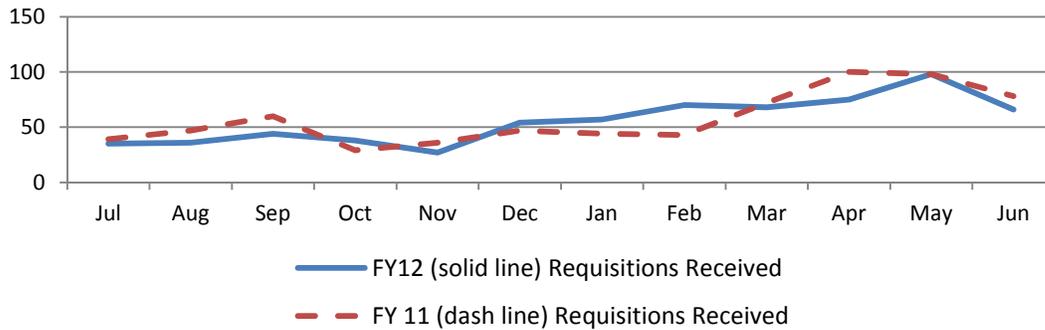
Information technology orders made by buyers in Computer Purchasing were lower in dollar value this year, compared to the previous two years, but within the expected year-to-year fluctuation.

Dollar value of buyer generated orders

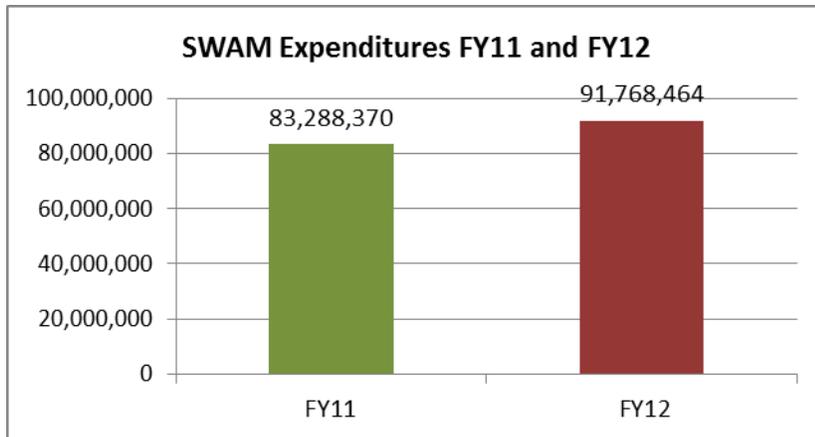


The timing of requisition submissions can also vary throughout the year. Variations can be influenced by new requirements for education and research, annual license and maintenance renewal, vendor release of new hardware and software, funding availability, timing of the release of funds from the State Council of Higher Education for Virginia, and budget reductions and uncertainty. This year's cycle was within expectations.

## Requisitions



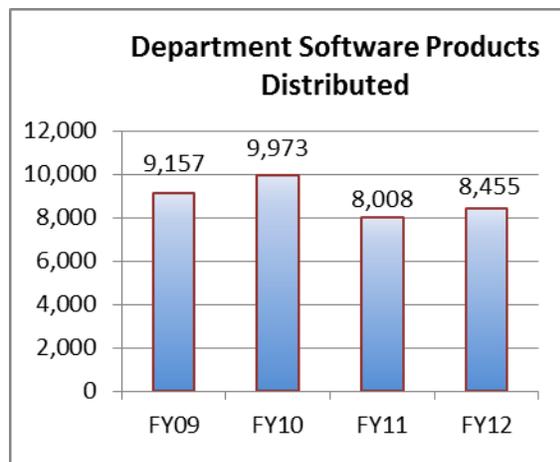
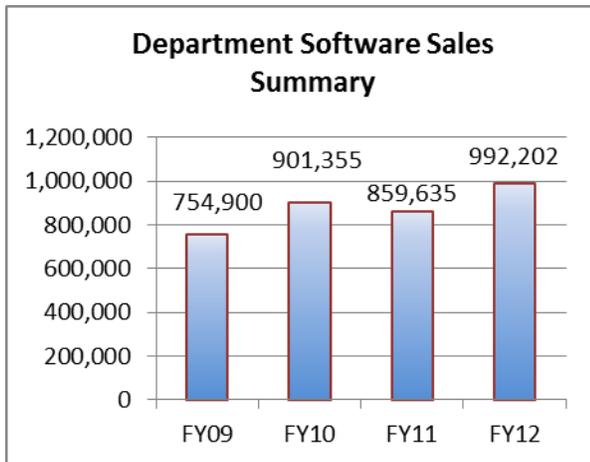
Computer Purchasing pursues our commitment to diversity and inclusion, and to strengthening of SWAM businesses. We develop and strengthen our supply chain when we seek competition from diverse sources. Combined expenditures with SWAM vendors for both Computer Purchasing and the Department of Purchasing increased from \$83.3 million in 2011 to \$91.8 million in 2012, with Computer Purchasing contribution significantly.



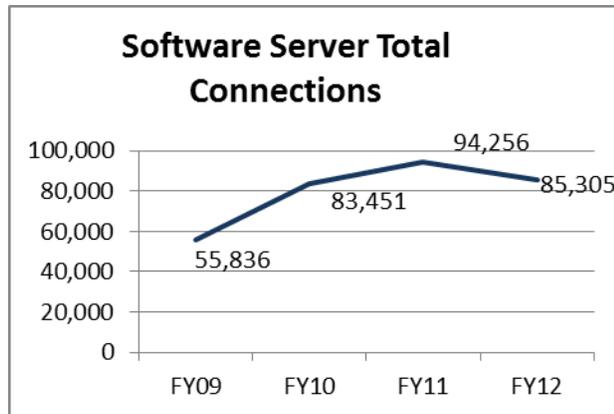
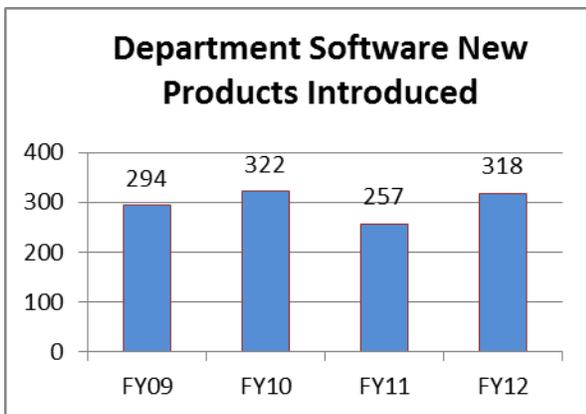
## Departmental Software Distribution

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. Some titles are available at no cost to departments, and some are available for individual faculty and staff purchase. 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 that we can obtain at quantity discounts and for which there is a demand by departments. Total recoveries include billings to other universities for their share of both the Virginia state-wide ESRI and Mathematica education site licenses which we manage.

The following graphs show totals of departmental purchases. The increase seen in FY2012 is due to significant sales in Microsoft products, Qualtrics, Matlab Toolboxes, and additions to the Microsoft Campus Agreement subscriptions. Total sales increased by \$154,400, an 18.22% gain, and product distribution grew by 437 units.



The number of new products introduced over the last four years has held relatively steady. The number of connections made to our software server during that same timeframe has increased. Distribution numbers do not include numbers related to site licenses which were distributed through the network software installation service. We saw a drop in the number of server connections.



Currently Software Distribution offers 184 titles for download on the network server, and Campus Agreement subscribers account for the majority of server connections. Other software titles offered on the network server include Matlab, JMP, LabVIEW, Chems sketch, Dyknow, Granta, ANSYS, Abaqus, SPSS, SAS, Mathematica, Autodesk, ESRI, Tecplot, PDF Annotator, Identity Finder and Simapro. Each year Departmental Software and Information Technology Acquisitions receive more requests to manage specialized software with our server.

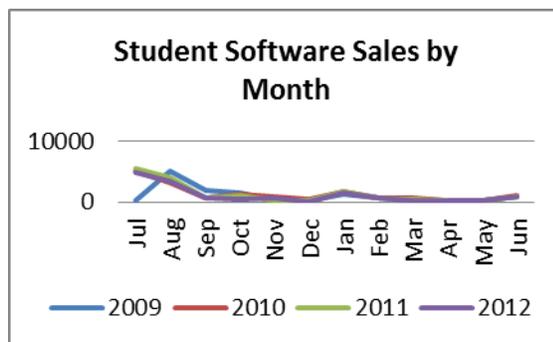
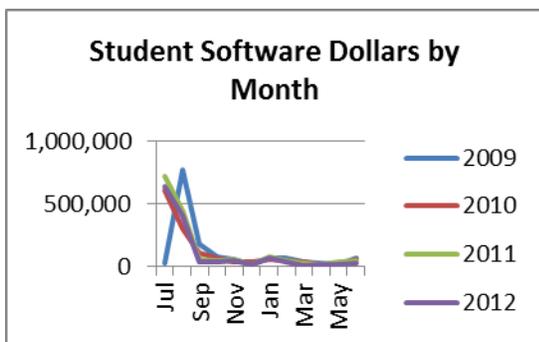
The decline in connections from FY2011 to FY2012 is due in large part to several improvements made by our staff. Simplified installation instructions and support assistance from the Software Assistance and Education Center (SAEC) help desk have had a positive impact, with fewer requirements for repeated downloads.

## Student Software Distribution

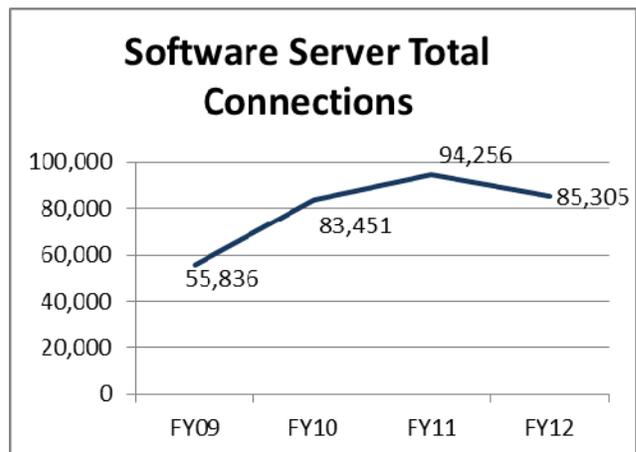
Student Software Distribution is a part of the Software Distribution Office and is organized as an auxiliary. Student Software was originally organized to provide software for the Freshman Engineering Bundle. It now handles bundle requirements for six academic areas (within the university and satellite campuses in Northern Virginia) and a Microsoft Undergraduate Bundle for all incoming undergraduates. Student Software also distributes software to other students, faculty, and staff. Because they are not eligible for a bundle, software distributed to those individuals is primarily 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 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 otherwise available.

Since the implementation of the Microsoft Undergraduate Bundle at the end of FY2009, ITA has become a permanent member of the university's New Student Orientation Team. This committee is composed of members from several academic areas across the university. Our participation with the committee keeps us abreast of current academic trends and issues in education that may affect the software that is 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. Crossing all academic, administrative, and support areas has allowed ITA to be on the forefront of the development of solutions that benefit the university.

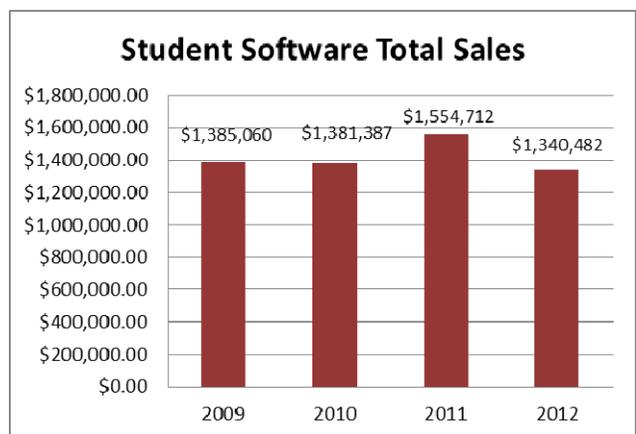
Implementation of the Microsoft Undergraduate Bundle in FY2009 resulted in a dramatic change in the timing of billing. There has been a steep increase in sales in August. In FY2012, as was done in FY2011, Student Software Distribution crafted an informational email message regarding the university's requirement and billing procedures for the bundle, which was sent to over 6000 incoming students.



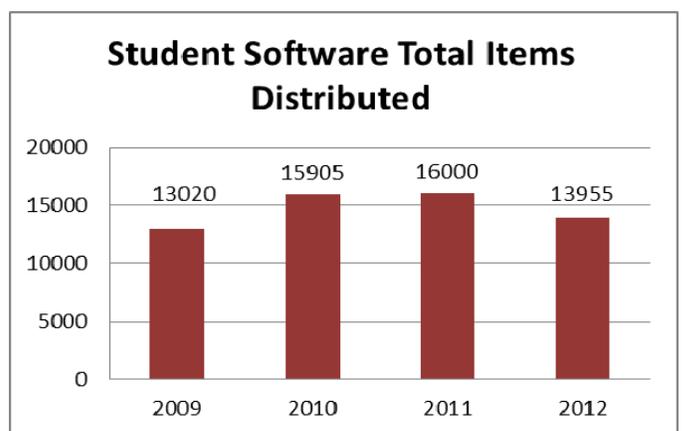
We have seen significant growth in distributing software to students and departments via downloads or virtual mounts. ITA offered 184 software titles encompassing more than 976 GB on the Network Software Server. Several factors contribute to the decline in connections to the download server. Many of the products are one-time downloads, such as the Office Suite for Mac and Windows and the Windows operating system. Additionally, ITA simplified its installation instructions to further assist students, faculty, and staff downloading software. Moreover, the SAEC help desk expanded their installation assistance this year, thus, reducing the need for multiple installation attempts.



Bundled packages have changed the way Student Software distributes software. During FY2012, Student Software Distribution sold fewer copies of individual products than in previous years. Much of this decline is due to the Microsoft Undergraduate Bundle requirement. Since all incoming undergraduates purchased the bundle, the need for individual sales of all Microsoft products decreased.



Overall, Student Software saw a decrease in total sales by \$106,896.50, a 12% decline. A reduction in sales of individual software titles led significantly to the decline. Total sales for Adobe products decreased from FY2011 to FY2012. Although Student Software Distribution offered the 5.5 version of the Creative Suite titles, many students, faculty, and staff chose to wait for the anticipated release of the full version 6. Sales also decreased due to the fact that some individual products are dependent upon class enrollment. Granta sales increased by nearly 41% from FY2011 to FY2012 as the more classes were added in Materials Science and Engineering classes, which require Granta.



## Software Assistance and Education Center

The Software Assistance and Education Center (SAEC) began operation November 1, 2010, as a joint initiative between Information Technology Acquisitions and University Computing Support. The purpose of the SAEC is to assist the university community through a hands-on approach where the customer is involved in resolving their own computer issue. By engaging the customer, we attempt to transfer knowledge so that they become more self-sufficient and perhaps able to assist others. Now in its second year of operation, SAEC has proven to be beneficial to the university community as patronage increased 150% over 2011 figures. Between August 2011 and August 2012, 512 people received assistance with issues such as software installation, wireless configuration, virus eradication, and software updates. Survey data revealed that students comprised 93% of the customer base; faculty, 5%; and staff, 2%. The survey also revealed an overall 97% approval rating of services based on timeliness in resolving the issue, knowledge, courtesy and professionalism of the support staff, and overall service experience.

## Contract Management, Licensing and Billing

The Contract Management, Licensing and Billing section of ITA has the responsibility for managing the various contracts and licenses that are used for distributing software to the university and the state of Virginia. New releases and additional software acquisitions drive much of the work generated by this part of the ITA organization.

Virginia Tech is in its eleventh year of managing the Esri statewide contract to provide GIS software to sixteen universities and twenty-three community colleges. Each participating university continues to save between \$10,000-\$15,000 on their yearly renewals by taking advantage of the statewide contract. The contract also provides complimentary full version software to students at each university under the contract. Unlimited free training is another feature provided by this contract to faculty, staff, and students. As holders of the contract, ITA is the single point of contact between Esri and the statewide users.

In 2012, ITA added two new software products, Business Analyst and Spatial Labs, to the Esri statewide contract. Adding these products involved contract negotiations and legal approval. ITA made the decision to require each school on the statewide contract to sign a new memorandum of understanding with Virginia Tech. This decision was made due to additional stipulations and license requirements concerning the new products. ITA continues to offer additional support to the Virginia Community College System as well as the Geospatial Extension Program.

Building upon the successful efforts of 2011, the Mathematica statewide contract successfully went into effect on August 1, 2012. All participating schools were pleased with the products offered and the licensing systems that are in place. Before the 2011 fall semester began, two additional schools—Hollins University and Emory and Henry College—joined the statewide contract. Additionally, in June of 2012, ITA began negotiations with Mary Washington University to add them to the statewide contract.

The Contract Management, Licensing, and Billing division handles billing for both Student Software and Departmental Software. It also manages most of the technical aspects related to software distribution. The division develops various software distribution methods. Students and faculty 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. Detailed documentation is provided to allow more straightforward software installations for faculty, staff, and students.

The group also acts as a liaison to departments regarding access to software and services specified in contracts (for example, Microsoft download products and volume license keys). We create and manage license codes, such as the yearly Matlab activation keys that terminates on a specific date.

Contract Management, Licensing, and Billing manage license servers including LabVIEW, ANSYS, Abaqus, and ArcGIS, and troubleshoot various software installation and activation issues.

The contract management team works to ensure that all end users are aware of contract requirements and stipulations. An extensive effort is given to working with each software vendor to take advantage of all licensing controls that are offered by the vendor to ensure that their software is controlled within the constraints of the contract.

An increasing demand for license server management has also continued. ITA works directly with the Document Management Systems group providing campus-wide license servers for ESRI, Matlab, Ansys, Abaqus, and Labview for faculty and students. License server administration often requires extensive testing and setup to ensure availability to the correct end users. Assuming license server management enables departments to focus on core competencies by relieving them of the burden of managing complex license requirements.

ITA has also assumed additional support for various software installations and activation issues. As software is more secured against piracy, more installation issues occur. Due to the methods that software manufacturers employ to guard against software piracy, additional support for the end-user is required.

This year Contract Management, Licensing and Billing negotiated Office 365 and Campus Agreement renewals, and created and tested builds for ANSYS, SAS, Matlab,

JMP, Granta, Mathematica, EndNote, LabVIEW, SPSS, SimpleHelp, and WebDrive. ITA was successful in negotiating a site license for SAS software at a significantly lower fee than previously paid for the limited license. This change will give us the option to install SAS on more servers throughout the university, including the servers in Advanced Research Computing, an option that was cost prohibitive under the previous agreement.

Through our initiatives, the Campus Agreement program also expanded in 2012. This year we added 24 new departments. To date, ITA manages the Campus Agreement program for 87 departments with a total FTE count of 4846. As departments discover the benefits of ITA's licensing management capabilities, we expect to see an increase in demand for services.

## Staff development

This year, ITA focused on staff development. Employees were encouraged to take advantage of educational opportunities designed to enhance their skills and abilities. Over the course of the year, all team members participated in training seminars and classes. Certifications and certificates of completion were either obtained or renewed and ITA's director of contract management achieved her Virginia Contracting Officer designation. Other key training achievements included the Virginia Public Procurement Act Seminar, Purchasing, Google Tools for Higher Education, Procurement Forum 2011, SANS Securing the Human, Contract Administration Seminar, Critical Thinking Skills, PowerPoint 2010-Introduction, Management Skills for New Supervisors, Diversity Development Institute: Understanding Ourselves and Our Multicultural Conflict Dynamics, Access 2010-Intermediate/Advanced, Excel 2010-Intermediate/Advanced, Outlook 2010-Introduction/Advanced, Word 2010-Intermediate/Advanced, Leading Change, and Effective Organizational Skills.

Once again, Information Technology Acquisitions has continued to serve not only Virginia Tech, but also, the Virginia higher-education communities within the state. We look forward to continuing our efforts in FY 2013.





# Information Technology Security Office

The Information Technology Security Office (IT Security Office) provides technology tools and services, education, awareness, 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. Key activities this year include network monitoring, forensics, information technology security reviews, training and awareness, and development and implementation of components for the restricted/limited access network.

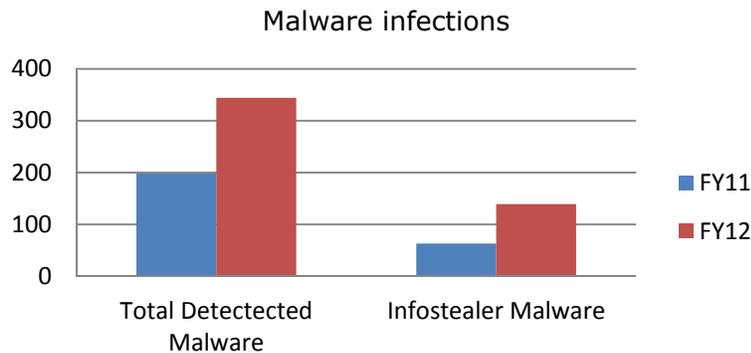
## Cyber Security Initiative

The IT Security Office benefited from a Cyber Security Initiative that was funded this year. This initiative helped meet critical needs for the IT Security Office including equipment for additional network monitoring, data correlation, and intrusion prevention systems (IPS) to assist in detecting and stopping network based cyber-attacks and malware. The IT Security Office also received funding for three new positions to assist in daily operations, network monitoring, and performance of security reviews. A majority of the equipment was in place and contributing to IT Security Office's daily operations by the end of the fiscal year, and the new positions were expected to be filled at the beginning of the coming year.

**Restricted Limited/Access Network (RLAN).** The development of a restricted limited/access network (RLAN) was another critical piece of the initiative. The purpose of the RLAN is to protect personally identifying information (PII) by developing a dedicated network with enhanced intrusion detection and prevention capabilities typical of defense-in-depth architecture. The network is designed to lower the risk of exposure of sensitive data for administrative units that access large volumes of PII. The IT Security Office and Network Infrastructure and Services began the collaborative project this year and we expect its completion during the coming year.

## Network monitoring

The information-stealing class of malware—malware capable of giving unauthorized access to systems, stealing passwords and having the ability to search for PII data and transfer copies of it to sites outside the Virginia Tech network—continues to attack Virginia Tech computers. During FY12, significant improvements were made to the IT Security Office’s ability to monitor the Virginia Tech network for this advanced malware. Two FireEye® malware detection appliances were purchased to enhance our ability to intercept malware. The FireEye® malware detection appliance monitors network traffic for malicious communications with known control servers associated with malware. The FireEye® appliance is also able to detect and warn of malicious files downloaded from the Internet that may carry zero-day infections and exploits. The IT Security Office was able to detect and mitigate 344 compromised machines from academic, administrative, and research units during FY12. Malware classified as capable of stealing passwords and PII was detected on 139 of the compromised machines. FY12 data also showed that more than 40% of the detected compromised machines had multiple malware infections.



Network monitoring improvements include a StoneGate Intrusion Prevention System (IPS) and a security incident event manager (SIEM). The IPS system will be an important tool assist in monitoring network based attacks using the IPv4 and IPv6 protocols. The SIEM will allow the IT Security Office to correlate data from multiple sources including existing network monitoring tools and event logs from desktops and servers. The SIEM will also allow the office to share data views with departmental support personnel in real time about their information technology assets. Both systems went into production during June.

**Notifications.** Compromised machines sometimes lead to potential data exposures and Virginia Tech notifies people who may have had their data exposed as a precaution. Ten different departments sent 895 notifications relating to incidents from compromised machines.

**Opportunities.** The threat from sophisticated malware is serious and improvements must be made in early detection and quick mitigation of issues. To meet the challenge, the ITSO is committed to improving all areas of compromised machine detection and mitigation. The ITSO has set the following goals to make these improvements:

- Reduce infection-to-remediation time with improved notification and response
- Continue to create or obtain tools to better correlate and analyze previously unseen malicious network traffic

## Awareness and training

The IT Security Office continued to present cyber awareness and technical training to faculty, staff, and students online and in-person during FY12.

**Online awareness training.** The SANS “Securing the Human” (STH) online cyber awareness training is managed by the IT Security Office and provides an excellent opportunity for faculty and staff to learn about cyber threats that put Virginia Tech data and systems at risk. Participation in the SANS STH online cyber awareness training increased by 800 people during FY12, with total enrolled almost surpassing 3000. The training continues to be well received and participation continues to grow. The ITSO anticipates adding an additional 1500 users to the STH system.

**Advanced cyber security training.** The IT Security Office sponsored the SANS SEC 503, “Intrusion Detection—In Depth” course as part of its annual technical training effort. Attendees gained skills necessary to detect and prevent cyber intrusions into systems. The course was attended by 115 people from the Virginia Tech and communities across the United States.

**Faculty, staff, and student awareness.** The Faculty Development Institute (FDI) continued to be one of the most effective ways to reach faculty. The IT Security Office was able to deliver 32 presentations to FDI, covering multiple topics:

- Answering your Technology Security Questions
- The Basics for Computer Security
- Using TrueCrypt for Encryption
- Identity Finder - Finding Sensitive Data on your Computer
- Securing Your Own PC
- Securing Your Own Mac

The IT Security Office also worked with staff and faculty members and presented general cyber awareness, how to search for PII, and encryption.

The IT Security Office continued to reach students through student orientations, guest lectures, and advertising in the "Welcome Back" issue for returning students. The IT Security Office also participated in Gobblerfest and shared awareness material and promotional items with hundreds of students.

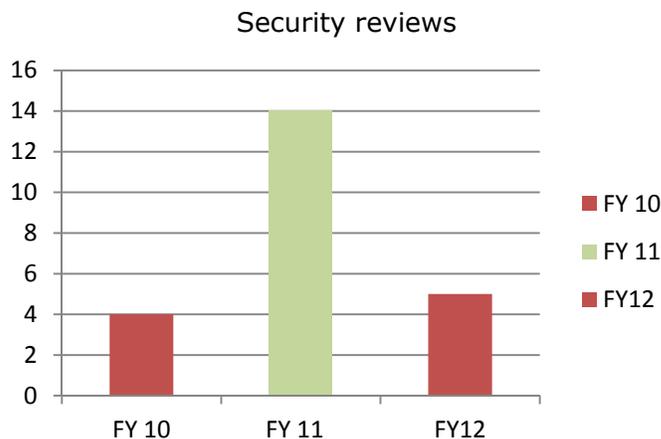
**Opportunities.** Awareness efforts for faculty, staff, and students equaled last year's efforts. While target goals were not met for participation in online training, we believe online training presents the best opportunity to reach large audience and we are committed to increasing participation.

The following goals have been set for the coming year:

- Increase the number of outreach presentations made to the community.
- Increase participation in online awareness training.
- Create and pursue an awareness strategy that helps protect data and systems.

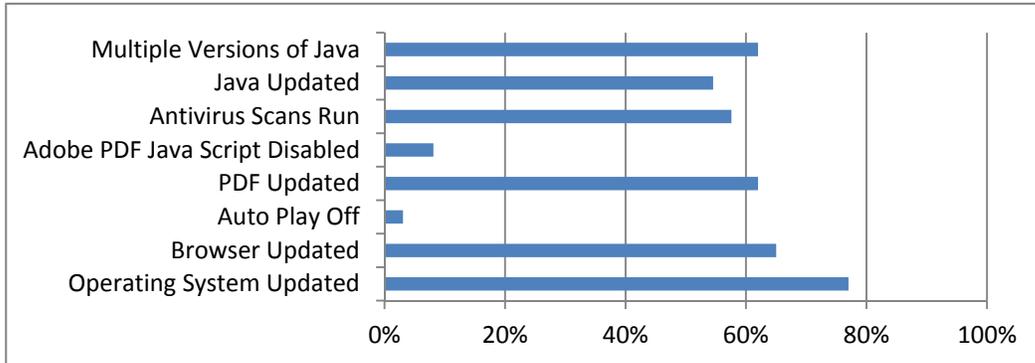
## Security reviews

Security reviews are offered by the IT Security Office to help departments discover potential cyber problems that could result in sensitive data disclosures, illegal usage, and potential vulnerabilities that weaken information technology systems. The IT Security Office did not meet its goal of 20 reviews this year, but is committed to increasing the number of security reviews conducted, their quality, and their relevance. The IT Security Office expects to exceed 20 security reviews for next year with the addition of new analysts.



Security reviews continued to uncover issues that put university data and systems at risk. Data from desktop configuration checks show common third-party software patching issues that are exploited by malware remain prevalent. The frequent patch

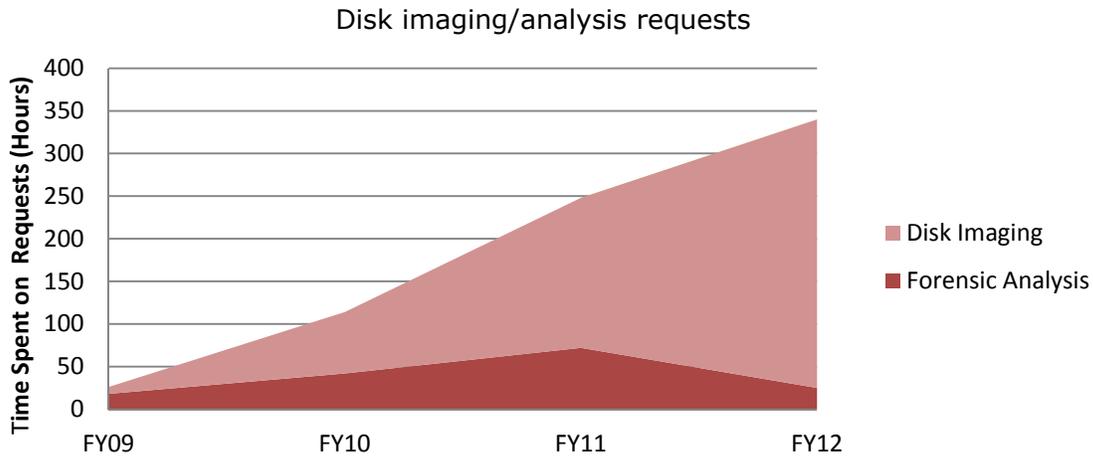
rates for third-party software, including Adobe Flash, QuickTime, Adobe PDF, and Java, continue to challenge departmental staff. Reviews commonly found issues with departments having improper backup procedures, poorly configured host-based firewalls, and poor data protection methods. The IT Security Office worked closely with these departments to help mitigate the issues.



**Opportunities.** The IT Security Office will continue to pursue information technology security reviews in areas of high risk and assign additional staff to conducting reviews. While improvements have been made in documentation, the IT Security Office will commit to improving completion rates and effectiveness.

## Forensic work

The IT Security Office observed a sharp decrease in forensic analysis and continued increase in the number of hours spent imaging disk. The increase time spent on disk imaging can be explained by the increased size of hard disk in use by newer computers. The IT Security Office developed and put into production a digital data requests system (DDRS). This system helps track forensic and imaging request and work progress. DDRS is used by many university stakeholders including University Legal Affairs, Internal Audit, and other individuals responsible for forensic and e-discovery activities.



## ITSO Lab

The IT Security Lab serves as a test bed for production-oriented hardware and software security systems and provides a teaching hospital environment for undergraduate and graduate students. Key goals for the lab going 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 intrusion detection system data with 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. The Cover-VT framework will be a component of the university's Cyber Security Operation Center.

Examples of Cover-VT displays: a campus view; a world view



**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.

**Autonomous vehicle security.** A new research opportunity has been started in collaboration with Dr. Al Weeks to incorporate cyber security defense techniques in autonomous vehicles. This research will investigate the effects of cyber-attacks against this class of vehicles.

**Cyber Security Teaching Hospital.** The IT Security Lab delivers hands-on classwork in a teaching hospital environment for ECE 4560 (Computer and Network Security Fundamentals) and ECE 5984 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 emerging IPv6 security. The SANS Institute provided a gift of \$30,000 to promote and advance the Cyber Security Teaching Hospital.

This year, a doctoral and a master's student who had been working with the lab completed their academic programs.

**MTD6 research.** The Moving Target Internet Protocol version 6 Defense (MT6D) was developed in the Information Technology Security lab by Matthew Dunlop and Stephen Groat under the advisement of Randy Marchany and Joseph Tront. The objective of this research is to protect hosts from targeted IPv6 network attacks, preserve the privacy of communicating hosts, and allow hosts to communicate anonymously over the network. 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 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 a number of Federal government research proposals coordinated by the Virginia Tech Applied Research Corporation. It has a US patent pending. MT6D papers were presented at the SANS IPv6 Summit, and will be presented at the IEEE Military Communications Conference. The researchers wrote an article on MT6D that is featured in the July/August 2012 issue of IEEE Security & Privacy Magazine.

**Cyber security competition.** Lab students created a cyber-security competition environment following the capture-the-flag format that was used for a cyber-security summit for students from Mid-Atlantic universities and colleges. The event was hosted at the Virginia Tech Research Center—Arlington. Participants were from James Madison University, Marshall Academy, US Naval Academy, University of Maryland, and Virginia Tech. The competition allowed these students to test their skills to successfully analyze attack and defend a network built by student officers of the Cyber Security Club at Virginia Tech.

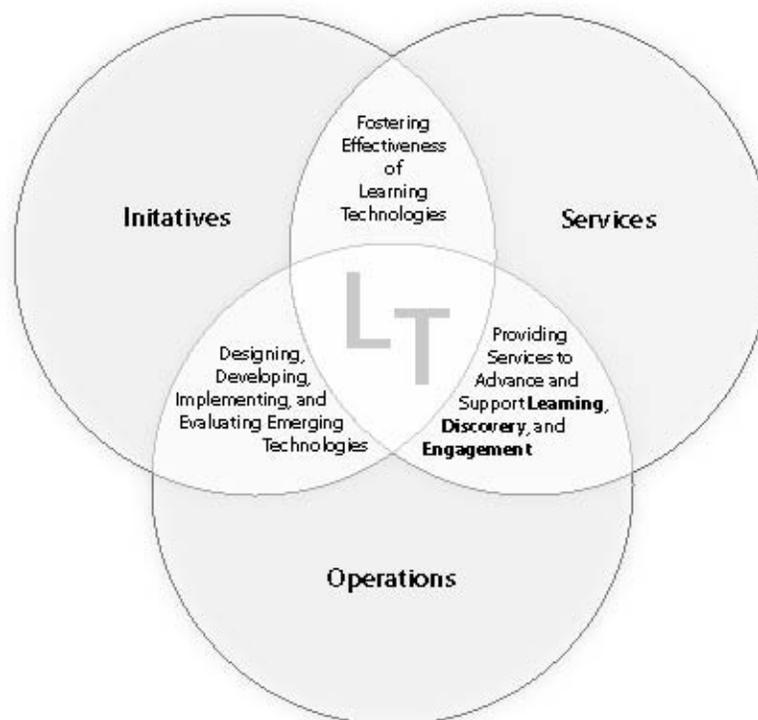
**Opportunities.** It is the lab's goal to continue to increase cyber-security research and provide a hands-on learning environment. The ITSO Lab will continue to pursue research and funding opportunities to help promote student learning and advancements cyber security issues.



# 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. We work

- 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.



Several initiatives stand out among the accomplishments for the 2011-2012 year.

**Distinguished Innovator in Residence.** Virginia Tech's first Distinguished Innovator in Residence (DIR), Jon Udell (see <http://blogs.lt.vt.edu/innovator>), was in Blacksburg in spring 2012. Under the leadership of Learning Technologies' Gardner Campbell and in partnership with University Libraries, the DIR program partnership will continue next year, with a DIR planned for both fall and spring semesters.

**Re-visioning of the Center for Innovation in Learning Programs.** The Center for Innovation in Learning has initiated new programming activities. One of the newest contributions is the New Media Faculty-Staff Development Seminar, a flagship program for the newly re-envisioned "proto-CIL." (The CIL's grand opening is in fall 2012.) Over both semesters of the 2011-2012 academic year, nearly thirty Virginia Tech faculty and staff took part in this experience, including members of these departments: Biology, Rhetoric, Mechanical Engineering, Urban Planning, History, ASPECT, Newman Library, Learning Technologies, the Institute for Policy and Governance, English, Forest Resources and Environmental Conservation, Geoscience, Fish and Wildlife Conservation, Science and Technology Studies, and the Virginia Tech Foundation. In addition, networked participants across the United States and around the world included the University of California-Berkeley, Brandeis, Houston Community College, Baylor, the University of Queensland, Benedictine University, Whitman College, the University of Central Florida, Tulane University, as well as participants in a Second Life seminar group with faculty, staff, and journalists living in Missouri, Florida, Aruba, Belgium, and other far-flung locations (see the Netvibes hub for this group at [http://www.netvibes.com/vw-nmfs-f11#NMFS\\_Home](http://www.netvibes.com/vw-nmfs-f11#NMFS_Home)).

Another "proto-CIL" initiative was the Honors Residential College (HRC) blogging initiative, which included over 300 student blogs written over the academic year. One HRC student presented on her work at the EDUCAUSE Learning Initiative in Austin, Texas in February 2012. She was joined by Dr. Rob Stephens, the faculty principal for the HRC, as well as Dr. Campbell (FDI/CIL director) and Dr. Sparrow (director of InnovationSpace). This initiative also won an XCaliber Award for 2012.

**E-book pilot.** In partnership with EDUCAUSE and Internet2, Learning Technologies initiated an e-book pilot that will be delivered in the fall 2012 semester in as many as 40 course sections where faculty volunteered to participate.

**New learning spaces.** Learning Technologies redesigned 1120 and 3080 Torgersen Hall with variations on white board space, flexible seating, new technologies, inviting wall and furniture colors, and experimental room arrangements to promote exploration of teaching and learning with technology.

**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. After pilot implementations in 2010-11, all colleges began using the system by the end of 2011-12.

**Report of the ePortfolio Innovation Committee—EPIC.** EPIC's mission is to define the use of ePortfolios for a general undergraduate population. Initiated in May 2010, the committee is composed of twenty faculty members representing all

undergraduate colleges. In 2011-12, the committee's work included a report with recommendations for next steps in ePortfolio implementation and use for undergraduates.

**Digital Preservation Network.** In partnership with University Libraries, Learning Technologies began support for a national Research University Repository and its associated Deep Archive Project in spring 2012. This federated approach to preservation of academic content will build upon the higher education community's current investments to create sufficient diversity of preservation approaches to assure access to the digital scholarly record far into the future.

**Discovery Commons.** The research repository opened last year 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, and public access and online viewing has grown significantly over the last year. Other major projects are in development for the repository. Discovery Commons is available as a permanent location for hosting and preserving collections associated with research and providing myriad levels of access to those university assets.

**4-VA.** 4-VA is 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 has installed Cisco TelePresence facilities to promote shared learning across campuses. Through TelePresence facilitated planning, programs are developing for STEM course redesign, foreign languages, research initiatives, and more. For example, a conference on course redesign in biology occurred at James Madison University that was attended by 4VA biology faculty and others from across the commonwealth.

**External links.** Selected organizations in which Learning Technologies actively participates, from maintaining the benefits of membership for the university community to serving as board members, reviewers, and editors, include the following:

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

Pearson Strategic Advisory Board	member
ResearchChannel	board member
Redesign Alliance	board member
Sakai	institutional representative
WICHE Cooperative for Educational Technology (WCET)	institutional representative

## Operations

The operations teams provide production support, documentation, quality assurance, maintenance, and application development for several enterprise-level systems. Those managed by Online Learning and Collaboration Services (OLCS) are Scholar, including ePortfolios and the SPOT survey system; the legacy course evaluation system; the FDI tracking system; ElementK; DyKnow; and WordPress. Together the development and systems administration teams that work on these systems provide practical and innovative technologies for university-wide use.

Digital Imaging and Archiving provides university-wide resources for production support, quality assurance, preservation, development, distribution, and stewardship of digital research assets in Discovery Commons, the research repository at Virginia Tech. Services include site development and content acquisition.

### Major systems supported

The operations teams are responsible for several production systems. For general information on the two operations teams noted above see [www.olcs.lt.vt.edu](http://www.olcs.lt.vt.edu) and [www.emd.vt.edu](http://www.emd.vt.edu).

**Course evaluation data mart.** This data mart, managed by the Information Warehousing and Access, is the first Virginia Tech data warehouse to use open-source JasperSoft software for reporting. It works as part of our end-to-end solution for SPOT surveys (see Scholar SPOT Survey System below and <https://webapps.es.vt.edu/jasper/login.html>).

**Discovery Commons Research Repository.** Discovery Commons is available as a permanent location for hosting and preserving collections associated with research and providing myriad levels of access to those university assets. The repository is hosted by the Database and Application Administration unit and managed by Document Management Systems in Enterprise Systems. Enterprise Systems 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 VTLIS, Inc., and built on Fedora Commons Repository Software, an open source solution for the development of digital object repositories. (<https://dcr.emd.vt.edu>).

**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](http://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](http://www.elementk.com))

**FDI tracking system.** The tracking system is used to manage program participant activity, workshop registration, Web pages, and computer selection, delivery and inventory.

**Legacy course evaluation.** The course evaluation software was developed from software provided by Columbia University and was a pre-cursor to the Scholar SPOT survey system. (<https://courseeval.cc.vt.edu/login/>)

**Scholar.** This course management system is based upon the open source Sakai Project ([www.sakaiproject.org](http://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 "Evaluation System" and has modest adoption by the open source community, with active development by approximately 10 universities. (<https://eval.scholar.vt.edu>)

**WordPress.** WordPress provides a blogging platform for faculty, staff, and students. Our enterprise instance is hosted offsite by ZippyKid. (<https://blogs.lt.vt.edu>)

## Completed initiatives

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

**Scholar.** We replaced our database server this year, which helped improve Scholar stability and performance. Furthermore, we upgraded Scholar from version 2.7.1 to 2.8.1 in May 2012, 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>

**Legacy course evaluation.** We discontinued support for and use of the Legacy course evaluation system in May 2012. Data was exported from this system and continues to be provided to departments as requested for historical reporting needs.

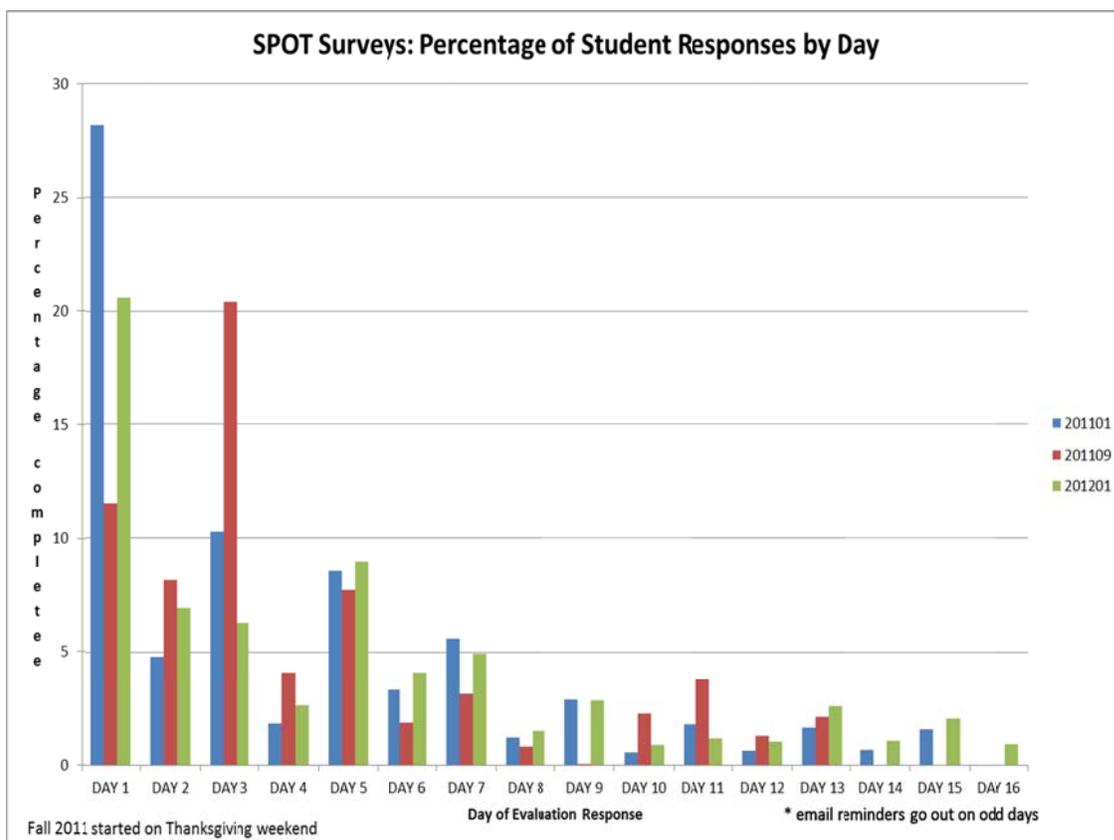
**WordPress.** A production level instance of WordPress was started this year and used in pilot-mode for Fall Semester 2011 and Spring Semester 2012. A yearlong contract with options for renewal was signed with our outsourced hosting company of this service. We expect considerable growth in use of WordPress during the next year.

**ElementK.** We decided to discontinue use of this product offering during this year and initiated a contract with Lynda.com to provide a similar service for the future.

**Scholar SPOT Survey System.** In partnership with the Office of Academic Assessment, we successfully deployed the Scholar SPOT Survey System for end of semester course evaluations university-wide. We grew from two colleges hundreds of courses in 2011 to running this for the entire university in Spring Semester 2012 (over 4500 courses and 85,000+ responses from students). Response rates have been quite strong.

Semester	College(s)	Total # of Requests Sent to Students	# of Student Responses	Response Rate
Fall 2010	CNRE	5,046	3,987	79%
Spring 2011	CNRE, COE	26,130	19,166	73%
Fall 2011	CALS, CAUS, CNRE, COE, COS	86,297	58,219	67%
Spring 2012	CALS, CAUS, CLAHS, CNRE, COB, COE, COS	125,502	86,362	69%

When you look at response rates by day of the evaluation period (chart below), you can see an interesting pattern. There is a "reminder effect" given that we send out email reminders every other day to students. We continue to study trends and analyze data for this process, striving to make sure we maintain a reasonable response rate from our students to give faculty the best feedback possible.



**Discovery Commons.** The Discovery Commons work included development of a solution for preservation storage that incorporates a single charge for indefinite maintenance of repository preservation files. The cost for permanent storage is in the final stages of implementation.

This year, we formalized a collaboration with University Libraries through a reporting structure between the Library Dean’s office and the Director for Imaging and Repository Initiatives. This structure allows for direct communications between the institutional repository supported by the library and Discovery Commons.

A solution was proposed for adding Shibboleth as a security measure to repository projects that require protected access. In cooperation with VTLS, this solution has been developed and is currently being tested. This upgrade will be introduced for VITAL 5.4 in August.

Data management became a requirement for grant-funded research during this fiscal year. As a result, we developed an outline for considerations related to data management, presented information related to data preservation in a workshop with the Research Division, and joined a working group for data management hosted by the Southeastern Universities Research Association in an effort to coordinate data management efforts across institutions.

## Operational work

Our operations teams strive for continuous improvement, taking input from those who use these technologies. A Scholar advisory board was re-launched this year, which includes representatives from all colleges and other major Scholar user groups (like VTTI and VCOM) to provide for ongoing discussion about what is working and not working with the system. Regular self-assessment and outside assessment of our offerings allows us to learn, grow, and improve regularly. Furthermore, such feedback helps us prepare for future maintenance releases and larger upgrades.

Additionally, we've regularly surveyed faculty and students each semester following use of the Scholar SPOT survey system. We found that students definitely prefer this method for taking surveys. The statement that was presented to over 23,000 students in different course sections across five semesters was, "I prefer filling out this evaluation form on-line rather than filling out the paper-and-pencil form in class." Their responses were 87% positive.

<b>Response</b>	<b>Percentage</b>
Strongly Disagree	5%
Disagree	4%
Somewhat Disagree	4%
Somewhat Agree	10%
Agree	20%
Strongly Agree	57%

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 up our expertise in quality assurance, improving our skills in this domain to ensure high quality Scholar releases. Responding to trouble tickets opened by faculty and students remains another important function of OLCS. One measure of our success regarding trouble tickets is driving volume down, while providing a high level of customer service, accomplished by providing better tools and better proactive support upfront through discussions and FDI training. The table below shows the volume of tickets our team has closed by fiscal year for the past several years.

<b>FY</b>	<b>Tickets closed by OLCS</b>	<b>Notes</b>
2009	4225	Running Blackboard and Scholar
2010	3458	Running Blackboard and Scholar
2011	2275	Blackboard turned off Dec 2010
2012	1560	Scholar only

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 Discovery Commons is increasing access to digital materials represented by research while adding value to discovery resources by organizing those materials in repository collections.

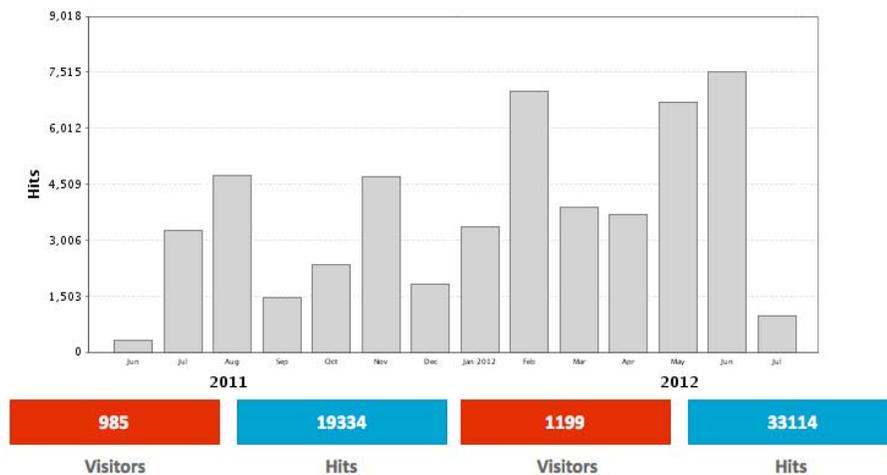
Quality remains a high priority for standards based formats and metadata schemes representing academic disciplines and fields of study. As a result, we are actively investigating methods to add consistent metadata tags that allow searches based on

discipline and other preset browsing topics in an effort to assist users. These efforts also include names associated with research, a key element for identifying authors and others persons involved with research projects.

Metadata entry also requires validation of terms for consistency. Our goal related to metadata entry is to assist departments and faculty in developing spreadsheets that simplify data entry while incorporating validation formulas for consistent content.

During the year, the team processed 84,494 unique. Each image was prepared for preservation either in TIFF or JP2 format. The images were also re-purposed as surrogate files for presentation in the repository. These images formed the basis for adding three new projects to the repository and become available with the upgrade to VITA 5.4 in August.

Usage of the repository is also increasing as indicated below for the existing American Civil War Newspapers project.



## ePortfolio, Faculty Development Institute, Graduate Education Development Institution

Within Learning Technologies, the units that focus on ePortfolios, the Faculty Development Institute (FDI), and the Graduate Education Development Institute (GEDI) form a hub of activity focused on transforming teaching and learning across the university.

### ePortfolio Initiatives

During the 2011-2012 fiscal year, the ePortfolio Initiatives office has continued to deepen its engagement with existing programs using ePortfolios, as well as to expand ePortfolio use in new programs throughout the university.

The ePortfolio Initiatives office has met with at least 18 groups to either further promote the adoption of ePortfolio software or to help programs envision the specifics of assessment and student learning projects that can take advantage of ePortfolio tools. We currently have 97 projects in some state of development, with projects in all of the university's colleges and the Division of Student Affairs. We have over 7,000 students participating in ePortfolio activities across all of the projects, and over 3,000 students building portfolios in our open Scholar site (eP@VT). Our most significant project is the collaboration with the Pathways First Year Experiences. In that project, we are working with twelve groups, more than 50 faculty and staff members, and more than 2000 students. We have performed some form of development or maintenance for at least half of our 97 existing projects.

We also continue to engage in the growing professional field of ePortfolio Studies. For example, our group has presented at least 10 major conferences, and we continue to publish the newsletter (*The AAEEBL Learner*) for the Association for Authentic, Experiential and Evidence-Based Learning (AAEEBL, the world ePortfolio organization). In November 2011, we hosted the AAEEBL Southeast Regional conference, we won an international award (the Teaching with Sakai Innovation Award), and we have participated in at least ten outreach activities, including presenting a keynote presentation for a symposium on ePortfolios and First Year Experiences. In addition, we were named as contributors to two campus-based awards given to the English Department for their extensive use of ePortfolios for student learning and for programmatic improvement (XCalibur, 2011; Exemplary Department Award, 2011).

During the 2011-2012 academic year, ePortfolio has also made a few important technical advancements. Firstly, we have made improvements to our templates behind the scenes with our underlying rendering techniques. Additionally, we are moving towards externally hosted static files to both remove load from Scholar and to speed up the display of our templates. These improvements will allow us to make our templates more modular and hopefully in the future allow for innovations in the types of pages we offer to students. We continue to shape the ability for the system to provide for a number of different kinds of ePortfolio activities.

Secondly, we have implemented a new version of the reports tools within Scholar. This will allow us to report on evaluations, attachments, reflections and other student-entered data in the system. This is a critical piece of the campus ePortfolio program, including the FYE Pathways programs. This provides the "closed loop," providing the data programs need to base their plans for improvement.

Our goals and objectives for the next fiscal year include continuing the growth of ePortfolios at Virginia Tech by drawing strong connections with Dr. Daniel Wubah's Undergraduate Vision Plan. With this as our focus, we plan to form three task-oriented committees. The first is a student-focused group developing a template for an ePortfolio for Personal and Professional Development (ePDP). This group will also develop a model for student peer mentors, as well as a student ePortfolio Showcase. The second group is faculty-focused, looking into ways to promote faculty use of ePortfolios, including grant opportunities and connections with larger campus curricular initiatives. The third group is ePortfolio-focused, and it seeks to determine best practices for ePortfolios, create an Activity Bank, and develop a curriculum for a

Summer Institute of ePortfolio evaluation. The Summer Institute connects with our overarching desire to revise our approach to faculty development.

In addition, we will continue to explore and develop ePortfolio-related technologies on campus. With new efforts on video management, we hope to see an expansion of video creation for students; also, the increased use of blogging on campus gives us another platform with which to experiment for use in ePortfolio processes.

Overall, our fourth year of the ePortfolio Initiatives has seen a continued deepening use of ePortfolios on campus. We have seen a steady growth in the number of programs and students using 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 continue to move from a grass-roots pilot to an institutional signature experience.

## Faculty Development Institute

FDI's mission 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 throughout civilization. FDI strives to help faculty engage with these rapid changes within the context of their work at a 21<sup>st</sup>-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 (GEDI), the Center for Innovation in Learning (CIL), and the ePortfolio initiative.

During the spring and summer of 2012, 480 faculty members participated in short courses and workshops associated with receiving a computer and software. Approximately 7,900 such participants have participated since 1993. Thousands of other participants have come in their "off years" to benefit from new learning opportunities. In 2011-12, FDI strengthened the program's value to faculty by providing a wider range of content, including topics that support the university's emphases on living-learning communities, international outreach (especially a week of faculty development for faculty in Senegal on behalf of OIRED), and research excellence. Our curriculum also helped support continued large-scale deployment of Scholar and ePortfolio. Total participation has increased this year, rising from 4,776 in 2010-11 to 6,345 in 2011-2012, a 25% increase.

New offerings under the "imprint" of the Center for Innovation in Learning have already increased the depth of courses available to faculty, staff, and graduate students during 2012-2013. The greatest contribution here is the New Media Faculty-Staff Development Seminar, a flagship program for the "proto-CIL." (The CIL's grand opening is in fall 2012). Over both semesters of the 2011-2012 academic year, nearly thirty Virginia Tech faculty and staff members took part in this experience,

including members of these departments: Biology, Rhetoric, Mechanical Engineering, Urban Planning, History, ASPECT, Newman Library, Learning Technologies, the Institute for Policy and Governance, English, Forest Resources and Environmental Conservation, Geoscience, Fish and Wildlife Conservation, Science and Technology Studies, and the Virginia Tech Foundation. In addition, networked participants across the US and around the world included the University of California-Berkeley, Brandeis, Houston Community College, Baylor, the University of Queensland, Benedictine University, Whitman College, the University of Central Florida, Tulane University, as well as participants in a Second Life seminar group with faculty, staff, and journalists living in Missouri, Florida, Aruba, Belgium, and other far-flung locations (see the Netvibes hub for this group at [http://www.netvibes.com/vw-nmfs-f11#NMFS\\_Home](http://www.netvibes.com/vw-nmfs-f11#NMFS_Home)).

Another “proto-CIL” initiative was the Honors Residential College (HRC) blogging initiative, which included over 300 student blogs written over the academic year. One HRC student presented on her work at the EDUCAUSE Learning Initiative in Austin, Texas, in February 2012. She was joined by Dr. Rob Stephens, the faculty principal for the HRC, as well as Dr. Campbell (FDI/CIL director) and Dr. Sparrow (director of InnovationSpace).

FDI has begun to leverage online affordances to increase both ease of access and overall participation in our curriculum. In 2011-2012, 20% of the FDI classes were conducted online through Adobe Connect, accounting for about 16% of the total participants. The use of Adobe Connect, or similar online products, was virtually non-existent with FDI classes two years ago.

#### Short Courses by Semester

<b>Term</b>	<b>Total short courses/workshops</b>	<b>Total seats filled</b>	<b>Online courses</b>	<b>Online participants</b>
Fall 2011	226	1,385	47	197
Spring 2012	380	3,478	81	485
Summer 2012	97	1,482	16	306
<b>Totals</b>	<b>703</b>	<b>6,345</b>	<b>144</b>	<b>988</b>

(Blitz Weeks are included in the main terms)

The FDI staff meets regularly with faculty and deans from all colleges to gather feedback for our program, and participants are asked to 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 2012-2013 those partnerships will continue to grow.

Our partnership with University Libraries grew stronger in 2011-2012 with one particularly noteworthy collaboration: Virginia Tech’s first Distinguished Innovator in Residence, Jon Udell (see <http://blogs.lt.vt.edu/innovator>). The DIR program partnership will continue next year, with a DIR planned for both fall and spring semesters. The Director of FDI, Gardner Campbell, also conducted a Faculty Inquiry

Group on “Designing Learning Environments” with the new Associate Dean for Learning and Outreach in Newman Library.

#### FDI Track Offerings, 2011-12

New Faculty: Community and Computing  
Teaching with a Tablet PC to Engage Students in the Learning Process  
Improving Instruction Using Scholar for Those New to Scholar  
Improving Instruction using Scholar (An Online Track)  
Improving Instruction using Scholar—Beyond the Basics  
Planning, Developing, and Delivering Online Instruction  
Improving Online Instruction—Strategies, Pedagogy and Best Practices for  
Advanced Online Instructors  
Faculty Inquiry Group: Exploration of Emerging Technologies for Active and  
Engaged Learning  
Faculty Inquiry Group: Strategies for Mindful Learning  
Faculty Inquiry Group: Designing Learning Environments  
Faculty Inquiry Group: Digital Storytelling and Video Projects across the  
Curriculum  
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  
Strategies for Inclusive Teaching and Mentoring  
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  
Design Your Own Development Experience  
Protecting Your University Data: Whether it's Research, Personal or Student  
Data  
Collaborative Creativity: Fueling the Future  
LT Conversations—Lunch Time with Learning Technologies

Faculty development classroom usage summary

Torgersen Classrooms 1120, 3060, 3080	FDI sessions 608	Meetings/other workshops 85	Total  693*
FDI sessions in other rooms	95		

\* This total does not include non-FDI classes in 1120

Summary of FDI computer distribution, Spring/Summer 2012

	<b>Apple</b>	<b>Dell</b>	<b>Fujitsu</b>	<b>ASUS</b>	<b>Totals</b>	<b>%</b>
Desktops	39	64	0	0	103	21%
Laptops	201	109	0	9	319	66%
Tablets	0	0	64	11	75	15%
Totals	240	173	64	20	486	
Percentage	49%	36%	13%	4%		

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 around 30% of our summer tracks. Additionally, these classes accounted for over 50% of the 6,345 seats filled this year (3,452). 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 2011/2012:

<b>University entity</b>	<b>Short courses</b>	<b>Tracks</b>
Division of Research	112	2
Branding	34	0
University Libraries	34	1
Institute for Distance and Distributed Learning	27	2
GIS	19	1
LISA	24	0
Computer Security	13	1
Diversity	0	1
Visualization	11	0
Totals	274	8

<b>Corporate partner</b>	<b>Short courses</b>	<b>Tracks</b>
MathWorks (MatLAB and Simulink)	10	2
SAS (JMP)	6	2
National Instruments (LabVIEW)	3	0
COMSOL (Multiphysics)	3	0
Totals	22	4

It should also be noted that the vendors who provide computer hardware for FDI all take part in the Hardware Showcase each year. This event allows faculty members to see the new line of computer options available to them and make a more informed computer selection. Vendors include Dell, Apple, Fujitsu and ASUS.

## The Graduate Education Development Institute

Engaging graduate student instructors in the process of discovering and defining their pedagogical praxis continues to be an 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 200 graduate students throughout the fall semester in Phase II workshops for the Graduate School's GTA Orientation course, GRAD 5004, focusing on using Scholar for interactive learning and Web tools for time and information management. The director also co-taught a GTA workshop on ethical dilemmas to 60 students. Over the year, 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." Three graduate students from the National Capital Region also enrolled and participated via Skype during seminars.

Assessment data for the GEDI pedagogy course continues to indicate 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; this year's exit data indicate that 97% 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. The GEDI participants also provided qualitative assessment exit data, and their feedback suggests that the course has a positive impact on their praxis: "I was aware of many of the modes of technology discussed in this class before I joined the class, but what this course has taught me are the different ways of implementing these technologies to address all different kinds of learning styles and learning objectives . . . "; "I learned [about] learner-centered teaching and problem-based learning for the first time, which made me start to think about better teaching techniques other than the traditional ways I have been taught"; "I was introduced to the power of technology inside the classroom and how to use it effectively"; "[t]his class has inspired me to be an innovative teacher."

The GEDI program looks forward to expanding its collaborative efforts and ways to further other initiatives within Learning Technologies. One of the goals for GEDI in the coming year is to discover ways to partner with ePortfolio initiatives, as well as with the CIL and new library faculty in order to support university-wide goals for teaching and learning.

## Services

Learning Technologies provides leadership to advance teaching and learning. The services division of Learning Technologies encompasses Assistive Technologies (AT), the Office of Technology for the Arts (OTA), Computer Integrated Learning Spaces (CILS), the InnovationSpace (IS), and Testing and Data Services (TDS). These departments work collaboratively to promote technology in the design, delivery, and assessment of teaching and learning.

### Assistive Technologies

Assistive Technologies (AT) ensured that students and employees with disabilities had appropriate technologies needed to access programs and services of the university. Within the broader mission of Learning Technologies, AT worked for inclusive environments for learning, discovery, and engagement for faculty, students, and university employees grounded in a thorough knowledge of integrating accessible technologies. This year, a consultant from the University of Delaware was contracted to ensure that the AT mission, goals, and services were meeting the needs of the university community. The consultant recommended several actions to increase accessibility and inclusion. In response to this report, planning was completed for the 2012-2013 academic year and will include significant data collection and continued assessment of AT. To further a proactive approach to assistive technologies and in response to the report recommendations the following

actions occurred: the establishment of a working group composed of AT, Services for Students with Disabilities and the ADA Office to increase communication, planning, and needs assessments; the initial development of a survey for users of AT; the transfer of AT server administration to Computer Integrated Learning Spaces (CILS); and identification of opportunities for outreach for increased accessibility.

Highlights of AT accomplishments include the following:

- Partnered with library leadership to increase access to AT hardware and software, including the procurement and deployment of OCR cameras for all library users.
- Established full Braille services for course materials, class notes, quizzes, tests, lab manuals, and exams and textbooks for physics, mathematics, astronomy and other science courses.
- Trained and supported students and employees with disabilities in use of new and unique assistive technologies for classroom and laboratory settings.
- Completed one year of sponsored research on a three-year NSF project, *Spatial Touch Audio Annotator and Reader (STAAR)*, for individuals with blindness or severe visual impairments.
- Continued awareness efforts through participation in outreach activities and STEM programs.
- Developed and deployed a fully accessible website for both AT information and as a model of accessible website development.
- With CILS, transitioned server management to allow for greater focus on accessibility and inclusion.
- Upgraded and tested all available AT software
- Provided accessibility support and knowledge for the university's Going Google project.

## The Office of Technology for the Arts

The Office of Technology for the Arts (OTA) supports the technology-related infrastructure, programs, and other technology-assisted components of the arts at Virginia Tech. The OTA utilized the guiding concepts of learning communities, experiential learning, and collaboration to frame the work of enhancing technology in the arts. The OTA collaborated on the design and review of the Center for the Arts/Institute for Creativity, Arts, and Technology (CFA/ICAT) building infrastructure equipment and staffing and provided quality assurance reviews of the construction. OTA supported the institute's director in program creation and development. Additionally, OTA coordinated and facilitated the construction of Virginia Tech's TelePresence 3210 facility in Torgersen Hall and supported 4VA program operations associated with the new facilities. In support of the guiding concepts, OTA supported the development and facilitation of trans-disciplinary and trans-organizational relationships leading to program collaborations at the nexus of the arts, technology, and education.

Specific areas of collaboration and effort for the OTA include the following:

- Facilities

- Interface with the design and construction team for the CFA/ICAT building and oversight of Information Technology resources engaged in the building's design and construction process, its technology infrastructure, equipment, and staffing requirements; overseeing accuracy of infrastructure construction and installation relative to design
- Negotiated telecommunications arrangement for "Studio 1" in Collegiate Square, which allows ICAT faculty to reconfigure their router connections on the fly
- Represent Information Technology among ICAT faculty
- ICAT Advisory Council—Created this cross-functional group within Information Technology to review and plan for future ICAT technology needs involving Information Technology
- Open Simulator—Learning Technologies, Network Infrastructure and Services, School of Visual Arts continued implementation of a virtual art gallery, enabling the redesign of a class in digital photography
- FDI on Collaborative Creativity—fosters collaborations among faculty across disciplines with special focus on redesign in the Math Emporium, the Theatre Workshop in Science and Technology, and generally building "community" across disciplines at the grass roots level
- Initiate Virtual ICAT and Center for the Arts project—Visualization Lab, School of Visual Arts, OTA collaborative importation of the CFA/CTA 2D design into, and development of, an interactive 3D immersive simulation of the facility
- Telepresence—partnership through CISCO with UVA, GMU, JMU on 4VA programs
- Outreach
  - Boys & Girls Club of the Blue Ridge
  - Community Outreach through the Blacksburg Electronic Village, Blacksburg Downtown Revitalization Committee, and Blacksburg Partnership: focused on technology and the arts

## Computer Integrated Learning Spaces

Computer Integrated Learning Spaces (CILS) supports learning, research, and outreach through the development and ongoing support of computer hardware and software in over 20 locations on campus maintained by CILS. These labs and classrooms include hardware, software, and maintenance at the Math Emporium, 3 classrooms in Torgersen (1010, 1080, and 3250), 3 classrooms in Shanks (160, 180, and 360), and 9 other labs across campus. CILS also coordinated the ordering and distribution of more than 500 FDI computers. CILS continued to support pay-for-print services and maintenance and support of the President's Conference Room.

CILS provided service and support for the following projects:

- Provided ongoing support and consultation for the SCALE-UP classrooms and the SCALE-UP Faculty Study Group
- Added copying and scanning capabilities to print services and increased revenue by 7% for print services
- Upgraded TimeClock to the meet audit requirements
- Certified Learning Technologies inventory

- Procured LabStats software to deploy in the Fall of 2013 to collect and analyze usage data
- Partnered with Assistive Technologies to explore expanding AT software to CILS managed labs
- Continued to do environmental scans on the status and viability of new technologies including virtualization

## InnovationSpace

The InnovationSpace advances 21<sup>st</sup>-century learning environments through three complementary service areas. The first is The Lab @ InnovationSpace, which supports teaching and learning through equipment loans, a multimedia lab, and expert support. The second is through Teaching and Learning @ InnovationSpace, which explores emerging technologies, provides connections for between teaching and technology, consults with faculty on transforming teaching, and pilot tests technologies to support the university's strategic goals. The third service is the Technology Exploration Lab @ InnovationSpace, which provides a flexible learning space with emerging technologies for faculty and students to explore collaborative technologies.

During the past year, the InnovationSpace continued to provide access to technology tools in a variety of ways:

- New equipment available for university-wide checkout includes new hard-drive based video cameras, Go Pro cameras, wireless projection adapters, and iPads.
- iPad pilot project served over 400 students in semester-long loans, including extensive work with faculty on course design to leverage technology to support active and engaged learning.
- We provided the WordPress platform and faculty and student support for the several university programs and departments.
- Consultations on learning space design was provided for Geography, Honors, the Center for European Studies and Architecture, and Career Services.
- 1120 Torgersen Hall was redesigned with extensive white board space, flexible seating, new technologies, and inviting wall colors to promote exploration of teaching and learning with technology.
- Student multimedia workshops continued to be developed and delivered on a range of topics and current software.
- The eBook pilot initiated in partnership with EDUCAUSE and Internet2 will be delivered in the Fall 2013 semester.
- We designed and delivered faculty interest groups on digital storytelling and emerging technologies.
- We partnered with the library to increase student access to technology, including laptops, iPads, and additional cameras, and increasing InnovationSpace services to the library during peak usage times.
- We managed and supported the university's iOS developer license to support app development in assistive technologies, computer science, and the library.

The InnovationSpace continues to provide services to all colleges, a variety of departments, and the community. Equipment loan demands continue to increase and were addressed through putting additional equipment into circulation.

InnovationSpace usage statistics show service to all university stakeholders for a variety of technology services (below).

<b>Lab Usage by Transaction Type</b>						
<i>Type</i>	<b>Total</b>	<i>Undergraduate</i>	<i>Graduate</i>	<i>Faculty</i>	<i>Staff</i>	<i>Public</i>
3D	<b>1</b>	1	0	0	0	0
Audio	<b>1069</b>	899	22	78	53	17
CD/DVD Burn	<b>6</b>	3	0	1	2	0
Consultation	<b>6</b>	3	2	0	1	0
Desktop Publishing	<b>97</b>	86	3	3	5	0
ePortfolio/Scholar	<b>220</b>	214	2	4	0	0
Equipment Loan	<b>3852</b>	3143	211	299	199	0
ETD	<b>1</b>	0	1	0	0	0
Flatbed Scanning	<b>403</b>	245	55	81	18	4
Graphics	<b>3356</b>	3046	121	83	69	37
Maintenance	<b>10</b>	2	0	0	8	0
Powerpoint	<b>27</b>	22	2	3	0	0
Slide Scanning	<b>64</b>	26	0	19	9	10
SpaceCamp	<b>34</b>	33	0	0	1	0
Video	<b>4266</b>	3777	157	197	106	29
Web Development	<b>303</b>	290	2	2	7	2
Totals	<b>13715</b>	<b>11790</b>	<b>578</b>	<b>770</b>	<b>478</b>	<b>99</b>

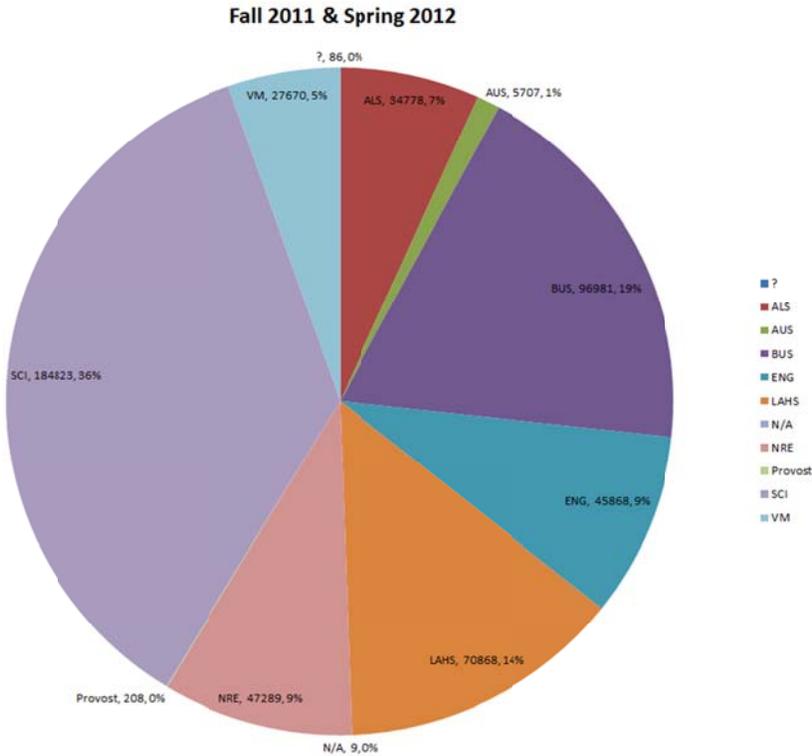
## Testing and Data Services

Testing and Data Services (TDS) supported the assessment of student learning through the accurate and timely scoring of optical scan forms for all colleges. This year, TDS moved from Derring to Torgersen to allow cross training and support of TDS operations. TDS supported additional assessment tools to faculty through iClickers that included a Sakai integration tool. The deployment of this tool allows faculty to assess students in real-time and easily upload the results to their Scholar gradebook. Testing and Data Services tested several options for clicker technology and supported faculty and graduate students on the technology and pedagogy of using clickers for assessment and engagement.

This past year, Testing and Data Services began exploration of new scanning technologies that would allow optical scan forms to be processed at several locations throughout campus. The purpose of this is to allow faculty control over test scoring, to provide results more quickly, and to increase the security of student data through the elimination of additional handling of tests. These new desktop scanners are undergoing field-testing to determine load and user capabilities. As this process progressed, Testing and Data Services continued to explore alternative assessment tools. The new location in Torgersen Hall has allowed TDS to leverage the resources of the InnovationSpace in working with faculty exploring new pedagogical tools for assessment.

### Fall and spring test scoring data

The following chart shows college/department and the number of sheets processed by TDS.







# Network Infrastructure and Services

NI&S administers the information technology infrastructure and related services including

- operating highly available, reliable, and secure networks and computing systems;
- Providing assistance and support to the university community for information technology services;
- 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.

## Involvement in instruction, outreach, and research

Rapid advances in technology and mobility are reflected in the constantly changing ways the university community can approach its work. Such change increases demand for, expectations of, and reliance upon technology and infrastructure and the benefits they provide. New computing and communications methods continue to enhance the educational experience of students, whether on-site or online, as well as the capabilities of faculty and staff. 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 placed on promoting robust and integrated information technology strategies to advance Virginia Tech's mission. 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. Increasingly the linkage is to mobile devices, increasing need for wireless and broadband access.

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 such as 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.

A project has also begun to allow the university community to take advantage of the convergence of various telecommunications technologies with a unified communications infrastructure supporting future research and instructional needs and fostering educational opportunities and economic development. This new information environment replaces 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 communications 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 the other Virginia Tech 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 update the network. Constant improvements in operational efficiency, in addition to cost reductions, are necessary to keep pace with

budget reductions and overhead cost limits imposed by the commonwealth and the university. The organization has always emphasized financial integrity and stability, administered a balanced budget, and ensured 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.

## Organization

Network Infrastructure and Services is organized into several units, described below.

### 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. John Pollard leads the Engineering Operations group which includes Network Research and Development, Field Engineering, and Video/Broadcast Services.

#### **Network Research and Development (Network R&D)**

Led by Steven Lee, 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; collaborate with other NI&S engineering units to facilitate the deployment and configuration of these solutions and to 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)**

Led by Doug Jones, FE plans, provisions, and provides structured telecommunications cable distribution systems (both inside and outside plant) designed to reliably and securely support the university's communications needs over the next 10 to 15 years. By working closely with 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)**

Led by Mark Harden, 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)

Directed by Brian Jones and led by Ron Keller, 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 continuously 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 electronics upgrades over the last few months will continue into the coming year as we upgrade the network design and configuration to support university-wide Unified Communications deployment. NE in conjunction with the IT Security Office will deploy equipment in support of a restricted access network to secure personally identifiable information (PII) for departments who use and must to protect this type of data. This network will be logically and functionally separate from the "normal" network and will be accessible only by units using PII as part of their duties.

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. Efforts are taken to implement highly available and redundant systems incorporating diverse cable paths and uninterruptable power systems where possible. Industry best practices are used to assist with interoperability of varying vendors and to prepare for future implementations not yet realized in our data networks today. 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 also broadcast 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 improves 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. We just completed the replacement of legacy receiver equipment in the CATV head-end facility. The new equipment provides a more reliable and serviceable system and improved signal quality. Analysis of our entire CATV system depicts a flatter signal response than previously attainable, resulting in significant improvement of signal quality across the spectrum.

## **Systems Support**

E-Communications Services and Windows Administration Services Team (ECS-WAS). Led by Ron Jarrell, the ECS-WAS team provides 99.97% or greater availability for all centralized messaging systems (email—including the 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 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. The ECS-WAS team is currently working to move remaining users from legacy email systems to the new VT Google Application systems and also working on planning for a migration to Microsoft® Office 365 from legacy Microsoft® applications and shared folder systems, once contracts have been signed and are in place for moving forward.

Storage Management Team (SMT). Wanda Baber leads SMT, which 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 for the university's LISTSERV system (100% up-time for the period). New storage systems are being procured and will be deployed to support research computing efforts and networked video surveillance camera systems' data in this year.

UNIX Administration Services. Led by Tim Rhodes, 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), and research applications (such as those running on Silicon Graphics Incorporated [SGI], and IBM and x86-based clusters). 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 Sun Microsystems' Solaris-based systems, SGI 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 (12) separate groups within Information Technology. The research cluster, System X has just been phased out, and a new cluster is being built in its place to meet research cluster computing needs.

## Revenue-based business planning and operations

NI&S is supported by several business administration and operations units. Pat Rodgers oversees the following units, which support the daily enterprise business activities and operations of the organization.

**Budget.** Dubby Charlton is the fiscal director for NI&S and serves as a liaison with the university's financial areas. He 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.

**Human Resources and Safety (HRS).** Dan Joyce's group provides support to managers, supervisors, and staff in the areas of recruiting, compensation, position classification, and leave reporting. He serves as NI&S' liaison to the university's 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).** Bill Blevins' 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.** Jeff Kidd's 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 support. The unit also processes Internet-based copyright infringement notifications in compliance with the Digital Millennium Copyright Act.

**Project Management.** The Project Management team is under the direction of Roy Smith. Virginia Tech was authorized to use its own project management process for information technology projects under the Virginia's Restructured Higher Education Financial and Administrative Operations Act.

**Information Technology Support (ITS).** ITS, led by Joyce Landreth, is comprised 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 is comprised of the Help Desk and the Content and Knowledge Management (CKM) groups. 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](#). CKM is responsible for [www.computing.vt.edu](http://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.** Led by Robert Rankin, Facilities Management is responsible for ensuring that the CNS-managed facilities supporting the university telecommunications infrastructure 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.** Led by Jerry Surface, the Warehouse is the receiving point for most of the inventory ordered by NI&S. Warehouse personnel ensure all 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 inventory that is classified as university fixed assets is accurately recorded in Banner.

## Voice and Mobile Technologies

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

**Network Administration.** Led by Diane Whitlock, 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, led by John Lawson, 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).** Led by Barry Linkous, 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 99.991% for FY 2011-2012. SE oversees the emergency "blue light" telephones on the Blacksburg campus and supports law enforcement and service providers.

## Systems Development and Administration

Systems Development and Administration (SDA), led by Morgan Allen, 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](http://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.

## **E-Discovery and Data Center**

**E-Discovery.** Led by William Dougherty, the E-Discovery group provides support to Virginia Tech's 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 other university departments. During the year, University Counsel provided funding for a full time position dedicated to the collection and preservation of E-Discovery materials and Lynn Donahue was hired in December of 2011 reporting to Michael Moyer, the Data Center Manager.

**Data Center.** Managed by Mike Moyer, the Data Center is located in the Andrews Information Systems Building (AISB) located in the Virginia Tech Corporate Research Center. Moyer is responsible for coordinating all cross-departmental research and project-related activity, including monitoring electrical power, environmental systems, and ensuring the availability of adequate physical space and network resources. The AISB Data Center's operations are coordinated with the auxiliary emergency center located in Cassell Coliseum. Mike coordinates with other university information technology units to ensure availability of needed telecommunications and storage network facilities, and prepares appropriate documentation, including project proposals and project management forms.

## **Strategic Initiatives**

Strategic Initiatives (SI), led by Jeff Crowder, directly supports Information Technology's executive administration in strategic programs and special projects with a goal of enhancing the quality and competitiveness of university research and instruction through advanced, broadband technology. SI programs include the following:

**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, interest in National LambdaRail, metro-area network systems in the National Capital Region,

advanced network security systems, and telepresence systems. Most recently, VT-TA has entered into software development agreements for Google Android and Apple iOS for the benefit of the university. VT-TA has multiple additional initiatives in various stages of development. SI manages the full portfolio under contract to the Virginia Tech Foundation.

**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.

During 2011-2012, SI provided leadership for the development of a formal, corporate structure to replace the MATP informal consortium. The new corporation, the Mid-Atlantic Research Infrastructure Alliance is in the process of incorporating as a charitable, non-profit corporation and will begin operation during the upcoming fiscal year.

**NetworkVirginia.** NetworkVirginia reached over 1.4 million Virginians at its peak. The network promotes equitable access to broadband, particularly in rural communities, through colleges, schools, government offices, municipalities, and other public and private entities. 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](#) and [LENOWISCO](#) constructed over 1,000 miles of fiber in south side 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-TA. The projects are managed by SI 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 and NI&S, SI led Request for Proposal 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 in 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, with SI leadership, is providing access to research and educational institutions and other community anchor institutions throughout the mid-Atlantic region.

**VT CyberInfrastructure Strategic Plan.** The term “cyberinfrastructure” refers to technology-based resources, tools, and services essential to the conduct of 21<sup>st</sup>-century science and engineering research and education. Examples include high performance computing, storage systems, visualization tools, high performance networks, data repositories, and software tools among other resources. As a STEM-focused research university, strategic investment in advanced cyberinfrastructure is crucial to Virginia Tech.

Recent solicitations from the National Science Foundation require the inclusion of a campus cyberinfrastructure plan as a supporting document. The Strategic Initiatives division led the drafting of a Virginia Tech Cyberinfrastructure Strategic Plan as a living document. The plan combined input from multiple related university planning efforts and collected input from experts across multiple domains including high performance computing, storage, visualization, learning technologies, and networking.

## Special projects support

**Special Projects and Initiatives Liaison.** As Network Infrastructure and Services' special projects and initiatives liaison, Richard Hach provides administrative coordination among diverse entities involved in delivering telecommunications services to the university. His 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. Richard is the program director of NetworkVirginia. In addition, he represents the university at meetings of outside organizations including EDUCAUSE, the Advanced Core Technologies Initiative (ACTI) Communication, Collaboration and Mobility (CCM) Working Group, The Association for Information Communications Technology Professionals in Higher Education, Internet2, and the QUILT Inc.

## Technology Innovation

Technology Innovation comprises 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.** A unit of Technology Innovation, Network Security is led by Phil Benchoff. The team 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. Network Registry services include the following:

- IP address assignment. Every host (computer) in 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.

# Projects

## "UC+3"

Communications technology is a fundamental tool for enabling Virginia Tech to realize its vision for the future. The core technology utilized to provide several mission-critical services needs to be replaced. The "UC+3" program is a group of four related Unified Communications projects that will significantly improve the quality of the communications services NI&S provides to the university community. The initiatives will provide Virginia Tech with high-quality communications services and re-establish communications technology as an advantage for collaboration and innovation.

A description of each project follows.

**Unified Communications Applications.** The Unified Communications (UC) Applications project is part of a comprehensive, technology reinvestment initiative that will provide Virginia Tech with high-quality communications services. UC is not a specific product or technology. Rather, it is a vision for integrating multiple communications applications and modalities to drive improvements in productivity and efficiency and to better enable innovation and collaboration.

The scope of the UC project includes the main campus and satellite office locations in the Town of Blacksburg and the National Capital Region. The UC Applications project will provide Virginia Tech's faculty and staff with current-generation telephone, unified messaging, contact center, conferencing, mobility, and collaboration services.

NI&S is now working towards completion of the core infrastructure implementation and will begin migrating users to the new UC system in the fall of 2012. Upon completion of the project, NI&S will decommission the ROLM telephone and voicemail systems that have served the university for nearly 25 years.

**IP Network.** The IP network is the foundation for virtually all communications-enabled applications at Virginia Tech. It is utilized to provide access and connectivity to the Internet and other state, regional, and national research networks. Many of the system components are eight to 12 years old and lack the capabilities to adequately support the requirements of Virginia Tech's academic, research, administrative, and public safety functions.

The IP Network project will replace outmoded equipment at the core, aggregation, access and border layers of the network. It will provide the university community

with improved utility, performance, and reliability of wired, wireless, remote, and secure access data network services.

NI&S has already upgraded the access and distribution-layer network equipment in several campus buildings and will continue to replace the existing facilities with devices capable of delivering power to IP telephones and supporting speeds up to 10 times faster than the previous-generation equipment.

**Cable Plant Upgrade.** The copper and fiber-optic cabling in over 40 buildings on campus is more than 15 years old and does not meet the current data-rate specifications required to support moderate or high-bandwidth applications. The Cable Plant Upgrade project will replace existing inside wiring to allow for full realization of the utility and benefits associated with the Unified Communications and IP network projects by improving system reliability, performance, and flexibility. NI&S has completed the cabling upgrade in several buildings. The Field Engineering team and customer service representatives in the Ordering and Provisioning group are working closely with departmental network liaisons to plan the upgrades for the remainder of the buildings that are in scope for the project.

**Facilities.** Construction of new telecommunications spaces is needed to support the physical space, power, security, and cooling requirements associated with the cable plant and IP network upgrade initiatives. Many of the existing spaces are collocated with electrical equipment, which imposes code-compliance restrictions when making adjustments to the design or resource inventory in those spaces. New space construction will facilitate the benefits of the cable plant, IP network, and unified communications applications projects as well as any future communications technology initiatives.

The NI&S Facilities team has been working closely with the university's design and construction group and the university's architect to identify and acquire space in several buildings on campus. Following acquisition of new telecommunications spaces, the Facilities team will work with contract architecture, engineering, and construction firms to design and build the spaces.

For more information, contact Joe Hutson, [Joe.Hutson@vt.edu](mailto:Joe.Hutson@vt.edu).

## Unified Communications business model

A multi-functional team was formed to develop a new model for communications services in the NI&S portfolio. The legacy model was unsuitable to support new unified communications products and services. The team was tasked with developing a model for communications technology services that is simple, flexible, strategically aligned with the university mission, and promotes fiscal responsibility while facilitating the full realization of the technology investment.

The new service model took effect on July 1, 2012, and reduced the total number of services in the portfolio from over 100 to approximately 20. The model provides university affiliates with the opportunity to subscribe to a bundle of essential communications services that includes wired, wireless, and remote access to the Virginia Tech data network, in addition to unified communication (UC) voice service with unified messaging.

Additional changes to the model eliminated charges for direct-dialed domestic long-distance for university departments and reduced costs for international long-distance dialing to most countries.

For more information, contact Joe Hutson, [Joe.Hutson@vt.edu](mailto:Joe.Hutson@vt.edu).

## Unified Communications SIP trunking

The Session Initiation Protocol (SIP) trunking initiative is a key component of the Unified Communications (UC) project. The project will upgrade the facilities utilized to connect Virginia Tech's telephone system to the public switched telephone network resulting in a more flexible and cost-effective network.

SIP trunking services utilize Internet protocol (IP) technology to provide additional flexibility in adjusting the number of concurrent telephone calls that can be delivered over the facilities. The ability to quickly expand and contract the size of the SIP trunk group—without adding or removing physical circuits—will allow NI&S to respond to seasonal or event-driven changes in demand for trunking resources. The SIP services also provide a high level of redundancy and geo-diversity.

The migration to SIP trunking provided by Level 3 also provides an opportunity to significantly lower the costs associated with delivering direct-dialed, domestic, long distance service. The cost savings and simplified billing will be passed along to the university's departmental customers. Additionally, the per-minute rates associated with direct-dialed calls to most international locations will be reduced.

The underlying transport facilities required to support the SIP service have been installed and initially tested. NI&S personnel are working with engineers from IBM and Level 3 to design and complete a plan for testing the various call scenarios—inbound and outbound—prior to moving the service into production this fall.

For more information, contact Joe Hutson, [Joe.Hutson@vt.edu](mailto:Joe.Hutson@vt.edu).

## Capital and renovation projects

The Field Engineering (FE) unit of Communications Network Services designs and installs telecommunications distribution systems to support current and future university needs—for both inside and outside cable plant.

Field Engineering works closely with project architects and engineers, as well as with University Design and Construction (UDC) teams, during project development to ensure communications cable pathways and spaces meet or exceed all applicable industry and Virginia Tech standards. As traditional telephony technologies migrate to voice-over-Internet-protocol unified communications systems, designs for new telecommunications cabling and facilities must also be enhanced. FE updates and maintains the Virginia Tech cabling standards for telecommunications systems utilized by project architects, engineers and the UDC, FE also coordinates its installation and maintenance activities with the university's Facilities department to minimize disruption of university operations and to avoid disturbing classes in session.

During the 2011-2012 fiscal year, FE installed telecommunications infrastructure for the following new construction and capital projects.



**Ambler Johnston West Wing renovation.** A major renovation of the west wing of this building resulted in a comprehensive upgrade to its residence rooms, meeting areas, and major electrical, mechanical and HVAC systems, as well as the addition of a movie theatre and laundry facility. Telecommunication upgrades included full deployment of wireless network service, as well as installation of Category 6 Ethernet cable and a pair of single-mode optical fibers in each room. A new main telecommunications equipment room (ER)

and six new telecommunications rooms (TR) were constructed. Following prior extensive renovation, the east wing of Ambler Johnston was occupied in the fall of 2011, while the west wing reopens for the fall semester of 2012.

**Academic and Student Affairs (ASA).** The ASA building, recently named Lavery Hall, will provide six new classrooms, an expansive food court to replace the Shultz Dining Hall and new offices for the Services for Students with Disabilities group. Telecommunications and network infrastructure were installed to support Unified Communications services being installed for a diverse set of building occupants. This facility opened in July 2012 and will begin serving meals and holding classes in the fall of 2012.



**Visitor and Undergraduate Admissions Center.** Located adjacent to The Inn at Virginia Tech, the facility provides a visible and accessible location for university visitors to obtain Undergraduate Admissions information. NI&S provided telecommunications cabling and equipment to support approximately 25 offices.

When scheduled to transition, its infrastructure will accommodate Unified Communications services.



**Veterinary Medicine Infectious Disease Research Facility.** This 22,000 square foot facility, located in the Veterinary Medicine complex, was completed in the fall of 2011. It provides additional classroom and office space, and includes several state-of-the-art laboratories used to conduct research in many veterinary disciplines.

All new buildings and capital renovations will receive Unified Communications-capable cable and equipment. Telecommunications and network infrastructure work is under way for the following capital projects:

Veterinary Instructional Addition  
Center for the Arts  
Sigma Phi Epsilon @ Oak Lane  
Turner Street Project  
Southwest Chiller Plant  
Signature Engineering Building  
Human Agriculture and Biological  
Building

Building 1901 (Corporate Research  
Center)  
Davidson Hall Renovation  
North Campus Steam Extension  
(NI&S to install duct system in  
this pathway)

Network Infrastructure and Services internal capital projects currently in progress:

Campus Fiber Upgrade  
Unified Communications

Within the past year, FE installed telecommunications infrastructure for the following building renovation projects and network upgrades:

Newman Library Upgrade  
Seitz 112 Classroom  
ICAT @ Collegiate Square  
Center for Student Engagement  
Surge Building Classrooms  
Chemistry move to Research  
Building 26

Surveillance cameras @ Perry  
Street Parking Structure  
Language and Culture Institute  
Installation of single mode fiber to  
Printing Services and the CNS  
Warehouse  
West End Market renovation  
Cassell 309 renovation

For more information, contact John Pollard, [jpollard@vt.edu](mailto:jpollard@vt.edu).

## Campus fiber optic backbone improvement

The Field Engineering (FE) staff is currently engaged in a project to improve the campus network and communication infrastructure. The campus's fiber-optic backbone was outdated and required updated cabling to accommodate current and future demands of a growing campus infrastructure and to support the university's transition to unified communications services.

The upgraded fiber-optic ring on campus consists of six high-count fiber segments interconnecting the six campus switching centers. Included in the fiber upgrades are several buildings' connections to the core campus fiber ring. Concurrent ring cable pathway improvements will increase capacity and enhance service diversity and redundancy. To maximize use of the available funding, the installation will take advantage of existing pathways in steam tunnels and other duct banks, where available and beneficial.

The multi-year project to install the university's new fiber-optic backbone began in January 2011, with associated construction commencing during summer of the year. The project, inclusive of design, construction, and equipment, is estimated to cost \$2 million and is scheduled for completion in January 2013.

In addition to placing miles of fiber-optic cable in the ground, FE Outside Plant employees have already made significant progress terminating the new fiber. Termination of segments of the upgraded fiber will be prioritized to ensure they are moved into production as required to support campus projects, in many cases, in advance of the scheduled completion of the entire backbone improvement project.

For more information, contact John Pollard, [jpollard@vt.edu](mailto:jpollard@vt.edu).

## Hokie Passport building security

In collaboration with Hokie Passport staff, NI&S' Engineering Operations team examined how to address a new university requirement to have Hokie Passport access controllers lock exterior doors of all major buildings on campus. In buildings where Hokie Passport (HP) does not currently have available infrastructure, NI&S has agreed in principle to allow HP to install servers in a given building's telecommunications equipment rooms and to accept associated HP cabling in existing cable pathways, where space is available. NI&S telecommunications technicians will install Hokie Passport controllers on the doors to telecommunications rooms shared with Hokie Passport.

For more information, contact John Pollard, [jpollard@vt.edu](mailto:jpollard@vt.edu).

## 4-VA Consortium—TelePresence

Videoconferencing for instruction and distance learning are increasingly important to the realization of the university's strategic educational and outreach objectives. During the report period, Cisco Systems donated two Cisco TelePresence rooms to each of four Virginia universities. The TelePresence rooms provide complete network control of high definition video communication and professional fidelity two-way audio services. As a result, courses originating at one university can include students at other universities, participating simultaneously alongside their distant, fellow students. Four Virginia universities—George Mason University, James Madison University, the University of Virginia, and Virginia Tech—constitute the 4-VA consortium. National Lambda Rail's "TelePresence Exchange" links the Cisco TelePresence rooms among the four universities.

Video/Broadcast Services engineers were charged with extending the reach of this technology through the TelePresence Interoperability Project. Cisco TelePresence rooms connect only to other Cisco TelePresence rooms. To expand TelePresence access, Ludwig Gantner, David Schuh, and Kyle Kirk of Video/Broadcast Services' Video Network Operations Engineering group collaborated on the design, development and testing of an interoperability service based on a video dial plan. The service provides connectivity between the TelePresence rooms and legacy video conferencing equipment. It also provides access to Virginia Tech's cable television and broadcasting infrastructure. This allows TelePresence meetings to be broadcast to campus and local television channels, to networks across the world through satellite uplinks, or via the research networks of National Lambda Rail and Internet2.

For future deployment, VBS also developed a prototype for interoperability of both TelePresence and legacy video conferencing via platforms such as Windows and Apple desktops and laptops, iPads, cellphones, and Android-based smartphones.

The 4-VA TelePresence interoperability service also supports connectivity to Virginia Tech's Unified Communication solution.

For more information, contact John Pollard, [jpollard@vt.edu](mailto:jpollard@vt.edu).

## Network research and development

**Wi-Fi upgrades for Torgersen and Library.** Torgersen Hall and Carol M. Newman Library frequently accommodate over 1400 wireless network users on a daily basis. Research and Development engineering staff specified, designed, and provided direction to ensure enhancement of both locations with updated equipment and the latest wireless technology. Designed to handle high densities of users and, installed and placed into production by CNS' Field Engineering group, the new system supports 802.11n connectivity.

**IPv6 support over wireless in Torgersen and Library.** While IPv6 support is available throughout the campus, wireless networks have not been able to leverage the full feature set due to the constraints of legacy hardware. Torgersen Hall and the Library are the first locations on campus to receive implementation of full IPv6 capabilities. This includes IPv6 captive portal support, DHCPv6 (dynamic host configuration protocol for IPv6) and first-hop IPv6 security measures, such as RAGuard (Router Advertisement Guard). Other areas of campus will follow as older wireless hardware is eventually replaced.

**Research with Cisco Systems improves IPv6 performance of campus routing platforms.** As one of the largest IPv6 deployments in the world, Virginia Tech's network provided an important test bed for Cisco Systems' IPv6 campus routing platforms. The sheer size of the university's campus network illuminated a variety of performance issues. Throughout the year, high level collaboration between NI&S R&D staff and Cisco Systems engineers and developers yielded diagnoses and troubleshooting of IPv6 related issues. The cooperative effort resulted in important design and configuration solutions to enhance performance of Cisco's campus routing platforms, particularly for large deployments. As a result, R&D is often consulted by Cisco and other global network equipment vendors on IPv6 issues.

**Network Address Translation and conservation of IPv4 addresses.** Network address translation (NAT) allows the university to conserve IPv4 network address space on campus. IPv4 addresses are a scarce commodity globally. Consequently, network services, typically wireless services, use non-routed addresses which are translated to a pool of global IPv4 addresses using NAT. As the service grows in deployment and popularity, the NAT pool allocation of IPv4 addresses must expand. R&D has taken the initiative to monitor, conserve, and add capacity, to meet growing demand.

**R&D support for distributed antenna system, video surveillance projects, and Ethernet RFP.** R&D Engineers provided consulting support, serving as committee members or content experts on the following requests for proposals: distributed antenna system, video surveillance system and the statewide Ethernet.

**Data Center server load-balancing services.** R&D continues to maintain, manage, and provide operational support for the Data Center load balancing services. This service is a critical component for ensuring high availability of various campus services including Banner, email, and the university website.

**Collaboration with Athletics yield Wi-Fi improvements for Lane Stadium.** Demand for Wi-Fi continues to grow at the university, and fans attending football games at Lane Stadium are no exception. During the fall of 2011, the high volume and high density of active mobile devices spectators carried led to seriously degraded performance of the university network. Problems accrued from fans' devices' Wi-Fi radios and from other sources during the events. NI&S Engineers researched the service requirements and stadium infrastructure. They developed recommendations for the Athletics Department to upgrade wireless hardware and described the

benefits of wireless spectrum coordination. In collaboration with Athletics, NI&S temporarily installed wireless network hardware in strategic areas of the Stadium as a proof of concept. The trial was successful with a permanent solution scheduled for installation in time for the 2012 season.

**Academic research support.** R&D Engineers collaborated with various researchers to design and implement network services which enabled outdoor research activity over the wireless network. Wireless connectivity was established to an on-campus portion of Strouble's Creek to allow remote monitoring of water quality and flow data.

Specialized network access was also established to support research of consumer grade wireless power monitoring devices for an Industrial and Systems Engineering research project.

**Classroom wireless applications.** R&D continued to provide high level, expedited support for wireless connectivity in support of the College of Engineering use of collaborative instructional tools. R&D engineers providing diagnostic and consultation services to professors on site and in real time, when necessary. R&D continues to coordinate with our wireless networking vendors to encourage development of improvements and efficiencies to support the unique requirements of a large educational campus.

**Technical consulting for Unified Communications project.** R&D is supporting the Unified Communications project in a variety of ways, including network design for architecture, quality of service, access control, and security. Evaluation of manageability and network serviceability of UC-specific network gear are developed for installation crews. Early testing of IP and digital phone hardware assisted in identification of performance issues and vulnerabilities to help ensure a smooth transition for UC service subscribers.

For more information, contact John Pollard, [jpollard@vt.edu](mailto:jpollard@vt.edu).

## Cable television infrastructure upgrade

Staff from both Video Engineering and Field Engineering units have planned, coordinated, and partially completed an upgrade to the television program delivery infrastructure on campus. Work is also underway to remove existing copper coax infrastructure from building entrance conduits, thereby freeing up high-value building access space for other network projects. More of the copper coax cabling will be removed as we continue to free up additional major segments of the cabling grid with new fiber installs and terminations.

Cable/switch center electrical equipment is being replaced with advanced passive electronics (require *no* electric power to function). New fiber-optic cables are being terminated in the centers and, with the new fiber-optic components installed in most

residence hall buildings, significant improvement in television programming signal quality has been achieved. This new fiber-optic cabling and equipment supports high-definition (HD) broadcasts via the campus cable television network and provides the foundation for improved content delivery. Local, over-the-air HD channels have been added, resulting in availability of enhanced programming. Network Infrastructure and Services is concurrently reviewing state programming contracts to identify opportunities to expand the university's HD program lineup.

CNS is currently preparing for the final stage of the fiber-optic television cabling upgrade which will include approximately 12 academic and administrative buildings served by the Hillcrest Hall and Cassell Coliseum switch centers. NI&S is evaluating ways to coordinate scheduling and allocation of Unified Communications project resources to expand and accelerate further installation of single mode fiber—a mutual benefit to both projects.

For more information, contact Brian Jones, [bjones@vt.edu](mailto:bjones@vt.edu).

## Restricted/Limited Access Network

Network Infrastructure and Services has initiated a collaborative project with the Information Technology Security Office to create a restricted/limited access network. The primary goal of the Restricted/Limited Access Network (RLAN) project is to protect electronically stored personally identifying information (PII).

Inadequate protection of PII data can result in a variety of liabilities, including potential or actual compromise of individuals' personal information. The university is susceptible to monetary liability and considerable negative perception.

Processes currently under development to better protect PII include a restricted or limited access network within the university's network. A RLAN enables precise control and monitoring of all network traffic in and out of the restricted network. Functioning as an "intranet," it accommodates managed client access to the public Internet for computers on the restricted network and confines those machines to the university's Information Technology resources.

To date, all equipment has been installed and testing of virtual desktop environment components is underway. Prior to the production implementation, pilot testing of the RLAN will include four university units.

Data controlled by the following university units are slated to operate via the production RLAN:

- Information Technology Security Office
- Communications Network Services
- Microsoft Secure Infrastructure Services
- University Computing Support (4Help)

## Enterprise Systems (for Banner access)

While security of PII for which the university is responsible will be significantly enhanced, strengthened controls and the RLAN's limited programmatic menu will necessarily impact employee access to and from public networks.

For more information, contact William Dougherty, [william@vt.edu](mailto:william@vt.edu).

## VT Google Apps

Four years ago Virginia Tech initiated a project to determine the feasibility of providing email services to alumni, without incurring costs that impacted services for the current students and employees. The "Google Apps for Education" email service was selected from multiple proposals by a product selection committee.



Google was the vendor of choice due to its features, vendor interoperability, and ease of integration into our environment. The transition went well and users were pleased by the extended feature set the Google collaboration offered.

With the successful implementation of that project, Information Technology began to pursue the concept of offering an enhanced email service for all students, faculty, and staff. A competitive vendor selection process was set in motion and after evaluation of proposals, Google was again the successful vendor. After planning and development work was completed, the service was placed into

production in July 2012, with open enrollment offered to those willing to transition early. Full deployment is scheduled to complete in October 2012.

Referred to on campus as "VT Google Apps," the service provides a private, secure area, where tools that mirror the publically available Google suite are available to Virginia Tech affiliates, yet governed by a privacy policy negotiated by university counsel that guards intellectual property rights of the university community. The policy also prohibits advertising. VT Google Apps is available at no cost to Virginia Tech and, when fully implemented, will provide significant cost savings in existing licenses, equipment, and human resources required to run an enterprise-scale mail system.

For more information, contact Ron Jarrell, [jarrell@vt.edu](mailto:jarrell@vt.edu).

## Advanced research computing

**HokieSpeed.** HokieSpeed is the culmination of a two million dollar major research infrastructure grant from the National Science Foundation. NI&S researchers and system administrators assisted the College of Engineering with the specification, construction, and testing of the new computer cluster. Unix Administration Services and Advanced Research Computing (ARC) were assigned responsibility for deployment and management of HokieSpeed.

**HokieOne— SGI Ultraviolet.** This new computing cluster was installed in June 2011. HokieOne is a shared-memory SGI UltraViolet system made available to Virginia Tech researchers in April 2012. It has 502 Intel Xeon 2.66Ghz cores (84 sockets on 42 blades) with 2.62 Terabytes of memory (5.3 GB/core). Because it is a shared-memory machine, it acts from the researcher's perspective as if it were a single large node (hence the name "HokieOne"). Users running pure shared-memory applications (e.g. OpenMP rather than MPI or hybrid code), are not restricted to working on a single node (i.e. a small portion of the total machine). It also allows users to request whatever allotment of memory they need when running a job, making HokieOne ideally suited for applications that require large memory shares. More information: <http://www.arc.vt.edu/resources/hpc/hokieone.php> .

**BlueRidge super-computer cluster.** The Advanced Research Computing group is deploying a new large-scale Linux cluster that will replace System X (third-fastest supercomputer in the world when built in 2003). Funded by the HPC Investment Committee, the new system facilitates the transition to ARC's new storage system and sets the stage for development of BlueRidge. Deployment is scheduled for third quarter of 2012.



## SGI HPC storage

Network Infrastructure and Services made substantial investments in the university's research data analysis and storage systems. These investments support data-intensive science programs, including those at the Virginia Tech Transportation Institute, the Virginia Bioinformatics Institute, and high performance computing systems such as HokieSpeed and HokieOne. These systems include over 500 terabytes of high performance file systems based on IBM's General Parallel File System (GPFS) and SGI's InfiniteStorage 16000 system, as well as a research data archive on SGI's Data Migration Facility (DMF) with several petabytes of capacity. The research data archive will allow Virginia Tech's scientific data assets to be maintained throughout the anticipated research lifecycle, enabling potentially

decades of continued scientific research. The storage service is anticipated to scale to over ten petabytes in the foreseeable future.

For more information, contact Wanda Baber, [wbaber@vt.edu](mailto:wbaber@vt.edu).

## Data Center power supply and generator upgrades

Following installation of a third power feed to the Andrews Information Systems Building, NI&S undertook a project in 2012 to expand backup power resources. A 2 Megawatt generator was installed in June to accommodate immediate and future growth of research computing, and to provide redundancy for other systems. The new generator will complement the 1.5 Megawatt generator already in service ensuring continuous, uninterrupted operation of critical systems.

The addition of a 900 kVA Uninterruptible Power Supply (UPS), completed in February 2012, bridges immediate, short-term power interruptions or anomalies, while the emergency generators maintain operations during longer-term interruptions. The Advanced Research Computing systems HokieSpeed and HokieOne are connected to this power system.

For more information, contact Mike Moyer, [Mike.Moyer@vt.edu](mailto:Mike.Moyer@vt.edu).

## EMC storage project

The EMC DMX 2000 storage system was replaced this year with an EMC VNX 5700 system. Also referred to as the storage attached network or SAN, it provides block level storage to NI&S virtualization servers, the Unified Communications project, enterprise systems database and application projects, Communications Network Services system development and administration projects and educational technology projects.

The legacy EMC DMX2000 was an enterprise class system with 99.999% availability, though at end of life with annual costs increasing rapidly. Following comparisons between other EMC enterprise class storage systems and the EMC VNX line of storage systems, the VNX5700, a mid-range system was selected. The 5700's ability to leverage solid state disk (SSD) technology enhances the overall system input/output performance for both reads and writes by as much as seven times, leverages a large selection of disk drive capacities and speeds, and its DVR-like replication functionality enhances business continuance and disaster recovery capabilities.

The RecoverPoint software and appliances along with a EMC VNX5500 storage system were also purchased to provide replication from EMC VNX5700 in AISB to Cassell—a major improvement. The RecoverPoint system is currently being installed with a completion target of August 1, 2012.

For more information, contact Wanda Baber, [wbaber@vt.edu](mailto:wbaber@vt.edu).

## Emergency Management— *Ready Virginia Tech*

Video/Broadcast Services completed development of instructional videos in cooperation with Virginia Tech's Office of Emergency Management in December 2011.

Comprised of more than twenty studio-recorded interviews and many hours of supporting footage, the videos include eight segments of five to 15 minutes in length. The university has plans to translate the programs into at least three additional languages—French, Spanish, and Mandarin Chinese. Emergency preparedness topics covered include outdoor safety, women's self-defense, alcohol education, and evacuation procedures.

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 instructional videos will serve as a resource for years to come. Sections for the library will be extracted for use in summer orientation.

For more information, contact Mark Harden, [mharden@vt.edu](mailto:mharden@vt.edu).

## Consulting support for the Center for the Arts

VBS consulted with leadership of the new Center for the Arts (CFA) to develop specifications for audio and video recording capabilities of the highest quality. An objective was to design a system that compliments a facility that will attract national and international performances and, with state of the art technology, will foster creative and collaborative efforts.

The specification provided to the CFA recommends that performance and recording spaces have a centrally located master audio/visual (A/V) matrix router with multiple remote access panels and software control. This centralized integrated switch approach will provide an interconnection pathway for a core set of select A/V components (audio, video, digital effects, etc.). It will facilitate allocation and sharing of resources and system capacity and provides a cohesive, integrated control and production environment. VBS also provided consultation support for equipment purchases for the newly renovated TV Studio and Converged Newsroom, a facility for the academic department of Communication Studies. This facility is also located in the center.

For more information, contact Mark Harden, [mharden@vt.edu](mailto:mharden@vt.edu).

## 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 for more than ten years to provide services, such as course management services and network connectivity, necessary to support their ever-changing and expanding environment. During this past year, NI&S and VCOM worked together to replace the temporary network connection between their new Spartanburg, S.C., campus and their facility in the Virginia Tech Corporate Research Center through a collaborative effort with Clemson University. This new permanent service interconnects their campuses via national high-performance research networks.

The VCOM Microsoft Exchange® server located in the Andrews Information Systems Building Data Center supports email for both of VCOM's Virginia and Carolinas campuses. In the summer of 2011, the VCOM Exchange server was updated from Exchange 2003 to Exchange 2010. An estimated 250 Faculty/Staff mailboxes and 1,841 student mailboxes were migrated. The VCOM Active Directory Forest and Domain were concurrently upgraded to Windows 2008. VCOM administration chose the "unlimited" quota option for their mailboxes, which significantly increased email storage capacity requirements. As a result, approximately nine terabytes of additional storage was brought online during the spring of 2012. Added to the 800 gigabytes of storage available from the existing Exchange server, the available storage essentially increased eleven-fold.

For more information, contact Brian E. Jones, [bjones@vt.edu](mailto:bjones@vt.edu).

## University Computing Support

**Computing.vt.edu.** Designed as a one-stop computing resource for Virginia Tech students, faculty, and staff, the *computing.vt.edu* website ("Computing") serves as central resource for content about Information Technology service offerings and associated support information at Virginia Tech.

During the multi-month project to renew this key university resource, the University Computing Support (UCS) team applied extensive improvements to the design, added significantly to



the number of topics addressed, streamlined navigation, and enhanced readability of articles.

Early in the process, UCS engaged stakeholders from other Information Technology units to obtain broader insight for the redesign effort. With information gathered from these meetings, a category structure was developed to organize website content. A new section was developed, to support accelerated learning about, and familiarity with, Information Technology offerings for students, faculty, staff, or alumni new to, or in a new role at, Virginia Tech.

Major objectives for the project included the following:

- Implement a readily maintained and accessible workflow that enables content owners to directly and promptly renew information
- Implement a content management system that provides a tool set to control who edits and publishes content
- Better align *computing.vt.edu's* content with its related "How-to" web resource *answers.vt.edu*
- Update *computing.vt.edu* website to conform to university website color and layout guidelines

"IT Systems Status" is part of the website that allows the community to post information about outages or degradation of services. The service was redesigned to provide a wider range of information about scheduled changes to systems, as well as detail about unplanned service or system issues. IT Systems Status also includes a historical status feature to provide access to information about issues that were recently resolved.

More features are planned which will build out IT Systems Status' array of services, including updates posted via Twitter and Facebook, RSS feeds, and a text messaging option. A proposed collaborative systems status service is being developed, which will allow other Information Technology groups to co-post news about their system operations, improving coordination and decreasing publicity response time.

**Crack the Code.** Designed to raise awareness of computing support resources at Virginia Tech, UCS staff members Carol Hurley and Luke Sullivan co-presented "Crack the Code: the results are in," at the 2012 conference of the Association of Collegiate Computing Services of Virginia. The presentation, summarizing challenges faced and lessons learned provided an update to last year's ACCS presentation on planning and development of the "Crack the Code" promotion.

The Crack the Code promotion took place at the beginning of the 2011 fall semester. A variety of QR (Quick Response) code stickers were created and placed around the main campus. When users' smartphones "read" the codes, the user was directed to a website, video, or the location of a prize. Expectations were for the campaign would go "viral" with students looking at a wide variety of university support resources, while searching for the prize codes.

The promotion was successful, generating over 1000 views of our educational videos. 83 prizes were awarded and the Grand Prize winner, a Virginia Tech freshman, won the 7-inch "Streak" computing tablet donated by Dell.

We plan to leverage these lessons this fall with a new Twitter promotion titled "4HelpTweets." A Twitter can engage students with a variety of resources (websites, self-help videos), topics (new initiatives such as Going Google, social networking security, cyber-stalking), and keep current participants interested over a long period to build an engaged audience for distributing information

**Special Computing Programs.** During New Student Orientation in July 2011, over 8500 new or transferring students and their family members were introduced to Information Technology at Virginia Tech and Computer Security Initiatives. UCS's largest orientation audience to-date received information about "Annual Password Security Management and Account Recovery options for PIDs." The VTnet security CD was put in the hands of approximately 5000 freshmen attending orientation, so they could prepare their machines with antivirus and firewall, software before connecting them to the university's network. Four new short video clips were added to the New Student Orientation video library. The library contains informative videos on a variety of topics that can be viewed by any Virginia Tech affiliate. Topics included Phishing, UCS' Crack the Code initiative, orientation to 4Help services and the Virginia Tech Call Center, along with instructions to guide freshman when picking up their Campus Agreement Software Bundles. The videos are available at: <http://www.4help.vt.edu/video>.

**Get Connected Program.** Get Connected (GC), a short-term program utilized during move-in and the first week of classes to orient new students to Information Technology resources at Virginia Tech, was enhanced during Fall Move-in 2011 by dispatching teams of GC students and staff to cover a wider area of residence halls, while concurrently reducing total staffing by six. During the first two weeks of the fall semester, 44 GC staff members provided in-person computing assistance to residence hall students, or provided technical support walk-in users at GC's headquarters in Torgersen Hall.

Planning is underway for future improvements to computing assistance for Fall Semester 2012. A pilot program will provide for deeper collaboration between the Information Technology Help Desk staff, comprised of full-time University Computing Support staff and student consultants, and the Get Connected teams, by consolidating walk-in support to a single location. By co-locating our services, advertising and support will be simplified, yielding efficiencies in our service model. Plans include offering real-time dispatching of support staff to provide more prompt problem resolution.

**UCS Technical Support Team.** An important objective for University Computing Support is to provide effective computer security protection and remediation. One method involves ongoing evaluation of software application security updates by highly qualified staff. In September 2011, Peter Franchi became a member of the

UCS Desktop and Faculty Services team. Peter brings extensive experience in desktop support and computer security.

Luke Sullivan joined UCS to assist Special Computing Programs and serve as an Information Technology consultant. Sullivan, who has experience providing training support at several corporate call centers and help desks, was instrumental in promoting the "Crack the Code" campaign and is currently developing the implementation plan for the "4HelpTweets" Twitter campaign.

For more information, contact Joyce Landreth, [jlandret@vt.edu](mailto:jlandret@vt.edu).

## Collaboration with the Virginia Bioinformatics Institute

As part of the high performance computing (HPC) storage investment, an Oracle SL8500 tape library with five thousand (5,000) tape slots and 64 tape drive slots was purchased. The library provides important additional capacity and serves a remote disaster recovery site for university's HPC storage and NI&S Network Backup service.

When Oracle produced the final quote for the SL8500 tape library from the draft quote, the number of expansions for the tape library increased, however the price remained the same. This resulted in a library with more capacity, ten thousand (10,000) tape slots, but too large for the Cassell space being prepared. The discrepancy was not detected until the shippers called to have the SL8500 delivered and the number of pallets was more than expected.

Network Infrastructure and Services (NI&S) had to either find an alternate location to house the SL8500, or return it in exchange for the tape library specified.

Oracle opted to let NI&S find an alternate campus site. NI&S approached Virginia Bioinformatics Institute (VBI) who was in the process of purchasing a replacement for their existing tape library. Collaboration between NI&S and VBI resulted in the SL8500 tape library being housed at VBI Phase I building and VBI having the right to use 2000 tape slots and 12 tape drive slots.

For more information, contact Wanda Baber, [wbaber@vt.edu](mailto:wbaber@vt.edu).

## Collaboration with the "Future of Music Coalition"

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, movies, and other digital content.

Based on provisions of the DMCA, Virginia Tech promptly addresses reports of Internet-based copyright infringement complaints (ICICs) alleged to originate from its network. In FY 2011-2012, the number of notices received by Virginia Tech continued at a significant rate, compared to historical data.

In addition to responding promptly to infringement allegations, Network Infrastructure and Services Public Relations' manager has conducted meetings to engage student groups in discussions on the topic of sharing copyrighted, digital creative works. PR continues to coordinate with the university's Office of Student Conduct to address student file-sharing cases and, to identify and communicate with appropriate student groups about Internet infringement issues.

Of particular note during the past year, NI&S also partnered with EDUCAUSE collaborator "Future of Music Coalition" (FMC) to develop a proactive educational approach for Virginia Tech on the subject of ICICs.

The FMC "is a national nonprofit organization that works to ensure a diverse musical culture where artists flourish, are compensated fairly for their



**Future of Music Coalition**  
WWW.FUTUREOFMUSIC.ORG

work, and where fans can find the music they want." PR and FMC developed a survey to measure file sharing habits and perspectives of Virginia Tech students and employees. The survey was distributed in spring of 2011.

A multi-channel publicity plan was employed by Public Relations staff Jeff Kidd and Phil Norman to advise the university community about the survey and panel. Channels included a 'weekly news' email notice to students, coordinating with Communication, Business, and Music professors to have them share information with their classes, notices placed on campus dining hall tables, public service announcements by the student-operated campus radio station, presentations to key student organizations, and an interview with the student-run newspaper.

Based on analyses of the survey findings, a public panel discussion was held in Squires Student Center in November 2011. Moderated by a member of the FMC, the panel included Virginia Tech students, music industry representatives, and a university employee, who is also a part time professional musician. The panelists provided a range of perspectives. Availability of legitimate low-cost services, as well as proliferation of illegal "no-cost" sources, were identified as a dilemma for proper compensation and support of even the most successful musicians. The program affirmed Virginia Tech's support of the DMCA and of copyright provisions in the Higher Education Equal Opportunity Act of 2008.

For more information, contact Jeff Kidd, [kiddj@vt.edu](mailto:kiddj@vt.edu).

## Housing and Residence Life— special service offerings

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

**Premium sports programming.** Premium cable television sports programming was made available during the fall semester to HRL. This offering provides telecasts of National Collegiate Athletic Association football and National Football League 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.** Internet access and telephone services were provided to thousands of HRL summer conference guests. Guests not directly affiliated with Virginia Tech reside 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.

For more information, contact Jeff Kidd, [kiddj@vt.edu](mailto:kiddj@vt.edu).

## Kestrel Internet Copyright Infringement Case Management System

Systems Development and Administration developers collaborated with the Information Technology Chief Technology Architect to complete the development of an Internet Copyright Infringement Case Management System. The system receives infringement complaint email, automatically researches cases, notifies alleged infringers, and allows for escalation of cases for repeat offenders. The system significantly automates the copyright infringement management process for the approximately 900 cases the university receives each year and provides improved reporting functionality. Additionally, this project provided an important opportunity to evaluate several Java-based rich client platforms.

An important companion application developed during this project was a Web service to support the management of administrative suspension of users' network services. This Web service is now available to the Information Technology Security Office to facilitate improved coordination between the two organizations regarding service deactivation due to security threats.

Kestrel is Network Infrastructure and Services' project for developing a next generation telecommunications management system to eventually replace legacy systems.

For more information, contact Morgan Allen, [allenm@vt.edu](mailto:allenm@vt.edu).

## National Capital Region Fiber Ring

Virginia Tech owns and operates a fully diverse, dark fiber ring interconnecting the NatCap nodes and other strategic locations including the Virginia Tech Research Center in Arlington, Virginia. The Network Operations Center operates an advanced packet optical network integrated with a dense wavelength division multiplexing (DWDM) system capable of delivering Metro Ethernet Forum standard carrier Ethernet services or dedicated channels at 1 Gbps-10 Gbps. Transport services can be tailored to meet specific requirements. Secure dedicated or shared access to any network or resource at NatCap McLean or NatCap Ashburn (Equinix) can be provisioned, including access to multiple service providers. The system is upgradeable to deliver 100 Gbps channel capacity in the future.



For more information, contact Jeff Crowder, [crowder@vt.edu](mailto:crowder@vt.edu).

## National Telecommunications and Information Administration Grant

NI&S provides program management and project monitoring and compliance for a fiber construction project funded by the US Department of Commerce—the National Technologies and Information Administration’s Broadband Technologies Opportunities Program (BTOP). The original proposal was developed by NI&S with strong support from the eCorridors program, 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.

Coverage will span over 110 miles through rural underserved communities. NI&S is contracting with the VTF to provide program management as well as grant compliance and oversight for the complex project. This fiber will improve high performance access for Virginia Tech, put the university “on-net” for state-funded fiber statewide, and extend broadband access to communities in the region. Virginia Tech provided support for additional successful BTOP proposals amounting to over \$130 million statewide. The project is on time for scheduled completion during 2012.

For more information, contact Jeff Crowder, [crowder@vt.edu](mailto:crowder@vt.edu).

## Transport Services request for proposal

On behalf of the members of the Mid-Atlantic Terascale Partnership (MATP) and the Virginia Tech extended campus reaching across the commonwealth, NI&S released a request for proposal (RFP) for advanced Ethernet transport services. The intent is to negotiate contracts with one or more service providers for high speed connections from MATP member sites, including Virginia Tech remote locations, to the NatCap Aggregation Facility operated by Virginia Tech, or to member campuses. These services should deliver affordable connectivity suitable for demanding research and video-intensive applications. The project is pending responses to the RFP from prospective providers, followed by contract negotiation.

For additional information, contact Jeff Crowder, [crowder@vt.edu](mailto:crowder@vt.edu).

## Local Multipoint Distribution Service

In 1998, Virginia Tech acquired FCC licenses permitting deployment of high-speed local multipoint data service (LMDS) -- beneficial for wireless backbone links and for alternate backup routes--in the region. 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 Gigabit Ethernet over distances of a few miles.

Three LMDS links have been installed in the Blacksburg area. One from Slusher Hall on campus to the Town Centre on Main Street to support classrooms and faculty offices, one from Slusher Hall to the Post Office on Main Street to support University Mail Services and a third from Slusher Hall to the Corporate Research Center Building 14 to provide a backup route for network data.

An important objective for acquiring LMDS service is to promote rural broadband infrastructure development. 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 business 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.

For more information, contact John Nichols, [john.nichols@vt.edu](mailto:john.nichols@vt.edu).

## Strategic Initiatives

**NetworkVirginia.** Virginia Tech's NetworkVirginia program delivers broadband services to rural and underserved communities throughout the state and provides access to 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.

For more information, contact Richard Hach, [rhach@vt.edu](mailto:rhach@vt.edu).

### In-Building cellular coverage/distributed antenna system

Work continues toward the implementation of a distributed antenna system (DAS) on campus to provide cellular coverage improvements. NI&S, Longent, LLC, and the wireless operators have completed testing and a campus-wide DAS design. A temporary, ballasted monopole and shelter has been placed near the Duck Pond overflow parking lot to improve coverage and capacity on that part of the campus, and work is underway to prepare Lane Stadium for improved coverage and to serve the main campus from that location.

Until completion of the project, in-building cellular coverage on the Blacksburg campus will vary, with areas where there is usable signal, to other locations where there is no service. Inadequate cellular coverage is primarily the result of the concrete-rebar-Hokie Stone-based construction used for most buildings on campus. 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.

For more information, contact Richard Hach, [rhach@vt.edu](mailto:rhach@vt.edu).

## IP-based safety and security cameras

Virginia Tech has entered in to a contract with X7 Systems Integration in Fairfax, Virginia. X7 will assist the university in the implementation of an enterprise-wide Internet protocol-based video surveillance system and the associated components to successfully implement campus safety and security surveillance systems consistent with University Policy 5617 Rev.:1.

X7 is an independent systems integrator. With its partners, X7 is capable of designing and deploying unique solutions for university personnel, departments, individual colleges, programs or campus organizations who require the use of video surveillance equipment. In conjunction with Administrative Services/Facilities Services and Network Infrastructure and Services, X7 Systems Integration can assist university personnel with camera implementation, operation and storage requirements in compliance with university policy.

Virginia Tech's first parking garage was also the site of the university's first implementation of the IP-based safety and security camera system. In cooperation with the Virginia Tech Police Department, Parking Services, the Office of Emergency Management, X7 and Network Infrastructure & Services, the 1300 space commuter lot was the pilot project for the successful installation and configuration of security cameras to improve campus safety.

For more information, contact Richard Hach, [rhach@vt.edu](mailto:rhach@vt.edu).

## Support for university research and innovation

### **Analysis of IPv6 stability and security in large network environments.**

Virginia Tech has been a leader in the adoption of IPv6. The university began experimenting with IPv6 networking in 1997. A Google paper using data collected from September 2008 to September 2009 found that 51% of the Virginia Tech hosts accessing Google's servers were capable of IPv6 and that Virginia Tech was third, globally in IPv6 connectivity. With one of the largest enterprise IPv6 deployments in the country, vendors are eager to partner with the university to investigate issues related to stability and security in a production IPv6 environment.

In January 2012, Cisco Systems Inc. awarded a grant to researchers in Network Infrastructure and Services (NI&S) to investigate security measures protecting IPv6 hosts from malicious users. Individuals associated with the research are Dr. Mark K. Gardner, Eric J. Brown, and M.S. student Naresh Gudipudi, from NI&S, and Stephen Groat, a Ph.D. student working with the Information Technology Security Office.

**Advanced Networking: Towards a Session Layer for the TCP/IP Protocol Suite.** Today's applications demand greater functionality from the network than was

required when the TCP/IP protocol suite was developed in the 1970s. For example, the ability for a networked device to seamlessly move between networks, without interrupting ongoing communications, was not a factor when TCP/IP was designed. Some researchers feel that completely new protocols are required to achieve the requested functionality. Research performed in NI&S suggests that it is not only possible to extend TCP/IP to achieve the necessary functionality, but that it is also highly desirable as a means to ease the transition to the new functionality. Findings of the research will be freely available to the Internet community through publications and research prototypes.

Work this year has focused on the development of a "smart user agent," or Context Manager, which arranges network communication contexts on the user's behalf. Research has focused on improving the transfer speed of data connections along high bandwidth paths

Virginia Tech researchers on this project are Dr. Mark K. Gardner, Eric J. Brown, and Ph.D. student Umar Kalim.

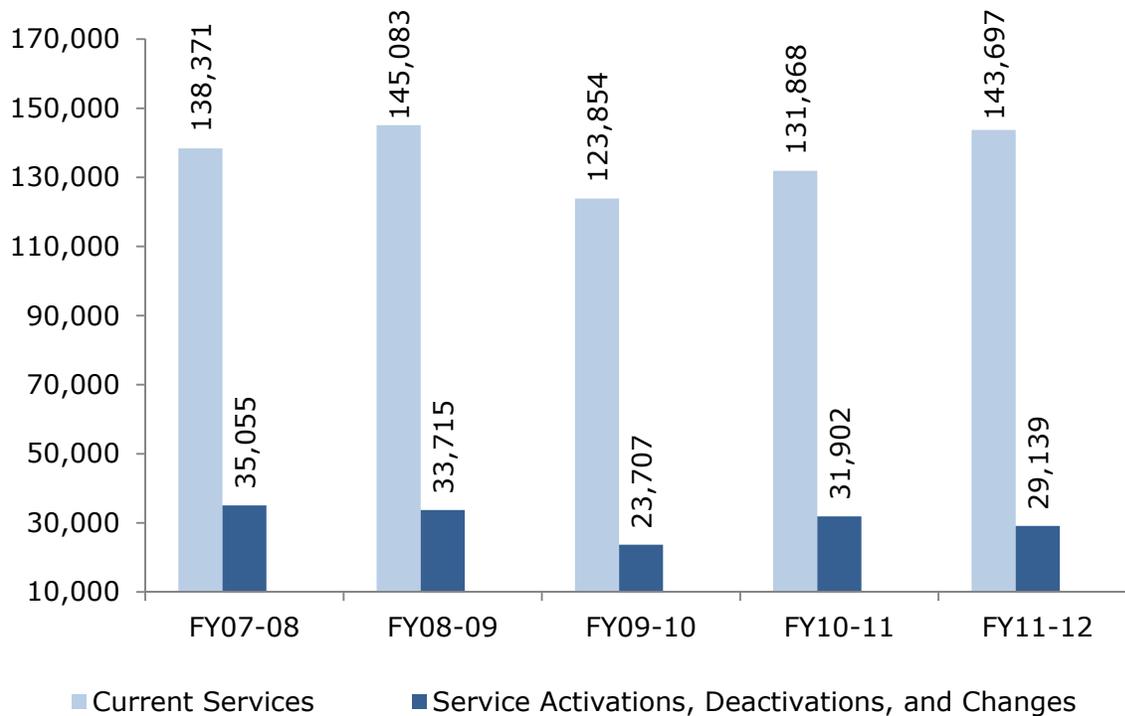
For more information, contact Mark Gardner, [mkg@vt.edu](mailto:mkg@vt.edu).

## Metrics

### Business operations

The increase in the number of current active services in FY 2012 is attributed to an increase in requests for Ethernet services, Wireless LAN/VPN services, and cellular services, equipment, and accessories. The number of telemetry services for the Virginia Tech Transportation Institute increased as well.

The number of service activations, deactivations, and changes represents the number of moves, adds, and changes to NI&S services. Such changes are often a result of departmental moves to new or renovated office space and the resulting domino effect when another department relocates to the space previously vacated. The decrease in service activations, deactivations, and changes in FY 2012 reflects a decline in the number of requests from departments due to moves and changes of services, and requests for new or changes to cellular telephone service, equipment, and accessories.



Number of current services billed to customers and the number of service activations, deactivations, and changes.

## Engineering operations

Network Engineering continues to improve and expand wireless local area network (WLAN) coverage. In FY 2011-2012, the number of buildings with WLAN service was static compare to the prior year, as some buildings are taken out of service for renovation or leases may have not been renewed. Facility renovation projects provide an opportunity to update and reconfigure the wireless networks to optimize coverage and capacity. Wireless utilization continues to grow as 25% more faculty, staff, students, or visitors to campus elected to use the WLAN for mobility and convenience during the fiscal reporting year.

### Wireless Local area network (LAN) subscribers and coverage

	FY07-08	FY08-09	FY09-10	FY10-11	FY11-12
Number of on-campus buildings with wireless LAN Service	143	162	170	193	192
Total number of deployed wireless access points	1,359	1,769	1,898	1,978	2,146
Total number of wireless LAN subscribers	29,885	32,089	35,995	36,012	45,082

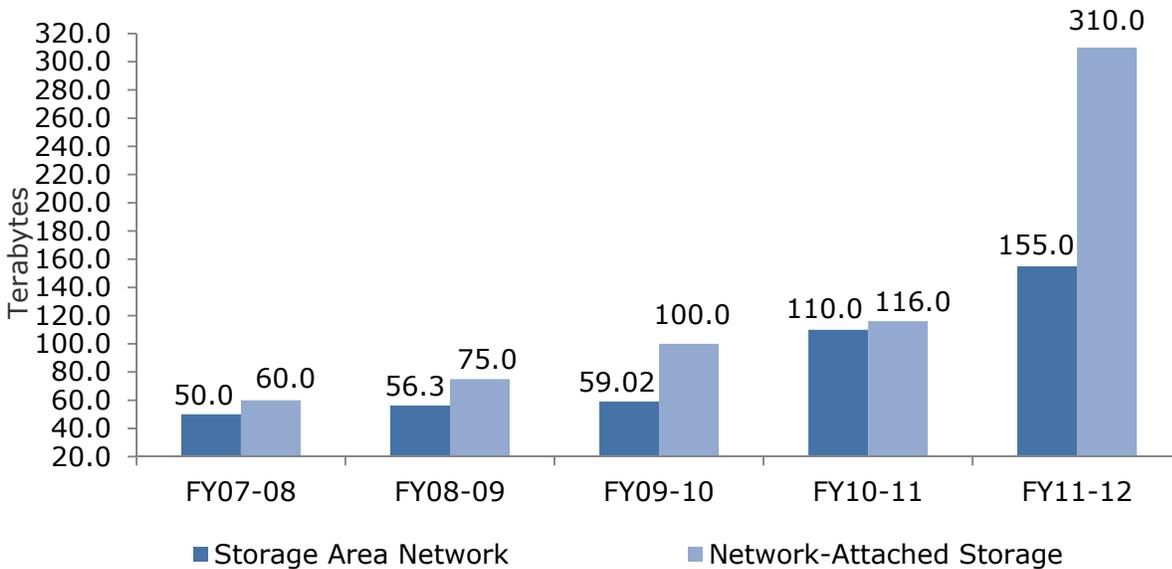
Wireless network users' simultaneous logins and unique device logins

Year	Peak number simultaneous devices	Total number of unique devices	Terabytes of traffic
2010	9,000	19,000	2.0
2011	9,900	26,000	3.8
2012	14,000	32,000	4.2
Growth since 2010	155%	168%	210%

### Systems Support

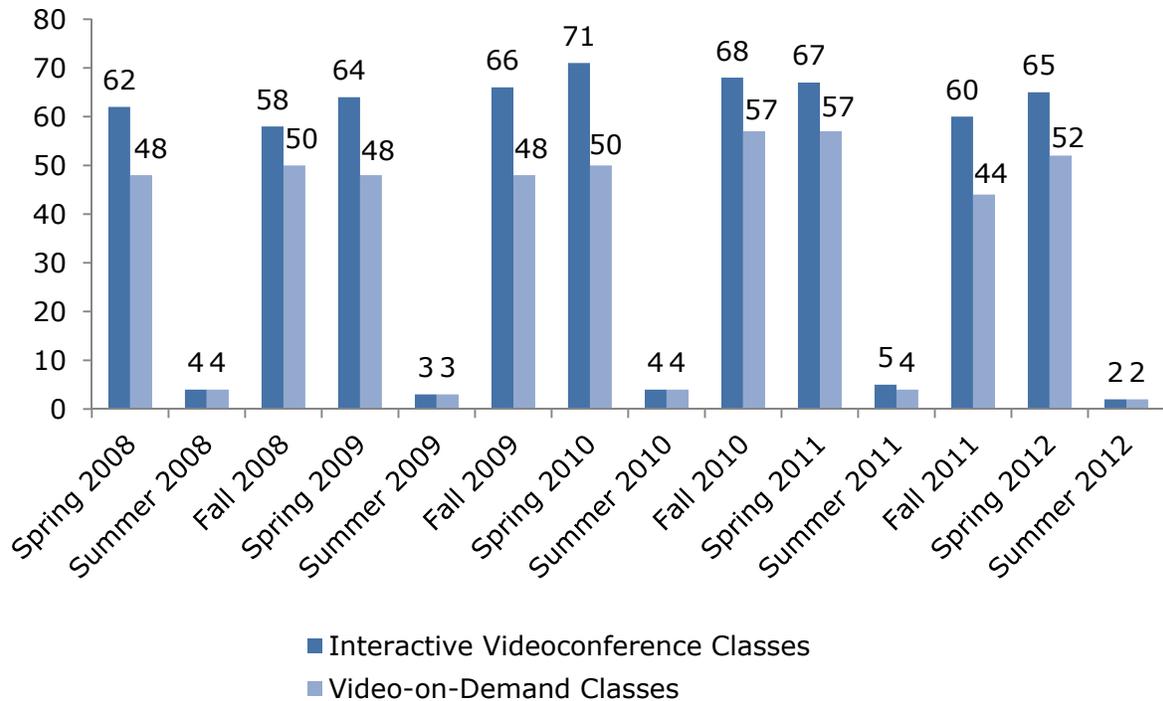
The EMC DMX SAN system was replaced this year with an EMC VNX5700 with a capacity of 155 Terabytes. Added storage on the SAN will be used to support projects, including projects in NI&S for virtualization, the Unified Communications project, and System Development and Administration projects; for projects in Enterprise Systems; and for Learning Technologies projects.

Network storage (terabytes)



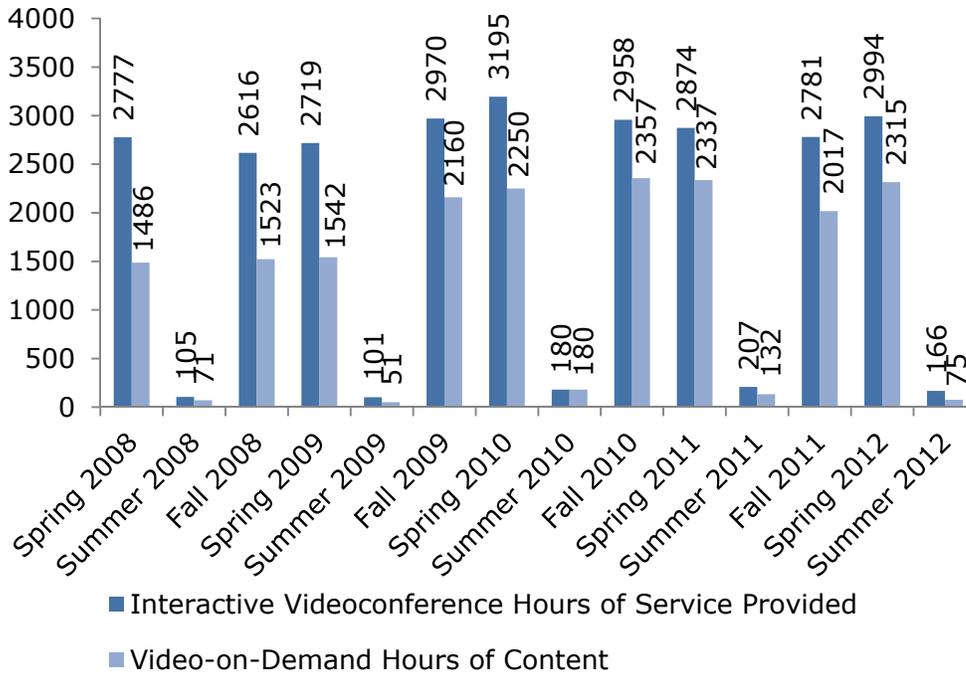
### Video/Broadcast Services-1

The graph 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.



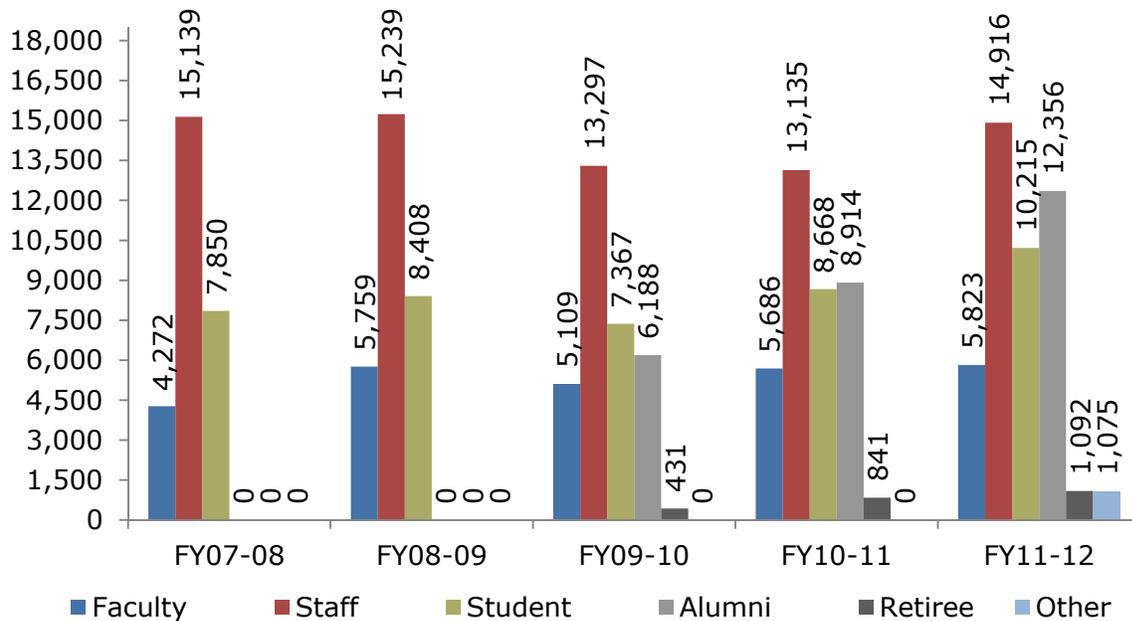
The next graph depicts the total number of hours of videoconferencing service that VBS provided and the total hours of lecture material prepared and hosted as video-on-demand files.

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 transcoding processor capability in order to deliver all its streaming classes in the high-quality, high-definition H.264 video format.

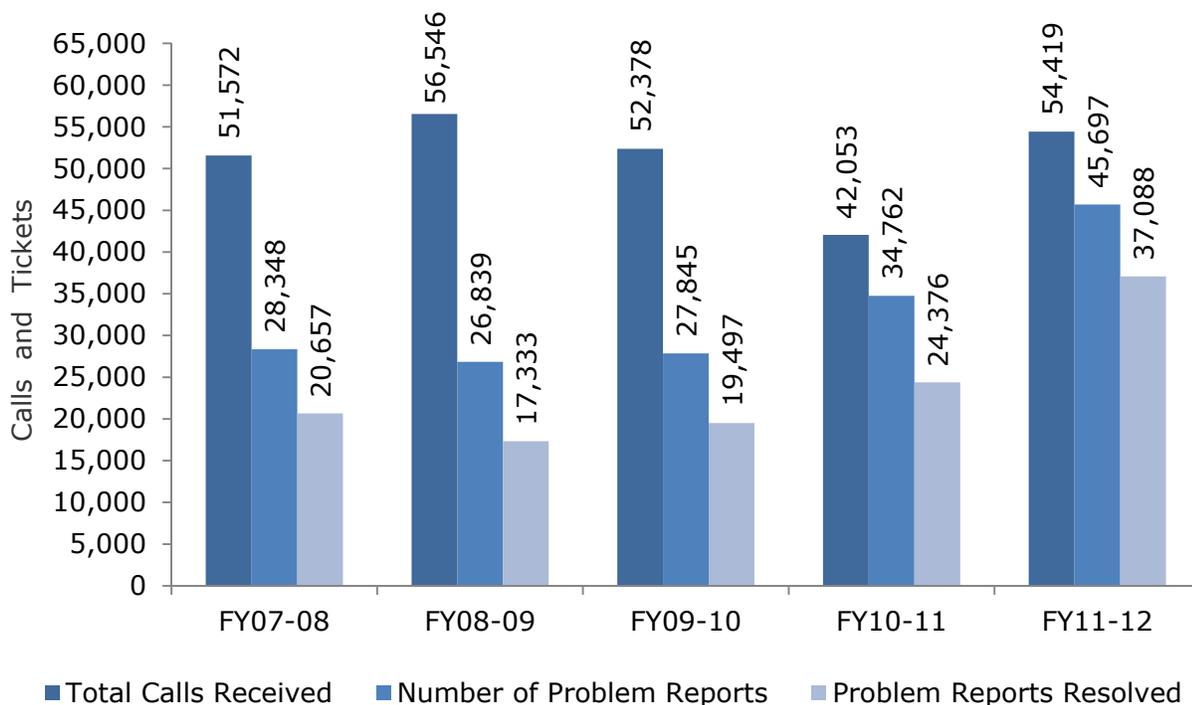


## Virginia Tech Operations Center

This graph depicts the distribution of the majority of problem tickets received in the VTOC by caller affiliation. "Student" calls increased principally due to the university's new requirement that account passwords be changed at least annually. "Alumni" and "Retiree" categories were added in FY09-10 and "Other" was added in FY11-12. "Other" includes calls about paying bills, service requests for NetworkVirginia, or misdirected (non-network/computing) inquiries. The number of tickets for alumni and retirees continue to increase, as a result of the Virginia Tech Google Email for Alumni project and an increasing number of recent retirees. The Virginia Tech Google Email project's objective was to move alumni from VT Mail servers to a comprehensive Google account—allowing them to retain their Virginia Tech email addresses.



The graph below depicts calls received by the Virginia Tech Operations Center (VTOC), the number of Remedy trouble tickets created, and the number of trouble tickets resolved by the VTOC. Support calls for Video/Broadcast Services are not included.

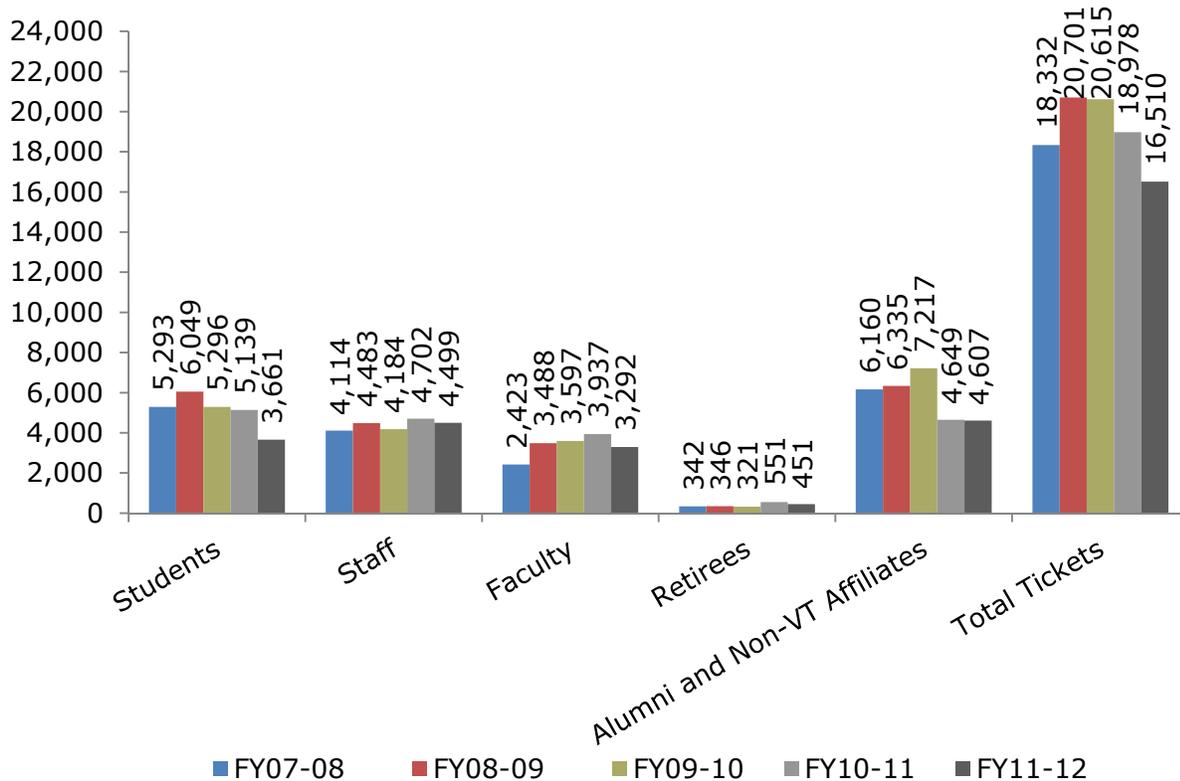


VTOC technicians receive questions and trouble reports from constituents and provide information and technical assistance as required. Trouble tickets are created, as necessary, and resolved if possible. If the problems cannot be resolved because of the need for additional data or a higher level of technical expertise, the trouble tickets are escalated to University Computing Support or other appropriate unit.

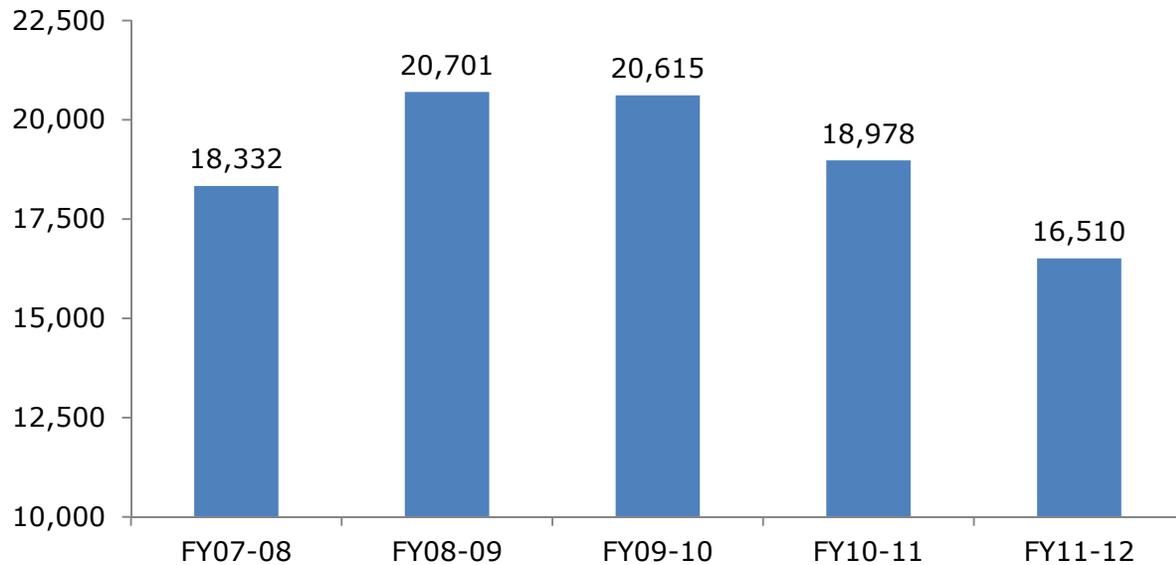
Due primarily to the new yearly Password Reset requirement, "Total Calls Received," "Number of Problem Reports," and "Problem Reports Resolved" increased substantially compared to FY 2010-2011.

## University Computing Support

Many callers have multiple Virginia Tech affiliations; the current university relationship of those seeking computing assistance is recorded where possible. The graph depicts the distribution of trouble tickets based on callers' affiliations. The distribution of tickets per customer affiliation, with the exception of students, for FY 2011-2012 was similar to FY 2010-2011. There was a decrease in the number of ticket from students due, in part, to increased efforts to educate them during New Student Orientation and the creation and presentation of self-help videos on Virginia Tech's YouTube and iTunesU channels.



The number of 4Help support tickets opened by University Computing Support (UCS)/4Help during the past five years reflects changes in the computing environment.



Guest Access Management System and Virginia Tech Google Email for Alumni were introduced during FY 2008-2009 and FY2009-2010, causing an increase in ticket counts. The decrease during FY 2011-2012 is primarily attributed to concluding implementation of the Virginia Tech Google Email for Alumni project, and a decrease in the number of calls related to Scholar implementation as users have become more familiar with the online course system.

UCS' employees are instrumental in facilitating the ongoing transitions to "Unified Communications" and "VT Google Apps" services, two very large projects impacting the entire campus community.

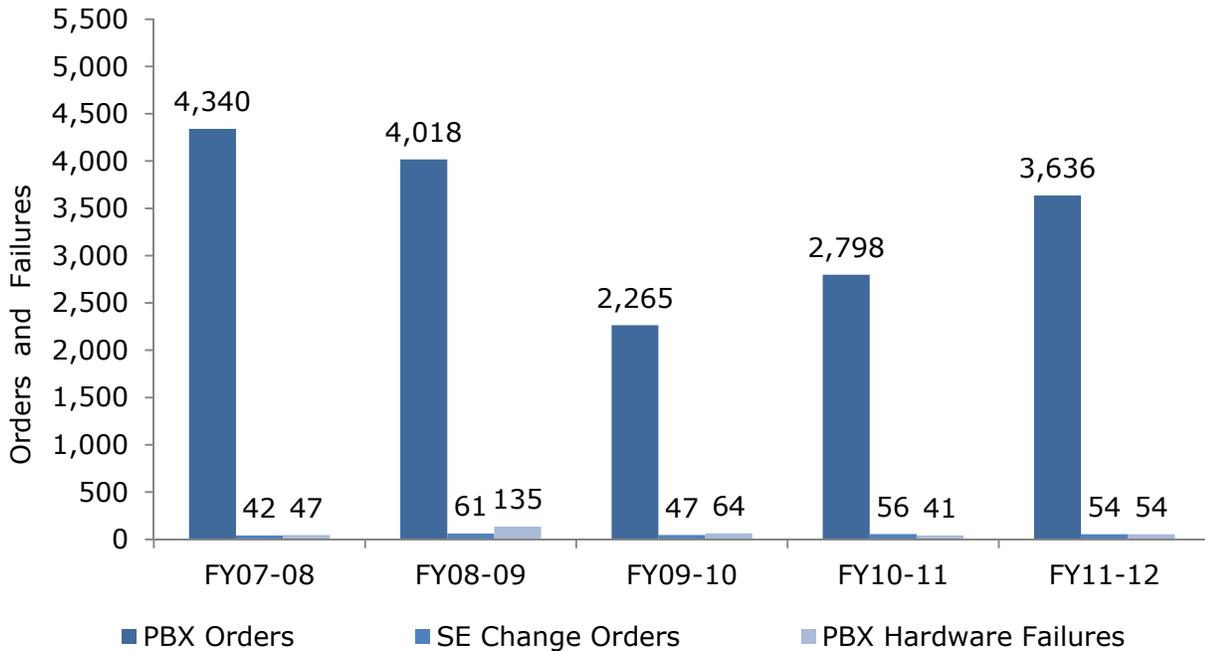
## Switch Engineering

*PBX (Private Branch Exchange) order* statistics 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 in FY 2011-2012 is related to renovation of Ambler-Johnston Hall's west wing, and construction of the new Academic and Student Affairs Building and the Veterinary Medicine Infectious Disease Research Facility.

*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 *PBX hardware failures*, which increased by 31% compared to the prior period, represent the total number of electronic circuit packs replaced in response to service-impacting failures of a node of the university's PBX.



As the system continues to age, component failures have become increasingly harder to resolve due to replacements not being as reliable or available as in the past. When there is a system failure, the completion time for problem resolution increases and there is a greater potential for user impact.

## Public Relations

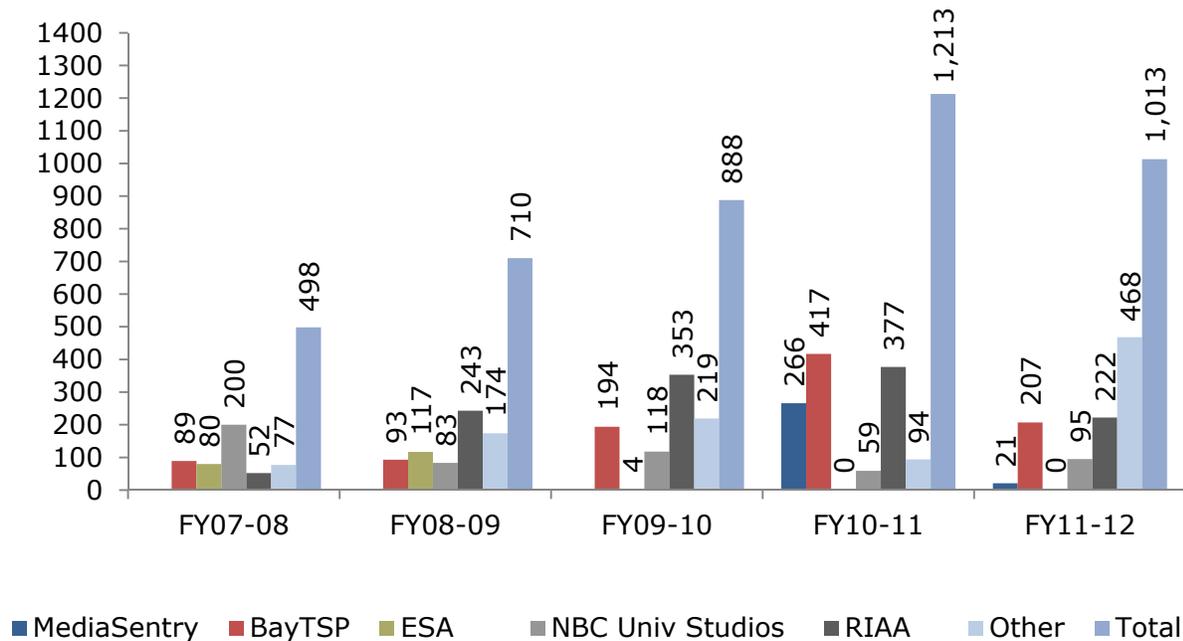
The Digital Millennium Copyright Act (DMCA, 1998) addresses the protection of copyrighted content that may be stored, played, copied, or transmitted in a digital format. The DMCA represents, in part, a legislative response to the proliferation of file-sharing or "peer-to-peer" software, which is a widely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

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, as a university ISP, is obligated to promptly address cases of Internet-based copyright infringement complaints (ICICs) alleged to originate from its network.

The volume of cases for 2011-2012 was down by about 17% from the prior year.

Over the period of 2004-2012, the principle originators of ICICs received by Virginia Tech have been BayTSP, the Entertainment Software Association (ESA), NBC Universal Studios, MediaSentry, the Recording Industry Association of America (RIAA), and new this year, Irdeto. Irdeto, an "anti-piracy" agency based in Netherlands, acquired nearly all Internet copyright infringement tracking and reporting agencies that communicate with Virginia Tech in October 2011.

### Internet Copyright Infringement Complaints (ICIC)



This report is available on the Web at <http://www.nis.vt.edu/2011-2012-annual-report>



# Secure Enterprise Technology Initiatives

Secure Enterprise Technology Initiatives (SETI) focuses on developing and supporting a secure infrastructure for computers, authentication, authorization, and digital identities. The following units are part of the organization:

Secure Information Exchange Services (SIES)

Enterprise Middleware and Authentication Services (Middleware)

Microsoft: Secure Infrastructure Services (M:SIS)

Quality Assurance and Verification (QA&V)

Accomplishments for the year span the organization.

**Identity Assurance Audit.** Select elements of Virginia Tech's Certification Authority (VTCA) were audited this year to satisfy the annual audit requirement for the VTCA. The VTCA audit and an audit of the Enterprise Directory authentication infrastructure served as the basis of a report submitted to InCommon to apply for certification as an identity provider that meets the requirements of the InCommon Assurance Program. To support these efforts, Secure Information Exchange Services deployed a new Token Administration System (TAS), and Enterprise Middleware and Authentication Services deployed changes to Shibboleth. Both groups provided assistance to Internal Audit during the assessment.

**ADAdmin.** Microsoft: Secure Infrastructure Services deployed ADAdmin to provide improved functionality over Hokies Self-Service, which is being deprecated. ADAdmin allows end users and organizational unit administrators to manage passwords, demographic information, computers, storage, and Exchange email and calendar options. The Quality Assurance and Verification team assisted with testing and usability recommendations.

**Google Apps for Education.** Middleware and QA&V participated in the request for proposal process for a new email system to replace the aging email and Webmail services. Implementing account provisioning for the selected product, Google Apps for Education, requires substantial and ongoing code development by Middleware, accompanied by testing by QA&V.

**IT Interns program.** QA&V and M:SIS employed two interns during the 2012 fiscal year. The QA&V intern collaborated with an intern from Enterprise Systems' Database and Application Administration group to work on SAMWise, a Bedework-based calendar tool for scheduling and communicating maintenance and system status events across all of Information Technology. This project should provide valuable real world experience for the interns.

**Assessment.** This year marked the first complete year of measurement data for assessing SETI's ability ensure that the department's infrastructure services are stable and available. The target metric is 99.9% uptime. While availability is still high, 2012 measurements revealed a slightly lower average for many services than the last reporting period, when statistics were only gathered for a few months, and measurement tools were less robust.

Service	Percent uptime	
	2012	2011
Central Authentication System (CAS)	99.971	99.975
Shibboleth	99.879	99.975
Enterprise Directory LDAP (ED-Id)	99.987	99.975
Enterprise Directory LDAP (ED-Auth)	99.993	99.975
Enterprise Directory LDAP (ED-Lite)	99.963	99.975
Middleware Messaging Services	99.898	not reported
Directory Access Tool (DAT)	99.965	99.935
Public Key Infrastructure (EJBCA)	99.999	100.000
Hokies Active Directory and University Services Domains	99.830	100.000
ADAdmin	99.890	99.960
Virtual Dedicated Windows Server (VDWS) service	99.930	99.970

Quality Assurance and Verification's assessment was to have less than one percent of JIRA issues resolved as 'Incomplete,' 'Cannot Reproduce,' 'Invalid,' or 'Rejected.' The purpose of this metric is to make the best use of developers' time in fixing problems that are relevant to our customers.

QA&V created or updated 149 issues this year, resolved as follows:

Completed	98
Open	21
Fixed/Fix Verified	10
Won't Fix (by developers)	7
Withdrawn (by QA&V)	7
Cannot Reproduce (by developers)	4
Duplicate	2

One issue was resolved as "Invalid" by a portal developer, but it turned out to be a Web service problem, and has since been fixed. Thus, the measurement is 4 of 149 issues, or 2.7%. A related goal was, "A process needs to be developed for reporting and acting on JIRA issues across multiple Information Technology groups." Enterprise Systems has created a "service request" JIRA issue type which makes it easier to assign issues outside of SETI.

## Secure Information Exchange Services

Secure Information Exchange Services has implemented the Virginia Tech Certification Authority ([VTCA](#)) to provide a digital certificate service to the campus community. SIES maintains and works to enhance and extend the use of public key infrastructure to better secure university systems and information.

**Token Administration System (TAS) v3.2.** Working together with members of the InCommon Silver for Virginia Tech project, the SIES unit developed and deployed a new TAS v3.2 release to implement the more rigorous identity validation requirements defined in the InCommon Identity Assurance profiles "Bronze" and "Silver." TAS is an administrative application developed by the SIES unit to support full lifecycle management of personal digital certificates (PDC) issued onto eToken USB smart devices. The TAS v3.2 release will help address the need for stronger identity management procedures and allow Virginia Tech service providers to place a higher level of trust in the identity of users who have been issued eToken PDC credentials that meet the InCommon Silver standard.

**Soft PDC early adopter program.** The SIES unit continued its work on a software requirement specification document for the soft personal digital certificates (Soft PDC) project. Soft PDCs are stored as files on a computer's hard drive or other storage media (flash drives, CDs) as opposed to storage on a smart device such as a smartcard or hardware eToken. The soft PDCs can be used for encrypting email and files as well as for digital signatures and authentication. In October 2011, the SIES unit initiated a Soft PDC early adopter program with the assistance of the Quality Assurance and Verification group. The early adopter program provided valuable feedback by helping to identify potential usability issues resulting from the technical complexities inherent with public key infrastructure (PKI). The SIES unit temporarily suspended its work on the Soft PDC project in January 2012 in order to reallocate personnel resources to the InCommon Silver for Virginia Tech project. SIES expects to resume work on the Soft PDC project during the coming year.

**Virginia Tech Global Root CA CRL profile.** The Virginia Tech Global Root Certification Authority (CA) uses profiles in establishing subordinate CAs that in turn issue certificates that are trusted by entities external to Virginia Tech. SIES quickly responded when learning about a serious SSL library implementation flaw in MAC's OS X release that was causing SSL applications to abend when processing the Virginia Tech Global Root CA Certificate Revocation List (CRL). While a permanent patch by Apple is anticipated to occur in the near future, the SIES unit decided to move forward with an interim solution. In January 2012, SIES removed the "CRL Distribution Point" extension from Virginia Tech Global Root CA CRL profile which

successfully resolved the CRL checking problem being experienced on MAC OS X platforms.

**TAS 3.2 identity assurance audit.** The SIES unit worked closely with the Office of Internal Audit to assist with the review of TAS 3.2 in conformity with the fiscal year 2012 audit plan. The TAS 3.2 review focused on compliance with the technical controls which were implemented to meet the stringent identity proofing criteria defined by the InCommon Identity Assurance profiles "Bronze" and "Silver" Version 1.1. The audit was completed on May 10, 2012.

**Globally-trusted SSL certificates.** The Virginia Tech Global Server CA, which the SIES unit implemented in March 2011, continues to provide a popular SSL certificate service for Web administrators needing to secure their Web applications. In March 2012, SIES initiated a project to address changes being implemented by GlobalSign, the company that provides external trust in Virginia Tech's certificates. The changes are designed to provide a more secure CA operational environment by implementing technical controls to restrict the domains where certificates can be issued. The SIES unit plans to continue working with GlobalSign to insure the required changes are deployed with minimal impact on current certificate services.

**GlobalSign Code Signing Certificates.** In March 2012, the SIES unit tested Virginia Tech's access to GlobalSign's Web-based Managed Code Signing certificate service. This service supports issuance of code signing certificates at no cost to developers on campus. Code signing certificates give developers the ability to digitally sign their code which provides relying parties confidence that code being downloaded is authentic and has not been altered or corrupted since it was created and signed. SIES provided training to the Identity Management Services (IMS) office on how to use GlobalSign's interface to issue the code signing certificates to Virginia Tech affiliates.

**Ongoing technical support.** Technical support of the VTCA is critical for the ongoing successful operation of its digital certificate services. SIES continued to provide support for its PKI Web services, Token Administration System, eToken RTE Installers, and the VTCA PKI infrastructure including the VT Root, Global Server, Middleware, and User CAs. SIES assisted the TAS administrators in the Student Network Services and Information Technology Acquisitions offices to ensure a successful TAS 3.2 deployment and provided training for their TAS operators. In addition, the SIES unit upgraded its VMware vSphere 5 Hypervisor development/support environment with a new DELL Precision T3500 WorkStation.

**VTCA service availability.** In April 2012, SIES, in conjunction with the SETI Microsoft: Secure Infrastructure Services group migrated the VTCA service availability monitoring function from using load balancer logs to Microsoft's System Center Operations Manager, which provides more reliable and flexible monitoring options. The PKI services that support the VTCA were extremely reliable this year, and issued certificates for SSL servers, users, and Middleware services.

Total VTCA server certificates issued during FY11-12	346
Total VTCA valid server certificates in circulation	638
Total VTCA user certificates issued during FY11-12	153
Total VTCA valid user certificates in circulation	828
Total VTCA middleware certificates issued during FY11-12	46
Total VTCA valid middleware certificates in circulation	69

## Microsoft: Secure Infrastructure Services

The primary responsibilities of M:SIS include maintaining the enterprise-level Active Directory (AD)—Hokies—and developing AD-enabled and AD-enhanced applications. Our focus is to provide a stable, scalable, and secure Microsoft-based computing environment.

**Hokies Active Directory passwords.** M:SIS successfully contributed to the initiative to change Hokies account passwords yearly. The group developed the Warden application to provide e-mail warnings of password expiration and to expire accounts with passwords older than 365 days. M:SIS wrote an Active Directory password filter to support extended character-set requirements for the Password Reset project, which will address Hokies passwords in fiscal year 2013.

**ADAdmin.** After several years of research, development, and testing, ADAdmin was deployed this year. ADAdmin provides a user-friendly interface to manage Hokies Active Directory accounts. The tool is available for both end users (self-service) and administrative users. Documentation was provided in the form of Knowledge Base articles. Updates to ADAdmin version 1.0 were made with version 1.09.

**Cyber Security Desktop Initiative (CSDI).** To complement the restricted network project initiated by Network Infrastructure and Services and the IT Security Office, M:SIS designed a highly secure virtual desktop environment. The group manager built a grant proposal and successfully received \$30,000 in consulting services from Dell and Microsoft for a three week engagement to bring up the environment. A new rack, power, hardware, and networking components were set up. A thin client prototype was demonstrated for the vice president of Information Technology and for Human Resources. Production deployment will require funding for support personnel.

**Energy monitoring.** M:SIS developed code "GreenVirt" to monitor energy consumption. GreenVirt interfaces with Watt's up .NET meters that are attached to Dell server systems. A production deployment of the Granola product was also reviewed for functionality.

**VT Windows Software Update Service (WSUS).** VT WSUS is an automatic software update service sponsored and managed in production by University

Computing Support. Work was begun to update VT WSUS to support Windows 8 and Group Policy.

**Hokies Self-service password reset.** Response to an audit of the IT Security Office in 2010 included a project to provide self-service password reset options for Hokies Active Directory account holders. The Hokies project, which was delayed until after a self-service option for PID password resets was complete, was initiated this fiscal year. The project will allow users to select from options that include resetting their passwords using an eToken PDC. Hokies self-service password reset options are expected to be in production before Fall Semester 2012.

## **System administration and maintenance**

**Virtual Dedicated Windows Server (VDWS) service.** VDWS, which utilizes Microsoft's Hyper-V clustering technology and advanced networking, was extended in production to support highly available guests, allowing for 99.99% uptime for the VDWS+ service. Support for Linux guests was also added. The service currently supports guests for 11 Information Technology departments and 18 other departments, representing 95 guest instances. VDWS generates over \$18,000 in yearly service fees. For fiscal year 2012, 96% of the VDWS/VDWS+ guests renewed their service subscriptions. 100% of the VDWS/VDWS+ customers have renewed their service for next fiscal year.

**Active Directory support.** M:SIS worked with Microsoft Premier Support to perform an Active Directory health check onsite. Reports were issued and remediation was applied to the centrally managed domains. Administrators of child domains were informed of any deficiencies, and some tighter security measures were planned to be pushed via group policy.

Other tasks related to Active Directory included testing an upgrade of the Active Directory to Windows 2008 R2, building a physical domain controller to resolve issued in the University Services domain, developing an application to support a request from IMS to restrict OU admin group membership, and deploying Microsoft Data Protection Manager to support Windows native level system and service backup and recovery for SQL and Hyper-V.

**Systems Center Operations Manager (SCOM).** The Microsoft SCOM product provides a management and monitoring platform for virtualized environments. M:SIS built a SCOM development and production environment to support proactive monitoring of their systems and services, and developed a distributed application to support watching complex services such as ADAdmin. They developed a SCOM monitoring task to monitor uptime for services managed by SETI's SIES group. Dell Operations Management Server Administration agents were installed in development, test, and production environments to extend hardware and software detailed reporting in SCOM. Support for Linux guests was also added to SCOM.

**4/16 SharePoint support.** M:SIS maintains the SharePoint site for the 4/16 documentation. Hardware problems with the site prompted M:SIS to migrate it to a virtual environment. The new environment reduces hardware support costs and provides a more reliable platform for the site.

**M:SIS process improvements.** M:SIS rolled out a centrally managed version of Identity Finder for their development, test, and production servers. They updated the [VT Windows User Group](#) and [M:SIS](#) web sites. Research and testing was performed to enhance Active Directory login with the eToken PDC.

## Collaboration

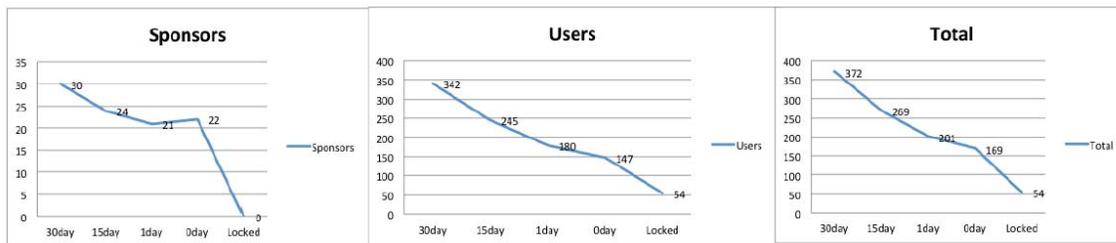
M:SIS hosts the Virginia Tech Windows User Group as one of the group's ongoing activities. Other collaboration included assisting other units within Information Technology with security, virtualization, child domain deployment, encryption, Active Directory storage of personal certificates, Office 365, NetApp permissions, software evaluation (Secunia Corporate Software Inspector,) and plans for the Institute for Creativity, Arts, and Technology. M:SIS brought up a Microsoft Certificate Authority to aid Veterinary Medicine in testing Systems Center Configuration Manager and helped the Business and Management Systems group with Citrix, DHCP, and RSA token testing for the Board of Visitors.

## New M:SIS open source offerings

**ADPasswordFilter.** ADPasswordFilter adds additional password complexity constraints when users attempt to change passwords in a Windows environment. The Windows Installer (MSI) package can be installed to a workstation to filter password changes on local accounts or it can be installed to domain controllers to filter password changes on active directory accounts. ADPasswordFilter can be downloaded at <http://opensource.w2k.vt.edu/adpasswordfilter.php>.

**Warden.** Warden finds Active Directory users who have not changed their passwords since a specified date. It will search for different types of users, such as "normal" or "sponsored" (as differentiated in the description field of the user account). Warden is equipped to log, email, and/or set the 'must change password at next logon' flag for such users. Optional logging is accomplished via Apache log4net, and is very customizable whether debugging the setup and configuration of Warden, or in a normal run cycle. Optional emailing has a variety of configurable settings for recipients and email content. And finally, Warden can be configured for warning mode (good cop) or password expiration mode (bad cop) to help enforce an organization's security policies. Warden was designed to be run from Windows scheduled tasks and has features for problem alerting as well as detailed logging for quick problem determination. To assist with setting up and configuring Warden for your environment, Warden also has test mode settings which can help prevent embarrassing misconfigurations during testing. Warden can be downloaded at <http://opensource.w2k.vt.edu/warden.php>.

## M:SIS Warden self-service password notification and reset statistics



User accounts within this window: 342  
Sponsored accounts within this window: 30

28.23% where changed between the 30-15 day window

26.77% where changed between the 15-1 day window

16.92% where changed between the 1-0 day window

28% got "bad copped" and were forced to change (or deleted)

## Enterprise Middleware and Authentication Services

Middleware is responsible for research, development, and implementation of infrastructure components to support identifiers, authentication, and authorization services. Some of these infrastructure components include directories, directory-enabled applications, and messaging systems.

### Enterprise Directory

**Google Apps.** Email account provisioning is accomplished by a set of software interfaces that are supported and largely developed by Middleware. So when it was proposed to switch from VT Mail to a cloud email solution, Middleware became heavily involved. The group manager participated in the procurement process to select a new email system. The selected solution, Google Apps for Education, required changes to the Enterprise Directory and supporting middleware code for creating email accounts, setting passwords, and setting aliases and forwarding. Middleware provided software development to support the first phase of the project: self-service provisioning of Google accounts.

**Lightweight directory access protocol (LDAP).** Middleware supports the university's LDAP directories that are used for VT People Search, and for PID (essential university username) authentication and authorization. This year,

Middleware upgraded OpenLDAP to 2.4.30 and began using tcmalloc for more efficient memory allocation. Improvements were also seen by using back-hdb rather than back-bdb to manage database objects.

**Directory Access Tool (DAT).** Authorized individuals use the DAT to manage and view information related to university affiliates. During this reporting cycle, Middleware updated the DAT to support the Google transition. Requirements were gathered and research was done on technology for the next version of the DAT. Minor bugs were identified and corrected.

**Replication.** Information must be correctly replicated from Banner to the Enterprise Directory Registry database and then to the LDAPs. Middleware improved replication by upgrading HornetQ to 2.2.14, which included several bug fixes. Middleware also deployed end-to-end health checking for messages.

**Improvements to support tasks.** Middleware created a new build and deployment environment that leverages file system encryption to secure sensitive data at rest. They updated and added tests to improve test coverage. An extensive code review was done to improve logging and eliminate the logging of sensitive data. Auditing data is now stored as JSON, rather than XML.

**Web Services.** Support for entitling services was added.

**Central Authentication System (CAS).** CAS is the university's secure single sign-on solution, which allows users to authenticate to services using PIDs, personal digital certificates, and as of this year, Enterprise Directory Guest accounts. During this reporting period, Middleware designed and deployed an improved system architecture based on a redundant memcached storage facility that improved throughput by up to 500% while improving availability and fault tolerance. An interactive help system was also designed and implemented to assist users with forgotten user names and passwords.

**Shibboleth.** Shibboleth is an open source solution that interfaces with CAS at Virginia Tech to allow single sign-on to federated services such as those provided to InCommon members. Middleware architected the authentication and assurance framework for Shibboleth/CAS in support of InCommon Silver certification. The group also performed testing with the CILogon service at the University of Illinois and provided valuable documentation of their test results to the InCommon community.

**Open source.** Middleware continued to develop their open source expertise by installing and configuring ApacheDS, OpenLDAP, and Active Directory in various environments to support testing. They contributed an authorization fix to mod\_auth\_cas and developed a number of improvements to Jasig CAS that are beneficial to Virginia Tech. Notable contributions were Performance enhancements to the memcached integration components and extensible monitoring framework for

integration with enterprise monitoring software. Middleware also implementation support for elliptic-curve cryptography algorithms in the vt-crypt project.

## SETI Quality Assurance and Verification

Quality Assurance and Verification provides functionality and usability testing for SETI applications and services. We also support the deployment process, providing input regarding schedules, standards, and documentation for production implementations.

QA&V provided testing support for SETI units' EJBCA upgrade, TAS upgrade for InCommon Silver, ADadmin replacement for Hokies Self-Service, and Enterprise Directory testing for account manager, CAS login, and email improvements. Other testing was performed for the following projects that were collaborative initiatives within Information Technology.

**Account Recovery Project.** The purpose of the Account Recovery Project is to enable users of PIDs to reset forgotten passwords without phoning 4Help. Options are SMS (cell phone text messaging), OpenID (login to Google or Yahoo), and disabling of the Call 4Help option, which were tested for all affiliations and many platform and browser configurations. QA&V assisted the help desk on the day the passwords expired, helped identify a problem with password replication delay, and discovered an auth group logic problem which would have prevented Student Network Services from resetting PID passwords for walk-in customers. These problems were fixed, and over 75,000 users have set account recovery options.

**Going Google Project.** The purpose of this project is to move vt.edu email accounts to the VT Google Apps domain. QA&V was represented on the product selection committee and on the group that is overseeing the transition. We tested all affiliations and many platform and browser configurations, and made many suggestions about documentation, workflow, and user interfaces. This project continues in fiscal year 2013.

**Personal Encryption Certificate Early Adopter Program.** The purpose of this project was to distribute soft personal digital certificates to users for encrypting email, authenticated logins, and digital signatures. The certificates were issued by a development certificate authority, so they did not "chain up" to an externally trusted root authority. The availability of the certificates was announced in October 2011. Three departments were interested in encrypting email for compliance with federal laws. Sixty-eight development certificates were issued during the 2012 reporting period. An informal survey showed that 55% of early adopters were using certificates for encrypting email and for authenticated login. About half said they would be more likely to use personal encryption certificates if they had configuration instructions for their specific applications, a directory for the exchange of public keys, and/or had

certificates signed by a globally recognized authority. Over half of those surveyed said they had used eTokens, VT-issued SSL certificates, Netcerts for wireless access, and self-signed or non-VT issued certificates. One user commented, "Please continue with this project, and expand certificates' usability."

**IT Interns.** The interview process for interns for QA&V began in September. Hokies4Hire and academic departmental listserv lists served as forums to advertise the positions, and after many interviews, interns were hired. In the spring, QA&V provided interview and orientation materials to the Database and Application Administration (DBAA) team in Enterprise Systems. The QA&V intern took a class in usability engineering, which helped her collaborate with the intern from DBAA on SAMWise, a Bedework-based calendar tool for scheduling and communicating Information Technology maintenance and system status events.

**Improving the test environment.** QA&V sorted and sent outdated equipment in the test bed to surplus, and set up some newer computers with Windows 7 and Mac OS Lion. A new guest was set up on a VDWS host. SSL and middleware client certificates were installed on several machines, along with mod\_auth\_cas and ruby\_cas clients.

**Committee work.** QA&V participated in the redesign of computing.vt.edu, the Data Quality committee, and the SAMS committee, which coordinates Information Technology system maintenance.