# Information Technology Annual Activities Report     2009-2010

VirginiaTech

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# Information Technology 2009-2010

The Vice President and Chief Information Officer and the Information Technology organization is responsible for

- enhancing and supporting teaching and learning;

- participating in, supporting, and enhancing research;

- fostering outreach, developing partnerships with communities, and promoting the capabilities of advanced networking and communications;

- providing, securing, and maintaining information systems allowing the university to accomplish its missions.

The vice president's annual report for 2009-2010 includes a review of key activities from across the organization, as well as unit reports from areas reporting to the vice president.

In the 21st century, Virginia Tech focuses the vast predominance of information technology investment on research and instruction rather than administrative systems (a reversal from the 1980s). We must meet the computational and network requirements for high-end research to maintain research funding competitiveness.

To meet these goals, the university leverages research investments to support administrative applications on the margin.

Today, university administrative applications at the enterprise level consume less than 5% of the total online storage, less than 1% of the total enterprise computing processor power, and less than 1% of total network bandwidth.

Administrative applications can be supported on research infrastructure. The reverse—support specialized research with administrative enterprise systems—cannot work.

A number of goals for Information Technology as an organization stem from this support for research with administration supported on the margin.

First, the research effort must drive the acquisition and deployment of new networking and computing infrastructure.

Second, safety and security are constant watchwords in our adoption and renovation of infrastructure. Basic communications systems (wireless and wired) are designed to support critical infrastructure such as energy management systems, access control systems, security systems, computer systems; the conduct of business; and personal communications. They enable multi-media interactions including voice, video, digital control streams, as well as traditional text transfers. These systems are designed for extraordinarily high availability because communications systems are the most critical element in the response to and mitigation of emergency situations potentially effecting personal safety. And these systems are designed to enable secure and private communications.

Therefore, we design, develop, implement and operate communications systems with the goal that communications services, once established, must be available continuously, and not be interruptible, except for critical maintenance activities where all potential affected parties have been notified.

Truly secure access to spaces—as well as to systems and services—means that Virginia Tech needs to have an appropriate level of confidence in the identity of authorized persons, with effective and efficient ways of ensuring that access is both appropriately provided as well as denied to unauthorized persons. No longer do building personnel exclusively control access to physical facilities. Today, people in diverse roles require self-service access to facilities

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and services that are both physical and online. Security must be designed to protect human safety and confidentiality, and to comply with federal and state mandates.

As the need for self-service access has grown, systems for identity and access have proliferated. In the realm of physical access, many spaces and facilities are secured with centuries-old physical keys with possibly imprecise records of possession, while other methods employ contemporary technologies (for example, encoded identification cards or fingerprint scans). Similarly, online access methods may be tied to enterprise systems with good methods of identification and provisioning/deprovisioning, or to multiple, localized methods run independently of one another. In both environments, multiple systems lack coordination and consistency with one another, and, often, the lines of authority for granting access and implementing access controls are split across varied offices and positions.

Safety and security also extends to the protection of university information. The university strategic plans calls for the implementation and maintenance of systems that protect the confidentiality of university data while also ensuring full replication of all mission-critical information.

Third, we must meet the imperative for technical currency in our administrative enterprise systems. Long-term viability requires that systems be updated both for security and for technical currency, positioning Information Technology units to deploy new administrative functionality as demanded by the operational environment at reasonable costs. As a part of this currency program, Information Technology must provide leadership to the distributed and decentralized computing installations within the university to also stay technically current so as to manage interoperability, security, and effective operations.

Fourth, development of the professional capabilities of the university's personnel and students furthers the learning mission of the university and benefits the effective and efficient managing of our information technology resources.

Finally, understanding and appropriately incorporating competitive edge technologies benefits both the university specifically, but also benefits the extended communities of the commonwealth and beyond. For example, Virginia Tech has been a leader among universities nationwide playing an active role for the emergence of information technologies which have changed the world. Through collaboration regionally and nationally and through private sector partnerships, we have influenced the information economy, driven costs down, and created advantages for Virginia businesses and citizens. These have included Blacksburg Electronic Village in the 1980s,

the pre-dawn of the Internet; NetworkVirginia in the 1990s that drove ubiquitous access in Virginia ahead of other states; and more recently, National LambdaRail/Internet2 evolving Internet technology and national research infrastructure.

# Administrative assessment

This section of the report highlights selected goals, objectives, and measures of achievement for these critical themes in information technology.

## Research support

Among the goals in the research arena for this past year have been those that focus on providing the appropriate, high-end computing and networking environments for the 21$^{st}$-century research university. From the Information Technology Strategic Plan, is the goal to provide the university with ubiquitous optical and wireless high performance network infrastructure.

The university strategic plans calls for robust and integrated information technology

strategies that advance Virginia Tech's excellence. Research is a key measure of this excellence, since upgrades to the university communications infrastructure and high performance computing, both on campus and regionally, provide the computing power needed to support faculty discovery.

One **objective** for 2009-2010 was to increase data storage appropriate for research.

**Achievement**

This year saw the purchase and installation of a scientific data warehouse system. The system offers an additional 1350 terabytes of parallel file system storage deployed to university research projects. Ongoing maintenance and growth of these resources delivers significant return on investment to accomplish strategic scientific research and protects Virginia Tech's critical research data assets.

The Datacentric Research Computing production environment was initiated to support research projects in various university centers, departments, and institutes—including the Virginia Tech Transportation Institute (VTTI), and the Center for Community Security and Resiliency (CCSR)—by providing them with the ability to receive, store, index, and retrieve large volumes of unstructured research data. This project integrated the computing environments provided by the

IBM iDataPlex and the Scientific Data Warehouse to support grant initiatives, research activities, and other application needs.

Another **objective** that continues across the fiscal year boundary is the campus upgrade project that seeks to establish 100Base-T (100 megabits per second) as the standard data service for the university by fall 2010.

Measures of satisfactory completion include metrics of the project itself:

- On-time project completion
- Minimize network interruptions experienced by users during the upgrade
- No cost to distributed university departments

Metrics also include qualities of the finished project:

- Elimination of all 10Mb half-duplex ports (to increase throughput speeds and allow data to be transmitted in both directions simultaneously)
- The increased number of switch ports capable of providing a minimum of 100 Mb full-duplex service
- Reduced power consumption and heating, ventilating, and air conditioning (HVAC) requirements for telecommunications spaces

As of June 30, 2010, upgrades in 81 buildings were completed and the project is on schedule. All network electronics were replaced in 23 buildings; 28 received a partial replacement; and 30 had port configurations changed to allow 100Mb service.

Advance notice about the proposed modifications was sent to affected departments, and schedule changes were made based on any departmental concerns. As a result, users were minimally impacted.

The scholarship of learning is wedded to many of the activities of Learning Technologies. Among these is the work with ePortfolio. One of the **objectives** of the organization is to participate in the professional community.

Metrics. The personnel of the ePortfolio group have presented at eight professional conferences in 2009-2010, and co-authored two book chapters, one that was published in May 2010 and one forthcoming in the next academic year. Through this and other active participation activities, the group ensures that the needs of Virginia Tech will be well-represented in the software.

# Safety and security

Information Technology security has long been a key concern that drives work across the world of computing, networking, and related infrastructure. Increasingly, physical security is tied to logical security, with access controls to physical spaces—from parking lots to toxic chemicals—being controlled by forms of electronic authentication and authorization. Additionally, law enforcement officials and others charged with safeguarding our community depend upon tools with their origins in information technology.

The topic of safety and security today in information technology refers to the range of concerns that focus on keeping people safe in their physical environment, safeguarding their personal information and communications, and providing the information technology tools required for modern community security.

**Achievements**

This year was one focused on the two broad goals of safeguarding personal data kept and used by the university, and on providing information technology tools to the Virginia Tech Police Department.

Intrusion detection system. During the summer of 2009, the Information

Technology Security Office proposed to deploy a distributed intrusion detection system (IDS) making use of several small, inexpensive, intrusion detection sensors in strategic locations throughout the campus network to replace the centralized, legacy IDS.

In May 2010, the initial sensor was deployed in the Andrews Information System Building switchroom. This initial real-world testing was successful and the coming year will see the deployment of more devices in key locations within the network, providing engineers and diagnosticians with the tools needed to identify and problems.

Behavioral security for university data. Publicizing the requirements for handling university data was focused this year on handling personal information about members of the community—faculty and staff members, students, alumni, business partners, and friends. The Information Technology Security Office worked through the Faculty Development Institute to educate faculty members about cyber issues, both on securing the technology and handling and securing the information. These presentations reached over 500 faculty members. Additionally, presentations were given to groups from the Pamplin College of Business, ROTC, international students, and graduate students.

Incident mapping and analysis for the Virginia Tech Police Department

Personnel in the geospatial and remote sensing area are working with the Virginia Tech Police Department to continue refining a prototype of an interactive, searchable incident map using geographic information systems and other geospatial visualization applications. Integrating geospatial information and visualization provides effective new tools that can enhance the ability of law enforcement to meet strategic, tactical and administrative goals. The ability to query, compare, display, and analyze complex spatial information about incidents and physical environments on campus can help enhance university safety and crime prevention strategies. The ease of use for an array of visualization tools and techniques means that law enforcement officers can use the resource immediately, without additional training or instruction.

Another potential outcome of this project is a publicly available Web-enabled online interactive campus map that can be used by the VTPD and other university departments to relate important information to the university community such as snow emergency routes, road closures and other traffic and parking information, construction, bus stops, bike lanes and more. Eventually, other technologies such as sensors, global positioning devices, and other visualized data can add new

functionalities for enhancing public safety and crime prevention. The incident map can also incorporate various layers of information, including secure information available only to specific university constituents to aid in resource allocation and planning, as well as historical and predictive incident analysis.

Mobile computing for the Virginia Tech Police Department. Information Technology helped secure the funding and provided critical expertise in procuring and deploying mobile data terminals for the police field officers using a ruggedized notebook computer with one or more radio interfaces, a touch screen interface, and a collection of specialized software applications mounted in a public safety vehicle. This year's work saw the completion of the requirements and the acquisition and installation of the hardware. Training on use of the computers will begin in Fall 2010.

Technical assistance for the threat assessment team of Virginia Tech Police. This year, Information Technology and the threat assessment team led by Gene Deisinger of the Virginia Tech Police embarked on the beginning phase of a project is to design and deliver a case management system for the campus Threat Assessment Team (TAT). This system will serve as TAT's core information system for tracking and documentation of cases being handled through the threat assessment protocol, and would enable TAT

members to add cases that agents would then use to record and track various activities regarding each case. This project is expected to be ongoing for two to three years and will be integrated with other such tools being developed for use by the police and emergency management.

# Technical currency

Maintaining systems for security and appropriately positioning for additional functionality is required in order to maintain support for administrative enterprise systems on the margin of the research investments.

One **objective** is to implement software upgrades and patches to maintain software support, extend the lifespan of systems, and promote security.

## Achievements

Among the measures of upgrades are the numbers and percentages of appropriate upgrades completed. Enterprise Systems, responsible for the core transactional and warehousing enterprise administrative systems, installed over 35 upgrades, all that were judged to be appropriate and timely, with proper consideration of application lifespan and system interdependencies.

A measure of technical currency from the user desk-/laptop is the VT WSUS service. Historically, Windows machines have been notably vulnerable to security exploits. To combat these vulnerabilities, the Microsoft Implementation Group developed a local Windows System Update Service, VT WSUS to automatically deploy VT-tested patches to subscribers. The testing allows checking for compatibility with other supported Virginia Tech applications, assuring both the necessary updates along with a judgment of their institutionally appropriateness.

Metrics. The majority of the 802 active VT WSUS clients were patched within three days of a patch release.

Another **objective** is to best craft the systems to the needs of the university, while maintaining a standards-based approach to best practices.

## Achievements

Scholar is Virginia Tech's brand for the Sakai community source software that is developed jointly with over 100 other universities around the world. A key effort this year was to transition between Blackboard and Scholar as options for learning management systems to Scholar-only. Moving to this community-source

software is a form of technical currency that puts control of this mission-critical software in the hands of the institution, rather than in the marketing needs of a proprietary vendor.

A judgment was made in early 2009 that version 2.5 of Sakai software was functionally acceptable. A joint announcement from the provost and the chief information officer was followed by extension transition activities to prepare the community to undertake the change: training sessions, written documentation, videos, and additional support tools.

Metrics. The project was on schedule at the end of the fiscal year and subsequently met the Fall 2010 deadline.

Finally, an **objective** is to reduce investments in services or applications that do not need to be customized to the university environment.

**Achievements**

E-mail has become thoroughly commoditized, with robust services available external to the university in a newly maturing market. Discussions are underway regarding the requirements of moving e-mail for various university community members to the "cloud." One population that has been served previously by university e-mail was moved to an external system this year—

alumni. The decision was made to route alumni's "@vt.edu" e-mail to a Google service.

The overarching goal is to send services to the market when those services can be provided better, at lower costs, and without loss of university control over university information.

The specific objectives of the project were to increase the size of each user's mailbox, increase service levels, reduce the costs of supporting an e-mail system, migrate all users prior to June 30, 2010 to avoid software license fee increases, and provide Virginia Tech alumni with the continued ability to use the @vt.edu domain for their e-mail address.

Metrics. Approximately 67,000 alumni were notified about the new service, and over 24,000 have opened alumni e-mail accounts. The accounts have been accessed from 163 different countries. Google e-mail is available at no charge and has no software requirements. The limit on the size of each mailbox is 10 GB—greater than what could be offered on the Virginia Tech e-mail system. Cost savings realized on software license fees are in excess of $200,000 per year. Users were migrated by the end of March, well before the goal of June 30th. Users are provided with an increased service level, in the form of a full online collaboration suite with e-mail, document

storage and editing, and calendaring, and additional features.

# Professional capabilities

Ongoing efforts in professional development within Information Technology related to employees and to students.

**Achievements**

The student-focused **objective** is to provide meaningful employment in the organization that extends the students' knowledge, skills, and abilities, even as the organizational work is furthered by the student's work. One measure revolves around the students employed in Information Technology departments.

Blacksburg Electronic Village's Web Support Services (WSS) is a small team of carefully selected undergraduates performing website development for departments throughout the university as well as for external nonprofits and government agencies. Client needs increasingly include sophisticated dynamic web and cascading style sheet features. Fifteen students have worked with Web Support Services over the past 4 years, and they have earned a reputation for technical expertise, professional polish, and real-world experience beyond that of most

graduating seniors. Web Support alumni report their experience with BEV was instrumental in their success landing jobs with international-scale organizations such as Microsoft, Rackspace, New City Media, and Virginia Tech.

Professional staff **objectives** include those in the security area. The Information Technology Security Office hosts training on information technology security. By brining this respected provider of such training to our local environment, costs of attending the training are reduced. The vice president's office also provides financial incentives for Information Technology departments to send 16 employees to the training and certification testing. This year, the SANS 560 Network Penetration and Ethical Hacking course during May drew 111 attendees.

# Competitive-edge technologies

Leading the way in competitive-edge technologies that offer economic advantages to the Commonwealth of Virginia is "the network." Virginia Tech is a leader in campus connections to the Internet and to national and global research and education networks, including Internet, Internet2, National LambdaRail, and NetworkVirginia. High performance connectivity for computational research, coupled with increased requirements for visualization and collaborative tools, resulted in a dramatic increase in capacity requirements. The capacity has nearly doubled from 10,622 megabytes/second in FY06 to 20,000 in FY10.

In 2009, the university nearly doubled access capacity with a second 10Gbps link from Blacksburg to the Washington, D.C., area. The new optical connection follows a different path than the existing 10Gbps link to McLean providing greatly increased reliability.

More than 800 universities, colleges, schools, and research labs throughout the mid-Atlantic region are served by the new facility in the national capital region. Several research universities maintain dedicated 10Gbps links through agreements negotiated by Virginia Tech. These links place those universities on a par with the best connected institutions worldwide.

The integration with geographic information systems into varied components of analytic and institutional data is another objective for the year in competitive-edge technologies.

For example, the tool used by the Information Technology Security Lab produces interactive maps that merge elements of cyber security with physical data. The maps display information about servers and the cyber-attacks directed towards them. In collaboration with VTGIS, the lab has developed Cover VT3D that can display cyber security information to the building floor level.

# Information Technology reporting units

# Advanced Research Computing

The mission of Advanced Research Computing (ARC) is to

- provide leadership, advanced infrastructure, and support to invigorate computational science and engineering at Virginia Tech;
- provide partnerships and support for joint faculty appointments in academic departments, building areas of excellence in computational science and engineering across disciplines, and providing opportunities for new innovation in scientific computing;
- offer educational programs and training on scientific computing, encouraging the development of knowledge and skills in computational tools and techniques for undergraduate, graduate, and research faculty and staff;
- offer programs to stimulate and expand interdisciplinary and computational-driven research activity;
- affiliate with business, industry, and government to help drive economic development growth in Virginia by building connections between research and applications for emerging tools and techniques in computational science

and engineering, and by establishing research agreements that facilitate knowledge creation and application in industry;

- collaborate with other computational science- and engineering-driven research centers in advancing knowledge and leading the evolution of scientific computing tools, techniques, and facilities that accelerate scientific discovery.

The report for 2009-2010 is organized around thematic areas and goals within those areas.

## Infrastructure

**Goal: Provide and increase high performance computing (HPC) and visualization (Vis) capacity for university researchers**

Milestones achieved this year include the purchase and installation of a scientific data warehouse system. The system offers an additional 1350 terabytes of parallel file system storage deployed to university research projects. Ongoing maintenance and

growth of these resources delivers significant return on investment to accomplish strategic scientific research and protects Virginia Tech's critical research data assets.

Additional milestones include the deployment of Parallel Matlab support on Ithaca (iDataPlex), and the specification, purchase, and delivery of new hardware for VT's HPC portfolio: Athena data analytics cluster, Visionarium Lab.

Metrics

Over 13,785,000 CPU-hrs delivered to researchers whom ran over 66,000 jobs on ARC resources. The ARC resources were used by over 225 users and 151 new users were added this past year.

Visualization provided 1293 millions of triangles-per-second; 304 GB/sec of GPU memory bandwidth; and 18,668,640 pixels.

Challenge for the coming year. System X is approaching its seventh year of operation and provides almost 75% of available compute cycles provided by ARC. Recently, the demand has been three times the

available compute resources, leading to researchers running reduced problem sizes or going elsewhere to meet their compute needs. A high priority goal for the coming year would be to replace System X with a system capable of meeting the demand.

## Services

**Goal: Provide technical support resources for faculty and students to use VT HPC and Vis facilities**

Milestones for the year include a new Web infrastructure for the VT Visionarium, including gallery, documentation, and reservations.

<u>Metrics</u>

Over 85% (85.5%) of tickets were successfully resolved (322/377).

## Education/training

**Goal: Offer multiple workshops per year to train faculty and graduate students on using VT HPC**

An Introduction to Parallel Matlab was developed and has been presented twice. Six two-hour sessions on Deep Media for

Research and Education introduced faculty members and graduate students to the production and deployment of visualization tools. A three-day, hands-on, intensive session introduced participants to the systems and resources available for high-performance computing at Virginia Tech. The Faculty Development Institute courses

<u>Metrics</u>

Forty hours of workshops were offered this year.

<u>Objectives for next year</u>. Work during 2009-2010 including planning for the current year's offering of the high performance bootcamp, to be offered shortly after the end of the fiscal year.

## Outreach

**Goal: Build HPC and VIs partnerships and technology**

The ARC team presentations at professional conferences, along with conference exhibits on ARC, provide the means to develop leadership and recognition for the program.

Among the highlights of work this year are the following:

- SuperComputing 2009 ( booth, 3D Internet panelist);
- IEEE VR 2010 (Medical workshop lead);
- Federal Consortium of Virtual Worlds 2010 (X3D Workshop lead);
- SIGGRAPH 2009 (Medical Workshop lead);
- Web3D 2009 (Medical Workshop lead)

The Web3D Consortium is an organization that focuses on the creation of open standards for Web3D specifications. Through participation in this group, ARC can assist in driving Web visualization standards that benefit scientists and students. Dr. Nicholas Polys was elected President for a two-year term.

Similarly, attendance and participating in HPC communities and HPC User Forum, (including the Coalition for Academic Scientific Computation, SURA, and Oak Ridge Associate Universities) contributes to the partnership capabilities of the unit.

Outreach efforts also included providing tours to multiple parties including classes and student groups, high school field trips, faculty candidates, and other visitors.

# Research

**Goal: Collaborate and lead on research projects with impact to HPC and visualization**

The ARC team works with faculty members to develop significant and successful proposals and collaborations. Examples include HokieSpeed with Professor Wu Feng of the Computer Science Department.

Other projects include the following:

- National Science Foundation's Course, Curriculum, and Laboratory Improvement—Enhancing the Structural Understanding of Architects
- National Science Foundation's Research Experiences for Undergraduates—Brain Computer Interfaces, Driving simulator

Metrics

Measuring research activities and effectiveness involves grants and contracts, as well as publications.

This year's bibliography of peer-review publications follows.

Bacim, F., Polys, N., Setareh, M., Chen, J., Li, J., & Ma, L. (2010). "Cognitive Scaffolding in Web3D Learning Systems: A Case Study for Form and Structure." *Proceedings of the 15th International Conference on 3D Web Technology*. ACM SIGGRAPH.

Henry, James A.G. and Polys, Nicholas. (2010) "The Effects of Immersion and Navigation on the Acquisition of Spatial Knowledge of Abstract Data Networks," *Proceedings of the International Conference on Computational Science* Amsterdam, Netherlands. Proceedia Computer Science, Vol. 1, Elsevier.

Hossain, S., Akbar, M., Polys, N., (2009), "Storytelling and Clustering for Cellular Signaling Pathways." *Proceedings of International Conference on Information and Knowledge Engineering (IKE)* Las Vegas, NV.

# Enterprise Systems

Enterprise Systems' mission is to support the university by developing, coordinating, and managing application software systems that provide critical information services for university constituents. Its role is to facilitate an enterprise-wide view of university applications while insuring that these systems maintain an effective balance between information technology, university functionality, and security and compliance.

Enterprise Systems (ES) consists of five units focused on different aspects of the mission.

**Application Information Systems (AIS)** serves as the central resource responsible for acquisition, development, and maintenance of the university's core administrative systems. To provide these services AIS is divided into teams for Advancement, Human Resources, Student Systems, and Finance.

**Information Warehousing and Access (IWA)** is responsible for the design, development, and implementation of the Virginia Tech Enterprise Data Warehouse. The data warehouse currently contains finance,

human resource, and student data. IWA services also include the development of dashboards, parameter driven reports, and training programs for ad-hoc query access.

**Database and Application Administration (DBAA)** provides the necessary controls, oversight, performance monitoring, and 24x7 on-call responses for application administration, database administration, Web hosting, and filebox services.

**Integration and Portal Services (IPS)** provides information technology support in the areas of portal administration, integration processes, the Banner General Person module and processes, Web user interfaces, and Enterprise Directory interfaces.

**Document Management Systems (DMS)** provides enterprise technology services for document management, Web content management, wiki services, and workflow, as well as software development and support for the Office of Information Technology Acquisitions.

## Assessment and outcomes highlights

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

Objective. *Implement organizational changes as the foundation for enterprise services for document management, workflow, and portal integration applications.*

In 2008, Enterprise Systems (ES) reorganized to more effectively utilize the expertise of our staff and address the evolving needs of the university. In particular, requirements for document management systems, approvals, and workflow applications needed resources dedicated to these projects and skill sets. Leveraging portal technology to provide an infrastructure for the integration and organization of applications was also an area of critical need for enterprise systems.

In 2009, the AIS Human Resources team was relocated to the Andrews Information Systems Building. The physical move of this unit has provided benefits to the organization through greater collaboration with other units of Enterprise Systems.

Objective. *Address demands for training and staff development to insure that the skill sets of ES employees continue to evolve and grow to meet new directions in enterprise applications*

In 2009, ES embarked on a training initiative for Java training as an ongoing effort that is being provided broadly across the organization. A training plan was specifically designed to facilitate participation and to provide a phased approach to integrating Java into our environment.

Onsite workflow training was provided to learn features and functionality of Banner workflow system. Staff members from IPS, AIS and DMS participated in the training.

**Goal: Begin implementation of research administrative system with tools to promote research activity, support principal investigators and grant administrators, and promote research compliance**

Objective. *Implement Banner 8.0 as an early adopter in Fall 2008 to facilitate participation in the design of effort reporting and labor redistribution for Banner*

Virginia Tech was an early adopter of Banner version 8.0 which included significant database and technology changes for converting Banner to an international character set. Enterprise Systems successfully accomplished the upgrade with minimal post-upgrade issues and has subsequently provided guidance and leadership to other universities concerning the process. Implementing Banner 8.0 as an early adopter facilitated Virginia Tech's collaboration with SungardHE (SGHE) concerning enhancements for labor redistribution and effort reporting in subsequent Banner 8.x upgrades.

Objective. *Collaborate with SungardHE on the design of effort reporting and labor redistribution*

Enterprise Systems participated in an effort reporting focus group, and facilitated the addition of distribution of effort on uncommitted cost sharing funds to the system. We also participated in a labor redistribution focus group, and collaborated on the expansion of labor redistribution

functionality to more general use cases beyond just effort reporting.

**Goal: Develop a strategy and software architecture implementation for an enterprise document management system with complementary workflow technology**

Objective. *Expand the licensing of the EMC Xtender Document Management Suite to an enterprise-wide license to provide the technology architecture for enterprise document management.*

The group developed and implemented processes and procedures for enterprise deployment of the Xtender product. We installed and implemented product upgrades and integration to Banner to facilitate required functionality. Also, a security assessment of the system for compliance with Virginia Tech security requirements was performed.

Objective. *Evaluate and test Nolij document management system to determine system effectiveness as an enterprise application*

ES performed extensive testing and collaboration with the vendor to attempt to address security and functionality issues with the system. We worked with cross-

functional teams across Information Technology to assess product functionality and provide vendor with recommended improvements. The result was a determination that the system was unable to scale for enterprise wide deployment.

# Accomplishments

## Expand functionality through new systems

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

Objective. *Design and implement processes and reports for accountability of receipt and usage of American Recovery and Reinvestment Act (ARRA) funds*

ES staff members worked with the Controller's Office and the Office of Sponsored Programs to develop requirements for the ARRA accountability system, creating new accounting attributes to track ARRA funds, and new and modified reports to facilitate fund tracking. The design began in June 2009 with production usage of the system deployed in September 2009.

Objective. *Develop and implement phase one of an employee performance management system that automates the university annual performance evaluation processes*

Requirements for the system were developed in conjunction with the Department of Human Resources. Features of the system include creation of performance plans by either employee or supervisor with routing and approvals, copying plans forward from previous years, and entering evaluation data based on the goals, metrics, and competencies defined in the performance plan. The design began in August 2009, and the system was deployed for pilot usage in February 2010.

Objective. *Design and implement a Pathways Planner system that facilitates creating and monitoring a student's academic plan from initial admission through graduation*

ES worked with the Registrar's Office, the Office of the Provost, and associated academic support staff members to develop requirements for the system. Features include the ability for students to enter and evaluate their academic plan for degree completion. The degree planning function is integrated with the Banner Student module and the Degree Audit Reporting System (DARS). The design began in January 2009, and the system was deployed in August 2010.

Objective. *Design and deploy a Hokie Mobile iPhone application*

In collaboration with undergraduate students, ES developed the concepts of an iPhone application. Enterprise Systems' developers and graduate students worked together to create the iPhone application. The application has these components: events, my courses, maps, account balances, course catalogue, news, and VT People Search.

Design work was begun in February 2010. Development work was completed in September 2010, and deployment is pending release by Apple.

ES also participated in mobile application team chaired by John Krallman to facilitate development standards and Apple licensing for the application.

Objective. *Install and configure Banner Enterprise Identity Management Services (BEIS), which provides the foundation for tighter integration across all Banner applications and ultimately results in better account management and improved usability*

We worked with Identity Management Services to implement BEIS, creating and implementing a baseline configuration beginning with Banner Self-Service. The Self-service configuration was installed into production in May 2010.

The next steps are to proceed with a project plan for expanding configuration to all Banner products.

Objective. *Design and implement processes and reports for support the SACS reaccreditation process*

ES worked with the Office of the Provost and the SACs compliance staff to develop requirements for the system. Requirements include a reporting system where university management and faculty members can review qualified faculty in the areas of teaching, student affairs, and library/learning resources including courses taught, degrees earned and certifications

and licensures. Features include the ability to report by subject area, on-off campus, college, department, or individual instructor. Design began in December 2008. The system was deployed in June 2009 with the data being frozen (SACS requirement), and the system became fully functional in October 2009.

Objective. *Provide database and application support for the implementation of the University Digital Repository*

This software simplifies the development of digital object repositories and provides seamless online search and retrieval of information. We installed and configured the VTLS Vital and Valet software, and provided application support for configuration of the system to support the Civil War project. The Civil War main pages have been loaded into production and with indexing of columns as the next step in the process. The VTLS system was installed in June 2007. The Civil War data project for using the repository was begun in April 2009 and will be live once the indexing is completed.

Objective. *Develop processes to pre-bill and deliver the Microsoft Campus Agreement bundle to new students during summer orientation*

Enterprise Systems teams identified the appropriate population of incoming students required to purchase the Microsoft Campus Agreement bundle, and ensured billing information was loaded to the students' accounts. Software agreements were pre-printed for Software Sales to use during summer orientation so they could collect signatures. The software download server was configured to allow students to download appropriate software after signing the agreements and being billed.

Objective. *Develop and implement a curriculum management workflow system*

We evaluated several possible technologies before choosing Atlassian JIRA system to implement the university's first electronic automated curriculum management system. New course proposals, course revision, check sheets, and program changes can now be entered into a system and tracked throughout the university governance process. The workflow tracks the proposals from the preparation all the way through entry in the catalog, allowing college and department faculty members and administrators to query, track, and comment on the proposals as they move through the approval process. This system replaces a paper and e-mail-based manual process in

use for many years. All information for all course proposals will now be organized and stored in a single location allowing for quick and easy access to proposal status.

Usage of the JIRA Curriculum Management system began in August 2010 for Fall term curriculum revisions.

Objective. *Develop document management processes for managing accounts payable (AP) invoices as a paperless process*

Using Banner Document Management Suite, Banner Workflow, and custom-developed software, ES created a system to replace the paper invoices received from vendors with scanned images and integrated those images with a fully automated work flow system. Project deliverables include the following capabilities:

- Paper invoices are scanned and assigned document numbers using a custom application.
- Invoices are transferred to the imaging system.
- A work flow task is created for each document automatically assigned to the appropriate AP processing team.

Benefits include increased accountability for AP managers through real-time monitoring of the workflows and improved information for university departments through access to invoice. System deployment included configuring the document management system for access by 1,800 departmental users. The system was deployed as a production application in July 2010.

Objective. *Participate in committee process to determine path for addressing university requirements for a research administrative system (RAS)*

Working with the Research Administrative Committee, Enterprise Systems helped assess options for an RAS. The committee prepared a report for the vice presidents recommending that the university proceed with a request for proposal procurement process. The committee attended a Kuali Conference to assess open source Kuali Coeus as a potential solution. The RFP was created, and the year ended with the selection process underway.

# Expand the functionality of production systems

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

Objective. *Implement expanded and enhanced functionality of existing systems and services*

**Alumni Services**

The ES staff participated in the transition of alumni e-mail accounts from Virginia Tech e-mail services to Google Mail. My VT was modified to enable qualifying users to activate and manage their new accounts.

ES staffers provided data to PCI, the vendor that produces the online alumni directory. We created a suite of programs to provide data to PCI for gathering updated information from alumni that can be loaded back into Banner, and for printing the alumni directory. The ES staff processed the data returned by PCI for updates in Banner system and then provided data files to PCI to produce the printed alumni directory.

## Development

Enterprise Systems staff members created several reports in support of the comprehensive campaign including the parent campaign report, campaign closing event invitation report, campaign participation rate report, the campaign honor roll approval report, and the campaign activity report.

ES automated the fundraiser evaluation process saving the research staff of University Development approximately two weeks each quarter. All calculations were standardized which reduced year-end reports from seventeen to one.

We automated the freshmen and transfer parent load process. The initial production run inserted 5,136 new parent records which saved an estimated 530 student-wage hours normally spent in manual data entry of these records.

## Purchasing

The ES staff created a reporting process to support the requirement to report purchasing activity from small-, women-owned, and minority businesses (SWAM).

Reports are sent to the state on a quarterly basis.

We created a one-time process to extract purchasing activity for specific fiscal years as required for the statewide disparity study.

## eCommerce

ES staff worked to enhance the accounts payable electronic payment process to support the new Wachovia payment card program.

The Nelnet Commerce Manager Payment interface was enhanced to generate cashier sessions that match the bank deposits received from Nelnet. This enhancement allows the Bursar's Office to more easily reconcile these deposits.

## HokieServ

The Enterprise Systems staff completed changes to locally developed processes to support the implementation of HokieServ for Facilities Services.

## Human Resources

Working with SunGardHE concerning the design and pilot implementation of new

Banner labor redistribution process, ES provided information on problems with the application, recommended enhancements, and performed extensive application testing. We specifically addressed performance issues.

## New deduction codes

Additional deductions in Banner were created for the new retirement program, tax shelter, life insurance, and other requirements as defined by the state. Programs were modified accordingly. We also automated the loading of these deductions, saving the HR benefits area hours of data entry efforts.

The new health insurance codes, performance evaluation codes and descriptions, and retirement deduction codes were added to the HR data mart. These new codes support reporting needs of the administrative areas.

The transition to a new long term disability company was automated by terminating existing deduction records and creating new records for each enrolled employee.

We expanded employee rank information was added to the HR data mart, enabling

Institutional Research to accurately analyze the information at different points in time.

The HR document management solution was expanded to include ADA documents.

**Financial Aid**

Financial Aid's reasonable academic progress program was enhanced.

Promissory notes and disclosures via the Web for Perkins, HPSL, and other loans were enhanced due to changes in regulations.

Enterprise Systems created a document management application to store non-student-related documents for the Financial Aid office.

**Graduate School**

We consulted with the Graduate School and provided services for improving their imaging system. ES assisted in the configuration of scanners to create more compact files and re-processed existing images to compress files and reduce storage requirements.

**Academic information for departments**

ES developed program to produce a report of financial aid awards to students.

The course enrollment management information was enhanced for departments.

**Research**

We added several new attributes to proposals and grants data mart to assist with monitoring compliance, as well as critical dates to the proposals data mart for use in tracking proposal process metrics by the Office of Sponsored Programs.

ES expanded the availability of current address information and salary encumbrance information for reporting from the Finance data mart.

**University Relations**

In collaboration with the University Relations Web Communications team, we worked to programmatically move a PHP/MySQL based implementation of *www.vtnews.vt.edu* into the enterprise CMS system.

**Virginia Tech Foundation**

We enhanced the Virginia Tech Foundation Finance data mart with the addition of endowment data.

**Dashboard enhancements for various university units**

ES provided additional functionality for existing dashboards that support Undergraduate and Graduate Admissions Offices, Alumni Chapter, Research Compliance, the Office of the Vice President for Research, University Unions and Student Activity and the Corporate Research Center.

Objective. *Expand usage of enterprise systems through improvements in application interfaces and user interfaces and through user training*

**Guest Account Management Services (GAMS)**

We implemented a Parent SPA for Financial Aid that provides various services including the financial aid award Letter, requirements to receive aid, financial aid holds, academic progress for financial aid, cost of attendance, and loan history.

We added student records access to the Parent SPA, including unofficial transcripts and grade webpages for the Registrar's Office.

ES worked to convert access for applicants to GAMS enabling applicants to check application status and manage their access more effectively.

Information Technology Acquisitions (ITA) expanded its software delivery to other schools sharing VT contracts in the state using GAMS to provide software for these contracts to other Virginia schools.

## HokieMart interface for Departmental Software

ES Implemented a billing interface for Departmental Software Distribution that allowed departments to begin receiving orders through HokieMart.

## Mobile interfaces for enterprise applications

A new mobile theme in My VT allows for faster downloads on mobile networks and easier viewing of the portal on mobile devices.

## Consistent user interface for enterprise applications

ES established the Enterprise System User Interface Working Group. This group meets periodically to discuss changes in user interface technologies and is working to create a consistent user experience across all Enterprise Systems applications.

We began the evaluation of user interface changes in Banner that SungardHE is expecting to release in 2011. SGHE will be replacing Oracle forms with a new Web-based interface.

## Improved Interfaces for data analysis

We created the Student Census Dashboard for Institutional Research to augment their Web application. The dashboard contains five years of data and offers a tabbed interface for information on entering freshmen, entering transfers, entering graduate students, demographics and trends. The dashboard is updated at census dates.

## Training

We trained 63 staff members on the new version of our Business Intelligence tool (Oracle's Enterprise Performance Management Suite, version 11, formerly called Hyperion Intelligence Client), query building, and dashboard navigation for all of the subject areas in the data warehouse. Training participants gave high marks for content, pace, and presentation on the instructor evaluation forms.

Updated training materials take into account the slight differences in the new version of

Jobs processes and reports distributed using Web Job and Web Distribution
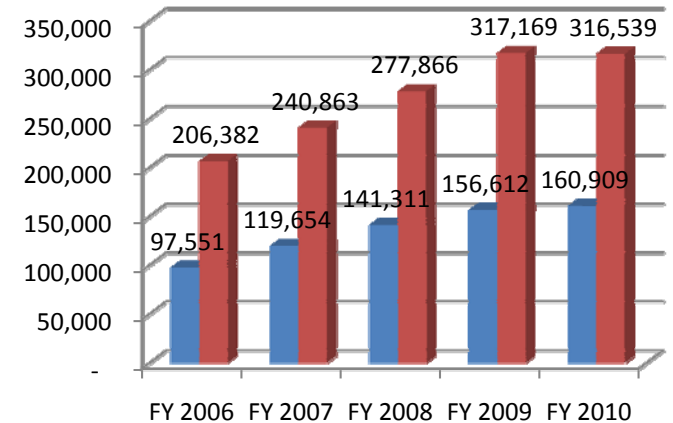
our Business Intelligence tool. The training documents provide illustrations and step-by-step instructions. Several users have been provided with electronic copies, and some of the materials are available on the IWA website (*www.iwa.vt.edu*).

## Usage metrics

Information Technology Acquisitions has offered network-based software to the campus for six years. During this time, 33,000 users have obtained over 275,000 network-delivered products. In FY2010, 75 new product titles were added to the service and over 78,000 products were delivered via download or network drive sharing.

In FY2010, 41 new sites were added to the content management system (CMS)

including *www.lib.vt.edu*, *www.vtnews.vt.edu, www.fdi.vt.edu*, *www.undergraduate.vt.edu*, *www.fye.vt.edu*, *www.armyrotc.vt.edu,* and *www.mi.vt.edu*.

The CMS now supports over 1,300 users across the commonwealth from the Blacksburg campus, satellite campuses, and Virginia Cooperative Extension.

We received more than 600 requests for assistance concerning data warehouse reporting and usage. In most cases, requests were resolved with immediate answers.

# Ensure long-term viability

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

Objective. *Implement software upgrades and patches to maintain software support and promote application security*

The updates to systems listed in the table were completed, as well as upgrades to My VT, VT Search, GAMS, Group Manager, and PIDGen Web applications to coincide with Middleware's ED 3.0 deployment.

FY10 Enterprise Systems upgrades

| Product A | pplication | Upgrade Versions |
|---|---|---|
| SGHE Banner | Accounts Receivable | 8.1 |
| EMC A | ppXtender | 5.4 |
| SGHE Banner | Banner Document Mgt | 8.1, 8.2, 8.3 |
| IBM InfoSphere | DataStage version | 7.5.3 |
| SGHE Banner | eInvoice | 8.2, 8.3 |
| SGHE Banner | Employee Self-Service | 8.2 |
| SGHE Banner | Finance | 8.2, 8.3 |
| SGHE Banner | Finance Self-Service | 8.1, 8.2 |
| SGHE Banner | Financial Aid | 8.5, 8.6, 8.7 |
| SGHE Banner | General | 8.2 |
| SGHE Banner | General Web | 8.2 |
| SGHE Banner | INAS | 8.6, 8.7 |
| Open Source | Lime Survey | 1.87 |
| Oracle DBMS | Oracle—Data Warehouse | 11g r2 |
| Oracle DBMS | Oracle—VT Foundation | 11g r2 |
| Oracle DBMS | Oracle—Scholar | 11g r2 |
| Oracle Hyperion | Oracle EPM | 11.1.1 |
| SGHE Banner | Payroll | 8.2 |
| SGHE Banner | Position Control | 8.2 |
| SciQuest | SelectSite (HokieMart) | 9.2, 9.3, 10.1 |
| SGHE Banner | Web Tailor | 8.2 |
| Atlassian J | ira | 4.1 |
| Atlassian Confluence | | 3.3 |
| MicroFocus Cobol | | 5.0 |
| Oracle S | QR | 9.3.1 |

Objective. *Provide efficient and effective operational support for enterprise systems as needed for maintaining system integrity.*

**System performance and responsiveness**

After experiencing significant performance degradation during Spring 2010 add/drop processes, we developed and implemented a plan for addressing potential issues during Fall 2010 beginning of term. After these changes, the university did not experience degradation of performance for the Fall term. We eliminated custom dynamic Web tailor roles which were adding processing overhead to every page load in Banner Self-Service. Since the performance demands from this extra overhead were at the database level, numerous critical systems were impacted including Internet Native Banner, HokieMart, and Cash Receipts. We also intentionally rebooted servers prior to Fall Semester to clear memory cache, and we applied a patch to the Veritas File system to address memory leak issues. We received assistance from representatives from all central administrative offices to schedule work during off hours as much as possible during first few weeks of August. Finally, we received significant assistance from the Registrar's Office through the rescheduling of the start for add/drop from a Monday to

the previous Friday night which moved this peak demand processing to the weekend.

Performance and responsiveness was enhanced in other systems as well. Multiple changes were made to Virginia Tech custom SciQuest receipt integration to improve daily processing performance. Since initial implementation, the execution time had gradually increased such that the afternoon check run was not processing in a timely manner.

We rewrote a significant portion of the process that feeds charges from general accounting module into the grant billing module. This process normally runs multiple times each day. Over time performance had deteriorated such that the first run each day was still executing when the second run was initiated.

The hosting and Filebox servers were moved to a load balanced environment to improve stability, availability and responsiveness for those systems.

The publishing performance of the content management system was improved by implementing multi-threaded publishing. Further CMS improvements came from moving the production database from a

shared Oracle instance to a dedicated instance on *rhythmyx.db.vt.edu*.

We implemented a DAV service that can be used by University Relations to maintain the *www.vt.edu* and *www.vtnews.vt.edu* websites if the CMS application tier is unavailable.

**Efficiency of process**

The duplicate PIDM process was improved to be more efficient and produce more relevant results.

Two authentication processes in Self-service Banner were consolidated to reduce maintenance and overhead.

We implemented AWStats in production CMS with custom authentication and authorization wrappers.

License servers for Ansys, operated by Engineering, and ArcGIS FlexLM to ITA Linux systems were consolidated. An ED-ID group-based permission system was developed to manage and automate FlexLM access.

**Quality control**

Process checkpoints and additional problem notifications were added to the nightly load processes to increase stability and reliability of the data warehouse by providing support staff members with early awareness of, and action on problems.

We developed additional quality control checks which identified discrepancies in data between data warehouse and source systems (usually Banner) so that corrective action could be taken.

Objective. *Promote new and evolving efficiencies in the technology architecture for delivery and provisioning of enterprise applications*

Additional functionality was provided to users with Mac equipment through the upgrade of the EPM Suite 11 Business Intelligence tool which enabled Mac users to create ad hoc queries.

We installed and configured the Disk Xtender product for effective management of documents in the EMC Xtender document management suite. DiskXtender provides more security for the image files and enhances the manageability of image files. It

also represents a first step toward a fully automated document retention system.

Enterprise Systems evaluated, tested, installed, and configured Oracle's Fusion Middleware software to address end-of-life of the Oracle Application Server.

**Diversify the database environment**

The databases supporting the VITAL and CAS application were migrated from the Oracle database platform to open source POSTGRES databases.

We evaluated, tested, and configured a DB2 database environment using a University of Florida workflow application as a test application.

**Move systems to virtual architecture**

The databases supporting Scholar, GIS, Content Management, and Registry were moved to a virtual environment.

We also moved the servers supporting the enterprise Web environment to a virtual environment.

The new version of our business intelligence tool (Oracle EPM 11) was launched on a

four-processor virtual machine running on an IBM Blade Server. This action saved the purchase cost of new hardware and allows for speedy restoration of services in the event of problems.

Objective. *Implement improvements in development methodologies including integration strategies, code reuse, object oriented design, and Web development architecture*

We worked with tax shelter and optional retirement vendors to automate the transfer of data between their systems and the Banner system.

We created common code for the processing of FOAPAL (fund, organization, account, program, activity, and location) code attributes. This code has already been used in multiple processes and reports speeding development time significantly.

The eVA interface was enhanced to automatically send an appropriate update when an eVA purchase order is cancelled. Previously, these were manually tracked by the purchasing department and required manual action by AIS Finance to send the update.

Enterprise Systems created stored procedures to allow Web applications developed by the Office of Human Resources to access Banner data while maintaining the authorization defined in the system.

We supported enhancements to Nolij Transfer in the Undergraduate Admissions office to more effectively load applications from CollegeNet.

Enterprise Systems provided data to support student elections using third party software for Leadership Development, University Unions and Student Activities.

Objective. *Promote and ensure security of data within `enterprise systems applications*

Routines were developed to sanitize and obscure sensitive data in non-production instances of Banner.

We separated the organization and departmental hosting sites to improve security, stability, and availability of Filebox/hosting services.

ES expanded and enhanced configurations of mod security filtering rules, Oracle Advanced Security Option, and the Oracle Enterprise

Manager software to strengthen security of database and Web environments.

The security of the CMS was enhanced via ModSecurity.

We deployed Windows Vista and enabled Bitlocker (whole drive encryption) on all machines in University Development to meet requirements for Policy 7105.

The ES staff updated the Budget Tuition Application system to always mask the bank account information after the initial entry of the information.

A more robust security interface with the National Student Clearinghouse was implemented.

The Dean of Students system's security was enhanced by implementing FOB technology for two-factor authentication, thereby eliminating need to use specific workstations.

We enabled CAS authentication for JIRA, Confluence, and the CMS.

The VPN requirement was eliminated for connections to the content management system by integrating Apache reverse proxy via an AJP connector.

We moved the CMS system to Mass Virtual Hosting with SSL, and worked with the VT PKI Policy Management Authority and eProv to implement RFC 2459, section 4.2.1.7, the Subject Alternative Name extension.

The AIS Advancement unit participated in an Internal Audit of the implementation of Policy 7105 including security scans of servers and various workstations.

Enterprise Systems coordinated the initiative to enable SSL connections for the WebXtender solution.

# Best practices

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

Objective. *Consolidate processes across Enterprise Systems and implement a standardized process for tracking issues and*

*operational support activities across all Enterprise Systems' units*

During this year, Enterprise Systems completed work on the Automated Service Request System using JIRA. All teams were transitioned to the new system. Regular meetings addressed how we can continue to improve our process. Use of the system was expanded with access to JIRA by external users (outside Enterprise Systems), thus enabling functional users to monitor progress on their requests.

Objective. *Encourage and support employee training and professional development to enable effective adoption and ongoing support of technologies and systems required for enterprise systems applications*

The Enterprise Systems Java Users Group was established. This group meets periodically to discuss topics surrounding new programming languages and technologies being introduced into our product environment. Meetings are structured to foster mentoring, sharing, and learning.

Employee professional development was also furthered by the service of several

employees in leadership positions for national organizations:

- Ken McCrery served on the board of directors for Jasig, an organization that promotes and sponsors open source software projects for higher education.
- Vicky Shaffer served as treasurer for the executive board of the Higher Education Data Warehousing Forum (HEDW).
- Siegfried "Ziggy" Hill serves on the advisory board for the Global Information Assurance Certification (GIAC) component of the SANS Institute. This advisory board provides a forum where information technology security professionals can exchange ideas and advice.

Enterprise Systems' employees also provide technical leadership for SungardHE's evolution of the Banner system:

- Lee Anne Hoppe serves on the SGHE community source team, the group that determines if source code written by Banner client institutions can be rolled into the baseline product.
- Lee Anne Hoppe also serves on the SGHE Human Resources Customer Advisory Board, which fosters SGHE

learning more about opportunities and challenges facing financial management professionals today.

- Jay Smith is serving as a member of the SungardHE "Database New" development partner group. This advisory panel for SungardHE concerns the database conversions for both Banner databases, and optionally for client-added schemas and tables, which will be required to support the new user interface for Banner (called Project Horizon) and for baseline availability of multi-entity processing.

Additional professional development activities of ES employees include participation through university-sponsored activities:

- Ken McCrery completed the University Organizational and Professional Development's IT Leadership Development program.
- Debbie Fulton completed the Administrative Evaluation and Development Program.

Technical training included the participation of several staff members in additional Java training, and attendance of DBAA team

members at the Oracle Fusion Middleware administration training.

Security training included attendance by several staff members at SANS Institute training. Georgiy Kolomiyets passed the certification exam to become a Certified Penetration Tester, and Darrell Wells passed the SANS Certification testing for the SEC 401 (Security Essentials) class.

The staff of Enterprise Systems stayed current with development in the field by participation in related organizations:

- Jasig—a consortium of educational institutions and commercial affiliates sponsoring open source software projects for higher education
- Higher Education Data Warehousing Forum
- The Degree Audit Reporting System or DARS, now renamed redLantern
- SANS—SysAdmin, Audit, Network, Security—Institute
- The Mid-Atlantic Banner Users Group
- Summit—SungardHE's annual users' conference
- Pillar—SungardHE's strategic planning group
- SungardHE's large school consortium group

# Enterprise Systems' goals and outcomes for 2011

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

Objective. *Develop and implement phase two of an employee performance management system that automates the university annual performance evaluation processes*

Objective. *Implement Banner Enterprise Identity Management Services (BEIS), which provides the foundation for tighter integration across all Banner applications and ultimately results in better account management and improved usability*

Objective. *Develop plan for implementation of a Travel and Expense system and begin system implementation*

Objective. *Prepare a Needs Analysis and proposal for implementation of a Leave, time and attendance system*

Objective. *Participate in implementation planning and activities for the Research Administrative system that is selected by the RAS RFP process*

Objective. *Participate in implementation of Digital Measures Activity Insight system. Activity Insight will provide the university faculty and administration with a secure, reliable system for recording, tracking, and reporting faculty activities in the areas of scholarship, service and teaching, and will provide a consistent means for generating annual faculty activity reports*

Objective. *Provide support for the Virginia Tech Police Department in working with Information Technology to facilitate converged security initiatives*

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

Objective. *Implement expanded and enhanced functionality of existing systems and services*

- Provide end of campaign support for the university's Comprehensive Campaign including the freezing of data and reports by the end of fiscal year 2011
- In conjunction with Department of Taxation, implement debt setoff system further reducing the University's dependence on the State's accounting system (CARS) by the end of fiscal year 2011
- Create reporting system to support the Office of Sponsored Programs (OSP) in fulfilling the new RCR compliance requirements by end of fiscal year 2011
- Develop report of SWAM (Small business, Women owned, and Minority) purchasing activity for the OSP area that is needed to fulfill federal reporting requirements by end of fiscal year 2011
- Assist the Financial Reporting area in compiling the data needed to complete the NSF Herd Survey FY10 by December 31, 2010

Objective. *Expand usage of enterprise systems through improvements in application interfaces and user interfaces and through user training*

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

Objective. *Implement software upgrades and patches to maintain software support and promote application security*

- Banner Upgrade (September 12, 2010) - AR 8.1.1, Financial Aid 8.8, INAS 8.8, and Financial Aid Self-service 8.8
- Banner Upgrade (November 13-14, 2010) - General 8.3, Advancement 8.2/8.3, Advancement Self-Service 8.2/8.3/8.4, Student 8.1/8.2/8.3, Student Self-Service 8.1/8.2/8.3,Faculty Self-Service 8.1/8.2/8.3, Web Tailor 8.3, Finance 8.4, Finance Self-Service 8.3, Payroll 8.3, Position Control 8.3, Employee Self-Service 8.3, BDMS 8.3, Workflow 8.0.1, AppXtender 6.5
- SmartCall Upgrade (December 2010) – 9.6
- Lime Survey Upgrade (Spring 2011)
- SciQuest (HokieMart) - SelectSite upgrades 10.2 (July 2010), 10.3 (November 2010) and 11.1 (exact timeframes to be determined by vendor)

Objective. *Provide efficient and effective operational support for enterprise systems as needed for maintaining system integrity*

Objective. *Promote new and evolving efficiencies in the technology architecture for*

*delivery and provisioning of enterprise applications*

- Migrate Banner systems to virtual environment

Objective. *Implement improvements in development methodologies including integration strategies, code reuse, object oriented design, and Web development architecture*

- Implement Finance Web Service that will initially be used by the OSP area to implement electronic PANs (project authorization notice) by December 31, 2010

Objective. *Promote and ensure security of data within enterprise systems applications*

- Upgrade AIS Finance workstations from Windows XP SP3 to Windows 7
- Upgrade AIS Finance workstations from Microsoft Office 2007 to Microsoft Office 2010

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

Objective. *Consolidate processes across Enterprise Systems and implement a standardized process for tracking issues and operational support activities across all Enterprise Systems' units*

Objective. *Encourage and support employee training and professional development to enable effective adoption and ongoing support of technologies and systems required for enterprise systems applications*

Objective. *Implement more formal change management process that creates a portfolio of requests for prioritization, resource utilization, and categorization of effort*

Objective. *Reorganize ES to meet evolving commitments and address staffing reductions*

- Create and hire new Enterprise Systems management position that is responsible for departmental information needs, for providing direction to administrative reporting needs and process, and for data analytics

# Identity Management Services

Identity Management Services (IMS) is the production office responsible for electronic identity and access management at Virginia Tech.

Identity Management Services provides the university community with policies, procedures, and support for secure access to information resources to complement its teaching, learning, research, and outreach as well as to support administrative operations.

- IMS currently manages the lifecycle of 688,398 electronic identities at Virginia Tech.
- IMS has defined 37 different affiliations which are used to describe the type of association that an electronic identity has with Virginia Tech.
- IMS has resolved 8686 Remedy trouble tickets regarding access issues from October 2009 until the present.

## Projects

Projects undertaken or brought to completion this year further the mission of IMS to provide secure identity management.

## Carilion

The director of IMS serves as member of a Virginia Tech/Carilion working group comprised of Virginia Tech representatives from the Office of the Provost, Legal Counsel, the Office of the Controller's, the Research Division, and others. This year, we worked with Carilion to determine the electronic access needs of Carilion faculty/staff members and students, and developed and implemented a plan for integrating Carilion identities into Virginia Tech's identity management system.

- We created a Carilion affiliation set.
- Electronic credentials were provisioned for the initial Carilion faculty/staff and 42 charter class students.
- We worked with other Information Technology teams to enable a self-provisioning e-mail scheme for the Carilion faculty/staff and students.

## Self-Service password reset

IMS personnel serve as the project leader for the development of a set of self-service password reset tools. The project includes development of the infrastructure, processes, and procedures for a Virginia Tech self-service password reset service.

The project leader directs all aspects of the project. This year's work includes researching appropriate technologies, writing the requirements document, holding cross-team project meetings, and overseeing a usability study.

The first deliverable of the project is a requirements document that will be available in November 2010. The PID password reset tool is slated to go into production in June 2011, with the Banner/Oracle password reset tool to follow in October 2011. The Hokies password reset tool is scheduled for June 2012.

## Google e-mail project

The director of IMS coordinated a cross-unit team—members of Middleware, Systems Support and e-Discovery, Integration and Portal Services, SETI Test and Deployment, and University Computing Support—to integrate individual technical components into a cohesive, self-provisioning Google e-mail service.

Migration of the e-mail accounts included identification of accounts based on affiliation eligibility, replication, generation of notification e-mails, and purging of "old" Virginia Tech e-mail accounts.

IMS performed the migration of 64,202 alumni e-mail accounts from Virginia Tech hosted e-mail to a Google hosted e-mail solution during November and December 2009.

IMS personnel are currently serving on the implementation team to define requirements for the next phase of the hosted e-mail migration.

## P-85 expansion

IMS is working with the Office of Human Resources to develop appropriate categories for the large number of Virginia Tech affiliates being entered into the Virginia Tech identity management system via the P-85 form (Request for Unpaid Faculty Affiliation with VT Academic Department).

IMS will create affiliations to define the resulting categories in order to allow Virginia Tech electronic service providers to make appropriate access decisions.

The director participates in a cross-unit group to develop secure identity processes that will address the need to identify and provide appropriate electronic access for non-Virginia Tech researchers, visiting scholars, and vendors participating in active projects on the Virginia Tech campus.

## Departmental PIDs

IMS has an advertised goal of replacing all departmental PIDs with a more secure electronic access method by October 2010. To date, IMS has worked with university departments to remove or replace approximately 4000 departmental PIDs.

IMS continues to consult directly with individual departments to assess functional needs and recommend appropriate replacements for the remaining 427 departmental PIDs.

## Emeritus affiliation

IMS worked with the Office of the Provost and the information technology director for policy and communications to define requirements for an employee emeritus affiliation.

IMS created the emeritus affiliation and developed the supporting process to allow the affiliation to be appropriately assigned and recognized in Virginia Tech electronic processes.

The initial load of eligible employees resulted in 701 people in the VT identity management system acquiring the VT-employee-emeritus affiliation.

## Oracle password management

IMS has undertaken a major overhaul of Virginia Tech Oracle password management processes in order to utilize additional controls and functionality available in Oracle 11g.

## AD Admin project

IMS staff members serve on a project team to define functional requirements for the AD

Admin tool being developed by the Microsoft Implementation Group. AD Admin will provide IMS with a tool for management of Active Directory accounts.

## Identity Management Summit

The director of IMS convened and led a half-day Virginia Tech Identity Management Summit in May 2010 at the Inn at Virginia Tech. The Summit was attended by representatives from the Hokie Passport Office, the Registrar's Office, Undergraduate and Graduate Admissions, Alumni and Development, Human Resources, Legal Counsel.

The format consisted of a presentation on the status of Identity Management at Virginia Tech, as well as an open-ended discussion to assess from the group what needs exist to provide electronic services to constituents outside core Virginia Tech affiliates.

## Banner enterprise identity services (BEIS) project

The IMS director is serving as the project leader for integrating Sungard's BEIS product into Virginia Tech's current identity management infrastructure. IMS identified and worked with Sungard to fix security issues with BEIS.

Changes to enable CAS to front-end Sungard products were put into production in October 2009.

## The Virginia College of Osteopathic Medicine (VCOM)

IMS continues to support VCOM via the workflow, load, and update identity management processes that IMS developed.

This year, IMS created an automated process for VCOM to incorporate students enrolled in the new post-baccalaureate program into current identity management processes.

IMS worked with VCOM to perform mass updates of VCOM affiliations and student class levels based on the lifecycle of identities.

## Central Authentication Service (CAS) project

IMS continues to sponsor the CAS project and define requirements for implementations.

The IMS director leads a bi-weekly meeting of a CAS technical group. Under the direction of IMS, CAS version 3.3.3 went into production in September 2009 enabling the use of authorization attributes via CAS.

## Public key infrastructure

IMS staff members continue to serve as both registration authority administrators and certification authority (CA) administrators for the Class 1 Server CA and the Middleware CA. IMS has issued 226 Class 1 Server certificates and 60 Middleware certificates from July 2009 through September 2010. IMS also continues to serve as the role manager for the Virginia Tech User Certification Authority.

The director and technical lead of IMS are members of the soft personal digital certificate project team.

## Enterprise Directory project

IMS continues to sponsor the Enterprise Directory (ED) project and define requirements for implementations. IMS also provides database programming support for the project.

The director of IMS leads a bi-weekly meeting of an ED technical group and also a bi-weekly meeting of an ED policy group.

**ED groups**

In order to avoid namespace collisions and ensure the appropriateness of group root names, IMS oversees the assignment and issuance of group roots to university departments wishing to create a departmental group structure.

IMS has begun defining requirements for new functionality for the group management tools. Additional desired functionality was identified via a reconvening of the focus group in 2009.

**ED-ID services**

ED-ID is the view of the Enterprise Directory that contains the full-blown set of identity attributes for Virginia Tech identities.

When new ED-ID services are requested, the IMS director coordinates a formal review of the request. A security review is done on the application that will be accessing ED-ID. The data stewards of identity data for faculty and staff members and students review the requested identity attributes for appropriateness. The review culminates with a meeting of all parties in which any outstanding issues or questions regarding application security and privacy and confidentiality of data must be resolved by the requestor before the service request will be approved.

# Professional activities

The IMS technical lead attended the Sungard Summit 2010 conference.

The IMS technical lead and an IMS staff member attended Advance CAMP: The Second Identity Services Summit—an Educause Identity Management mini-conference—in June 2010.

The IMS director attended the ALI Identity Management for Government Conference in Washington, DC, in September 2010.

The director of IMS is a member of a joint Virginia Tech/Carilion working group that meets bi-weekly.

Both the IMS director and technical lead participate in CIC InCommon Silver certification conference calls.

The director is a member of both the EDUCAUSE and Sungard SCT Identity Management groups.

The IMS director leads three standing bi-weekly meetings—Enterprise Directory policy/project planning meeting; Enterprise Directory technical issues meeting; and CAS technical meeting.

The IMS director leads the ED Liaison Group and is a member of the SAMS group which reviews Information Technology implementation dates to assess dependencies and potential conflicts.
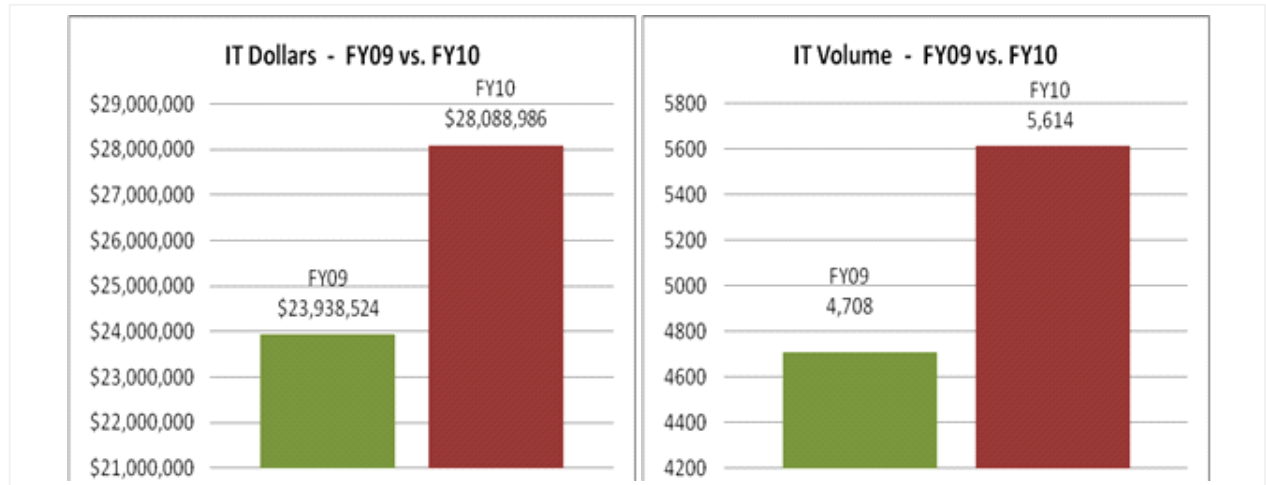
# Information Technology Acquisitions

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

## Computer Purchasing

Computer Purchasing manages university-wide information technology procurement, an integral component of the university's mission to discover and disseminate new knowledge. The office fulfills information technology requirements for computers, software, systems, storage, maintenance, service, and negotiation of end-user license and other agreements. The office establishes new competitive contracts, utilizes existing internal and external contracts, and solicits competitive quotes, bids, and proposals to achieve the most effective and efficient

procurement process, meet end-user requirements, and assure compliance with university and state policies and procedures and legal requirements.



Increasingly, information technology-based systems are the foundation of education, research, and business solutions. These solutions are usually very complex and may include modular components and hosted solutions. Security and legal considerations are critical for Computer Purchasing. Key security considerations include secure web-based logon, userid and password security and control, system access control, data integrity, personal identifiers, and multi-system interface. Legal agreements for

software licenses, maintenance, and orders are involved in nearly all information technology purchases, and assuring legal soundness and compliance is essential.

Over $28 million was expended for information technology purchases in FY10. The graphs *IT Dollars* and *IT Volume* show a dramatic increase of 17% ($4.2 million) in total information technology dollars and 19% in total information technology volume for FY10, clearly demonstrating the trend toward information technology-related solutions for education, research, and business. In FY09, the increase was 12% in total information technology dollars. The data represent combined buyer-generated

and HokieMart auto-generated information technology orders.

In FY10, Computer Purchasing achieved savings and cost reduction for the university by awarding nine new contracts. Most contracts were written with a cooperative clause, thus affording savings to nation-wide educational and governmental agencies as well. To efficiently and effectively meet the growing demand for information technology-related commodities, Computer Purchasing issued solicitations, negotiated and established new competitive contracts, and utilized existing internal and external contracts.

Strategic advancements including the following activities:

**Host a state seminar.** Computer Purchasing hosted the first state-level professional procurement training seminar at Virginia Tech, with participants from southwestern and central Virginia.

**New HokieMart punchout.** Fujitsu was added as a new punchout vendor, thus providing simplified direct ordering by departments for mobile computers.

**New contracts.** Nine new contracts were awarded to fulfill emerging information technology requirements. Most contracts were written for cooperative use by other educational and governmental agencies.

Several contracts were renewed and other solicitations continue in process.

**Savings.** New and existing competitive contracts continue to save significant funding for the university and other agencies ordering from the contracts.

**Data accessibility.** The data repository for contract and license agreement e-files was expanded to support increased research capability using spreadsheet summaries and document scans. Frequently used forms were also added for ease of access.
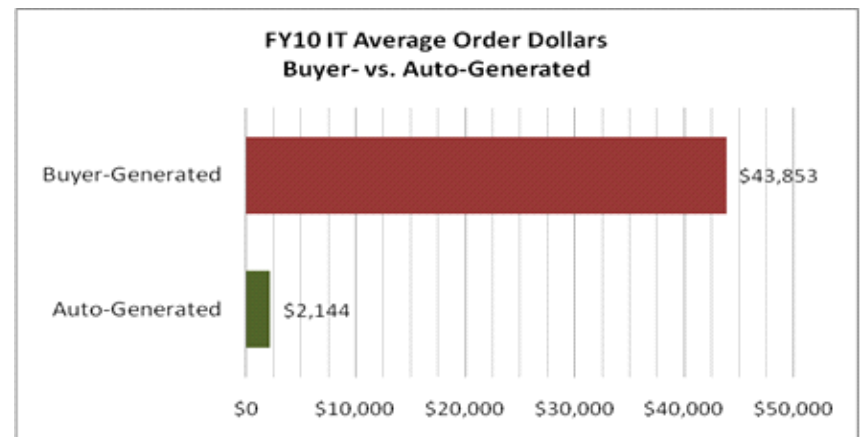
**Research support.** Several competitive procurements were completed to support research program requirements for vast data collection, high computational speed, and custom-information technology components.

**Cost reduction.** Expanded creation and use of cooperative contracts improved the state's return on investment for procurement costs, allowing multiple agencies with overlapping requirements to share contracts.

**Commitment to competition and diversity.** Computer Purchasing continues to solicit and award new contracts and orders to small, woman-owned, and
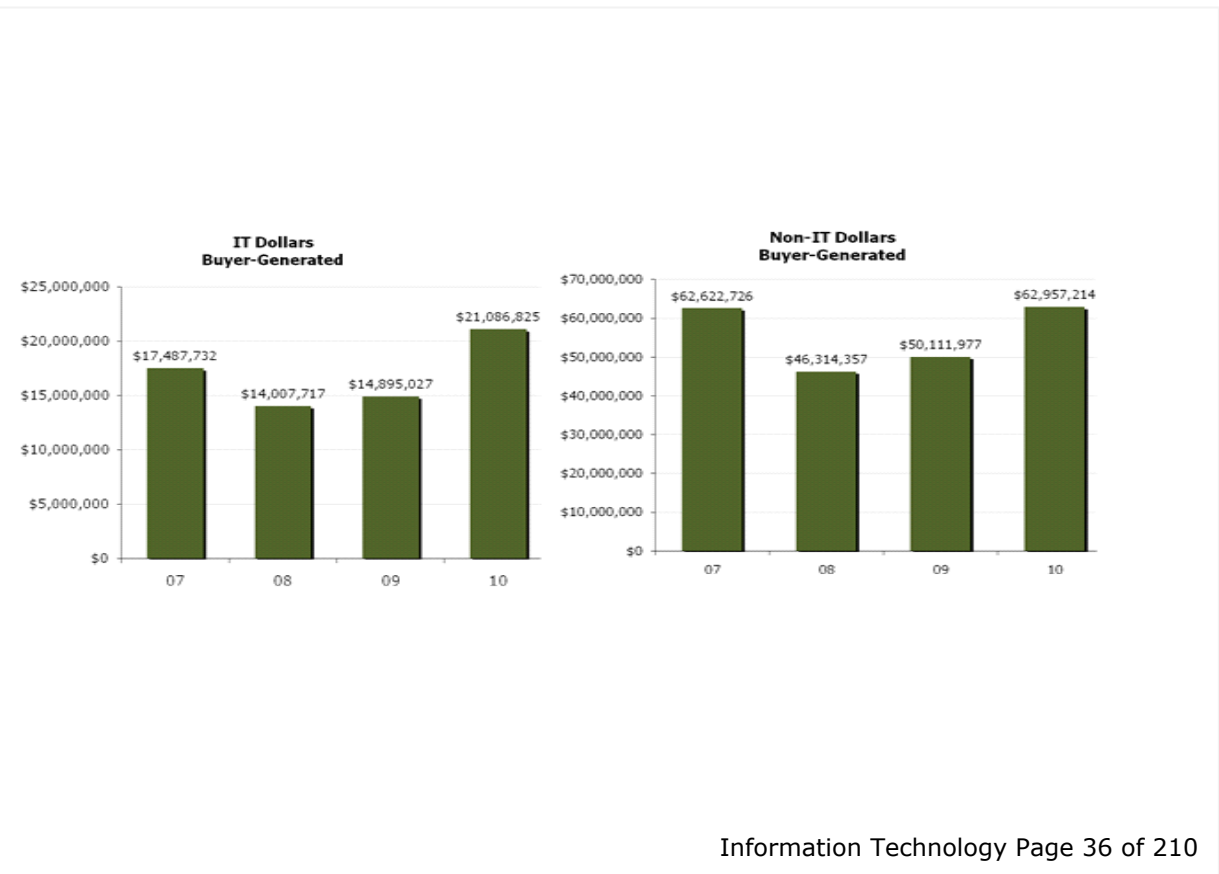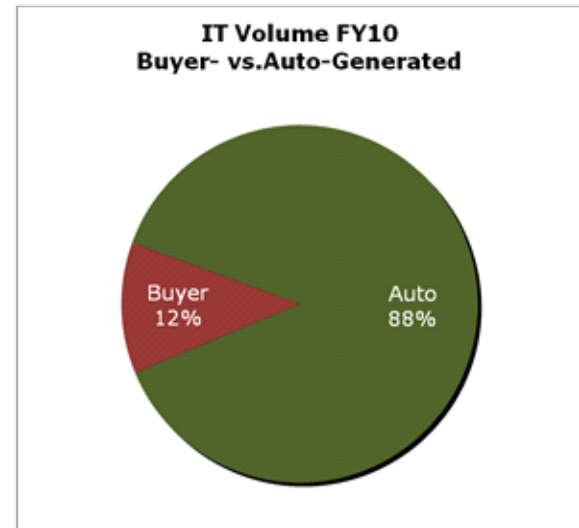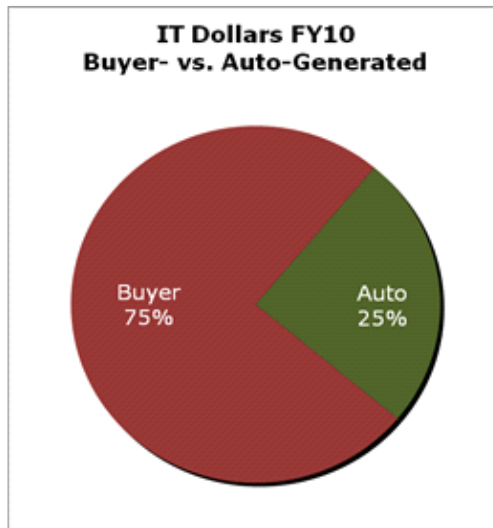
minority-owned businesses (SWAM). This effort provides strong pricing and service to the university and supports the university's efforts to increase SWAM participation.

HokieMart completed its second full year in FY10 as the university's single point of entry for procurement. This e-system enabled both Purchasing and Computer Purchasing to manage increased volume by automatically generating smaller dollar orders and many contract orders. HokieMart is continually enhanced, and in FY10 Fujitsu was added as a new punchout vendor. Further enhancements to HokieMart included the addition of nearly all university internal vendors. These include interdepartmental service requests (such as software distribution), printing requests, travel agency authorizations, reimbursement requests, and direct pay orders.



FY10 IT Average Order Dollars
Buyer- vs. Auto-Generated

Buyer-Generated $43,853

Auto-Generated $2,144

The chart *FY10 IT Average Order Dollars* clarifies the immense difference between average information technology order dollars for buyer-generated versus HokieMart auto-generated orders, at $43,853 and $2,144 respectively. This is a significantly wider gap than in FY09, which had average order dollars of $18,044 and $1,523 respectively. The next pie charts illustrate that buyer-generated orders focus on higher dollars at 75% of total dollars, while HokieMart auto-generated orders focus on a higher <u>volume</u>, 88%. The two processes complement each other and allow each to utilize their strengths to best advantage. Analytical skills and legal and regulatory processes are more heavily mandated in higher-dollar orders, and these require the buyer's value-added knowledge, skills, and experience. Buyer-generated orders often require competitive bids or proposals, negotiation of legal agreement terms and conditions, or involve special processes.

FY10 saw a dramatic increase in dollars for buyer-generated orders. The *IT Dollars Buyer-Generated* chart demonstrates the increase of over $6 million (42%) between FY09 and FY10. The increase has been managed by the existing staff of two and one-half information technology buyers and one support staff for the university. Some key factors in the information technology dollar rise are complex software and hardware systems and expanded research

**IT Dollars FY10**
**Buyer- vs. Auto-Generated**

Buyer 75%  Auto 25%

**IT Volume FY10**
**Buyer- vs.Auto-Generated**

Buyer 12%  Auto 88%

**IT Dollars**
**Buyer-Generated**

| Year | Amount |
|------|--------|
| 07 | $17,487,732 |
| 08 | $14,007,717 |
| 09 | $14,895,027 |
| 10 | $21,086,825 |

**Non-IT Dollars**
**Buyer-Generated**

| Year | Amount |
|------|--------|
| 07 | $62,622,726 |
| 08 | $46,314,357 |
| 09 | $50,111,977 |
| 10 | $62,957,214 |

requirements. The figure *Non-IT Dollars Buyer-Generated* shows the variation in non-information technology buyer-generated order dollars, with the FY10 increase of 26% heavily influenced by the timing of large capital outlay projects. Non-information technology includes equipment, supplies, and services for scientific, medical, office, facilities, food services, and agriculture requirements, as well as travel and capital outlay for construction.

Each year has variation in peaks and valleys in receipt of requisitions, depending on arising needs. The monthly volume of requisitions received by Computer Purchasing throughout FY10 (see *IT Requisition Volume FY 2010 Buyer-Generated)*, shows peaks in April, May, August, and June. The previous year's peaks were in February, April, May, and June.

Computer Purchasing continues to provide quality value-added service for education, research, and administration, with a focus on complex, higher dollar orders and related processes. The office formed partnerships with the university community, provided best value procurements, supported competition and diversity, and assured legal and procedural compliance. The investments in information technology and the efforts of Computer Purchasing support Virginia Tech's mission to discover and disseminate new knowledge.



IT Requisition Volume FY2010 Buyer-Generated
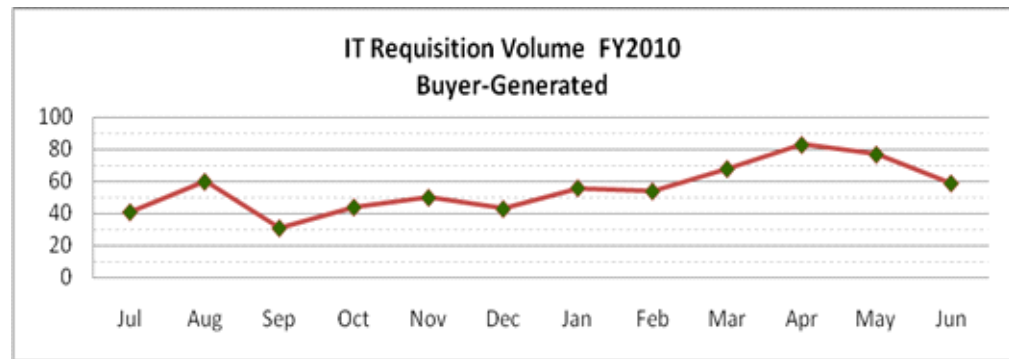
# Departmental Software Distribution

Departmental Software Distribution is a part of the Software Distribution Office and is organized on a partial cost-recovery basis. Departmental Software Distribution provides software at discounted prices, and occasionally at no cost to departments, with limited support for individual faculty and staff members of Virginia Tech. Software distributed by Departmental Software Distribution includes software purchased through major contracts or site licenses (e.g., Adobe, Microsoft Select, ESRI, and Campus Agreement contracts) and any software that can be obtained at quantity discounts for which there is a demand by departments. Departmental Software Distribution also offers a limited number of laptops for short-term lease to departments. Total recoveries include billings to other universities for their share of the Virginia state-wide ESRI education site license which we manage.

In FY10, Departmental Software Distribution once again expanded its capabilities in support of the academic missions of the university community by serving as a resource for departments that were in need of specialized software but did not have the numbers to purchase the software at

reduced rates. At the beginning of the year, ITA finalized a new university three-year contract for the Microsoft Campus Agreement program. In order to simplify the management of the program, the 16 previous subscriptions were consolidated into 11. Through our initiatives, we also added 10 new departments to Microsoft's Campus Agreement in FY10. To date, ITA manages the Campus Agreement program for 62 departments with a total full-time equivalent personnel count of 4309. As departments discover the benefits of our software management capabilities, more seek ITA services. This year, ITA assumed the management of ANSYS, Qualtrics, Rhino, SimaPro and Abaqus. Each of these software applications were previously managed by individual departments across the university. Once ITA took over their administration, these applications became available to more members of the university community and the cost to departments was significantly reduced.

The management of new software releases became more complicated with the release of Microsoft's Windows 7 and Office 2010; and Adobe's release of their new Creative Suites product line in the third and fourth quarters. Eighteen new product releases from Adobe were incorporated into ITA systems as well as ANSYS, Qualtrics, Rhino, Simapro, and Abaqus. New versions of PDF Annotator, Granta CES Edupak, Mathematica, LabVIEW, MapPoint,

Dyknow, SmartDraw, EndNote, ESRI, Bentley, Matlab, Minitab, Visual Studio, Project, and Visio were also tested and incorporated into our systems. For the first time in FY10, each new product release had to be tested on both 32bit and 64bit systems. In doing so, the associated installation documentation became more complicated and time consuming.

On November 2, 2009, Departmental Software began taking software orders only through the university's HokieMart purchasing system. This e-procurement system helped Departmental Software manage the increased volume of software orders that had been seen over FY09 and eliminated the need for paper. Extensive preparation and system integration were finalized during the first and second quarters of FY09 before implementation could begin. This effort included the redesign of ITA's
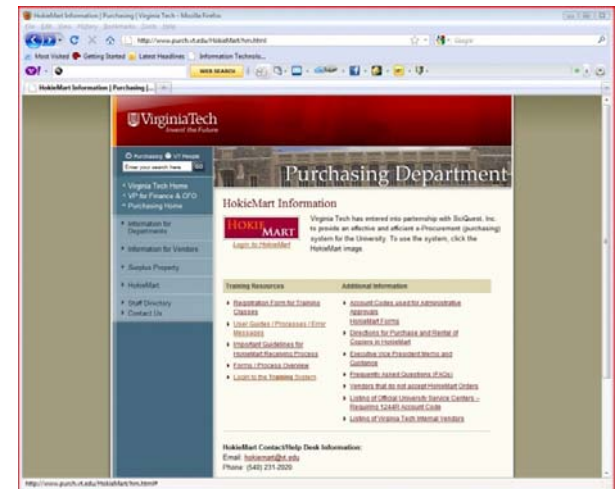


HokieMart

billing format to align with the system used by the Office of the Controller, development of internal approval processes, and the creation of a comprehensive communication plan designed to educate end users. Although the mode of order delivery changed, the strong regulatory processes that had previously been established to track and distribute software and codes remained intact. Approval process development was integrated into the Departmental Software System (DSS) to ensure accuracy of fund codes, prices, license agreements, and departmental software order forms. Additionally, a HokieMart order processing log that tracks each order from inception through final approval was developed and is maintained by the members of the Departmental Software staff.

The following graphs show totals per fiscal year of interdepartmental service requests (ISRs) for FY07 through FY10, and HokieMart orders in FY10 processed in regard to sales—*Departmental Software Sales Summary* and *Total Items Distributed*. Sales billings to departments vary each year based on the
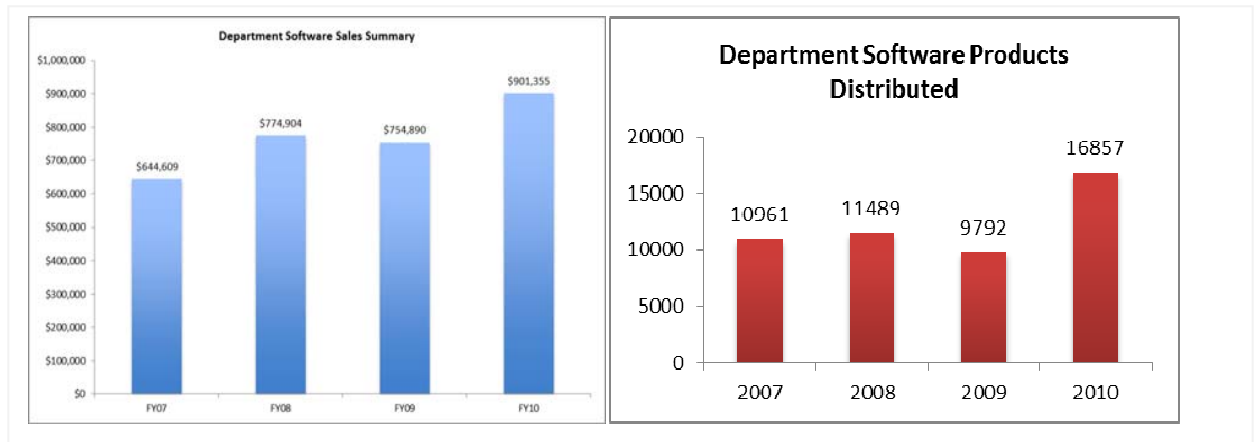


mix of products that are purchased by departments. Sales include all ISRs and HokieMart orders processed for departments. In FY08, we saw an increase in overall revenue as well as an increase in products distributed. In FY09, we saw a slight decline in sales and products distributed as the result of impending budget cuts throughout the university; additional departments that chose to opt for membership in the Campus Agreement program; the anticipated release of Windows 7; and as more software titles were relegated to the download server for

distribution. New product releases from Adobe and Microsoft, additional Campus Agreement memberships and ITA's management of more university software products all worked to produce a sales increase in FY10 of $146,465 and an increase of overall software distributed by ITA of 7065 products over the same period of time in FY09. The increase seen in FY10 is due to a significant increase in sales of Microsoft products over FY09 and new sales of ANSYS and Qualtrics.

**Department Software New Products Introduced**
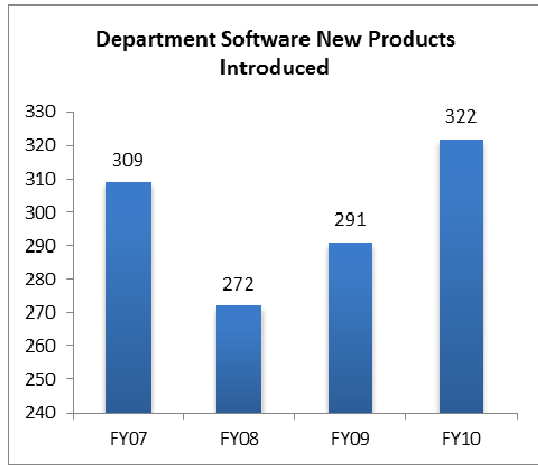
The next charts, *Department Software New Products Introduced* and *Software Server Total Connections*, show the number of new products introduced over the last four years as well as the number of connections that were made to our software server during that same period of time. Individual products distributed include departmental licenses and additional CDs and DVDs purchased. Distribution numbers do not include numbers related to site licenses distributed through the network software installation service. The decrease seen in FY08 is due in large part to a redesign of the naming convention of many of our products, a significant increase in the distribution of Microsoft products on our network server beginning in FY07 (see *Software Server Total Connections*), and as departments established base product "staples" within their programs. While there was a slight

increase in new product offerings in FY09 over FY08, FY10 saw major new product releases from both Microsoft and Adobe, with Microsoft releasing both their new operating system Windows 7 and Office 2010 and Adobe updating their entire Creative Suites collection.

FY10 saw a dramatic increase in the amount of software being distributed by download all across the university as related to previous years. Several "staple" applications saw large download increases including the Microsoft products, Matlab, JMP, LabVIEW, and Chemsketch. New products that were added in FY10 to the server also contributed to the increase. These include Dyknow, Granta, ANSYS, and Simapro. While several departments were added to Campus Agreement last year, it is the satisfaction with the program that has been impressive. The technology and those that maintain the system have made the "just-in-time" program successful. To date, we are currently serving 4309 faculty and staff FTE across the university. While the Campus Agreement program accounts for the majority of the connections, each year ITA receives more requests to manage specialized software through the use of our server. This year, as more departments became familiar with the benefits associated with this distribution method, requests to take over the management of specialized software came to ITA. The College of Engineering asked ITA to assume the

management of ANSYS, Dyknow, Granta, and Simapro on the download server. Other software additions to our network downloads that impacted the steep rise, as seen in *Software Server Total Connections*, include new versions of PDF Annotator, Mathematica, LabVIEW, MapPoint, SmartDraw, EndNote, ESRI, Bentley, Matlab, Visual Studio, Project, and Visio.
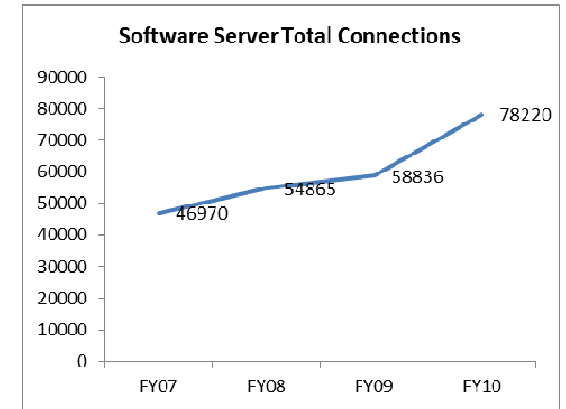
# Student Software

Student Software Distribution is a part of the Software Distribution Office and is organized as an auxiliary. Student Software Distribution was originally organized to provide software for the Engineering Freshman Software Bundle. It now handles bundle requirements for six academic areas and a Microsoft Campus Agreement bundle for all incoming undergraduates. Student Software also distributes software to other students, and to faculty and staff members. Individuals seeking software that does not fall under a bundle requirement primarily purchase Microsoft Office and Adobe releases. Student Software only handles software that is specifically requested to support an academic program, such as the Freshman Engineering Bundle; or is only available as an add-on to a current university contract. Additionally, the software must be obtained for students at a price that is significantly lower than otherwise available.

In April 2009, a decision was made by the vice president and dean for undergraduate education to require a new Microsoft Campus Agreement software bundle for all incoming undergraduates. Once fully implemented, all freshman and transfer undergraduate students were required to purchase a Microsoft Desktop Software Bundle (Microsoft Office, Operating System upgrades, and core CALS). Successful implementation of this new initiative required precise planning and cooperation among many departments across campus. Once all 15 orientation sessions had been completed at the end of July 2009, information was gathered from the university committee that had originally coordinated the program. Overwhelmingly, it was felt by all that the distribution initiative had been successful. The communication plan, convenient location, knowledgeable staff, and the collaborative efforts of the committee proved instrumental in making the new undergraduate software requirement a positive experience for our incoming students and their parents.

Since the implementation of the Microsoft Incoming Undergraduate Campus Agreement software bundle at the end of FY09, 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 and those that support those areas. 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 problem solve that cross all academic, administrative, and support areas and has allowed ITA to be on the forefront of the development of solutions that benefit the university.

Once the university implemented the Microsoft Incoming Undergraduate Bundle we saw a dramatic change in billing over FY09. *Student Software Dollars By Month* illustrates how students were charged for the desktop bundle. In FY10, as was done in FY09, ITA chose to craft a simple informational piece in the form of an e-mail message and sent it to over 6300 incoming students that clearly explained the requirement and how the bundle was to be billed.



Student Software Dollars By Month
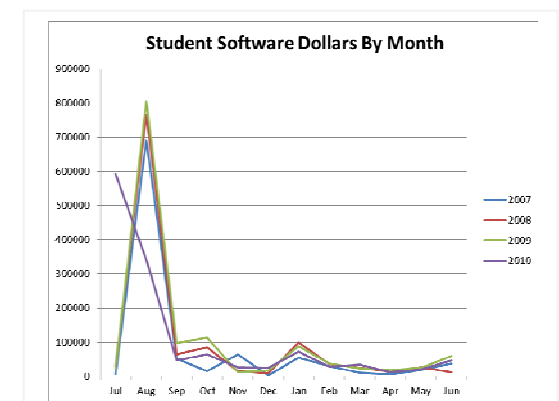
*Student Software Sales By Month* shows how the distribution of the incoming undergraduate software bundle affected overall sales of software. As shown, overall billing as a result of the separation of the desktop bundle (Microsoft Office, Operating System upgrades, and core CALS) from the program-specific bundles that we distribute has increased sales and distribution in July.
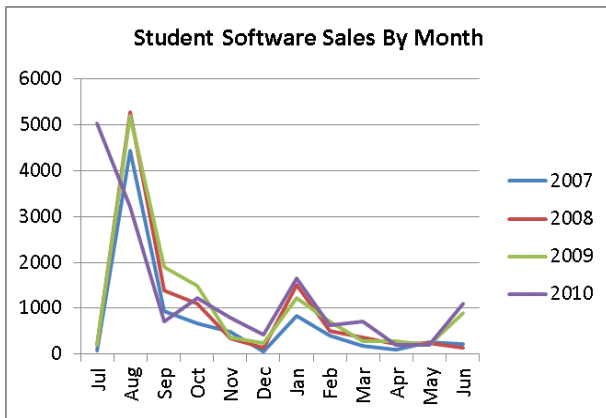


*Software Server Total Connections* shows the explosive growth that has been seen in distributing software to students and departments via downloads or virtual mounts. We now offer 114 software titles encompassing more than 963 GB on the Network Software Server. The significant increase seen between FY09 and FY10 is due in large part to the implementation of the incoming undergraduate software bundle and to the addition of new software applications to our server. We continue to invest in new hardware and software to stay ahead of this demand.
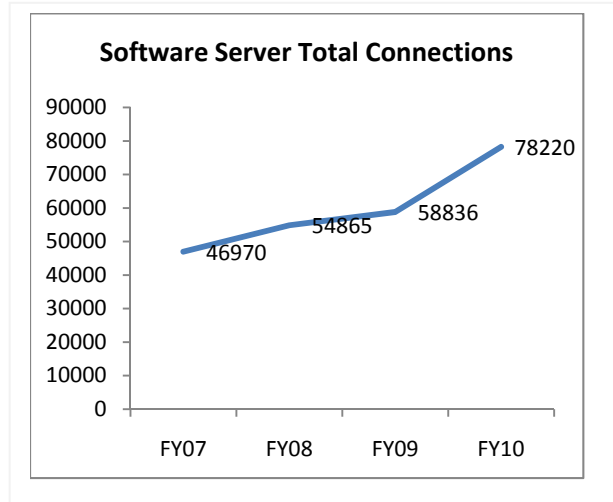


In the first quarter of FY09, ITA looked at server usage and how future plans for the expansion of software distributed via our download servers would impact our ability to serve our customers. At that time, we saw the potential for significant increases. In order to assure continuity of service in the event of extremely high server usage, strategic initiatives were put in place. These ongoing improvements to the system enabled ITA to effectively handle the implementation of the Microsoft Campus Agreement bundle for all incoming undergraduates despite the extremely short implementation timeline. In evaluating the initiatives that were put in place to upgrade our systems and analyzing the demands that have been placed on our servers, the effort that was expended on these upgrades was critical to the successful implementation of the new undergraduate requirement. Going

forward as we continue to look at usage patterns and examine the priorities of the academic areas that we serve, ITA will continue to invest in improvements in this area.

In FY09, ITA moved to a site license with Mathworks to provide Matlab to all incoming engineering students. This new and different licensing methodology, total academic headcount (TAH) required extensive planning, testing, and research. The distribution of over 9200 licenses was accomplished with a very limited number of problems. In the summer of 2009, we renewed the TAH contract and were required to do more planning and research to make sure that the university's students could continue to utilize Matlab. We worked with Mathworks to ensure a smooth transition in providing new licenses to end users without disruption to current license holders. This new contract has also been very successful in being more cost effective for our department as well as the student population. At that time, Mathworks also changed their licensing mechanism used to provide licenses to the faculty and staff. Much more work is required to administer this license but we have full license accountability so there is less concern with software piracy or license misuse. The extra work involved helped keep costs down for the end-users. In the fall of 2009, additional toolboxes were added to the concurrent Matlab license that services the faculty and

staff. For the first time, this addition allowed faculty and staff members to have access to the same tools that are included on the student TAH license.

FY10 brought about several new product releases that affected overall sales and distribution totals. Microsoft released both a new operating system, Windows 7 and the new Office 2010 software suite. Adobe released new versions of Creative Suites, Photoshop, Web Premium, and Dreamweaver. Other new product releases that affected sales and distribution practices included PDF Annotator, SAS, Matlab, LabVIEW, ESRI ArcEditor, Granta, and Visio.
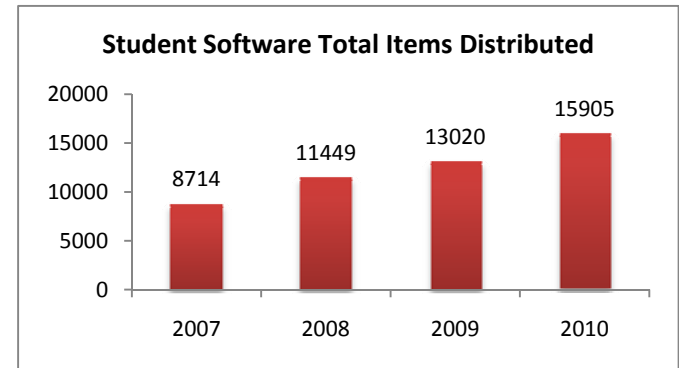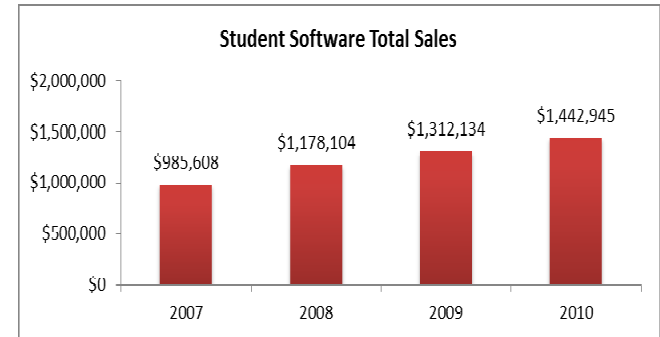
In FY10, ITA instituted its first technical support initiative on the Torgersen Bridge during the promotional release of Windows 7. The Installation and Upgrade Support Program, which ran from October 23 through December 16, 2009, was available to all faculty and staff members and students that purchased Windows 7 through Software Distribution. Assistance was available three afternoons per week and provided help to those that needed support backing up data for transfer, installing Windows 7, installing Windows 7 compatible drivers, restoring data, and simply answering questions concerning Windows 7 upgrades. By establishing a Windows 7 installation support service, ITA was able to assist the university community with an upgrade process that, in most instances, was less

than straightforward. During the initiative, 79 individuals received help with their Windows 7 installation. The support component of the initiative allowed ITA to implement a "full service" methodology and see a purchase transaction through to installation. The use of the Torgersen Bridge as the venue for the service gave faculty and staff members and students the opportunity to receive assistance with their installation issues on a regular basis and at the same location as they had purchased their software package. It was also an excellent opportunity for ITA to educate users who were unfamiliar with software installation.

Once again in FY10, ITA served as a valuable resource to departments that were in need of product negotiation with vendors. Products such as ANSYS, Granta, Rhino, and Simapro were acquired at a much discounted price from the original quote due to our efforts. As we move forward, colleges and departments in need of specialized software for their students continue to call the Software Distribution office to make their requests.

*Student Software Total Sales* and *Student software total Items Distributed* below show a slow increase in total sales by fiscal year and a more rapid increase in total products distributed through those sales. Better pricing obtained on the components of the

bundle, an increase in sales of the Engineering bundle, introduction of the new incoming undergraduate software bundle, and sales of several individual products including Granta, Rhino, and Windows 7 led

**Student Software Total Sales**

| Year | Sales |
| --- | --- |
| 2007 | $985,608 |
| 2008 | $1,178,104 |
| 2009 | $1,312,134 |
| 2010 | $1,442,945 |

**Student Software Total Items Distributed**

| Year | Items |
| --- | --- |
| 2007 | 8714 |
| 2008 | 11449 |
| 2009 | 13020 |
| 2010 | 15905 |

to this result. Total units distributed have continued to rise since FY07 primarily due to increasing numbers of students, introduction of the new incoming undergraduate software bundle in FY09, an increase in sales of existing products such as Auralog, and the acquisition of new products such as Windows 7 and Granta.

In FY08, we saw a considerable growth in sales than in FY07. Much of this growth can be attributed to the significant increase in sales of the upperclassman business and engineering bundles as well as Microsoft's new release of Office 2008. FY09 saw an increase in both total sales and items distributed due to an increase in sales of Microsoft Office 2008; Microsoft Office 2007; engineering bundles; architecture bundles; PDF Annotator; SAS, and the incoming undergraduate software bundle that was distributed during the summer semester. In FY10, we saw an increase in total student sales over FY09 of more than $130,000. This increase is attributed to the increase in sales of the incoming undergraduate software bundle, Auralog, Granta, new product offerings such as Windows 7, and Adobe's 20% price increase on their new Creative Suites line. New product releases for FY10 that affected overall sales totals include purchases of Windows 7, Granta, and Rhino.

# 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 Commonwealth of Virginia. New releases and additional software acquisitions drive much of the work generated by this part of ITA. Virginia Tech continues to hold the VASCUPP contracts for ESRI's geographic information system software which now includes all middle and high schools in the commonwealth. Again, this year, we added another private university to the ESRI statewide contract. The University of Richmond moved from a university site license to the statewide contract. This move saved the University of Richmond approximately $12,000 and reduced the cost for all other schools on the contract.

Four years ago, Information Technology added an addendum to the ESRI Virginia Statewide Higher-Ed to add 800 high schools and middle schools to the ESRI contract. In December 2009, ESRI and the Virginia Department of Education approached Information Technology Acquisition to aid in the distribution of the software. In January 2010, a pilot project was launched with the Office of Career and Technical Education Services at the Virginia Department of Education. By the end of January, the Guest Software Service went into production to allow schools within the commonwealth to download and receive license information via the Network Software Server. The project was a great success providing a very streamlined process to supply software to many schools without delay.

In June 2010, ITA teamed up with Wolfram to organize a statewide contract for Mathematica. We have provided contact information and extensive guidance to the sales team at Wolfram to aid them with the startup. As soon as the contact is in place, ITA will be in charge of managing the contract. This contract includes both public and private universities.

This part of the ITA organization handles billing for both Student Software and Departmental Software. It also manages most of the technical aspects related to software distribution. Responsibilities of the area include the following:

- Developing various software distribution methods (e.g., students and faculty members are able to access software via direct download of ISO images, as well as through the creation of virtual mounted drives)
- Creating and managing license codes (e.g., creating yearly Matlab activation keys that terminates on a specific date to manage our licenses)
- Managing license servers (e.g., in addition to managing and hosting the license manager for LabVIEW and ANSYS and ArcGIS (ESRI); and accessing the license managers hosted by MathWorks and Minitab to generate license files)
- Troubleshooting various software installation and activation problems
- Acting as a liaison to departments regarding access to software and services specified in contracts (i.e. Microsoft download products and volume license keys)

This year the Contract Management, Licensing, and Billing section spent time working on the university's Campus Agreement renewal, creating and testing of builds for ANSYS, SAS, Matlab, JMP, Granta, Mathematica, EndNote, LabVIEW, SPSS, SimpleHelp, and WebDrive.

# Information Technology Security Office and Lab

The Information Technology Security Office and Lab saw several changes during the 2010 fiscal year. Wayne Donald retired as the Virginia Tech's IT Security Officer but left a strong foundation for the IT Security Office and Lab to continue carrying out its mission. Randy Marchany assumed the role of University Information Technology Security Officer. Furthermore, Information Technology reorganized some of its units to align itself with it strategic needs. Identity Management Services (IMS) was moved to the area of Converged Technologies for Security, Safety, and Resilience. The realignment allowed the Information Technology Security Office and Lab to refocus on its core competencies. These include

- an established ability to provide forensic analysis;
- a demonstrated ability to provide intrusion detection analysis;
- recognized ability to provide effective information technology security training;
- expertise in information technology security-related technical and compliance issues;

- certifications in forensics, network penetration, and intrusion detection;
- the ability to create and maintain information technology security tools and applications.

The Information Technology Security Office and Lab operate under separate missions. The Information Technology Security Office provides services, training, and analysis to help protect Virginia Tech's data and systems. The Information Technology Security Lab provides testing, research, and development of information technology security tools and applications. The work of the Information Technology Security Office and the Information Technology Security Lab complement each other to help protect Virginia Tech's information technology assets.

# Information Technology Security Office

The mission of the Information Technology Security Office (IT Security Office) is to provide 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.

## Awareness and training

The IT Security Officer believes that technical training and awareness efforts are a proactive way to help protect Virginia Tech's information and information technology assets. A key component of the IT Security Office's mission is to give students, faculty members, and staff members information that empowers them to help protect the data and systems they use. Awareness presentations are the most important component to our "Securing the Human" initiative.
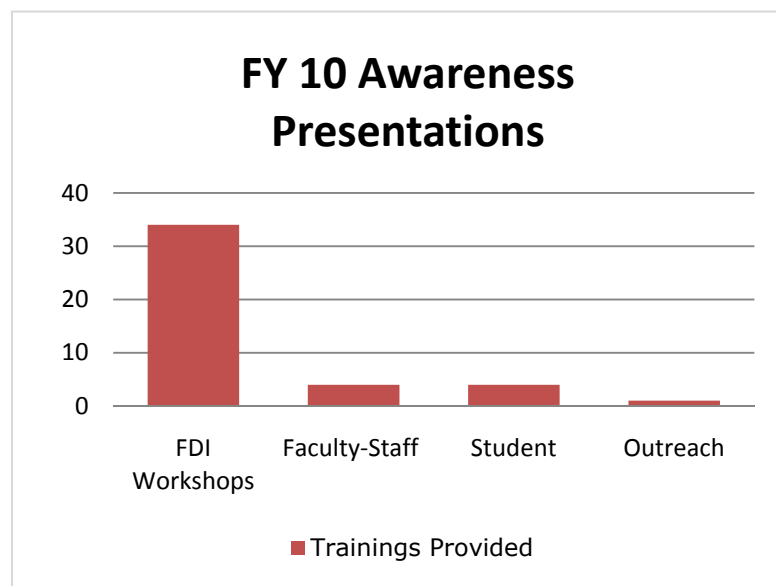
**Awareness**

The IT Security Office is committed to delivering cyber-security awareness presentations to any part of the Virginia Tech community requesting it. Awareness presentations are crafted to the audience and deliver messages including general cyber awareness, safe computing practices, Virginia Tech information technology policies and standards, and ways to find sensitive information and how to protect it.

The IT Security Office worked closely with the Faculty Development Institute (FDI) to educate faculty members about cyber issues in presentations titled:

- Securing Your PC
- Securing Your MAC
- Hunting for and Protecting Sensitive Information
- General Information Technology Security Awareness

## FY 10 Awareness Presentations

A bar chart titled "FY 10 Awareness Presentations" showing Trainings Provided. FDI Workshops approximately 34, Faculty-Staff approximately 4, Student approximately 4, Outreach approximately 1. Y-axis ranges from 0 to 40.

Trainings Provided

By presenting at FDI, the IT Security Office was able to present cyber awareness issues to over 500 faculty members. Presentations were also given to three faculty and staff events and to student groups from the Pamplin College of Business, ROTC, international students, and graduate students. As part of an outreach effort, the IT Security Office also delivered a cyber-awareness presentation to computing students at Blacksburg Middle School.

Awareness efforts were not limited to presentations. The IT Security Office delivered awareness messages to the Virginia Tech community through Web and printed material. Some of the IT Security Offices efforts included

- a holiday table card campaign;
- Tech Fundamentals orientation handout (circulation of 14,000);
- distribution of 300 awareness mouse pads with support from Information Technology Acquisitions;
- IT Security *Quarterly Hot Sheet Newsletter*.

The IT Security Office also participated in National Cyber Security Awareness Month to raise cyber awareness among the faculty and staff, and students. This campaign incorporated several low cost initiatives—redesigning the website with a focus on

cyber security issues, providing downloadable posters and screensavers, delivering awareness ads through the *Collegiate Times* website, and providing information technology security training to Virginia Tech information technology professionals. The IT Security Office also created a social network presence on Facebook, YouTube, and Twitter.

An awareness training module was produced that could deliver effective training to a large audience at low cost. The IT Security Office collaborated with InnovationSpace to produce an online Gramm-Leach-Bliley-Act awareness course that can be delivered through the Scholar learning management system. The course provides information to help faculty and staff members protect non-personal public financial information and helps address the training needs required by university Policy 7025. The course was ready for distribution at the end of the year.

**Training**

Virginia Tech's information technology professionals need to maintain a skill set that reflects cyber security issues. The IT Security Office provided training opportunities to fulfill this need, with two workshops and sponsored SANS training during the year.

The first workshop was during fall break and gave system administrators and Web developers an opportunity to learn about open source tools that can be used to harden information technology systems. The second workshop was held in January and demonstrated important security audit techniques on Linux and Windows systems. Participation was high for both workshops, and departments from across the campus community were represented.

Professional development is an important part of the Information Technology strategic plan. The IT Security Office contributed by hosting a SANS 560 Network Penetration and Ethical Hacking course during May. Attendees numbered 111 from Virginia Tech and across the country, gaining an opportunity for professional certification and continuing education credits in the field.

**Opportunities**

The IT Security Office believes that opportunities exist and improvement can be achieved in awareness efforts for staff employees, outreach efforts, and the use of online training resources. We have set the following goals:

- Increase the number of awareness efforts that include staff members

- Increase the number of outreach presentations made to the community
- Expand offerings of online training modules
- Seek funding opportunities from grants for the purpose of awareness

## Security reviews

The IT Security Office conducts information technology security reviews throughout the university as a service to help departments discover potential cyber problems that could result in sensitive data disclosures, illegal usage, and potential problems that weaken information technology systems. These reviews are considered beneficial to check compliance and help protect university data.

By the end of this fiscal year, the IT security Office had completed four security reviews and was engaged in three others. This number represented underperformance in security reviews compared to previous years. The lower number is mainly attributed to staffing issues. In January, the IT Security Office filled a vacant analyst position to address the staff deficit.

To address the underperformance in this area, the IT Security Office adopted a new plan to pursue and complete security reviews. This new strategy focused IT

Security Office resources on offering and providing security reviews that focus on distinct areas.

Areas of higher inherent risk. These areas include departments that consistently handle sensitive data or have systems that are critical to the operation of the university.

Areas that have shown consistent negative trends. These areas have a higher rate of vulnerability and compromises as detected by intrusion detection sensors and network scanners.

We will also focus on areas that Internal Audit has scheduled for an audit, and areas that request security reviews.
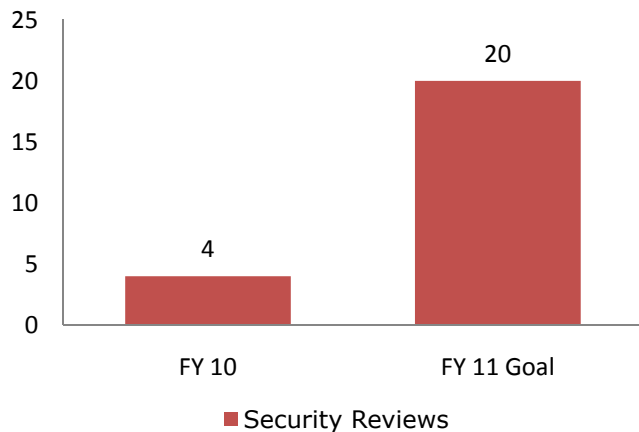
The new strategy is a more proactive approach to protect information and systems by performing security reviews based on higher inherent risk and detected issues from intrusion detection sensors and vulnerability scans.

The security review process acquired a team approach to allow for more flexibility and efficient use of resources and personnel. The IT Security Office also improved methods of internal communications and documentation for security reviews. The changes allowed the IT Security Office to perform multiple security reviews in an overlapping manner.

**Opportunities**

The IT Security Office believes adopting the new strategy will increase in the number of security reviews as well as improve the overall quality. The IT Security Office has set internal performance goals of completing 20 security reviews with a majority of the reviews in areas that handle sensitive data for fiscal year 2011.

**Forensic work**

As part of its mission to provide analysis for information technology security-related issues, the IT Security Office provides disk imaging and forensic analysis. The service is provided at the request of Internal Audit or University Legal Counsel. This service is often requested on short notice and requires the IT Security Office to maintain the equipment and training necessary to carry out forensic work in a professional manner.

To help conduct the forensic and imaging work, the IT Security Office acquired Acunetix Forensic software during the beginning of FY10. The use of this software helped reduce imaging times and increase forensic capabilities. The IT Security staff was called upon to provide imaging or analysis on 19 devices during the year.



Bar chart: FY 10 = 4, FY 11 Goal = 20. Legend: Security Reviews

# Network scanning and intrusion detection

## Network scanning

Scanning Virginia Tech's network is a proactive way to find machines that could be susceptible to compromise. The IT Security Office uses an internally developed application named Netscan that searches the network daily for machines that have open ports. Netscan provides a secure Web interface to provide detailed reports on each service that is discovered.

Vulnerability scanning is conducted every two weeks and specifically looks at vulnerabilities that may be exploited to compromise a machine. The IT Security Office targets machine types such as databases that may have sensitive data on them. Once vulnerabilities had been analyzed and verified, the IT Security Office notified vulnerable system owners to request mitigation. The IT Security Office then tracked the progress of mitigation using Remedy issue tracking software.

During the second half of this fiscal year the IT Security Office updated and improved it procedures to deal with vulnerable machines. With improved procedures in place and the use of Remedy software, the

IT Security Office believes the time necessary to mitigate server vulnerabilities will be reduced. Procedures are available at *www.security.vt.edu*.

### Netscan System

| | Hosts | Reports |
|---|---|---|
| AppleTalk | | |
| Filemaker | | |
| FTP | | |
| HTTP | | |
| HTTPS | | |
| MS-DS | | |
| MS-RPC | | |
| MySQL | | |
| NetBIOS | | |
| Oracle | | |
| Postgres | | |
| SMTP | | |
| SSH | | |
| SQL Server | | |
| VNC | | |

## Netscan Service Overview

Please use the menu on the left to obtain detailed reports for each service.

The numbers below are accurate as of September 5th 2010.

| Service Type | # Hosts |
|---|---|
| AppleTalk | 660 |
| Filemaker | 56 |
| FTP | 1205 |
| HTTP | 5315 |
| HTTPS | 3909 |
| MS-DS | 3626 |
| MS-RPC | 3836 |
| MySQL | 198 |
| NetBIOS | 3959 |
| Oracle | 37 |
| Postgres | 20 |
| SMTP | 661 |
| SSH | 4631 |
| SQL Server | 41 |
| VNC | 1557 |

**How does Netscan work?**

Netscan works by scanning both /16 VT IP ranges for specific ports. When a host is found advertising the service, they are recorded.

**Why don't the numbers for the host list and reports match up?**

Netscan scans the network every day, so you may be visiting the website when a scan is running. Also, the host list generally includes hosts that were discovered today AND yesterday. This does not count a single host twice, but changes in the network, including scan delay, cause this number to fluctuate slightly.

The Netscan application provides information on the number of servers on Virginia Tech's network by type.

**Intrusion detection system**

In the second half of the fiscal year, the IT Security Office started deployment of its open source intrusion detection system (IDS). The IDS system was developed by the IT Security Lab as a low-cost solution compared to paid products. Ever mindful of budget constraints, the IDS was developed using open source "Snort" software to power eight sensors built with low-cost desktop units.

Lab testing of the system proved positive and with the collaboration of Communication Network Services, the IT Security Office started deployment in May 2010. Completion of the deployment is expected in the fall of 2010. Once full deployment is in place, the IT Security Office will have the capability to detect traffic from compromised machines on the Virginia Tech network. Moreover, the three-layer design of the Intrusion Detection System will be able to detect whether those machines are trying to attack other machines inside the network.

To adjust to the expected impact on operations, the IT Security Office produced and updated procedures to deal with compromised machines and possible data exposures.

**Opportunities**

Careful analysis of the network scanning and IDS data will help identify trends that reveal departments who are experiencing consistent problems. The IT Security Office will then be able to target those departments to offer awareness training and security reviews in an effort to reverse the negative trend.

There remains room for improvement in the process to notify and verify remediation of issues regarding vulnerable and compromised machines. To improve the process, the IT Security Office will seek to take the following steps during FY11:

- Improve methods to identify responsible IT support for compromised machines
- Improve methods of communication with stakeholders
- Operate a separate Remedy queue to allow for better issue tracking and metrics collection
- Develop relationships with other Information Technology units that can aid in compromised machine identification
- Reduce the average time it takes from the point of notification to mitigation of the issue



IT Security Office IDS Sensor Deployment Plan
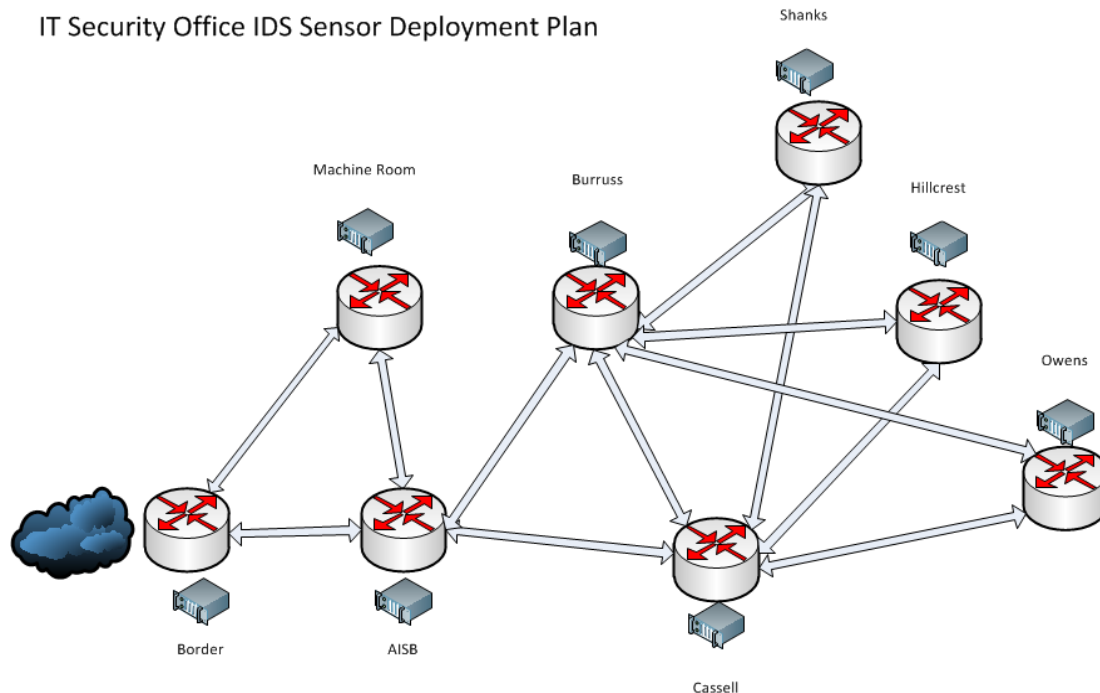
# IT Security Lab

The IT Security Laboratory mission has two primary roles. The first is to serve as a test bed for hardware and software security systems that will be used in a production environment under the direction of the IT Security Office. The second role is to provide a research and teaching hospital environment for IT Security Office faculty and staff members, and graduate and undergraduate students. It will be used to actively design, develop, and implement computer and network security training materials, intrusion detection systems, security metrics tools for IT production facilities and cyber security research efforts. It will act as a facility for cooperative cyber security research projects between the IT Security Office and academic researchers.

## Information technology security application and tool development

### Cover-VT

The IT Security Lab finished its development of an open source intrusion detection system in early May 2010. As part of its effort to contribute to the Virginia Tech's converged security objective, the lab developed a visualization framework that uses data collected by the IDS. This virtualization tool is called Cover-VT.

By using a combination of IDS data, Google Earth, and mapping information provided by Enterprise GIS Research and Administration Development, Cover-VT has been able to merge elements of cyber security with physical data. The project produces interactive maps that display information about servers and the cyber-attacks directed towards them.

Further collaboration with Enterprise GIS Research and Development has allowed the IT Security Lab to develop a spin-off project called Cover-VT 3D. Cover-VT 3D has the ability to display cyber security information down to the floor level.
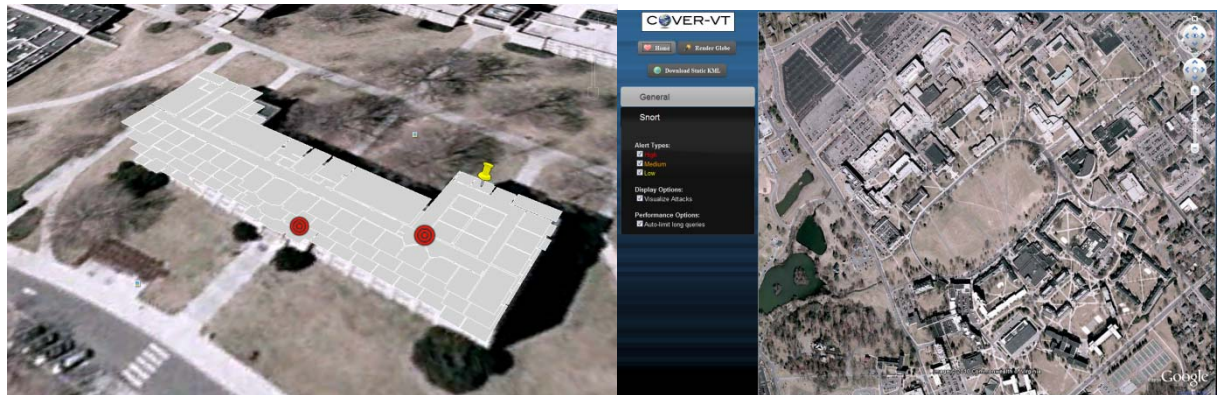


Cover-VT merges physical mapping data with cyber threat data provided by the IDS sensors.

**BASE**

BASE, Basic Analysis and Security Engine, is a Web-based reporting and analytics engine for working with Snort alerts. It is used to analyze data provided from the Virginia Tech's Intrusion Detection System. The Security Lab is contributing towards the improvement of this open source tool.

**Find_SSNs, Dshield, Self-Scan Tool, ASE**

Find_SSNs is an application developed to help users discover forgotten or hidden Social Security and credit card numbers on their computer. The application is provided at no cost and is widely used across the Virginia Tech campus. It is also in use at organizations, by individuals, and other universities across the country. The IT Security Lab provides maintenance support to keep the application updated and available for download.

An improvement plan was adopted to upgrade features of Find_SSNs to make it more user-friendly. Find_SSNs planned improvements should be available in early 2011.

The Dshield and Self-Scan applications are still popular among Virginia Tech's



Screen shots from the Self-Scan Tool, Dshield, and ASE

information technology professionals and the IT Security Lab continues to provide hardware and technical support. Dshield is an application that correlates firewall logs contributed from across campus. It is a useful resource to analyze malicious scanning trends. Self-Scan is an application that allows users to scan their machines for vulnerabilities that could cause cyber issues.

**ASE**

The ASE is an application created by the IT Security Lab to integrate the alert data from the Virginia Tech's Proventia IPS and the Snort IDS. The application allows reporting from both systems in one central interface. By providing and IP address, the application will produce a complete list of all the alerts that all of Virginia Tech's IDS systems have

seen for that address. The IT Security Office has been using ASE as a tool since March 2010.

**Cyber Security Operations Center**

The Cyber Security Operations Center (CSOC) is a single interface that provides multiple information technology security tools and resources. The goal is to use this single interface to combine all of the tools and resources available to the IT Security Office to quickly analyze threats as they emerge. The IT Security Lab actively supports applications that are part of the CSOC.

With the deployment of Virginia Tech's IDS system and the addition of new applications such as Netscan and ASE, the IT Security Office feels that the value CSOC has increased and will soon be a key tool for system administrators throughout the campus.

**Teaching hospital**

The Lab provides an environment for research and learning based on a "teaching hospital" model. A controlled cyber environment is provided to facilitate experiments and give students a chance to observe and harden systems in a real world setting. The IT Security Lab is open to any student who is interested in research in the information technology security field.

Students working within the lab gained valuable experience in programming and managing server environments. Students also received an opportunity to gain experience by participating in the maintenance of applications such as Find_SSNs and Cover-VT. Two courses, ECE 4560 and ECE 5984, were supported by the IT Security Lab. Students learned audit techniques and vulnerability mitigation. Master's and doctoral students conducted research in areas of mobile device security, security tool evolutions, IPv6, and visualization of cyber threats.

A lab graduate assistant had an article entitled "Taming the Bluetooth Beast" published in the prestigious *IEEE Security & Privacy Magazine*. Students also presented at the following conferences:

- 70th IEEE International Conference on Portable Information Devices
- System Sciences (HICSS), 2010 43rd Hawaii International Conference
- 6th Annual Cyber Security and Information Intelligence Research Workshop (CSIIRW 2010)
- 5th International Conference on Internet Monitoring and Protection (ICIMP 2010)
- 1st International Conference on Computing for Geospatial Research & Application (COM.Geo 2010)

**Opportunities**

The IT Security Lab will continue its efforts to investigate security issues related to mobile devices, develop tools for the user community, IPv6, and visualization of information technology security threats. To help improve the use of its resources and work towards performing its mission, the IT Security Lab will increase the use of virtualization of its systems, increase the use of students in development and maintenance of security tools and applications, and seek outside funding opportunities for research.

# Learning Technologies

Learning Technologies' mission is to provide a learning infrastructure that meets modern needs for integrating technology across content areas. We seek to create and support robust environments for learning, discovery, and engagement for all faculty members and students that are grounded in sound principles of learning and in a thorough knowledge of integrating technology for effectiveness and efficiency of effort,

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

Building on its record of achievements as demonstrated by several national awards received in the recent years, Learning Technologies continues to influence modern university activities in four basic program areas:

1. Professional development and e-portfolios
2. Learning, collaboration, and evaluation systems
3. Initiatives in learning, discovery, and engagement
4. Imaging and repositories

## Professional development and ePortfolio

### Faculty Development Institute

*www.fdi.vt.edu*

Established in 1993, the nationally recognized Faculty Development Institute (FDI) continues to provide technology and pedagogy knowledge, skills, and tools needed by faculty members in 21$^{st}$ century university. The FDI program continues to have a transformative impact on Virginia Tech's instructional program by ensuring that faculty members have opportunities to provide efficient and effective learning environments for our students. Clear demand continues across campus for FDI's training and development short courses, workshops, and online training options, as participation of faculty members, graduate students, and staff members grew across FDI programs.

The learning management system migration from Blackboard to Scholar, coupled with such FDI curricular improvements as more flexible scheduling and online training, produced a 9% increase in participation, from 5,524 in 2008-2009 to 6,067 in 2009-2010. During the spring and summer of 2010, 484 faculty members selected an extended workshop from 20 tracks offered. These participants received a computer and software as part of the FDI mission of keeping faculty technology current. This year marked the first offering of a track conducted entirely online, to which faculty reaction was very positive.

The past year marked the first year of the fifth four-year cycle (2010-2013) of FDI. In 2009-2010, our aim was to strengthen the

program's value to the faculty by providing a wider range of content, including topics that support the university's emphasis on research excellence. A major emphasis this year was to prepare faculty members for the large-scale deployment of Scholar and ePortfolio

FDI 2009-2010 tracks

New Faculty: Community and Computing

Teaching with a Tablet PC to Engage Students in the Learning Process

These Scholar(ly) Days: Moving, Building, and Conducting Courses in Scholar

Moving, Building, and Conducting Courses in Scholar (An Online Scholar Track)

Innovations: Exploring Emerging Learning Technologies

Planning, Developing, and Delivering Online Instruction

Improving Online Instruction: Strategies, Pedagogy and Best Practices for Advanced Online Instructors

Teaching as Part of the First Year Experience

QEP RFP: Preparing Your Proposal for the QEP

Community of Practice: Librarians at Virginia Tech

NVC Track: Improving Instruction using Scholar —Strategies, Pedagogy, and Best Practices (Taught on-site in Northern Virginia)

An Introduction to MATLAB and Statistical Methods

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

Visualization and Research Computing: Deep Media for Research and Education

Creative Technologies: Arts in the Digital Age

What is YOUR Track —Design Your Own Development Experience

In addition to extended workshop tracks, the FDI program each semester offers over 250 short courses covering a large variety of topics ranging from course management systems, pedagogy issues surrounding learning technologies, ePortfolios, eFolio thinking, Google Apps for education, concept maps, making online courses accessible, scientific visualization, statistics software, research productivity and technology, conversion of software and problems for supercomputing, GIS applications, one-on-one help sessions, digital media development, podcasting, web

development, web design, Ensemble CMS usage, and dozens of others.

Short course attendance*

| Term | Short courses | Participants |
|---|---|---|
| Fall 2009 | 271 | 1,950 |
| Spring 2010 | 318 | 3,145 |
| Summer 2010 | 95 | 972 |
| Totals | 684 | 6,067 |

*Includes faculty, staff, and graduate student attendees; Blitz Week programs are included in the semester counts.

The FDI staff meets regularly with faculty members and deans from all colleges to gather feedback for the program, and participants are asked to provide suggestions for future FDI workshops. Gathering this information helps to ensure that the FDI curriculum continues to stay relevant and timely, while providing a venue to introduce new and emerging topics that are consonant with the diversification and growth of Virginia Tech's applications of technology in research and instruction.

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 over 28% of the classes offered by FDI and close to 40% of our summer tracks. Since these classes tend to be part of the missions of the partnering entities, this strategy is certainly sustainable for the short-term and potentially for the long-term as well. Below is a breakdown of the main partnerships and the number of courses in 2009-2010.

| Corporate partner | Short courses | Tracks |
|---|---|---|
| Mathworks (Matlab And Simulink) | 12 | 1 |
| SAS (jmp) | 2 | 2 |
| National instruments (Labview) | 2 | |
| Comsol (Multiphysics) | 2 | |
| Autodesk Inventor | 1 | |
| Totals | 19 | 3 |

FDI classroom usage summary (Torgersen 3060 and 3080)

| | |
|---|---|
| FDI sessions | 492 |
| VT class meetings | 61 |
| Meetings, other workshops | 96 |
| Total | 649 |

| University unit | Short courses | Tracks |
|---|---|---|
| Division of Research | 77 | 2 |
| Branding | 33 | |
| University Libraries | 16 | 1 |
| Institute for Distance and Distributed Learning | 15 | 2 |
| GIS | 12 | 1 |
| LISA | 13 | |
| Visualization | 10 | 1 |
| Totals | 176 | 7 |

Summary of FDI computer distribution, Summer 2010

| | Apple | Dell | Fujitsu | HP | Totals | % |
|---|---|---|---|---|---|---|
| Desktops | 66 | 63 | 0 | 6 | 135 | 27.1% |
| Laptops | 164 | 89 | 0 | 19 | 272 | 54.7% |
| Tablets | 0 | 0 | 90 | 0 | 90 | 18.1% |
| Totals | 230 | 152 | 90 | 25 | 497 | |
| Percentage | 46% | 31% | 18% | 5% | | |

# ePortfolio Initiatives

*http://eportfolio.vt.edu*

The 2009-2010 year showed much growth for the ePortfolio Initiatives. This report will focus on three outcomes for the program. First is a report on the increased usage of the ePortfolio technology and pedagogy across the university. Next, the group has demonstrated success in engaging students, faculty members, and administrators in planning for ePortfolio use, including new efforts for the First-Year Experiences. Finally, our staff has engaged in sustained professional development and outreach within the national and international organizations that form an emerging professional community of practice.

During 2009-2010, ePortfolio adoption experienced 50% growth. From our previously reported 55 projects in 2008-9, we have grown to more than 80 unique projects in all colleges. The projects range from course-based adoption, such as the work with Interdisciplinary Studies or Horticulture, to full-scale implementations for programmatic assessment, including a growing effort in the College of Engineering to encourage portfolio usage across all departments and early pilot efforts for the Veterinary Medicine Clinical Rotation program.

There was more than a three-fold growth in student-developed, Web-based presentation portfolios. In 2008-9, we reported approximately 750 portfolios in the system. In 2009-2010, this number grew to more than 2500 Web-based presentation portfolios in the system. In addition, our open-enrollment site, where any student, faculty member, or staff member can make a portfolio of their own design, grew from 500 members to more than 750 by June 2010. Given the addition of the first-year programs over the coming few years, this number will continue to grow rapidly as more programs and students come to find uses for the ePortfolio concept.

One of the reasons that ePortfolio adoption has grown so rapidly has been our successful effort at engaging students, faculty members, and administrators in ePortfolio concepts and encouraging all parties to become involved in some capacity. To engage students, we have always had a tradition of working closely them; and two long-term relationships with students in the Department of English and HNFE's Didactic Program in Dietetics had many results in 2009-2010. After working with these students in groups, we mentored two through Honors Program-related research projects. We have consistently encouraged the student voice to be loudly represented in the ePortfolio effort; for example, when Olivia Walsh, a sophomore English major, was asked to write a piece about ePortfolios for the Office of Academic Assessment's yearly newsletter, or when we co-presented with both English and Dietetic students at the Virginia Assessment Group conference in Lynchburg. In terms of engaging the faculty members, we continue to offer both pedagogical and technological workshops for teaching faculty members and program administrators through the Faculty Development Institute, the Office of Academic Assessment, and the Center for Instructional Design and Educational Research. These workshops are most often followed by individual meetings with groups of administrators and/or faculty members to discuss how the ePortfolio concept will mold to their individual needs.

Two good examples of this are a growing effort to disseminate the ePortfolio concept developed in conjunction with Dr. Lisa McNair and Dr. Maura Borrego for the Engineering Education Ph.D. program across the other departments in the College of Engineering. For the past year, we have met with representatives of many other programs in Engineering, and we worked closely with a class of Dr. McNair's to do a user-design concept of the portfolio process specifically for the Department of Mechanical Engineering. From that process of interviewing members and students in mechanical engineering, the students in Dr. McNair's class worked with us to design a prototype for that program. That prototype was eventually turned into one that is being tested by eight other programs in the college currently, and we will continue to work with Drs. McNair and Borrego and their students to support the use of ePortfolios for assessment and professional development within the College of Engineering.

A second example of our attempt to engage all levels of the university has been our continued effort to become an integral part of the quality enhancement plan (QEP) for the university's reaccreditation with the Southern Association of Colleges and Schools (SACS). Representatives from SACS visited the university in May 2010, and commented that the plans for our use of

ePortfolios, along with an integrated plan for improving student learning, increasing professional development, and planning for assessment made ours a successful plan. From that point at the end of 2009-2010, we are working with five pilot projects that will become the initial First Year Experience (FYE) programs to be offered in Fall 2010. These five projects cover about 1200 new students, and the plan is to scale up to all entering first-years and transfers within three or four years. In order to accomplish the task, we spent 2009-2010 working with a cross-campus committee to discuss educational strategies and assessment planning. We gave six presentations to various campus groups, mostly offered as co-sponsored workshops and devoted to the plans for the QEP, including the creation of an ePortfolio as an integral activity of the FYE.

Finally, the ePortfolio Initiatives group has participated in many professional development activities, both as an opportunity for our members to grow professionally and for us to begin to share our expertise with an expanding international community interested in ePortfolios and new modes of learning and assessment. We have presented at eight professional conferences in 2009-2010, and the members of our group have co-authored two book chapters, one that was published in May 2010 and one forthcoming in the

next academic year. As a group, we continue to participate in the Sakai development groups, including significant work that is going into the visioning for the forthcoming Sakai 3 release. Through participation in online workgroups, we are ensuring that ePortfolio functionality, and specifically the needs of Virginia Tech's use of the tools, will be well represented in the next version of the software. This is one of the great benefits of working with an open-source consortium such as Sakai.

Another group with which we have been working extensively is the newly formed Association for Active, Experiential, and Evidence-Based Learning (AAEEBL). As a new organization with aims to bring portfolio-oriented academics together as a unique group of researchers, teachers, and educators, we have been actively engaging in launching and sustaining AAEEBL's efforts. Beyond presenting at the first international ePortfolio conference, held in Boston in June, we also have become co-editors for the organization's online bimonthly newsletter.

Finally, 2009-2010 represents our third year in the fifth cohort for the International Coalition of ePortfolio Research. In this third year, our group has led a cross-campus research effort to investigate reflection within ePortfolio programs of different sizes and scopes. In 2009-2010, we conducted

student interviews and surveys, and we led a two-day assessment of a sample of student portfolios from five different programs on campus. Results of this research will help us better plan and also be useful to other universities who are beginning to consider large-scale deployments of ePortfolio pedagogies and technologies.

With adoption growing alongside our efforts to engage more students, faculty members, and administrators in the use of ePortfolios at Virginia Tech, 2009-2010 was a significant growth year. We demonstrated successful sustainability in many programs that are in their third year of deployment, and we are still bringing in an ever-growing number of projects each semester (including 15 new projects in the summer of 2010). The local campus efforts, combined with successful representation in national and international research venues show that Virginia Tech stands as a leader in ePortfolios.

# Learning, collaboration, and evaluation systems

## Online Course Systems.

Online Course Systems (OCS) manages enterprise-level learning management systems for courses, projects, and other technology-assisted activities.

**Scholar**

*https://scholar.vt.edu*

Scholar is Virginia Tech's brand for the Sakai community source software that is developed jointly with over 100 other universities around the world. During 2009-2010, the major agenda of Online Course Systems was to make Scholar the primary learning and collaboration system at the university by fall semester 2010, totally supplanting Blackboard. This transition followed several years of Scholar use for projects and collaboration, a strategy taken to introduce the software to faculty members and administrators while the Sakai software functionality was advanced to a viable state for use in courses at Virginia Tech. This multi-year trial further enabled Learning Technologies staff to become familiar with the software, to participate in its further development, and to study the experience of other institutions in their early uses of Sakai for instruction.

A concerted judgment was made in early 2009 that version 2.5 of Sakai software was functionally acceptable for courses. OCS, FDI, the systems and application development groups, and management undertook extensive planning to prepare for a 15-month transition of courses and of faculty training. In April 2009, a joint announcement from the provost and the chief information officer announced that Blackboard would be replaced by Scholar for the Fall 2010 semester.

The major OCS activities undertaken in 2009-2010 to accomplish this transition included

- over 330 Scholar training sessions taught to 2400 faculty members, graduate students, and staff members in several different formats: single-concept, extended, novice, experienced, etc.;
- writing, editing, and production of 55 online Scholar documents;
- writing, editing, and production of 130 online Knowledge Base articles;
- writing, editing, and production of ten step-by-step videos;
- deployment of SimpleHelp software to enable 1:1 remote desktop support of faculty members needing assistance in Scholar;
- development of a fully-online FDI track "Moving, Building, and Conducting Courses in Scholar";
- development of an online tool to partially automate migration of Blackboard content into Scholar;

- development of sophisticated techniques to migrate and translate 76,959 items in Blackboard tests and quizzes into Scholar for 316 courses taught by 160 faculty members;
- establishment and monthly meetings with a Scholar Advisory Board.

The Scholar Advisory Board provides feedback and perspective on the functionality of Scholar and the transition from Blackboard. The board includes faculty members, students, and staff representatives from across the university and meets monthly with Learning Technologies representatives.

In June 2010, Learning Technologies upgraded the production Sakai software to the community source version 2.6.2. This, in concert with Unicon for third-party technical support, offers more flexibility and closer alignment to the global community of Sakai developers.

All these activities were conducted while continuing to support Blackboard users, DyKnow users, and ePortfolio users, and providing limited quality assurance testing of monthly updates to Scholar software in concert with the application development group.

As expected, faculty and staff use of Scholar continued growing significantly during 2009-2010, as shown in the tables below.

**Number of Scholar sites created by type**

|  | Course sites created or modified | Project sites created or modified | Total |
|---|---|---|---|
| Summer 2009 | 311 | 131 | 442 |
| Fall 2009 | 2621 | 914 | 3535 |
| Spring 2010 | 2009 | 787 | 2796 |
| Summer 1 2010 | 656 | 191 | 847 |

**Scholar users who have logged in by type**

|  | VT users logged in | Guests logged in | Total |
|---|---|---|---|
| Summer 2009 | 10909 41 | 3 | 11322 |
| Fall 2009 | 34297 | 1232 3552 | 9 |
| Spring 2010 | 33458 | 1413 3487 | 1 |
| Summer 1 2010 | 16941 | 680 1762 | 1 |

# Blackboard

During 2009-2010, the Blackboard system continued to be used by faculty members, while transitioning to Scholar by Fall 2010. The Blackboard software was augmented with several service packs, but no major upgrades were done.

**Blackboard usage 2009-2010**

|  | Course sections | Faculty members, GTAs | Students | Total |
|---|---|---|---|---|
| Summer 2 2009 | 311 | 205 26 | 45 | 3161 |
| Fall 2009 | 2621 | 1630 | 28270 | 32521 |
| Spring 2010 | 2009 | 1238 | 24694 | 27941 |
| Summer 1 2010 | 259 | 140 | 2303 | 2702 |

**DyKnow Vision.** DyKnow Vision is a Web-based tool that is used to foster interaction through collaborative note-taking, student response tools, content replay and more. It is used primarily in the College of Engineering for integrating tablet PCs into instruction. Online Course Systems staff provides helpdesk, user account administration, and in-classroom assistance for DyKnow.

**DyKnow usage**

|  | DyKnow courses created | Users |
|---|---|---|
| Summer 2 2009 | 9 | 317 |
| Fall 2009 | 87 | 3347 |
| Spring 2010 | 60 | 2585 |
| Summer 1 2010 | 16 | 216 |
| Total | 172 | 6465 |

**Online Course Systems Helpdesk.** The OCS Helpdesk continues as the department's primary means of providing in-depth application support to the faculty and staff and to students, as well as serving as a valuable channel to receive feedback and rapidly detect issues of growing importance. 4Help continues as a valuable partner and collaborator, receiving support requests and answering front-line, first-level questions.

During 2009-2010, we saw a decrease in helpdesk problem tickets that can generally be attributed to Blackboard's termination. Similarly, the number of Scholar questions grew as faculty members began transitioning. In 2008-09, Scholar questions totaled 1,544, while in this year, 2,411 questions were answered. Blackboard users generated only 906 questions.

| OCS Helpdesk questions by category | |
| --- | --- |
| Blackboard | 906 |
| Scholar | 2,411 |
| DyKnow | 118 |
| Course Evaluation | 115 |
| Courseware | 12 |
| ePortfolio | 12 |
| Element K | 8 |
| InnovationSpace | 2 |
| No Category | 2 |
| Total | 3,586 |

**OCS training.** OCS staff played an active instruction and supporting role in FDI, reaching hundreds of faculty members who use the systems supported by OCS. Staff paid visits to several classrooms and faculty members groups to do hands-on training for ePortfolio and Scholar. In conjunction with the recent upgrade of Scholar to version 2.6.2, OCS revised its curricular approach in FDI to provide more variety and depth, while also more narrowly targeting specific themes and functionality. A focused branch of the training is on using Scholar in academic, research, and portfolio situations with emphasis on actual uses and examples rather than what buttons to push.

OCS is also responsible for the creation and delivery of training materials as part of the Scholar upgrade project and in response to other documentation needs. Technical writer undergraduate interns continually update the OCS website and update and create handouts.

**Online Course Evaluation System development**

Over 20,000 unique students completed one or more online course evaluations during 2009-2010. A student response rate of 70% or greater continued to be achieved. New this year was the spring semester test of a Scholar-based online evaluation system that was run concurrently alongside the legacy system that has been used for several semesters. This project involves Learning Technologies staff in Online Course Systems, Application Development, Systems Integration, and management.

The Scholar course evaluation pilot was run in conjunction with the Evaluation of Teaching Taskforce's investigation and trial of a new evaluation instrument. Learning Technologies worked in close collaboration with the Office of Academic Assessment to carry out this pilot. We worked with a committee of faculty members from the Taskforce to develop the new instrument, recruit volunteer faculty members, run the evaluation within a separate instance of Scholar (as a safety measure), and assess the evaluation results and overall process. Items on the instrument were adapted from several existing Virginia Tech questions combined with others from the University of Minnesota's evaluation, used by permission. The Scholar-based course evaluation pilot was run during spring semester in 31 course sections involving 1086 students. A 71% response rate was achieved.

The legacy online system, developed from software provided by Columbia University, continues to be used in the majority of courses using online evaluations. Results are integrated with the paper opscan evaluation

system so that all results from both systems are kept in a secure database. The limited production phase of the legacy course evaluation system was expanded this year to reach over 20,000 students who responded to online questionnaires. The experience with online rating systems at other universities has shown that there is initially a lower response rate. At Virginia Tech, however, the use of e-mail reminders, among other factors, produces response rates of more than 70%, which is comparable to the response for the paper-based system. This pilot provided insights on local requirements and technical issues impacting on wider adoption of online course evaluations. We summarized these issues in a whitepaper that was presented to other units within Information Technology, as well as to the Committee on Teaching Evaluations.

The Application Development group contributed to the development of the Scholar Course Evaluation tool, an open-source Sakai-compatible version of the evaluation system. It provides more flexibility and allows colleges, departments, and instructors to manage their own body of questions and collect targeted information from their students while preserving a consistent set of questions used throughout the institution. The tool was developed with assistance from University of Michigan,

University of Maryland, and Cambridge and is in production at several universities. Members of the team also assisted in documenting the tool, and OCS provided quality assurance for the project.

During the 2010-2011 academic year, the Sakai Course Evaluation tool will be used in expanded pilots with new functionality. Virginia Tech continues to contribute to improvement of the tool by contributing bug fixes and enhancements to the community. We are also in the process of making available a quality assurance instance of Sakai running the evaluation tool to assist with community quality assurance.

Online Course Evaluations 2009-2010

| | Courses | Students | Completions | Completion % |
|---|---|---|---|---|
| Summer 2 2009 | 47 | 916 | 497 | 54.2 |
| Fall 2009 | 1082 | 42257 | 33945 | 80.3 |
| Spring 2010 | 1101 | 40202 | 30518 | 75.9 |
| Summer 1 2010 | 90 | 2120 | 1081 | 50.9 |

Student responses in these online systems are confidential. The system prevents multiple responses from students and is designed with safeguards for confidentiality and authentication of responses. The online system offers many other advantages:

- Easy addition of questions
- Flexibility to administer mid-term and end-of-term evaluations
- Improved efficiency through elimination of paper handling
- Saving valuable class time
- Improved turnaround of results
- Student comments more thoughtful, in-depth
- All students have opportunity to respond
- Improved security

# Learning Technologies Technical Support

**Application Development**

Learning Technologies is focusing its application development efforts on open source projects in order to enlarge the scope of programs and services available to faculty members and students, and ensure products are available to meet diverse needs across the university. ePortfolio and Online Course Evaluation are components within the Scholar system

**Scholar (Sakai) development.** Scholar is part of a community source software development effort to design, build, and deploy a new collaboration and learning environment (CLE) for higher education and

research (*www.scholar.vt.edu*). More than 170 issues were addressed by the development group in 2009-2010, including the implementation of a Web service that allows help documentation to be enabled in real time, and the integration of a new gradebook tool. We also worked with our other university partners to correct numerous software bugs. The aforementioned examples illustrate a tangible advantage of implementing an open source system: with relatively rapid modifications, repairs and enhancements can be achieved through collaboration, without the need to wait on a vendor's revision schedule to include the changes desired.

Updating Scholar to a new community version was one of the major projects this year. We have made local customizations to more than 30 Sakai projects, and all of those customizations were merged to the new version as necessary. We devised a workflow that allowed us to get a version of Scholar running early on in this process, which enabled early and ongoing testing of each tool as its customizations were merged.

**FDI administrative system development.** The FDI tracking system is used to manage program participant activity, workshop registration, webpages, and computer selection, delivery, and inventory. During the reporting period, a series of refinements and modifications were accomplished including the addition of several reports and extended and improved e-mail communication options.

**Systems Support and Integration**

The Systems Support and Integration team handles all aspects of server application administration from design and deployment to daily maintenance and monitoring for enterprise academic applications including Scholar, DyKnow, and Blackboard.

**Application scaling.** The Systems Support team oversaw the growth of user activity within Scholar to a level surpassing that of Blackboard during this academic year. Concurrent user sessions on Scholar grew six-fold between Spring 2009 and Spring 2010. Meanwhile, the Systems Support team worked closely with the Application Development team to address growth related issues as they arose while improving stability and performance.

**Development support.** Systems Support works closely with the Application Development group to support and assist in development projects where possible. The team regularly works together with developers to solve problems or plan upgrades to Scholar and other applications.

# Computer-Integrated Learning Spaces

The mission of the Computer-Integrated Learning Spaces (CILS) unit is to provide the highest quality and most reliable computer-integrated learning spaces to enable faculty members to transform teaching and learning at the university. The CILS unit provides support for sixteen computer-integrated classrooms on campus, consisting of approximately 1000 computing stations (*www.cclab.vt.edu*).

CILS services include the following:

- Provide software/hardware installation, maintenance and troubleshooting for computer-integrated classrooms (CICs) and labs
- Train faculty and staff members on the use of computer teaching stations and A/V equipment in CICs
- Provide consultation and support as requested to other departments
- Provide TimeClock System administration and training
- Support the President's Conference Room—Burruss 325
- Manage and maintain computer-integrated learning spaces (see table)

The majority of the CILS-managed facilities, excluding the Math Emporium, are now dual-boot with Windows XP and Mac OS X. Interestingly, in the facilities where we do not specify a default OS, the user's selection leans heavily to Mac OS X. If Windows is specified as the default OS then users seldom choose Mac OS X.

| CIC | Mac-intosh | Win-dows | Dual-Boot* |
|---|---|---|---|
| AIS Classroom | | | 19 |
| Architecture Annex 1 | | | 25 |
| Hahn 305 | | | 25 |
| Graduate Life Center | | 18 | |
| Litton-Reaves 1370 | | | 19 |
| Math Emporium | 557 | | |
| Price 301A | | | 15 |
| Randolph 114E | | 36 | |
| Saunders 101 | | | 25 |
| Shanks 160 | | | 30 |
| Shanks 180 | | | 25 |
| Shanks 360 | | | 25 |
| Torgersen 1010 | | | 33 |
| Torgersen 1080 | | | 35 |
| Torgersen 3250 | | | 36 |
| Ware 103 | | 5 | |
| | 557 | 59 | 312 |

*XP & OS X

CILS utilization is increasing in our most heavily used spaces as shown in the following charts. The average number of logins per computer in the Torgersen 1010 and Torgersen 1080 classrooms increased by 15% and 38% respectively from 2008-2009 to 2009-2010 with the average time used increasing by 31% and 46%.

| | Torgersen 1010 | | Torgersen 1080 | |
|---|---|---|---|---|
| | FY09 | FY10 | FY09 | FY10 |
| Logins | 23704 | 27292 | 16931 | 23385 |
| Avg/wk/comp | 20.52 | 23.63 | 13.83 | 19.09 |
| Time | 392818 | 51378 | 27880 | 40591 |
| Avg/wk/comp | 34.01 | 44.48 | 22.76 | 33.14 |

**Pay-for-Print service.** For FY09-10, printing decreased across the board. There were fewer jobs and smaller jobs resulting in reduced revenue.

| Printer Jobs | | Pages | Sheets | Amount Charged |
|---|---|---|---|---|
| Architecture Annex 1 | 979 | 4919 | 4495 | $491.90 |
| Bishop-Favrao 330 | 1637 | 5719 | 5718 | $621.06 |
| Cheatham 217 | 201 | 811 | 746 | $81.10 |
| Cheatham 220 | 993 | 2378 | 2376 | $237.80 |
| Chem-Phys 306 | 2906 | 9445 | 9258 | $944.50 |
| Donaldson-Brown 40 | 2397 | 11625 | 10213 | $1,162.50 |
| Litton-Reaves 1370 | 2519 | 6858 | 6836 | $685.80 |
| Math Emporium | 27545 | 113629 | 112458 | $11,362.90 |
| Pamplin 2010 | 5797 | 19728 | 19114 | $1,972.80 |
| Patton 316 HP4000 | 2346 | 2615 | 2615 | $523.00 |
| Patton 316 HP5100 | 2580 | 6531 | 6526 | $653.10 |
| Patton 319 | 1031 | 2823 | 2823 | $282.30 |
| Randolph 114E | 1693 | 5423 | 5423 | $542.30 |
| Randolph 114E Color | 499 | 2728 | 2657 | $272.80 |
| Saunders 101 | 187 | 527 | 521 | $52.70 |
| Shanks 160 | 72 | 119 | 119 | $11.90 |
| Shanks 180 | 216 | 362 | 362 | $36.20 |
| Shanks 360 | 6 | 8 | 8 | $0.80 |
| Torgersen 1010 | 1948 | 6194 | 6129 | $619.40 |
| Torgersen 1080 | 2245 | 7145 | 7118 | $714.50 |
| Torgersen 1140 | 683 | 1946 | 1910 | $194.60 |
| Torgersen 3250 | 257 | 853 | 853 | $85.30 |
| VetMed Library 101T | 2112 | 10210 | 10210 | $1,021.00 |
| | 60849 | 2225 96 | 218488 | $22,570.26 |
| % change from FY09 | -12% | -14% | -14% | -14% |

**PACE/PDM collaborative course support.**

The CILS group is also providing an essential support and development role for Dr. Jan Helge Bøhn in the Department of Mechanical Engineering. Dr. Bøhn has been the driving force behind the creation of several collaborative product data management courses involving other PACE institutions: Technische Universität Darmstadt Germany, Howard University, Brigham Young University, ITESM—Monterrey Mexico, ITESM—Toluca Mexico, Monash University, Hongik University South Korea, University of British Columbia, University of Toronto, University of Waterloo, and University College Trollhättan, as well as General Motors. CILS is providing the administration of the Teamcenter Engineering application and database servers, Teamcenter Community Web and database servers, as well as consultation with the other institutions on installation and setup of their clients to interface with our systems.

# Initiatives in learning, discovery, and engagement

## Teaching, Learning, and Innovation

This newly formed Learning Technologies pedagogy and innovation group encompasses Assistive Technologies, the Graduate Education Development Institute, InnovationSpace, the Learning Technologies Pervasive Computing Lab, and Testing and Data Services. The group works to create and support robust environments for teaching, learning, and discovery that are grounded in contemporary principles for technology-enriched engagement. The group's activities are aligned with the university mission to enhance the quality and accessibility of undergraduate and graduate education and its groups work closely to further the missions of the university and of Learning Technologies.

**Assistive Technologies**

*www.assist.atc.vt.edu*

Empowering a lifetime of learning**,** Assistive Technologies serves students, employees, and the general public by ensuring that individuals with disabilities have the appropriate technologies needed to access programs and services of the university.

Operationally, the Assistive Technologies (AT) department is responsible for the AT Research Lab in Torgersen Hall, as well as for Special Services, located in Newman Library. Functionally, AT serves in a leadership role within the university by promoting AT related research, supporting AT software and accessibility services, and conducting training and consulting services for technology-based disability accommodations used at Virginia Tech. Additionally, the AT department works to increase the awareness of accessibility issues and the benefits of AT for people with disabilities by classroom instruction, hands-on demonstration of AT, and public presentations at a variety of outreach events.

**AT Lab**. The Assistive Technologies Research Lab (AT Lab) is a multidisciplinary research lab and teaching facility that is used to create or improve assistive technologies for persons with disabilities and to advance emerging technologies and research applications useful for all individuals. Research and teaching activities of the AT Lab include: collaborating and supporting university research programs with AT expertise and/or services of the AT Lab; working to obtain grants or sponsored funding from government, industry, or the private sector for AT research and the dissemination of AT research results through outreach activities and publications; and providing AT expertise and/or services of the AT Lab for independent research studies and for teaching/learning research projects that may benefit individuals with disabilities.

**Sponsored research**

Innovative Flexible Experimental Environment for Learning SCIENCE (I Feel SCIENCE). This is the last year of research into an interactive learning environment to support science education for students with blindness. The environment—a multidisciplinary, learner-centered approach called the Innovative Flexible Experimental Environment for Learning SCIENCE or *I Feel SCIENCE*—integrated haptic feedback by implementing the sense of touch in science instruction for students with blindness when studying heat, temperature, and intermolecular forces. AT Lab participation included advising graduate and undergraduate researchers from the Grado Department of Industrial and Systems Engineering on accessible technologies for visual impairments and related human

interface design issues. *I Feel Science* partners included Virginia Tech, University of Arkansas, Arkansas School for the Blind, and the Virginia School for the Deaf and Blind. The funding is from the National Science Foundation for 3 years. Publications from this research will follow the August 31, 2010, technical portion of the project.

Community Living Connection (CLiC).  CLiC research addresses a need to help people with acquired brain injuries (ABI) in rural settings to live within their community and home environments. During the first phase of the CLiC project, the AT Lab was subcontracted by Brain Injury Services of Southwest Virginia (BISSWVA) to research the technical feasibility of emulating services that are currently available in long-term ABI treatment centers in urban areas, but rarely located in rural communities and home environments. The AT Lab working for BISSWVA and with Radford University (RU) conducted a one-year telehealth research study using the Internet, educational videoconferencing, and assistive technologies for the delivery of rehabilitative services. Results on the CLiC telehealth approach to brain injury services, as a viable alternative have not yet been published by RU researchers. The Jason Foundation and BISSWVA are providing funding for 1 year.

Sponsored Research Proposals FYE2010—ACEMS. In support of university research, the AT Lab partnered on a variety of proposals this year to secure grants or sponsored research. Of the proposals submitted, it appears that collaboration between IBM and Virginia Tech will result in funding through the VT Center for Community Security and Resilience (VT CCSR) for *Improving the Accessibility of Community of Emergency Management Systems* (ACEMS). These funds were given to the CCSR by Arlington County to address programs with accessible EMS. The ACEMS project goals are to identify the most significant challenges today in managing communications and interactions with people having disabilities when planning for and responding to emergency situations. ACEMS will use mature and/or prototyped accessibility technologies developed by researchers at Virginia Tech and IBM. In addition to demonstrating accessibility benefits to selected Arlington County EMS function(s), researchers will disseminate benefits produced by the ACEMS system as a proof of concept for additional research funding for a national "EMS+" emergency management system. Funding Source: Arlington County, Virginia (via the VT CCSR), for 1 year. Work will begin July 1, 2010.

Independent research studies: Opening New Doors with Assistive Technologies. Students

working with printed materials, such as textbooks, have been aided in recent years by digital scanners and optical character recognition (OCR) software. Although OCR software converts print media to electronic text for assisted reading, few of today's assistive technologies can effectively interpret science, mathematical formulas, and engineering terms without manual intervention. This long-term independent study offers student researchers from multiple disciplines the opportunity to investigate methods for improving this situation. Additional work by students on independent research studies involved identifying new technologies that may be used to help create or to improve existing assistive technologies for the disabled. AT Lab support for independent research studies included Fall 2009 and Spring, Summer I 2010 semesters. The academic supervisor is Lynn Abbott, Associate Professor, Department of Electrical and Computer Engineering.

**Special Services.** Special Services has facilities in Newman Library for conducting individualized training and supporting specialized software, computer hardware, and AT equipment for university disability accommodations. Special Services customers include students, faculty members, and employees with qualified disabilities approved for accommodations by the Office

of Services for Students with Disabilities (SSD) or University ADA Services in Human Resources.

Special Services, as requested by the vice president for multicultural affairs, also serves the regional On-Campus Transition Program (OCTP). The OCTP gives high school students with disabilities the opportunity to try a variety of vocational work experiences on-campus and/or the opportunity to attend college classes. The students and their aides use the accessible computers in Special Services for instructional purposes, AT training, or to write activity logs about their vocational accomplishments and/or their college experiences during the OCTP.

**E-text scanning and alternative media formats.** Assistive Technologies aided Services for Students with Disabilities by helping train the Alternative Text and Note Taking coordinator on the use of high-capacity scanners for students seeking textbooks in alternative formats. In addition, AT continues to assist in scanning textbooks at Special Services and training students in the use of text scanners so they can independently scan printed materials, such as class handouts, for assistive reading using synthetic speech or refreshable Braille. Assistive Technologies also continues to support Braille and tactile graphic production for educational accommodations and/or research purposes of the university.

**Student referrals for disability accommodations and training.** Special Services continuously works to improve the coordination of student referrals from Services for Students with Disabilities by notification and introduction of the AT staff to new students. Although notification is not mandatory, this effort is intended to help decrease the number of students who delay the use Special Services for needed disability accommodations or assistive technologies training.

**University employee referrals.** Employees with disabilities due to aging, illness, or injury continue to be served. These referrals from ADA Services are typically for training faculty and staff members about assistive technologies that will help them perform their job duties.

**Unique accommodations.** Unique one-time accommodations were placed in university computer labs for students and administrative offices for employees. Assistive Technologies also provided on-campus proctoring services and study space as an accommodation for one student.

**AT Central Services.** Assistive Technologies, working with partners in Learning Technologies, such as Computer-Integrated Learning Spaces and the InnovationSpace, helps coordinate AT support for computer workstations and equipment across campus. Workstations are located in university computer labs, in college and departmental computer labs, administrative facilities, and satellite locations. Constantly changing customer demands, AT equipment, operating systems (e.g., Windows 7, OS X Snow Leopard), and AT software makes providing ubiquitous support for university computers and AT equipment a continuous and challenging effort. AT Central Services supports local and networked licensing of specialized computer software for the university community and maintains a wide range of adaptive equipment needed for post-secondary education.

AT Central Services also makes consulting services available to any university entity providing support for disability accommodations or wanting to utilize assistive technologies for any academic, research, or administrative purpose. For departments wanting to develop a better understanding of assistive technologies and accessibility issues for persons with or without disabilities, formal instruction by Assistive Technologies is available upon request.

**Web accessibility support**. Due to significant changes in Web Content Accessibility Guidelines (WCAG 2.0), the focus of web accessibility has moved from guidelines and checklists (WCAG 1.0) to design principles, success criteria, and levels of success (WCAG 2.0). Understanding WCAG 2.0 success criteria and techniques and the university's use of content management systems for academic (Scholar) and administrative websites (Ensemble) has resulted in the AT department moving to a more cost-effective approach for evaluating website compliance starting in Fall Semester 2010. The AT department continues to support university licensed software (through Information Technology Acquisitions) for entities evaluating accessible website designs within the university community.

# The Graduate Education Development Institute

*www.gedi.vt.edu*

Consonant with the mission of Information Technology to enhance and support teaching and learning, the Graduate Education Development Institute (GEDI) offered three graduate-credit courses during the year: GRAD 5114, "Pedagogical Practices in Contemporary Contexts," (two sections with a total enrollment of 84), and GRAD 5984,

"21st-c. Strategic Pedagogies Practicum" (enrollment of 11). The practicum course was offered in response to student requests for a smaller seminar with more opportunities to develop and apply their discipline-specific technology-enhanced teaching strategies in a peer-to-peer collegial setting. In addition, the director conducted an independent study with a graduate student focused on discipline-specific technology-enriched teaching strategies in Public Admin/Public Affairs, in order for the student to complete the requirements of the Future Professoriate graduate certificate. The director also taught FDI short courses on learner-centered pedagogy and was a collaborator in the creation of and served as a co-facilitator for the Faculty Learning Community pilot (in partnership with CIDER), a project that supported transitions to technology-enriched active learning in large introductory courses.

As part of our ongoing collaborative efforts with the Graduate School, GEDI Fellows taught over 300 graduate students throughout the fall semester in CMS (Scholar) workshops as part of our support of the Graduate School's GTA Orientation course, GRAD 5004. The director co-taught a 5004 GTA workshop on effective teaching practices. During the spring, the staff revised the GEDI website *www.gedi.vt.edu*, and

worked on programming for an LG screen to provide greater electronic visibility and access to Learning Technologies, in general, and GEDI, specifically.

**Assessment data**

Assessment data for the GEDI pedagogy course continues to suggest that the program is fulfilling a need in helping graduate students explore technology-enriched pedagogy, and that the course plays a vital role in their professional development as current teachers and future faculty members. Formative and summative assessments guide the continual improvement of the GEDI courses. Student input is an important factor in the ongoing revisions of the GEDI curricula.

Of the graduate students completing GEDI in AY 2009-2010 (n=81),

- 79% indicated that the course had improved their awareness of teaching and technology resources either extensively or moderately;
- 89% indicated that they were confident using Scholar as instructors in their own courses;
- 88% either agreed or strongly agreed that they are likely to incorporate problem-based learning into their teaching;

- 84% either agreed or strongly agreed that cultural diversity is a relevant issue that informs their teaching

**Sample 2009-2010 qualitative reponses**

*What impact has the GEDI course had on your development as a teacher?*

WOW —this course has provided interesting information regarding the changes to how we approach students, what we had when I was growing up does not apply to the 21st C students. Knowing that the learners were different was the easy part—finding out how to reach them...this course focused on this :) I really enjoyed learning how to interact with these learners in new and technologically up-to-date ways.

This course has been instrumental for my development as a professional academic. My experience at Virginia Tech has been very exclusionary and I have been on my own with my professional development for the last three years. This course has helped to fill that gap. I am also appreciative of the opportunity to demonstrate to prospective employers that I have been reflective upon my brief teaching experiences and also given me the opportunity to think deeply about my future teaching experiences via an ePortfolio. I now have a clearer

picture of how I wish to model my teaching.

This course has given me better understanding of teaching concepts and strategies to use in my future classrooms. It has also contributed to my knowledge of getting students more involved and variety of approaches to use when teaching in large classrooms (don't always have to lecture because of the size of the class.)

It helped me understand use of technology as a medium of engagement with the students and how to use existing technology to become more learner centered. Instead of going against the grain of "no lap tops" and "cell phones" kind of idea, the GEDI course critically engaged my thinking about use of multi-media, the internet, creative ways of using camera etc., to help students learn. While I understood the importance of diversity, the GEDI course made me think more about the role of issues of diversity in all areas of academia and helped me understand how it exists in strictly 'scientific' disciplines as well.

It gave me great understanding of strategies for 21st century learners- eye opening to the multi-tasking they are used to, etc. and how to best connect with them, including ways to use technology. Learning scholar and the different tools available through scholar

helped me understand a great deal of using technology to address the needs of the 21st century learner.

Loved the class. I appreciated how you modeled each of the techniques you discussed. I also enjoyed having the GA/TA's participate and teach, as well. You don't see professors doing that very often. It truly was an excellent example of a learner-centered class.

I learned that many of the things I was doing [in] the classroom setting were actually learner centered but I did not know there was such a thing —I just knew they worked. The discussions in class helped solidify the things I was doing right and how to expand even further —specifically assessment, goal oriented learning objectives. Now it is not just a trial and error teaching development but using what others have already learned.

It was the first time I'd really done any backward design for a syllabus. It was also the first time I wrote a syllabus. First time I used a wiki. Helped me to refine professional documents like teaching philosophy and professional development website.

All of them. Prior to this class, I preferred chalk and talk! Now I am comfortable with online technology and how this is useful in the classroom. The electronic portfolio is also a useful tool that I will continue to use in my professional life. I rate the tech skills learned in this course ….10 STARS!!!

Scholar was a new tool for me in particular, so learning the different ways it could be incorporated into classroom activities was beneficial. I had never thought of having my students using a wiki or a blog for a classroom activity but I think these could be useful tools.

The technology tools and skills that were new to me were:

1. using the scholar site and the features on this site

2. creating an ePortfolio

The Wiki and the other collaboration tools online were all new to me. I had not heard of these online tools before, and they definitely opened my eyes to new ways to engage 21st century learners with collaborative work.

I will definitely use case study approaches to introduce topics and wikis in my courses. My field is pretty "boots on the ground" oriented, so I think that using case studies will not only challenge my students, but also make them see the relevance of a college degree.

Biweekly blogs as assignment focused on a specific question or themes. Ask students to look for relevant articles/pictures and post them on their blogs to illustrate the theme, etc.

[I will use] more group projects and assignments, more problem-based discussions, and scholar forums.

# InnovationSpace

*www.is.vt.edu*

InnovationSpace's mission is to foster creativity in teaching and learning with technology, to provide access to emerging and cutting-edge technology hardware and software, and to provide outstanding customer service that includes expert knowledge. Services are provided through a free hardware loan program that includes digital video cameras, iPads, digital still cameras, audio recording equipment, and lighting and audio kits; an open multimedia lab with dual-boot Mac computers with high-end software for video editing, hardware and software for scanning, and two audio-recording bays; and through highly trained staff to support all users. Equipment is continually updated to meet emerging technology needs and user demand.

InnovationSpace provides free and open access to multimedia technologies for the diverse needs of all segments of the university community. In addition, we provide reasonable and efficient consulting in multimedia technologies for all segments of the university community. The teaching and learning with technology lab is a classroom space that allows faculty members, staff and students to test new technologies.

| **Lab Usage by Transaction Type** | | | | | |
|---|---|---|---|---|---|
| **Type** | **FY 05-06** | **FY 06-07** | **FY 07-08** | **FY 08-09** | **FY 09-10** |
| 3D | 16 | 5 | 1 | 2 | 1 |
| Audio | 222 | 401 | 592 | 723 | 1163 |
| CD/DVD Burn | 105 | 80 | 58 | 114 | 75 |
| Consultation | 0 | 0 | 0 | 0 | 1 |
| Desktop Publishing | 612 | 443 | 263 | 510 | 187 |
| ePortfolio/Scholar | 0 | 0 | 0 | 49 | 1341 |
| Equipment Loan | 681 | 565 | 782 | 1098 | 2183 |
| ETD | 22 | 8 | 3 | 3 | 6 |
| Flatbed Scanning | 1014 | 910 | 1050 | 903 | 635 |
| Graphics | 754 | 1205 | 1771 | 2259 | 2673 |
| Powerpoint | 76 | 61 | 44 | 19 | 52 |
| Slide Scanning | 236 | 178 | 224 | 138 | 147 |
| SpaceCamp | 0 | 0 | 0 | 0 | 328 |
| Video | 1968 | 1853 | 2689 | 3557 | 4675 |
| Web Development | 367 | 323 | 599 | 678 | 800 |
| **TOTAL** | **6073** | **6032** | **8076** | **10053** | **14267** |

**Class and teaching support.**
InnovationSpace continues to directly support classes and departments including, HNFE, ENG 2614, FOR 2554, in the integration of technology in teaching and learning. Professional staff provided one-on-one support for faculty members for the Scholar transition, integration of technology into existing learning outcomes, and additional pedagogy changes that enhance active and engaged learning.

**Emerging technologies and pilot projects.**
InnovationSpace is partnering with faculty members to test the educational impact of OpenSim, a locally-hosted and open-source alternative to Second Life. A locally-hosted version of WordPress MU is being tested with student and faculty member users. Reusable learning objects are being created with the expertise of faculty members and the creative and design resources within InnovationSpace. Additionally, iPads are loaned to faculty members and staff to test their educational application within higher education.

**SpaceCamp**. Space Camp is a series of for-student, by-student multimedia workshops modeled after FDI. This year, 19 sessions were delivered for 154 students. Subjects covered included Photoshop, iMovie, InDesign, Illustrator, Mac Basics, Final Cut Pro, Garage Band, and more.

**Outreach programs**. In support of community outreach, InnovationSpace provided time, talent, and computer resources to the Upward Bound programs, Blacksburg Stories Project, Progeny Film Festival, 24-Hour Film Festival, and the Digital Media Sandbox Consortium.

**Feedback on InnovationSpace services.**
Some of the responses to IS services are listed below.

Faculty members: I wanted to make sure that we expressed our sincere thanks and appreciation from the HNFE Department to Jason Lockhart and the staff of the InnovationSpace.

As you are aware, our HNFE 3224 course Communicating with Food uses IS for many of our projects. We absolutely could not have done this so successfully this past spring without the incredible amount of assistance Jason organized for the 50 students in the course. Spring 2010 was the third time we offered HNFE 3224. Working with Jason this year made my job much easier than ever before and our work with IS almost seamless. He made an effort to meet with me before the semester began, worked with me through schedule changes, made special arrangements for us with classroom space and assisted us with our MANY questions and equipment needs. I am so very

grateful for all his hard work that made my job immensely more manageable.

Faculty members: I just wanted to pass on a note letting you know of the impressive help I received at InnovationSpace. Jason Lockhart and James Dustin both went well beyond anything I expected in helping me out and insuring that I both understood what I needed to do and that my project was completed successfully. They were absolutely great. You definitely have a program that is one to be proud of.

Faculty members: I just wanted to send a quick and big thank you to both of you and all the InnovationSpace staff for your assistance and accommodation this week. We're very excited about being back in the lab next week as well.

I don't think words adequately express how much the kids are enjoying being in such a stimulating space as the IS lab. I hope, perhaps, some of the photos we've taken this week say it better.

Faculty members: I just wanted to let you to know, yet again, that I was very impressed with your staff and enjoyed working with Steve. He was very patient and helpful in assisting me with my research

project. I'm really glad that you have him on staff.

Student: I enjoyed working on a video... It was definitely challenging because my group did not have much experience with that kind of technology. I feel that all the use of technology in the class kept the subject matter interesting and allowed students to engage more, which allows students to learn more. When students are actively learning as they are in this course, they are more likely to want to learn and then remember what they learned later because it has been applied to an activity.

**Learning Technologies Pervasive Computing Laboratory**

The Learning Technologies Pervasive Computing Laboratory serves as a convening point for collaborative research activities between Learning Technologies, Information Technologies, and the university research community. This lab supports undergraduate research projects and basic and applied graduate research initiatives with university partners. This past year's undergraduate research project studied the use of Quick Response Codes as a component of physical mobile interaction.

In addition, the Pervasive Computing Laboratory is working with InnovationSpace

on a cross-reality project that combines the concept of detected and identified presence in a physical space with online virtual environments such as Second Life or OpenSimulator. The InnovationSpace, in Torgersen 1120, will be equipped with far-distance RFID readers (Alien Technologies (ALR-9650)). Room 1120 will be replicated in a locally-managed (VT) OpenSimulator instance called OpenLife. A framework will be developed that links these two technologies allowing the study of mirrored physical/virtual environments as how they would support instructional and administrative activities.

**Testing and Data Services**

Testing and Data Services (TDS) is a university-wide service that supports assessment within courses, support of research data collection, and class attendance reports. This service supports University Goal II of the eLearning and Information Systems goals related to assessment and research data collection. In addition to scanning the optical mark reader forms, TDS provides analysis of the captured data.

The TDS staff also provided one-on-one Scholar training sessions and website development. Collaborative work with Online Course Systems and the Faculty

Development Institute has allowed the TDS staff to provide support to faculty members and staff throughout the Scholar transition. Technical expertise in the use of the content management system, Ensemble, was provided to continue the migration of Learning Technologies' websites. TDS staff updated and improved content in congruence with the Ensemble system.

**University service.** Primary uses of optical scan forms at Virginia Tech are for exams, evaluations and collection of research data. Volume varies slightly from year to year, but shows no consistent direction of change. Statistics for the 2009-2010 academic year show little change from last year.

| | FY09 | FY10 |
|---|---|---|
| Number of different clients served | 784 | 808 |
| Exam jobs processed | 6200 | 6000 |
| Exams | 5100 | 5000 |
| Final exams | 1100 | 1000 |
| Course evaluations | 500 | 500 |
| Research data capture jobs | 600 | 600 |
| Total sheets processed | 790000 | 730000 |

While opscans remain a popular, cost-effective information-gathering method for many applications, TDS also provides support for other methods utilizing new

technologies. Testing and Data Services continues to work with other units within Learning Technologies to ensure that the new online course evaluation system is compatible with current policies and supports provision and merging of data gathered via optical scan sheets.

**Improving workflow**. TDS continues to support assessment at the university by streamlining procedures and creating new and updating existing proprietary programs used to process data and send out results. TDS has begun to examine ways to continue to support the university as more technology-based solutions for assessment become available.

# Digital Imaging and Repositories

## Digital Repository Development

*http://www.emd.vt.edu*

The mission associated with development of the university research repository at Virginia Tech is to provide a unified infrastructure for preserving and presenting data associated with research and discovery.

We seek opportunities to support these activities by providing

- a comprehensive range of digitizing services that support collection archiving for research and instructional media applications;
- a secure network environment for collection specific site development within the repository;
- a standards-based approach for creating and preserving university assets that require consistency for quality control.

For the research repository initiative, fiscal year 2009-2010 activities spanned several projects that varied widely in their stages of development and their associated support needs. Taking center stage and illustrating the range of the repository's pursuits this fiscal year was our continued collaboration with the Department of History and the Virginia Center for Civil War Studies to develop the American Civil War Newspapers Repository. This project is being built using the VTLS VITAL repository software that was initially installed in 2008-2009. VITAL underwent two major upgrades this fiscal year that implemented critical multi-site features and that addressed issues identified from our original work on this project.

The upgrades and reinstallations of VITAL made necessary by the software enhancements were interspersed with our work to develop a customized web interface for the Civil War project, efforts to prepare file surrogates of the digitized newspapers for inclusion in the repository, and our exertions in preparing and implementing the unique index feature of the project. In addition to attending to the past and present of this project, we were also involved in planning and preparing technology to support the ambitious future proposal for the project to digitize and include eleven more newspapers in this repository.

Another notable opportunity introduced in 2009-2010 involves supporting the Graduate School in renovating the 13-year-old Electronic Theses and Dissertations (ETD) Initiative. This project involves addressing several improvements needed in the original ETD initiative, developing an updated online solution for submitting and dispensing graduate theses and dissertations, and arranging for the archiving and preservation of the university's research resources into the future. This repository project forecasts significant demands on resources and a great deal of future effort in migrating

existing ETDs into standards-based formats, developing new features while maintaining the site as an open-source database, and preparing for adequate preservation of a diverse collection of student-generated research.

Work for the American Civil War newspaper project produced 5,845 pages and 35,911 columns of the *Macon Daily Telegraph*. Electronic theses and dissertation work for the Graduate School included 17, 159 ETDs. In all, 58,915 unique viewable objects became available to users.
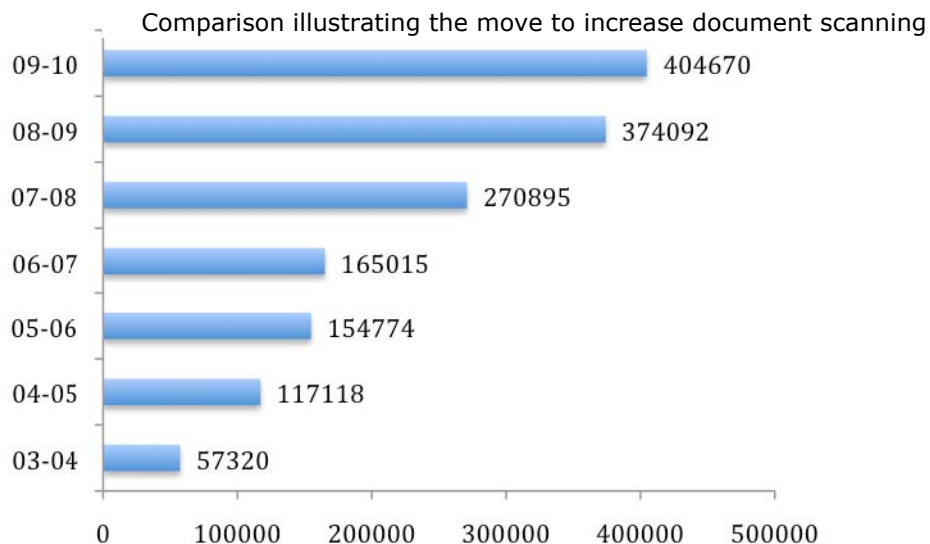
A contributing factor for success in building the repository manifests itself through the confidence our faculty members and administrators continue to show for the digital imaging services we provide. Beginning with the 2003-2004 year and extending through this reporting cycle, a total of 1,543,884 scans representing 90 distinct projects have been created at resolution settings required for standards-based image archiving. The chart below represents the total

scanes per year since July 2003.

Providing high quality archival master files creates the basis for future development of repository projects. Master images also provide our faculty members with increased flexibility for integrating derivatives of those images into online instruction, classroom presentations and multi-media applications that require sufficient detail to encourage learner discovery.

A move over the past year to focus our digitizing efforts on bound document conversion greatly expanded the number of graduate theses and dissertations available in digital format. With this reporting cycle, 8,348 graduate documents have been

scanned and now await author permission to be added to the publicly accessible database for theses and dissertations. All activities support the overall goal for making these documents 100% accessible within the next four years.

Comparison illustrating the move to increase document scanning

| Year | Scans |
|------|-------|
| 09-10 | 404670 |
| 08-09 | 374092 |
| 07-08 | 270895 |
| 06-07 | 165015 |
| 05-06 | 154774 |
| 04-05 | 117118 |
| 03-04 | 57320 |

**Scanning summary for 2009-2010.** This year, Digital Imaging produced a total of 404,670 individual scans associated with 5 distinct projects. A representation of this effort includes:

| | | |
|---|---|---|
| Electronic reserve | 303 article pages | 28 documents |
| Bound ETDs | 394,992 manuscript pages | 3301 documents |
| Image collection | 1716 assorted media | 1716 images |
| Model scans | 4 assorted objects | 4 3-D images |
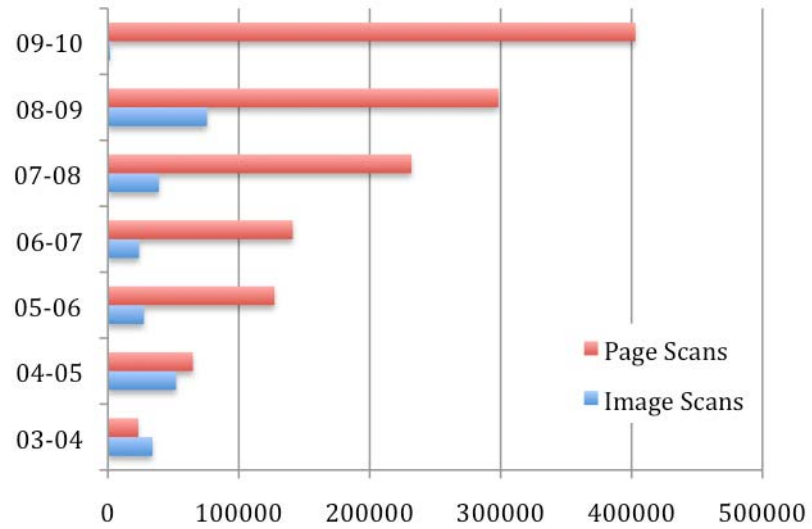
# Learning Technologies professional activities

## Courses taught

Fowler, S.B. GRAD 5114 Contemporary Pedagogy, Fall, 2009, Spring 2010.

Fowler, S.B. GRAD 5984 Strategic Pedagogy Practicum, Spring, 2010

Fowler, S.B. GRAD 5974, Independent Study: Change the Paradigm to TEAL, Spring, 2010.

Plymale, W. O. ECE 4994 Application of Pervasive Computing Concepts to Teaching and Learning, Fall, 2009.

Summers, T.M., Co-taught English 4974: Undergraduate Research course, focused on ePortfolio development and use in education

Summers, T.M., Honors Undergraduate Research, UH 4994, Spring 2010, 2

Zaldivar, M.R., Co-taught English 4974: Undergraduate Research course, focused on ePortfolio development and use in education

Zaldivar, M.R., Co-taught English 4784: Senior Seminar, focused on Bob Dylan's Life and Art

## Workshops taught

Evans, A.D. Scholar, GTA Seminar, Pedagogy (Student-centered learning, Community of Practice), Technology Planning and Evaluation, Train-the-Trainer (Scholar), and Collaborative (Web 2.0) Technologies; Track C Facilitator, Faculty members Development Institute, Spring 2010 - Summer 2010. Facilitated 1 Spring track (of 7 sessions) and 5 (3-day) Summer tracks on the Scholar CLE and pedagogy training; Track D Facilitator, Faculty members Development Institute, Spring 2010 - Summer 2010. Facilitated 1 Spring track and 2 Summer tracks (each 8 weeks) on the Scholar CLE and pedagogy via online training.

Fowler, S.B. FDI: New Faculty members Orientation, panelist: Faculty members Life at VT; FDI: New Faculty members Orientation session, Instructor: Re-thinking the Ways We Engage 21$^{st}$-century Learners: Teaching Strategies for all Disciplines; CIDER/FDI: Engaging Students with Problem-based Learning; GTA Phase II: "How GTAs can Foster Learning: Effective Teaching Strategies for New & Experienced Teachers," OSP: "'Teacher' Training for OSP/OVPR Presenters,"

Plymale, W.O. FDI: Creative Technologies: Arts in the Digital Age

Schwartz, E.E. Overview of Campus Computing Resources; Student Response Systems–Clickers; Adobe InDesign; Backup presenter for Computer Security short course; Co-Facilitator for Track A; Facilitator for Spring Track X and Summer Track Y; Taught Computer-Based Graphics, Reports & Presentations for the Summer Veterinary Student Research Program

Sparrow, J.L.V. FDI: Engaging Students with Problem-based Learning; FDI: Google Earth, Google Maps and Mashups; FDI: Presentations Beyond PowerPoint: Introduction to Prezi; FDI: Web 2.0 Tools to Enhance Writing and Research; FDI: Google Wave; FDI: Web Widgets: Customizing Content for your Class; FDI: Seven Technology Tools to Use Today; CIDER/FDI: Engaging Students with Problem-based Learning

Walker, J.P. Dreamweaver CS4 (Part Two): An Introduction to CSS;Dreamweaver CS4 (Part Three): Intermediate CSS and Incorporating Media;Navigation within the Ensemble CMS; Ensemble CMS (Part 1): An Introduction to the CMS; Ensemble CMS (Part 2): Advanced Content and Concepts Navigation within the Ensemble CMS

## Workshops attended

Fowler, S.B., IT Leadership Development Program (pilot), UOPD

McPherson, E.J., Society of Research on Adolescence Preconference Roundtable

McPherson, E.J. American Educational Research Association Preconference Institute; Beyond Deficit Paradigms

## Graduate committees

Fowler, S.B., Holly Kasperbauer (Ph.D. Agricultural and Extension Education)

Moore, A.H., Nicole Sanderlin (Ph.D. Planning, Governance & Globalization)

Sparrow, J.L.V., Ignaci Roca, (MS, Civil Engineering)

## Publications

Moore, A.H., Fowler, S.B., Sparrow, J.L. 2010 (in press). Faculty learning communities for web-enhanced learning *in* Trentin, G. and Repetto, M. (eds.), *Faculty members Training for Web Enhanced Learning* NOVA Science Publishers, Inc.

Plymale, W.O. and Watson, C.E., (2011, in press) The pedagogy of things: ubiquitous learning, student culture, and constructivist pedagogical practice,

*Ubiquitous Learning: A Survey of Applications, Research, and Trend.* Information Age Publishing.

## Presentations

Brackett, H.J. and Holbach, W.H. Assistive Technologies overviews and/or hands-on experiences to the following classes—CS 3604: Computer Science "Professionalism in Computing"; EDCI 5784: "Universal Access, Disability & Technology"; EDCI 6134: "Instructional Design for Distance Education"; EDCI 5784: "Science Education" Graduate Seminar"

Dustin, J., Sparrow, J.L.V., Reed, C., and Hinson, P., "SpaceCamp, Student Digital Media Workshops," New Media Consortium, Anaheim, CA, June 2010

Evans, A.D., Summers, T.M., Blevins, S.J. (2010, April). Working with a Course Management System (or Collaborative Learning Environment): Lessons we can all learn, regardless of platform. Panel session at the 2010 Virginia Community College System New Horizons Conference in Roanoke, VA.

Evans, A.D., Summers, T.M., Blevins, S.J. (2010, April). Refining Course Management Systems: Listening to those who do it and use it. Research paper presentation at the 2010 Virginia Community College System New Horizons Conference in Roanoke, VA.

Evans, A. D., (2010, March). "Google Applications for Education." Invited speaker, Faculty members Development at Longwood University, Farmville, VA.

Evans, A.D., (2009, October). Scholar: Update on the Transition from Blackboard. Symposium presentation at the bi-annual Virginia Tech Departmental Computer Support Symposium of Blacksburg, VA.

Evans, A.D., (2009, July). Concerning their concerns: Using CBAM to Map Support for a Transition. Roundtable discussion session at the 10th Annual Sakai Conference in Boston, MA.

Fowler, S.B. and Sparrow, J.L.V. "Transforming Teaching & Learning Across the Disciplines via a Faculty members Learning Community Project," Poster presentation at EDUCAUSE Learning Initiative conference, Austin, TX, January 2010

Fowler, S. B. "Graduate Student Development Opportunities through FDI and GEDI," 11th Annual Professional Development Seminar, COE, (Fowler, S.B. & Watson, C.E.), Blacksburg, VA, College of Engineering symposium

Humphries, W., Moore, J., and Head, T., (2010). Online Course Evaluations at Virginia Tech: Critical Technical Issues. Whitepaper presented to Committee on

Teaching Evaluations and relevant IT staff members

McPherson, D., ACCS conference "How to do MORE with LESS' and "Teach Support and Critical Information"

McPherson, E.J., Association of Collegiate Computing Services of Virginia: Tech Support and Critical Information

McPherson, E.J. American Educational Research Association Annual Meeting, Sustaining Adolescent Prosocial Commitment to Learning

Moore, A.H., "Humanities and Writing Intensive Courses: Topic Roundtable." March 2010. Redesign Alliance Annual Conference. Orlando, FL. With Xiaoping Wang, Sheldon Walcher, and Doug Wilson

Moore, A.H., "Research Universities: Sector Roundtable." March 2010. Redesign Alliance Annual Conference. Orlando, FL. With John Harwood

Moore, A.H., "Transforming Teaching and Learning Across the Disciplines via a Faculty members Learning Community Project." January 2010. Poster presentation at ELI (in absentia). Austin, TX. With Jennifer Sparrow and Shelli Fowler

Moore, A.H.,"New Technologies for New Learning." December 2009. Nigerian Delegation to Virginia Tech

Moore, A.H., "Hands-On Leadership and Cross-Discipline Collaborations for Change." July 2009. Campus Technology

Annual Conference. Boston, MA. With Wayne Brown and Chris Coppola

Moore, J. F., Virginia Tech's Transition to Sakai. With Dave McPherson, Amber Evans, Teggin Summers, and Will Humphries. July 2009, Sakai Conference, Cambridge, MA.

Moore, J.F., Virginia Tech status reports. Learning Technology Consortium, Athens, GA (October, 2009) and College Park, MD (April, 2010)

Moore, J.F., Open Source Learning Technologies, for visiting Egyptian delegation, January 2010

Moore, J.F., Scholar Update, to NIS Line Managers, October 2009

Moore, J.F., Scholar survey results, LT Advisory Committee, May 2010

Sparrow, J.L.V. and Fowler, S.B. "Research in the Cloud: Web 2.0 Tools for Writing, Scholarship, & Collaboration," EDUCAUSE Southeast Regional, panel accepted, but did not attend due to budget concerns. January, 2010

Summers, T.M., "Teaching/Course Portfolios." 11th Sakai Conference. Denver, CO. June 2010

Summers, T.M., "Using the Portfolio Options form to build a customizable portfolio." 11th Sakai Conference. Denver, CO. June 2010

Summers, T.M., "Using OSP Tools in the Assessment Cycle: Models, Partial and Complete." 11th Sakai Conference. Denver, CO. June 2010.

Summers, T.M., "Refining Course Management Systems: Listening to Those Who Do It and Use It." VCCS New Horizons 2010: Discover What's Next. Roanoke, VA. April 2010.

Summers, T.M., "Working with a Course Management System (or Collaborative Learning Environment): Lessons We Can All Learn, Regardless of Platform." VCCS New Horizons 2010: Discover What's Next. Roanoke, VA. April 2010.

Summers, T.M., "Blogs, Wikis, and ePortfolios: Benefits, Challenges, and Practical Applications for Multiple Disciplines." VCCS New Horizons 2010: Discover What's Next. Roanoke, VA. April 2010.

Summers, T.M., "Engaging student voices in ePortfolio." Conference on Higher Education Pedagogy. Blacksburg, VA. February 2010.

Summers, T.M., "Virginia Tech ePortfolio Systems Development." Portfolio. 10th Sakai Conference. Boston, MA. July 2009.

Summers, T.M., "OSP User Experience: Current Examples and Calls for Future Collaboration." Using Sakai. 10th Sakai Conference. Boston, MA. July 2009.

Summers, T.M., "Virginia Tech's Transition to Sakai." Deploying Sakai. 10th Sakai Conference. Boston, MA. July 2009.

Zaldivar, M.R. "Teaching/Course Portfolios." 11th Sakai Conference. Denver, CO. June 2010.

Zaldivar, M.R., "Using the Portfolio Options form to build a customizable portfolio." 11th Sakai Conference. Denver, CO. June 2010.

Zaldivar, M.R., "Using OSP Tools in the Assessment Cycle: Models, Partial and Complete." 11th Sakai Conference. Denver, CO. June 2010.

Zaldivar, M.R., "Engaging student voices in ePortfolio." Conference on Higher Education Pedagogy. Blacksburg, VA. February 2010.

Zaldivar, M.R. "*VALUE-ing What We Do*: A Tale of Tailoring & Embedding Meaningful Assessment of the Essential Learning Outcomes at a Research I Institution." AAC&U Annual Symposium, January 2010.

Zaldivar, M.R., "The ePortfolio as a Program Assessment Tool." Virginia Assessment Group Conference, November 2009.

Zaldivar, M.R., "Virginia Tech ePortfolio Systems Development." Portfolio. 10th Sakai Conference. Boston, MA. July 2009.

Zaldivar, M.R. "OSP User Experience: Current Examples and Calls for Future Collaboration." Using Sakai. 10th Sakai Conference. Boston, MA. July 2009.

Zaldivar, M.R., "Virginia Tech's Transition to Sakai." Deploying Sakai. 10th Sakai Conference. Boston, MA. July 2009.

# Outreach activities

Brackett, H.J. and Holbach W.H., College Bound "Preparing students with disabilities for a collegiate experience" (A two and ½ day conference).

Brackett, H.J. and Holbach W.H., Real World Day and Takin' the Next Step "Program to deliver assistive technologies transition information to middle and high school students, parents, and educator"

Brackett, H.J. and Holbach W.H., NASA Inspire (Interdisciplinary National Science Project Incorporating Research and Education Experience), hands-on tour and demonstration of assistive technologies

Brackett, H.J. and Holbach W.H., C-Tech2 "Computers and Technology at Virginia Tech"

Brackett, H.J. and Holbach W.H., Imagination, 6 workshops for 90 students on assistive technologies.

Brackett, H.J. and Holbach W.H., Kids' Tech University, hands-on experience interacting with a range of assistive technologies.

Brackett, H.J. and Holbach W.H., Higher Achievement, middle school students experiencing college and universities

Brackett, H.J. and Holbach W.H., Community Connections, USAID sponsored tour for professionals in disability rehabilitation

Dustin, J., Technical support for local rescue squads' classes on tablet PCs

Evans, A. D., Teaching with Sakai Innovation Award (TWSIA) reviewer, 2010.

Evans, A. D., "Google Tools 4 School." Invited speaker, Faculty members Development at Longwood University, Farmville, VA, March 2010.

McPherson, E.J., Africa Committee member, Outreach and International Affairs

Moore, A.H., Sponsor – CIDER Annual Conference on Higher Education Pedagogy @ VT. February 2010.

Moore, A.H., Development Team – Leadership Development Through the Arts, Urban Affairs and Planning, Theatre Arts, Southern Virginia Higher Education Center, 2003

Moore, J.F., Met with Egyptian representatives visiting College of Engineering and presented FDI and Scholar projects.

Schwartz, E.E "Selecting A Computer" to teachers from several countries at VT as part of the Humphries Fellows program;

Schwartz, E.E. Sudan Project – Member of a working team to develop a proposal to rebuild higher education in agriculture to support food security, economic growth and peace efforts in post-conflict southern Sudan.

Sparrow, J.L.V., Curriculum Advisory Board, Digital Art and Design Program, Southern Virginia Higher Education Center, South Boston, VA

Sparrow, J.L.V., Emerging Technologies In-service Workshop, Roanoke Valley Governor's School for Science and Technology, Roanoke, VA

Sparrow, J.L.V., Kids Tech University, Video creation

Sparrow, J.L.V., Technology for Learning, Blacksburg Middle School Technology Education Class Presentation, Blacksburg, VA

Summers, T.M., Virginia Tech Webcast for EPAC, January 2010

Summers, T.M., Contributed to Sakai OSP 2.6 community user documentation effort

Summers, T.M., Co-editor AAEEBL Learner

Summers, T.M., Regular weekly attendance at Open-Source Portfolio development group planning meetings (conference calls on Monday)

Summers, T.M., Other including webinars, listservs, or other methods: AAC&U Value Project; EPAC (ePortfolio Action Committee); AAEEBL (The Association for Authentic, Experiential and Evidence-Based Learning); Sakai; TLT (Teaching and Learning with Technology); ELI (Educause Learning Initiative)

Zaldivar, M.R., Virginia Tech Webcast for EPAC, January 2010, with Dr. Kate McConnell, Office of Academic Assessment

Zaldivar, M.R., Webcast for WEAVE Online, May 2010, with Dr. Ray Van Dyke, Director, Office of Academic Assessment

Zaldivar, M.R., Contributed to Sakai OSP 3.0 Visioning and Development (several online meetings)

Zaldivar, M.R., Co-editor AAEEBL Learner

Zaldivar, M.R., Other groups including webinars, listservs, or other methods: AAC&U Value Project; INCEPR (International Coalition of ePortfolio Research); EPAC (ePortfolio Action Committee); AAEEBL (The Association for Authentic, Experiential and Evidence-Based Learning); Sakai; TLT (Teaching and Learning with Technology); ELI (Educause Learning Initiative)

# University service

Alford, J.U., Member University Council

Alford, J.U., Staff Senator Representing Information Technology

Alford, J.U., Member Commission on Staff Policies and Affairs

Brackett, H.J. and Holbach W.H., Hokie Wellness and Benefits Fair 2009, Information provided to employees with demonstrations of assistive technologies.

Brackett, H.J. and Holbach W.H., National Disability Employment Awareness Month, AT workstations provided to demonstrative AT devices and software.

Brackett, H.J. and Holbach W.H., Hosted an Open House for Family Day

Brackett, H.J. and Holbach, W.H., ACEMS Proposal, Improving the Accessibility of Community of Emergency Management Systems, grant proposal

deWindt, W., Member of the IT Network and Systems Performance Team.

deWindt, W., Member of Scheduling and Maintenance Subcommittee (SAMS)

Dustin, J., Founding member of Drupal Users Group

Evans, A. D., CLE (Sakai) Coordinator and Instructor, Scholar Advisory Board, 2009-2010.

Evans, A. D. Invited Faculty members Development Institute facilitator for Track (C & D) and NoVA NVGC Track (G) Summer 2009-Summer 2010.

Evans, A. D., GTA Orientation presentation on Blackboard, August 2009.

Fowler, S.B., Invited faculty members panelist, GSA Ethics Bowl

Fowler, S.B., "The Graduate Education Development Institute: A Collaborative Initiative," New Technologies and New Learning session for SCHEV's visit to VT

Fowler, S.B., Guest lecture, "Inclusivity and Productivity: What the Research Shows Us About Diversity," for GRAD 5984, Special Topics: Diversity,"

Fowler, S.B., Guest lecture, "Social Justice and Scholarship," for GRAD 5204, Citizen-Scholar Engagement Seminar,

Fowler, S.B., Member, Evaluation of Teaching committee; participated in the SPOI online course evaluation pilot,

Fowler, S.B. and Sparrow, J.L.V., Contributors (section co-authors) and potential participants, Dr. Ishwar Puri's NSF proposal, "iEthics: An Innovative and Inclusive Online Ethics Resource Center for Transformative Education and Research for the 21$^{st}$ century,"

Fowler, S.B., Invited faculty members panelist, "Choosing the Right University for You," AEE department seminar,

Fowler, S.B., Moore, A.H., and Sparrow J.L.V., Facilitators, Faculty members Learning Community, Provost's office

McPherson, E.J., Fellow, Multicultural Fellows, Office of Equity and Inclusion

Moore. A.H., University Task Force, Strategic Plan for Undergraduate Education, Spring 2010.

Moore, A.H., Assembled *ad hoc* advisory group related to GEOG 1014, consultation with course instructor related to pedagogy, technology integration, and learning outcomes, December 2008 – 2009.

Moore, A.H., Advisory Committee, Center for Creative Technology in the Arts, 2008 -

Moore, A.H., Advisory Committee/Consultant, Institute for Governance and Accountabilities, 2005-

Moore, A.H., University Director, Center for Innovation in Learning; Coordinates annual XCaliber Award; Provides grants for technology-enriched learning development when funds are available. 1998-

Moore, J.F., Member, CIL XCaliber Award Committee

Moore, J.F., Member, University Computing Requirements Committee

Moore, J.F., Member, Faculty members Course Evaluation Taskforce

Moore, J.F., Contributor to IT Project Management standards group

Plymale, W.O., Technology Advisor, Assisted Center for Creative Technologies in the Arts (CCTA)

Plymale, W.O., Member of IT PKI Policy Management Authority (PMA)

Sparrow, J.L.V., Common Book Committee,

Sparrow, J.L.V., Mobile Hokie Committee

Sparrow, J.L.V., Hosted VT Twitter Poetry Contest

Sparrow, J.L.V., Parents Fund Grant Proposal with Foreign Languages and the University Library

Walker, J.P., Technical advisor for Tolls of Madness Theater Group

## Professional service

Evans, A. D., Member of Sakai End-Users Support Group (Documentation) and Teaching and Learning Group, Sakai (www.sakaiproject.org), 2008-.

Evans, A. D., Member: American Educational Research Association (AERA), Association for Educational Communication and Technology (AECT),

American Society for Training & Development (ADTD), International Society for Performance Improvement (ISPI), Eastern Educational Research Association (EERA), 2007-; Golden Key National Honors Society (GKNHS), 1995-.

Fowler, S.B., named Co-Director of the EDUCAUSE Learning Technology Leadership Institute for 2009 and 2010

Fowler, S.B., Member, EDUCAUSE Professional Development Committee, ex-officio,

Fowler, S.B., External reviewer, tenure for Dr. Michael Wesch

Moore, A.H., Pearson Strategic Advisory Board, November 2007 -

Moore, A.H., Virginia Tech/OTE Oman University Project, Learning Technologies expert consultant, October 2007 -

Moore, A.H., The National Center for Academic Transformation, Redesign Alliance Advisory Board, January 2007–

Moore, A.H., State Council for Higher Education In Virginia, Learning Technology Advisory Committee, November 2006-

Moore, A. H., Adobe Higher Education Leadership Advisory Board, 2006 –

Moore, A.H., Research Channel Advisory Board, 2006 –

Moore, A. H., WCET, the Cooperative advancing the effective use of technology in higher education, Elected

to Executive Council, 2005 – 2008, Institutional representative ongoing.

Moore, A. H., Commons Solutions Group, 2005-

Moore, A.H. EDUCAUSE Center for Applied Research, Institutional Representative to ECAR, 2003-

Moore, A.H., Blue Ridge Public Television, Higher Education Council/Consultant. 2002 – 2010.

Moore, A.H., Electronic Campus of Virginia. Founding Chair. Virginia Tech Liaison to Steering Committee and Treasurer, 1999 –

Moore, A.H., Virginia Institute for Government, Advisory Board Member, 1996-

Moore, J.F., Member, 2010 Teaching with Sakai Innovation Award international taskforce

Moore, J.F., Member, Learning Technology Advisory Committee, SCHEV.

Moore, J.F., Reviewer, 2010 Virginia Outstanding Faculty members Awards, Teaching with Technology category, SCHEV.

Moore, J.F., Consulted with University of Waterloo, Texas State, and USC-Fullerton on Sakai implementation and migration issues.

Moore, J.F., Participant and presenter, Learning Technology Consortium meetings, University of Georgia and University of Maryland.

Moore, J.F., Attended two training sessions on conducting focus groups and survey research methods.

Plymale Program committee member, Sixth IEEE International Workshop on PervasivE Learning (PerEL 2010)

Sparrow, J.L.V., EDUCAUSE Learning Initiative Advisory Board

Sparrow, J.L.V., EDUCAUSE Emerging Technologies Committee

Sparrow, J.L.V., SITE 2010 Annual Conference Program Committee

Sparrow, J.L.V., EDUCAUSE Mid-Atlantic Regional Conference Program Committee

Sparrow, J.L.V., International Journal of Teaching and Learning in Higher Education, Manuscript Review Committee

# University and community service

Dustin, J., Lieutenant and technical consultant for Blacksburg Fire Department

# Research

Brackett, H.J. and Holbach, W.H., Innovative Flexible Experimental Environment for Learning SCIENCE (I Feel Science) graduate and undergraduate Industrial and Systems Engineering research

Brackett, H.J. and Holbach, W.H., Community Living Connection (CLIC) Technical and assistive technologies support for sponsored research project.

Holbach, W.H. & Brackett, H.J. a four-year joint proposal by ISE, ECE, and AT to the National Science Foundation for a Collaborative Accessible Functional Environment (CAFÉ´) emergency preparedness simulator (Not Funded)

Holbach, W.H. & Brackett, H.J. submitted proposal for Community Living Connection (NTIA CLiC) to U.S. Dept. of Commerce/NTIA (Not Funded)

Holbach, W.H. & Brackett, H.J. proposal submitted by IBM and Virginia Tech to the VT Center for Community Security and Resilience (VT CCSR) for Improving the Accessibility of Community of Emergency Management Systems (ACEMS). AT will serve as advisors on research scenarios and help supervise graduate researcher(s) (Funded for 1 year starting July 1, 2010)

Sparrow, J.L.V and Moore, J., Student focus group on technology usage and requirements at Virginia Tech, Spring 2010.

Summers, T.M. Watson, C.E, Zaldivar, M., and Summers, T. (2010) "ePortfolios for Learning, Assessment, and Professional Development." *Critical Design and*

*Effective Tools for eLearning in Higher Education*. Hershey, PA: IGI Global Publishing.

Zaldivar, M., Summers, T., and Watson, C.E. "Ubiquit-E: Issues of Standardization, Assessment, and Transference for 21st Century ePortfolios." *ePortfolio Performance Support Systems: Teaching, Learning, and Assessing Portfolios in the Academy and Work Place.* (*pending*)

## Awards

Plymale, W.O., Intel Research WISP Challenge, "Pebbles and Urns: A Tangible, Presence-Based Messaging Service**,** with Dr. Scott F. Midkiff, Bradley Department of Electrical & Computer Engineering, Virginia Tech

Sparrow, J.L.V., XCaliber Award, Team Award with Bruce Hull and Courtney Kimmel

# Network Infrastructure and Services

During the 2009-2010 fiscal year, Network Infrastructure and Services (NI&S)  reported to Ms. Judy L. Lilly, Associate Vice President. The departmental website is *www.cns.vt.edu.*

NI&S provides and manages the university's information technology infrastructure and related services by

- operating available, reliable, and secure networks, systems, and services;
- researching, testing, and advancing emerging technologies;
- developing and deploying technologies and services that directly support the learning, discovery, and engagement missions of the university;
- disseminating information obtained from research and development;
- embracing our role as a corporate citizen and partner in local, state, regional, and international communities;
- practicing sound fiscal management.

**Our role in learning, discovery, and engagement**

Rapid advances in technology, mobility, flexibility, and the nature of broadband infrastructure are reflected in the constantly changing ways the university community must approach its work. Such change, in turn, drives increased demand for, and expectations of, technology and infrastructure and the benefits they provide. New computing and communications methods continue to enhance the educational experience of students on-site and online.

In response, NI&S continually invests in innovations and improvements that directly support programs which enhance Virginia Tech's reputation as a research university in an increasingly competitive, global, and digital environment. The university recognizes the all-important need to maintain exceptional core strength in scientific and technological research and innovation.

Access to next-generation networks, protocols, services including reliable, secure, electronic communications and central computing facilities, in-depth service monitoring, trend analysis, predictive capacity-planning, and e-

discovery support for the university is critical if Virginia Tech is to achieve a modern, technology-enriched, discovery and learning environment; fulfill its engagement mission; share our knowledge resources; and improve the quality of life for citizens of the commonwealth.

**Infrastructure and access**

NI&S is a leader in advanced network services enabling innovation and discovery. Emphasis is placed on promoting robust and integrated information technology strategies to advance Virginia Tech's excellence. The department participates in and supports the deployment of wide-area, high-performance computing and communications to provide the university with ubiquitous and direct access—essential for collaboration and computing-intensive research—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 along with the visualization of results and remote access to specialized, scientific equipment.

All members of the university community expect and depend upon efficient and effective

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

Meanwhile, planning is underway to allow the university community to take advantage of the convergence of various telecommunications technologies with a unified communications infrastructure to support future research and instructional needs and foster educational opportunities and economic development. The totally new information environment will replace the legacy network and telecommunication facilities and provide next-generation performance, reliability, survivability, and flexibility.

Based on a diverse, survivable, optical core with ubiquitous wireless and wired access, the enhanced network will provide the university with advanced optical networking capabilities, high-performance computing technologies, and a pervasive, leading-edge, technology infrastructure to support the vision and mission of the university well into the future.

Making an initial capital investment to consolidate systems will allow us to take advantage of economies of scale and lead to reduced operating expenses year after year. Enhanced software components will provide better management and documentation of the new technology infrastructure. Increased resources for data storage, application platforms, and messaging services to advance instructional and research-related computing and communication and enhance the programmatic content critical for the student learning experience will be available.

**Our business model: personnel, partnerships, and prudence**

NI&S seeks to attract, develop, and retain quality employees who enhance the organization's effectiveness and contributions

to the university. The highly skilled and talented workforce is committed to excellence; staff members work together with an innovative and collaborative spirit to improve delivery of services, keep complex network projects on track, and accelerate the deployment of new technologies.

Ongoing evaluation of next-generation services determines the key technologies and vendors that will be important to the university's overall telecommunications strategy. Goals include the development of new, high-quality services and the enhancement of existing services to accommodate identified technological needs and anticipate the future demands of Virginia Tech students, faculty members, and researchers.

**Staffing by unit**

Staffing in NI&S has remained relatively stable over the past few years.

| NI&S salaried personnel, by unit | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|
| Communications Network Services | 113 | 114.5 | 114.5 | 113.5 | 110.0 |
| Systems Support Services—4Help and VTOC | 21 | 16 | 21 | 23 | 21 |
| Systems Support Services—Server Administration | 7 | 8 | 6 | 9 | 10 |
| Systems Support Services—Storage Administration | 6 | 6 | 6 | 6 | 6 |
| Systems Support Services—E-Communications Clients | 7 | 7 | 7 | 6 | 6 |
| Video/Broadcast Services | 14.5 | 14.5 | 15.5 | 15.5 | 15.5 |
| **Subtotal** | **168.5** | **166** | **170** | **173** | **168.5** |
| University Printing and Digital Imaging | 26 | 26 | 26 | N/A | N/A |
| University Mail Services | 18 | 18 | 19 | N/A | N/A |
| **Total** | 212.5 | 210 | 215 | 173 | 168.5 |

Effective July 1, 2008, University Printing Services and University Mail Services and their employees report through the Office of Transportation and Campus Services. Wage employees are not included in these full-time equivalent numbers. The 2010 numbers reflect organizational assignments as of December 2009. NI&S collaborates with Advanced Research Computing, Learning Technologies, Enterprise Systems, and the Information Technology Security Office to provide centralized network management, support, and services emphasizing security and reliability, all of which are essential for a healthy and productive university network. Through collaboration with academic programs and external partners, NI&S helps enhance the university's reputation in advanced network research initiatives and learning environments.

NI&S is required to recover all operational costs as well as the expenses necessary to build, maintain, and continually upgrade the network. Constant improvements in operational efficiency and cost reductions result in savings to be reinvested into enhanced technology infrastructure. 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, education and general, and cost-center 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 resale of services. In addition, NI&S participates in

funded sponsored projects and research and develops new ways to analyze information in order to connect people and resources together.

The past few years have presented serious financial challenges to the university, and to NI&S, as the Commonwealth of Virginia has made further reductions to higher education funding. State revenues continue to decline as we head into the third year of a national recession. During the current fiscal year, non auxiliary units faced a five percent budget reduction. In addition, the auxiliary faced an unanticipated late-year reduction to the current budget that presents challenges in our ability to make some significant improvements in the telecommunications infrastructure. Additional reductions are being proposed for the next fiscal year.

# Organization

Network Infrastructure and Services is organized into several units.

## Strategic Initiatives

Strategic Initiatives (SI), led by Jeff Crowder, directly supports Information Technology's executive administration in strategic programs and special projects to enhance Virginia's competitiveness through advanced, broadband technology. By design, SI is broadly engaged technologically, geographically, and politically. Current SI involvements include the following:

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

**NetworkVirginia.** Promoting equitable access to broadband, particularly in rural communities, NetworkVirginia serves an estimated 1.4 million Virginians 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.

**Mid-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. Work continues in this area: the Mid-Atlantic Broadband Cooperative and the LENOWISCO Planning District Commission have constructed over 1,000 miles of fiber in Southside and Southwest Virginia respectively. Virginia Tech enabled significant expansion of this network with federal grant funding. Both projects are facilitated by SI with significant Virginia Tech investment.

**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.

## Research, Development, and Technology Innovation

Research, Development, and Technology Innovation (Technology Innovation) is led by Carl Harris. This team of NI&S engineers works 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 other 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 members in defining advanced network and application requirements to meet their needs.

Goals for Research, Development, and Technology Innovation include the following:

- In conjunction with other NI&S engineering teams, develop, deploy, and integrate solutions in network

operations, configuration management, fault/performance management, and telecommunications security
- Research and select new telecommunications systems and applications to be investigated in order to provide state-of-the-art voice, data, and video services to the university community
- Research, develop, implement, and utilize network and systems management tools
- Coordinate with other NI&S engineering teams to specify, recommend, and implement 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
- Conduct operational and theoretical knowledge transfer sessions in support of the department's engineering and operations staff
- Consult with university, local, and regional groups on emergency communications 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
- Provide support for network solutions for multi-disciplinary, funded research activities
- Represent Virginia Tech on technical committees and collaborative engineering staffs serving regional, national, and international high-performance network initiatives
- Promote the vision and use of information technology within the university and research community
- Develop vision of university's technological direction and form strategies to achieve this vision
- Provide high-level consultation and develop innovative networking solutions to solve problems and meet needs

**Network Security.** A sub-unit of Research, Development, and 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 are 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 provided include several areas:

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 that allow those hosts to be moved among networks without manual reconfiguration by a system administrator.

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

# Network Engineering and Management

The university's network must serve the diverse and challenging needs of teachers, learners, researchers, and administrators.

Reliability and security are paramount concerns given the university's critical dependence on computers and the sensitive nature of the data they contain. In addition, technology operations are highly dynamic and require that we plan and invest in technologies of tomorrow while operating and maintaining those of today. John Pollard leads the Network Engineering and Management group that includes Network Engineering, Network Research and Development, Switch Engineering, Telecommunications Facilities Management, Field Engineering, Safety, and Video/Broadcast Services.

**Network Engineering.** The Network Engineering (NE) team, led by Brian Jones, implements, manages, and operates the university network. Team members utilize and manage new protocols, configure and employ software, measure and analyze performance, constantly adjust configurations, and improve processes. To ensure highly reliable and available systems, NE staff members use various software management, testing, and troubleshooting tools and systems. Network Engineering activities encompass three major areas: infrastructure planning and upgrades; network services planning and implementation; and systems and applications integration, utilization, and administration. NE works with other NI&S

engineering teams to recommend and implement improvements to existing services and related infrastructure.

Infrastructure planning and upgrades. Appropriate physical facilities, up-to-date cable plant, and continually upgraded network systems are essential elements of the university's communications infrastructure. NE coordinates closely with other NI&S engineering groups to develop comprehensive plans to re-engineer pathways and building wiring to support the design and ongoing implementation of high-quality network architectures and upgrades.

Network services planning and implementation. NE collaborates with Network Research and Development personnel 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 operations.

Systems and applications integration, utilization, and administration. NE integrates, utilizes, configures, and manages a wide variety of software to efficiently and effectively operate and troubleshoot campus networks and related support systems and services.

NE's video engineers provide uplinks for the Virginia Satellite Educational Network for distance learning programs and distribute commercial television programming via the university cable television system. Additionally, they provide support to the university and its departments by broadcasting special events. The team emphasizes rapid response and close collaboration with commercial providers to maintain a high level of availability and to enhance services.

**Network Research and Development.** Network Research and Development (Network R&D) is led by Steven Lee. This team of engineers works closely with Technology Innovation and Network Engineering to identify new technologies and tools to support the evolving networking needs of the university.

Given high-level, strategic direction from 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 our operations and management infrastructure, and 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 university community to ensure all network applications—including wireless—function optimally.

Goals for Network Research and Development include the following:

- In conjunction with other NI&S engineering teams, develop, deploy, and integrate solutions in network operations, configuration management, fault/performance management, and telecommunications security
- Design, specify, and oversee the deployment of telecommunications systems and applications to deliver voice, data, and video services to the university community
- Research, develop, implement, and utilize network and systems management tools
- Coordinate with other NI&S engineering teams to specify, recommend, and implement modifications and enhancements to ensure network performance is consistent with

application requirements and user needs and expectations
- Serve as liaison to industry and user groups on multimedia and next-generation applications

**Switch Engineering.** Switch Engineering, led by Barry Linkous, provides telephone and voice messaging services for the main campus and for university locations statewide. In addition, the group oversees the emergency "blue light" telephones on the Blacksburg campus and provides appropriate support to law enforcement and service providers.

**Telecommunications Facilities Management.** This group helps plan, secure, and maintain telecommunications systems and equipment spaces. Led by Robert Rankin, the group schedules and performs required maintenance and repairs and serves as the primary contact for telecommunications facilities issues.

**Field Engineering.** Field Engineering (FE) led by Doug Jones, plans, provisions, and provides telecommunications distribution systems (both inside and outside plant) designed to reliably and securely support university communications needs through the next 10 to 15 years.

By working closely with the Office of Physical Plant Operations, university architects, and project engineers, and through testing and evaluation of vendor products, FE ensures pathways, spaces, and 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.

**Safety.** Because of its size, NI&S has on staff its own safety coordinator, Steve Gordon, who works closely with Facilities Services and with Environmental, Health and Safety Services.

The coordinator's duties include providing information and training about health issues and assuring Occupational Safety and Health Administration compliance through environmental investigations, distribution of necessary personal protective equipment to staff members, reviewing construction sites, and raising employee awareness of safety-related issues. The result is a safer, supportive, work environment for NI&S employees.

**Video/Broadcast Services.** Video/Broadcast Services (VBS), led by Mark Harden, produces multimedia-based, instructional materials and manages and schedules—on a statewide level—the interactive

videoconferencing network and electronic classrooms required to deliver learning materials to thousands of students through distance education. VBS offers live and on-demand streaming media servers for classes, projects, and special events.

# Systems Support and e-discovery

Systems Support, led by William Dougherty, provides reliable and secure electronic communications and central computing facilities, in-depth service monitoring, trend analysis, and predictive capacity planning. E-discovery support is provided to the Office of 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 also performed by members of Systems Support, though work can involve personnel from the Information Technology Security Office and/or from individual departments.

**E-Communications Services and Windows Administration Services Team**. The E-Communications Services and Windows Administration Services (ECS-WAS) Team, led by Ron Jarrell, provides support for all centralized messaging systems (e-mail—

including the recently launched Google e-mail 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 also maintains the university LISTSERV system and Virginia Tech UNIX/Linux mirror site. The ECS-WAS staff responds to Internet abuse complaints, functions as members of the Computer Incident Response Team, and provides e-discovery services in support of civil, criminal, and regulatory investigations.

**Storage Management Team**. The Storage Management Team (SMT), led by Wanda Baber, provides self-managed storage and backup/archive facilities, administers the EMC Storage Area Network (SAN) for large, data-intensive applications, the high-performance storage for research applications (IBM brand equipment), and the network-attached storage (NAS) devices 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 also participates in e-discovery efforts as the bulk of the data collected and preserved resides on storage and backup/archive equipment administered by the SMT staff. SMT administers the central UNIX print server and provides back-end support to the university LISTSERV system.

**UNIX Administration Services**. The UNIX Administration Services Team, led by Tim Rhodes, supports UNIX/Linux-based hardware and operating systems for administrative applications (such as Banner and the Enterprise Data Warehouse), instructional applications (such as Blackboard and Sakai), and research applications (such as those running on System X, SGI, and IBM and Sun-based hosts). Standardization across all systems enables a comparatively small team to manage over 250 non-research systems and more than 1,000 research systems (including the Apple MAC OS X-based System X, Sun Microsystems' Solaris-based systems, SGI IRIX and Linux-based systems, and the IBM iDataPlex cluster and other Power-based and Intel-based systems) even as they provide systems administration support to 12 separate groups within Virginia Tech Information Technology.

**Research and development project facilitator for Systems Support**. Mike Moyer is the research and development project facilitator for the Systems Support unit. He is responsible for coordinating all cross-departmental research and project-related activity, overseeing and reconciling the departmental telecommunications inventory (including the Data Center Ethernet and storage network facilities), writing documentation (including project proposals

and project management forms), and assisting the director of the department in e-discovery activities.

# Blacksburg Electronic Village

The Blacksburg Electronic Village (BEV), an outreach effort of Virginia Tech Information Technology in collaboration with the Town of Blacksburg, is led by William Sanders. Since its inception in 1993, BEV has supported and encouraged the use of technology to enhance social capital and to broaden educational and economic opportunity in Virginia communities.

BEV (*www.bev.net*) remains one of the longest-operating and best-known community networks in the world. Its initial focus on building infrastructure and prototyping community connectivity has continually expanded. Today, BEV is a Web-services resource of choice for many civic, social, and nonprofit organizations, while serving as a real-world test bed for new technologies, applications, and funded research projects.

# Systems Development and Administration

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

**Software Development Team**. The Software Development Team builds and maintains software systems and Web applications supporting 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, equipment, materials, and cable plant inventory. The team continues to develop and improve *cola.cns.vt.edu,* the organization's customer portal used by students, departments, and university guests. Development platforms include Oracle Forms, PL/SQL, Jasper Reports, Remedy, Java, and many Java-related technologies. The team collaborates with Research, Development, and Technology Innovation on development of next-generation systems.

**UNIX System Administration Team.** 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 Team**. The Database Administration team provides database and security administration for Oracle and PostgreSQL systems. The team manages 17 Oracle instances for the organization's administrative systems, as well as several PostgreSQL instances supporting VT Alerts systems.

**Windows Systems Administration and User Support Team**. The Windows Systems Administration and User Support Team administers over 300 desktop systems and mobile computers as well as a classroom and several Windows servers. The team also provides user assistance for the NI&S staff.

**BEV Development and Administration Team.** The BEV Development and Administration Team provides website and Web application development, hosting, e-mail, and DNS services for citizens and nonprofit organizations throughout the state. A team of Virginia Tech students working under NI&S direction makes up the Web Support Services group. They develop and maintain websites for departments

throughout the university as well as for external nonprofits and government agencies. Development platforms include Linux, Apache, MySQL, PHP, and Drupal.

**CAD/GIS Team**. The CAD/GIS Team documents the university's network infrastructure using computer aided design and geographic information systems tools that facilitate network management, troubleshooting, and strategic planning.

# Business Administration and Operations

Network Infrastructure and Services is supported by several business administration and operations units. Pat Rodgers, director of Business Technologies, oversees Business Operations, the Warehouse, Information Technology Support, and the Project Management units. Network Administration is led by Richard Hach. These groups support the daily enterprise business activities and operations of the organization.

**Business Operations.** Business Operations includes Ordering and Provisioning, Business Services, and Public Relations. These groups serve the administrative and business needs of NI&S in compliance with university policies and procedures and consistent with industry best practices.

Ordering and Provisioning. Led by Bill Blevins, Ordering and Provisioning (O&P) facilitates and fulfills customer requests for telecommunications equipment and services. O&P provides planning assistance for major telecommunications projects including new building construction.

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

Public Relations. Led by Jeff Kidd, Public Relations operates the university switchboard and manages NI&S reception services as well as the department's Web design, development, and documentation. The Public Relations staff facilitates communication between NI&S and its customers and constituents.

**Warehouse.** Led by Jerry Surface, the NI&S Warehouse is the single receiving point for the vast majority of inventory ordered by the department. Warehouse personnel ensure all items are received in an undamaged state and are properly recorded in NI&S inventory tracking systems. The Warehouse is responsible for inventory control and for issuing inventory for the department's work orders and projects. The group also works closely with the Controller's Office to track and monitor the location of university fixed assets.

**Information Technology Support.** Led by Joyce Landreth, Information Technology Support—comprising the Virginia Tech Operations Center (VTOC) and University Computing Support (UCS)—provides a single point-of-contact for computing and telecommunications services.

Virginia Tech Operations Center. The VTOC integrates the customer support center, the computing Help Desk, and all network, video, and systems operations functions—proactively monitoring university information technology networks, systems, and services. The VTOC receives trouble calls and opens tickets to track the diagnosis, escalation, and resolution of reported problems.

University Computing Support. University Computing Support consists of the Help Desk and the Content and Knowledge Management (CKM) group. The Help Desk consultants resolve escalated problem tickets and serve as liaisons with other Virginia Tech Information Technology groups. CKM publishes and manages content for Information Technology products and

services and maintains an extensive, publicly accessible, knowledge base, *http://answers.vt.edu.*

**Project Management.** Many NI&S projects involve enhancement of campus communications services and infrastructure, are lengthy and complex, and require significant financial and personnel resources. Project Management uses state-of-the-art tools and techniques to increase efficiency and help ensure projects are completed successfully, on schedule, and within budget.

Under the state's Restructured Higher Education Financial and Administrative Operations Act, Virginia Tech has been authorized to use its own project management process for information technology projects. NI&S has used the university's policies, benchmarks, and guidelines to create a standard template to plot project tasks. Complex plans may be multi-tiered and are available in both PDF and HTML formats.

At periodic meetings, team members review timelines and deliverables, update pertinent details, and resolve problems that could interfere with success. At project completion, the team prepares a final status report to highlight lessons learned for the benefit of future projects.

**Network Administration.** Network Administration provides administrative coordination among diverse entities involved in delivering telecommunications services to the university. The group's duties include 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.

Network Administration's director, Richard Hach, is the program director of NetworkVirginia. In addition, he represents the university at meetings of outside organizations including EDUCAUSE, the Net@EDU Converged Communications Working Group, Internet2, QUILT Inc., and National LambdaRail.

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

# Projects

## VT Alerts

Since 2007, Information Technology has been developing and extending the emergency notification system known as VT Alerts. During the 2009-2010 fiscal year, several units of NI&S—Technology Innovations, Blacksburg Electronic Village Web Support Services, and Systems Development and Administration—collaborated on enhancements to VT Alerts. Four significant new capabilities were developed—VT Desktop Alerts, Policy Group Notification, Subscriber Database Management, and Subscribe-by-Proxy.

*VT Desktop Alerts* is a client that provides the means to receive emergency notifications using only a computer and Internet access. When an emergency alert is activated, the client displays the alert information on the screen and sounds an audible alert. The system uses standard Web technologies for secure communications to ensure alert information is received and displayed in a timely manner. NI&S software architects and developers created the desktop alert plug-in for Windows and Mac OS X along with the Java-based central services to support

it. Since fall 2009, the plug-in has been available for download to anyone who wants to receive alert information from Virginia Tech. Improving and diversifying the potential mechanisms through which the university community can receive emergency information will have a direct and positive impact on campus safety and security. Providing additional channels for notification will increase the likelihood that impacted individuals will receive alerts in a timely manner.

The *Policy Group Notification* application is a Web-based tool allowing authorized persons from the Office of the Director for Emergency Management to quickly send notifications to members of the university's Safety and Security Policy Group. The system supports notification via phone calls and e-mail and was designed based on specifications provided by the Director for Emergency Management.

*Subscriber Database Management* for VT Alerts provides a means to help ensure that only eligible individuals are subscribed. When the VT Alerts service was first activated in 2007, there was no associated functionality to systematically remove individuals no longer actively affiliated with the university from the database. Work has now been completed to remove subscribers, such as students who have graduated and are no longer eligible, from the database. Prior notice of removal is provided to subscribers. Removing ineligible subscribers

from the VT Alerts contact database improves the timeliness of alert delivery.

*Subscribe-by-Proxy* provides VT Alerts support for certain members in the university community who do not have an "official" affiliation with the university. For these individuals, an authorized proxy manages their contact information in the VT Alerts database so they will receive the notifications. The new feature in the VT Alerts subscription application allows a proxy to view, add, update, and/or remove contact information on behalf of individuals for whom the proxy is authorized.

NI&S will continue to work with University Relations and the Office of the Director for Emergency Management to enhance the VT Alerts system and improve campus safety and security.

For more information, contact William Dougherty, *william@vt.edu.*

## VT Alerts message boards

The Classroom Notification System project addresses a major recommendation of the Security Infrastructure Working Group's report following the April 16, 2007 tragedy. After the initial installation of 184 VT Alerts message boards—most being installed prior to the

beginning of classes in August 2008—CNS has worked with University Relations and Emergency Management to install over 250 additional message boards in university classrooms. CNS organized and coordinated site visits to most, if not all, proposed classroom locations to identify the optimum location for each board within a room as well as any possible challenges.

Possible locations for additional message board installations are being reviewed.

When there is no alert, boards display the time and date as a quality assurance measure.



For more information, contact Pat Rodgers, *prodgers@vt.edu*.

# IP-based safety and security cameras

In conjunction with the Office of Emergency Management (OEM), Network Infrastructure and Services led a series of informational meetings to assess the ability of technology companies to provide IP-based security and safety camera systems. Such systems are intended to deter crime and will assist in protecting the safety and property of the Virginia Tech community. Multiple vendors gave presentations that were attended by representatives from Parking Services, the Virginia Tech Police Department, and the Institute for Critical Technology and Applied Science (ICTAS).

A recently adopted university policy is now in place regarding safety and security camera use (*www.policies.vt.edu/5617.pdf*). One purpose of the policy is to formalize the procedures for the future use of camera systems and bring existing security systems into compliance while respecting and preserving individual privacy. The purpose of the meetings was to gather data in anticipation of a request for proposal for an enterprise-wide system to support the new guidelines.

Virginia Tech is committed to the enhancement of the quality of campus life through the integration of safety and security best practices with the campus technology infrastructure. The presentations addressed the use of security cameras as well as other video-monitoring and recording systems that may be used to enhance personal safety and the protection of property.

For more information, contact Richard Hach, *rhach@vt.edu*.

# E911 telephone system implementation

This year, Network Infrastructure and Services successfully completed the implementation of a new E911 telephone system in support of the Virginia Tech Police Department (VTPD). The new system is designed to improve the ability of the campus 911 dispatchers to quickly and accurately send officers in response to emergency events. NI&S partnered with Intrado-Positron, a leading provider of public safety technology solutions, to provide a robust and reliable communications system capable of supporting all aspects of the VTPD's dispatch operations.

E911 call handling and map viewer applications

The new system was designed in accordance with established industry standards enabling successful integration with local and remote Automatic Location Information (ALI) services to provide 911 dispatchers with accurate location information for both wireline and wireless 911 phone calls. Additionally, the system's geographic information system (GIS) map-viewer automatically shows the caller's location on the campus map providing dispatchers with an additional resource to improve the accuracy

and efficiency of dispatch operations. NI&S engineers worked closely with the VTPD's technology partners to ensure successful integration with the existing Computer Assisted Dispatch, digital audio recording, and radio console systems.

Decommissioning the legacy E911 telephone system will enable the transition to a new unified communications (UC) system for the campus. The new system will support emergency service operations for both the legacy campus telephone system and the new UC system during the transition period.

For more information, contact Joe Hutson, *joe.hutson@vt.edu.*

## New River Valley 911 emergency communications center

Montgomery County, the Towns of Blacksburg and Christiansburg, and Virginia Tech have joined together for the purpose of establishing a working group to study whether it is technically, practically, and economically feasible to establish a regional 911 emergency communications center that would combine the Public Safety Answering Point (PSAP) and dispatch center operations of the four entities.

Currently, each entity operates its own PSAP and dispatch center.

A feasibility study conducted by AECOM Designs/CTA Communications in 2009 concluded that consolidation would result in significant enhancements to interagency coordination in emergency response situations. The study also states that a consolidated center is estimated to save $26 million over a 20-year period. The consolidated center would enable support for emergency medical dispatch (EMD) operations improving the quality of service to citizens of the New River Valley.

RCC Consultants, Inc. has been hired to develop a technology plan for the consolidated center. RCC has conducted an analysis of the existing information technology and communications systems and provided a draft recommendation to facilitate merging the disparate systems to support the consolidated center.

Future initiatives include the creation of a regional 911 authority, site selection, hiring an emergency communications center director, and ultimately transitioning to the consolidated emergency communications center.

Sources:
*www.roanoke.com/news/nrv/wb/215513*
*www.montva.com/filestorage/1144/100/326/3 28/336/356/2009-08-17_m.pdf*

For more information, contact Joe Hutson, *joe.hutson@vt.edu.*

# Mobile computing for the Virginia Tech Police Department

The technology infrastructure currently used by the Virginia Tech Police Department to support communication, coordination, and dispatch functions is limited to audio communication using radio and telephone technology. Significant work to provide the VTPD's field officers with wireless-enabled computing devices continued this year.

Mobile data terminal (MDT) is the term used to describe a ruggedized notebook computer with one or more radio interfaces, a touch screen interface, and a collection of specialized software applications mounted in a public safety vehicle. The specialized software applications typically deployed on MDT's include:

- Computer-assisted dispatch client software for improving the efficiency and accuracy of dispatcher operations and reducing radio network traffic
- Mapping client software providing real-time graphical representations of an officer's location and call information

- Crime information network client software to enable field officers to query vehicle and criminal records from state and federal data repositories
- Mobile field report client software to allow officers to generate and submit incident and accident reports in the field

A team of information technology engineers and consultants has continued to work together with VTPD representatives on this project. During the past year, the group determined the interface software, networking infrastructure, server hardware, and vehicular hardware necessary to best bring the benefits of mobile computing to fruition. The major hardware elements of the project have already been procured and installed. The software vendor is expected to complete their installation this summer and provide training on use of the system to VTPD officers during the fall semester.

For more information, contact Mike Moyer, *mike.moyer@vt.edu*.

# E-discovery and data preservation

In order to support law enforcement investigations, provide documentation for internal audit reviews, and comply with

discovery requests from ongoing litigation, Systems Support staff members answered more than a dozen data collection and preservation requests this year. In addition to the new cases, activity related to the events of April 16, 2007, continues.

These efforts produce volumes of unstructured data that require review, indexing, redaction, and presentation. Computing and storage equipment, along with database management and information warehousing software, was purchased and installed to enable Virginia Tech personnel to begin investigating new techniques for indexing and mining the collected data. Systems Support personnel and university legal counsel also reviewed commercial products available for use in this field.

For more information, contact William Dougherty, *william@vt.edu.*

# Disaster recovery plan

NI&S has completed an extensive update to our disaster recovery plan. Our original plan was a very large, cumbersome document focused primarily on internal, "content expert," assessment teams and the manufacturer and part numbers of essential devices or systems. The old plan did not adequately address mission-critical devices, systems, data, and

dependencies. It lacked the ability to be a useful tool during an emergency—particularly if the critical personnel who work on those systems on a regular basis were unavailable to assist in the recovery effort.

A team met periodically this year to complete a new plan. The updated strategy assumes the content experts who manage essential systems on a regular basis may be unavailable to assist in the recovery effort. The plan—based primarily on documentation of system requirements and/or features—is designed so persons with appropriate technical skills and experience can recover essential systems in the absence of the content experts. In the event of a disaster where there is a need to purchase or re-purpose replacement hardware, we would procure equipment based on minimum system requirements and/or features and what equivalent equipment was readily available rather than attempt to procure exactly the same device lost in the disaster.

A major change to the new strategy is identifying and including key dependencies of essential systems to assist in prioritizing our recovery efforts. For example, a mission-critical service such as Banner requires a great deal of network and related infrastructure to be operational before the actual Banner server can be utilized by the university community.

The concept of assessment and recovery teams remains a component of the new plan.

During the 2009-2010 fiscal year, the data documenting our essential systems was compiled, and the update to the plan was completed and published.

For more information, contact John Pollard, *jpollard@vt.edu*.

## Disaster recovery location at the University of Virginia

Virginia Tech Information Technology is deploying a group of systems to be located in the University of Virginia (UVa) Data Center to address our disaster recovery needs.

The current scope of the project is focused on implementing a backup for the Information Technology services that support critical university functions in the event of a disaster that results in the loss of our normal computer operations.

The equipment is being staged in the Andrews Information Systems Building Data Center and is scheduled to be moved to the UVa Data Center before the coming fall semester.



Disaster recovery equipment

For more information, contact Tim Rhodes, *rhodes@vt.edu*.

# Intrusion detection systems

During the summer of 2009, the Information Technology Security Office (ITSO) approached CNS with a proposal to deploy a distributed intrusion detection system (IDS) making use of several small, inexpensive, intrusion detection sensors in strategic locations throughout the campus network to replace the centralized, legacy IDS. These devices will allow the ITSO to monitor patterns in network traffic to detect attacks and gather metrics about attack types and sources. Should a machine within the Virginia Tech community become compromised, the IDS system will initiate an automated process to send a trouble ticket to 4Help. The new IDS equipment has been developed in-house, making the devices inexpensive to acquire and eliminating the need for expensive maintenance contracts. The system uses open source "Snort" software to power sensors built with low-cost desktop units.

After some initial tests in the CNS lab with the help of the Research and Development team, ITSO determined the devices were ready for test deployments. In May 2010, CNS and ITSO deployed an IDS sensor in the Andrews Information System Building switchroom. ITSO used this equipment to conduct further testing of the system's capabilities. ITSO is now ready to move forward with deployment of the

devices throughout the network. ITSO will provide and operate the sensors, and NI&S will provide high-speed network connectivity to the campus core in each of the switching centers, conditioned power with generator backup, and equipment rack space.

These devices will also be available to CNS to use as network sensors. They will be well-placed in each of our six core campus switching centers to monitor traffic and will not place significant, additional load on network infrastructure. Therefore, the IDS devices will provide our engineers and diagnosticians with additional tools to identify and resolve network problems as they arise. Deployment of the entire system is anticipated to be completed by late autumn 2010.

For more information, contact Jacob Dawson, *dawson@vt.edu,* or John Pollard, *jpollard@vt.edu.*

# New student computer security awareness initiatives

In 2009, 4Help/University Computing Support's (UCS) Special Student Programs continued efforts aimed at increasing the awareness about computing services, software, security, and network policies at Virginia Tech for the

incoming freshmen population of over 5,000 students and their parents.

Under the supervision and direction of Anne Sheppard, manager of Special Student Programs (SSP), four students were hired to assist with two of SSP's important programs—New Student Orientation (NSO) and Get Connected (GC). The student staff members created, filmed, and edited a number of short videos for a NSO computer security presentation. The goal of this effort was to engage students in critical thinking about what constitutes computer misuse and copyright violations. The videos addressed conduct referrals and/or fines to which these behaviors can lead. Information technology vulnerabilities such as viruses, spyware, identity theft, and phishing scams were identified and discussed. Incoming students were provided with information on how to maintain a safe and secure computer and not fall prey to such scams during their tenure at Virginia Tech.

During NSO and GC, emphasis is placed on the many Virginia Tech safeguards in place in order to protect a student's personal information. The steps students themselves need to take to protect their information and to adjust privacy levels of publicly available information on the VT People Search tool are also addressed.

SSP is also responsible for outreach and the marketing of 4Help services and the VTNet software security CD. SSP ensures that each of

the students who attend orientation in July receive a copy of the VTNet CD. Again, creative short videos were developed to quickly grab students' attention so they would be aware of the computer security benefits available to them by running this software on their systems.

The Special Student Programs video library is available at *www.4help.vt.edu/video*. Future plans include making the videos available on Virginia Tech's campus cable TV programming during move-in and posting them on Virginia Tech's *copyright@vt.edu* site.

For more information, contact Anne Sheppard, *ashepard@vt.edu.*

## 10 gigabit Ethernet Data Center network

A critical aspect for high-performance computing, research computing, and virtual computing is the ability to access high-performance storage. In order for access to the storage to be unimpeded, the interconnecting network must support the same performance capacity as the storage. The 10 gigabit Ethernet network provides a common, high-speed network for research computing and other similar systems to access storage.

The intent for the connectivity provided by the

10 gigabit network is within the Data Center itself. The network will serve applications that handle sensitive data—there will be no direct connectivity between this network within the Data Center and external networks.

Although this deployment will serve research and production needs, it remains a pilot implementation in the sense that the network has limited capacity to expand. Equipment was purchased to cover anticipated needs for two to three years, but there is no way to expand the system in its current architecture. This strategy allowed for a minimal initial investment until we really understand the degree to which the service will need to be deployed.

The first 12 connections to the new network were delivered by February 9, 2010. At that time, the initial project was closed, and the system transitioned to normal operations. The number of connections to the 10 gigabit network continues to grow, and it is serving research computing needs.

For more information, contact Eric Brown, *eric.brown@vt.edu.*

## Datacentric Research Computing

The Datacentric Research Computing production environment was initiated to support research projects in various university centers, departments, and institutes—including the Virginia Tech Transportation Institute (VTTI), the Center for Community Security and Resiliency (CCSR), and University Legal Counsel—by providing them with the ability to receive, store, index, and retrieve large volumes of unstructured research data. This project integrated the computing environments provided by the IBM iDataPlex and the Scientific Data Warehouse to support grant initiatives, research activities, and other application needs.

The new environment provides Information Technology with a unique opportunity to assist VTTI with data collection and storage. Additionally, a framework will be built to allow researchers to access and study the data for the next two decades positioning the university to be a major player in the highway safety arena. VTTI has begun to utilize the environment in support of work they are doing for the Strategic Highway Research Program (SHRP) grant. The VTTI project involves data collection at a level of detail and scale not previously possible.

Analysis time and effort required by the Information Technology staff and the Office of

the University Legal Counsel for e-discovery inquiries is reduced. In the longer term, the Datacentric Research Computing environment will be used for real-time data analysis to facilitate both the dispatch of law enforcement personnel and the reaction to emergency events—a major focus for CCSR.

For more information, contact Wanda Baber, *wbaber@vt.edu.*

## Data analytics cluster

Through funding received from the commonwealth's Higher Education Equipment Trust Fund, the Advanced Research Computing group has purchased and is deploying a data analytics cluster to provide general-purpose computing on graphics processing units (GPGPU).

GPGPU provides an extremely high-performance computational environment. In this environment, high-precision mathematics is performed on computer graphics cards. This is the first GPU-based cluster being made available for general research use at the university.


Data analytics cluster

The cluster installation is in progress, and we plan to make the resources generally available during fall semester.

Current discussions with the Virginia Department of Environmental Quality may result in expanding this cluster to support their computational needs.

For more information, contact Tim Rhodes*, rhodes@vt.edu.*

## IBM iDataPlex installation and implementation

Through a strategic partnership with IBM, we received one of the first IBM iDataPlex systems built with Intel Nahelem processors. This system adds another very powerful clustered computing resource provided to Virginia Tech researchers.

This system was deployed to address three computational needs. It provides a Parallel Matlab environment, general clustered computing, and the computational resources used in the VTTI Vehicle Study project.

IBM iData Plex system

Shortly after this system was released to users, the workload has consistently run at close to 100% utilization.

Due to the level of usage and feedback from users, we plan to expand the resources assigned to the Parallel Matlab installation.

For more information, contact Tim Rhodes, *rhodes@vt.edu.*

# Investigating database architectures and infrastructures for large datasets and data warehousing techniques

The goal of this project was to provide test environments for Oracle database administrators within the Datacentric Research Computing Production environment. VTTI personnel and Information Technology's Database and Application Administration (DBAA) team were able to install and test IBM's DB2 database software with applications using large datasets. Data warehousing techniques, including data mining and parallel search strategies, were also tested. The IBM DB2 software is a relational database management suite of software comparable to the Oracle environment.

A workflow application developed at the University of Florida utilizing DB2 was evaluated for possible use at Virginia Tech by the DBAA team. VTTI used the environment to establish a research database in support of their 2000+ vehicle study being conducted as part of phase two of the Strategic Highway Research Program (SHRP2). The IBM data warehousing product

suite known as InfoSphere is also being used to support this project. Large datasets are more difficult and time-consuming to index and search. InfoSphere provides parallel search mechanisms that can speed search and retrieval times.

IBM DB2 was the recommended database architecture for both of these applications and provided a way to compare and contrast DB2 with Oracle. The test environment also allowed an opportunity to gain experience with IBM DB2 database installation and administration.

For more information, contact Wanda Baber, *wbaber@vt.edu.*

# Data Center power systems upgrade

The Data Center, located in the Andrews Information Systems Building, has two 1500 KW power feeds. One of these provides power for a 240 KW uninterruptible power system (UPS) for the Data Center and for other building electrical needs. The second feed provides power for an 800 KW UPS and is mainly used for System X and other research computer systems. With the constant addition of equipment to the Data Center, the power supplied by these two UPS systems is not sufficient for the equipment installations expected in the near future.

The purpose of the power systems upgrade project is to increase the total power available in the Data Center by adding another 1500 KW power feed. This project will result in more raw power with surge protection but will not include a UPS or backup generator. The UPS and generator can be added later when funds are available.

Work has started on the upgrade and will be completed in during the 2010-2011 fiscal year.

For more information, contact Marshall Fisher, *mfisher@vt.edu*.

# Support for university research and innovation

Mark Gardner, network research manager, focuses on network, communications, and computing issues and coordinates Network Infrastructure and Services' efforts in these areas with other research activities on campus. Gardner is working with NI&S personnel, research faculty members, and other Virginia Tech information technology professionals to develop and implement solutions enabling high-performance computer communications and computing projects.

**Virtual computing.** The trend toward low-cost, high-performance, multi-core microprocessors,

coupled with the continued development of virtualization technologies, makes it possible to provide customized virtual computing environments for students and the faculty to use in their educational and scholarly activities. Using their laptop browsers, students will be able to request and connect to a wealth of preconfigured or customized virtual environments having all the tools needed for completing specific class assignments or research projects. In this respect, virtualization can be thought of as the computing equivalent of the television "picture-in-picture" capability.

As a result of the flexibility provided by virtualization, it will appear to each student that they have exclusive use of computing resources even though, in reality, many virtual environments run simultaneously on a single, physical computer. The centralized management of computing resources is likely to improve service reliability and may reduce costs to departments and colleges by decreasing the amount of hardware needed and by allowing better utilization of software licenses. It may also result in lower space requirements in computer labs.

Meetings were held this year with faculty members on campus to explain virtual computing and identify courses or laboratories that would be good candidates for virtualization. Godmar Back of the Computer Science department utilized a prototype

infrastructure for a class he taught on computer system administration. He is planning to teach the course again using virtualization in the fall.

A team co-led by William Dougherty and Gardner has continued to deploy virtual machines to support important computing services for the campus. A large number of production services have been virtualized over the past year. Procedures and policies are being developed that will allow for the transition of server virtualization to a production service. The goal is to provide an easy-to-use method to request virtualized servers and to enable, as much as possible, self-service by the requestor.

Virtualization has also been a vehicle for providing students with research experience. Gardner, along with Wu Feng from the Computer Science department, obtained a grant to fund four undergraduate students to investigate issues surrounding the use of virtual machines in education: Wu Feng, Mark Gardner, Annette Feng, Michelle Datoc, Scott Fernandez, William Gomez, and Gabriel Martinez, "Virtual Ecosystems for K-12 Pedagogy in Science, Technology, Engineering, and Mathematics," CREU/CRA-W grant (awarded Fall 2009). This effort follows up on work on virtual machine performance which resulted in an ACM Best Undergraduate Poster Award: Gabriel Martinez, Mark Gardner, and Wu Feng, "Characterizing and Optimizing Virtualization Overhead for Portable High-

Performance Networking," ACM Best Undergraduate Student Poster at ACM/IEEE SC|08: The International Conference on High-Performance Computing, Networking, Storage, and Analysis (Supercomputing 2008).

In addition to Gabriel Martinez and William Gomez, undergraduates Adam Herr, Drew Budwin, and David Mazary assisted in developing techniques for using virtual machines to make the task of deploying the Storytelling Alice environment—used for teaching computer programming—easier for elementary and middle school teachers: Mark K. Gardner, Adam Herr, David Mazary, Heshan Lin, Thomas Scogland, and Wu Feng, "A Flexible and Extensible Framework for Delivering Designer Images for K-12 Pedagogy," Third International Conference on the Virtual Computing Initiative (ICVCI-3), Research Triangle Park NC, October 22-23, 2009. A full paper on the work is to appear in the proceedings a top computer science education conference this summer: Mark Gardner and Wu Feng, "Broadening Accessibility to Computer Science for K-12 Education," 15th Annual Conference on Innovation and Technology in Computer Science Education (ITiCSE 2010), Bilkent, Ankara, Turkey, June 26-30, 2010.

As part of disseminating the benefits of virtualization to a wider audience, Gardner gave a presentation on the use of cloud computing and virtualization at the Cloud Computing for

Education Forum: Mark K. Gardner and Wu Feng, "Cloud Computing at Virginia Tech and K-12 Outreach," Cloud Computing for Education Forum, SUNY Binghamton, Binghamton NY, April 22-23, 2010.

The key personnel associated with the virtualization project are Mark K. Gardner, William Dougherty, and Wu Feng, with assistance from many others.

**PlanetLab.** The PlanetLab project, *www.planet-lab.org*, is a worldwide collaborative effort to provide an infrastructure to perform networking-related research in computing systems and applications. It is often viewed as a test bed for the development of the "Internet of tomorrow." Participating institutions provide resources that are centrally managed by personnel at Princeton University. Virginia Tech researchers acquire an account locally and are able to do their research using over 800 nodes at nearly 400 sites around the world by utilizing a "slice" of the infrastructure. A "slice" consists of a set of virtual machines running on PlanetLab nodes connected by an overlay on top of the Internet.

As an example of the kinds of research being run on PlanetLab, Yipan Deng and Wu Feng are investigating "the difference in bandwidth and transfer times between two types of TCP implementations." Last year, Ali Butt of the Department of Computer Science obtained a

National Science Foundation (NSF) Faculty Early Career Development (CAREER) award utilizing the PlanetLab infrastructure for his work entitled, "A Scalable Hierarchical Framework for High-Performance Data Storage," resulting in the publication of a number of important papers.

The personnel associated with the PlanetLab project are Mark K. Gardner and Bill Marmagas at Virginia Tech, as well as the PlanetLab crew throughout the world. Kevin Shinpaugh and William Dougherty dedicate resources to administer the day-to-day operations of the machines.

**Advanced networking**. The primary goals of the advanced networking area have been to identify research topics, seek funding, and mentor students.

Over the past year, a way to improve the TCP/IP protocol suite was identified. The TCP/IP protocol suite forms the basis for the Internet upon which much of modern communications depends. At the time the protocols were being developed, computers were massive machines filling large rooms. Assumptions—such as each machine would only have one interface to a given network and hence could be referred to by their network address—allowed simplifications that are no longer valid in this world of ubiquitous, networked, mobile devices. Many of our devices today contain

connections to multiple networks. For example, contemporary cell phones, such as the Apple iPhone, can utilize WiFi connections for voice or data communications in addition to the traditional cellular networks. As a result of the tight coupling between a device and its address on a particular network, communications in process when the device switches from one network to another are disconnected causing a disruption of service that is noticeable to users.

We decided to create an abstraction of communication, called a "session" that will enable migration from one network to another without disrupting an ongoing conversation. The work is funded under a joint collaboration with Juniper Networks: Colin Constable, Barnaby Crahan, and Mark Gardner, "Towards a Session Layer for the TCP/IP Protocol Suite," awarded January 2010.

Personnel associated with this project are Mark K. Gardner, Eric Brown, Umar Kalim, and Carl Harris at Virginia Tech, as well as Colin Constable, Barnaby Crahan, and others at Juniper Networks.

**High-end computing**. Theory, experimentation, and computation are the three legs upon which the modern scientific method depends. The goal of NI&S work in high-end computing is to ensure computing resources sufficient to meet the needs of university researchers are readily available.

One challenge for high-end computing is how much a scientist needs to know in order to effectively utilize supercomputers. Not only must scientists compile and test their program on the system, but they must learn and create a job-submission script that directly exposes the idiosyncrasies of running on a particular supercomputer. Each supercomputer site requires subtly different scripts be written, even if they utilize the same batch-queuing system. For supercomputer resources to be effectively used by the broader academic community, the process of submitting computational jobs and receiving results must be made more user-friendly. We proposed creating a user-friendly, Web-based system for interacting with supercomputers that eliminates arcane details: Wu-chun Feng, Pavan Balaji, Mark Gardner, Danesh Tafti, and Keith Bisset, "NSF SDCI HPC: EcoPower: Empowering End Users with an Easy-to-Use (and Green) Cyberinfrastructure Ecosystem." In addition, the proposed work will incorporate recent techniques for power management for supercomputers, while automating their use, to make it straightforward for users to adjust computation speed and power consumption to save energy.

For more information, contact Mark Gardner, *mkg@vt.edu*.

# Virtualizing computer systems and applications

In an effort to extend the life of our existing Data Center facilities and to keep pace with the information technology industry direction, we are working on a phased implementation of virtualizing computing systems. By "virtualizing"—making the application and service less dependent on a specific physical host—and consolidating the computing environment, resource utilization rates rise overall, and total infrastructure costs are reduced. The virtualization process allows us to procure and install high-performance computing resources while expanding research and administrative computing applications with reduced impact on electrical power resources and physical infrastructure.

This approach to system and application deployment reduces physical space requirements, power consumption, and cooling needs required for traditional physical system deployment. In addition, virtualization provides improvements in system and application management and availability.

We currently have 110 systems operating in our virtualized environment. These systems provide services that range from Windows infrastructure to Banner application servers to research computational systems.

We have completed the project-oriented testing as well as the initial phase of the implementation and have moved virtual system deployment into our standard operational procedures.

For more information, contact Tim Rhodes, *rhodes@vt.edu.*

## Network Infrastructure and Services virtualization

The Systems Development and Administration team firmly established its move toward virtualization this year, moving 10 systems to the centrally managed Information Technology virtualization environment in the Data Center. Applications moved to these virtual servers include test environments for route servers, FreeRadius, TACACS, Oracle, camera systems, and BMC Remedy. Production applications include syslog, NetworkVirginia management, and some DNS.

Additionally, three systems have been deployed to a locally managed virtual environment. Those applications are *cola.cns.vt.edu* (test and production) and JasperServer.

For more information, contact Morgan Allen, *allenm@vt.edu.*

## ICTAS II Cat 6A pilot

Field Engineering (FE) frequently evaluates new cabling and termination products. In the spring of 2010, with assistance from the NI&S Research and Development group, FE installed a Cat 6A test bed. The purpose of the test bed was to evaluate a cost-effective solution for next-generation, station cabling capable of supporting 10gigabit connectivity.

The test bed was set up to simulate a worst-case scenario for alien crosstalk using unshielded twisted pair (UTP) products. Alien crosstalk is induced signal (noise) from one cable to adjacent cables. This effect is especially common at higher data rates. The test bed was configured with six disturber cables surrounding one victim cable. We installed four cable/connector scenarios where each group of seven cables was terminated with specific connectors and termination blocks. We asked Fluke Networks to participate in the test bed.



Cat 6A test bed

Fluke Networks was an enthusiastic partner; they demonstrated the testing methods and shared the test results with us. From these results, we were able to select the most cost-effective, best-performing, cable/connectivity combination. This work also served as an excellent training exercise for our field technicians.

The products selected from the test bed are now being installed in the Institute for Critical Technology and Applied Science II (ICTAS II) building now being constructed. During this installation, we are continuing our evaluation of these products as they relate to ease of placement, ease of termination, and cable pathway capacity (conduits and cable trays). If the product selection for ICTAS II proves to be cost-effective and reliable, it is very likely to become our standard for upcoming administrative and academic capital projects.

For more information, contact Doug Jones, *jonesd@vt.edu*.

## Regional initiatives

**Mid-Atlantic Terascale Partnership.** The Mid-Atlantic Terascale Partnership (MATP) is a consortium of research institutions in Virginia, Maryland, and the District of Columbia. MATP provides aggregated access for member institutions to the National LambdaRail and to multiple other high-performance national and global networks. MATP also provides a forum for collaboration in high-performance networking and computing for regional universities. A representative from the NI&S Strategic Initiative Group serves as Program Director for MATP as well as the mid-Atlantic Administrative Representative for National LambdaRail. MATP representatives meet three times per year.

**New River Valley Multimedia Services Access Point.** The Multimedia Services Access Point (MSAP) concept was created by Virginia Tech as an evolutionary component of the Blacksburg Electronic Village program. The original MSAP provided a community exchange among service providers, anchor institutions, residential providers, and local government to keep local traffic local. In fall 2008, Virginia Tech partnered with New River Community College and Radford University to create a next-generation version of the MSAP centrally located in Montgomery County adjacent to the New River Valley Mall (NRV). The updated MSAP provides a regional, optical exchange facility to enable high-performance connectivity among participants and to support peering among an array of service providers and other entities.

A key benefit of the new MSAP model is the capability to provide a virtual representation of the NatCap, tier-one, access facility operated by Virginia Tech in the National Capital area. The NRV MSAP is tied to NatCap with an extremely high-capacity, optical link operated by Virginia Tech. Services available at NatCap—including direct access to National LambdaRail and Internet2—are made available at the NRV MSAP facility. This provides relatively low-cost, high-performance access to these specialized networks for local participants. Effectively, the MSAP brings the capabilities of National LambdaRail to the New River Valley.

The MSAP also supports advanced service



CNS meet point with Radford University and New River Community College

features. For example, Citizens Telephone Cooperative of Floyd and Virginia Tech are experimenting with IPv6 peering through the MSAP.

The NRV MSAP was co-sponsored by Virginia Tech, Radford University, and New River Community College. It is operated by the NI&S Virginia Tech Operations Center.

For more information, contact Jeff Crowder, *crowder@vt.edu.*

# National Capital Region initiatives

**National Capital Region Aggregation Facility.**
Virginia Tech operates the National Capital Region (NatCap) Aggregation Facility to provide a high-performance, research and education network aggregation and exchange point for institutions located in the mid-Atlantic region. NatCap evolved from the NetworkVirginia

gigaPOP created by Virginia Tech in 1996 with the aid of a National Science Foundation (NSF) grant. The objectives at that time were to provide aggregated access to the NSF's vBNS network and the early Internet2 network.

An ongoing goal for NatCap is to provide extremely high-capacity, gateway access to regional, national, and international research networks and global Internet content in order to enhance the research competitiveness and educational effectiveness of regional institutions. A second goal is to maximize the benefit/cost ratio through efficient and effective fiscal and technical management.

NatCap is managed by the Virginia Tech Operations Center under the direction of the NI&S Strategic Initiatives group. NatCap sustained reliable, high-performance operation during the 2009 fiscal year with availability exceeding 99.999 percent.

NatCap's primary node is located in McLean, Virginia, in a strategic location with proximity to several national network access points. NatCap currently provides gateway access to the following major networks and services:

- National LambdaRail
- Internet2
- United States Department of Energy ESnet
- NASA Research and Education Network
- Mid-Atlantic Crossroads
- NetworkVirginia
- Commodity Internet Service (including commercial services)
- National TransitRail

A major milestone was achieved in the 2009 fiscal year with the addition of a second NatCap node located at Equinix in Ashburn, Virginia. The Equinix facility is a major, commercial Internet exchange. This NatCap node provides direct access to virtually every major Internet service provider, content providers, cloud computing providers, and other resources.
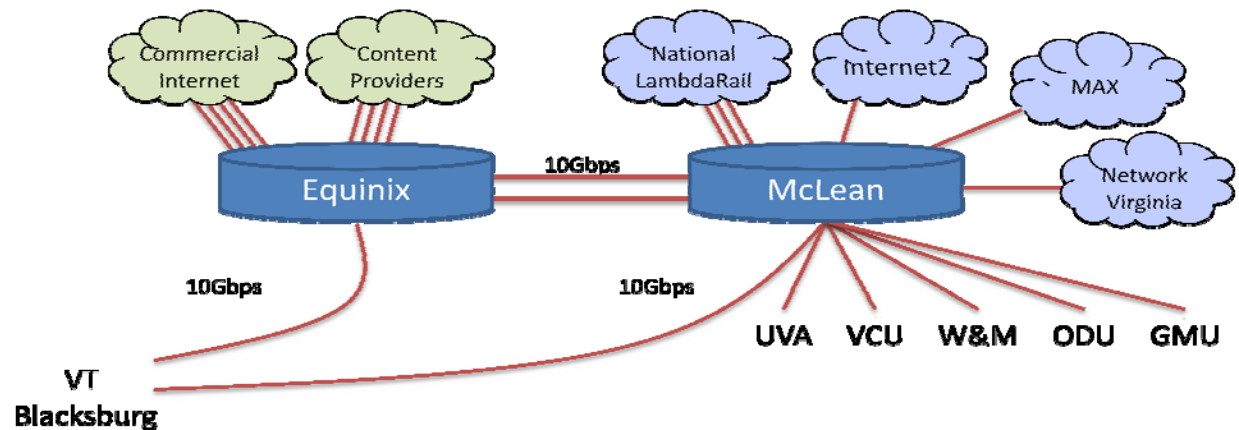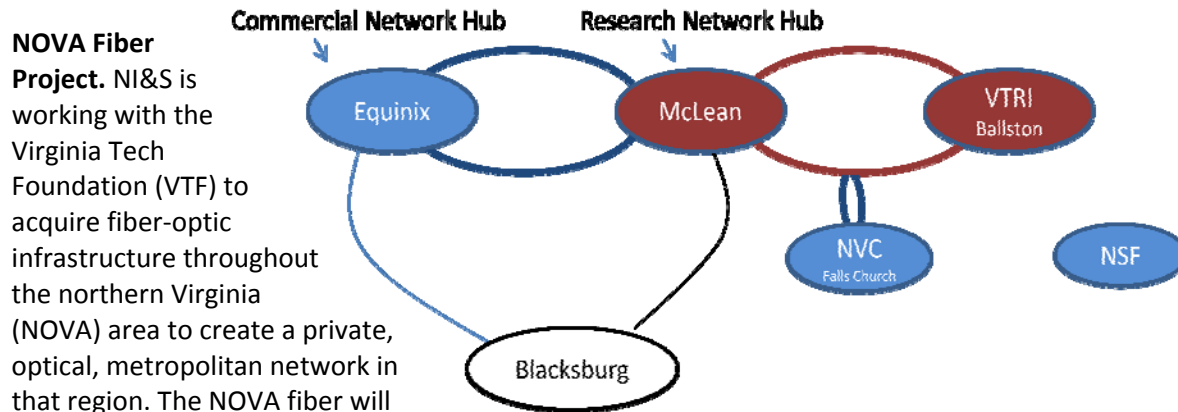
More than 800 universities, colleges, schools, and research labs throughout the mid-Atlantic region are served by the NatCap facility. Several research universities, including Virginia Tech, maintain dedicated 10Gbps links through agreements negotiated by NI&S. These links place those universities on par with the best-connected institutions worldwide.

**NOVA Fiber Project.** NI&S is working with the Virginia Tech Foundation (VTF) to acquire fiber-optic infrastructure throughout the northern Virginia (NOVA) area to create a private, optical, metropolitan network in that region. The NOVA fiber will interconnect several strategic resources including the NatCap aggregation nodes at Equinix and McLean, the Northern Virginia Center, and Virginia Tech's new research center now under construction in Ballston, Virginia.
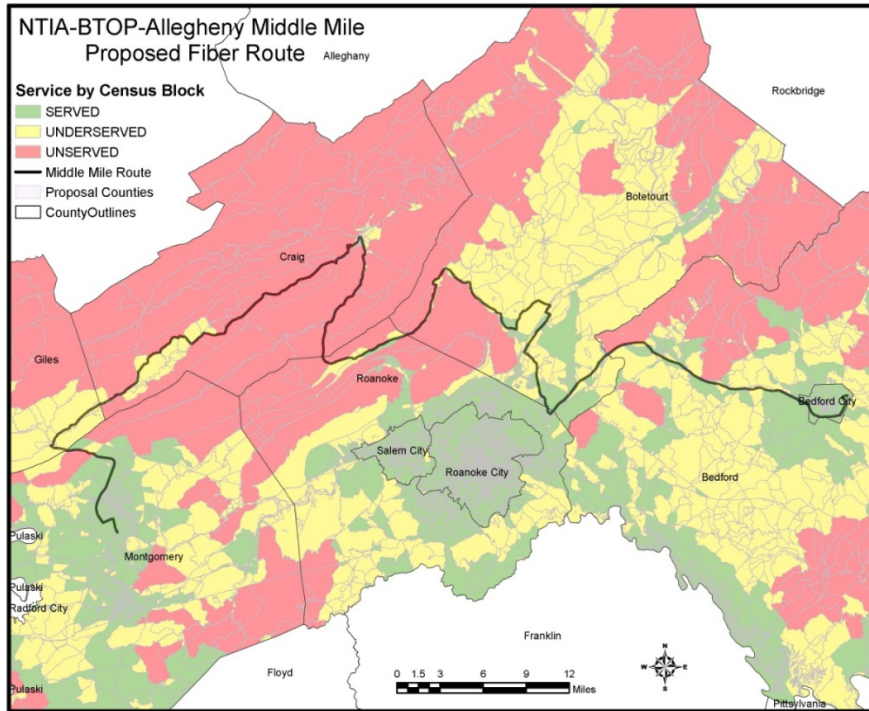
The VTF will hold the fiber, indefeasible right to use agreements and will enter into a licensing agreement with NI&S. NI&S will light the fiber with a high-performance network system. Once in place, the network will provide Virginia Tech with virtually unlimited capacity to and among these resources. The university will gain control

over escalating costs for upgrades over the life of the network and will realize strategic opportunities for partnerships with third parties.

For more information, contact Jeff Crowder, *crowder@vt.edu*.



## Allegheny Fiber—Broadband Technologies Opportunity Program grant

In February 2010, the Virginia Tech Foundation was awarded a grant from the U.S. Department of Commerce Broadband Technologies Opportunities Program (BTOP) to extend Virginia's open-access, fiber-optic backbone into the central Appalachian region of the state. The principal investigator for the grant proposal

was a member of the NI&S Strategic Initiatives team. On contract to the VTF, NI&S designed the project, developed strategy for the grant application, wrote the proposal, pulled together project partners, managed the exhaustive due-diligence process, and is overseeing all post-award reporting and compliance activities.

The VTF served as the applicant and provided financing for a $1.385 million cash-match to meet the 20 percent match-eligibility requirement for the National Telecommunications and Information Administration (NTIA) program. The total project budget is $6.925 million, with $5.54 million provided from federal grant assistance.

Over the last decade, Virginia has invested funds from the tobacco indemnification settlement and federal funding sources to build high-performance, fiber-optic networks throughout the rural, tobacco-growing regions in the Southside and Southwest areas of the commonwealth. The grant will enable extension of the network outside the tobacco region. The new path will add 108 miles of fiber to the system beginning at an existing node in Bedford and stretching through Bedford, Roanoke, Botetourt, Craig, Giles, and Montgomery counties to reach Blacksburg and Virginia Tech. Engineering is already underway, and construction will begin on the new fiber path during the summer of 2010.

NTIA-BTOP-Allegheny Middle Mile
Proposed Fiber Route  Alleghany

Service by Census Block
- SERVED
- UNDERSERVED
- UNSERVED
- Middle Mile Route
- Proposal Counties
- CountyOutlines

performance national and international networks required for large-scale science and engineering research.

The MBC partnered with VTF to develop the proposal and will help to build and operate the network, which is expected to become part of MBC's system. MBC is a non-profit entity created to build and operate the Tobacco Commission-funded fiber network in Southside Virginia. MBC has already constructed more than 800 miles of fiber blanketing the region and a long-haul network connecting Southside to major metropolitan areas in Washington and Atlanta. MBC operates as an open-access, wholesale provider enabling multiple fiber-optic and telecommunications providers to deliver services to customers.

The fiber will bring sorely needed optical infrastructure to several underserved and unserved communities. It will put the resources of Virginia Tech "on-net" for the entire Mid-Atlantic Broadband Cooperative (MBC) system adding significant value to the network through broadband-enabled research, education, and public service. Virginia Tech will use the fiber to enhance research, development, public safety, health care, and education programs throughout the region. The university also plans to use the fiber to improve access to high-

For more information, contact Jeff Crowder, *crowder@vt.edu*.

## Contract for NTIA grant administration

Network Infrastructure and Services and the Mid-Atlantic Broadband Cooperative partnered to win a combined $21.5 million in grant funds from the U.S. Department of Commerce Broadband Technologies Opportunities Program. BTOP funding is administered by the NTIA. The BTOP project will extend open-access, fiber infrastructure throughout rural Virginia including a new link from Blacksburg to Bedford. The Virginia Tech Foundation provided matching funds and is designated as the award recipient for the Blacksburg-to-Bedford portion of the link.

The BTOP program is an element of the American Reinvestment and Recovery Act (ARRA), which mandates heightened levels of accountability and transparency for the expenditure of federal funds. Recipients face unprecedented reporting, compliance, and audit requirements which the Virginia Tech Foundation was not prepared to take on. Since the BTOP program does not allow indirect costs, grant administration presented a significant, unfunded challenge.

NI&S stepped forward to offer considerable project and business management expertise in an innovative, multi-party, contract relationship with VTF and MBC. In exchange for use of a small portion of the fiber for the benefit of the university, NI&S is providing oversight and administration of MBC's implementation of the project on behalf of VTF. This arrangement solves the administrative challenge for VTF and effectively puts Virginia Tech "on-net" for the BTOP fiber projects dramatically increasing the value of that investment for the university and for the communities it will serve.

Under the leadership of Pat Rodgers, director for business technologies, and Roy Smith, director for operations, NI&S undertook specialized training to become familiar with ARRA administration requirements and implemented the oversight, monitoring, and compliance program with MBC. The first quarterly reports for the BTOP grant were completed and submitted ahead of schedule, and the complex fiber construction project is progressing as planned.

As Virginia Tech pushes to expand federal and private sector contract and grant revenues, the expertise being developed within NI&S will be available to enhance the competitiveness and effectiveness of the university and our affiliates.

For more information, contact Jeff Crowder, *crowder@vt.edu.*

## The Quilt

Virginia Tech is a member of an association of advanced regional networks based in Seattle, Washington, called "The Quilt." Participants come from the advanced research and education network community and draw on the experience of fellow members in developing and operating leading-edge networks. Building on best practices, the coalition attempts to influence the national networking agenda and promote networking services at the lowest possible cost.

The NetworkVirginia Program Director, Richard Hach, is a member of the Quilt Inc. board of directors representing Virginia Tech and those who participate on NetworkVirginia. One way the Quilt supports its members is through business agreements providing advanced technology and best value from the participating vendors. Through a request for proposal process, the Quilt Commodity Internet Services group completed its sixth national review of Internet service providers. Later this year, as part of the RFP process, Quilt participants should be able to take advantage of advanced network services at reduced cost.

For more information, contact Richard Hach, *rhach@vt.edu.*

## National Capital Region research facility

NI&S has continued to advise and consult with the university team and the contracted architects and engineers designing a new, research-based, Virginia Tech Foundation-owned facility being built in Ballston, Virginia. This facility is located near major, federal, research facilities and is an integral component of Virginia Tech's strategic plan to increase research grants awarded to the university.

NI&S personnel have acted as consultants to the university team designing the facility. We have provided specifications for structured inside plant, cabling systems, and related infrastructure capable of providing gigabit Ethernet service to the desktop. We have also specified infrastructure to provision physically diverse, outside fiber connectivity to link the facility to high-speed research networks and the Internet using diverse routes to ensure external connectivity is not disrupted as a result of any incident that cuts one of the fiber paths.

In addition, NI&S has worked closely with the facility's information technology team to plan a unified communications (UC) solution capable of meeting the fixed and mobile telephony, messaging, desktop video, and collaboration requirements of the faculty, the staff, and researchers assigned to the facility. The solution

will integrate with the UC solution planned for the main campus in Blacksburg to facilitate rich and robust communications and collaboration experiences for Virginia Tech affiliates in the National Capital Region.

We have offered our services to facilitate establishing a contract for Internet/research network connectivity and to provide oversight, inspection, and testing of contractor-installed, inside plant cabling systems to ensure that the systems are properly installed.

The new research facility is expected to be occupied in the spring of 2011.

For more information, contact John Pollard, *jpollard@vt.edu*.

## NetworkVirginia initiatives

NetworkVirginia is an outreach program of Virginia Tech to promote early access to advanced network technology and services throughout Virginia. The goal is to improve the quality of life and enhance economic competitiveness. It supports a wide range of needs from leveling the playing field in rural and underserved communities to providing the world's most advanced research network infrastructure for regional universities and labs. Scientists, educators, economic developers, government, regulators, and businesses have all used NetworkVirginia to meet their communication needs. Promoting equitable access to broadband, particularly in rural communities, NetworkVirginia serves an estimated 1.4 million Virginians 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.

Since 1996, the services under NetworkVirginia have continually been updated to offer the latest access technologies, applications support, and network capacity at the lowest possible prices. This year, Addendum Number 23 to the NetworkVirginia agreement with Verizon Business was successfully completed to improve the pricing of Ethernet services. This modification assisted schools and libraries making purchasing decisions in connection with the E-rate funding process. Addendum Number 24 to the agreement with Verizon Business was successfully negotiated as well in order to clarify the effective rates for an ordering party when a term agreement ends.

In connection with universal service funding for rural health care support, we successfully completed work with the University of Virginia's Office of Telemedicine, Verizon Business, and Sprint to improve the price performance of NetworkVirginia service to 20 rural health care locations.

For more information, contact Richard Hach, *rhach@vt.edu*.

## Center for Creative Technologies in the Arts

This year, NI&S has continued to be very involved in the Arts Initiative at Virginia Tech with particular focus on the Center for Creative Technologies in the Arts (CCTA).

In a split appointment, Bill Sanders served as the director of the Blacksburg Electronic Village and as the interim director of the Center for Creative Technologies. He describes the CCTA as follows:

> The Center for Creative Technologies in the Arts will be an applied research laboratory operating across disciplines and at the intersection of the arts, education, and technology. It will design and develop new learning environments, models, methods, and materials in direct collaboration with teachers in PK-12 schools. The resulting collaborative products and experiences—many of which will be available in digital formats—will be available across the commonwealth. Such an approach—integrating the arts and technology with education based on both research and

the practical experiences of top public school educators—will help increase student engagement and retention rates, enhance creativity, sharpen critical thinking skills, improve learning and performance on SOLs, and help Virginia to better prepare, within its own communities, the creative workforce necessary for productive entrepreneurship and participation in an increasingly technology-based global economy.

The split appointment arrangement was designed to more directly leverage the university's centralized investments in technology and infrastructure for the benefit of the Arts Initiative and related academic programs.

John Pollard serves on the Arts Initiative Building Committee as a representative from NI&S and is assisting with some of the logistics required to support programs in transition. For example, in addition to being certain that specifications for conduit and cabling are sufficient to support creative technology in the arts, Video/Broadcast Services has been very involved in consulting with and assisting the Communications Department and the Office of the Provost in making potential alternative arrangements for the teaching of television and studio-related communications classes during the time when current facilities in Shultz Hall are unavailable due to construction. Video/Broadcast Services has also been working

with the consultants planning the audio/visual infrastructure in the facility to ensure it is designed to the highest possible standards and will be capable of supporting the innovative programs envisioned for the CCTA and the large performance hall in the facility.

In support of the CCTA program development, NI&S and other Information Technology staff members are engaged as needed to address the technological implications of arts-related facilities, proposals, projects, or programs. Examples of this involvement include the following:

- NI&S technical consulting (mentioned above)
- Design and installation of network infrastructure for the Creative Technologies Gallery in Kent Square in downtown Blacksburg
- The inaugural and highly successful Faculty Development Institute course on creative technologies
- Participation from NI&S and Learning Technologies with the faculty members serving on the CCTA Working Group
- Consultations with the VT-STEM (science, technology, engineering, and math education) coordinator preparing a grant project to provide statewide network access to a potential repository of online materials at Virginia Tech

The CCTA—clearly a technology-based embodiment of the Virginia Tech land-grant mission—will require the statewide infrastructure that NI&S (and Information Technology in general) is continually working to develop. To that end, NI&S resources—whether related to infrastructure and technology per se, technical planning, or business planning/development/execution—are becoming more directly engaged in this presidential initiative and are acknowledged by university leaders as critical to its success. We should expect increasing demand for Information Technology-related engagement and partnership as the university's arts initiatives move forward in the coming years.

For more information, contact John Pollard, *jpollard@vt.edu.*

## Virginia Tech/Carilion collaboration

This year, we consulted with university leaders, Carilion, and the newly hired Virginia Tech faculty and staff members who will be working at the Virginia Tech Carilion School of Medicine and Research Institute (VTCRI) in Roanoke. The VTCRI facility is adjacent to the Carilion Roanoke Medical Hospital. The goal of our collaboration was to determine how to best coordinate with Carilion's information

technology team to provide telecommunications services and support to the faculty and staff working at the newly established VTCRI.

Research conducted at the VTCRI creates a bridge between basic science research at Virginia Tech and clinical expertise at Carilion Clinic and increases translational research opportunities for both partners. Research conducted by scientists at the institute is aimed at understanding the molecular basis for health and disease, as well as the development of diagnostic tools, treatments, and therapies that will contribute to the prevention and solution of existing and emerging problems in contemporary medicine. Research areas of emphasis that align with areas of strength and active research at Virginia Tech include inflammation, infectious disease, neuroscience, and cardiovascular science and cardiology.

Carilion's information technology organization will install and manage the local area network at the VTCRI. NI&S will install and manage very high-speed network connections between the VTCRI and the main campus in Blacksburg. NI&S will provide help desk and technical support, coordinating with Carilion information technology, as required, to resolve any technical issues. The VTCRI will have high-speed access to all network-based resources and services available to employees in Blacksburg. In addition, VTCRI will have access to our very

high-speed network connections to national and international research networks and to the commodity Internet.

For more information, contact John Pollard, *jpollard@vt.edu.*

# Unified Communications request for proposal

Network Infrastructure and Services (NI&S) is planning for a transition to a new unified communications (UC) system. The new system will provide the foundation for integrating real-time communication services like instant messaging, chat, telephony, and desktop videoconferencing with other non-real-time communications services like e-mail, voicemail, and fax. The UC system will be designed in support of NI&S' vision to create an information technology environment that enhances learning, discovery, and collaboration.

A request for proposal has been developed to establish contracts with technology partners to plan, design, and implement a UC solution for Virginia Tech affiliates on the main university campus in Blacksburg and throughout the Commonwealth of Virginia. The UC project will be designed to gradually migrate subscribers from the legacy campus telephone system to one that is better suited to meet the

communication requirements of today's faculty and staff members, and students.

NI&S will work to evaluate solutions from industry-leading technology vendors and system integrators to develop a UC solution that provides Virginia Tech affiliates with a robust set of features and capabilities while maintaining established service-availability expectations.

For more information, contact Joe Hutson, *joe.hutson@vt.edu.*

# Google services for alumni

In the fall of 2009, Information Technology—in conjunction with the Alumni Association—deployed Virginia Tech Google Services to alumni of the university.

The goals of the project were to increase the size of each user's mailbox, increase service levels to our alumni users (in addition to e-mail functionality), reduce the costs of supporting an e-mail system, migrate all users prior to June 30, 2010 to avoid software license fee increases, and provide Virginia Tech alumni with the continued ability to use the @vt.edu domain for their e-mail address.

After several months of reviewing the alternatives, the university selected Google. A year-long project followed as we worked to seamlessly integrate the Virginia Tech Google Services offering into our existing environment. Students, upon becoming alumni, are automatically given the option of transitioning to the Virginia Tech Google Services account. They have the opportunity to move any e-mail they might want to save from their existing student account. If they elect not to get an alumni e-mail account initially, they can do so at any time in the future.

All alumni are welcome to register for an e-mail address using the Google service.

Approximately 67,000 alumni were notified about the new service, and over 24,000 have opened alumni e-mail accounts. The accounts have been accessed from 163 different countries on every continent except Antarctica. The top countries from which the service has been used include the following:

1. United States
2. Germany
3. Japan
4. Canada
5. France
6. United Kingdom
7. South Korea
8. India
9. Australia
10. Italy
11. Netherlands
12. Hong Kong
13. Turkey
14. Spain
15. Thailand
16. Hungary
17. Saint Kitts and Nevis
18. Switzerland
19. Egypt
20. United Arab Emirates

The goals of the project have been met. Google is available at no charge and has no software requirements. The limit on the size of each mailbox is 10 GB—greater than what could be offered on the Virginia Tech e-mail system. Cost savings realized on software license fees are in excess of $200,000 per year. Users were migrated by the end of March, well before the goal of June 30th. Each user can continue to use the *@vt.edu* e-mail address. Users are provided with an increased service level, in the form of a full online collaboration suite with e-mail, document storage and editing, and calendaring. The document service allows for storage of any file online and allows editing of Word documents, spreadsheets, presentations, and line drawings. In addition, users have access to Google Talk, Web hosting, and personalized home pages. A virus scanning/spam filter is included. Virginia Tech continues to offer new services via this platform, including tools for graphics and audio editing, trip planning, to do

list/project management, and contact list administration. All of these services are offered without charge to alumni.

For more information, contact Ron Jarrell, *jarrell@vt.edu.*

## Local Multipoint Distribution Service

The Virginia Tech Foundation acquired four Federal Communications Commission (FCC) A Block Local Multipoint Distribution Service (LMDS) licenses in June 1998. In the United States, LMDS is a wireless data service that uses licensed frequencies in the 27.5 GHz to 31.3 GHz range of the electromagnetic spectrum. Virginia Tech manages the use of the licensed spectrum through an operating license and lease agreement between the Foundation and the university. The licenses may be renewed every 10 years, if FCC conditions are met. Since the availability of LMDS equipment required to deploy competitive market services has been slow to develop, the FCC granted an extension of the initial 10-year deadline for meeting "substantial service" requirements until June 1, 2012.

LMDS service can be used for point-to-point and point-to-multipoint broadband data links. Equipment is available to support throughput

speeds up to 400 megabits per second. Line-of-sight distances up to several miles may be supported. The A Block spectrum license provides 850 MHz of contiguous bandwidth, which could potentially support much higher data speeds in the future.

The Virginia Tech licenses cover most of Southwest Virginia as well as parts of North Carolina and Tennessee. The license areas include the Roanoke, Martinsville, Danville, and Bristol Basic Trading Areas (BTAs), which cover an area of 16,000 square miles and are home to about 1.6 million citizens.

Virginia Tech's LMDS objectives are to leverage the spectrum for wireless technology research and to promote rural broadband infrastructure development. The spectrum has been used in several research and outreach areas. In 1998, the university led the creation of the LMDS Research Consortium which brought together licensees, equipment manufacturers, and research laboratories to develop and promote LMDS technology. The university's wireless research groups *(www.wireless.vt.edu)* have conducted research sponsored by an array of military, federal, and commercial affiliates including the National Science Foundation, the

National Security Administration, the Defense Advanced Research Projects Agency, the U.S. Customs Service, Boeing, Lockheed Martin, Hughes, ITT, and others. Other groups at Virginia Tech, including the Space and Wireless Business Center, the Blacksburg Electronic Village, and eCorridors have used LMDS for research and outreach programs.

In addition to research, Virginia Tech has engaged in multiple test bed and commercial build-out projects. In 1999, Virginia Tech constructed one of the first rural point-to-multipoint LMDS systems—a test bed in association with WavTrace and Harris Corporation. The test bed, located in Blacksburg, supported multimedia applications including Web-based video, weather data instrumentation, and remote office access at multi-megabit per second speeds.



LMDS BTAs (Basic Trading Areas)
- Bristol
- Danville
- Martinsville
- Roanoke
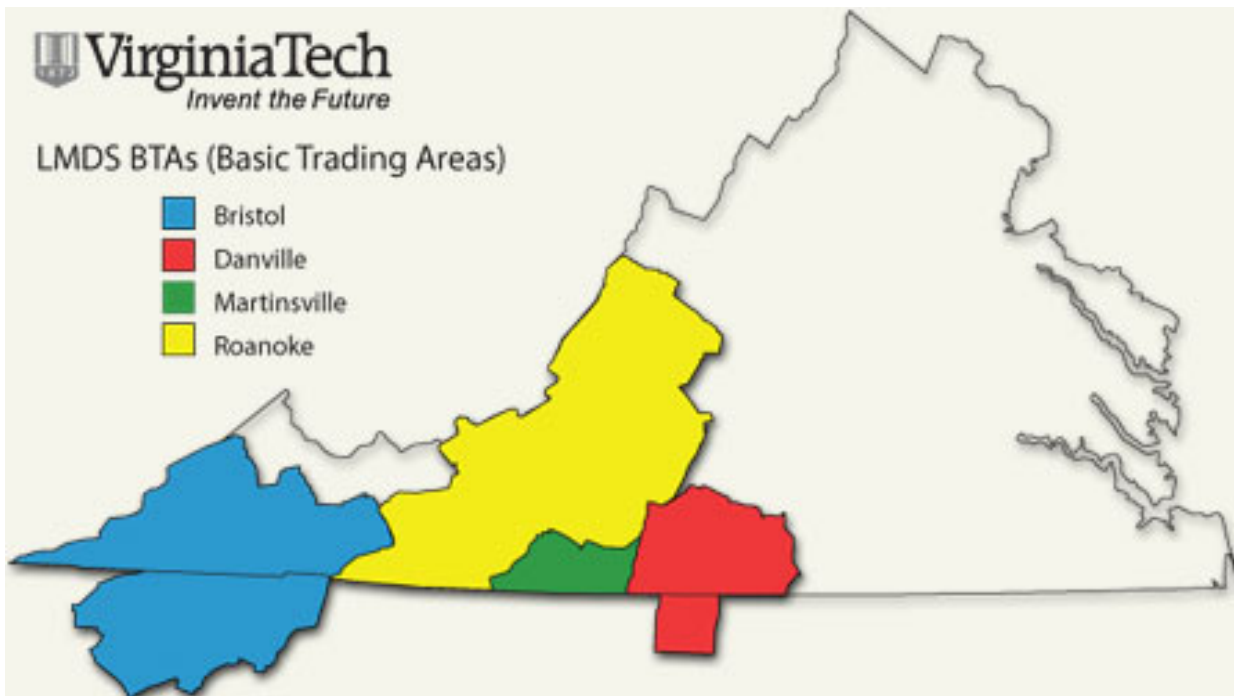


Harris-WavTrace LMDS multipoint nub deployed at Virginia Tech

In 2001, the university entered into an agreement to lease a portion of the spectrum in the Roanoke BTA to a wireless network service provider exploring the use of Radiant Network's LMDS mesh wireless technology for commercial and residential service. The project was discontinued a few years later when Radiant ceased product development.

In 2008, Virginia Tech began developing an LMDS service project to assist entities in the implementation of high-speed Internet protocol (IP) backbone links for on- and off-campus applications. The service may be particularly beneficial for sites that do not have affordable access to local broadband transport or for those that need diverse, redundant routes for disaster avoidance. Virginia Tech partnered with XO Communications—one of the largest holders of LMDS spectrum in the United States—for selection of the initial LMDS equipment to be used for the project. LMDS equipment from Ceragon Networks was selected for our project. It supports an Ethernet link with up to 400 Mbps throughput. Throughput can be doubled by adding a second radio module. The equipment can automatically adapt its modulation method to maintain maximum performance during periods of signal degradation.

In June 2008, two LMDS point-to-point links were installed in the Roanoke BTA serving the Virginia Tech campus. A third link on campus is to be completed during summer 2010. In addition, three links are planned for the Bristol BTA and one for the Martinsville BTA during this summer. Installations are in progress in the Bristol BTA. In March 2010, a demonstration link was installed in the Danville BTA, and a more permanent link is planned.
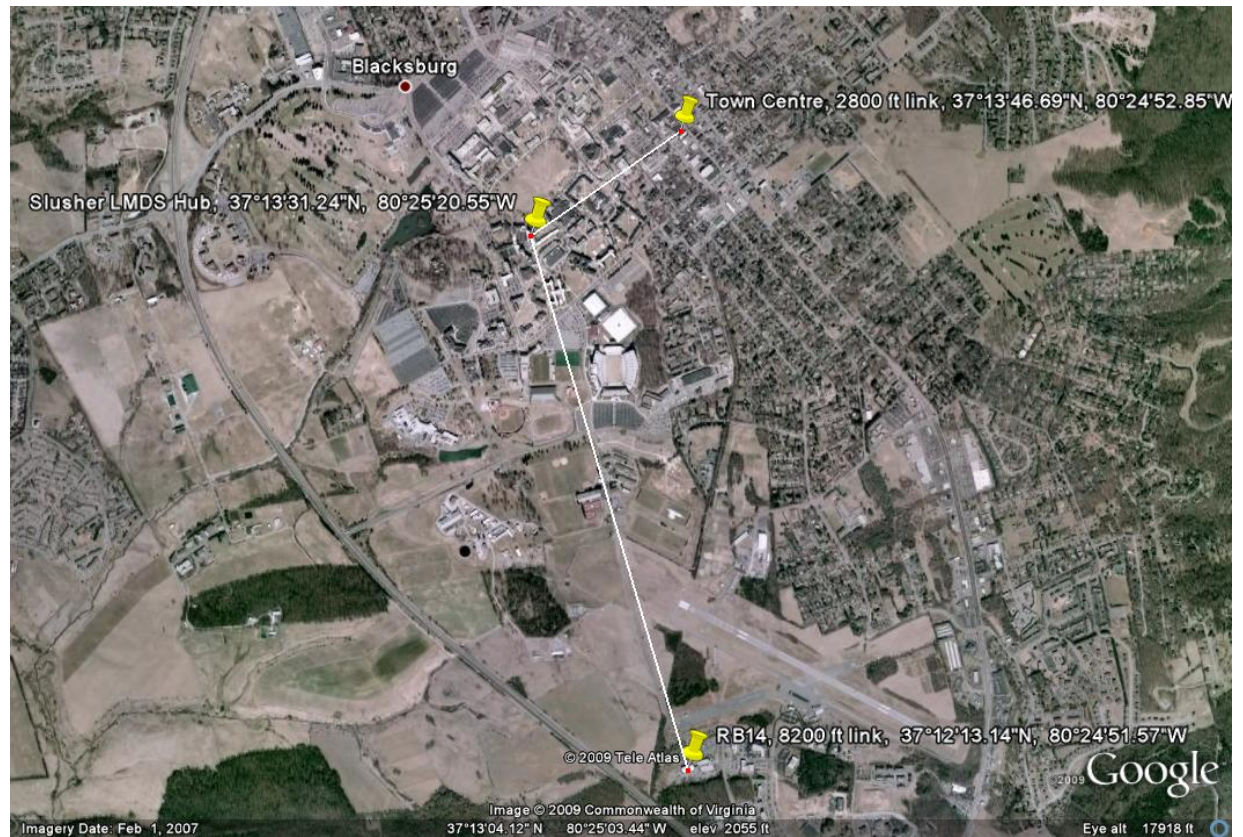


LMDS links at the Virginia Tech campus and in Blacksburg, June 2008

The following photo shows one end of an LMDS link on top of the Town Centre building in downtown Blacksburg, Virginia. A non-penetrating, ballast type, roof mount is used to support a Ceragon outdoor unit with a one-foot microwave dish antenna attached. The dish antenna points at the top of Slusher Hall on the Virginia Tech campus about 3000 feet away over the treetops.



Town Centre LMDS roof antenna mount with Ceragon one-foot dish

Virginia Tech intends to continue to conduct research involving wireless technology to generate value beyond the delivery of service. The university plans to focus on use of information technology in emergency management. As high-capacity LMDS equipment becomes more available and less expensive, Virginia Tech will aggressively seek to leverage the spectrum for rural infrastructure development and for high-capacity campus and community services.

For more information, contact John Nichols, *john.nichols@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 initially funded through several foundations established by the late Marion Bradley Via. Edward Via was instrumental in dedicating funds to this initiative. John Rocovich, the Via attorney, served as the rector for Virginia Tech during the time VCOM was established and was the individual instrumental in founding the college. The vision for the College is to provide healthcare for Southwest Virginia and the Appalachian region and to promote biomedical



VCOM II

research with Virginia Tech. VCOM is located in Virginia Tech's Corporate Research Center. *(www.vcom.vt.edu/)*

Since 2001, VCOM has operated with a collaborative agreement with Virginia Tech. This collaboration creates an environment that promotes excellence in education and research. Both Virginia Tech and VCOM recognized the contributions that each would make to the other's mission and goals, and they have agreed to provide certain services and resources to the other.

Information Technology has worked closely with VCOM over the last nine years to provide services necessary to support their ever-changing and expanding environment. Services currently provided by Information Technology to VCOM include support and backup of some servers, Web hosting, course management services, and network connectivity.

During the past year, CNS has worked closely with VCOM to provide telecommunications services to meet their needs in their new facility at Research Building 25. In addition, we started work with them to arrange for services to their new medical school to be located in Spartanburg, S.C. The new facility is scheduled to open and welcome its first students in the fall of 2011.

For more information, contact Pat Rodgers, *prodgers@vt.edu.*

# Blacksburg Electronic Village technology initiatives

**Web Support Services**. Blacksburg Electronic Village's Web Support Services (WSS) is a small team of carefully selected undergraduates performing website development under the supervision of full-time BEV staff. The group develops and maintains websites for departments throughout the university as well as for external nonprofits and government agencies. Client needs increasingly include sophisticated dynamic web and cascading style sheet features. WSS has seen an increase in project scale for new websites and major redesigns including the projects listed below.

AmericaView National Geographic Information System (GIS) site**.** The AmericaView Consortium has accepted BEV Web Support Services' proposal to redevelop and host the AmericaView National GIS website (*www.americaview.org/*). AmericaView is a nationwide program that focuses on satellite remote sensing data and technologies in support of applied research, K-16 education, workforce development, and technology transfer. BEV WSS will redesign the existing site and convert it to the Drupal content

management system. This conversion will enable AmericaView to more easily maintain their content and will facilitate the addition of more advanced features in the future. The current schedule calls for the new AmericaView site to go live at the end of September, 2010.

Virginia Tech Laboratory for Interdisciplinary Statistical Analysis service portal. BEV Web Support Services developed a new service information and client management portal for Virginia Tech's Laboratory for Interdisciplinary Statistical Analysis (LISA; *www.lisa.stat.vt.edu/*). LISA is a project of Virginia Tech's Department of Statistics to support service, research, and education to the university. The new portal provides information to prospective clients and facilitates interaction between clients and the statistics department staff as they collaborate on a wide variety of projects.

Virginia Community College System (VCCS) geospatial portal**.** BEV Web Support Services completed a new portal site for the Virginia Community College System GIS faculty and their students (*www.vccsgis.org/*). The new site supports the VCCS GIS educational mission by centralizing access to GIS-relevant programs and resources. Students and K-12 faculty members are able to find local institutions offering events and classes, and the VCCS GIS faculty and staff can share and evaluate resources and curriculum-planning materials.

FIT Extension site upgrade. BEV Web Support Services developed a significant series of enhancements to the Virginia Cooperative Extension (VCE) FIT Extension website (*www.fitextension.ext.vt.edu/*). WSS worked on the initial version of this website last year. The site supports a popular health and physical activity program administered by Family and Consumer Sciences extension agents working in local offices throughout the commonwealth. It was very challenging for agents to keep up with the hundreds of teams and participants last year. This year, WSS implemented improvements including online registration and reporting features. As a result, VCE agents reported their workload to support the program, as well as that of team captains, was cut in half.

**BEV system security improvements.** BEV has improved system security by extending the use of OSSEC—an open source, host-based, intrusion detection system—from workstations to its Linux servers. The product provides remote logging, file-integrity checking, and rootkit detection with a real-time log analysis and alerting capability. We can now monitor and correlate alerts from all of our network-connected systems, aggregating input from over 300 separate logfiles. This security enhancement has enabled us to identify and respond to attacks stopped at our perimeter as well as attack attempts and hostile

reconnaissance not detected and stopped by system and application firewalls.

For more information, contact Luke Ward, *lukew@vt.edu.*

# Cellular transition statewide contracts

During the summer of 2009, new statewide contracts for cellular voice and data services were announced and the details regarding each of the plans and the service providers were made available. Contracts were awarded to Verizon Wireless, nTelos, AT&T, and Sprint Nextel. These plans replaced existing statewide contracts which had expired.

As a result of its purchase by Verizon Wireless, Alltel customers were automatically transitioned to identical Verizon Wireless plans. This conversion required no action on the part of the cellular subscriber or the CNS Liaison. Existing AT&T and U.S. Cellular customers had the option to remain with their current provider or migrate to a new carrier. If they chose to remain with their provider, customers were required to select a new cellular service plan. Approximately 400 subscribers at Virginia Tech obtain their cellular service from the statewide contracts and were affected by the transition.

The Sprint Nextel cellular contract expired on June 30, 2010. Customers with this service were transitioned to new service plans by the Virginia Information Technologies Agency. Ordering and Provisioning evaluated the new plans assigned to Virginia Tech customers and submitted orders to convert to service plans that more closely resembled the customers' plans prior to the transition.

The Ordering and Provisioning team prepared a matrix for use by university subscribers listing the options available to them under the new contracts and provided ongoing support regarding the service plan and equipment choices. The Business Office worked closely with O&P, the carriers, and the departments to ensure that billing rates were modified, as necessary, to accurately reflect the costs of the new plans.

In most cases, the new contracts, in addition to other service options available through CNS, should not have increased departmental costs for cellular service and may have provided an opportunity for added value through new plans and/or new providers.

For more information, contact Pat Rodgers, *prodgers@vt.edu.*

# 100Mb campus upgrade project

Communications Network Services (CNS) continues to position the Virginia Tech network to support future, data-based services through a campus-wide upgrade that began in the spring of 2010. The project is part of an ongoing effort by CNS to upgrade the network to better support the university's present and future communications needs.

Goals of this project included the following:

- Establish 100Base-T (100 megabits per second) as the standard data service for the university by fall 2010
- Complete the upgrades without cost to individual departments in order to avoid additional financial strain on university departments during a time of severe budget cuts
- Eliminate all 10Mb half-duplex ports to increase throughput speeds and allow data to be transmitted in both directions simultaneously. (Half-duplex means data can only be transmitted in one direction at a time, either from the host or to the host. Full-duplex provides simultaneous transmission which allows more effective throughput.)

- Increase the number of switch ports capable of providing a minimum of 100 Mb full-duplex service
- Reduce power consumption and heating, ventilating, and air conditioning (HVAC) requirements for telecommunications spaces
- Minimize network interruptions experienced by users during the upgrade

At the beginning of the project, the university's academic and administrative networks consisted of 42,384 available switch ports. Of the available ports, 8,352 were capable of only 10Mb half-duplex.

At project completion—on schedule for September, 2010—the networks will consist of 35,496 available switch ports capable of providing a minimum of 100Mb (10 times the speed of 10Mb) full-duplex service. There will be no 10Mb half-duplex switch ports remaining on campus.

During the course of the project, we have also been able to consolidate network resources onto platforms that support most of the services offered by CNS. This consolidation has allowed us to reduce power consumption by lowering the total number of electronics deployed and minimizing the HVAC requirements for telecommunication spaces.

As of June 30, 2010, we completed the upgrades in 81 buildings. All network electronics were replaced in 23 buildings; 28 received a partial replacement; and 30 had port configurations changed to allow 100Mb service.

Between July 1, 2010 and project completion on September 10, 2010, CNS will completely replace the networks in three buildings, complete partial replacements in 28 buildings, and make software configurations allowing 100Mb service in 54 additional buildings.

The goals of this project have been exceeded. During the process of upgrading individual switch ports, Network Engineering has been able to upgrade building connections from 100Mb to one gigabit. On June 30th, we had completed core upgrades in four buildings. An additional 20 buildings will be upgraded by the time the project is finished.

To lessen the effects on the university community, upgrades were performed after 6 p.m. Advance notice about the proposed modifications was sent to affected departments, and schedule changes were made based on any departmental concerns. As a result, users were minimally impacted.

The significant goal of achieving 100 megabits per second as the standard data service for the university, at no additional cost to individual departments, is imminent.

For more information, contact Ron Keller, *rkeller@vt.edu.*

# Wireless initiatives

**Wireless controller architecture**. The wireless local area network at Virginia Tech provides mobile users with convenient, untethered connectivity to Internet resources and services. This service is available in over 170 buildings comprising approximately 95 percent of all academic and administrative spaces on campus. The service is also available in 80 commons areas within 25 residential halls. On a daily basis, the network serves 28,000 unique users peaking at close to 9,000 simultaneous users. The installed base of wireless access points totals over 1,900 and continues to grow**.**

In order to effectively maintain, manage and support a network of this scope and size, NI&S has deployed a centralized wireless controller system. This system and its underlying network architecture provide a reliable, scalable service to meet the emerging needs of the university. The system is compatible with existing wireless access points, leveraging prior hardware investments while reducing ongoing maintenance tasks and costs. The new wireless architecture system was placed into production for the Fall Semester 2009.

The new architecture provides

- the capability for users to roam seamlessly across campus while connected to the network, an enhancement required for future location-awareness and Voice over IP applications;
- enhanced, dynamic, radio features, allowing wireless access points to actively avoid interference and intelligently distribute clients to less utilized access points, features necessary to support the adoption of collaborative educational tools in classroom settings;
- significantly reduced labor and time to provision new equipment while simplifying the underlying network configuration required to deploy the service.

**Wireless 802.11n research, testing and deployment.** 802.11n is the latest, wireless local area network communications technology. It improves on the throughput provided by the 802.11a and 802.11g standards. 802.11n utilizes multiple antennas to provide multi-streaming radio techniques to acquire speeds of up to 144 Mbps—a drastic improvement over the 26 Mbps allowed with 802.11a and 802.11g. The 802.11n standard was ratified by the IEEE in September 2009. Manufacturers are now shipping products fully compatible with the IEEE standard. It is anticipated the demand for wireless service will continue to increase and academic and research applications will require

more bandwidth. NI&S engineers researched and conducted several evaluations that led to a pilot deployment of an 802.11n wireless service in Research Building 14. This pilot project led to production deployments in various spaces on campus and the configuration will now be the standard in all new installations. Incoming students are encouraged to purchase 802.11n dual-band capable, wireless, network interface cards.

**Wireless architecture engineering enhancements.** As the wireless network at Virginia Tech continues to grow and expand, its users find many unique ways to utilize its services. From collaborative instructional tools to alert systems and navigation applications, our users have readily adopted mobile and portable devices and consider wireless service to be an absolute necessity. As a result, Virginia Tech has pushed the wireless controller system to limits not seen at any other institution. NI&S engineers have worked closely with developers and engineers from Cisco Systems throughout the past year to identify and resolve challenges presented by user-load and the unprecedented number of users accessing the system simultaneously. Cisco was able to use the findings to improve its products based on the unusually high system demands. These improvements will benefit both Cisco Systems and Virginia Tech immensely.

**Provide hosting services for Virginia Tech Facilities GPS deployment.** Virginia Tech Facilities Services requires a permanent, global positioning system (GPS), base station to be located on campus. This base station will allow Facilities Services to provide exceptionally accurate geospatial positioning data for campus projects. NI&S will provide hosting and physical security services for the antenna and base station in the Andrews Information Systems Building. The service will also track the Global Navigation Satellite System (GLONASS) which will allow NI&S to acquire additional timing references. These references will improve the accuracy of the campus clock-synchronization necessary for the delivery of modern communications services.

For more information, contact Steven Lee, *stlee@vt.edu.*

## Wireless authentication via NetCert registration

Communications Network Services supports automatic wireless authentication using 802.1x and a personal network access certificate (NetCert). Users create and manage certificates via the NetCert Web registration application (*netcert.cns.vt.edu*). In response to feedback from users, departmental information technology support personnel, and University Computing Support personnel, NetCert software was updated this year to make it easier to use.

Prior to the change, instructions for use were distributed between Knowledge Base (KB) articles and the NetCert software itself making the process of installing the certificate and configuring their computers difficult for some users. After analyzing user behavior, the NetCert software was modified to incorporate a mechanism allowing a user to return to the Knowledge Base article that directed them to the application. Relevant KB articles were updated to reflect this change. Because all NetCert instructions are now maintained in one place, users can find all the information they need in the relevant KB article.

This software modification may result in many Virginia Tech affiliates using the more secure 802.1x VT-Wireless network.

For more information, contact Morgan Allen, *allenm@vt.edu.*

## WebMail

Virginia Tech's WebMail system provides a portal for students, and faculty and staff members not using the premium Microsoft Exchange e-mail system to send and receive e-mail using a Web browser. Since 1999, this service has provided secure, mobile, global access to Virginia Tech e-mail without the need for configuration.

This year, a team was formed to plan for and shape the next release of the WebMail service. This upgrade is expected to enhance the functionality, performance, and security of the WebMail system. The team is nearing completion of code customizations to an open source product to tailor the service to the needs of our constituents and the capabilities of our e-mail infrastructure. The team anticipates a production release of the service before the start of the 2010 fall semester.

For more information, contact Mike Moyer, *mike.moyer@vt.edu.*

## Cassell/Jamerson/Merryman upgrade/pilot

This year, NI&S began a major cable plant and network infrastructure upgrade to Cassell Coliseum, the Jamerson Athletic Center, and the Merryman Athletic Facility. The aging cable plant in these facilities was not able to support traditional Ethernet service at greater than 10 megabit per second speeds (10Base-T) or

wireless network technology. These facilities were selected to be part of a network infrastructure upgrade pilot project. In these largely non-academic spaces, the pilot allows us to develop processes and procedures to minimize the disruption of service inherent in moving from an existing to a new infrastructure. We will use the lessons learned during this process to ensure minimal disruption of service as we upgrade other campus buildings over the coming years.

The upgrade includes the improvement of—or building new—telecommunications rooms in the facilities, installation of fiber-optic cabling interconnecting all telecommunications rooms, and the deployment of modern, twisted pair cabling between telecommunications rooms and users' data or telephone jacks.

Our goal is to improve our existing telecommunications rooms or construct new ones to meet or exceed industry standards. Such rooms have space and power adequate to support telecommunications needs for 20 or more years. The upgraded facilities will be capable of providing one gigabit per second (1000Base-T) Ethernet service and wireless network service.

For more information, contact John Pollard, *jpollard@vt.edu.*

## Customer Online Access

Customer Online Access (*cola.cns.vt.edu*) is the NI&S Web-based customer portal for departments, students, and university guests. The suite of applications provides users with the ability to provision telecommunications services, manage accounts, and electronically access bills. The design and development of *cola.cns.vt.edu* is a collaborative effort by Systems Development and Administration, Public Relations, and BEV Web Support Services.

Significant improvements this year included a redesigned interdepartmental communications request (ICR) cellular service provisioning interface, work on Central Authentication Service (CAS) integration, and a separate and significantly improved Guest Wireless service provisioning interface.

**ICR cellular**. As a result of new cellular contracts with vendors, the ICR cellular service provisioning interaction had to be redesigned to support new and different business rules. The new version was released in November 2009. Designers, developers, and usability engineers took advantage of the opportunity to redesign the interface and better leverage Ajax (*Asynchronous JavaScript* and *XML*, *http://en.wikipedia.org/wiki/Ajax_%28program*

*ming%29 - cite_note-garrett-0*) functionality to build a more effective and richer user interface.

**CAS**. In an effort to improve user experience and better align with overall university security directions, we intend to integrate COLA with CAS in early July 2010. CAS allows for single sign-on functionality, central authentication, and Enterprise Directory group authorization.

**Guest Wireless**. As a result of CAS integration, the Guest Wireless registration application was removed from *cola.cns.vt.edu* and deployed as a standalone application. Once again, designers, developers, and usability engineers took advantage of the opportunity to significantly redesign and improve the user interface for the new *guest.cns.vt.edu* application. The team developed an interface based on industry-leading examples that are familiar to a wide audience of users.

For more information, contact Morgan Allen, *allenm@vt.edu.*

## Virginia Tech Knowledge Base

*Answers.vt.edu* knowledge base is an online, self-service, collection of documented solutions to issues pertaining to Virginia Tech Information Technology services. Problems and solutions are presented in question/answer format, with

each answer consistently formatted according to established style conventions. The knowledge base is run by KBPublisher, an open source, knowledge base, work-flow system.

For as long as university computing has existed, there has been centralized computing help available at Virginia Tech; but the need for such assistance increased dramatically when the computing requirement was established for all students in 1998. Less knowledgeable than today's undergraduates, those students often asked common questions about basic computing. The *answers.vt.edu* effort began in February 2000, when a push was made to provide self-service assistance on the Web. The knowledge base provided a solution for effectively and efficiently answering the most frequently asked questions.

Now including over 1600 solutions, *answers.vt.edu* provides 24 x 7 online support for a wide variety of computing problems. The majority of the articles are actual answers written and used by 4Help consultants when assisting customers requesting support.

Today, common questions often relate to new options or new vulnerabilities—updating to different operating systems and software versions, setting up a VPN, or safeguarding against constantly evolving computer viruses. The changing nature of the questions points to the increased sophistication of university

students, and faculty and staff members in regard to computer use.

Following the December 2008 transition to KBPublisher, the work-flow has continued to be customized to better meet the needs of the knowledge base staff. The knowledge base now utilizes Enterprise Directory for authentication and group management in order to collaborate with other Information Technology groups, such as Online Course Systems (OCS). The transition was recently made from two older Dell servers running Debian to three virtual servers running Ubuntu in order to allow for greater expandability and flexibility, as well as improving security.

In addition to continued improvements for the knowledge base, changes have been made to improve *computing.vt.edu*. We recently began work on updating the site to make it more contemporary. Our first big change was to update the "look and feel" to be more in line with the standard Virginia Tech templates. The old templates were dated and did not incorporate many of the Virginia Tech Web Guidelines. The current template is a transitional one, as we move toward a completely standardized template, using a content management system that follows the Virginia Tech Style Guide and templates.

For more information, contact Joyce Landreth, *jlandreth@vt.edu.*

# University Computing Support's improved helpdesk model

In recent years, information technology services in use at Virginia Tech have dramatically changed and expanded, necessitating a review of how we provide helpdesk support and services to the university community. In the 1990s, most helpdesk questions were related to network connectivity or general computer usage. Today, the university has incorporated new technologies into almost every business process. Users have matured from using a single computer to using multiple devices, including smartphones and other mobile devices.

Although there has been a massive increase in technology usage in all aspects of university business, education, and research activities, there has been less change to Information Technology support services needed to assist with those technologies and processes. The current helpdesk model was established in 1995. Our support offerings to the university community have been evaluated and realigned to better meet the current needs. Our goals include the following:

- Reorganizing and clarifying the 4Help service page on the computing website to better represent the services we provide

- Revising our training materials for new helpdesk consultants
- Better defining service agreements with other groups in Information Technology who provide computing support and services
- Updating and creating tools needed to perform consulting tasks more efficiently

This year, we have made significant progress in achieving these goals. Training and documentation has been reorganized. A new "dashboard" was created to streamline the process of hiring and training new consultants, and definitions of our service levels and relationships with partner groups were refined.

One of our larger efforts was the design of a new consulting dashboard. In an attempt to reorganize helpdesk information to allow student consultants and full-time staff members to more quickly find answers to common questions, a new dashboard was implemented on the NI&S wiki space. The redesign organized our information into eight different areas—consulting guidelines, resources, work tools, Notepad area, search, common problems, news, and updates. In addition, a tool bar area was created to display commonly used consulting tools. Several new tools were developed to allow the staff to search the NI&S wiki pages more efficiently and allow them to keep a record of the amount of time spent answering a question. The new dashboard went into production in March 2010, and modifications continue to be made. The enhanced dashboard has been instrumental in allowing us to quickly train new student consultants and has facilitated their ability to solve user problems quickly and more effectively.

We plan to continue the effort to enhance our support services with the ultimate goal of offering a more useful helpdesk experience to the university. Future objectives include the following:

- Improve our trouble-ticketing system
- Continue development of training materials and hands-on labs for our consulting staff
- Integrate various system tools into our dashboard view to reduce total time from ticket (problem) submission to ticket closure (problem resolution).

For more information, contact Joyce Landreth, *jlandreth@vt.edu.*

# Collaboration between University Computing Support (4Help) and Learning Technologies online courseware

In late 2007, Online Course Systems (OCS), a division of Learning Technologies, and 4Help/University Computing Support (UCS), part of Network Infrastructure and Services, initiated a project to improve the support model for Virginia Tech's Online Course Systems. OCS was utilizing an outdated ticketing system and received trouble tickets only via e-mail. 4Help had a dynamic 24 x 7 call center, along with an online trouble ticketing system (Remedy) and a phone number dedicated to taking customer calls. The two groups met over the course of several months to develop a plan to optimize the availability of 4Help resources and the expertise developed by OCS to support courseware. As a result, a collaborative support network—making use of broad–spectrum support from the 4Help group and more narrow expert knowledge about learning systems utilized by instructors—was developed.

In 2007, OCS support included just 2.5 FTEs. The group supports approximately 1500 faculty members and over 25,000 students using enterprise-level learning systems including Scholar, ePortfolio, Blackboard, iTunes U,

Dyknow, Course Evaluation, and Element K. 4Help offered the advantages of a tiered support system comprised of a 24 x 7 call center, UCS (second-tier support), and an extensive, online, public knowledge base managed by the Content and Knowledge Management group.

During the first phase of collaboration, OCS began using the Remedy trouble ticketing system as a replacement for their existing system. They also began the process of incorporating their extensive website content into *answers.vt.edu*, 4Help's Knowledge Base.

In the second phase, 4Help began to take all calls and trouble tickets for OCS and provided first-line support for the faculty and for students for Blackboard. 4Help provided answers based on OCS-contributed knowledge to *answers.vt.edu*. When necessary, tickets requiring second-tier support were transferred to OCS. 4Help is now able to resolve approximately half the tickets related to online courseware without the need to escalate to OCS.

The third phase of collaboration began in late 2009. It involved the creation of a dedicated workflow within UCS's new knowledge base system, using KB Publisher, for OCS. The UCS team worked closely with OCS documentation staffers to facilitate a seamless way for OCS to contribute, edit, and publish articles related to

Online Course Systems. This process was especially helpful with the transition from Blackboard to Scholar.

The end results of the collaboration are beneficial for everyone involved. End users now have one place to get answers to their questions, and basic questions can be answered very quickly.

They can also refer to one website, *answers.vt.edu,* for answers to common questions. OCS can now devote more time to working on second-tier problems, documentation, and the deployment of new courseware systems. 4Help can quickly deflect calls that are not related to courseware and create new efficiencies between the OCS and other Information Technology entities.

For more information, contact Joyce Landreth, *jlandreth@vt.edu*.

# Virginia Tech Operations Center enhancements

Virginia Tech Operations Center (VTOC) management and staff are constantly striving to enhance the level of service and support provided to the university community and to improve the center's ability to address technology questions from students and

university employees in a timely and professional manner. They engage in proactive planning and ongoing review of policies and procedures to enhance the VTOC's ability to effectively respond to user needs and to help ensure the university community is able to access the network. Some of the recent changes and enhancements implemented in the VTOC to support these goals and objectives are listed below.

**Campus network switch upgrade.** In order to support future, data-based services, 100Base-T (100 megabits per second) will soon become the standard data service for the university as a result of a campus-wide upgrade. The upgrade is part of CNS' continuing effort to improve the network so we can better support present and future communications needs. The VTOC diagnosticians provided network configuration assistance for the installation of new Cisco switches associated with this project. The network devices were configured according to an installation schedule provided by Network Engineering.

**Remedy trouble tickets.** Remedy enhancements were made in the following areas:

- Specialized tabs were added to a form that the VTOC staff uses for common issues. The process captures relevant and specific data pertaining to the particular issue that

are not common to all reported problems and ensures consistency of data-gathering and documentation.

- Color-coded notifications indicating that a particular ticket requires attention are now available for the staff of Online Course Systems.
- A separate queue for problems submitted to *abuse@vt.edu* was added.
- Speed-of-ticket creation was improved through the use of a new form to be used by volunteer staffers when students return for the fall semester.

**Scheduling and Announcement of Maintenance Group (SAMS).** The VTOC is now a participant in the SAMS group. SAMS brings together members of various Information Technology units to help avoid possible scheduling conflicts resulting from maintenance and deployment. The SAMS group is responsible for ensuring that services and functions needed to support the deployment of new services are available and that planned or contingent outages are known in advance.

**Information Technology status updates.** The VTOC began to use blog software to disseminate maintenance and outage notifications. The goals are to enhance the speed with which reduced performance/outage notifications are posted and increase the size of the audience. When fully implemented, these messages will be published on the CNS

homepage and the *computing@vt.edu* website. University information technology staff members will also be able to subscribe to an associated RSS feed.

**Wiki documentation.** We created templates—one-page, high-level, quick answer guides—for several Information Technology services (e.g., Google mail, wireless, etc.). A call center portal page was added. The portal lists the various services we provide and allows staffers to find basic informational articles with just a few successive clicks.

**Quality assurance.** The VTOC management and leadership group focused increased attention on minimizing response time to systems alerts to ensure all Big Brother alarms are escalated within 10 minutes.

**Premium sports programming.** VTOC and Public Relations staff reviewed various aspects of the cable TV premium sports service—offered in selected residence hall lounges—with Housing and Dining Services' (HDS). At the request of HDS, the VTOC has implemented a procedural change that will

enhance the service's appeal to students. If a previously scheduled event is unavailable due to technical problems or is not entertaining, the designated HDS contact can ask the VTOC staff for a change to a different program. For each scheduled event, the VTOC will accept one or two, up-to-the-minute, telephoned requests for changes.

**Information Technology implementations.** The VTOC is involved, either explicitly or implicitly, in all new Information Technology production implementations. VTOC personnel coordinate with other groups to define, plan, and implement the required support for all new Information Technology applications. This fiscal

year, the implementations included the following:

- Google mail for alumni
- Scholar transition from Blackboard
- Directory Access Tool (DAT) enhancements
- Guest Access Management System enhancements
- Central Authentication System (CAS) upgrade
- Banner upgrade
- VT Desktop Alerts
- Windows server update services (WSUS) upgrade

For additional information, contact Rob Sprague, *icanhelp@vt.edu*.

## University Computing Support model for issue escalation

The Executive Support Services/Desktop Support team (ESS/DTS) provides "escalated support" for Virginia Tech's central information technology services. The ESS/DTS team provides a second-tier level of support to faculty and staff members, and students for complex problems as well as 24-hour emergency support for the university's senior management.

The support model has been redesigned to provide streamlined service via remote assistance and walk-in support thus reducing the number of on-site desktop support visits required. Creating more online content has enabled many users to solve common questions on their own.

Those eligible to receive Executive Support Services were notified how the new procedures would better serve them. Desktop support procedures were redesigned around a three-step escalation process that begins with an initial consultation, a remote help session, and an appointment for a visit, if necessary, to solve complex issues.

In September 2009, UCS began researching desktop streaming solutions. After investigating multiple products, Simple Help—a third-party, remote-access application—was purchased and installed. Simple Help is a product that can be used to perform remote assistance for an end user across the Internet. The product requires no software installation on the user's machine. The Simple Help remote service model was put into production in Decembe, 2009.

Several projects were initiated to simplify what were identified as common problem areas for Virginia Tech constituents. ESS/DTS staff members have focused more time and attention on the creation of instructional content to improve self-help services. A series of podcasts, "Hokie How-to's," has been produced and posted on Virginia Tech's iTunes U site. "Hokie How-to's" include a series of installation instructions in video format. In addition, UCS worked with Information Technology Acquisitions to provide images of virtual machines—with Windows and other commonly used applications pre-installed—that members of the university community can download.

Another area identified as a focus point this year was support of mobile messaging. A new page on *computing.vt.edu* was developed. The page includes instructions on how to configure various mobile devices to use ActiveSync to connect to Virginia Tech's Exchange service, how to download mail from Virginia Tech e-mail service, and how to connect a device to the wireless network. UCS also collaborated with CNS Ordering and Provisioning to implement a Remedy queue to facilitate purchasing, support, and warranty issues for phones and smartphones purchased from CNS.

Future enhanced support goals include the following:

- Implementation of a separate model for departmental information technology support (DIS) personnel allowing tickets entered by them to be quickly reviewed and, if necessary, escalated to DTS support. An issue reported by DIS is often one impacting their entire department, and a quick resolution may ultimately

reduce the overall number of tickets received by 4Help. In addition, DIS personnel can assist in resolving the issue for the users in their department once a solution is found. The possibilities for implementation of such a model from a technical standpoint are under review.

- Posting our "Hokie How-to's" videos on Virginia Tech's new YouTube site
- Creation of additional video training materials

For more information, contact Joyce Landreth, *jlandret@vt.edu.*

## Net@EDU Converged Communications Working Group

The purpose of the Converged Communications Working (CCWG) was to engage the vendor community and institutions of higher education in discussions regarding converging services, wireless technology, spectrum issues and best practices, while attempting to highlight future technology and strategic direction.

As a working group of Net@EDU, the CCWG provided information to Net@EDU members during the annual meeting in February and the EDUCAUSE national meeting in October. The CCWG also provided topic-specific information to participants through day-long sessions offered at both meetings. The content of those sessions was developed by a core group which formed a steering committee. John Nichols and Richard Hach are both members of the Converged Communications Steering Committee (CCSC). The steering committee chose topics based on current importance to the community or of general interest to the members.

This year, as EDUCAUSE contemplated how to renew Net@EDU and broaden the scope of its involvement, the CCSC offered its help and support in the effort to increase the value proposition of the working groups to the full range of members. The new EDUCAUSE program is tentatively named the Advanced Core Technologies Initiative (ACTI). The CCSC has been involved in discussions regarding ACTI and plans to present a converged-communications program before the annual meeting in October.

Members of the CCSC were pleased to learn that the journal article we contributed last year to the EDUCAUSE Review was selected through the EDUCAUSE Current Issues Survey as a recommended resource for the Top-Ten IT issues of 2009. ("The Multi-Dimensional Nature of Emergency Communications Management," *EDUCAUSE Review,* vol. 44, no. 1, January/February 2009)

For more information, contact Richard Hach, *rhach@vt.edu.*

## Housing and Dining: special telecommunications services

Communications Network Services (CNS) collaborates with Housing and Dining Services (HDS) to provide custom telecommunication services during the summer terms for university guests attending conferences and premium cable television sports programming for students in residence halls during the fall and spring semesters.

Internet access and telephone services are made available to HDS' thousands of summer conference guests. During the summer, guests not directly affiliated with Virginia Tech live on campus while participating in sports camps or other special events sponsored by the university. Guests use university facilities which accommodate large groups and, through the custom telecommunications agreement, are able to access the university's network and the Internet while staying in the residence halls.

Since 2006, CNS has provided premium cable television sports programming during the fall and spring semesters. This offering is renewed annually and provides special telecasts of sporting events to residence hall students.

Premium sports programming, distributed via the campus cable television system to most residence hall lounges, encourages on-campus residents and their guests to socialize.

These two programs are expected to continue. Additional custom service offerings will be developed as needs and opportunities are identified.

For additional information, contact Jeff Kidd, *kiddj@vt.edu*.

# Cable TV system infrastructure upgrade

During the past fiscal year, NI&S engineers began investigating the possibilities for upgrading the television-delivery infrastructure on campus. While many options were initially discussed, we determined that changing the existing distribution infrastructure from a copper, coaxial cable-based system to a fiber-based one would be the most effective. This conversion will provide the foundation for improved content-delivery in the future and allow us to remove the copper coax infrastructure from building entrance conduits, freeing up valuable space for other network upgrade projects.

With this goal in mind, the group looked at a variety of vendors and solutions before deciding to move forward with Cisco's Scientific Atlanta equipment allowing the organization to leverage existing contracts and discounts with Cisco. A plan has been developed, and we are moving forward to take advantage of an existing, but underutilized, single-mode, fiber infrastructure for this project. The result will allow for data network usage *and* the cable TV upgrades.

At this time, the new system will not provide any digital or high-definition content. However, the distribution infrastructure CNS is putting in place now will be fully capable of supporting these technologies in the future, requiring only the replacement of source components and possibly the edge switches within buildings.

For more information, contact Jacob Dawson, *dawson@vt.edu.*

# Ghiza project

To facilitate efficient handling of Internet-based, copyright infringement complaints (ICICs) received by the university under the provisions of the Digital Millennium Copyright Act (DMCA), a Web application with the project name Ghiza was developed by Network Infrastructure and Services' Systems Development team.

A Web-based system was developed to accelerate case research using the Internet protocol address and the reported date and time of the alleged infringement. Once the case reviewer is satisfied that incident details and the implicated user are properly correlated, the system generates an e-mail notice. The e-mail provides pertinent details for each event and concurrently informs the implicated individual(s), the university's Office of Student Conduct (for student cases), and the university's copyright coordinator.

Ghiza was placed into production in March 2009. 869 cases were processed via Ghiza during the 2009-2010 fiscal year.

It takes approximately two minutes to process a routine case implicating a residence hall Ethernet connection. For wireless incidents, processing is partially automated, and "hands-on" time required to address each event varies between five and 10 minutes per case.

Subsequent Ghiza development will address automated data collection, organization, and storage accruing from all ICIC cases received by Virginia Tech. These functions are presently tracked in a spreadsheet. Other developments will enable generation of statistics to facilitate production and distribution of ICIC performance reports providing month-to-month and same-month-last-year activity comparisons. Enhancements will also be made to the

research tool to broaden its ability to handle varied types of cases.

For additional information, contact Jeff Kidd, *kiddj@vt.edu*.

## Student television network preference survey

CNS Public Relations collaborated with the university's student-operated Residence Hall Federation (RHF) to modify programming on the university's cable television line-up. A survey was proposed to determine program preferences of residence hall students. CNS Public Relations provided advice to the RHF on structuring the survey to list options available under the terms of the existing university contract. Coordination between CNS and the RHF ensured an accurate representation of available programming options and increased the efficacy of survey results.

The RHF administered the survey using their subscribed, online, survey service called StudentVoice. An e-mail notice was sent to all residence hall students on three separate occasions beginning in the fall semester 2009 and continuing into the spring semester 2010.

With a cumulative response rate of over 48 percent (unique respondents), the survey was considered effective. It identified two proposed channels as highly desired and indicated negligible interest in two other channels that could be removed. These changes were implemented in late May 2010.

For additional information, contact Jeff Kidd, *kiddj@vt.edu*.

## NI&S participation in the Emergency Communications Task Force

NI&S participates on the Emergency Communications Task Force, along with the Virginia Tech Police Department, the Office of Emergency Management, the Office of the Associate Vice President for Facilities, the University Registrar, University Relations, and other groups within Information Technology.

The purpose of this task force is to create a communications infrastructure to generate alerts that notify the university community in the event of an emergency. This committee is led by the Associate Vice President for University Relations.

While various alert formats are discussed, NI&S has specific responsibility for installing message boards with guidance and input from University Relations and the Office of Emergency

Management. NI&S is also providing design and programming support for the Emergency Notification System (ENS). The ENS can be used by both the Virginia Tech Police Department and University Relations to generate alerts in a variety of ways, including, but not limited to, sirens, e-mails, phone calls, and computer desktop "pop-ups."

For more information, contact Pat Rodgers, *prodgers@vt.edu*.

## Network Infrastructure and Services Advisory Subcommittee

In fiscal year 2007-2008, the Office of the Vice President for Information Technology established an advisory committee structure to better involve its constituents in technology-related issues, discussions, and planning. The NI&S Advisory Subcommittee (which will work in parallel with similar subcommittees for Learning Technologies, Enterprise Systems, and the Information Technology Security Office) has been charged "to provide advice and counsel that assists in guiding, supporting, and communicating Network Infrastructure and Services' strategic aims at Virginia Tech."

Over the next several years, NI&S must acquire and deploy the next-generation technologies

the university needs in order to pursue top-30 research status, provide technology-enriched learning environments, and improve economic opportunities and quality of life for Virginia citizens. To those ends, the subcommittee will advise NI&S leadership as it integrates strategic directions for voice, data, and video; identifies and analyzes needs; and evaluates alternatives related to network infrastructure, computing systems, and services.

For more information, contact William Dougherty, *william@vt.edu*.

# Networking Brown Bag Lunch series

The Networking Brown Bag is a collaboration between Eric Brown, Mark Gardner, and Allen MacKenzie from the Department Electrical and Computer Engineering. From the Networking Brown Bag Series announcements:

We seek to create a venue for continuing dialog between diverse researchers, students, and staff members interested in networking. We define networking broadly to include applied modeling, analysis, and measurement of networks; innovative and new uses of computer networks; smart/intelligent/active computer networks; human-centric networking; transient/dynamic network organization; emergent behavior in networks; innovative

implementation of computer networks; and related topics. The format will be a monthly lunchtime seminar with presentations from various researchers. We seek to openly exchange ideas, understand application areas, share opportunities, and create ties with like-minded individuals.

During its first year, we met on a monthly basis and discussed various topics in networking including infrastructure to support research, network modeling, security, host-based anomaly detection, collaborative networks, and cognitive networks. This series will continue in the future on a monthly basis.

For more information, contact Eric Brown, *eric.brown@vt.edu.*

# Systems Performance Team

The Information Technology Network and Systems Performance Team is a small group of participants from across the Information Technology organization that will provide ongoing expertise and proactive attention to the overall performance of Virginia Tech's enterprise network and systems. Network Infrastructure and Services team members include Eric Brown, Steve Lee, Tim Rhodes, and Pat Rodgers (team leader). Meetings are held as needed, but at least monthly.

Specifically, the vice president for information technology has charged the group with the following:

- Cultivate expertise and assume responsibility for a broad, integrated view of network, systems, and applications performance that focuses on an enterprise perspective
- Develop proactive processes for ensuring effective performance through ongoing assessment and attention including trends in performance, deviations from normal activity, capacity-planning, etc.
- Implement and manage utilization of a comprehensive toolset that supports performance monitoring, analysis, and tuning and that facilitates an overall systems perspective

For more information, contact Pat Rodgers, *prodgers@vt.edu.*

# Filming a documentary with IBM and QLogic

In early November 2009, Virginia Tech Information Technology played host to the Marlowe-Pugnetti company (*www.mpcinc.com*), documentary film-makers specializing in industrial and commercial productions. Marlowe-Pugnetti was contracted

by IBM and network switch manufacturer QLogic to document the world's first installation of the IBM System X iDataPlex computing cluster with QLogic high-speed interconnect switches (running at four times the rate of regular switches).

During the filming, interviews were conducted with the Vice President for Information Technology and Chief Information Officer Erv Blythe; Director of Research and Cluster Computing Kevin Shinpaugh; and Director of Systems Support William Dougherty. The film covered the installation and implementation of the equipment, the software that would be used, and the overall positive impact on physical space and electrical power the new cluster would have when compared to its processing power.

The film was used at the 2009 Supercomputing Conference and on IBM's and QLogic's websites. The iDataPlex is now available for general research use at Virginia Tech.

For more information, contact William Dougherty, *william@vt.edu*.

# Campus cabling infrastructure upgrades

Virginia Tech's Communications Network Services has been installing the university's cabling infrastructure since 1987 when preparations began to put in the first university-owned telephone system. Before that time, telephone cabling on campus was installed by local telephone companies. AT&T placed cables from telephone wiring closets to communication outlets at individual work areas, supplied telephone sets, and provided long distance telephone service. C&P (later known as Bell Atlantic and now, Verizon) installed backbone cables from wiring closets to their switching center in downtown Blacksburg, provided local telephone service, and routed long distance calls to AT&T.

In 1984, AT&T divested itself of the Regional Bell Telephone Operating Companies, which included C&P Telephone. C&P worked with Virginia Tech to establish three demarcation points on campus where C&P services were to be terminated. Virginia Tech extended the telephone company lines over university cabling infrastructure to communication outlets in buildings. In 1988, the university installed a digital telephone system. Over time, the arrangement saved the university millions of dollars and provided greatly enhanced voice and data telecommunications services.



Test setup for new cables and connectors that support 10 Gbps to workspaces

Cabling standards and technologies have changed over the years. As buildings were constructed or renovated, different cabling materials and methods were used. Older cabling may only support 10 or 100 megabits per second Ethernet; however, newer cabling supports at least one gigabit per second Ethernet. The latest cabling technology supports up to 10 gigabits per second Ethernet. There is a critical need to upgrade the inside cabling and equipment room infrastructure in many buildings to support current and future telecommunication needs.

Over 200 buildings on campus receive some combination of voice, data, wireless Wi-Fi, and/or cable TV services. Access to wired services is via communication outlets in user work areas that are cabled to telecommunication equipment rooms using four-pair copper cables for voice/data and coaxial cables for TV. The equipment rooms on each floor are connected over backbone cables to main building equipment rooms. The main equipment rooms are connected over outside backbone cables to one, or more, of six campus switch centers. The campus switch centers interconnect with each other via backbone ring copper and fiber-optic cables. The campus switch centers contain demarcation points for copper and fiber-optic cables that connect to off-campus service providers.



Main telephone equipment room in a newer building
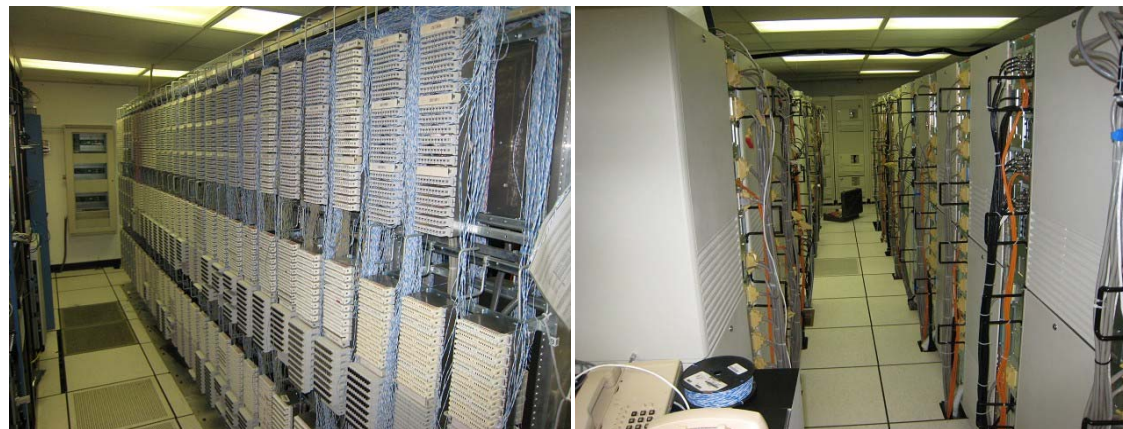


Switch center main distribution frame and telephone switch cabinets

Upgrades and additions are needed for outside cable infrastructure to provide additional fiber-optic cables to existing buildings, to cable new buildings, and to improve infrastructure reliability.





Fusion splicing of fibers at a switch center for connection to a core Ethernet switch

In May 2009, renewed planning began for cabling infrastructure upgrades needed for equipment rooms, power/cooling systems, cable pathways, inside cables, and outside cables to meet next- and future-generation telecommunication needs. Planning involves keeping abreast of new methods, reviewing existing infrastructure in each building and between buildings, determining what changes are needed, and preparing designs with cost estimates to upgrade the infrastructure.

In late summer 2010, an RFP is expected to be released for a next-generation telephone and unified communications system. Current plans are to focus infrastructure upgrades on immediate needs and those necessary to support the next-generation telephone system.

Maintenance hole for pulling underground cables and splicing them together
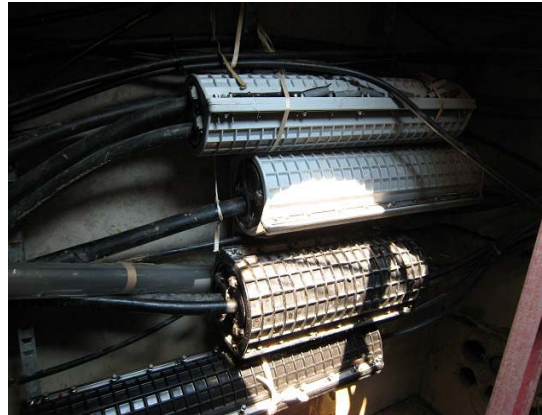


For more information, contact John Nichols, *john.nichols@vt.edu*.

## Spectrum optimization

Mobile communication has become an increasingly critical component of the university's day-to-day activities. Spectrum, "the series of electromagnetic waves which move through space at different frequencies (*The Mobile YOUniverse: Spectrum Basics and Beyond*, CTIA)"—both the licensed and unlicensed bands—allows us to be mobile and perform our various job functions from almost anywhere. These resources, often taken for granted now that cellular phones, mobile connections to the Internet, e-mail, and text messages seem ubiquitous, are not unlimited; and the infrastructure required to support the many and varied mobile devices is not trivial.

The spectrum optimization project is a data-collection effort to obtain information about the utilization of Radio Frequency (RF) spectrum at the university. The feedback we receive will help Communications Network Services (CNS) evaluate the university's technology environment and enhance the usefulness of existing service.

We are coordinating this effort with Environmental Health and Safety Services, which is working on general roof safety issues including chemical exhaust, fall protection, and RF hazards. Our intention is to gather data regarding campus antenna installations including what procedures are in place for working near antenna locations, to update and augment Federal Communications Commission wireless license information, and to address concerns regarding radio frequency emissions and abandoned equipment. At the same time, we will provide guidance to the university community regarding the future use of radio spectrum on campus, antenna installations, changes or transitions being planned by regulatory agencies, and to enable research.

The project was highlighted during the presentations at the spring Departmental Computer Support Symposiu), and a pilot survey was sent to a small group of CNS liaisons to test the survey instrument and solicit feedback regarding the project. We are currently evaluating the pilot survey results and discussing possible changes to the project before proceeding with a campus-wide rollout of the survey.

For more information, contact Richard Hach, *rhach@vt.edu.*

# Video/Broadcast Services production

The video/multimedia production arm of Video/Broadcast Services produced 41 projects this year. Many of these productions were long, complex, and very labor-intensive. These projects generally require extensive preparation, execution, and post-production work. Therefore, the completion time was several weeks, or even months, from the first meeting about requirements until final delivery. Some of the longer-form productions completed for clients during the past year are listed below.

**Choices and Challenges.** VBS recorded the annual Choices and Challenges Forum on location at the Lyric Theatre. This annual event—the 24th that VBS has recorded—discusses ethics in science. This episode investigated the rights of animals. The VBS studio was used as a staging area to secure the large amount of equipment required.

**Effective search committees.** VBS wrote, directed, and recorded three short movies for the Office of Diversity and Inclusion. The programs were designed to show both proper and unsuitable methods for conducting a personnel search.

**"Versus."** VBS produced and recorded a three-hour discussion about how food processors and drug manufacturers interact with the U.S. Food and Drug Administration. VBS work included the design and construction of the set and lighting for this event.

**Favorite African-American poetry.** VBS constructed the set and arranged special lighting for the recording of several hours of poetry reading. Hosted by University Distinguished Professor Nikki Giovanni, readers included President Charles Steger and Ruby Dee, the winner of both an Academy Award and the Kennedy Center Honors Award.

**Wood Products.** The VBS studio was used to record a series of five lectures by off-campus experts about forest products marketing for use by the U.S. Forest Service.

**Nutrition for Dancers.** This program—two hours in length, when finished—dealt with the specific nutritional requirements of teenage ballet dancers. The production was a major portion of a doctoral dissertation and required hours of shooting with the doctoral candidate, recording a collection of dancers, and taking still images of food items.

**Satellite uplink.** University Relations made special arrangements with VBS so a Virginia Tech professor could appear with the Canadian Broadcasting Company.

**"Kids Tech U".** VBS provided video support for the second annual Kids Tech University, which meets on Saturday mornings and seeks to introduce science and engineering to children, ages 8-12. These programs are produced for Web-delivery via video-on-demand and are made through a cooperative effort between the Virginia Bioinformatics Institute and the Virginia Cooperative Extension's 4-H program.

**Vecellio Lecture.** The Vecellio Distinguished Lecture Series is sponsored through an endowment provided for the Construction Engineering and Management Program in Virginia Tech's Via Department of Civil and Environmental Engineering. The guest speaker for 2009 was former dean of the College of Engineering and former Virginia Tech president, Paul Torgersen.

**Virginia Tech Transportation Institute.** VBS produced a 20-minute program in support of a grant-funded research project that the Virginia Tech Transportation Institute will conduct nationwide. The video provided a method to explain the intent of the study to several hundred research subjects.

**Emergency Management.** VBS is currently developing a series of four productions with Virginia Tech's Office of Emergency Management. The program is funded by a large grant from the U.S. Department of Education and aims to prepare students and employees for emergency situations by keeping them informed and vigilant.

**The Inn at Virginia Tech and Skelton Conference Center.** In 2009, VBS entered into an agreement with the Inn at Virginia Tech and Skelton Conference Center to offer services to conference center clients. The clients served in the past year have included the following:

- *Office of Student Affairs.* VBS recorded and distributed a 90-minute program, "The Critical Role of Faculty and Staff in Identifying Threats."
- *Pamplin College of Business.* Two BB&T lectures
- *Office of Diversity and Inclusion.* Three events associated with a vice presidential search
- *Virginia Tech Police Department*. VBS is in pre-production on a short program for Web-delivery. The purpose of the program is threat assessment.
- *College of Engineering.* VBS is in pre-production on a short program about the Joseph F. Ware Advanced Engineering Laboratory for the Dean of Engineering.

For more information, contact Mark Harden, *mharden@vt.edu.*

# Video/Broadcast Services activities and initiatives

**SACS site-certification.** Virginia Tech is currently undergoing an accreditation process administered by the Commission on Colleges, Southern Association of Colleges and Schools (SACS). The role of Video/Broadcast Services (VBS) in this process is the verification of information related to support requirements for videoconference-based, distance-learning education as determined by SACS and the Institute for Distance and Distributed Learning (IDDL). IDDL provides leadership, coordination, management, and support of the university's distance and distributed (eLearning) activities. During this certification process, VBS also verifies the interoperability and connectivity abilities of non-Virginia Tech sites by physically connecting to each unit to insure compliance with the SACS standard audio and video requirements.

**SACS site-renewal.** During the SACS site-renewal process, VBS contacts non-Virginia Tech sites about any changes or modifications since the original site certification, updates current profile records, and conducts tests for

continued interoperability with Virginia Tech systems.

**Emergency Video Network Operations Center (E-VNOC).** Part of the VNOC's Research and Development (R&D) infrastructure has been moved from the Corporate Research Center to Whittemore Hall on the Virginia Tech campus. The designation for this area is E-VNOC. This location and infrastructure—including a multi-conference unit (MCU) and an Internet protocol videoconference recorder (IPVCR)—provides a redundant system of current production equipment to maintain operations in case of emergency.

Implementation continues on a management solution for the E-VNOC. Various Web frameworks are being researched and evaluated for ease of use, security, and straightforward maintenance of scheduling information. The goal is to provide for uninterrupted videoconferencing services during an emergency.

The E-VNOC has expanded encoding capabilities with the addition of a new video-streaming server and two new transcoding servers expanding our ability to provide for Adobe Flash, Microsoft Silverlight, and mobile video formats for cross-platform, Web-based, multimedia applications and services.

**Video Network Operations Center (VNOC) emergency remote site support.** In June 2010, the VNOC discovered a network anomaly at a non-VBS interactive videoconference (IVC) site on the Virginia Tech campus, which was scheduled to connect to a remote location in Darmstadt, Germany. The VNOC coordinated the support operation, and full network connectivity was restored to the IVC site without a loss in class-time for students at Virginia Tech or in Germany.

During an April 2010 system-wide failure of the videoconferencing ISDN infrastructure connecting Naval Surface Warfare Center in Dahlgren, Va., and Virginia Commonwealth University, the VNOC provided all necessary services for both sites to continue operations for 48 hours without any loss in class-time.

A statewide emergency plan for remote site support is in development to provide consulting and technical assistance to universities across the commonwealth.

**Research Building 14 conference room project.** VBS technicians and engineers have upgraded a large, frequently used, conference room in Research Building 14 (RB14) to a distributed, multi-use, high-definition, videoconferencing room.

Two high-definition (HD) monitors were installed on the wall of the room, allowing computer images to be displayed or to give the videoconference a life-size, face-to-face feeling. A liquid crystal on silicon (LCOS) HD projector and high-powered projection screen were set up to automatically display high-resolution graphics and video. The existing speaker system was integrated into the new, distributed, audio/video system.

A central HD videoconferencing unit was installed in the VNOC rack to provide the ability to bridge a videoconference to four HD sites. A table-mounted, "one touch" control was installed and programmed. This master control—handling all the equipment in the room—allows users to choose an icon that turns on, prepares, and operates several pieces of equipment for a predefined function. Conference room users don't need to know how to reconfigure any of the equipment—they just chose the correct room function, press the button, and the equipment is prepared for that use.

Cable drops have been made to the working lab on the first floor of RB 14 to allow for testing the integration of this conference room to additional rooms that can be used as satellite overflow locations or independently from the main conference room.

All the upgrades were accomplished without interrupting the daily schedule of conference room use.



Research Building 14 video conference room 215 in multi-site conference mode

**The VNOC electronic lab.** The VNOC maintains an electronic repair bench for use in testing and circuit board-level repair of videoconferencing and other devices. An electrostatic protective workbench was installed for repair of spark- and shock-sensitive components. With the warranty expiring on many of our videoconference units, circuit board repair of these devices will be required.

Cable drops from the distributed classroom system were made into the lab to allow for the programming and testing of various devices and classroom videoconferencing systems. This lab gives VBS the capability to unpack, set up, and program new videoconferencing units, including

SIP and open source-based, before deployment to a production environment.

**Streaming video services.** VBS continues to provide streaming and rich-media support to the university using RealMedia, QuickTime, and Flash streaming servers. In the past year, VBS has streamlined its media creation with automation tools, worked with external content distribution networks to deliver live video around the world, and doubled its transcoding processor capability in order to deliver all its streaming classes in high-quality H.264.

For more information, contact Mark Harden, *mharden@vt.edu.*

# Current capital and renovation projects

Field Engineering (FE) designs and installs telecommunications distribution systems—designed and maintained to support current university needs and those of the next 10 to 15 years—for both inside and outside cable plant.

The Field Engineering team strives to maintain positive relationships with and fully support the university community. FE works closely with project architects and engineers, as well as with University Planning Design and Construction teams during project development, to ensure

communications cable pathways and spaces meet all industry and Virginia Tech standards. As technologies migrate toward voice over Internet protocol, the designs for new facilities include the required environmental controls, physical security, and backup power systems. FE coordinates its activities with Physical Plant to minimize disruption of university operations and plans its work schedules to avoid disturbing classes in session.

Within the past year, FE has installed telecommunications infrastructure for the following new construction and capital projects:

New Hall West. This building provides office space for Student Programs and includes 264 beds on the residence hall floors.

Henderson renovation and Black Box Theatre. This project involved interior and some exterior renovation of Henderson Hall and the addition of the 8,479 square foot Black Box Theatre. The renovated building provides academic space for the visual and performing arts programs.

Basketball Practice Facility. This building provides a state-of-the-art practice facility for men's and women's basketball. It includes two full size courts, facilities for the coaches, and locker rooms.

Research Building 25. Located in the Corporate Research Center, the building provides

classrooms for VCOM and space for the Biomedical Engineering and Sciences Sled Lab.

Baseball batting facility. This facility provides new practice areas for the Virginia Tech baseball team.

Work on the following capital projects is currently in progress:

- Ambler Johnston renovation
- McComas Hall addition
- Jamerson Athletic Center football locker room.
- Perry Street parking structure
- Materials Management facility
- Visitor and Undergraduate Admissions Center
- Institute for Critical and Technical Applied Science (ICTAS II)

According to the University Planning Design and Construction schedule, the following projects will start during the 2010-2011 fiscal year:

- Infectious Disease Research facility
- Center for the Arts
- Academic and Student Affairs building

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

- Cassell Coliseum
- Jamerson Athletic Center
- Merryman Center
- River Course Clubhouse
- Equine Medical Center
- Powerhouse
- Fleet Services facility

For more information, contact Doug Jones, *jonesd@vt.edu.*

# Outside plant projects

Robust, reliable, adaptable, and secure outside infrastructure is required to provide the basis for the pervasive, leading-edge technology services supporting the vision and mission of the university. Outside plant infrastructure is designed and sized to provide adequate capacity to serve the facility being built and to provide for the university's master plan expectations for future construction in the area. Communications cable pathways and spaces meet all industry and Virginia Tech standards and are flexible enough to meet the university's evolving technological needs.

Cable plant serving new buildings is generally routed from the appropriate campus cable center(s) through steam tunnels, duct systems, and /or adjacent buildings. The infrastructure includes cable and pathway components such as ducts, steam tunnels, maintenance holes, and building entrances. When NI&S receives site plans and drawings for a proposed building or project, the required outside cable size, optimal routes, and duct systems are determined.

During the 2009-2010 fiscal year, the following projects involving the installation of outside plant cabling and infrastructure were completed.

**New Hall West.** This new facility, which includes office space and residence hall rooms, required duct system construction from an existing maintenance hole as well as the placement of optical fiber, coax, and copper from Hillcrest Hall.

**Basketball Practice Facility.** The new building required duct system construction and the placement of optical fiber, coax, and copper from Cassell Coliseum.

**Research Building 25.** Located within the Corporate Research Center, this project required duct system construction along Ramble Road and placement of optical fiber and copper from the Andrews Information Systems Building.

**ICTAS II duct system.** A new duct system was constructed from Hillcrest Hall to the ICTAS II building. The duct system was sized to accommodate the future construction planned in the I-Lot area.

**McComas duct system relocation.** The existing duct system currently serving the Rector Field House, English Field, and other sports venues was in conflict with the proposed foundation plan for the McComas addition. The current ducts were cut and then reconstructed using a different route. Cabling serving the sports facilities was replaced after the new duct system was completed.

**Miscellaneous projects.** The following miscellaneous projects were completed by the Outside Plant team:

- Emergency blue-light phone installation at the Duck Pond
- Outside cabling at the Dry Cow barn
- Installing voice/data services to construction trailers at the Perry Street parking structure, the Visitor and Undergraduate Admissions Center, ICTAS II, Materials Management facility, and the new Academic and Student Affairs building.

For more information, contact Doug Jones, *jonesd@vt.edu*.

## Ordering and Provisioning activity and initiatives

**Message boards.** CNS installed 45 message notification boards for University Relations in various campus buildings during the summer of 2009. Message boards are installed primarily in instructional spaces; however, some areas that may serve dual purposes as performance venues and student gathering locations also have boards. In September 2009, an additional 200 message board locations were identified. Installation of these boards will be completed prior to the beginning of fall semester, 2010. O&P coordinated the installation with University Relations and the Office of Emergency Management to ensure the boards were installed on schedule and in the designated locations.

**E911 enhancements.** O&P assisted CNS Switch Engineering personnel completing improvements to the Virginia Tech Police Department E911 services and dispatch area. Orders were placed with Verizon for specialized trunk facilities associated with the upgrade.

**Cellular telephones and mobile messaging.** The number of orders received from faculty and staff members for new smartphones and mobile data devices continues to increase. An additional 159 mobile data devices were received during fiscal year 2009-2010.

**Alarm approval procedure**. In cooperation with the vice president for administrative services, the Office of Converged Technologies for Security, Safety, and Resilience, and the Virginia Tech Police Department (VTPD), O&P revised operational procedures used by departments to request the installation of panic and intrusion alarms. In the continuing effort to improve overall campus safety and security, departments are now required to submit all alarm requests to the VTPD for their review, input, and approval prior to work order processing.

**VITA cellular transition**. During the summer of 2009, O&P worked with employees who have university-owned cell phones to transition services to a new state cellular contract. The new contract affected U.S. Cellular, AT&T, and Nextel users. Alltel users were automatically moved to the new service provider, Verizon Wireless. Nearly 400 users were affected by cellular transitions during the 2009-2010 fiscal year.

**Major project synopsis**. Ordering and Provisioning worked on the following major projects during the past fiscal year:

- Basketball Practice Facility
- Henderson Hall renovations
- Burruss Hall renovations
- Theater 101
- New Hall West

- River Course Clubhouse
- Football replay booth fiber installation
- Upper Chicken Hill parking lot blue-light emergency phones
- Jamerson Athletic Center renovations
- Football locker room addition
- Cassell/Merryman/Jamerson upgrade to gigE
- Equine Medical Center server room project
- Construction trailer installations for the New Visitor Center, the Academic and Student Affairs Building, and Veterinary Medicine Infectious Disease Isolation Unit
- AISB Machine Room upgrades
- Motor Poll/Fleet Services expansion
- HokieMart approvals—more than 2000

For more information, contact Bill Blevins, *blevins@vt.edu*.

## Improved inventory processes at the CNS warehouse location

Improving inventory control, costs, and accuracy are ongoing objectives at Communications Network Services. During 2009-2010, minimum stock-level and re-order points were evaluated and adjusted. Revisions were made on approximately 40 percent of the current inventory, and final revisions for the balance will soon be completed.

This past fiscal year, the "pick list" method of inventory control was put into full production, increasing efficiency by reducing or even eliminating the time CNS engineers wait to pick up material. We continue to make process changes to improve the accuracy of our inventory cycle-counts.

For more information, contact Jerry Surface, *jesurfa1@vt.edu*

## University audits and reviews

During 2009-2010, Communications Network Services successfully completed an audit that evaluated the control systems that management had in place to mitigate potential risks and exposures in technical and business processes.

One outcome of this audit was for CNS to coordinate an effort within Information Technology to review plans to help ensure continuity of critical enterprise systems in the event of an emergency. Critical enterprise systems were identified and the Communications Network Services continuity of operations plan was updated.

For more information, contact Pat Rodgers, *prodgers@vt.edu*.

## Increased network management and monitoring capabilities

Several network management improvements were implemented this year. Configuration enhancements and upgrades were deployed for our Traffic Sentinel tool from InMon Corporation. The new version allows us to monitor IPv6 traffic flows and IPv6 SNMP data in addition to our traditional IPv4 traffic analysis data. sFlowTrend-Pro was purchased and implemented as well as a supplemental tool for Traffic Sentinel. sFlowTrend-Pro is an inexpensive add-on that provides quick reporting functionality for monitoring, reporting, and alarming based on network flow data. In particular, it allows for detailed, down-to-the-minute, current and historical data analysis for our Data Center gigabit and 10 gigabit Ethernet ports. The tool also breaks down network conversations and associated applications by TCP ports.

Such detailed analysis and reporting allows us to diagnose and determine root cause problems between server/host issues and application/services issues with greater authority. We can determine if there is

a large amount of some particular flow data that points to a misbehaving application or if we are experiencing various errors on a network port or device. These tools also provide a way for us to correlate denial-of-service attacks and port scanning hosts. In addition, we can point out other traffic flows that may cause undesirable affects to production network traffic.

We continue to strive toward the most effective methods for managing our network containing more than 3,000 edge switches, 93 routed links, nearly 40,000 users, and more than 100,000 hardware addresses. Other network management software, hardware, and in-house solutions are being researched, evaluated, and/or developed on an ongoing basis.

For more information, contact Brian Jones, *bjones@vt.edu*.

## Moving IPv6 routing into core routers

This year, IPv6 routing improvements to the network core were considered and planned. Moving IPv6 routing into our six major routing/switching nodes in the campus gigabit

Ethernet core—Burruss, Cassell, Hillcrest, Andrews Information Systems Building (AISB), Owens, and Shanks—is the ultimate goal. IPv6 routing is currently accomplished by smaller routers installed at each switchroom location.

Once the necessary hardware and software is obtained (expected within the next six to 12 months) for Shanks, one of our major switching/routing core nodes, we will complete the IPv6 routing move.

All core routers other than Shanks received supervisor hardware upgrades along with new Internet operating system code to support new features and configuration command sets during 2008-2009. The upgraded core will allow us to consolidate our IPv6 routing into the core routers in the near future and free up the 7301 routers for other purposes. We moved IPv6 routing to the Hillcrest, Cassell, and Owens core routers during this past fiscal year. Burruss, AISB, and Shanks will be completed in the 2010-2011 fiscal year.

Moving IPv6 routing into our core routers will allow us to have a more consistent and manageable IPv6 deployment by paralleling the IPv4 network at the core nodes. This configuration permits better management of our network traffic by giving us the ability to enable flow analysis and export data flows to our network management platforms for IPv6

flow data. Analyzing network traffic flow data allows us to better account for network utilization, track heavy data usage, plan for network expansion, find compromised hosts on the network, and respond to network security issues in a more efficient manner.

When the IPv6 routing is moved into the remaining core routers, we will have significantly increased our ability to provide the university community with the data network services and bandwidth they require for IPv6 applications. At the same time, our ability to "view" network performance and analyze bandwidth utilization characteristics for IPv6 capacity-planning and troubleshooting will improve.

For more information, contact Brian Jones, *bjones@vt.edu*.

## Kestrel

Project Kestrel was established to build the next-generation, telecommunications management system for NI&S. It is a collaborative project of the Systems Development and Administration team, Public Relations team, and the Technology Innovations team. Eventually, it is expected to replace the current legacy telecommunications

management systems such as ATLAS and NEMISYS. The primary goals of the project are to improve organizational effectiveness through better application usability, reduce reliance on proprietary software, and enhance software reliability, maintainability, and extensibility.

Project Kestrel delivered two applications this fiscal year—a replacement and redesign of the Engineering Change Order (ECO) application and a fiber-optic cable plant documentation tool. Additionally, significant progress was made towards a second release of the ECO. The new release is designed to evaluate RESTful architecture and the Google Web Toolkit as potential, standard, Kestrel technologies.

**Engineering Change Order (ECO)**. The ECO is a workflow process and application used by the organization's engineers and facilities managers to plan and manage changes to the university's network infrastructure. Kestrel ECO was deployed in February of this year. The Kestrel ECO replaced a proprietary, BMC Remedy-based system with an open source technology solution focused on improving the ECO process.

**Fiber-optic cable plant documentation tool**. In January 2009, the Field Engineering unit began to document the inventory of the fiber-optic plant resources installed in the network. Software architects and designers within the Systems Development and Administration unit designed a process that would facilitate a

paper-based, data collection approach. A paper-based approach was deemed necessary because many of the facilities in which fiber-optic cable plant is terminated do not have network access. Moreover, it was determined that it would be difficult and expensive to develop a data-entry application for the field that could adequately cope with the real-world irregularities of the physical cable plant. Instead, it was determined that the most expeditious approach would be for field personnel to record observations of the physical cable plant in a loosely structured and flexible manner—using simple paper forms—and manage the complexity of analyzing the observations in a separate and subsequent process.

In 2010, architects and developers in the Technology Innovations group began research on a prototype software tool to facilitate data entry from the forms recorded in the field. A process was designed in which each original paper form is scanned to produce a digital image. The digital image for a data-collection form is displayed on-screen in the software tool used by a data-entry technician. The tool provides a very sophisticated user interface that manipulates the digital image of the original paper form during the data-entry process. As the cursor moves from field to field in the data-entry screen, the corresponding field on the digital image of the paper form is brought into focus and highlighted automatically. This

approach dramatically improves the fidelity of the transcription of the information on the paper forms into a structured, electronic format.

The output from this data entry tool will be used to build a relational database of the cable plant observations recorded in the field. Analysis of the resulting database to draw inferences on the structure and capacity of the fiber-optic cable plant system will be the subject of additional research work in the future.

**Technology evaluation**. Two technologies were identified by the Technology Innovations team as strong candidates to improve the efficiency and effectiveness of Kestrel development.

Google Web Toolkit (GWT) is a development toolkit for building and optimizing complex browser-based applications (*http://code.google.com/webtoolkit/*). The Kestrel team expects GWT to provide an effective framework for building the complex Kestrel Web applications needed to replace existing client-server systems as well as developing new applications.

The team also evaluated approaches and solutions for "RESTful" Web services. representational state transfer (REST) is a style of software architecture for distributed systems, commonly used in rich Internet

applications. A RESTful Web service provides mechanisms for a rich Internet application to query and manipulate enterprise data using Web technologies. The team believes that RESTful Web services will play an integral role in the development of Kestrel applications.

Significant work was completed this year in converting the ECO application to leverage these technologies in an effort to evaluate and establish these as key Kestrel technologies. The RESTful/GWT version of ECO is expected to be released in August.

For more information, contact Morgan Allen, *allenm@vt.edu.*

# ATLAS—the telecommunications management system

ATLAS is an internally developed telecommunications management system that supports the accounts receivable, accounts payable, budget, inventory (services, assets, materials, and cable plant), and work order functions of the organization.

This year, the most significant added functionality included support for project management with integrated project-estimation. Closely related to this was progress

made towards project cost-analysis reporting. New cable plant and service models to support documentation of fiber channel-based storage area network service were implemented. Support for Virginia Tech Foundation accounts as a separate account type was added which allows managers of Foundation-funded accounts to administer accounts and provision services through *cola.cns.vt.edu.*

In addition, the ATLAS database was upgraded to Oracle 11g.

For more information, contact Morgan Allen, *allenm@vt.edu.*

## Business intelligence

Prior to this fiscal year, business intelligence within the organization relied primarily on proprietary Oracle tools such as Oracle Query Builder and the Oracle client version of Discoverer, as well as various standalone Web applications. Legacy Oracle tools will not work with the UTF-8 character of the upgraded ATLAS database. Therefore, we replaced these tools.

The development and administration teams deployed JasperServer as the new business intelligence platform in March 2010. JasperServer is an open source, business intelligence platform based on the reporting tool, JasperReports, and a suite of other open source technologies.

In previous years, the development team had firmly established JasperReports as a replacement for legacy Oracle Reports applications, setting the stage for Jasper as a consolidated business intelligence platform for all databases within the organization. The establishment of the Jasper platform significantly improves the ability of the development team to rapidly build and deploy reports to a common platform to meet organizational needs.

Developers built and deployed 85 reports on the Jasper platform this year to replace legacy business intelligence functionality. Additionally, work was begun to leverage JasperAnalysis tools for multidimensional data analysis.

Remaining legacy ad-hoc analysis not addressed by the Jasper suite was replaced with Advanced Query Tool (AQT). The development team converted over 300 ad hoc queries to AQT queries.

For more information, contact Morgan Allen, *allenm@vt.edu.*

## BMC Remedy problem-reporting system

The development team supports development and administration of the BMC Remedy problem-reporting system used by the Virginia Tech Operations Center and numerous other organizations throughout Information Technology. The system supports up to 78 users and was used to manage nearly 54,000 tickets during the 2009-2010 fiscal year.

This year, the system was moved to new hardware, and the BMC Remedy version was upgraded from version 6.3 to 7.5. Additionally, the supporting database was upgraded from Oracle 9i to Oracle 11g, including a conversion to UTF-8 character set.

For more information, contact Morgan Allen, *allenm@vt.edu.*

## Database administration

The organization's Systems and Database Administration (SDA) team manages 17 Oracle databases and 13 PostgreSQL databases that support the varied NI&S business processes. The Oracle databases store a total of just over 270Gb of data. Databases support as many as 140 named users and numerous applications that serve the organization, students, staff

members, faculty members, departments, and university guests.

During this fiscal year, the SDA team migrated the remaining two Oracle 9i databases to Oracle 11g, including the organization's largest and most heavily used database, ATLAS. The migration of ATLAS to Oracle 11g and new server hardware resulted in significant improvements in application performance. Online transaction processing applications became noticeably faster, and batch process performance improved by as much as 10 times over the previous response time.

Additionally, six databases were upgraded from Oracle 11gR1 to Oracle 11gR2.

For more information, contact Morgan Allen, *allenm@vt.edu*.

# Software upgrades for network operations support

CNS engineers implemented several upgrades to mission-critical software. These enhancements resulted in the deployment of the most recent software versions and the addition of new features.

Atlassian Confluence, which is used for collaboration and information-sharing within CNS and with partner organizations both inside and outside the university, has been brought up to version 3.0.2. This upgrade brings it in line with the Document Management Services Confluence wiki, enabling smooth transfer of content between them. Atlassian JIRA is used by CNS development teams and the Blacksburg Electronic Village to manage software projects, request new features, and report errors. JIRA was upgraded to the most recent version, ensuring access to the latest features and support by Atlassian.

In addition, Airwave Management Platform (AMP)—a wireless, network monitoring tool— was upgraded to the latest version, 7.0. This version adds the ability to monitor wired switches thereby providing the same easy interface for management and monitoring as is available for the wireless network. This upgrade enables better troubleshooting by automatically correlating device discovery information in the network to determine which devices are connected and, therefore, provide information on the impact of any outages. CNS also purchased additional hardware and licenses for AMP to allow the organization to expand its installation to handle these additional devices as well as the continued increase in the number of wireless access points without the loss of usability associated with overloading the server.

For more information, contact Jacob Dawson, *dawson@vt.edu.*

# Telecommunications facilities upgrades

Several upgrades to telecommunications systems and equipment spaces on campus have been recently completed or are in progress. The goals are to provide the necessary power and space to support current and future telecommunications needs. Generators, heating, and air-conditioning units—many of which were installed during the late 1980's— are now at the end of their service life. In order to maintain network reliability, to reduce long-term maintenance needs, and to provide a platform for next-generation services, we must replace these systems.

**Uninterruptable power system upgrades for CNS switchroom locations. C**NS provides uninterruptible power (UPS) for its Ethernet systems and for switchroom locations classified as major switching centers. Our goal is to provide reliable, up-to-date, UPS equipment that will support the next-generation Ethernet switching applications and equipment for voice and data communications.

The CNS Facilities group was able to acquire and install UPS equipment in the Shanks Hall switchroom. Completion of this installation leaves only one of six switchrooms on the main campus—the Andrews Information Service Building—still in need of a UPS equipment

upgrade. One additional CNS switchroom, located at the Northern Virginia Center in Falls Church also requires improvements to existing UPS equipment.

CNS Facilities plans to upgrade the two remaining UPS systems—in the AISB and at the Northern Virginia Center—with advanced equipment similar to what is currently operational in the other five CNS switchrooms. These enhancements will be scheduled during the 2010-2011 academic year.

**Heating, ventilating, and air conditioning (HVAC) upgrades for CNS switchroom locations.** CNS provides and maintains heating, cooling, and climate control systems for its telecommunications switchroom locations classified as major switching centers. Providing reliable HVAC services is critical to the maintenance and support of current and next-generation applications and equipment for voice and data communications.

The CNS Facilities team installed new HVAC equipment in the Hillcrest and Shanks switchrooms providing increased operational reliability as well as a decrease in the need for major maintenance and repair. Owens Hall and the Andrews Information Systems Building are the two remaining facilities requiring new HVAC equipment.

The CNS Facilities group plans to install advanced HVAC systems in these two locations during the 2010-2011 academic year.

**New generators for CNS switchroom locations.** CNS provides emergency power for its major campus switching centers. During the 2009-2010 fiscal year, the CNS Facilities team acquired new generators to provide reliable power in the major switchrooms in the event of a power interruption. These generators will support next-generation telecommunications equipment and will result in lower repair and maintenance costs as well as greater fuel efficiency. Installation will be completed early in the 2010-2011 fiscal year.

For more information, contact Robert Rankin, *rankinr@vt.edu*.

# Project management

When the Virginia General Assembly passed the Restructured Higher Education Financial and Administrative Operations Act of 2005, Virginia Tech was authorized to develop its own project management policies and procedures for information technology initiatives.

Information Technology project leaders and project managers must meet certain requirements and have the required amount of

prior project management experience including team-building, leadership, education, and necessary technical skills. Network Infrastructure and Services currently has one staff member who has earned professional certification from the Project Management Institute (PMI) and several individuals who have obtained the required amount of project management experience to lead and manage projects.

NI&S recognizes the importance of project management and has created a working team to assist the project leaders. The NI&S Project Management team is developing training materials and processes related to project management standards for the department's employees. Each project leader/manager will maintain a personal, project management portfolio to track project management training/experience.

A project management portfolio application has been developed and implemented to provide all NI&S groups with the capability of sharing project information and status. The project management portfolio is available to other Information Technology groups, including the Office of the Vice President for Information Technology.

Project management was provided from July 1, 2009 through June 30, 2010 for 17 completed projects and for 15 projects still in progress.

For more information, contact Christine Morrison, *imsvs@vt.edu*.

## Office 2007 upgrade

In June 2009, the Systems Development and Systems Administration group began upgrading departmental machines to Office 2007 Enterprise Edition, which is a suite of software including Word, Excel, PowerPoint, and other applications.

As a result of this upgrade, users were able to migrate documents to the most current format of the Office applications. Spreadsheets and locally used databases were converted to ensure they supported customer needs and other functionality. Some staff members attended training sessions to learn more about the upgraded Office applications.

When the university's Exchange Server was upgraded to Exchange 2007, e-mail clients on machines running Office 2002, or earlier versions, were no longer going to be supported. Machine upgrades in NI&S were completed in such a way that there were no long term e-mail outages in the department. As of August 2009, almost every departmental machine had been upgraded.

Office 2007 software provides better

application functionality and additional features. Despite a learning curve associated with the new software, users are taking advantage of the new features and benefits. Users are encouraged to participate in training classes to increase their knowledge in any of the Office application skill sets.

For more information, contact Danny Wright, *dano@vt.edu*, or Eric Fischer, *eric.fischer@vt.edu.*

# Performance and productivity metrics

## Strategic Initiatives

The graph *Campus capacity* depicts the aggregate capacity of Virginia Tech's campus connections to the Internet and to national and global research and education networks—Internet, Internet2, NetworkVirginia, and National LambdaRail. Capacity requirements have trended upward with the increased utility of the Internet and the demand for related services. High-performance connectivity for computational research, coupled with increased requirements for visualization and

collaborative tools, resulted in a dramatic increase in capacity requirements.

In 2009, the university nearly doubled access capacity with a second 10Gbps link from Blacksburg to the Washington, D.C., area. The new optical connection follows a different path than the existing 10Gbps link to McLean providing greatly increased reliability. As part of the upgrade, NI&S created a second aggregation facility located at Equinix in Ashburn, Virginia, which is connected to the existing aggregation facility in McLean with fiber. The new 10Gbps link goes to Equinix providing Virginia Tech with extraordinary access to all national and international research and education networks, Internet backbones, content

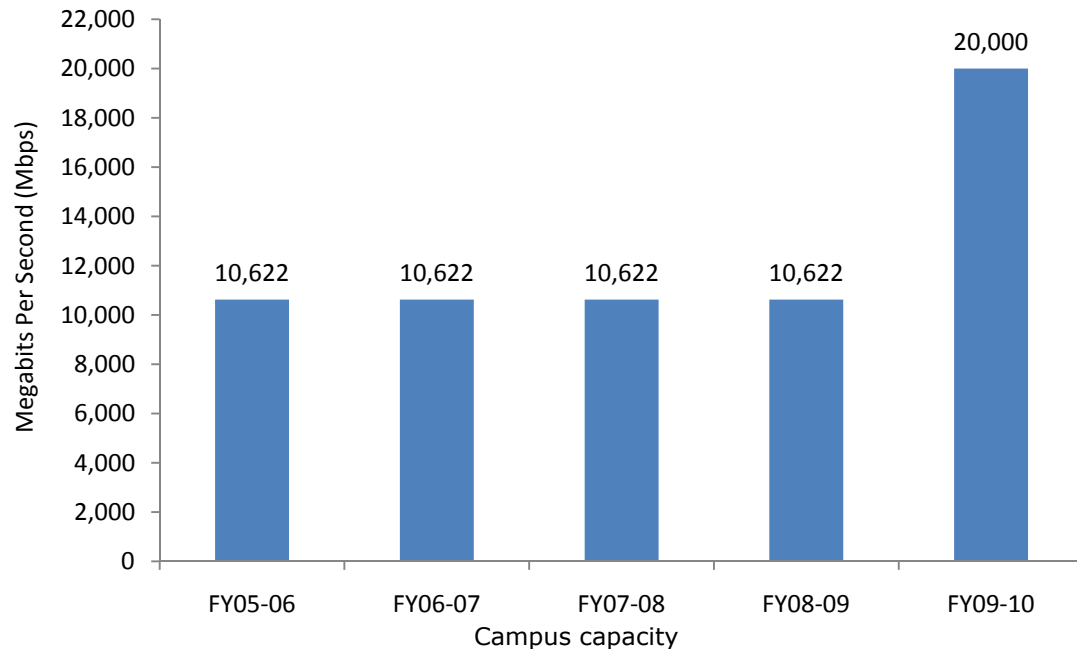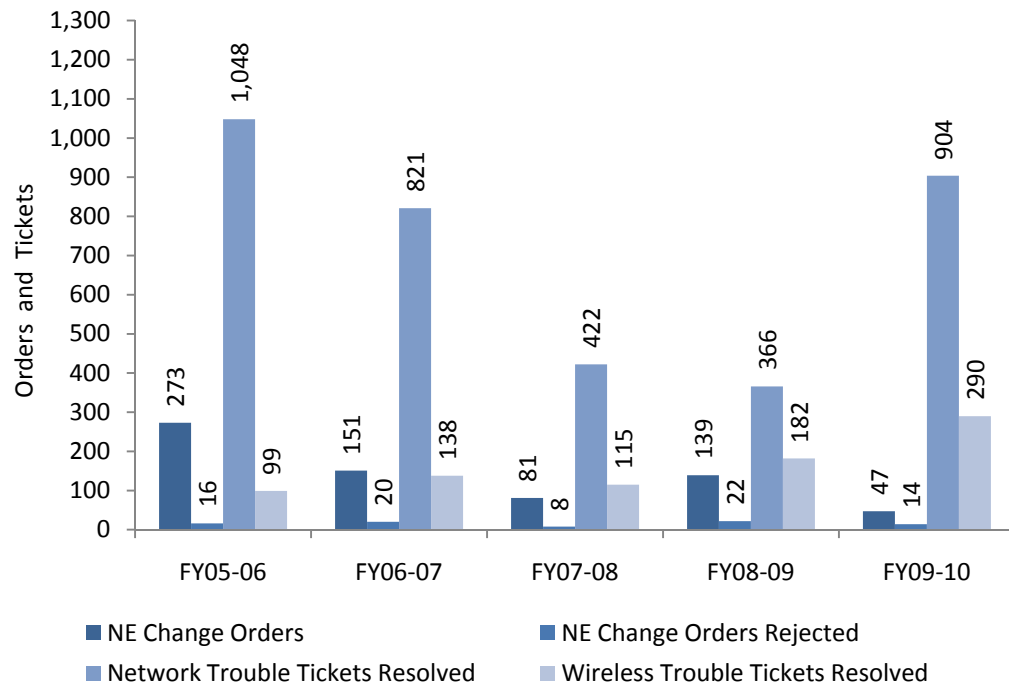providers, and other resources.

## Network Engineering

Network Engineering (NE) *change orders* are submitted to make changes to existing network configurations or to introduce new equipment and configurations into the network.

On the following graph, *change orders rejected* represents orders that were submitted but rejected by the Engineering Change Order Committee. Orders may be rejected for many reasons—the submitted change is deemed unnecessary; the submitted change has been superseded by another change order; the committee determined the submitted change would not result in the desired effect; the change was deemed too disruptive to be implemented due to other changes taking place or conflicts with the "critical dates" calendar, etc.

*Network trouble tickets resolved* is the number of opened network trouble tickets in the Remedy trouble-ticketing system that were successfully resolved.

*Wireless trouble tickets resolved* is the number of opened wireless trouble tickets in the Remedy trouble-ticketing system that were successfully resolved.



Campus capacity

Orders and Tickets

- NE Change Orders
- NE Change Orders Rejected
- Network Trouble Tickets Resolved
- Wireless Trouble Tickets Resolved

During the past fiscal year, some core routers were upgraded with new hardware to increase bandwidth capabilities and CPU/processing power. Overall, however, NE change orders have decreased in number this fiscal year due to minimal changes in network software.

The number of network trouble tickets increased during 2009-2010 as a result of the installation of many new wireless access points. However, the number of wireless trouble tickets resolved also increased from last year. Another increase in network

trouble tickets can be attributed to the installation of more power over Ethernet ports in support of the message-board alert system which doubled in size this fiscal year.

*Rejected engineering change orders* have decreased in proportion to the NE change orders processed. (See above)

The number of wireless trouble tickets has generally increased as the number of wireless access points installed throughout campus has increased.

Network Engineering continues to improve wireless local area network (LAN) coverage. In the past year, eight more facilities have received wireless LAN service. As building renovation projects continue to reshape our campus, access points are continuously removed from and returned to service to optimize coverage and capacity. Wireless utilization continues to grow, and the number of registered users climbs each semester as more faculty and staff members, and students choose to use the wireless LAN for mobility and convenience. (See table below).

|  | FY06 | FY07 | FY08 | FY09 | FY10 |
|---|---|---|---|---|---|
| Number of buildings with Wireless LAN Service | 122 | 129 | 143 | 162 | 170 |
| Total number of deployed wireless access points | 1,179 | 1,248 | 1,359 | 1,769 | 1,898 |
| Total number of Wireless LAN registrations | 23,167 | 26,358 | 29,885 | 32,089 | 35,995 |

**Typical daily wireless utilization**

The following graphs represent a snapshot of the usage of the wireless network over a typical 24-hour time period on an academic day—April 28, 2010.

*Wireless users* shows the number of users connected to the wireless service throughout the day. The second graph shows the aggregate bandwidth utilization over the time period.

Trend analysis of a typical day shows heavy utilization of the service, peaking at over 8,000 users during the middle of the academic day. This usage represents a 30 percent increase over a typical day in 2009. Small dips throughout the day coincide with breaks between classroom periods. This pattern would imply that portable and mobile devices are heavily utilized by the student population during lecture and lab periods on a typical day when classes are in session.

The second graph, *Aggregate bandwidth*, shows the aggregate bandwidth seen on the wireless network over the 24-hour time period. *Bits per second out* represents the amount of bandwidth that the wireless users consumed (downloaded); *bits per second in* represents the amount of bandwidth generated by the wireless users (uploaded).
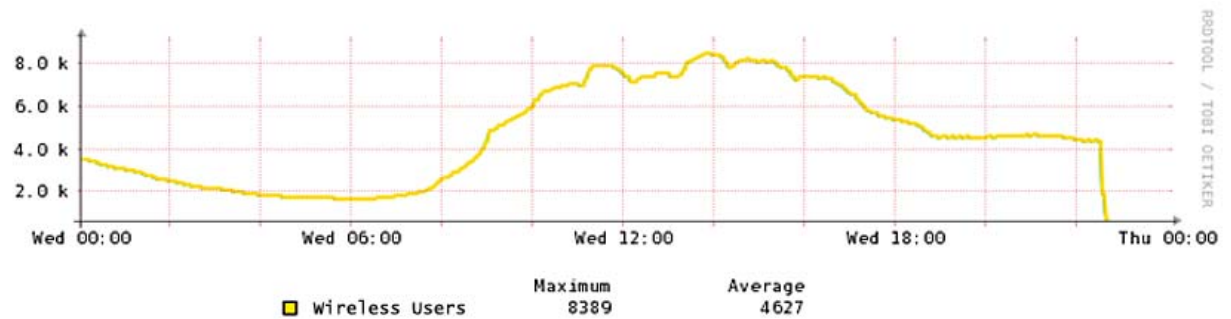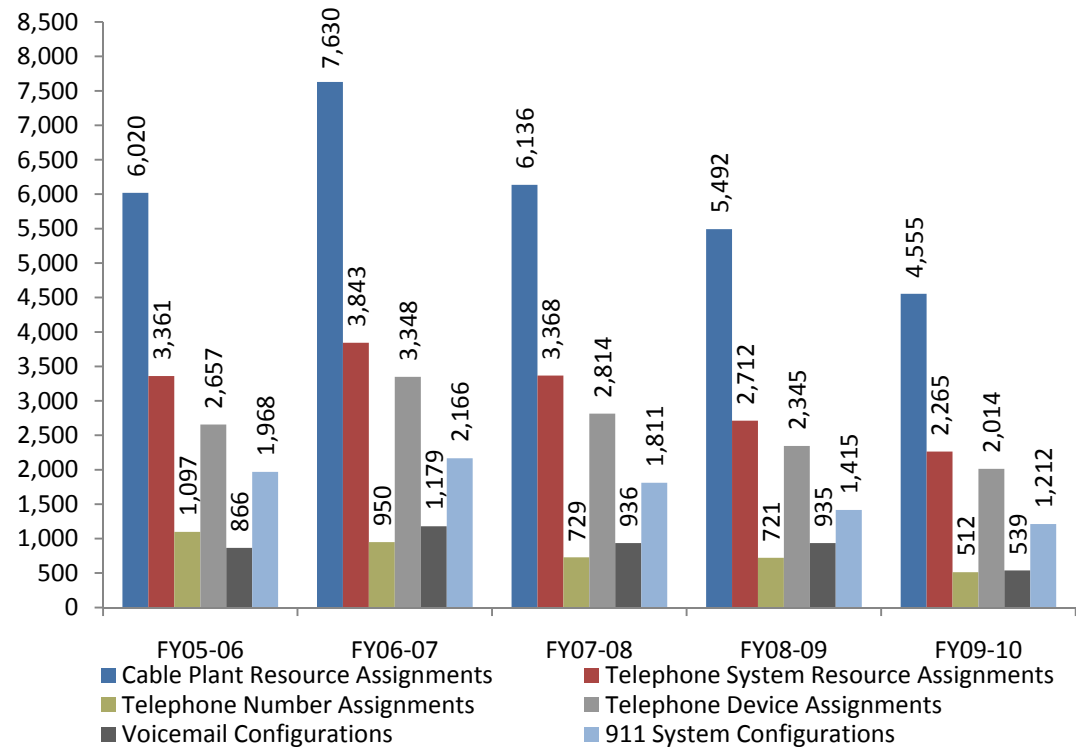
Wireless users
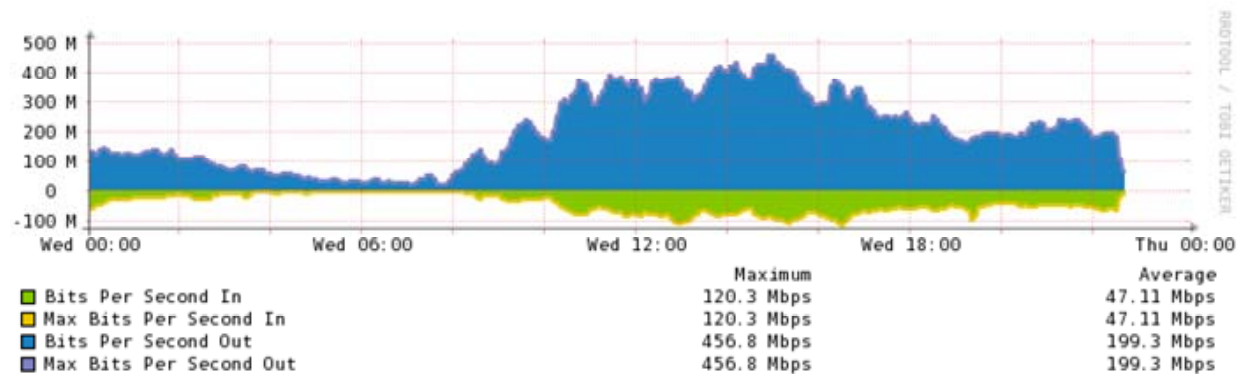
Aggregate bandwidth

The average bandwidth consumed is four times greater than the bandwidth generated by wireless clients, reinforcing the assumption that wireless clients are *users* of Internet services and are not serving content. The graph also shows that the heaviest use is during the late afternoon and into the early evening.

## Switch Engineering

The graph (right) represents the total number of resource assignment transactions—cable plant, telephone number, telephone system, and telephone device assignments—required to support requests for new telephone and network services. *911 system configurations* track software configuration and verification activities to ensure a telephone's location is accurately documented. *Voicemail configurations* track the software activity to provision voicemail and call processing services.



Legend:
- Cable Plant Resource Assignments
- Telephone Number Assignments
- Voicemail Configurations
- Telephone System Resource Assignments
- Telephone Device Assignments
- 911 System Configurations

| | FY05-06 | FY06-07 | FY07-08 | FY08-09 | FY09-10 |
|---|---|---|---|---|---|
| Cable Plant Resource Assignments | 6,020 | 7,630 | 6,136 | 5,492 | 4,555 |
| Telephone System Resource Assignments | 3,361 | 3,843 | 3,368 | 2,712 | 2,265 |
| Telephone Number Assignments | 1,097 | 950 | 729 | 721 | 512 |
| Telephone Device Assignments | 2,657 | 3,348 | 2,814 | 2,345 | 2,014 |
| Voicemail Configurations | 866 | 1,179 | 936 | 935 | 539 |
| 911 System Configurations | 1,968 | 2,166 | 1,811 | 1,415 | 1,212 |

In this graph, *PBX order* statistics represent the total number of move, add, and change orders for telephone and/or voice messaging services. This statistic tracks hardware, software, and cable plant activity that, in most cases, affects a *single* telephone user.

Switch Engineering *change orders* represent changes to the campus telephone and/or voice messaging systems to add capacity or additional functionality. This statistic tracks hardware and/or software activity affecting large groups or, in some cases, *all* users of the telephone system.

*CBX hardware failures* represent the total number of electronic circuit packs replaced in response to service-impacting failures of the university's telephone system.

The university's telephone system is aging but remains highly reliable. The number of *CBX hardware failures*—which significantly increased in fiscal year 2008-2009 – returned to previous levels this past year. As the CBX ages, it is more difficult to repair as dependable replacement parts are difficult to locate and purchase prices continue to increase. The vendor has discontinued any upgrades that would involve system change orders and the possibility of initial failures related to those changes. However, as the system continues to age, routine card failures have increased, and replacement
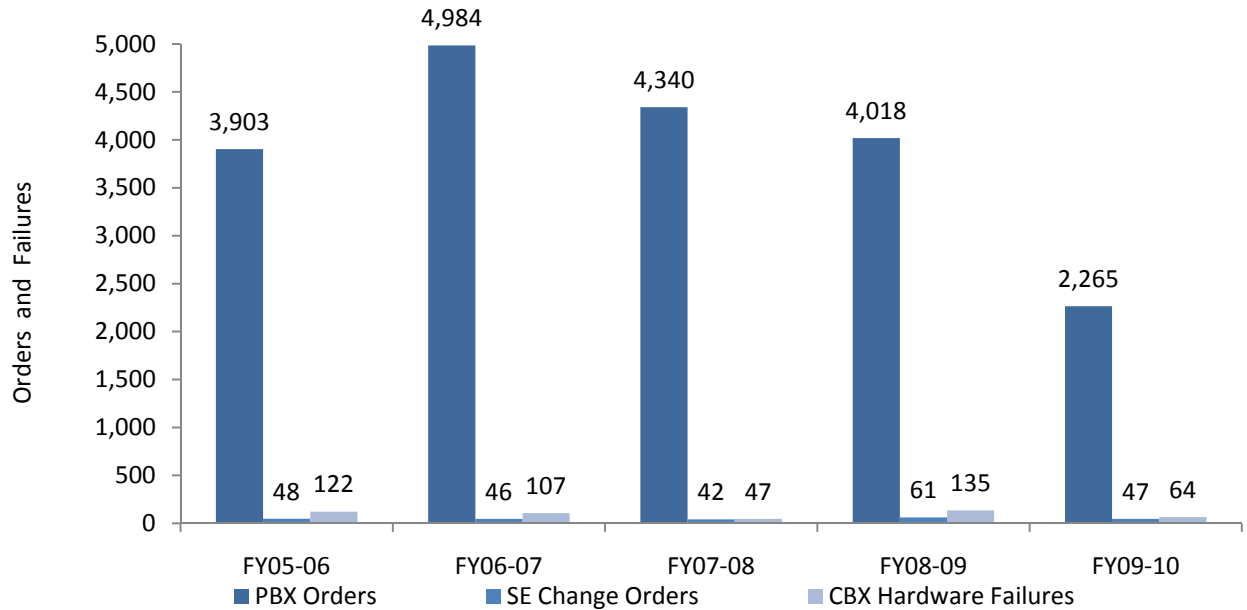


Orders and failures

hardware/cards from the vendor are not as reliable as they were in the past. Currently, when there is a system failure, the magnitude of the problem is much greater; there is a greater potential for user impact; and the time for problem resolution increases.

The campus telephone system was designed and is maintained to ensure a high level of service availability. The statistics in the following tables illustrate the effectiveness of engineering, maintenance, and monitoring efforts of the Switch Engineering group.

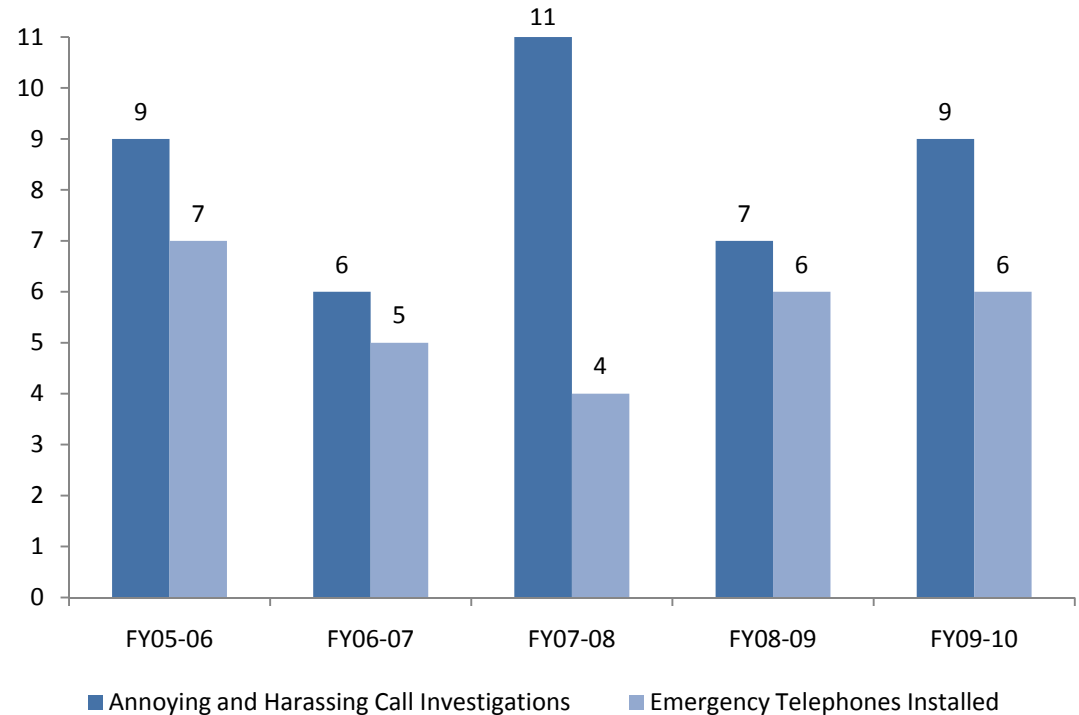We believe the larger number of user-reported failures during the past two years is related to the phone instruments and associated equipment reaching end-of-life and requiring replacement rather than the result of overall system failures.

Telephone system operation and maintenance

| | FY05-06 | FY06-07 | FY07-08 | FY08-09 | FY09-10 |
|---|---|---|---|---|---|
| System availability | 99.999% | 99.999% | 99.999% | 99.995% | 99.999% |
| System hardware failures resolved | 0 | 2 | 3 | 2 | 2 |
| Operating system and application patches | 0 | 0 | 0 | 0 | 0 |
| User-reported failures resolved | 756 | 591 | 412 | 869 | 726 |
| Hardware architecture modification projects | 2 | 2 | 4 | 6 | 13 |
| Software architecture modification projects | 46 | 49 | 41 | 35 | 25 |

Voicemail system operation and maintenance

| | FY05-06 | FY06-07 | FY07-08 | FY08-09 | FY09-10 |
|---|---|---|---|---|---|
| System availability | 99.982% | 99.999% | 99.999% | 99.999% | 99.999% |
| System hardware failures resolved | 3 | 2 | 1 | 2 | 2 |
| Operating system and application patches | 0 | 0 | 0 | 0 | 0 |
| Hardware architecture modification projects | 1 | 2 | 0 | 0 | 1 |
| Software architecture modification projects | 1 | 2 | 1 | 3 | 1 |

The next graph shows the total number of requests by the Virginia Tech Police Department to have a telephone monitored for the purpose of identifying the source of malicious or harassing telephone calls.

*Emergency telephones installed* represents the number of additional blue-light emergency phones installed on the campus. Blue-light telephones are strategically positioned to provide fast access to emergency services to members of the university community.



Legend: ■ Annoying and Harassing Call Investigations ■ Emergency Telephones Installed

| | FY05-06 | FY06-07 | FY07-08 | FY08-09 | FY09-10 |
|---|---|---|---|---|---|
| Annoying and Harassing Call Investigations | 9 | 6 | 11 | 7 | 9 |
| Emergency Telephones Installed | 7 | 5 | 4 | 6 | 6 |

# Field Engineering

*Work orders* indicates the number of completed work orders of various types as well as the total of all types of orders completed.

The increase in voice/data orders during 2006-2007 can be attributed, in part, to the completion of several new buildings and the move of the Office of Sponsored Programs from Collegiate Square to Research Building 15. In addition, numerous voice/data orders were worked in the days following the April 16th tragedy including the relocation of the Department of Engineering Systems and Mechanics and the dean of engineering from Norris Hall and supporting the needs of multiple command centers, counselors, and call centers. The work order totals for fiscal year 2009-2010 are significantly lower than previous years. A contributing factor in this decline is the significant cuts to departmental operating budgets which limited the number of telecommunications moves, additions, and changes.

NOTE: In 2005-2006, the graph illustrates total work orders processed and worked by Communication Network Services. Beginning in 2006-2007, only work orders completed by Field Engineering are illustrated. Examples of "non-field" work orders include NetworkVirginia, cellular orders, main switch, and PBX software only orders.

## Work orders

| Fiscal Year | Data Orders | Voice Orders | Video Orders | Other Orders | Total Orders |
|---|---|---|---|---|---|
| FY05-06 | 2,758 | 2,201 | 304 | 3,332 | 8,595 |
| FY06-07 | 4,237 | 4,083 | 122 | 628 | 9,070 |
| FY07-08 | 3,426 | 3,461 | 129 | 578 | 7,594 |
| FY08-09 | 3,439 | 3,025 | 120 | 962 | 7,546 |
| FY09-10 | 2,745 | 2,575 | 73 | 860 | 6,253 |

The table below shows the number of jacks, the amount of station cable, and the number of optical fiber fusion splices completed by Field Engineering for capital projects—new construction and major renovations—during each fiscal year. Capital Project statistics are compiled for projects *completed* between July 1$^{st}$ and June 30$^{th}$ of each year. However, these projects typically have a construction duration of one to four years. Field Engineering is frequently engaged in capital project installations where statistics of work performed are not posted until the annual report year in which the buildings/renovations are finished. This report also contains statistics for new construction installations in the Corporate Research Center.

| Capital projects | FY05-06 | FY06-07 | FY07-08 | FY08-09 | FY09-10 |
|---|---|---|---|---|---|
| Total RJ-45 jacks installed (each) | 4,400 | 1,923 | 1,639 | 2,368 | 3,339 |
| Total Cat 6 station cable installed (feet) | 1,101,000 | 415,700 | 312,460 | 443,000 | 624,660 |
| Total optical fiber fusion splices (splices) | 1,656 | 1,136 | 768 | 1,704 | 1,644 |

# Video/Broadcast Services

The first graph shows the total number of *interactive videoconference classes* and *video-on-demand classes* supported by Video/Broadcast Services (VBS).

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 indicates total hours of service provided by VBS for interactive videoconference classes and the total hours
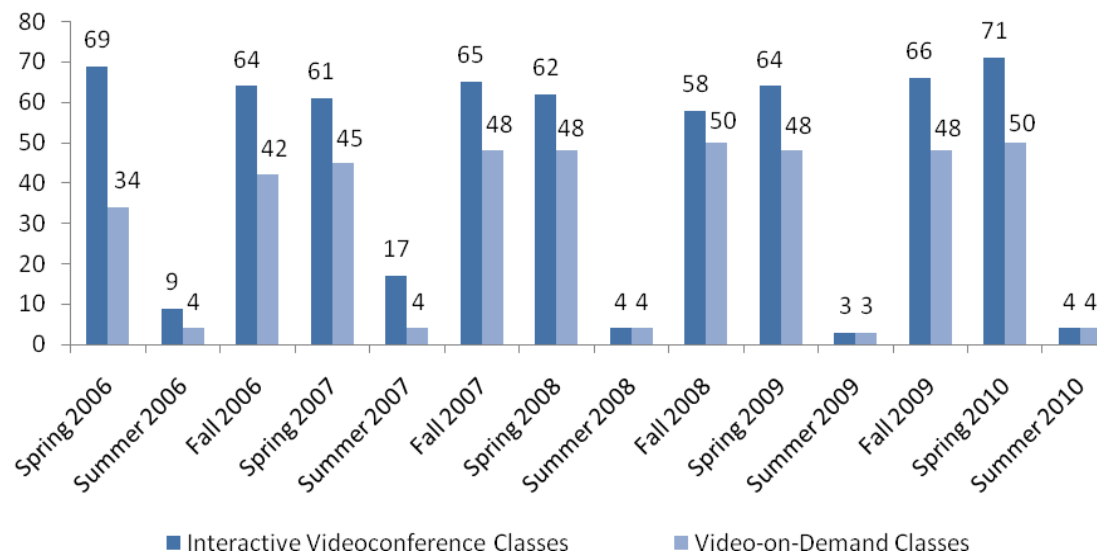
of lecture material prepared and hosted as video-on-demand files.

VBS IVC classrooms have the capability to broadcast two separate channels of information simultaneously (dual video). VBS also developed a 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 RealMedia, QuickTime, and Flash streaming servers. In the past year, VBS has streamlined its media creation with automation tools, worked with external content distribution networks to deliver live video around the world, and doubled its transcoding processor capability in order to deliver all its streaming classes in high-quality H.264.

The IVC facilities are used for many "one time event" interactive videoconferences including instructional use such as connecting guest speakers with Virginia Tech classes as well as assisting with preliminary exams, thesis, and dissertation defenses. The facilities also support administrative meetings among dispersed campuses.



Interactive Videoconference Hours of Service Provided ■ Video-on-Demand Hours of Content
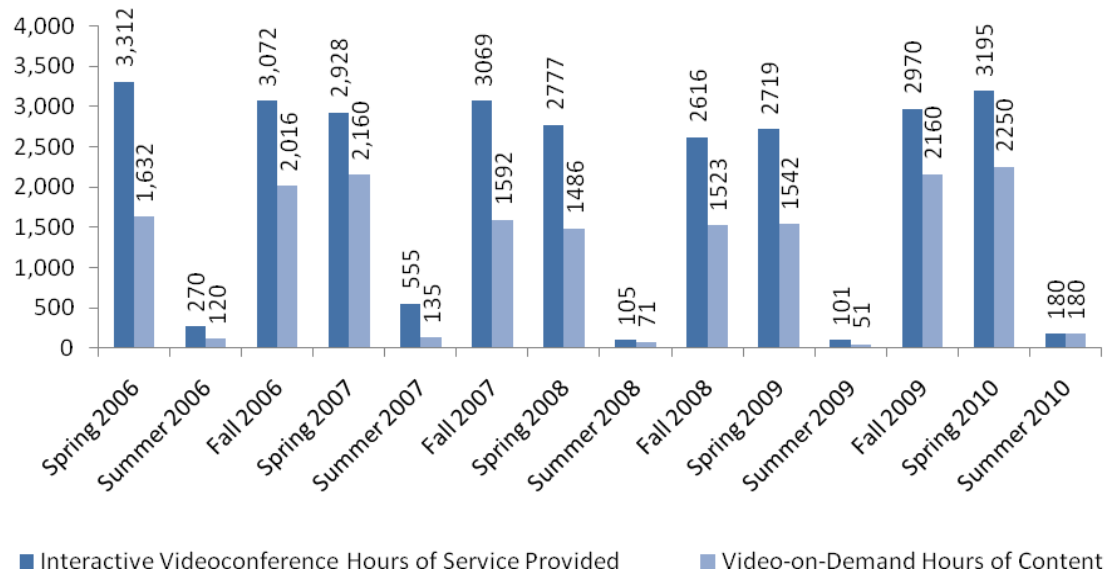
In the next graph is the tally of completed multimedia productions. The video/multimedia production arm of

Video/Broadcast Services produced 41 projects this year. More than 20 of these productions were longer format, more

complex, and more labor-intensive projects. These productions generally require extensive preparation, execution, and post-

production work. Therefore, the completion time was several weeks, or even months, from the first meeting about requirements until final delivery.

During the 2009-2010 fiscal year, the number of multimedia and interactive videoconferencing projects declined from previous years. A contributing factor in this

decline may be the significant budget cuts faced by departments who normally use these services.
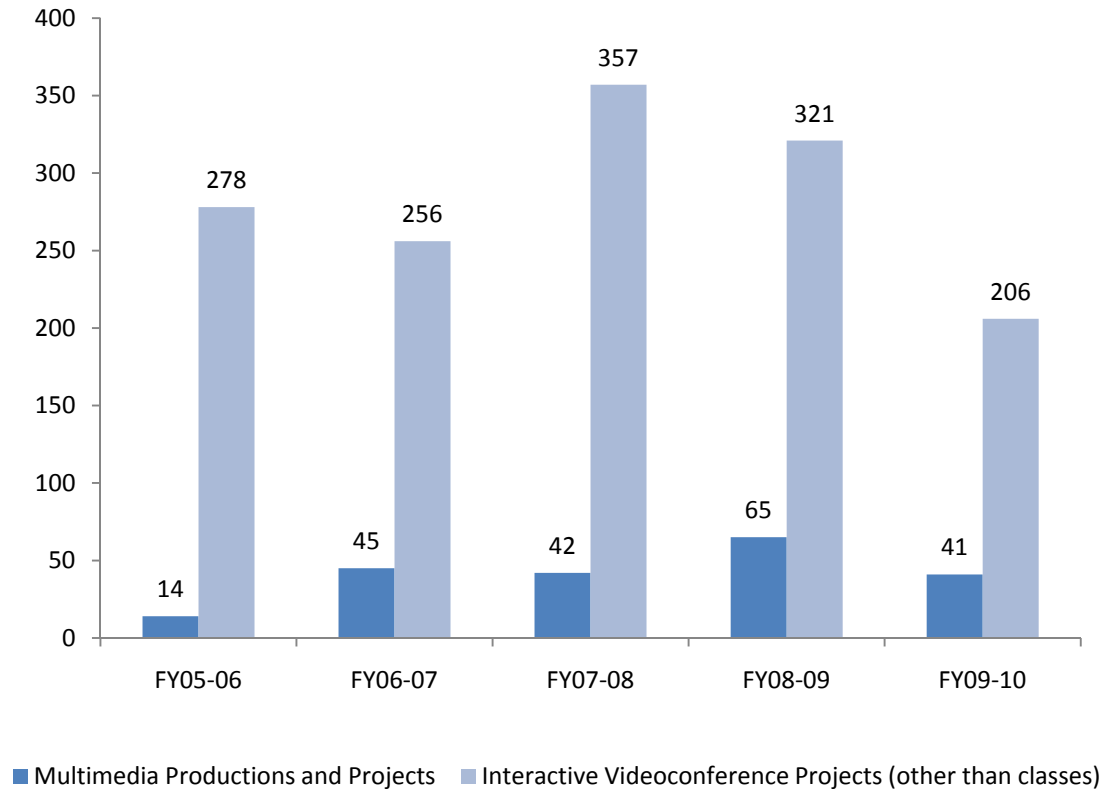


■ Multimedia Productions and Projects   ■ Interactive Videoconference Projects (other than classes)

VBS maintains and operates Virginia Tech's 32 interactive videoconference (IVC) classrooms throughout the commonwealth and the Video Network Operation Center (VNOC) in Research Building XIV.

Part of the VNOC's research and development (R&D) infrastructure has been moved from the Corporate Research Center to Whittemore Hall on the Virginia Tech campus. The designation for this new area is E-VNOC. The core of the new R&D area

consists of a multi-conference unit (MCU) and an Internet protocol video conference recorder (IPVCR). This infrastructure provides a redundant system of current production equipment to maintain operations in case of emergency.

### Interactive videoconference facilities

| | FY05-06 | FY06-07 | FY07-08 | FY08-09 | FY09-10 |
|---|---|---|---|---|---|
| VNOC—ATM Video Bridges | 2 | 0 | 0 | 0 | 0 |
| VNOC—IP Video Bridges | 2 | 3 | 3 | 3 | 3 |
| VNOC—IP VCRs | 2 | 3 | 3 | 3 | 3 |
| ATM Origination Sites | 23 | 0 | 0 | 0 | 0 |
| ATM Receive Sites | 17 | 0 | 0 | 0 | 0 |
| IP Origination Sites | 0 | 22 | 22 | 22 | 22 |
| IP Receive Sites | 0 | 10 | 10 | 10 | 10 |
| RAID 5 Streaming Media Storage Server (terabytes) | 2.2 | 7 | 10 | 10 | 10 |

VBS Field Engineering provides planning, installation, and maintenance services for Virginia Tech's interactive videoconference facilities located on the Blacksburg campus and across the commonwealth. VBS Field Engineering handles routine and preventive maintenance of video systems, providing a fast response for the repair or replacement of broken equipment and coordinates efforts with the VNOC to resolve communication problems.

### Service calls by VBS Engineer

| | FY06 | FY07 | FY08 | FY09 | FY10 |
|---|---|---|---|---|---|
| Off-campus calls resolved by remote access or telephone support | 65 | 53 | 51 | 61 | 64 |
| Off-campus calls resolved by on-site visit | 17 | 10 | 8 | 11 | 12 |
| On-campus calls resolved on-site | 21 | 26 | 27 | 29 | 35 |

## Systems Support

The graph below illustrates the flow of all e-mail into the Virginia Tech domain from July 2009 through June 2010. The red line, hovering between 1 and 7 million, represents all e-mail messages received. The green line represents messages actually processed through the system (not blocked or rejected due to viruses or suspected spam). The blue line represents those messages that were delivered and not tagged as being potential spam.
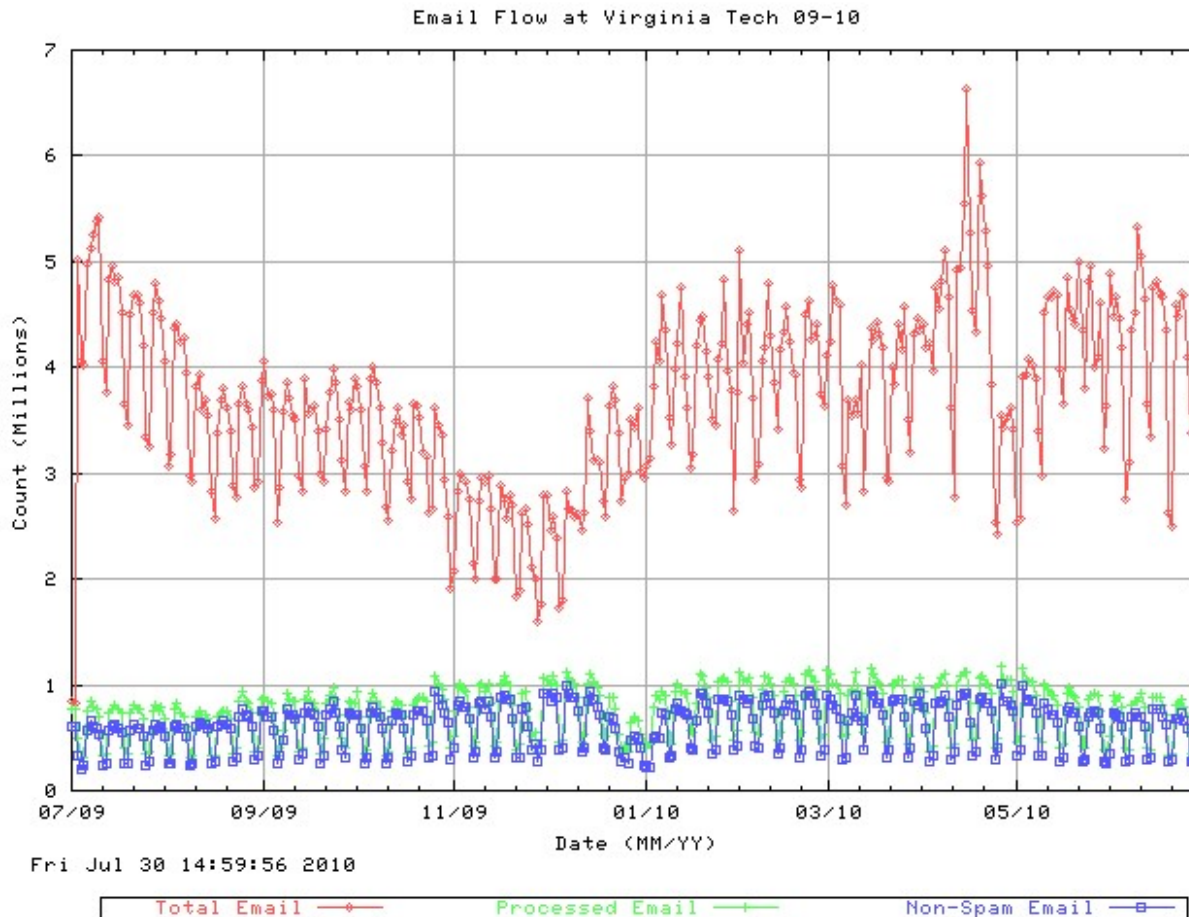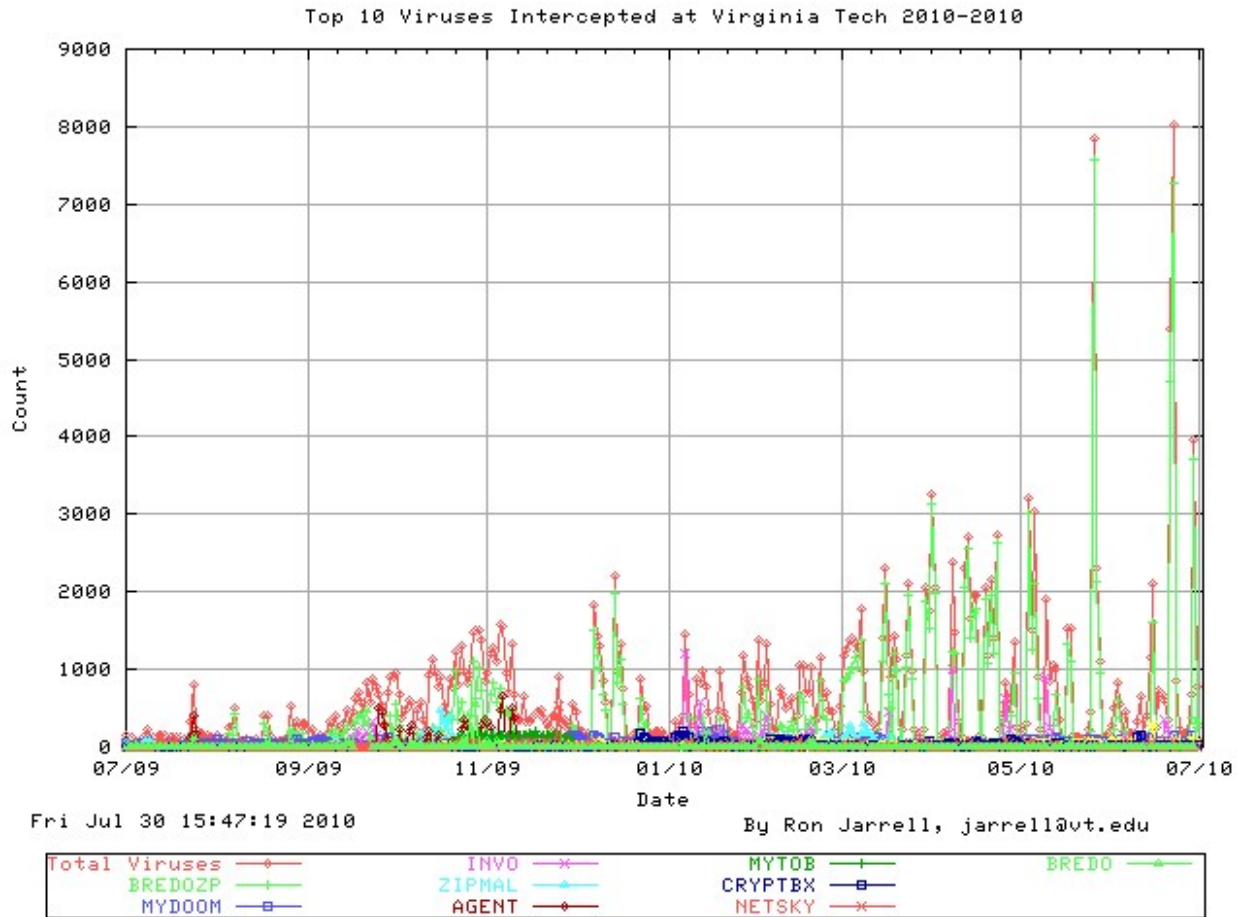
E-mail flow at Virginia Tech FY10

The next graph represents the "Top Ten" viruses received at Virginia Tech during the fiscal year. All of these viruses were intercepted by the virus scanners.

Many of these viruses are several years old; MYDOOM was released in late 2004 and BAGLE in early 2002. Viruses are not eradicated; they are only blocked and prevented from doing damage. Very few new viruses are released "into the wild" these days, but the older ones continue to plague users.

.

Top 10 Viruses Intercepted at Virginia Tech 2010-2010

Fri Jul 30 15:47:19 2010

By Ron Jarrell, jarrell@vt.edu

| Total Viruses | INVO | MYTOB | BREDO |
|---|---|---|---|
| BREDOZP | ZIPMAL | CRYPTBX | |
| MYDOOM | AGENT | NETSKY | |

The dramatic decrease in fiscal year 2006-2007 and beyond is indicative of increased user awareness, improved client software penetration (VTnet provides software to all university affiliates at no charge at the start of each fall semester), and the decline of e-mail as a delivery mechanism for "malware." Malware can now be received via Web bugs, instant messaging, and other services deployed by younger users, such as college students.

The graph below illustrates the number of computer viruses captured by the scanners associated with the central e-mail systems.

The high number seen in 2005 was a direct result of a major virus outbreak (MYDOOM)

which severely disrupted operations at Virginia Tech



Viruses captured
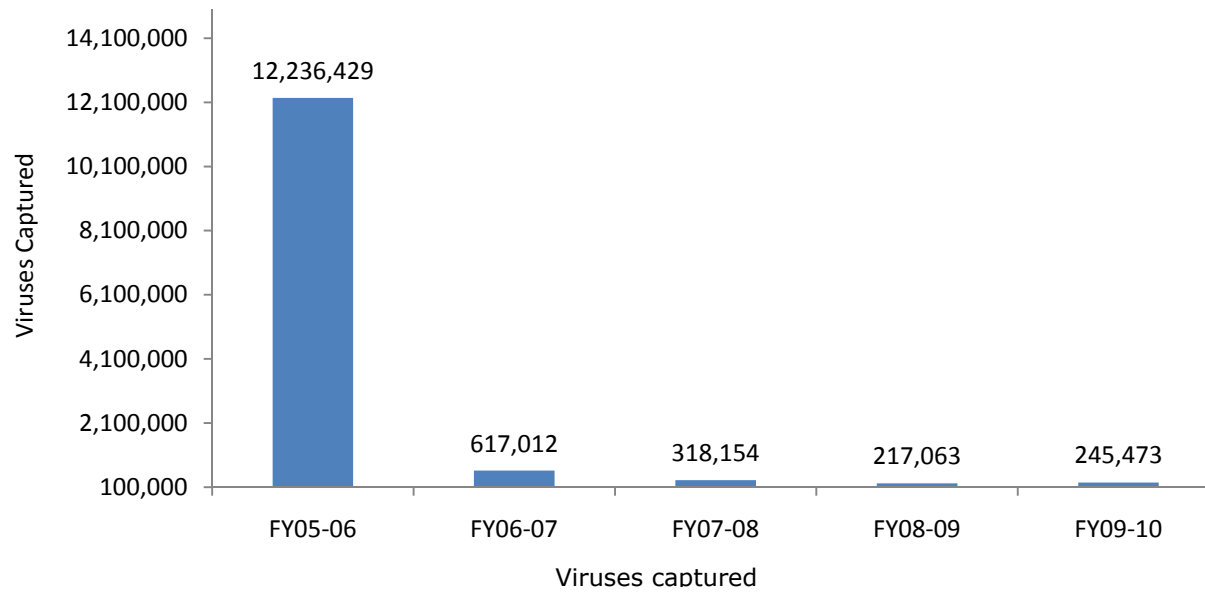
The graph below illustrates the Virginia Tech "SPAMDAQ." This index reflects the severity of incoming spam. Much like a stock index, it shows the long-term ebb and flow of unsolicited/unwanted e-mail received by Virginia Tech's central e-mail servers.

The SPAMDAQ is an internally developed index. It is computed by comparing a single day's intake of spam, as detected by Virginia

Tech's spam and virus filters, against the average spam received during a baseline period—fall semester 2003 (August 25-December 18, 2003). The number "10,000" is set as the index value for the _median_ spam amount. (A score of 5,000 means half the index amount was received; a score of 20,000 would mean twice the index amount was received.)

Unsolicited e-mail is a significant issue at Virginia Tech as it is elsewhere. The amount received continues to grow steadily. This year, the quantity of incoming spam during some months was as much as five times the amount received in 2003 when the Virginia Tech SPAMDAQ was originally created.
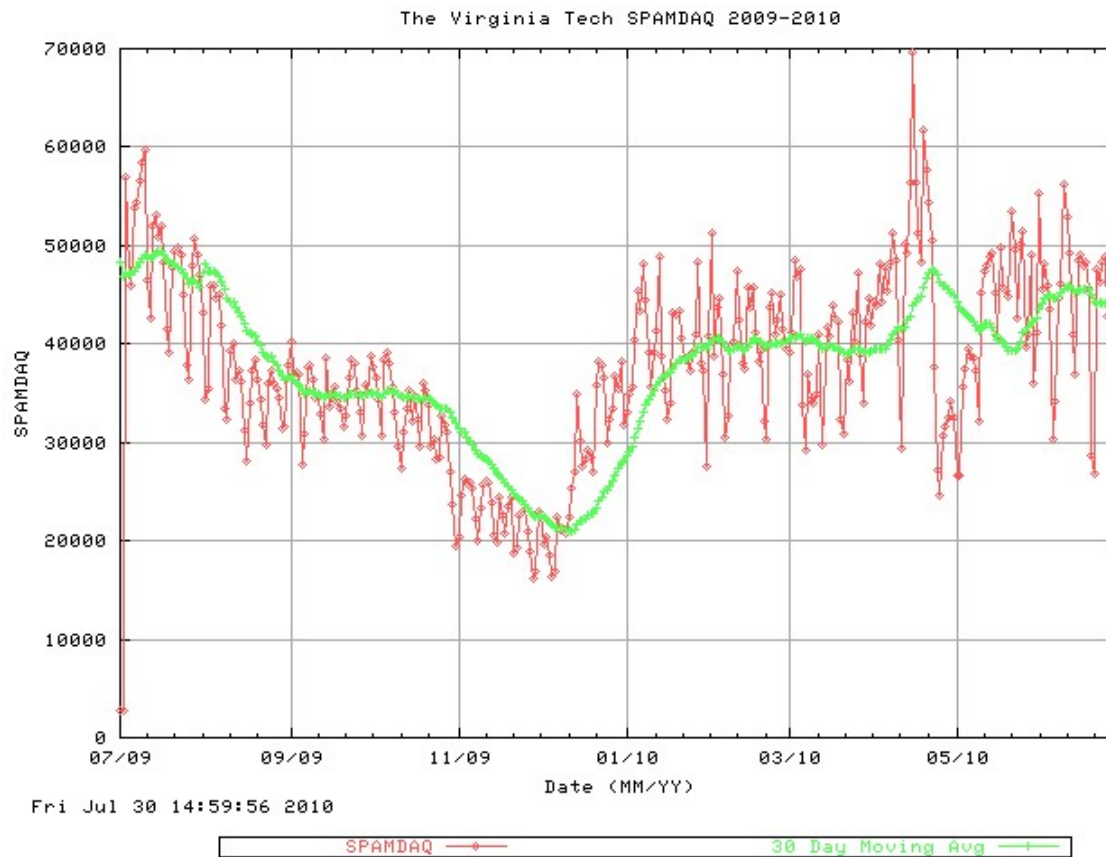
Below, the table illustrates the number of complaints received through the *abuse@vt.edu* account about events not related to unsolicited e-mail (or spam).

Of the 10,861 messages received during fiscal year 2009-2010, only 23 related to serious matters—issues of health, safety, or systems security—requiring immediate, corrective action. A large percentage of what is received is complaints which cannot be pursued because additional information necessary to fully process the issue is not received from the sender.
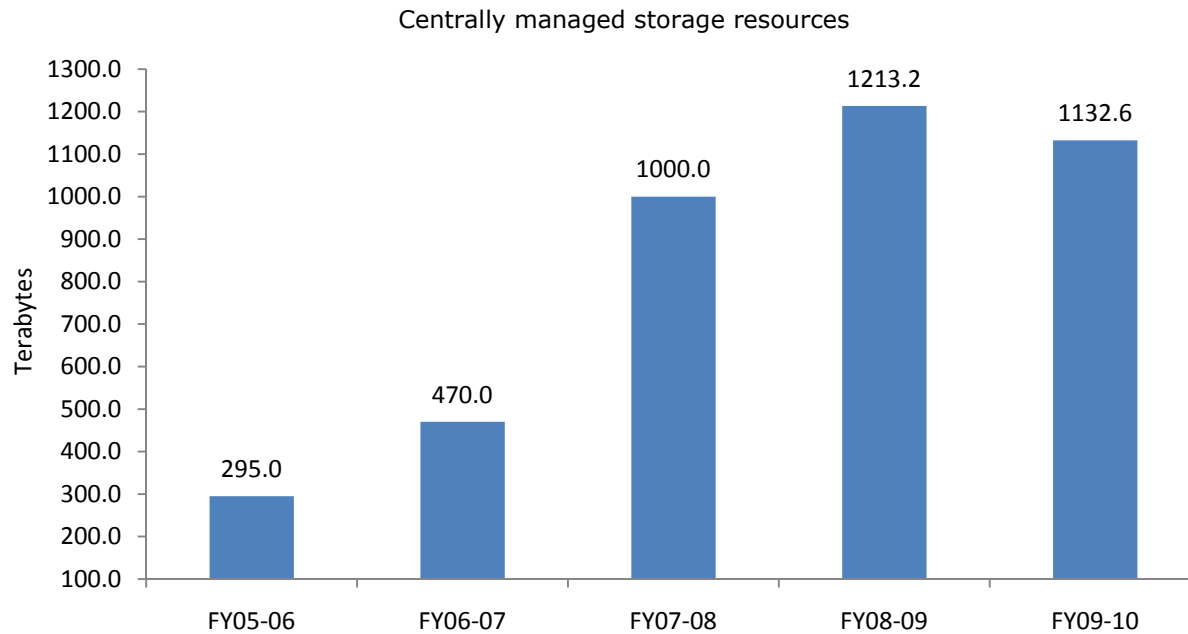
Complaints requiring immediate corrective action

| | Total Received | Threats | Harassment | Abusive | E-mail break-in | Bot/Trojan Activity |
|---|---|---|---|---|---|---|
| July 2006-June 2007 | 11,604 | 2 | 3 | 1 | 0 | 0 |
| July 2007-June 2008 | 12,108 | 2 | 3 | 5 | 1 | 0 |
| July 2008-June 2009 | 12,209 | 0 | 4 | 3 | 0 | 200 |
| July 2009-June 2010 | 10,861 | 0 | 1 | 0 | 0 | 22 |

Semester breaks impact the volume and type of traffic/complaints considerably; normally there are fewer complaints, but they are usually more serious. During break periods, complaints tend to be related to faculty and staff activity as opposed to that of students and are more likely to be server-based rather than individual workstation-based.

Systems Support also manages the central storage resources. Prior to the 2005-2006 fiscal year, gradual increases occurred as the availability of such services became more widely known, and colleges and departments that had previously run their own file servers switched to the central service. The dramatic increase in 2007 is a direct result of data preservation requirements associated with the events of April 16th.
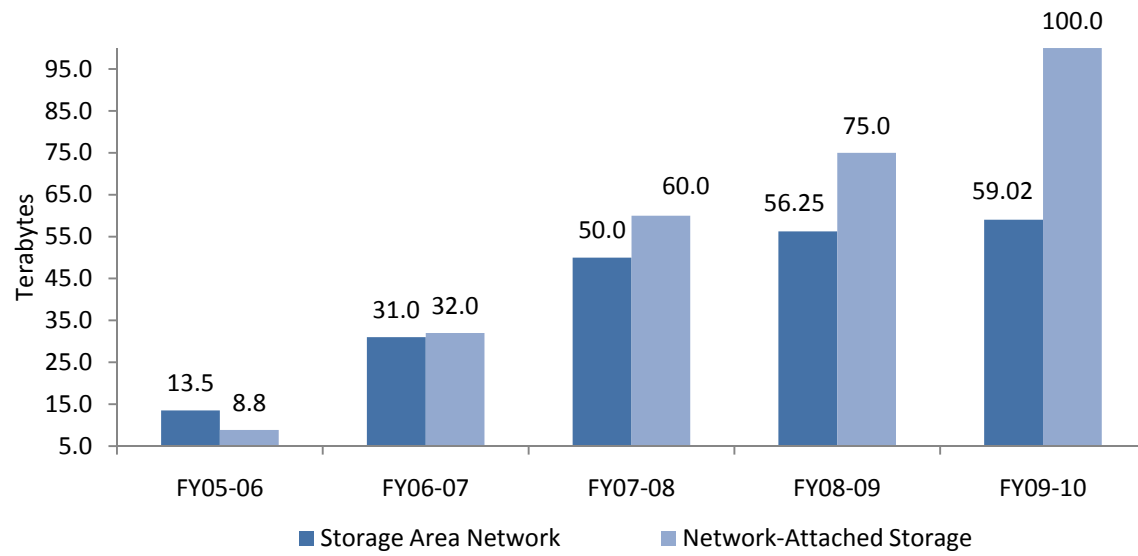
## Centrally managed storage resources

1300.0
1200.0                                                                    1213.2
1100.0                                                                              1132.6
1000.0                                             1000.0
900.0
800.0
700.0
600.0
500.0                                470.0
400.0
300.0                     295.0
200.0
100.0

FY05-06          FY06-07          FY07-08          FY08-09          FY09-10

Terabytes

This graph illustrates the amount of data stored on the centrally managed storage resources (SAN and NAS).

The next graph illustrates the amount of data stored on the centrally managed backup service (disks and tapes). Prior to 2005-2006, gradual increases occurred as the availability of such services became more widely known, and colleges and departments that had previously run their own file servers switched to the central service. The dramatic increase between fiscal years 2006-2007 and 2007-2008 is a direct result of data preservation requirements associated with the events of April 16, 2007.

Terabytes

| | Storage Area Network | Network-Attached Storage |
|---|---|---|
| FY05-06 | 13.5 | 8.8 |
| FY06-07 | 31.0 | 32.0 |
| FY07-08 | 50.0 | 60.0 |
| FY08-09 | 56.25 | 75.0 |
| FY09-10 | 59.02 | 100.0 |

■ Storage Area Network    ■ Network-Attached Storage

| UNIX administration services managed systems—Overall systems availability 99.99271 | | |
|---|---|---|
| Group | Availability | Number of Hosts |
| Content Management system | 99.99495 % | |
| —Production | 99.99621 % | 2 |
| —Development/preproduction | 99.99369 % | 2 |
| Collaborative Technologies Unit | 99.98528 % | |
| —Production | 99.99177 % | 2 |
| —Development/preproduction | 99.97880 % | 3 |
| DBMS/Banner systems | 99.99855 % | |
| —Production | 99.99812 % | 24 |
| —Development/preproduction | 99.99898 % | 19 |
| Digital Repository | 100.00000 % | |
| —Production | 100.00000 % | 1 |
| —Development/preproduction | 100.00000 % | 1 |
| Ed Fox research project | 99.98938 % | |
| —Production | 99.98938 % | 4 |
| eProvisioning/eToken systems | 99.99668 % | |
| —Production | 99.99561 % | 6 |
| —Development/preproduction | 99.99776 % | 7 |
| Filebox | 99.99240 % | |
| —Production | 99.99240 % | 2 |
| GIS system | 99.99510 % | |
| —Production | 99.99805 % | 6 |
| —Development/preproduction | 99.99215 % | 1 |
| Web Hosting system | 99.99286 % | |
| —Production | 99.99414 % | 8 |
| —Development/preproduction | 99.99158 % | 4 |
| Information Technology Acquisitions | 99.99701 % | |
| —Production | 99.99913 % | 9 |
| —Development/preproduction | 99.99489 % | 4 |
| Information Warehousing system | 99.99449 % | |
| —Production | 99.99385 % | 2 |
| —Development/preproduction | 99.99514 % | 2 |

| | | |
|---|---|---|
| Knowledge Base System | 99.98821 % | |
| —Production | 99.99962 % | 1 |
| —Development/preproduction | 99.97680 % | 2 |
| Legal archive system | 99.98918 % | |
| —Production | 99.98918 % | 2 |
| Learning Technologies | 99.99611 % | |
| —Production | 99.99510 % | 25 |
| —Development/preproduction | 99.99713 % | 11 |
| Enterprise Directory/Middleware | 99.99119 % | |
| —Production | 99.99427 % | 18 |
| —Development/preproduction | 99.98810 % | 20 |
| Advanced Research Computing | 99.99250 % | |
| —Production | 99.99250 % | 31 |
| Scientific Information Data Warehouse | 99.99982 % | |
| —Production | 99.99982 % | 8 |
| SETI Systems | 99.99917 % | |
| —Production | 100.00000 % | 1 |
| —Development/preproduction | 99.99835 % | 4 |
| University Online Notification Systems | 99.96749 % | |
| —Development/preproduction | 99.96749 % | 1 |
| UNIX Administration Services | 99.99713 % | |
| —Production | 99.99705 % | 9 |
| —Development/preproduction | 99.99722 % | 7 |
| Virtualization resources | 99.98946 % | |
| —Production | 99.98946 % | 15 |

The table above displays the availability of servers managed by the UNIX Administration Services Team.

Percentages of less than 100 percent represent unscheduled downtime for a particular service. In most environments (wherever the number of servers is greater than one), service is provided by clustered servers so an outage on a single host does not actually cause a disruption. The hours of operation are, in all cases, 24 hours per day, seven days per week, and 365 days per year.

Figures for both production and test (development and preproduction) servers are shown as an average for the overall service availability percentage.

The number of hours of downtime over the course of the 2009-2010 fiscal year is extremely small. Using the Information Technology Acquisitions production hosts as an example, 99.99913 percent of 8760 hours (24 hours x 365 days) means those production servers were down for less than five minutes for unscheduled outages during the entire period.

## Blacksburg Electronic Village

As seen in the table below, the number of domain names supported dropped again in 2009-2010 as the last TOP county discontinued service and more Sprint/NetworkVirginia customers moved to alternate providers.

Blacksburg Electronic Village (BEV) website and e-mail services continue to be popular, although an increasing number of customers have migrated to nationally based service providers such as Google and Yahoo.

The number of e-mail lists was pruned significantly this year when BEV decommissioned a number of lists originally configured as part of Community Connections packages but no longer used by those customers.

E-mail volume decreased substantially this year. This reduction is partially the result of a smaller customer base, but spam-blocking efforts have had a larger effect.

### BEV services

| | FY05-06 | FY06-07 | FY07-08 | FY08-09 | FY09-10 |
|---|---|---|---|---|---|
| Domain Names Supported | 296 | 281 | 274 | 254 | 238 |
| Websites (Full Service) | 66 | 56 | 62 | 52 | 50 |
| Websites (Community Connections) | 123 | 130 | 113 | 110 | 71 |
| E-mail boxes | 504 | 479 | 481 | 468 | 407 |
| E-mail lists | 157 | 155 | 142 | 56 | 56 |
| E-mail volume per week (valid messages) | 23,000 | 30,000 | 36,000 | 43,000 | 28,000 |
| E-mail volume per month (valid messages) | 100,000 | 130,000 | 156,000 | 186,000 | 121,000 |
| E-mail volume per year (valid messages) | 1,196,000 | 1,560,000 | 1,872,000 | 2,236,000 | 1,456,000 |

BEV's Web Support Services project, using undergraduate staff to provide at-cost Web development service to campus organizations and area nonprofits, continues to see increases in project scale for new websites and major redesigns. The development focus has shifted almost exclusively to Drupal--an open source, content management system. Customers want the ability to update content without the need for HTML editing skills, and the Drupal platform makes it relatively easy to add new, interactive, website features.

### Web Support Services projects

| | FY06-07 | FY07-08 | FY08-09 | FY09-10 |
|---|---|---|---|---|
| New websites or major redesigns completed | 10 | 6 | 4 | 3 |
| Site maintenance or assistance projects completed | 6 | 8 | 5 | 10 |
| Projects in progress as of June 2010 | 4 | 4 | 4 | 3 |
| Proposals in development as of June 2010 | 1 | 4 | 1 | 0 |

# Systems Development and Administration

COLA is the telecommunications customer portal. This chart shows three COLA statistics:

- *Students using COLA*—The number of students who made at least one service request during the year using COLA;
- *Total service requests made by students*—The number of service requests and/or service updates (wireless LAN or long distance authorization code) made by students using COLA;
- *Guest wireless requests*—The total number of service requests made by university guests, using COLA, to register for sponsored wireless LAN service.

Lower usage of COLA after a peak in 2005-2006 is likely due to two factors. First, there was a rapid increase in the use of wireless LAN by students during the period of 2003 thru 2005 to reach a near-saturation point. It is to be expected after a large increase in the number of customers during the first couple of years a service is offered, the activity would decrease to a steady state generally determined by the number of students new to the university. Secondly, beginning with on-campus summer orientation in 2006 through May 2009, the Student Network Services staff registered many students in person for wireless LAN service and long distance authorization codes. These numbers would not be reflected in COLA's *total service requests*.
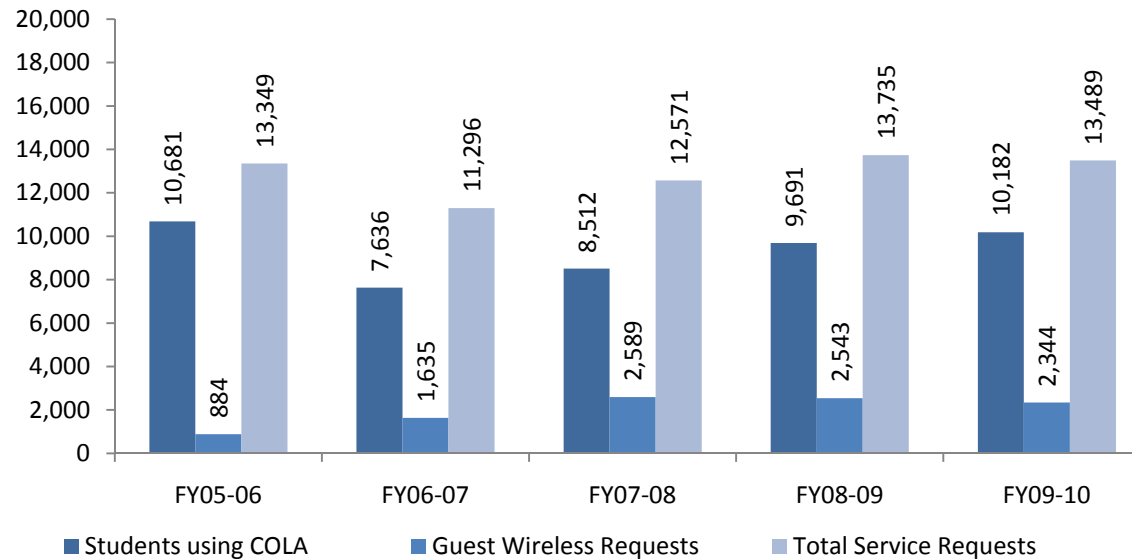


Student Network Services implemented an awareness campaign for students attending New Student Orientation (NSO) in 2009. This campaign encouraged them to register for wireless service prior to attending the summer orientation sessions, resulting in almost 1,000 more students accessing COLA in June 2009, compared to June 2008. This campaign was successful again in 2010, with another increase in COLA. Additionally, the 2010 campaign was extended to transfer students, in addition to incoming freshmen.

The third statistic relates to guest wireless LAN—a service that has only been offered via COLA since 2006.

## Business Operations

The graph below, *Services overview,* depicts the numbers of customer invoices, current services billed to customers, service activations, deactivations, and changes.

The decline in the quantity of customer invoices is primarily the result of the continuing decrease in the number of students who subscribe to modem pool service and long distance authorization codes.

The number of current active services has decreased because most services provided by Mail Services and Printing Services, with the exception of the Copier Management Program, are no longer billed by NI&S.

The number of service activations, deactivations, and changes represents the number of moves, adds, and changes. 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 is primarily attributed to a decline in student orders (53%) for modem pool service and long distance authorization codes and a decrease in the number of departmental requests (36%).
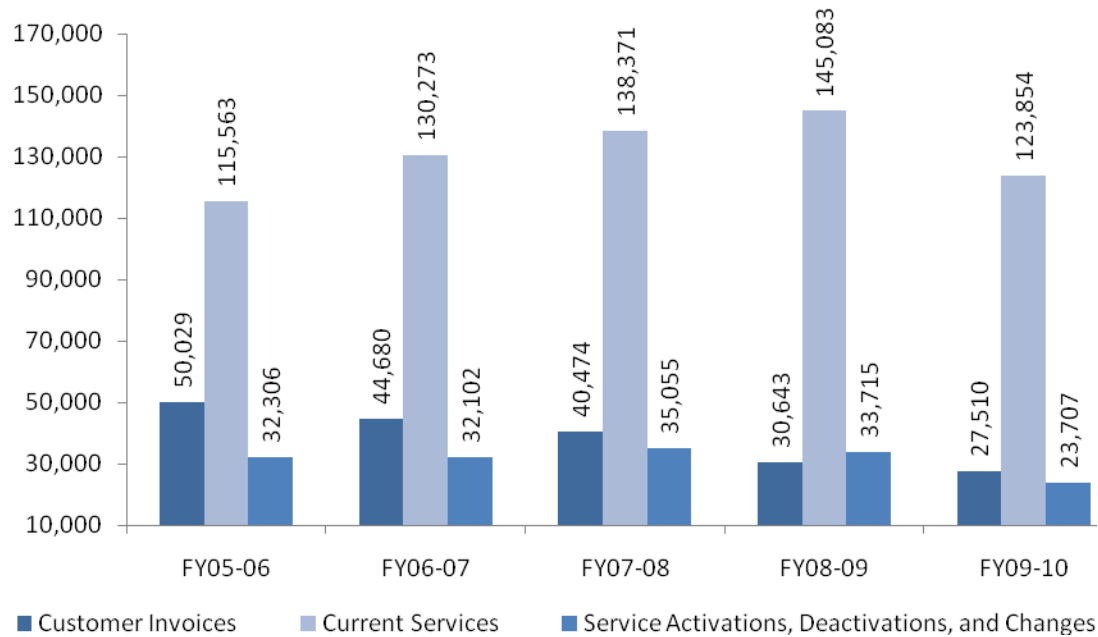
Services overview



Services overview

The graph *Wireless LAN customers* depicts the number of wireless LAN subscribers by customer type—department, Foundation, non-student private, and student.
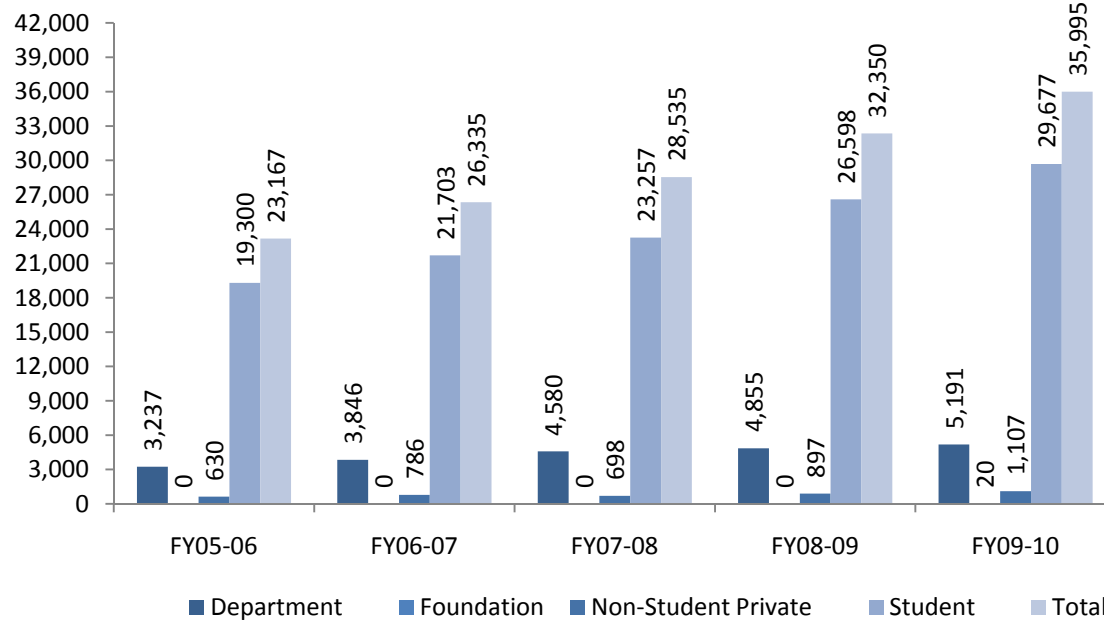
Effective with the April 2010 bill, a new customer type, "Foundation," was identified in the ATLAS system. All Virginia Tech Foundation customer accounts were segregated from the non-student private accounts as of April 1, 2010.

The increase in the number of wireless LAN subscribers is attributed to continuous/ongoing network expansion making the service available to the academic and administrative spaces across campus.

Students represent 74% of the total number of subscribers.



Wireless LAN customers

The number of modem pool subscribers by customer type—department, Foundation, non-student private, and student—are represented in the graph below.

As is the case with wireless LAN, effective with the April 2010 bill, a new customer type, "Foundation," was identified in the ATLAS system. All Virginia Tech Foundation customer accounts were segregated from the non-student private accounts as of April 1, 2010.

The decline in modem pool subscribers is due to the availability of other competitive broadband offerings—such as DSL and cable

modems—from telecommunications, cable television, and satellite providers. In many local apartment complexes, data service offerings are included with the rental package.
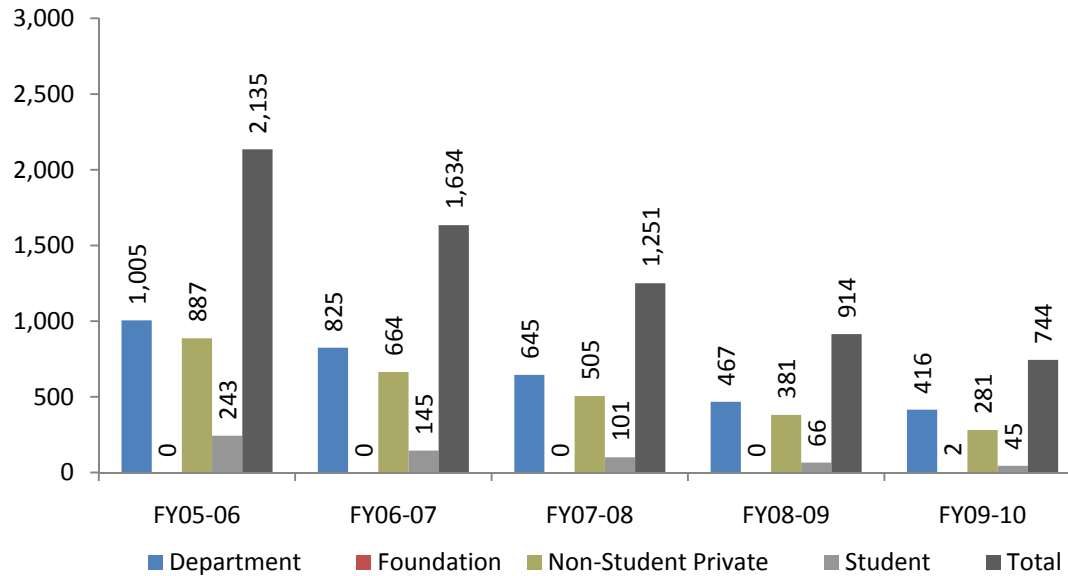


Modem pool customers

## Ordering and Provisioning

The graph below represents the distribution by work order type and the total number of work orders completed since FY06.

*Voice orders* are for digital or analog service provided through the university PBX. *Data orders* include orders for 10BaseT, 100BaseT, 10/100BaseT, or 1000BaseT Ethernet connections. *Video orders* are associated with campus CATV service. C*ellular orders* are for voice only, mobile broadband, and smartphones. *Other* work orders include those for PBX software only, time and materials, cable plant only, NetworkVirginia, fiber channel, internal field work, message boards, and the installation of wireless access points.

CNS began processing orders for cellular services in 2003 and began offering mobile messaging services in 2005. Migration to mobile voice and data has continued as faculty and administrators request mobile access to e-mail and calendaring.

From 2004 to 2006, CNS installed a wireless network in most administrative and instructional buildings on campus. This new network deployment accounts for the large number of *other* orders during that time period in the above graph. Two projects contributing to the increased number of orders in this category are the Edward Via

Virginia College of Osteopathic Medicine building and hotel rooms at The Inn at Virginia Tech.

During 2006-2007, increases in data and voice work orders are attributed to several projects. Many renovations occurred on campus including changes in Burruss Hall that displaced several departments. As these departments moved, other groups relocated. After the renovation was completed, another round of moves occurred to facilitate the Henderson Hall renovation. A complete renovation of Cowgill Hall resulted in moves to the Surge

Building. Also contributing to the increase were a major infrastructure improvement for the Art Department at the Amory, orders related to the April 16th tragedy, and completion of the University Gateway Center.

During fiscal year 2009-2010, the trend toward mobile telecommunications continued with many mobile messaging users upgrading to newer smartphones. The decrease in the overall number of orders is attributed, at least in part, to budget reductions and an increase in mobile phone usage
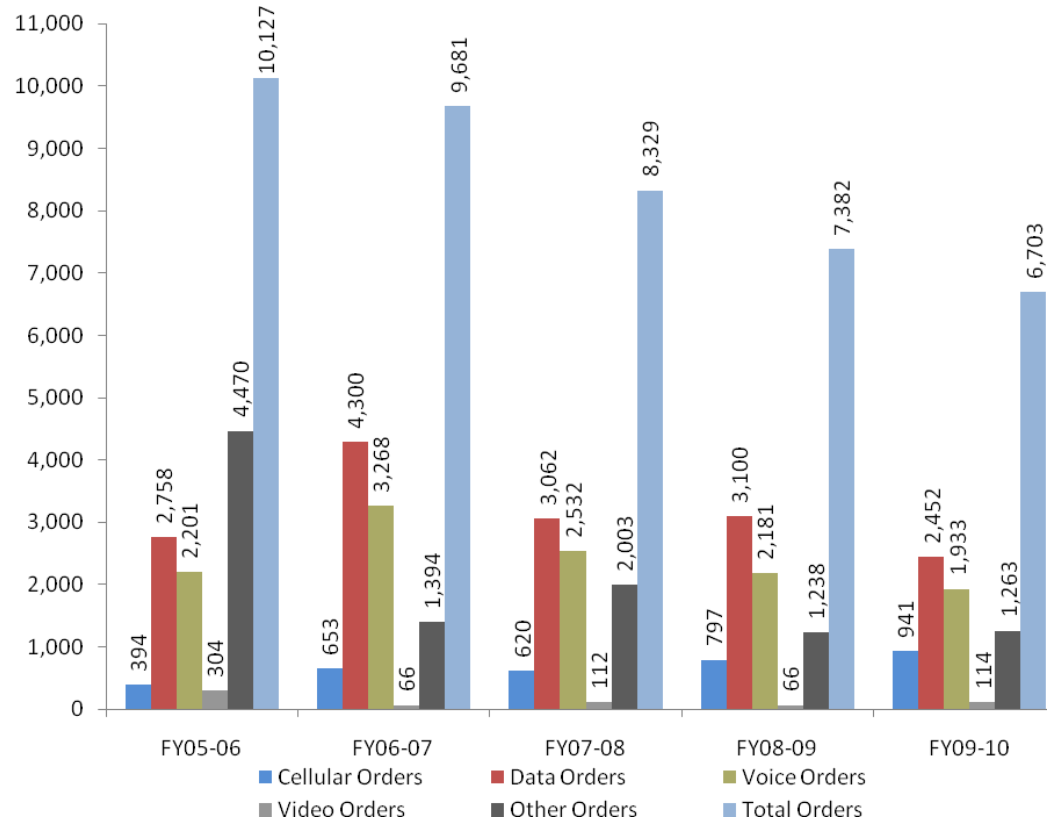
Work orders

# Public Relations

Telephone call volume at the University Switchboard reflects a fairly consistent decline with the exception of the most recent year. The proliferation of cellular telephone use and carriers' directory assistance services, combined with ready access to an array of directory listing services on the Web, contribute to the trend. Call data is collected between 12 a.m. and 5 p.m. each day.

The University Switchboard is a key component of Virginia Tech's emergency communication system.
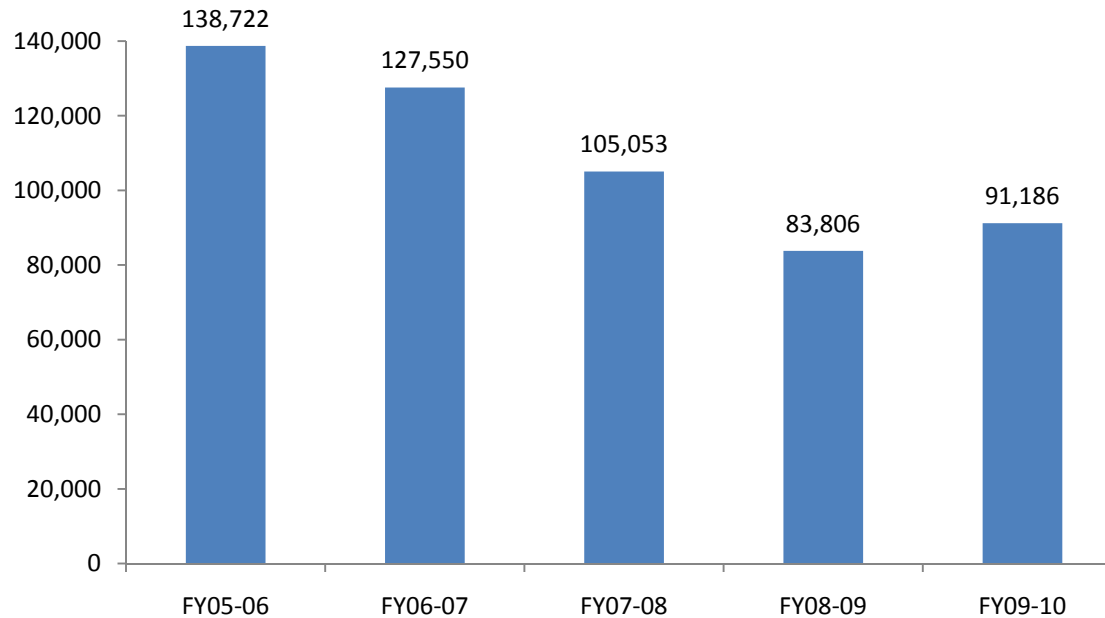


Calls to University Switchboard

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

DMCA guidelines allow owners (or agents of owners) of copyrighted music, movies, photos, audio books, and software to contact Internet service providers (ISPs) to request prompt termination of illegal sharing of copyrighted material via their network resources. Virginia Tech, as a university ISP, promptly addresses cases of Internet-based copyright infringement complaints (ICICs) alleged to originate from its network.

Virginia Tech has received a fairly consistent number of these notices each year. However, volume *tripled* during the 2006-2007 academic year compared to prior years. The increase was largely due to intensified efforts on the part of copyright owners and agents to address and publicize the file-sharing problem.

Over the period of 2005-2010, the principal originators of ICICs received by Virginia Tech

have been BayTSP, the Entertainment Software Association, NBC Universal Studios, and the Recording Industry Association of America (RIAA). The RIAA temporarily suspended referrals to Virginia Tech shortly after April 16, 2007, and did not resume sending them until May 2008.
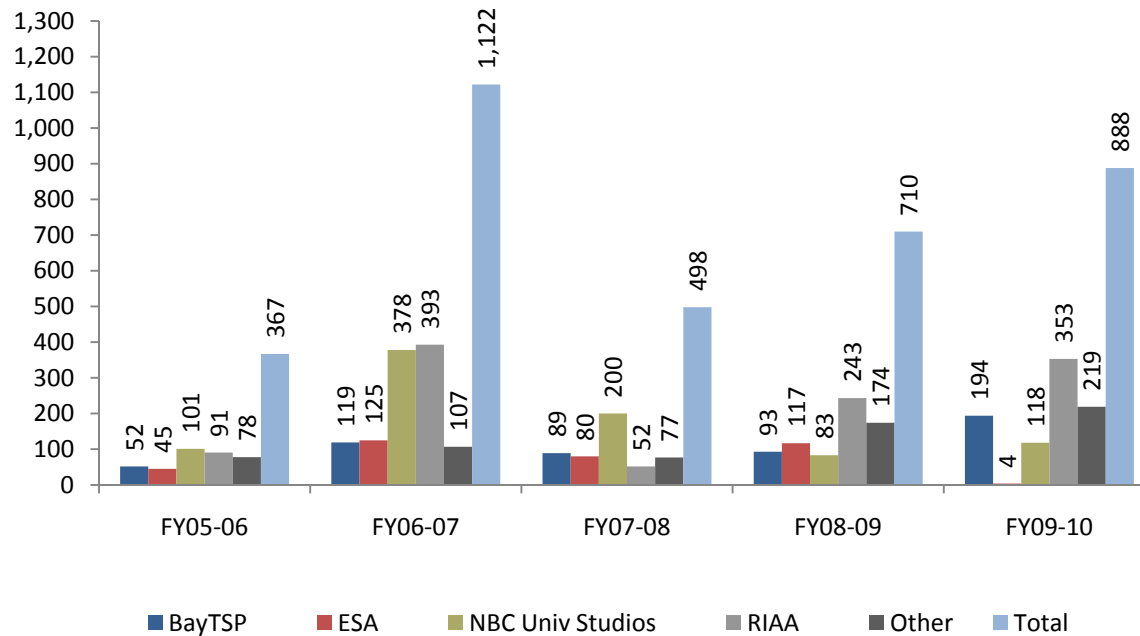


Internet copyright infringement complaints (ICIC)

# Virginia Tech Operations Center

The graph below, *Total calls and problem reports*, shows *calls received* in the Virginia Tech Operations Center (VTOC), the number of Remedy *trouble tickets created*, and the number of *trouble tickets resolved* in the

VTOC. The graph does not include support calls for Video/Broadcast Services.

VTOC technicians receive questions and trouble reports from constituents and provide information and technical assistance as required. Trouble tickets are created, as necessary, and resolved if possible. If the problem cannot be resolved as a result of the need for additional data (e.g. financial

records or accounts) or a higher level of technical expertise, the trouble ticket is escalated to the appropriate unit.
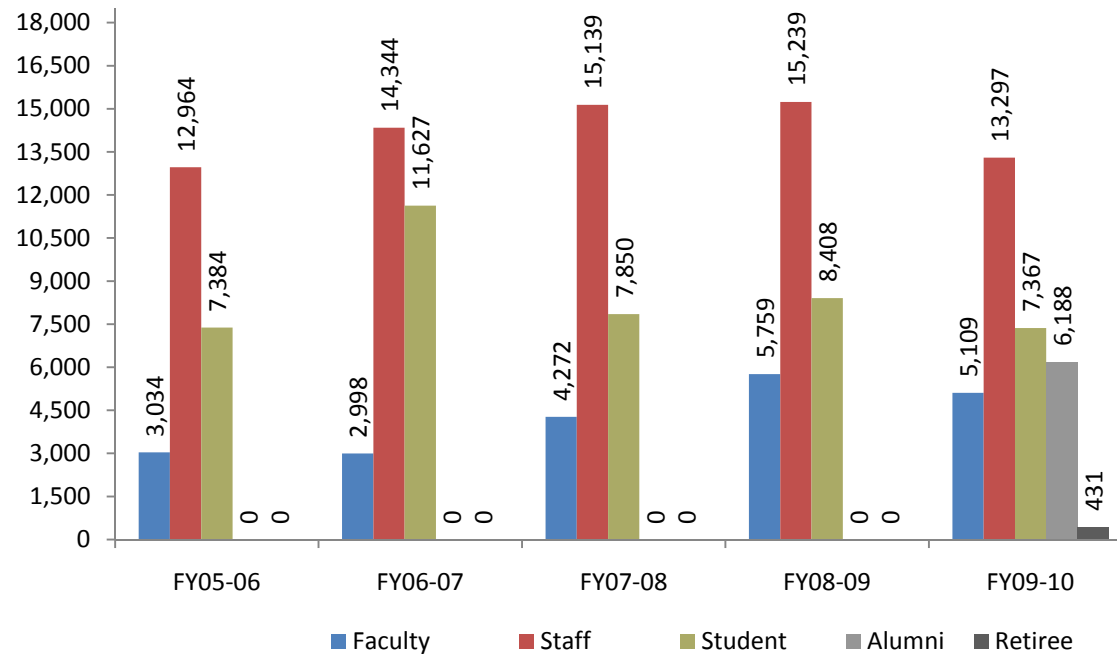
Total calls received have remained relatively constant, and a continued emphasis on training enables the VTOC technicians to create and resolve a significant percentage of trouble tickets. However, some inquiries must be transferred to other staff.
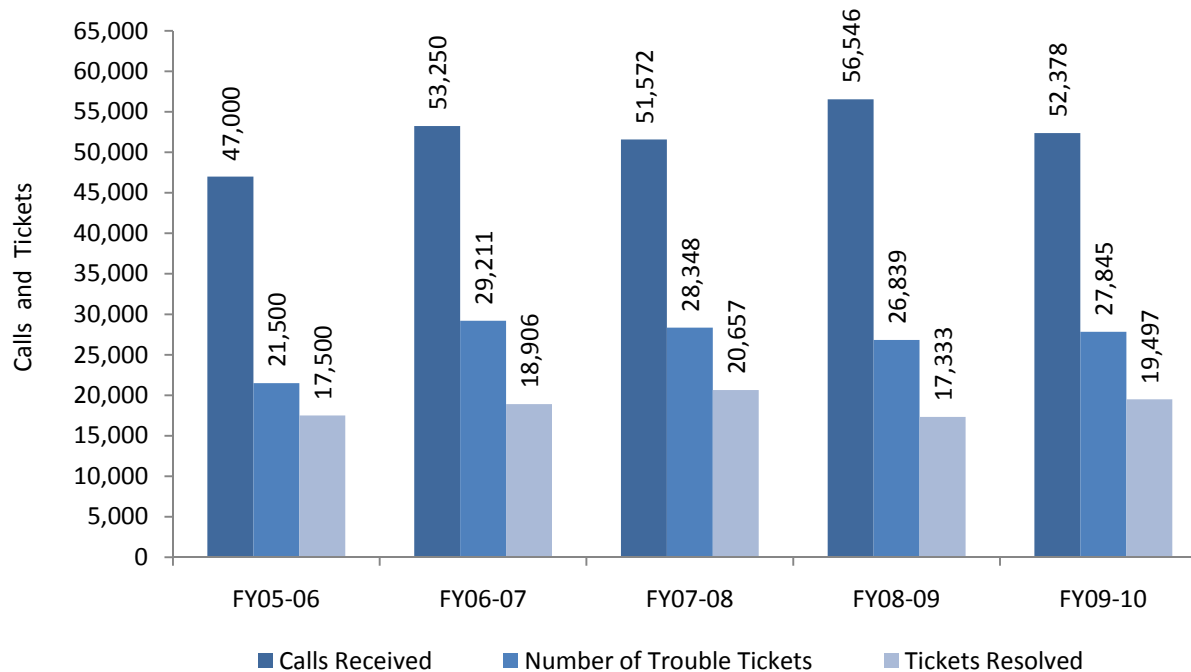


Total calls and problem reports

The next chart shows the distribution of the majority of the problem tickets received in the VTOC by the affiliation of the caller. This
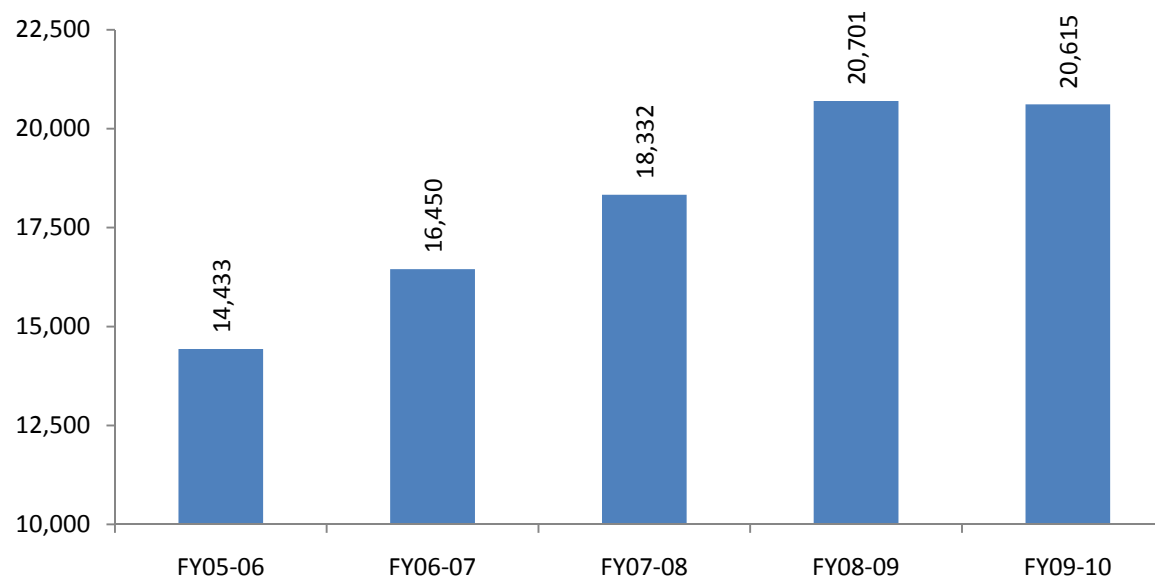
year, the graph shows the alumni and retiree categories that were not shown in previous years.

Tickets by affiliation

Chart data:

| | Faculty | Staff | Student | Alumni | Retiree |
|---|---|---|---|---|---|
| FY05-06 | 3,034 | 12,964 | 7,384 | 0 | 0 |
| FY06-07 | 2,998 | 14,344 | 11,627 | 0 | 0 |
| FY07-08 | 4,272 | 15,139 | 7,850 | 0 | 0 |
| FY08-09 | 5,759 | 15,239 | 8,408 | 0 | 0 |
| FY09-10 | 5,109 | 13,297 | 7,367 | 6,188 | 431 |

# University Computing Support

The graph below, *Help Desk tickets*, shows the number of tickets opened by University Computing Support (UCS)/4Help during the past five years.

This year, the total ticket count remained virtually the same as last year. The slight increase in ticket volume over the last two fiscal years can be attributed primarily to the continued collaboration with Online Course Systems (OCS). OCS is transitioning to a new course management system, Scholar. This conversion has contributed to an increase in ticket volume as the faculty makes the transition from Blackboard to Scholar. 4Help also saw an increase in the number of questions related to the implementation of Virginia Tech Google E-mail for Alumni and the new Guest Access Management System (GAMS) now being utilized by the Offices of University Scholarships and Financial Aid and Undergraduate Admissions.

Help desk tickets

| FY05-06 | FY06-07 | FY07-08 | FY08-09 | FY09-10 |
|---------|---------|---------|---------|---------|
| 14,433 | 16,450 | 18,332 | 20,701 | 20,615 |

Below, *Support tickets, calls, and visits* shows the distribution by type and over time.

As shown, the total numbers for desktop support calls show a marked decrease due to the implementation of a new support model that includes the ability to initiate a remote access session with a faculty or staff member in lieu of going to an office to provide assistance.

The number of students requiring assistance during the fall Get Connected period also

showed a marked decrease because of better education and the shift to a more centralized model of support. A call is first placed to 4Help. Get Connected staff are only dispatched as an escalation path. In addition, the student body continues to become more knowledgeable about computer security, in part, due to our educational efforts on this topic during New Student Orientation.
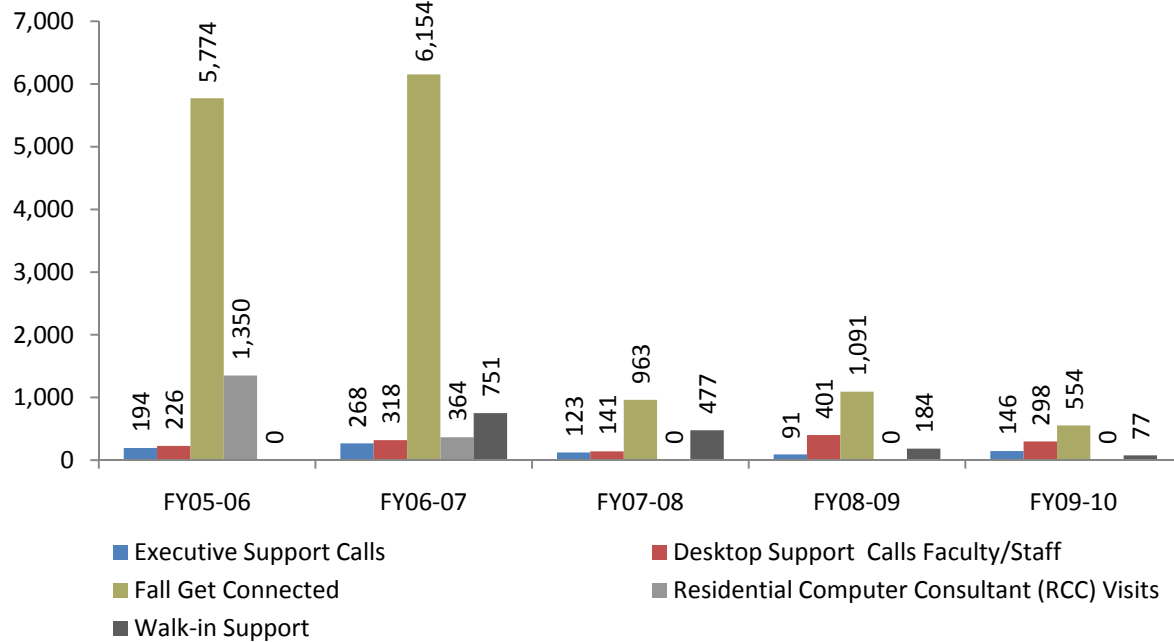


Support tickets, calls, and visits

In fiscal year 2006-2007, 4Help replaced the Residential Computing Consultant program with a walk-in support model, providing assistance to both residential and off-campus students. UCS has refined procedures for newer Windows and Macintosh operating systems to provide better, more efficient service to university constituents. Changes have been made to our scheduling system to increase efficiency, and we continue to update our procedures to address new computer issues and provide more streamlined services.

This fiscal year, there was another significant decline in the number of walk-in services performed as a result of a streamlined program to better utilize phone and remote-access support. An updated antivirus page also allows users to solve many problems without the need for a walk-in appointment.

The next graph shows the distribution of trouble tickets based on the affiliation of the caller.

Keeping in mind that many people have multiple Virginia Tech affiliations, we record

the affiliation of those seeking computing assistance where possible. The distribution of tickets per constituent class was similar to last year's with the exception of an increase in ticket counts from alumni due to Virginia Tech's implementation of VT Google E-mail for Alumni.
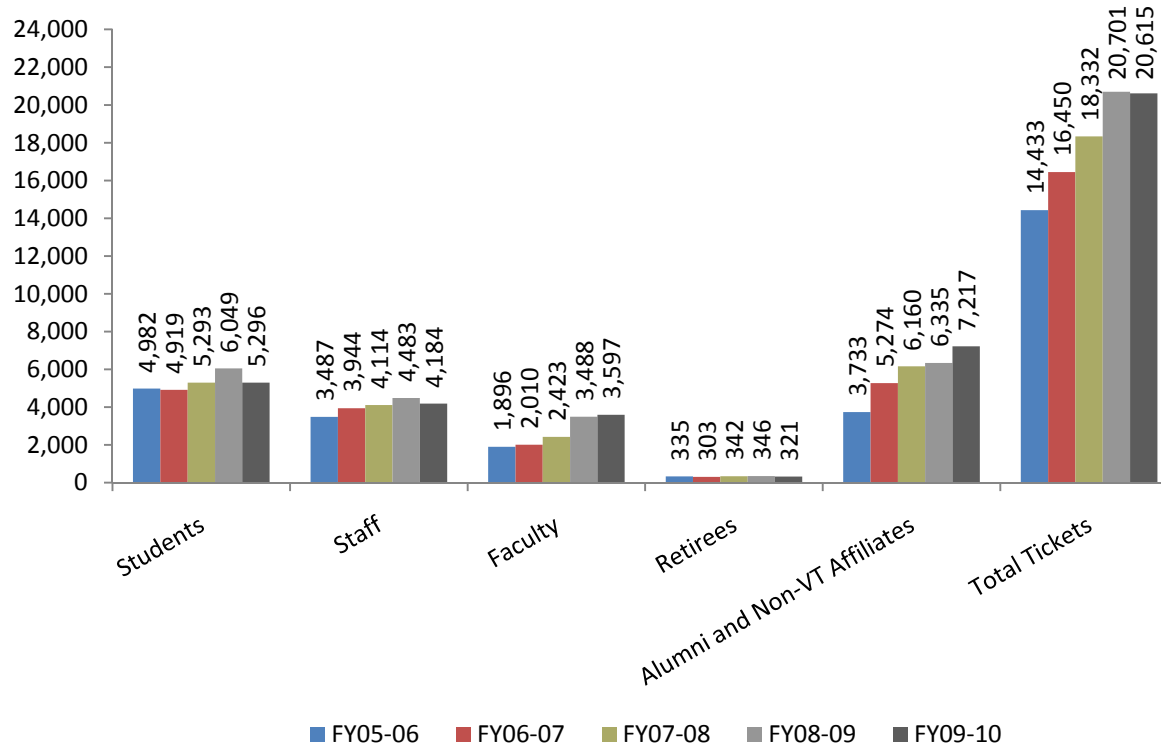


Tickets by affiliation

The graph *Tickets by cause of problem* displays the various causes associated with problem tickets.

The most significant increase during 2009-2010 was in the *accounts/passwords* category. This increase was the result of the implementation of Virginia Tech's Google E-mail for Alumni and the utilization of the Guest Access Management System (GAMS).

Tickets in the *academic services* category, which includes Hokie SPA, LISTSERV, and Blackboard, increased significantly again this fiscal year due to continued collaboration and initial support for Online Course Systems.

Ticket counts associated with the *Desktop Operating System* classification showed a marked decrease because the release of

Windows 7 generated fewer calls than those of previous new operating systems. UCS has recently released a series of "Hokies How-To" videos on Virginia Tech's iTunes U site and provides downloadable images of Windows for Mac machines. These proactive measures have contributed to fewer calls related to operating system issues.

Tickets in the *administrative* category are those related to Information Technology-provided applications and services such as Banner, mail, Filebox, hosting, network attached storage, and Hokies domain issues.
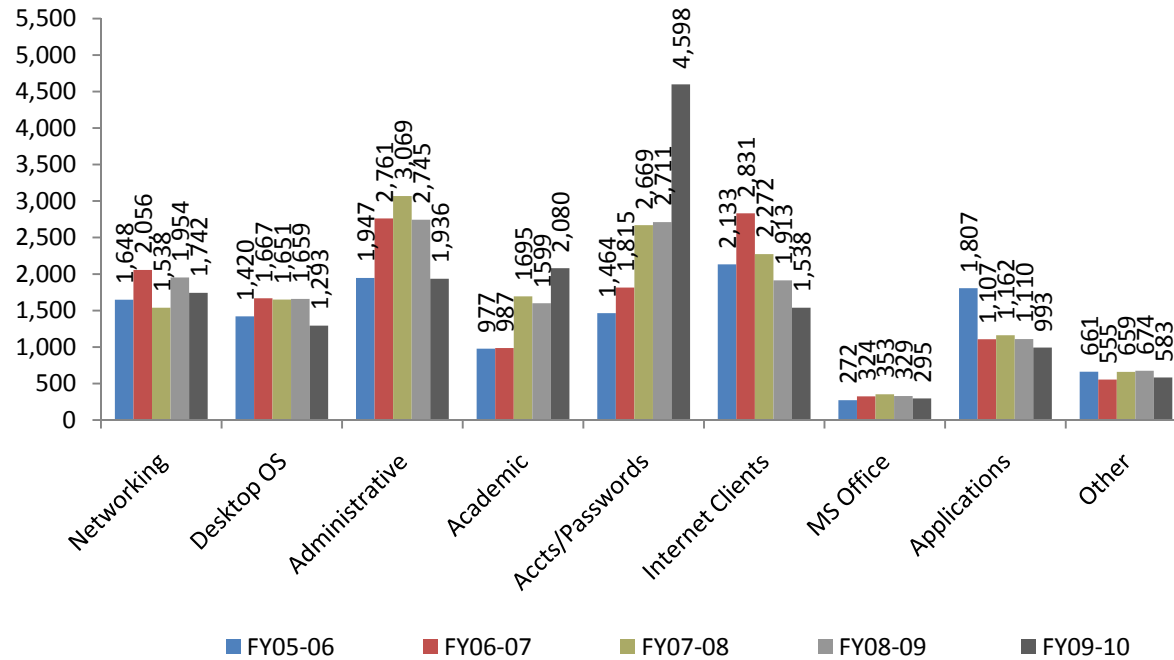


Tickets by cause of problem

Each year, four students are hired by the manager of Special Student Programs (SSP) to assist in the preparation for New Student Orientation (NSO). The student staff members create, film, and edit a number of short videos as part of their NSO Computer Security Presentation about computer misuse and copyright violations. Both parents and students are encouraged to attend this presentation. As shown in the graph above, this year, as a result of SSP's efforts to encourage attendance at this important presentation and changes in the NSO schedule, we set a new record for participation.
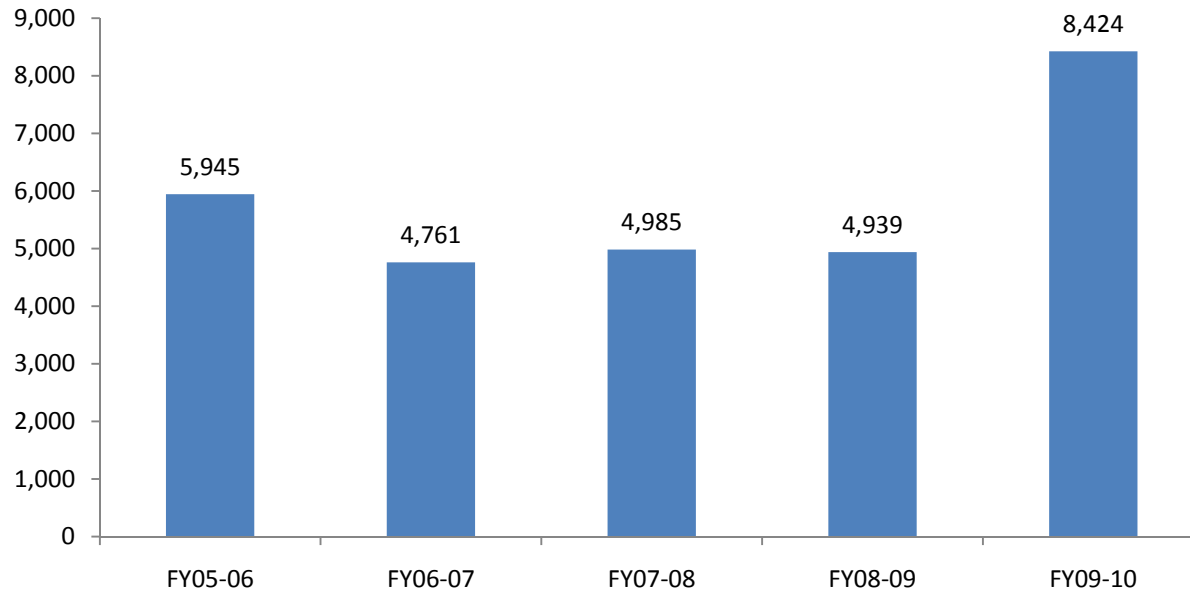
New student orientation: computer security presentation attendees

The *Top 10 Knowledge Base Articles Viewed* chart indicates the number of views for our most frequently accessed articles. This year, because of the implementation of Virginia Tech's Google E-mail for Alumni project, our top article was related to *Transitioning Your VT E-mail Account to a Virginia Tech Google Services Account*. Its number of views exceeded the next most viewed article, *Changing Your PID Password*, by almost 70,000 views within eight months. Articles related to establishing a *VPN connection* and *Connecting to VT-Wireless* also appear in the Top 10 list.

A VPN connection is required for downloading software from the Information Technology Acquisitions site. This year, we answered many questions related to establishing a VPN to download Microsoft products and updates. VT-Wireless questions are also an area where we continue to receive questions, particularly when wireless certificates expire one year after being created. We have made efforts to make these processes easier by publishing "Hokie How To" videos on Virginia Tech's iTunes U site and by expanding the Knowledge Base articles.

Top 10 Knowledge Base articles viewed

| Article title | Number of views |
|---|---|
| Transitioning your VT Mail E-mail Account to a Virginia Tech Google Services Account | 87,668 |
| Changing your PID Password | 29,269 |
| Downloading and Installing Symantec Endpoint Protection 11.0.6 for Windows XP/Vista/7 and Windows 2003/2008 Server | 28,069 |
| Creating a Virtual Private Network (VPN) Connection in Windows XP | 22,980 |
| Connecting to the VT-Wireless Network in Windows Vista | 22,228 |
| Configuring Outlook 2007 to Connect to the VT Mail Server | 21,502 |
| Connecting to the VT-Wireless Network in Windows XP | 21,022 |
| Connecting to the VT-Wireless Network in MAC OS X v10.5/10.6 | 16,843 |
| Setting your Remote Access Passphrase for VPN | 16,654 |
| Creating a Virtual Private Network (VPN) Connection in Windows Vista | 11,807 |

The table below highlights the number of articles per category, as defined on *computing.vt.edu*. This year, due to continued collaboration with Online Course Systems, the number of articles within the *Academic Services* category dramatically increased in response to the implementation of Scholar. The largest category, *E-mail, Web, and other Internet*, includes information about e-mail systems (including VT Mail, Exchange, and VT Google Services accounts), configuring clients, and accessing VT's wireless networks.

Number of Knowledge Base articles per category

| Category | Number of Articles |
|---|---|
| Academic Services | 453 |
| Accounts and Passwords | 145 |
| Administrative Services | 418 |
| Connection | 223 |
| Desktop OS | 393 |
| Document Creation | 85 |
| E-mail, Web, and other Internet | 1,163 |
| General/Other | 140 |
| Third-Party Applications | 446 |

# Professional development

In addition to regular job responsibilities, many Network Infrastructure and Services staff members participate in professional pursuits including presentations at university-based and regional or national conferences, teaching seminars or class sessions, and outreach activities. The list below reflects some of these activities for the period from July 1, 2009 through June 30, 2010.

## Seminars and academic course support

Eric Brown. April 2010, guest lecturer for ECE 4616: Telecommunications Networks Class, Spring 2010, substitute teacher, high school physics

Joyce Landreth and Julia Mays. September 2010, assisted with the development of an online overview of central Information Technology services and 4Help to be used by the 2009 freshmen engineering class, organized by SWAT (SoftWare Assistance Triage team) and the engineering department

William Sanders. Summer 2009, worked with Learning Technologies to develop and deliver the first FDI Workshop on creative technologies

Anne Sheppard. July 2009, produced presentations delivering an overview of 4Help and central Information Technology services at Virginia Tech to the entering freshmen class and their parents during the 12 sessions of New Student Orientation

## Degrees, certifications, classes, and training

Thirty-two staff members, February 2010, completed Asbestos Operations and Maintenance training

One staff member, January 2010, completed CPR training

One staff member, January 2010, completed first aid training

Eleven staff members, January 2010, completed hearing conservation training

One staff member, June 2010, completed Powered Industrial Truck (forklift) training

Wanda Baber, attended Scholar training

Wanda Baber and Roy Smith, October 2009, attended Introduction to Project Management training conducted by Patty Samuels, President of the Samuels Training and Resource Development in Richmond, Virginia

Wanda Baber, Jackie Davis, Kevin Davis, David Ducket, Jason Hubbard, Carol Hurley, Raven Jennings, Joyce Landreth, Julia Mays, Rob Sprague, and Flex Vaughn, attended project management overview presentation given by Henry Floyd;

Wanda Baber, Roy Smith, and Rob Sprague. Attended Harassment Prevention and Complaint Handling training; Attended Performance Evaluation training for Supervisors

Eric Brown and Brian E. Jones. February 2010, attended winter 2010 ESCC/Internet2 Joint Techs, Salt Lake City, Utah; May 2010, attended Juniper Networks Research and Education Summit, Sunnyvale, California

Dan Cook, Richard Phipps, and Luke Ward. October 2009, SANS GIAC GSEC Security Essentials Certification; May 2010, SANS SEC-560 Network Penetration Testing and Ethical Hacking

Dan Cooper, April 2010, completed FDI Dreamweaver course

Dan Cooper and David Schuh, June 2010, completed Virginia Tech Citizens Police Academy training

Jeff Dalton, completed Adobe Flash and Photoshop training

Kevin Davis, SANS GSEC certification and recertified for SANS GCIA certification

Kevin Davis, Joyce Landreth, Anne Sheppard, and Rob Sprague, March 2010, attended CareerTrack seminar: "How to Deal with Difficult People"

Jacob Dawson, Brian Jones, and Steven Lee, May 2010, attended Aruba Airheads Conference in Washington, D.C.

William Dougherty. Participated in task force assisting the town of Blacksburg prepare a submission for the Google broadband project; September 2009, participated in ACUTA webinar on Electronically Stored Information (ESI) collection and retrieval ; Provided tours of data center and associated operations center to information technology staff from Liberty University, staff from the Optical Cable Company, members of the State Council of Higher Education in Virginia (SCHEV), and a film crew preparing video segments for IBM and QLogic ; Appeared in video prepared by IBM and QLogic related to the IBM iDataPlex shown at the Supercomputing conference in 2009; November 2009, received training on federal research contract compliance ; April 2010, participated in site planning activities for Commonwealth of Virginia use of the university as an emergency shelter location; June 2010, received training in administering the Clery Act

Russ Eller. Spring 2010, New River Community College, completed courses: RCC, Windows 2003 Server, Networking Security; Spring 2010, completed Element K course: Fundamentals of VoIP

Russ Eller, Joe Hutson, and Patricia Rodgers, March 2010, attended VoiceCon, Orlando, Florida

Russ Eller and Gene Thistle, summer 2010, The SIP School, SSCA SIP Certification Class

Russ Eller, Joe Hutson, John Lawson, Barry Linkous, and Danny Wright, completed Intrado's Positron Viper and Power911 M100, M200, M300 and M400 series training courses

Nola Elliott, winter 2010, New River Community College at Virginia Tech, completed Continuing Education courses in Microsoft Outlook, Excel, and Word 2007

Nola Elliott, Joe Hutson, Gene Thistle, Diane Whitlock, and Vicki Wright, completed 11 hours of Continuing Education for Introduction to Telecommunications

Eric Fischer, completed first year of Professional MBA program, Pamplin College of Business

Henry Floyd. October 8, 2009 – Passed Project Management Professional (PMP) examination to become professionally certified in Project Management

Patsy Galliher, Mike Ganoe, Valdis Kletnieks, Eliza Lau, Roy Vickers, and Eric Wonderley, attended Harassment Prevention and Complaint Handling training

Mike Ganoe, Eliza Lau, Roy Vickers, and Eric Wonderley, attended Performance Evaluation training for employees

Mike Ganoe, Valdis Kletnieks, Eliza Lau, Roy Vickers, and Eric Wonderley, attended the following presentations provided by vendors pertaining to storage management, monitoring, backup, data replication, and data de-duplication; IBM on Tivioli Productivity Center, XIV

storage, Tivoli; EMC – RecoverPoint, Data de-duplication, NetWorker; SGI – Data Migration Facility (DMF)

Ludwig Gantner. October 2009, completed Dark Arts Security Workshop, by Virginia Tech Information Technology Security Office; October 2009, completed FDI GIS and Remote Sensing Data Discovery course; November 2009, completed FDI Introduction to GIS course; November 2009, completed FDI Introduction to Google Maps course; January 2010, completed Security Training for System Administrators course, Virginia Tech Information Technology Security Office; Attended the 2010 "James D. McComas" Staff Leadership seminar

Ludwig Gantner, David Mattox, and Joe Schottman, May 2010, completed SANS Course 560 – Internet Security Training Workshop

Mark Gardner. Attended network security training hosted by Information Technology Security Office; Completed FDI course: Writing Successful Grants (parts 1 & 2); Attended Policy and Practice Changes, Federal Contract Compliance; Completed LISA statistics short course; Attended ICTAS Center for Naval Systems seminar on seeking defense funding

Jason Hubbard, Nate Smith, Flex Vaughn, and Laurie Zirkle, May 2010, SANS Internet Security Training Workshop: Network Penetration Testing and Ethical Hacking

Kerry Johnson and Steve Lee, July 2009, attended ESCC/Internet2 Joint Techs hosted by Indiana University, Purdue University Indianapolis

Doug Jones, Asbestos Inspector Certification

Bruce Kemp. 2010, SANS GSEC certification; 2010, Community Emergency Response Team (CERT) certification

Jeff Kidd, Master of Science in Corporate and Professional Communication at Radford University; earned December 2009, awarded February 2010

Joyce Landreth and Rob Sprague, attended Advancing Diversity at Virginia Tech workshop

Steven Lee, January 2010, attended Aruba Airheads Conference, Scottsdale, Arizona

John Nichols. Recertified Master Telecommunications Engineer by iNARTE (The International Association for Radio, Telecommunications and Electromagnetics); Recertified Asbestos Inspector

Robert Roberts; September 2009, FDI Adobe Photoshop CS4: Photoshop Basics; October 2009, FDI Adobe Photoshop CS4: Selection Techniques and Layer Creation; October 2009, FDI Introduction to Project Management; October 2009, FDI Microsoft Project: Managing Complex Projects; May 2010, Ensemble CMS Web Administrator

Patricia Rodgers and Roy Smith. April 2010, listened to National Oceanic and Atmospheric Administration (NOAA) Broadband Technologies Opportunities

Program (BTOP) Grant webinar – American Recovery and Reinvestment Act of 2009 (ARRA) Reporting; April 2010, attended NOAA Acquisition and Grants Office's – 2010 Financial Assistance Workshop Grants Management Division (GMD) Connected: The New Decade ; April 2010, listened to NOAA BTOP Grant webinar – ARRA Reporting – Grants-On-Line Reporting – Progress Performance Report and SF-425 Financial Report; May 2010, listened to National Telecommunications and Information Administration (NTIA)/NOAA BTOP Grant Compliance Requirements webinar ; June 2010, attend NTIA Broadband Technology Opportunities Program (BTOP) Workshop for Grant Awards

Anne Sheppard. November 2009, participated in online EDUCAUSE Annual Conference sessions: "Collaborating Outsourcing of the IT Help Desk" and "It's About Time: Getting Our Values Around Copyright Right"; March 2010, attended the Association of Collegiate Computing Services (ACCS) of Virginia Annual Conference, Charlottesville, Virginia

Roy Smith. July 2009, attended a presentation on Federal Trade Commission Ruling–Identity Theft Protection Program conducted by the Virginia Tech Controller's Office; August 2009, attended People Admin training provided by Human Resources; November 2009, attended Federal Contract Compliance information session

conducted by Dr. Tom Inzana, Office of the Vice President for Research and sponsored by the "Task Force on Federal Contract Compliance: Lessons from Yale and Duke."

Roy Smith and Myrtle Yopp, July 2009, attended Office/Reception Security training session conducted by Virginia Tech Police Officer, Geoffrey Allen

Rob Sprague. Completed professional development needs assessment for VTOC with John Massey, Assistant Director for Professional Development with Virginia Tech Organizational Development; Attended University Organizational and Professional Development course: Time Management; Attended wireless network monitoring and troubleshooting training provided by Airwave and Aruba Participated in EDUCAUSE online session: "Managing a Student Help Desk"

Doris Stock. Participated in a web seminar given by attorneys from Dow Lohnes, "NTIA and RUS Broadband Funding Availability and Application Deadlines"; Participated in an Inova Solutions webcast on Higher Education Opportunity Act resources and requirements for emergency and fire notification and reporting; July 2009, participated in a Web-streamed session of the EDUCAUSE/Cornell Institute for Computer Policy and Law, "Dancing with the Devil: New Alternatives for Campus Music"; July 2009, participated in a Web-

streamed session of the EDUCAUSE/Cornell Institute for Computer Policy and Law, "P2P War Stories: Tales from the Trenches"; July 2009, participated in a Web-streamed session of the EDUCAUSE/Cornell Institute for Computer Policy and Law, "Outsourcing E-mail: Technology and Policy Issues"; Participated in RedSky-sponsored webinar, "Complying with the new Virginia E911 Law" on recent 911 legislation in Virginia; September 2009, participated in ACUTA webinar on Electronically Stored Information (ESI) collection and retrieval; November 2009, participated in EDUCAUSE webinar, "Complying with P2P Mandates"; May 2010, participated in EDUCAUSE webinar, "Government Access to Electronic Communications—Updating the Rules"; May 2010, participated in EDUCAUSE webinar, "The FCC and Network Neutrality"

Flex Vaughn, December 2009, received B.S. in Biochemistry from Virginia Tech

Luke Ward and Laurie Zirkle, February 2010, SANS GIAC GCIA Intrusion Detection Analyst recertification

Diane Whitlock, completed 48 hours of Continuing Education for Microsoft Outlook, Excel, and Word 2007 and 10 hours of Continuing Education for Fundamentals of Voice over IP

Danny Wright. November 2009, CIW v5 Site Designer Certification; July 2009, CIW v5 Database Design Specialist Certification;

June 2010, CompTIA Security+ Certification

## Military service

Ron Keller, active member, Army National Guard

Robert Roberts, Member, United States Army Reserve

## Presentations, papers, and publications

Eric Brown. Initiated Network Brown Bag seminar series with Mark Gardner and Allen MacKenzie; August 2009, invited speaker for Get Connected staff training; September 2009, Network Brown Bag: Vision for Networking' May 2010, Network Brown Bag: Modeling Networks with Uncertainty

Jeff Crowder. Provided a presentation/seminar to the Montgomery County Office of Economic Development and members of the Montgomery County Board of Supervisors for local broadband strategy and opportunity. The presentation focused on the New River Mall MSAP and Allegheny Fiber projects; Invited presenter for the International Executive Collaborative Study Tour/Workshop for the Nigerian Governing Board of National Commission for Colleges of Education, Abuja, on

modern management for tertiary institutions as well as to foster long-term collaborations between Nigerian higher education institutions and Virginia Tech

William Dougherty. May 2010, presented "E-Discovery: Real World Lessons from Virginia Tech" to the College and University Auditors of Virginia (CUAV) conference; "Preservation of Digital Assets: One Approach" *Journal of Academic Librarianship*, (Vol. 35/no. 6) published by Elsevier, North America; "Will the Google Book Project make Libraries Obsolete?" *Journal of Academic Librarianship*, (Vol. 36/no. 1) published by Elsevier, North America; "Linux is for everyone; Librarians included!" *Journal of Academic Librarianship*, (Vol. 36/no. 2) published by Elsevier, North America; "E-Readers: Passing Fad or Trend of the Future?" *Journal of Academic Librarianship*, (Vol. 36/no. 3) published by Elsevier, North America; "The Copyright Quagmire" *Journal of Academic Librarianship*, (Vol. 36/no. 4) published by Elsevier, North America

Ludwig Gantner. Gave presentation to several departments about the use and operation of Elluminate Live; Gave presentation to several departments about the use and operation of Adobe Connect Pro Meeting

Mark Gardner. October 2009, Mark K. Gardner, Adam Herr, David Mazary, Heshan Lin, Thomas Scogland, and Wu-chun Feng, "A Flexible and Extensible

Framework for Delivering Designer Images for K-12 Pedagogy," Third International Conference on the Virtual Computing Initiative (ICVCI-3), Research Triangle Park, North Carolina

April 2010, Mark K. Gardner and Wu-chun Feng, "Cloud Computing at Virginia Tech and K-12 Outreach," Cloud Computing for Education Forum, SUNY Binghamton, Binghamton New York

June 2010, Mark Gardner and Wu-chun Feng, "Broadening Accessibility to Computer Science for K-12 Education," 15th Annual Conference on Innovation and Technology in Computer Science Education (ITiCSE 2010), Bilkent, Ankara, Turkey

Carol Hurley, Julia Mays, and Nate Smith, March 2010, presented "How to do MORE with LESS," a Birds of a Feather Session at the Association of Collegiate Computing Services (ACCS) of Virginia annual conference, Charlottesville, Virginia

Joyce Landreth and Rob Sprague, March 2010, presented "How Do You Get the Word Out to Your Campus?" at the Association of Collegiate Computing Services (ACCS) of Virginia annual conference, Charlottesville, Virginia

Steven Lee with David Bailey, Joseph Tront, and Thomas Walker, June 2010, presented "Developing Network Infrastructure for Classroom Technologies" at 2010 American Society for Engineering Education Annual Conference and Exposition, Louisville, Kentucky

Nate Smith, April 2010, presented at Technical Tools and Tips for Research at 8th Annual Undergraduate and Prospective Graduate Student Conference

## Consultation and outreach activities

Wanda Baber. Member, Systems Performance Team; Member, High-performance Computing/Research Computing Storage Evaluation Committee

Wanda Baber and Dan Cook, members, Judy D. Albert Memorial Scholarship Committee

Eric Brown, Richard Hach, Mark Harden, Carl Harris, Joe Hutson, Judy Lilly, John Pollard, Pat Rodgers, members, Emergency Communications Task Force

Dan Cook, Staff Senator—President's Award Selection Committee, University Council, University Employee Benefits Committee; Pledged and gave over 200 volunteer hours through VT ENGAGE; Served as a judge for the Eastern Elementary and Middle School Academic Fair; Member, Information Technology Advisory Committee for the Division of Business and Technologies of New River Community College; Member, NI&S Emergency Action Plan Committee; Attended EDGE training through Boy Scouts of America; Cubmaster and Pack Trainer of Pembroke Cub Scout Pack 460 as well as serving on the Pack Committee as the Training Chairman; Troop Committee member, Training Coordinator, and Unit Advancement Chairperson for Boy Scout Troop 264; Member, District Training Committee for the Buckskin District of Boy Scouts of America; Member, Giles High School Class of '82 Scholarship Committee; Member, InfraGard (Richmond Chapter) *www.infragard.net;* Member, Averett University Alumni Association Executive Board

Dan Cook and Patsy Galliher, served as judges for the Giles County Academic Fair

Dan Cook and Kevin Davis, members, SANS GIAC Advisory Board

Kevin Cook, Jeff Dalton, Andrew Tweedt, and Doug Whorley, supported VTTI grant for Driver Safety Education

Kevin Cook, Jeff Dalton, and Andrew Tweedt, supported Department of Education grant for Emergency Management

Jeff Crowder. Principal Investigator for Virginia Tech Foundation (VTF) proposal to NTIA Broadband Technologies Opportunity Program entitled "Allegheny Fiber: Extending Virginia's Open Access Fiber Network to the Ridge and Valley." Negotiated public-private partnership between VTF and Mid-Atlantic Broadband Cooperative. Proposal submitted August 18, 2009. Awarded $5.54 million in federal funding February 1, 2010;

December 2009, elected to serve as an ex-officio member of the board of the Blacksburg Electronic Village; March 2010, panelist, NTIA BTOP program for the SURA Board of Trustees Information Technology Committee meeting

William Dougherty. Member, Network Infrastructure and Services Advisory panel; Member, university's Policy Management Authority; Participated in committee of Information Technology representatives drafting the project management standards for the university under the structured management agreement with the Commonwealth of Virginia; November 2009, attended IBM Dynamic Infrastructure conference; Chair of Information Technology Roundtable Discussion Group; Chair of Scheduling and Announcing Maintenance Subcommittee (SAMS)

Eric Fischer, coach, New River Valley Lacrosse Club

Henry Floyd. July 17, 2009 – Joined Project Management Institute (PMI), the largest international Project Management organization;—November 9, 2009 – Joined the Southwest Virginia Chapter of PMI (PMI-SWVA);—April – July, 2010 – Performed volunteer work for PMI-SWVA chapter (assisted in development of welcome package and other membership drive materials);—April 23, 2010 – Attended daylong seminar on Agile Project Management at Southwest

Virginia Higher Education Center, Abingdon, VA

Ludwig Gantner. Member, Virginia Tech/Wake Forest School of Biomedical Engineering and Sciences Videoconference Tech Support Team; June 2009 and January 2010, primary technical support and advisor, SANS training/conferences; Technical support/advisor at Virginia Tech for Megaconference; Member, Internet2's Audio Video Communication Infrastructure Special Interest Group

Ludwig Gantner and Mark Harden, members, Distance Learning SACS approval team

Nancy Gibson, Spanish tutor for Upward Bound/Talent Search

Mark Harden and David Schuh, consulted on audio/visual and videoconferencing specification for the STEM Lab/Seitz 112

Richard Hach. Member, Sprint Higher Education Advisory Board; Member, Net@EDU Converged Communications Working Group; Member, Converged Communications Working Group (CCWG) steering committee and participated with CCWG to support Net@EDU and the EDUCAUSE Advanced Core Technologies Initiative (ACTI); November 2009, participated in EDUCAUSE 2009 Online; Consulted with peer institutions regarding best practices, service, policies, procedures, and regulatory issues including colleagues at Radford

University, University of Iowa, University of Richmond, Old Dominion University, and William and Mary; Participated in the "Virginia Summit on Broadband Access" hosted by Senator Mark Warner at Piedmont Virginia Community College to discuss broadband in the Commonwealth of Virginia and opportunities available through 2009 American Recovery and Reinvestment Act; Collaborated with Administrative Services on a Department of Education Emergency Management grant proposal. Under the initiative, Virginia Tech was awarded $247,419 in funding; Successfully completed a Department of Homeland Security course through the National Center for Biomedical Research Training at Louisiana State University, "Executive Seminar: Prevention of, Response to, and Recovery from Campus Emergencies"; Appointed to serve on the National LambdaRail, Inc. board of directors representing the Virginia Tech Foundation and the members of the Mid-Atlantic Terascale Partnership; With Mark Harden, Video/Broadcast Services, consulted with the Science Museum of Virginia Director of Technical Solutions regarding electronic delivery of course content to middle and elementary school children; Chairman, National LambdaRail, Inc. Audit Committee; Executive liaison to Internet2 as a Research and Education Network Member representing NetworkVirginia; Served on the Quilt,

Inc., board of directors representing NetworkVirginia; Member, Network Infrastructure and Services Advisory Board of the Information Technology Advisory Committee, Commission on University Support

Valdis Kletnieks, member, Computer Incident Response Team

Kathy Kobza. State Bowl Evaluator, Texas Future Problem Solving; Scholarship Chairman, Lubbock ISD Council of PTAs

Spencer Riddile. GSA Representative, Virginia Tech Energy and Sustainability Committee; Treasurer, Rogues Racing Amateur Cycling Team; Contributor to OpenStreetMap for local mapping efforts; Outdoor leader and Website administrator for the Outdoor Club of Virginia Tech

William Sanders. Split appointment with the Arts Initiative at Virginia Tech focused in large part on developing infrastructure and program plans for the university's proposed Center for Creative Technologies and related activities. Visited and advocated throughout Virginia with state legislators, county supervisors, school officials, and art-related organizations; Ex officio member, Arts Initiative Steering Committee; Ex officio member, Arts Policy Board ; Served on the Blacksburg Partnership Collaborative for the Arts focusing particularly on the relationships among the economic development implications of the arts in downtown Blacksburg,

municipal broadband infrastructure, and the arts initiatives at Virginia Tech; Ex officio member, Blacksburg Telecommunications Advisory Committee; With Jeff Crowder and Brenda Van Gelder, coordinated "message" relative to regional broadband infrastructure and met consistently on the topic with local government leaders in Blacksburg, Christiansburg, and Montgomery County; Member, Downtown Revitalization Committee; Member, New Century Technology Consortium Information Technology Professionals Forum Steering Committee;

David Schuh. Captain, Civil Air Patrol United States Air Force Auxiliary; Director of Aerospace Education, Virginia Wing; Emergency Services Officer, Montgomery County Squadron; Summer enrichment seminar for sixth graders of Montgomery County Schools, aerospace, math, and physics lessons; Musical performances at Montgomery County and Giles County Relay for Life benefits; committee member, Montgomery County Relay for Life; Virginia Department of Emergency Management, Incident Command Staff School: ICS 300; July 2010, Virginia Tech Citizens Emergency Response Team (CERT) member

Doris Stock, Member, Legislative and Regulatory Committee, Association for Information Communications Technology Professionals in Higher Education (ACUTA)

Andrew Tweedt. Helped develop QT software for online presentation of dual videoconference presentations

Diane Whitlock. Member, the Association for Information Communications Technology Professionals in Higher Education (ACUTA); Member, NI&S Emergency Action Plan Committee; Member, officer, genealogist and website administrator for the General William Campbell Chapter, National Society Daughters of the American Revolution; Member, P. Buckley Moss Society

Laurie Zirkle. Member, SANS Institute Advisory Board; SANS GIAC Proctor; Reviewer for the Unix Day for Security Essentials, SEC401; SANS Security Consensus Operational Readiness Evaluation (SCORE) Project Red Hat Best Practices documentation (contributor); Website/Facebook/Twitter administrator for the nonprofit Greater Roanoke Area USBC (Bowling Association)

# Secure Enterprise Technology Initiatives

Secure Enterprise Technology Initiatives (SETI) develops and supports secure applications, middleware, online directories, and authentication solutions for the university community. SETI includes eProvisioning, the Microsoft Implementation Group, Middleware, and the Test Group. Each unit contributes to the strategic goals of Information Technology by providing secure, robust and highly functional authentication, authorization, and directory infrastructure components that enable integration with teaching, learning, research, and outreach services.

## Goals

- Provide secure authentication and authorization solutions that can be integrated into applications to protect access to electronic resources
- Ensure that Virginia Tech's Microsoft computing environment is stable, secure, and scalable—and increasingly "green"
- Ensure that all SETI services are thoroughly tested prior to production deployment

## Highlights

**Supporting digital identity management through authentication solutions and standards**

Many of SETI's activities involve providing and supporting solutions and infrastructure for Virginia Tech digital identities—personal digital identities (PIDs, Hokies IDs, PDCs) and server/service identities.

The eProvisioning unit successfully completed a key project to migrate the Virginia Tech User Certification Authority from OpenCA to Enterprise Java Beans Certification Authority during the summer of 2010. This achievement marks a milestone in the eProvisioning unit's efforts to implement a simplified public key infrastructure support model and to provide a robust, high performance, and platform independent certification authority. The new infrastructure will facilitate a project to provide the university with personal digital certificates that can be stored on a computer or mobile device rather than on an eToken. These new "soft" personal digital certificates (PDCs) are designed to give the university a credential with a higher level of trust than the PID, and with wider distribution than the PDCs on the eToken.

Middleware extended their support of federated identity management by providing customized Shibboleth integration for Google e-mail, the Virginia Tech Carilion School of Medicine, BioRaft, Digital Measures, and Internet2 wiki spaces.

SETI staff members played a significant role in drafting the Standard for Personal Digital Identity Levels of Assurance. Current and ongoing SETI projects provide options for implementing Virginia Tech credentials that satisfy criteria for various levels of identity assurance.

**Securing Windows platforms with VT WSUS**

Historically, Windows machines have been more vulnerable to security exploits than any other platform. To combat these vulnerabilities, the Microsoft Implementation Group developed a local Windows System Update Service, VT WSUS. This service automatically deploys VT-tested patches to subscribers. The testing allows checking for compatibility with other supported Virginia Tech applications, enhancing 4Help's ability to support our user community. VT WSUS was upgraded this year to support Windows 7 clients, and new features were added. One enhancement notifies users when their clients expire (after 60 days of inactivity), and another feature

notifies them monthly if their system still needs updates. Supporting servers were upgraded and virtualized.

# eProvisioning

The eProvisioning unit recognizes the increasingly important role of the Virginia Tech Certification authority (VTCA) as a security solution and has ensured that the university is positioned to continue offering comprehensive enterprise-wide digital certificate services to the campus community. Accomplishments during this cycle facilitate the integration of public key technology with critical university business processes.

**VT User Certification Authority.** The eProvisoning unit completed its project to migrate the Virginia Tech User Certification Authority (CA) from OpenCA to the open source Enterprise Java Beans Certificate Authority (EJBCA). The migration of the Virginia Tech User CA completes the transition of all Virginia Tech digital certificate services to use EJBCA as its underlying certificate authority application software.

**Token Administration System (TAS).** The e-Provisioning unit completed the development of TAS v3.0 with a deployment to production scheduled for August 2010. TAS is an administrative application developed by the eProvsioning unit to support full lifecycle management of personal digital certificates (PDC) issued onto eToken USB smart devices. TAS v3.0 provides an updated application program interface using Web services to support integration with EJBCA as its backend certificate authority. In addition to implementing a simplified administrative interface, the new TAS release has been upgraded to allow the issuance of PDCs to include graduate students.

**Certificate profiles.** In order to address special needs to provide customized certificates, the eProvisioning unit worked closely with other groups to develop several application specific certificate profiles. With the assistance of Identity Management Services (IMS), the eProvisioning unit successfully deployed a customized Middleware certificate profile to allow client SSL authentication by BioRaft, a non-Virginia Tech affiliate. Working with Database and Application Administration, a custom-designed certificate profile was deployed to meet specialized requirements for server SSL certificates to permit the specification of multiple subject alternative name entries. In addition, the eProvisioning unit has collaborated with the Microsoft Implementation Group to develop certificate profiles needed to support the use of eToken/PDCs with the Microsoft Smart Card login facility.

**Application service hosting.** The eProvisioning unit, together with Database and Application Administration, successfully migrated its PKI web service applications from physical application servers to a new virtual hosting environment. The migration to virtual hosting has enabled the physical application servers to be decommissioned and provides a more efficient and cost effective alternative for application hosting.

**PKI Client Software.** The eProvisioning unit completed updating the eToken (x32 and x64) PDC RTE installer to support the installation of SafeNet's new PKI Client Software 5.1 SP1 release. With the assistance of the SETI Test Team, the 5.1 SP1 release was tested and deployed to production in March 2010. The new release of the PKI client extends the support for using eTokens on the Windows 7 platform, providing eToken users with a Windows operating system upgrade solution.

**Root key signing.** The eProvisioning unit took a leadership role to help develop a request for proposal for a root key signing solution for the VTCA. As a result of these efforts, a root key signing vendor has been selected and there are tentative plans to implement root key signing during the fourth quarter of 2010. By implementing a root key signing solution, certificates issued by the VTCA will automatically inherit the trust associated with the root certificate of the key signing vendor and will be

transparently accepted by the majority of mainstream PKI-enabled applications.

**Soft PDC project.** The eProvisioning unit is a key contributor in the project initiated in April 2010 to develop and implement a soft personal digital certificate service. 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 token. Currently the project group is focused on the development of the functional requirements for a soft PDC service with a production implementation planned for sometime during the spring of 2011.

**Ongoing support.** The e-Provisioning unit continued to provide ongoing maintenance and support for its PKI web services, Token Administration System, eToken RTE Installers, and the VTCA PKI infrastructure including the VT Root, Class1 Server, Middleware and User CAs. eProvisioning worked closely with the Northern Virginia Center to accommodate their requirements for issuance of PDCs onto eTokens and to provide training and support to their administrators. In addition the eProvisioning unit provided the Faculty Development Institute with instructor training and helped with the development of training materials for digitally signing Adobe Acrobat documents.

**Valid VTCA certificates.** The usage of VTCA certificates continues to increase.

| As of: | 8/19/2009 | 8/18/2010 | Percent increase |
|---|---|---|---|
| Personal digital certificates | 540 | 583 | 8% |
| SSL class 1 server certificates | 307 | 360 | 17% |
| Middleware application certificates | 71 | 80 | 13% |

# Middleware

The Middleware Services group 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. Virginia Tech's Enterprise Directory is supported by Middleware.

**LDAP and application servers.** Middleware completed several infrastructure updates that were vital to maintaining Enterprise Directory services. OpenLDAP was upgraded to version 2.4. JBoss was upgraded to version 5.1.0, and JBossMQ was replaced with Hornetq as the Java Messaging Service provider for replication. Additionally, the software development environment was enhanced by switching the build framework from Ant to Maven.

LDAP attribute changes included removing *legalName* in favor of using the more descriptive *bannerName*. The ou=Accounts,dc=vt,dc=edu branch of the LDAP was also removed to clean up old, unused references. *mailExternalAddress* was added to support the Google e-mail project. The *udcIdentifier* was also added, making way for more robust single sign-on integration using CAS with Banner.

Working with SETI's eProvisioning group, support for external middleware certificates was added, enabling approved non-Virginia Tech service providers to obtain a certificate for use with an ED-ID service.

**Google e-mail and Apps.** Middleware developers played key roles in the design, development, and implementation of Google e-mail provisioning for Virginia Tech alumni and for the VT Carilion School of Medicine. Middleware also provided Enterprise Directory integration with the VT Google Apps domain for alumni.

**DAT.** The Directory Access Tool (DAT), developed and supported by Middleware, is the administrative user interface to the Enterprise Directory's Registry database. The implementation of Google Apps accounts required DAT changes for management support, including the ability for a DAT user to search the Google namespace from the name arbiter interface. Other DAT changes included usability improvements and enhancements to security and auditing. Middleware continues to improve the DAT, soliciting input from the SETI Test Group, Identity Management Services, and University Computing Support.

**Shibboleth.** Shibboleth use was expanded this year, providing federated authentication and single sign-on integration to the Google domain for Virginia Tech alumni and Carilion School of Medicine. Development work was done to integrate uApprove into Shibboleth. uApprove will allow us to investigate user-driven attribute release as a solution to concerns about data disclosure to third party services. As a member of the InCommon federation, Virginia Tech is well poised to take advantage of services provided by InCommon partners. uApprove will allow users of those services to make better choices about sharing their data.

**CAS.** The Central Authentication Service (CAS) underwent a smooth upgrade to version 3.3.3. Along with the upgrade, changes were made to increase performance, security, and availability. CAS also became the user-facing page for Shibboleth authentication, thus presenting a single, familiar login screen for Virginia Tech affiliates to use to access services hosted at Virginia Tech and elsewhere.

# Microsoft Implementation Group

**Hokies domain administration**. MIG maintains both the hardware and software to support the VT Active Directory and ancillary services. During this timeframe, MIG upgraded the UPS for the remotely hosted Cassell domain controller and leveraged the Virtual Dedicated Windows Server (VDWS) system to migrate two physical domain controllers to virtual ones. After extensive testing, the root was upgraded to Windows 2003 R2 to support new features and functionality (like printer assignment via group policy), and security setting upgrades were put into place to mitigate potential "Google Aurora" style attacks. MIG also proactively requested the IT Security Office scan dev, test, and production systems with the Rapid-7 security scanner. When valid results were found, steps were taken to mitigate any potential security issues as a pre-cursor for an upcoming internal audit review.

**Hokies Self-Service.** MIG updated the Hokies Self-Service Web application to support a hybrid Exchange 2003/2007 environment.

**Outreach.** MIG hosts monthly VT Windows User Group meetings (*http://vtwug.w2k.vt.edu*) to provide

discussions and proactive guidance in Windows-related matters.

A new program was also instituted called "Fireside chats" to help the technical support staff in departments gain traction in smarter-not-harder deployment of Microsoft (MS) technologies for better management, support and security. Two departments participated in this program during the timeframe.

The MIG staff provided early access to MS Mac Office 2011 betas to departmental information technology staff members and acted as the conduit for feedback and bug tracking to MS support. MIG staff members are also on the MS Macintosh Business Unit council to provide higher education-related feedback and discussions.

**VDWS.** MIG rents VDWS systems to Information Technology units (no charge) and to departmental information technology administrators for a small yearly fee. MIG also hosted VDWS training for VDWS customers, updated and streamlined online forms, and migrated the purchase requisition process from paper to HokieMart for this service. The service saw huge customer guest growth from last year's 60, with the maximum number of guests being reached by mid-year. A project began to develop a storage SAN solution to support the MS DPM (Data protection manager) application. DPM will ultimately allow MIG

to provide stateful guest backups. Supporting a four nines (99.99%) uptime service is also being developed by MIG, utilizing the MIG SAN, clustering, network line aggregation and tagging, and Microsoft Windows 2008 R2 and Hyper-V R2 technologies.

**Security/VT WSUS**. MIG began a project for 4help to update VT WSUS to 2.0. This included a program to e-mail users if their clients weren't completely updated, an update for the MS backend WSUS 2.0 to 3.0, virtualization of the two application WSUS servers and continued functional and UI improvements to the Web reporting interface. The VT WSUS client was also updated to support all versions of Windows 7 and 64 bits operating systems while de-supporting Windows 2000. A private company (Denamotion) also inquired into additional functional add-ons to support non-MS related updates. MIG worked with the information technology organization at Washington State University to update MIG DictFilt opensource to support Windows 2008.

**Sharepoint**. MIG maintains a private 4/16 Sharepoint site to support executive and related staff management of documentation. During this year, the system was maintained, updated to fix login issues, and parity discussions commenced for matching dev, test, and production for this service.

**Customer support**. MIG discussed uses for Windows Rights Management Services (WRMS; now called ADRMS) with the Information Technology Security Office, Business and Management Systems, and Identity Management Services to support encryption of Office documents (on-the-wire and at rest). MIG had discussions with NI&S Systems Support and Microsoft about potential migration of on-site Exchange services to Live@EDU or Business Productivity Online Services (BPOS). Testing of currently available Microsoft cloud services as a proof-of-concept concluded with a discussion and write-up. MIG had discussions with Virginia Bioinformatics Institute on Sharepoint technology to support their grant review process.

MIG staff members are active members of the Information Technology performance team as well as the Information technology project management development group. MIG reviewed the Trustware Bufferzone product on behest of Information Technology Acquisitions.

**ADadmin.** MIG is working on an extensive infrastructure update named ADadmin to support automated provisioning and deprovisioning of VT AD resources. Work on back-end components for ADadmin (ILM, ADAM, Synchro) are going well, with synchronization of current and new attributes for objects into the test environment.

**Green computing.** The MIG staff reverse-engineered Wattsup.NET network traffic to support rolling out a Web application that continually monitors power utilization in MIG hardware racks. MIG personnel also acted as a technical liaison to a computer science professor in his effort to develop a start-up providing green power savings technology. MIG tested office desktop systems in three power modes to determine best settings to save power, and these findings were then presented at Spring DCSS.

**VDWS stats**

73 virtual guests

> 28 paying guests (non-IT)
> 45 non-paying guests (internal to IT)

Consuming 120 GB of memory and 5.72 TB of storage

Emulating 104 CPUs and 80 network connections

**Opensource stats**

*http://opensource.w2k.vt.edu*

| Unique downloads | | |
|---|---|---|
| | FY09 | FY10 |
| authad_v1.4 180 | | 193 |
| daisy_v2.2 3367 | | 3427 |
| DictionaryFilter_v2.1 748 | | 780 |
| Faith_v1.01 488 | | 500 |
| Ivy_v1b22 235 | | 239 |
| OUadmin_v1.0 155 | | 160 |
| Portinator_v1.0 187 | | 191 |
| SafetyNet_v1.0 656 | | 673 |
| SelfService_v2.3 483 | | 560 |
| VTwsus_v1.0 306 | | 428 |
| Win32_perms_v0.2 65 | | 69 |

## VT WSUS statistics

VT WSUS is used on approximately 10% of
faculty/staff Windows computer systems.
Approximately 37%of VT WSUS users are
running Windows 7, 11% run Windows Vista,
and 52% are running Windows XP. VT WSUS
provides Information Technology with a
powerful tool to help profile the user
community.

The chart and graph show that the majority
of clients fully patched within three days of
patch release.
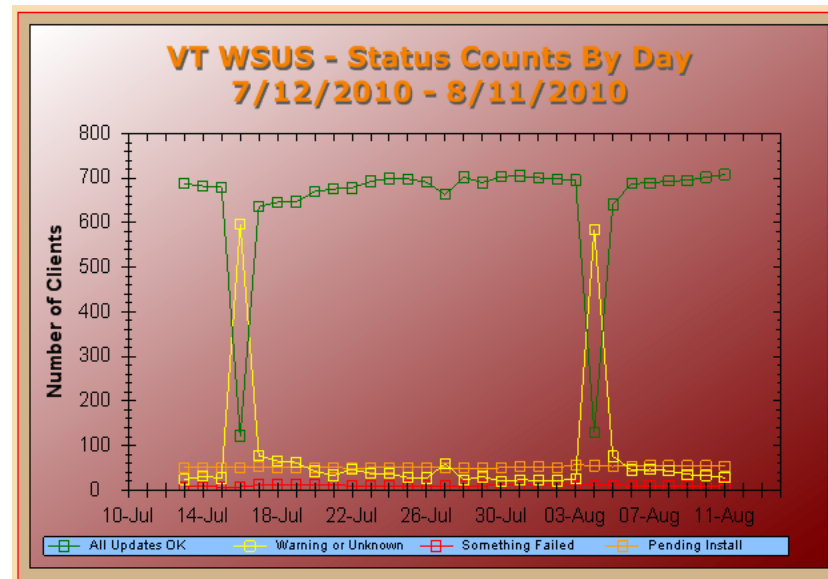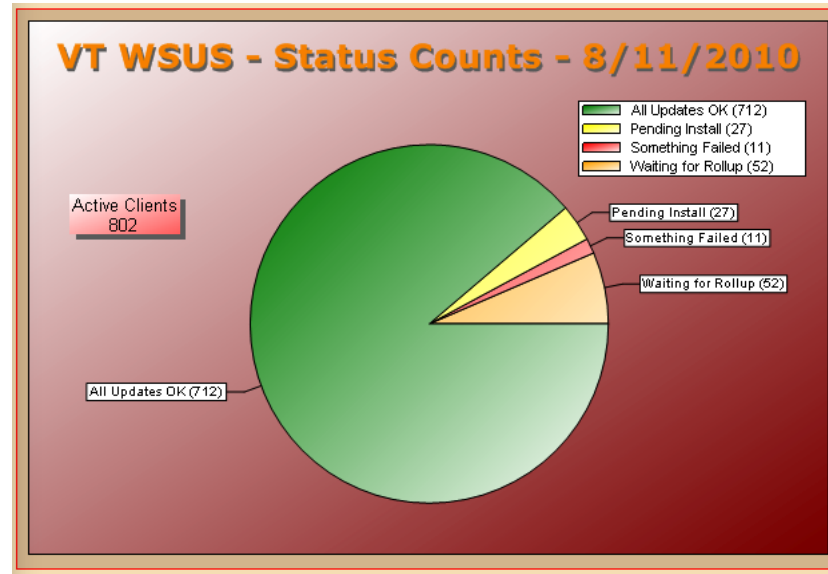
# SETI Test Group

The primary mission of the SETI Test Group is to test applications developed by the eProvisioning, the Microsoft Implementation Group, and Middleware. Our secondary mission is to support Virginia Tech's information technology users by testing and recommending enhancements for related services. As such, we tested the following applications and services this year:

**MIG**

- Hokies Self-Service/My Exchange upgrade for Exchange 2007 upgrade
- WSUS 2.0
- Active Directory contact/user management and deprovisioning
- VDWS
- Office 2011 beta for Macintosh

**eProvisioning**

- TAS 3.0 (Token Administration System)
- VT Certification Authority migration from OpenCA to EJBCA
- Issuance of certificates and ED-ID services for non-VT entities (BioRaft)
- eToken software testing for Windows 7 and Mac OS 10.6
- Captcha for PKI Policy Management Authority webpage contact form

- Knowledge base articles on the creation and use of digitally signable PDF documents

**Middleware**

- Google email for Alumni
- Groups manager application
- Guest manager application
- Directory Access Tool (DAT)
- Workflow for certificate acquisition and ED-ID services
- OpenLDAP upgrade
- CAS 3.3.3 and 3.4.2 deployments
- ED 3.0 deployment, including mail attribute and affiliation changes

**Related services**

The Test Group also worked on My VT, PIDGen, Filebox, and Scholar projects.

**Other contributions**

The Test Group participates in several activities within Information Technology to promote quality services. These include the standing groups—Scheduling and Announcement of Maintenance and Data Quality.

We also participate in projects as they are developing, including certificate and ED-ID service consulting with the Math Emporium, self-service password reset project, soft personal digital certificate project, Identity Finder evaluation, and SAS testing.

**Students**

We supported two graduate students from the Department of Electrical and Computing Engineering (ECE), and one undergraduate intern. The two ECE students earned MSEE degrees this spring, and the intern will return to us for her senior year. The graduate students developed sample Web applications for inventory tracking and for soft certificate issuance and digital document signing. All three students performed testing for eProvisioning and Middleware, and our intern was especially helpful with usability testing and process documentation.

**Audit**

In preparation for the SETI audit, we have streamlined our inventory, made better use of virtual machines, and have used scanning tools to verify that we are not storing sensitive data or creating exploitation vulnerabilities on our computers.

# Virginia Tech Geospatial Information Sciences

Virginia Tech Geospatial Information Sciences (VTGIS) is a geospatial initiative of Virginia Tech, a division of Information Technology's recently formed Converged Technologies for Security, Safety and Resilience unit (formerly called Strategic Partnership Initiatives). It serves as an interdisciplinary resource providing integrated geographical information system (GIS) and related information technology support to geospatial research, teaching, outreach, and administrative functions.

Our mission is to advance geospatial science and research at Virginia Tech through collaborations with the Virginia Tech faculty and administrators, research centers, local, state and federal agencies, and external partners.

VTGIS applies geospatial technologies and analytical methods to address our strategic objectives in the areas of

- research and collaboration;
- safety and security;
- community broadband, economic development, and resilience;
- lowering barriers to the use of geospatial tools and data.

During the period of July 2009-June 2010, VTGIS included three units.

**Center for Geospatial Information Technology (CGIT).** CGIT is an interdisciplinary, university research center that seeks opportunities to partner with university researchers, government agencies, and the private sector to conduct funded research and to develop advanced uses of geospatial technologies and resources.

**Enterprise GIS.** This administrative unit provides centralized storage and hosting of GIS data, Web-mapping applications hosting and design assistance, and, in collaboration with the Facilities Services, a centralized base map for the campus and the Commonwealth of Virginia.

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

## Highlights

### National Telecommunications and Information Administration (NTIA) broadband mapping

Information Technology's eCorridors Program through the Center for Geospatial Information Technology obtained funding as a sub-contractor to the Center for Innovative Technologies and the Virginia Geographic Information Network of the Virginia Information Technologies Agency to develop and maintain a comprehensive statewide data library of Virginia broadband data. The funding from NTIA (as part of federal stimulus funds) is for $442,551 over two years, with an additional award pending for subsequent three years.

### 3D Blacksburg—creating a virtual 3D city model for the future

Utilizing a trans-disciplinary approach, and starting with the Town of Blacksburg and the Virginia Tech campus, a consortium being

led by CGIT comprised of multi-disciplinary researchers, experts, and students from various universities and governments is creating a model for a virtual 3D city. This 3D model will provide innovative tools to serve three distinct user groups: (1) public (tourism, retail, social, real estate.); (2) operations (emergency management, threat assessment, police department, town planners, civil engineers); (3) K-12 school curriculum and university researchers.

## Google request for information response and FutureForward Blacksburg submission

In March 2010, Virginia Tech Geospatial Information Sciences, along with others from Information Technology, represented the university in a collaborative effort with the Town of Blacksburg to submit a joint application named "FutureForward Blacksburg" for Google's "Think Big with a Gig" experiment to build ultra-high speed fiber to the home networks in a number of locations across the country. As part of the Town of Blacksburg's submittal, faculty and staff of VTGIS produced a video that illustrates a number of applications that citizens, students, government officials, and businesses in the town would be able to use if a gigabit Ethernet were made available to them. In addition, staff of eCorridors, Blacksburg Electronic Village, and others

worked to gather and prepare data that was used as part of the extensive request for information response that went forward from the Office of the Town Manager.

## Enterprise GIS enabling research leveraging GIS tools

During the past year, Enterprise GIS, the administrative function of VTGIS, worked with over a dozen faculty and departments to enable research involving the use of GIS tools and resources. One example is the "Community Food Explorer," conceptualized by Jonah Fogel of Cooperative Extension. Enterprise GIS staff created a website and resulting Web mapping application that is designed to deliver information about community food systems in Virginia and North Carolina. The map presently includes over 70 individual layers of information for each state that are grouped into six relevant themes: assets, land use and conservation, demographics, health indicators, agribusiness, and local production capacity.

## Health information technology

Over the past year, VTGIS has been involved in conversations with potential collaborators, exploring ways that geographic information systems could be leveraged in health information technology.

Topic areas include personal health data and information security, real-time air quality mapping, omni-scale health applications, interior spaces and health care, broadband access mapping and rural medicine, traffic accident "hotzone" mapping, and nano-scale material particle mapping.

## Community security, and resilience

VTGIS is engaged with the Center for Community Security and Resilience in a funded research project, begun during the spring of 2010 and continuing throughout the fall of 2010 with IBM to explore ways that GIS can assist with video analytics by extracting geographic information from video surveillance. This preliminary work will lead to opportunities for further funding for research and development of this critical area for community security as well as the ability of regions to mitigate and recover from disasters.

## Faculty Development Institute

VTGIS offered three GIS courses during the Fall 2009 semester via the Faculty Development Institute (FDI). These courses were open to Virginia Tech faculty and staff, as well as graduate students with their faculty advisor's permission. Content was

geared towards novice, intermediate as well as advanced GIS and remote sensing users.

## Virginia's vineyard projects

As the popularity of wine varieties change over time, new models developed by CGIT will be used to help industry meet market demands quickly and efficiently, providing the information needed to accelerate planting and growing in the right zone with the right cultivar. CGIT is working on multiple funded research studies that use GIS and other models to determine what grape cultivars (varieties) can be successfully grown in different areas throughout the eastern United States.

## The Open Geospatial Consortium

CGIT recently invested in becoming a member of the Open Geospatial Consortium, Inc. (OGC). OGC is an international industry consortium of 398 companies, government agencies and universities participating in a consensus process to develop publicly available interface standards. OpenGIS® standards support interoperable solutions that "geo-enable" the Web, wireless and location-based services, and mainstream information technology. The standards empower technology developers to make complex spatial information and services accessible and useful with all kinds of applications. The CGIT faculty and staff will

be participating in a number of working group collaborations focused on specific standards development and advancement of geospatial resources for Virginia Tech and the commonwealth.

## CGIT director joins International Charter 'Space and Major Disasters'

CGIT is active on an international scale through a newly established connection with the International Charter (the Charter) Space and Major Disasters, a collaboration among space agencies from around the world. Peter Sforza, director of CGIT, joined the Charter's network of project managers in the spring of 2010. To manage large disasters, the Charter makes use of data collected by orbiting space satellites, promoting cooperation among space agencies to support humanitarian relief efforts around the world. When disasters such as the recent earthquakes in Haiti and Chile, and Tropical Storm Hubert in Madagascar take place, charter member agencies supply important information about these events' impact and scope. As project manager for the Charter, Peter Sforza participated in 2 intense days of training for conducting the distribution and processing of images and information needed by end users assisting in response work. This group is made up of remote sensing and emergency management experts from emergency operations centers, universities, other government agencies,

United Nations agencies, and volunteer organizations around the world.

# VTGIS by the numbers

These metrics are for the period July 2009-
June 2010

Proposals submitted                                    24
   (VTGIS faculty were PI or co-PI on
   20 of these proposals)
Grants awarded                                          6
Information Technology's share of
   sponsored research funding from
   awarded grants                    $483,551
Information Technology's share of
   sponsored research funding from
   five pending awards, if awarded in
   full $1,                      273,693
Students employed                                      13
Students mentored (but not employed)
   by VTGIS                                 17
Faculty Development Institute courses
   taught 10
Safety- and security-related courses
   attended by VTGIS staff                   8
Collaborative projects with the campus
   police 3
Communities requesting assistance from
   eCorridors 9
Media events or coverage generated by
   outreach and GIS activities              15