

**information technology  
annual activities report  
2008-2009**

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**office of the vice president for  
information technology**

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

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# office of the vice president

## highlights

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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 2008-2009 includes a review of key activities from across the organization, as well as unit reports from areas reporting to the vice president.

### Virtualization

Virtualization achieves economies in hardware investments, “greener” use of electrical power and cooling, and improved security for both the physical computing resources and for the data those resources handle.

Estimates for the utilization of campus servers range from five percent to 30 percent—leaving a high percentage of free cycles. Virtual computing makes an application less dependent on a specific physical host, increasing overall utilization rates and reducing infrastructure costs. Virtualization allows installation of high-performance computing resources to support both research and administrative computing applications.

Improved security for information handled by these systems, including any sensitive data, comes with the expertise of the personnel who manage the operating systems—keeping them updated, adhering to security protocols, securing against attacks, providing for back-ups and disaster recovery. Departmental technical support personnel can be freed to work on direct support of departmental business.

Virtualization work this year includes meeting with the faculty to explain virtual computing and identify courses or laboratories that would be good candidates for virtualization, and virtualizing applications. Information Technology's Support Services and Advanced Research Computing groups work closely with the Virginia Bioinformatics Institute, the Virginia Tech Transportation Institute to determine best uses of virtualized computing.

This year, nine services have been virtualized, including an enterprise geographic information systems application, the digital repository, and messaging and authentication applications. In addition, feasibility testing for the high-performance/high-volume storage project showed promise. Additional equipment was purchased to begin the transfer of production applications and services in phases. Part I of Phase I of the server virtualization project is underway at this time.

Virtual Dedicated Windows Servers (VDWS) is a specific example of the benefits of virtualization. Deployed in the summer of 2009, VDWS allows departments to run Microsoft Windows-based operating systems and applications without purchasing or maintaining server hardware. VDWS offers a low-cost, flexible, virtual configuration, with hardware managed by the Secure Enterprise Technology Initiatives staff.

## Research computing

The University Committee on High Performance Computing evaluated the computational resources and computational science needs of the university and provided recommendations for a research computing budget. Recommendations from this and follow-on committees build on the work done by the Advanced Research Computing group this year.

**Storage and data warehousing.** The large hybrid storage system purchased from IBM delivers a petabyte of raw storage, and is used to address the needs of the Virginia Tech Transportation Institute (VTTI), Virginia Bioinformatics Institute, and general researchers supported by Advanced Research Computing. This system serves as an anchor system for future scientific data warehousing.

**iDataPlex.** The new IBM iDataPlex provides Intel x86 architecture in a clustered environment to support commercial software packages such as Matlab, Fluent, and other third-party software. The iDataPlex provides 672 cores with a total peak performance of 6 TeraFLOPS. The system is being partitioned to provide 12 compute nodes to VTTI and eight compute nodes (64 workers) for Matlab, with the rest will be available for general research computing applications. The system was delivered in early June 2009 and production use will begin in the next reporting year.

**Visualization.** New additions to the visualization software infrastructure include immersive support for COVISE, KeckCaves, and Instant Reality. For remote users, Advanced Research Computing is performance testing visualization services across server hardware systems, for deployment in the coming year.

## Digital repository project

In March 2009, software for the digital repository project was installed in a virtualized environment. The digital repository provides networked access, delivery, and permanent archival storage for collections of research materials. The initial use of the system makes available images of the *Macon Telegraph* newspaper during the period of the Civil War. Images of the newspaper, indexed by a Civil War historian, provide researchers—students and faculty alike—with windows into the period as reflected in this daily newspaper. Plans for additional newspapers will create a regional picture of the newspaper coverage of the era. Over 88,000 pages are expected in this project by the Virginia Center for Civil War Studies.

The digital repository is resource for additional research proposals. Benefits of the project include organized digital delivery methods—secure hosting, system backup, archival storage, access administration—as well as improved reliability over departmentally or individually managed servers.

## Scholar

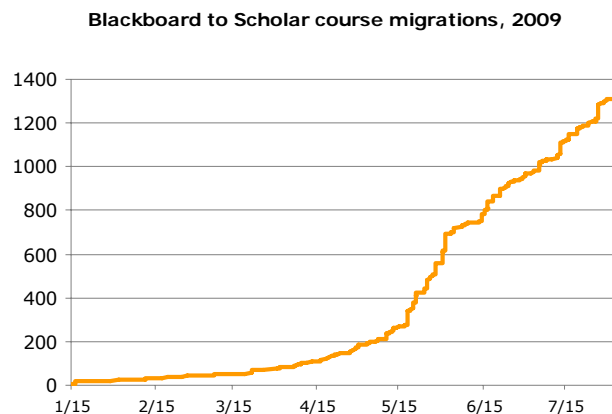
Scholar is becoming Virginia Tech's online system for learning and collaboration, with full implementation by Fall 2010.

Designed *by* higher education *for* higher education, Scholar offers tools in support of teaching and learning, research and collaboration, and assessment/accreditation. It supports announcements, assignments, discussion forums, chat tools, tests and quizzes, gradebook, electronic portfolios, an appointment tool, wikis and blogs.

Learning Technologies supports the migration from Blackboard to Scholar. Tools and services available to instructors include a course copy tool to import content from Blackboard, Faculty Development Institute classes, and drop-in support at the InnovationSpace.

Over the summer ending the fiscal and academic year, the number of courses migrated to the new system increased rapidly with the assistance of Learning Technologies staffers.

Online Course Systems (OCS) and University Computing Support/4Help staffs help desk services. During the transition, most Scholar questions come to



OCS to maximize their knowledge of Scholar. Over time, 4Help will respond to first-level Scholar issues.

Scholar is the Virginia Tech label for the community software Sakai. Collaboration among several universities—Virginia Tech, Michigan, Indiana, Virginia, Cambridge, Stanford, Berkeley, Rutgers, Yale, and Georgia Tech—created and continue to maintain and enhance Sakai. The Learning Technologies development staff this year created the course content copy tool for migration from Blackboard.

## Enterprise GIS

The Enterprise GIS Research and Development Administration Group was created in the Fall of 2008 to address the need for storage and hosting of geographic information system (GIS) data, and for access and training for GIS tools. Efficiencies of scale derive from leveraging the latest technologies in data hosting and storage. Enterprise GIS works with programs across the university to support a wide-ranging project set. Some of the projects underway are listed below.

The Virginia Tech Police Department is developing a prototype of an interactive, searchable incident map to enhance the ability of law enforcement to query, compare, display, and analyze complex spatial information about incidents and the campus physical environment. The interactive mapping tool is easy to use for an array of visualization tools. The map permits additional uses for community information such as snow emergency routes, road closures, construction, or bike lanes.

Virginia's Region 2000 and Virginia Tech's eCorridors group are developing a prototype of a vertical asset inventory tool using GIS and other geospatial technologies. Vertical assets are structures—tall buildings, silos, smokestacks, water tanks, existing communication towers—that wireless Internet service providers can use to deliver for the delivery of services. The geographic inventory system allows the localities to enter, search, sort, display, and retrieve data to facilitate investment in rural broadband deployment.

The Department of Entomology is working with Enterprise GIS to spatially enable databases for tracking the spread of the Gypsy moth and the Hemlock Woody Adelgid.

Enterprise GIS is working with staff from University Relations to integrate the centrally stored and regularly updated campus base map with the next generation of the published campus map. Future iterations of the campus map will be more dynamic and kept current through real-time links to current campus infrastructure data.

Multiple projects are underway from the Virginia Cooperative Extension. In the Northwest District, extension agents are taking advantage of the Enterprise GIS system to build Web-based maps illustrating the effects of different forestry techniques employed in demonstration plots at the Shenandoah Agricultural Research and Extension Center. These maps will offer a new, interactive format in which Extension can further the dissemination of best practices. At the

Alson H. Smith, Jr. AREC, researchers are interested in using the Enterprise GIS system as the backend for a web-based disease forecasting system for grapes.

## Converged security

The Converged Security Retreat held May 19, 2009, represented common needs between information technology and physical security for the university. Representatives from Facilities Services, the campus police, and various offices within Information Technology produced recommendations in four key areas.

**Identity Management Planning Committee.** A new working group will be convened, charged to examine identity management issues and develop a strategic master plan to guide the evolution of current systems and the selection of new systems and practices.

**Mobile data terminals (MDT) for police cars.** Hardware and software have been specified and selected for MDTs—ruggedized notebook computers with one or more radio interfaces, a touch screen interface, and a collection of specialized software applications mounted in a public safety vehicle.

**Video surveillance policy.** Policies for the acquisition and deployment of video cameras on campus will be developed.

**GIS for safety and security.** The goal is to provide geospatial tools and resources for safety and security.

## E-discovery and forensics

Information Technology provides support to the Office of University Legal Counsel and to Office of Internal Audit for e-discovery and forensic processes. Network Infrastructure and Services and the Information Technology Security Office are key units for these efforts.

During the year, eight cases were handled to respond to subpoenas, address internal human resources matters, and other possible cases of litigation. Specific tasks included creating 19 disk images, amassing 2.8 TB of data. Because these efforts produce such volumes of unstructured data that require review, indexing, redaction, and presentation, a new project to manage this type of data has been initiated to better equip the university to face these issues in the future. The large quantities of unstructured data in the realm of e-discovery mirrors needs of research institutes like the Virginia Tech Transportation Institute. The project seeks to develop systems and provide sufficient computing and storage resources to meet the challenges of these dual needs.

## Increasing administrative efficiencies

In June 2008, the university's board of visitors affirmed the importance increasing administrative efficiencies through automated systems and enhanced security. Using information technology for administrative processing can improve efficiency, decrease environmental impacts, and increase security.

Work by Information Technology staff this year involved changes in administrative processing as well as the provision of infrastructure to support moving transactions online.

**Purchasing/accounts payable.** Enterprise Systems integrated receipts and invoices into the relationship between Hokie Mart and the enterprise administrative system (Banner). When a departmental staffer enters this information into HokieMart, the data now flows into Banner, enabling end-to-end automation, reducing staff resources required, and improving accountability.

The new online interdepartmental communications request form provides registered users with Web-based entry for requesting network portals, telephone service, and wireless network service. The system reducing the work of entering information from paper forms and offers increased responsiveness.

**Accounts receivable.** The Bursar's Office offers secure electronic payment methods. Work this year has made this system available for undergraduate applicants to pay the matriculation fee and to sign-up for HokieCamp.

**Payroll.** The electronic 1042 for foreign national employees is now available through the self-service gateway, HokieSPA, decreasing paper flow and increasing the timeliness of receiving the information.

**Human resources.** Departments now directly enter transactions for summer faculty appointments, rather than submitted paper forms. Reducing paper and integration processes is also an outcome of work of an Enterprise Systems team to image benefits files.

The Faculty Online Credentialing System supports the regional accreditation process by documenting that the university employs qualified faculty members for teaching, student affairs, and library/learning resource management.

**Student services.** Access by the Office of the Dean of Students to reports of students who may be in distress was made available online to critical staff members. With the sensitivity of this information, access is carefully controlled by two-factor authentication.

**Student enrollment services.** Using last year's implementation of the Guest Access Management System (GAMS), the Office of University Scholarships and Financial Aid had



implemented the ability for student-designated guests—parents, guardians, other individuals of their choosing—to access financial aid information. This year, access to unofficial transcripts and grades was added. These applications are supported by Enterprise Systems.

**Personal digital certificates.** Upgrades to the underlying hardware and a migration of university-issued personal digital certificates (PDCs) created a more easily maintained full-featured certification authority. Issuance of personal digital certificates was broadened to include all university employees. PDCs enable trusted signing of documents as well as more secure access credentials, permitting more processes to be moved online.

## Financial summary

The organizational units of Information Technology were provided resources totaling \$55,424,911 for the fiscal year.

	Source of funds	
Educational and general funds		\$31,943,804
Equipment Trust Funds		2,581,958
Auxiliary operations		19,900,360
Sponsored grants		400,264
Continuing Education funds		76,352
Overhead funds		<u>522,173</u>
Total		\$55,424,911

### Use of funds

Support for university research, academic, and administrative infrastructure and systems totaled \$19,259,543. Support for telecommunications, video, data, and networking services totaled \$7,159,552. Learning Technologies systems' support totaled \$5,464,546.

The Communications Network Services auxiliary expended \$18,898,979 in network infrastructure and communications support. The Student Software Sales auxiliary expended \$1,166,101 supporting software sales to students.

# advanced research computing

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The mission of the Virginia Tech Advanced Research Computing Group (ARC) is to advance the university's research computing capacity, including visualization and visual computing. ARC provides support services, hardware, and software for faculty members and graduate students and assists faculty members in proposal development to build capacity that involves or requires research computing. ARC seeks opportunities to build synergy and work with other universities, national and international computing centers, industries, and agencies on research computing projects for the benefit of Virginia Tech, the Commonwealth of Virginia, and the nation.

Advanced Research Computing provides an innovative and interdisciplinary environment cultivated to advance computational science, engineering, and technology. We seek to

- provide leadership and advanced infrastructure to support, invigorate and incubate computational science, engineering and arts 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 and graduate students and for the faculty and staff;
- offer programs to stimulate and expand interdisciplinary and computational-driven research activity at Virginia Tech, including visiting researcher, travel, events, distinguished post-doctoral fellow and graduate student programs that provide new sources of support for collaboration, research, and development;
- 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.

Activities for Advanced Research Computing include

- reviewing, evaluating, and enabling the institutional research computing and visualization needs of faculty and graduate students, including support services and hardware and software infrastructure;
- assisting faculty members in proposal development, focusing on research computing and visualization support in grants and contracts;

- seeking opportunities to work with Virginia Tech research faculty members, other universities, national and international computing centers, and industries and others on basic and applied research computing projects.

The University Committee on High Performance Computing, chaired by Erv Blythe, completed a strategic evaluation of the computational resources and computational science needs of the university and provided recommendations for a research computing budget. As a result of this report, President Charles Steger appointed a High Performance Computing (HPC) Investment Committee to prepare recommendations on computing investments. Erv Blythe will chair the HPC Investment committee and Terry Herdman is a member of this committee.

## Infrastructure

### Computing

**Storage and data warehousing.** In August 2008, we purchased a large hybrid storage system from IBM for \$2.4 million. The system delivers a petabyte of raw storage and addresses the current needs of the Virginia Tech Transportation Institute (VTTI), Virginia Bioinformatics Institute (VBI), and Advanced Research Computing. This system serves as an anchor system for future scientific data warehousing.

**iDataPlex—MatLab.** Information Technology provided over \$525,000 to purchase an IBM iDataPlex. The primary purpose of the system is to provide Intel x86 architecture in a clustered environment to support commercial software packages such as Matlab, Fluent, and other third-party software. The system provides

- 84 compute nodes with dual-socket quad-core 2.26 GHz Intel Nehalem processors with 24 GB of memory;
- quad data-rate InfiniBand provides the interconnect;
- 10 of the compute nodes have 48 GB of memory.

The iDataPlex provides 672 cores with a total peak performance of 6 TeraFLOPS. The system will be partitioned to provide 12 compute nodes to VTTI, eight compute nodes (64 workers) for Matlab, and the rest will be available for general research computing applications. The system was delivered in early June 2009. The target date for production release of this resource is October 2009 and will be served by a separate allocation and queuing system.

**International traffic in arms regulations (ITAR).** ARC worked closely with David Brady of the Office of Export Control on a technology control plan for users needing ITAR data or codes running on the centrally provide research computing resources. ITAR requires a secure environment for restricted data and computations. During this period, two researchers had immediate needs so a solution was needed quickly. ARC proposed the following:

1. ITAR data/programs stored on separate storage system in locked room with video surveillance
2. Separate login head nodes also located in locked room with storage
3. Encrypt data on the wire between the storage system and the compute nodes
4. We assume that Unix system file-system security is sufficient on shared usage machines to prevent other from accessing the ITAR data/programs
5. The principal investigator is responsible to ensure that ITAR data in use is not publically viewable or accessible from their end
6. When the principal investigator is done with the ITAR data/program, they will notify ARC to wipe the data

Information Technology provided \$35,000 in funds to acquire a storage system for ITAR data. The system is in a locked room within the Data Center. Initial users include a group from the Department of Mechanical Engineering.

## Visualization

For visualization hardware infrastructure, we have maintained the CAVE™ (3-D virtual environment) and other immersive platforms in the Andrews Information Systems Building (AISB) and Torgersen Hall at full functionality so that no ongoing research projects or class activities were interrupted. The six degree-of-freedom motion platform continues to work and support funded research grants such as Aerospace and Ocean Engineering's stability sensor studies (e.g. Dr. McCue-Weil). However, due to the aging CAVE equipment and no budget, full illumination of the walls was only possible through the donation of surplus projectors and parts by the Naval Research Laboratory. In the Torgersen Visual Computing Lab and in AISB, we support a number of Windows, Mac, and Linux workstations. Some of these machines also have commercial software for 3D content conversion, high-end modeling, animation and rendering, geographic information systems (GIS), and computer-aided design.

New additions to the visualization software infrastructure include immersive support for COVISE ([www.hlrs.de](http://www.hlrs.de)), KeckCaves (<http://keckcaves.org>), and Instant Reality ([www.instantreality.org](http://www.instantreality.org)). In particular, the Instant Reality software framework realizes a rich collaboration between Visual Computing, Technical University of Darmstadt and Fraunhofer IGD ([www.igd.fraunhofer.de/](http://www.igd.fraunhofer.de/)). This support includes full and extended ISO scenegraph formats of X3D and VRML environments in our CAVE and Vis Walls as well as augmented reality applications. For remote users, we are performance testing visualization services across a number of server hardware systems including Spectra and System X. We hope to deploy these services to production in 2009-2010 when users will be able to generate figures, plots and movies by offline script or real-time interactive link with Visit (<http://visit.llnl.gov/>) or Paraview ([www.paraview.org/](http://www.paraview.org/)).

# Support Services

## Computing

### Hosting

Information Technology also provides hosting and/or management services for faculty and departmental owned research computing systems. These systems are located in the AISB Data Center. Research teams, principal investigators (PIs), and departments are provided space, power, and cooling within the Data Center. Any modifications required to locate the systems in the Data Center is the responsibility of the system owner.

### Current systems managed by ARC

#### HESS

- Geosciences; PIs: Scott King and Ying Zhou
- Comprised of 96 Dell 1950 dual-socket quad core cluster nodes (768 total cores); Dell 1950 head node; Dell 2950 storage node 2.1 TB; primary interconnect DDR IB (20 Gbits/sec)
- ARC provides unused cycles to other users

#### Tempest and Teapot

- Geosciences; PI: Chester Weiss
- Two SGI Altix 3700 each with 64 CPUs and 512 GB RAM
- ARC provides unused cycles to other users

#### Pecos (new system deployed in February 2009)

- VBI/NDSSL; PI: Chris Barrett
- SGI ICE – 768 3.0 GHz Xeon cores, 1536 GB memory; DDR infiniband

#### Other systems housed in the Data Center

#### Enterprise

- AOE; PIs: Roger Simpson and Joseph Schetz
- SGI Origin 3800 with 512 CPUs and 512 GB RAM

## CBCC

- Computational Biology Compute Cluster; PI: Dr. Xing
- The cluster is 32 xservers with 2 x 2.66 Dual Core Xeons and 4GB of 667 Mhz DDR2 FB-DIMMs; connected to a 3.5TB xraid for a data pool

## Thunderbird

- Physics; PIs: K. Park, Leo Piilonen and Michel Pleimling
- Comprised of 137 Dell PowerEdge cluster nodes with a mix of AMD and Intel processors with up to 8 GB memory each; primary interconnect Gig-E

## Kudzu

- ICAM; PIs: Jeff Borggaard, Traian Iliescu
- 20 nodes; primary interconnect Gig-E

## Chemistry (new system deployed 2009)

- PI: Diego Troya
- 24 HP nodes

## Visualization

Upon request by the Geosciences faculty, we installed an immersive version of the open-source Keck Caves software 3DVisualizer in the VT-CAVE and on our stereo walls. 3D Visualizer is a software designed for interactive exploration of 3D gridded data sets including geodynamics simulation results, seismic tomography, 3D serial sectioning, fluid dynamics simulations, and computed tomography. After installation and configuration, this software has been added to the Visual Computing stack.

Through our support efforts in Torgersen Hall and around campus, we have provided support for a wide range of active faculty research projects including: the evaluation of novel visualization techniques, new tracking methodologies, geo and physical simulation, autonomous vehicle design and simulation, geo-mapping, and mine safety training, just to name a few. In addition, we provided visualization support for the preparation of volumetric microscopy data (fossils) for publication as well as support to the Solar Decathlon team to illuminate and fly through their virtual models for design review of their 2009 Solar House. We will continue to engage and deliver visual communications solutions for the many disciplines around campus.

## Education and training

**Faculty Development Institute.** Building on the success of the last three years, we continue engaging and training faculty through our multiple Faculty Development Institute (FDI) courses. Our FDI classes continue to attract and empower faculty members and graduate students from diverse fields.

**Bootcamp.** As part of Information Technology's Computing Commonwealth initiative, we helped organize 2009 Virginia Tech-University of Virginia High Performance Computing Bootcamp. Faculty members and graduate students from both institutions and across the state attended the six-day session, learning fundamental skills in code parallelization, optimization and visualization. Once again, feedback from attendees was very positive; the waiting list demonstrates that this type of training is in high-demand.

## Computing

Dr. John Burkardt, computational specialist, ran a number of FDI courses in scientific computing including a summer 2008 course in parallel programming covering message passing interface (MPI) and OpenMP. In Summer 2009, along with Dr. Kevin Shinpaugh and Dr. Nicholas Polys, he also taught a three-day workshop, "High Performance Computing using Virginia Tech Systems." As part of that workshop, he lectured on parallel MATLAB, and had the students run parallel MATLAB jobs on a local experimental mini-cluster. In addition to advising a number of students, Dr. Burkardt also designed and presented a short course for undergraduates on computational science algorithm development, programming techniques and mathematical modeling.

## Visualization

**FDI.** In addition advising graduate and undergraduate students, Dr. Polys organizes FDI visualization courses that provide an essential mechanism to develop visualization literacy and capability among our faculty and graduate students.

**Deep media for research and education.** Dr. Polys taught this seven-session course on the production and deployment of Deep Media. "Deep Media" refers to interactive 3D virtual spaces that may include rich media types such as images, sound, video and animation. Attendees critically examine the features and methods of different publishing approaches and will leave

with the knowledge and skills to translate and publish their content in next-generation information spaces. We ran this course in Spring 2008, Fall 2008, Spring 2009, Fall 2009.

In the spring, Dr. Polys also presented the third annual presentation called “Strengthening Your Grant Proposal II: Adding High Quality Computer Visualization.” In this session, we presented two sessions on the many guidelines, gotchas, and angles for successfully integrating a visualization component into grant proposals.

## Outreach

### Memberships

Virginia Tech’s Advanced Research Computing faculty are consistent leaders in the broader community of computational science and information technology. We are active members in a number of regional, national, and international consortia where we develop cutting-edge technologies, standards, and initiatives promoting excellence in computing research and education:

- SURA—Dr. Herdman is a Board member ([www.sura.org](http://www.sura.org))
- CASC ([www.casc.org](http://www.casc.org))
- IDC HPC User’s Forum ([www.hpcuserforum.com](http://www.hpcuserforum.com))
- Web3D Consortium—Dr. Polys is Board member ([www.web3d.org](http://www.web3d.org))

### Conference participation and panels

**HPC User Forum.** The Spring IDC HPC User Forum meeting was held at the Hotel Roanoke in Roanoke Virginia on April 20-22. IDC requested that Virginia Tech provide additional speakers and provide tours of the campus and computing facilities. These included cooling issues, directions and solutions (Roger Panton, Avetec and Dr. Wu Feng, Virginia Tech), shared memory-like compiler framework (Dr. Srinidhi Varadarajan, Virginia Tech), simulating the Spread of Infectious Disease over Large Realistic Social Networks (Dr. Keith Bisset, VBI, Virginia Tech).

We also had senior undergraduate students in aerospace engineering and in mechanical engineering present their work using high-end technical computing in their senior design projects. The student talks were very well received and the students received many compliments and were also encouraged to apply for jobs with the respective company or national lab. The tour of Virginia Tech included the Institute for Critical Technology and Applied Science (ICTAS), VTTI, VBI, and the high-performance computing resources housed in the Andrews Information Systems Building.



**SuperComputing 2008.** Once again, ARC provided significant support for the Virginia Tech exhibition booth at SuperComputing 2008, which was held in Austin, Texas during November 16-21. Notably, we participated in two workshops (Petascale Data Storage & Ultrascale Visualization) and a birds-of-a-feather session for the Green500 list ([www.green500.org](http://www.green500.org)). The Green500 list is a ranked list of computational systems based on an index of computing power (FLOPS) divided by power consumption (wattage). The list was created and is maintained by computer science faculty member Dr. Wu Feng. In addition, there were three research papers and two posters published by faculty members and students. Computer science major Gabriel Martinez received the “Best Undergraduate Student Poster Award.”

## Computing

Kevin Shinpaugh was appointed as the Virginia Tech “TeraGrid Campus Champion.” The Campus Champion is meant to provide information regarding TeraGrid resources and services, serve as a source for start-up accounts and allocations of time on TeraGrid resources. By having a Campus Champion, the university benefits by having direct access to and assistance for national computational resources on the TeraGrid.

Dr. Burkardt organized a student conference on Computational Science at Virginia Tech, which included 21 presentations from graduate student from Virginia Tech, Clemson, University of Pittsburgh, and University of Tennessee.

Data center tours including Key tours for groups from: Virginia Economic Development Partnership, National Cheng Kung University, University of Trento in Italy, TU Darmstadt, dignitaries from South Korea, Universidad Austral de Chile, and regional industry such as AREVA.

## Visualization

Dr. Polys organized and chaired the thirteenth annual Web3D 2008 Symposium (co-located with SIGGRAPH 2008). The program chair for the conference was Dieter Fellner, professor at the Technical Universitat Darmstadt (TUD) and director of the Fraunhofer Institute for Graphische Datenverarbeitung (IGD). Our relationship with TUD and IGD continues to prosper and we look forward to more collaboration in the future. These activities reflect our ongoing leadership in the research and development of international standards (ISO) for interactive Web3D informatics. Our significant role in standardizing medical imaging (DICOM), geospatial rendering, and user interfaces puts Virginia Tech Visual Computing at the epicenter of Web (W3C) graphics innovation.

The Department of Computer Science and ARC had a strong presence at IEEE VR 2009 in Lafayette, LA, from March 14-18 where Drs. Bowman and Gracanin (Computer Science)

presented research and Dr. Polys served as finance chair. At Web3D 2009 in Darmstadt, Germany, Dr. Polys organized an all-day workshop for DICOM WG-11 (Presentation States Working Group) to specify n-dimensional presentation states for medical imaging with X3D. In addition, he presented Visual Computing's recent scientific visualization work in a panel session entitled "Interactive 3D Visualization—Technologies and Applications."

These outreach activities reflect our ongoing leadership in the research and development of ISO standards for interactive Web3D informatics.

Finally, we hosted a number of groups for tours of the CAVE including visitors from Dahlgren, the Structural Biology Symposium, International Rotary, local alumni and businesses, IEEE student chapter and parents, students in the Research Experience for Undergraduates program, and the Virginia Economic Development Partnership.

## Research

### **MAPP Initiative—NSF track II proposal—Data-Intensive Computing**

In a healthy trend of regional HPC cooperation, we were co-principal investigators on the University of Maryland-Johns Hopkins-Virginia Tech joint proposal to the National Science Foundation for the Track II Data-Intensive Petascale machine. Virginia Tech's contributions included the technical specification of the proposed machine, science application areas, visualization, and management planning. The process enabled Virginia Tech to foster positive relationships with our counterparts at these institutions and examine a variety of paths to the future of computational science in the Mid-Atlantic and National Capital Region.

Dr. Terry Herdman was elected to the Oak Ridge Associated Universities (ORAU) board of directors, providing a potent opportunity for Virginia Tech input on ORNL and ORAU research initiatives.

## Computing

ARC staff conducted significant testing on MATLAB performance, benchmarking a number of representative test programs on MATLAB's Parallel Computing Toolbox (PCT). The results of these tests were written up and made into posters, which were presented at the MathWorks booth at the SIAM annual conference in Denver, July 2009.

Dr. Mark Gardner played the role of lead PI for preparation of an NSF ARI proposal, "Revitalizing Infrastructure in Support of 21<sup>st</sup> Century Research." Terry Herdman and Eric Brown are co-PIs. The proposal will be submitted August 2009.

Dr. Shinpaugh and ARC also worked with Dr. Andrew Grimshaw from the University of Virginia to submit a proposal to the NSF on Cross-campus Grid Initiative (XCG). The XCG is designed to support high-throughput, or capacity, computing (HTC). HTC is a common paradigm in computational science today. It is used frequently in the life sciences, the pharmaceutical industry, in aerospace, engineering, materials science, economics, weather forecasting, computer science, data mining, the humanities, and many other disciplines. In high-throughput computing, a user needs to execute a large number of similar jobs.

The initial XCG configuration consists of almost 5000 computers with over 13,000 cores (think CPUs) located in public labs, classrooms, and desktop machines at the University of Virginia and Virginia Tech. These computers provide an average peak performance of 120TF. The cost to the taxpayer if they were to rent such a resource from the Cloud, (e.g., an Amazon EC2 cloud at 10 cents a CPU hour) would be in excess of \$8M a year. By leveraging facilities already in place the cost is under \$2M. Further, the XCG is enabled to expand easily to more resources and more sites without any new software required.

Unlike other HTC grids today, the XCG is implemented completely using open standards developed by the grid community and the wider Web Services community. The advantage to this solution is that the XCG can utilize best-of-breed implementations for different services from different vendors or software development groups, eliminating the vendor lock-in so common in large scale systems. This also allows tool developers to have a fixed development target that they can count on, rather than needing to code to many different interfaces. Due to the use of standards the XCG is able to smoothly interoperate with the large scale national resources in the Teragrid.

XCG is also a data-sharing infrastructure. Users can easily and securely share data on their local machine with other users throughout the world – allowing them to form virtual communities based on shared data. Finally, the XCG is a simple to use infrastructure. Rather than make users learn a whole new paradigm to use the grid, the XCG maps the grid into their local desktop as a mounted file system. Users can interact as easily with the XCG as they can with files and directories on their own machine.

## Visualization

Through our relationships with Oak Ridge National Labs (ORNL), we are investigating a common challenge in service-based computational science: remote visualization. We are running a series of experiments profiling the performance scalability of various computer architectures for data size, image size, and quality of rendering. With a target for production rollout next year, we include systems such as ORNL's Lens, and Virginia Tech's System X, and the IBM virtualization power series. This work continues and one journal article has been submitted to date (*International Journal of Virtual Reality*).

Dr. Polys also supervised a number of student research projects. Undergraduate interns and computer science independent study students have generated a number of Web3D environments

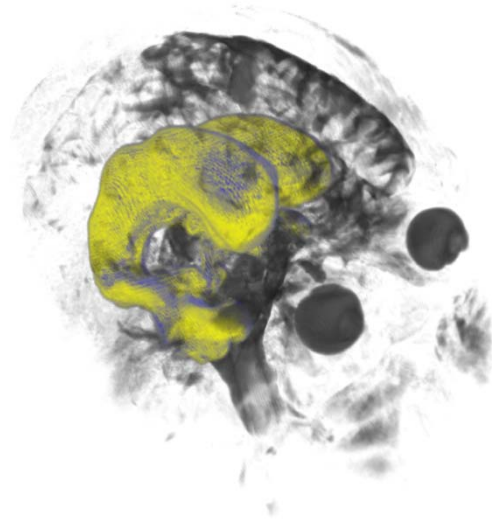
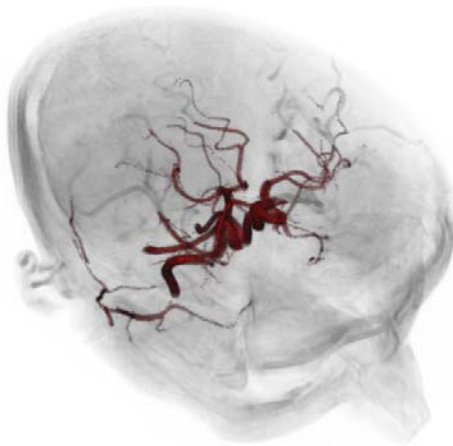
this year including: a virtual reality biomechanical study of locomotion, buildings and artifacts from campus for a new interactive 3D Blacksburg Electronic Village based on GIS data sets (terrain and imagery levels of detail) for Montgomery County, Virginia. These resources will be integrated and published online over the coming year.

Graduate research projects under Dr. Polys in the last year generally fall into two main areas: autonomous vehicle visualization and bioinformatics visualization. The autonomous vehicle visualization project is in conjunction with VaCAS and the Naval Postgraduate School and sponsored by ICTAS. We produced vis software (real-time and video production) for MATLAB vehicle simulations as well as developing the AV Workbench, which we evaluated in a live operational context at AUVFest in NUWC, Rhode Island. The results of this software engineering research work have so far been published at the international Web3D 2008 (short paper) and IEEE VR 2009 (full workshop paper) conferences and positions us well for other Navy Human Systems Interface and data interoperability research.

The second area examined the challenges of graph visualization. The visual analysis of cellular signaling pathways (the AAAS STKE dataset) provided an excellent case study. We generated and evaluated three different techniques across desktop platforms to the CAVE, again showing the empirical value of immersive technology. One aspect of this work related to graph mining was presented and published at the International Conference in Knowledge Engineering 2009.

The X3D Medical Working Group (MWG) of the Web3D Consortium has been developing a medical imaging profile (MedX3D) and a Volume Rendering Extension (VRE) for X3D, funded by the National Library of Medicine and the Army's Telemedicine and Advanced Technology Research Center (<http://TATRC.org>) to specifically address the needs of the medical community for 3D visualization of medical images. The project included the specification and implementation of the MedX3D components and these components are the basis for the specification of the n-Dimensional Presentation States standard underway in the DICOM community (WG-11) DICOM [<http://www.medical.nema.org>]. Dr. Polys is the official Web3D liaison to DICOM and will continue to lead the effort of introducing and adapting MedX3D to the DICOM community and their requirements.

ARC Visual Computing also worked with Dr. Hesham Rakha (Civil and Environmental Engineering and Director for Sustainable Mobility at VTTI) and his students to build an X3D **driving simulator** system that could be used on a desktop, stereo wall or CAVE. Within a few weeks, we implemented a proof of concept with an off-the-shelf force-feedback steering wheel and pedals. This provides an initial platform for user navigation studies and a means for these VTTI, ARC, and CHCI to work together more closely. We are also seeking grant opportunities that include adding real-time rigid body physics and motion platform integration to the driving simulator.



### **MedX3D Volume rendering examples of segmentations and composed rendering styles**

N.W. John, Aratow, M., J. Couch, D. Evestedt, A.D. Hudson, N. Polys, R.F. Puk, A. Ray, K. Victor, Q. Wang (2008). *MedX3D: Standards Enabled Desktop Medical 3D*. Medicine Meets VR (MMVR), IOS Press, Amsterdam.

See also: N.W. John, "The Impact of Web3D Technologies on Medical Education and Training", *Computers & Education*, Vol 49. Issue 1, August 2007, pp19-31. [www.sciencedirect.com/](http://www.sciencedirect.com/)

### **Speculations on the formation of Tharsis rise**

A temperature isosurface from a convection calculation of the martian mantle with an imposed near surface martian crustal structure (King, submitted). The martian surface topography is transparently overlain (red high topography, blue low topography). The calculation uses the finite element code CitcomS (Zhong et al., 2000) on 216 cores. The visualization was done with KeckCAVES software ([www.keckcaves.org](http://www.keckcaves.org)).

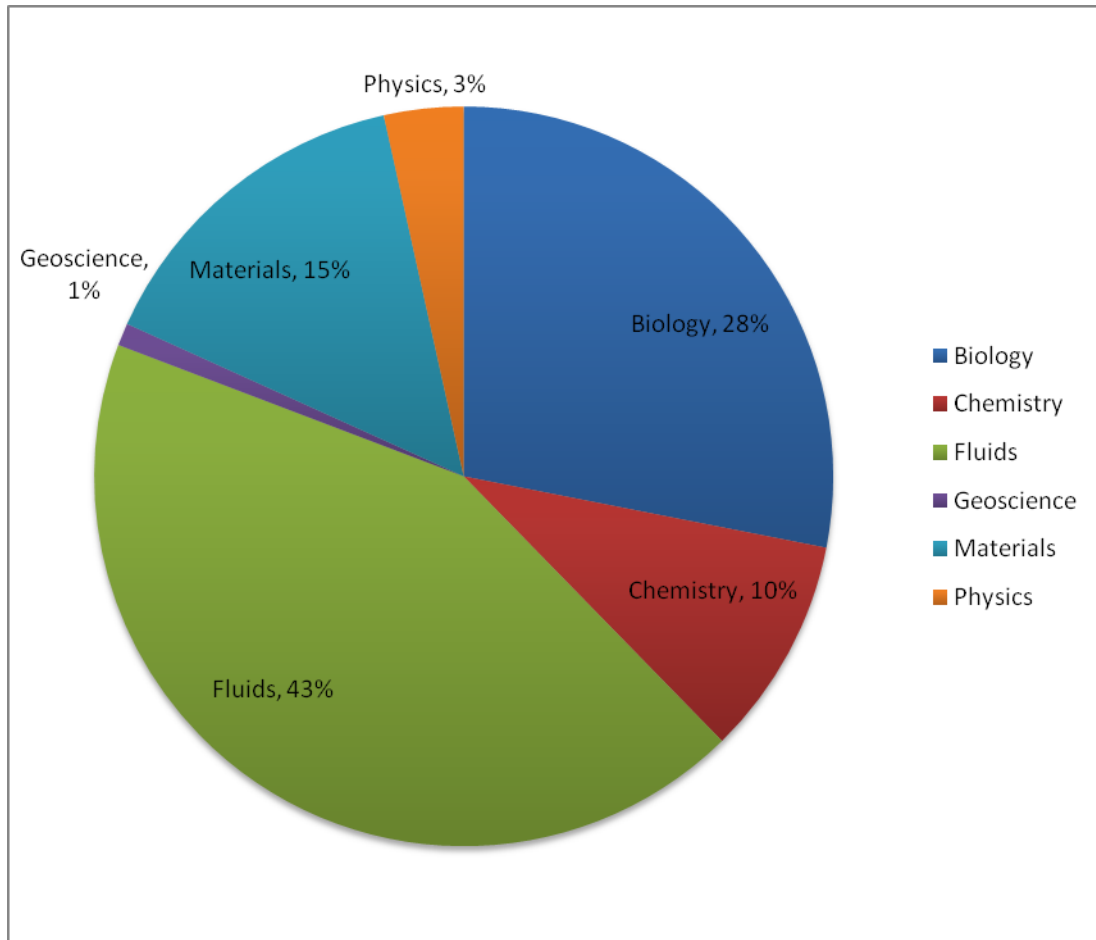
From King, S.D., Speculations on the formation of Tharsis rise, Mars, *Science*, submitted, 2009.



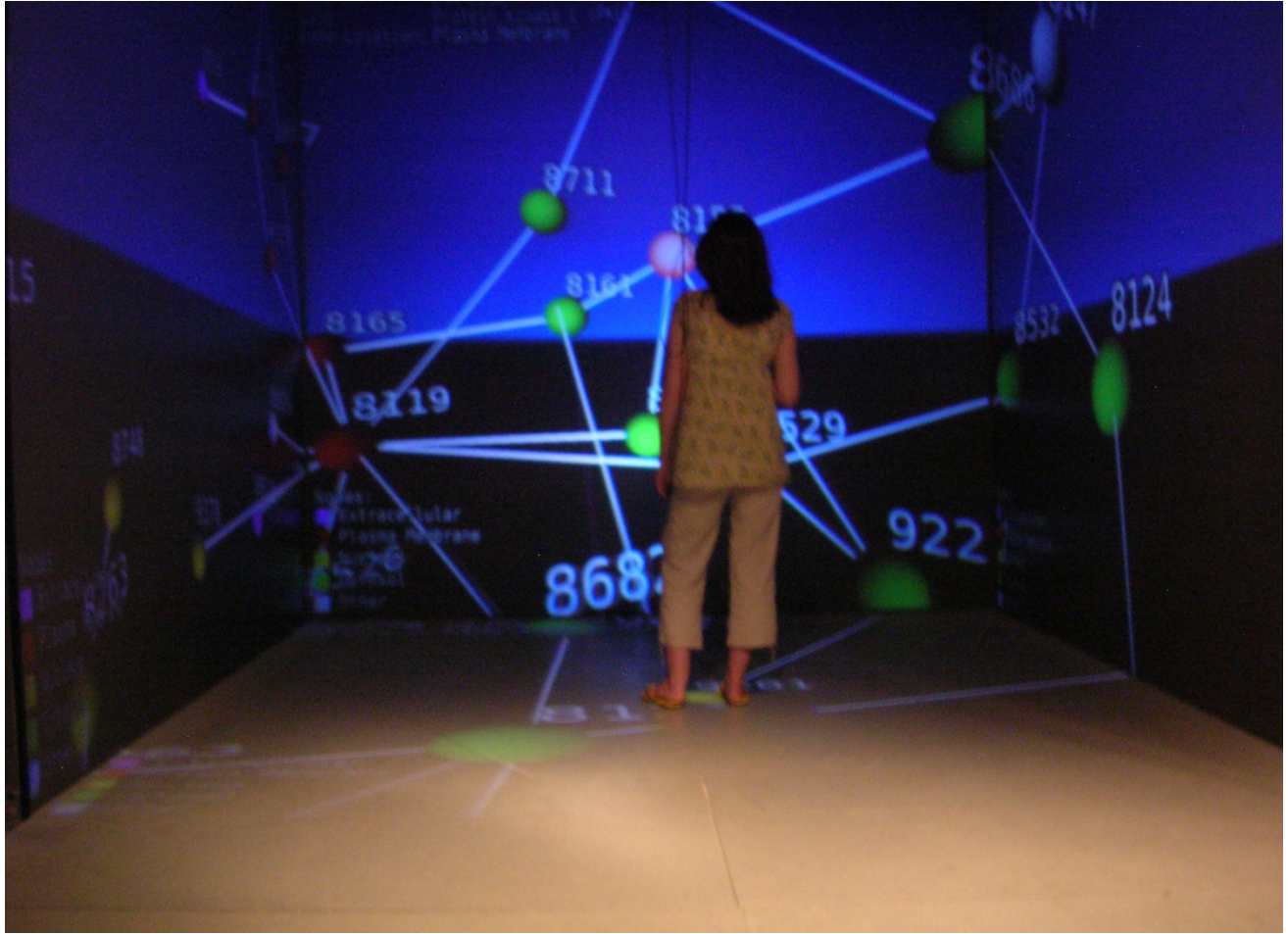
See also Zhong, S.J., M. T. Zuber, L. Moresi, and M. Gurnis, Role of temperature-dependent viscosity and surface plates in spherical shell models of mantle convection, *J. Geophys. Res.*, 105, 11063-11082, 2000.

## Statistics

System X ran research projects for 11,298,477 hours in FY 2009. SGI ran research projects for 1,576,803 hours.



ARC System X usage based on science area for FY 2008-2009



A graduate student explores a cell signaling network while immersed in the VT-CAVE; Photo by James Henry.).

From: Henry, James A.G., and Polys, Nicholas F. "The Effects of Immersion and Navigation on the Acquisition of Spatial Knowledge of Abstract Data Networks," submitted 2009.

See also M. Shahriar Hossain, Monika Akbar and Nicholas F. Polys, "Storytelling and Clustering for Cellular Signaling Pathways," *International Conference on Information and Knowledge Engineering (IKE'09)*, Las Vegas, Nevada, USA, July 13-16, 2009.



Virginia Tech exhibit booth at SuperComputing



# enterprise systems

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Enterprise Systems (ES) supports the missions of the university by developing, coordinating, and managing application software systems that provide critical information services for all university constituents. Enterprise Systems' role is to facilitate an enterprise-wide view of university applications while ensuring that these systems maintain an effective balance between information technology and university functionality.

Enterprise Systems develops and supports university, mission-critical information technology systems with the following objectives:

- Implementing applications from an enterprise-wide view to address availability, scalability, security, integration, and software standards
- Managing a portfolio of enterprise priorities and projects to ensure alignment with strategic needs
- Continually developing and enhancing information systems to ensure long-term viability of enterprise software investments
- Collaborating with university faculty and staff members, and students to facilitate process transformation
- Ensuring that information is accessible while safeguarding against loss, abuse, and corruption

Enterprise Systems includes Application Information Systems, Information Warehousing and Access, Database and Application Administration, Integration and Portal Services, and Document Management Systems.

**Application Information Systems (AIS).** 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 organized into teams for advancement, human resources, student systems, and finance.

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

## Initiatives

The Banner 8.0 upgrade was a significant initiative for Enterprise Systems that was completed in the fall of 2008. Virginia Tech decided to become an early adopter of Banner version 8.0 and worked with Sungard Higher Education (SGHE) to evaluate version 8.0, to critique documentation, and to assess the preparedness of SGHE for deploying the system. The upgrade included significant database and technology changes for converting Banner to an international character set. The character set conversion affected not just all Banner systems but required Virginia Tech to ensure that all other systems that integrate with Banner were also compatible with the international character set. This requirement significantly broadened the scope and impact of the upgrade. 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 SGHE concerning enhancements for labor redistribution and effort reporting to be included with subsequent Banner 8.x upgrades.

The Office of Internal Audit conducted a risk-based audit of Enterprise Systems this year. The audit included assessment of the adequacy and effectiveness of ES processes and identifying areas of potential high risk. For the period of July 1, 2007, to December 31, 2008, the audit focused on project management; service requests; software design, development, testing, and configuration management; managing sensitive information; and continuity of operations plans.

For these areas of assessment, Internal Audit determined that ES has effective processes and controls for reducing risk, with one recommendation for improvement. A recommendation was issued concerning an opportunity to increase the use of automated tools for the management of service requests. Enterprise Systems agreed with the recommendation and has begun the implementation of Atlassian Jira for uniform tracking and monitoring of all service requests for the organization.

Enterprise Systems continues to evaluate and consider methods for increasing effectiveness for managing prioritization and administration of projects. Enterprise Systems has been working with the Office of the Vice President for Finance and Chief Financial Officer to define overall project directions and planning, with particular emphasis on gains in efficiency. From the perspective of Enterprise Systems, increased emphasis on project prioritization and coordination is essential to meet the converging demands of new technology, accelerated pace for project implementations, and resource constraints. To that end, Enterprise Systems has begun sharing

personnel across groups to address staffing shortages and to more effectively balance resources with demands and priorities.

## Enterprise Systems' training initiatives

Enterprise Systems is responsible for maintaining the ongoing viability of enterprise applications. To that end, ES is involved in many organizations that provide new information, opportunities, and contacts that aid us in supporting and enhancing administrative applications. This past year, we participated in these organizations and communities and attended various meetings and conferences.

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

Enterprise Systems began several training initiatives this past year to address specific new technologies. ES contracted with SungardHE to provide training on Banner's workflow product to learn features and functionality of the product. The training was attended by staff from IPS, AIS, and DMS. Enterprise Systems and Identity Management Services will be receiving training from SungardHE in Banner Enterprise Identity Services (BEIS) to utilize BEIS for integrating Banner into the enterprise identity management system.

To address overall changes in technology, 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 allow the majority of the staff to participate and to provide a phased approach to integrating Java into our environment. To begin the process, this past year we had 10 people go through a hands-on Java Web Application Bootcamp class taught by Carl Harris from Network Infrastructure and Services (NI&S). The class material was at an intermediate skill level and intended for those who had some Java experience. The trainees met twice a week for 2 hours at each session for 12 weeks and were tasked with assignments between classes. In addition, we offered an introductory, self-paced course. For this first class, we had 20 people participate in the self-paced introduction to Java course using *Head First Java* (O'Reilly). This group met face-to-face for one hour once every two weeks for a period of 16 weeks and worked on exercises from the book between sessions. For several staff who have individual continuing education goals, Enterprise Systems supported them in taking on-line Java classes at local community colleges.

## Application Information Systems

Application Information Systems (AIS) provides the university community with information technology and support to complement its teaching, learning, research, and outreach missions. AIS serves as the central resource responsible for supporting administrative information systems including acquisition, development, and maintenance of the university's core business systems. The organization is dedicated to the continual improvement of the services we provide to students, to the faculty and the staff, and to the public through effective implementation and management of information technology products, services, and support. Application Information Systems consists of teams for advancement, human resources, student and financial aid, and finance.

The focus of Application Information Systems' work over the last year includes the following:

- Performed Banner maintenance and upgrades, required to ensure currency of Virginia Tech's SunGard Higher Education Banner implementation
- Implemented significant enhancements to HokieMart, Virginia Tech's implementation of SciQuest HigherMarkets including major efforts to integrate these systems with eVA (Virginia's electronic procurement system)
- Provided extensive reporting and support for the university's comprehensive campaign
- Participated in an audit of Enterprise Systems that included security of personally identifiable information; implemented Identity Finder software to locate Social Security numbers, credit card numbers, and other sensitive information stored on individual machines and created a plan to monitor the ongoing removal or encryption of this type of data
- Began an initiative for AIS staff to begin to learn new tools and technologies beginning with Java, with many of the AIS staff either going through a self-paced course or attending a 15-week course led by Carl Harris from NI&S

## Advancement Team

The Advancement team, supporting both the Office of University Development and the Alumni Association, completed 3,713 service requests (an 11 percent increase from 2008).

Production control requests	2,132
Programming requests	1,215
Desktop support requests	366

Programming requests include mail files, Banner form fixes, report development and modification, batch updates, record corrections, and new data.

Major activities for the Advancement Team this past year include the following:

- Implemented versions 8.0 and 8.1 of Banner advancement software, tested, conducted troubleshooting, and verified the impact of the Oracle 10.2.0.4 upgrade
- Created two reports in support of the comprehensive campaign including the campaign honor roll and the campaign prospects visited report
- Completed analysis of the current handling of donor-advised funds and outsourced matching gifts and made a recommendation for changes within business processes and reporting for these funds
- Created several new reports in support of the new definition of Pylon Society membership
- Provided programming and analysis support for the Alumni Association in the implementation of the Hokie Nation Network and the alumni directory project
- Deployed 30 new workstations in the Student Calling Center
- Deployed Vista operating system to approximately 60% of the Development user community
- Performed cell phone system analysis, testing, and deployment of new cell phones for leadership and fundraisers

The Data Integrity group under the Advancement Team's direction was involved in numerous projects to verify and correct Banner data including addresses, phone numbers, deceased indicator, marital indicators, and parent data. Several major projects were completed for employment and corporate data.

- Completed the annual batch address screening and update. A total of 22,627 records with bad MA addresses were sent to Alumni Finder (Data Vendor) for screening. This project resulted in: 7,326 good mailing addresses updated in Banner, 2,729 good phone numbers updated in Banner, 1870 birthdates updated in Banner and 490 records identified as deceased which will be verified before being updated in Banner
- Received approximately 6100 parent records for fall 2008 freshmen and transfer students. Entry into Banner has been completed for approximately 4,000 records
- Completed approximately 4,000 service requests for research and biographical data updates requested by personnel in the Office of University Development
- Created Advancement organization records for over 10,000 companies stored in employment history records that were only in the Finance module; did a major cleanup project for active employment history records where the id number starts with 'FC' and existed in only the Finance module and created advancement records where appropriate
- Created 1,365 organization records for corporate entities that existed only in Finance and were needed in advancement
- Created a new corporate record audit report to identify new corporate records entered into Banner during a specific timeframe; created audit reports for addresses and phone numbers, spouse and marital status and employment records; corrected data problems identified, and processed all year-end team leader and team member assignments for corporate and foundation records; added approximately 286 secondary contacts to Banner

## Finance Team

The Finance Team serves as the support unit for the Banner Finance and Accounts Receivable modules. The Finance Team also supports the integration of Banner with both HokieMart and eVA for purchasing, and Nelnet for electronic payments and bill presentment. The Finance Team coordinates their work with the Controller's Office, the Purchasing Office, the Office of Sponsored Programs, and the Bursar's Office.

Major activities for the Finance Team this past year include the following:

- Finance 8.0 and Accounts Receivable 8.0
  - The Banner 8.0 upgrade involved the database moving to the UTF-8 characters set and the “internationalization” of various name, address, and amount fields within Banner
  - Due to database changes, the Finance Team had to analyze their interfaces with external vendor software such as SciQuest SelectSite(HokieMart), Nelnet Quikpay, Core Onestep, and the university's check writer software
  - Modifications were required for integration with Nelnet Quikpay
  - An updated version of the Core Onestep software was required
  - Database changes required the Finance Team to alter a large number of locally developed tables, forms, processes and reports
  - Multiple areas that the Finance Team supports were still using the old Query Builder or Data Browser software for ad-hoc queries. Neither Query Builder nor Data Browser supported the UTF-8 character set. The Finance Team assisted in the search for a replacement product and with the conversion of some ad-hoc queries into Banner reports
  - Re-application of 60 local modifications
- Finance 8.1 Upgrade
  - Re-application of 12 local modifications
- Lime Survey 1.72 Upgrade
- SciQuest SelectSite 8.2, 8.3, 9.1
- Both Finance servers (HERMES and ARTEMIS) were replaced with new hardware running Windows Server 2003 R2
- Implemented receipt integration between SciQuest and Banner, allowing departments to enter receipt information within HokieMart which then flows into Banner and is used by the baseline invoice matching process  
This has provided a significant automation improvement within the accounts payable area of the Office of the Controller.
- Implemented electronic Invoice (eInvoice) integration between SciQuest and Banner  
This has also provided a significant automation improvement within the accounts payable area by reducing the number of invoices that are manually entered into the system
- Enhanced support for Nelnet Commerce Manager by providing the Bursar's Office the ability to configure most new storefronts without involvement by the Finance Team  
This enhanced configurability was important, as the Bursar's Office was able to convert

several areas on campus to Commerce Manger from other payment gateway solutions. The cashier reporting was also enhanced to streamline the finalization of cashiering sessions by the Bursar's office

- Modified some of the baseline invoice API logic to better handle how Virginia Tech defaults the fund, organization and program code from the index code  
Previously a change to the default organization for an index would cause significant problems for the accounts payable area when an invoice was paying against a purchase order established with the old organization code
- Rewrite of accounts payable batch invoice process to use the baseline Invoice APIs and provide some enhanced functionality  
The Finance Team was able to eliminate a baseline clone that is no longer required.
- Major rewrite of the custom field export process to support a new DTD provided by SciQuest  
As required by the new DTD the process now transmits only changes each day reducing the daily export from 50+ MB to less than 150 KB. The corresponding response was reduced from 20+ MB to less than 50 KB
- Developed a set of new finance warehouse reports to support reporting based on activity codes
- Implemented online interface that allows students to opt out of receiving paper copies of their 1098-T forms
- Created a new process that allows departments on campus to batch load departmental invoices into the Banner accounts receivable system
- Provided the Office of Sponsored Programs with monthly reports to replace ad-hoc queries
- Made various corrections and enhancements to the online budget tuition application process
- Continued to enhance the Web-based direct deposit signup process
- Enhanced purchase order and purchase requisition integration with SciQuest to support a new Work Order Number custom field required for the FacilityMax implementation
- Delivered a Banner Finance and HokieMart security audit report. This report provides a listing of Banner Finance and HokieMart access for all users in each department and is delivered to the department head for review

Professional development included the following:

- Jay Smith attended Sungard HE Summit 2009 and was the presenter for two presentations
- Jay Smith and Nora Kirstein attended Banner Workflow training
- Wendy Biggs attended the SANS Security Essentials class

## Human Resources Team

The Human Resources Team serves as the support unit for the Banner Human Resources and Position Control modules. The Human Resource Team also supports the integration of Banner with PeopleAdmin (applicant processing). The Human Resources Team coordinates their work with the Office of Human Resources (HR) and the Controller's Office.

Major activities for the Human Resources Team this past year include the following:

- Completed approximately 200 service requests
- Completed all the modifications and testing required to move to the Banner 8 release and to the Banner 8.1 release
- Began analysis and testing of the new labor redistribution process delivered with Banner HR 8.2  
This application is written in Java and Adobe Flex. Staff attended either an introductory or advance Java class in preparation for understanding this application
- Enhanced the electronic interface of personnel information with the state personnel system to include an accessions and separations file each month
- Implemented the electronic 1042 for foreign national employees through Employee Self-Service (HokieSPA) so they would have the same paperless options as employees receiving a W2; modified, tested, and installed the yearend tax and W2 release; made additional changes to the W2 and 1042 programs and reports
- Created an electronic personnel action form for summer school faculty appointments such that the appointments and approvals are completed on line eliminating the paper forms sent to HR each year
- Worked in conjunction with the Document Management Systems Team and HR to implement imaging in HR starting with the benefits files. Developed a workflow to notify employee administration of scanned documents that need to be processed in Banner including opening the appropriate Banner form for the employee. This process integrates imaging, workflow, and internet native Banner
- Converted existing ethnicity information to the new ethnic and race codes and modified reports to use the new fields. Add a self-service page so employees can self identify
- Implemented a new self-service-based subsystem that allows graduate assistants to apply to have their comprehensive fees payroll deducted. Joint effort with the Banner Finance Team to determine fees, create payroll deduction records, supply balance information to finance so the student is not billed for fees
- Worked with the Office of the Provost to validate and correct faculty data, provide reports, etc. to prepare for the upcoming SACS accreditation audit
- Continued to implement new HRIS Web reports based on user requests
- Involved in the normal yearly processing for the HR system: performance reviews, position roll, salary increases, benefit premium updates, tax updates, CVC, tax shelter limits, leave roll, etc.
- Continual changes to the system to automate more paper processes and to improve data quality, system performance and customer satisfaction

## Student/Financial Aid Team

The Student/Financial Aid Team serves as the support unit for the Banner Student and Financial Aid modules. The Student/Financial Aid Team coordinates their work with the Office of the



University Registrar, Undergraduate Admissions, the Graduate School, and the Office of University Scholarships and Financial Aid.

Major activities for the Student/Financial Aid Team this past year include the following:

- Over 215 service requests for modifications/enhancements were submitted during this period of time
- Ongoing daily support of student/financial aid processes as required
- Assisted in the implementation of several point releases for the Financial Aid module, modifying forms and shell scripts as required
- Participated in the testing and verification for implementation of release 8.0 of Banner in October 2008; converted several C programs to account for the UTF8 character set
- Continued to support processes to feed student data to such areas as NI&S, Career Services, Learning Technologies, and the Institute for Distance and Distributed Learning
- Continued to provide student name/address data to peripheral areas needing it—Student Health Services, Athletic Advising; continued to develop ways for these areas to process requests themselves
- Continued to run processes to clear PIDMs associated with recruit records no longer needed thus reducing the size of several General tables
- Expanded the distribution of self-service data extracts from the Student Data Warehouse
- Supported enhancements to NOILJ Transfer in Undergraduate Admissions to load applications from CollegeNet
- Supported NOLIJ Web imaging/workflow system in the International Office of the Graduate School, as needed
- Enhanced the crisis management system for the Dean of Students Office to have an additional level of security using an e-token; added the ability to add additional users more efficiently
- Continued the implementation of the processes/programs that support the Electronic Loan Management implementation in Financial Aid
- Reworked and enhanced the reasonable academic progress program for the Financial Aid Office
- Developed functionality for several Financial Aid processes to run automatically
- Developed a program to produce report of awards to students for departmental review
- Helped to implement the reporting to National Student Loan Data System for unofficial withdrawals
- Continued work to support the SACS accreditation process; created tables to contain “frozen” data related to the faculty and courses to be reported
- Implemented a Parent SPA for Financial Aid using the guest access system; also, added access to unofficial transcript and grade webpages for the Registrar’s Office using this system
- Developed and implemented capability for undergraduate applicants to pay matriculation fee via the e-commerce interface
- Developed and implemented capability for attendees of Hokie Camp to sign-up for the camp using the Web and submit payment via the e-commerce interface
- Continued testing a Web-based system for spot assignment of classrooms

- Implemented display of student photographs on the Hokie SPA for faculty and advisors
- Implemented functions to have students opt in/opt out of VT Alerts during the course request or drop/add period periods
- Implemented a more robust security interface with the National Student Clearinghouse
- Began development of Web-based presentation of accept and reject letters for graduate applicants
- Began development of a course planner with an interface to the Degree Audit Reporting System (DARS), scheduled to go production the beginning of Fall semester, 2009
- Enhanced management reports and webpages associated with course request and class scheduling
- Assisted in the implementation of prerequisite checking during course request and drop/add processing
- Initiated work with Veterinary Medicine admissions office to move supplemental data required for that application process to the Banner system and to complement with data loads using Noli Transfer
- Throughout the year held sessions with DBAA staff to learn more about technical environment and tools/techniques that could be of help to the team
- Several members of the team went to Banner workflow training
- Provided resources to HR team to assist with their development efforts

## Information Warehousing and Access

The mission of Information Warehousing and Access (IWA) is to design, develop, and implement an enterprise Data Warehouse that allows easy access to management information for analysis and reporting.

IWA works together with the central administrative offices and the data users from the university community to develop the Virginia Tech Enterprise Data Warehouse. The Warehouse is being built in iterations by subject area. Each subject area of data is called a data mart. The various data marts are linked together to form an integrated warehouse using the Ralph Kimball (<http://www.rkimball.com/>) design methodology. The resulting enterprise Data Warehouse is used to report across the spectrum of university data to support both day-to-day administrative functions and management decision making.

The data warehouse now contains financial data, human resource data and student data, and grants and proposals data. This past year, IWA worked closely with Institutional Research on a Student Census data mart. The data mart now has a year's worth of data loaded, and plans are in place to load data from previous years. This fall's census is currently being processed. The goal is to provide 10 years of data. IWA also is working with Learning Technologies, the Office of Academic Assessment, and the Center for Instructional Development and Educational Research on a data mart to support course evaluation.

Although we continue to develop new data marts and add new data, focus is changing to include dashboards, ad-hoc query access, and parameter-driven reports.

## Accomplishments

**Website.** IWA designed and developed a new website [www.iwa.vt.edu](http://www.iwa.vt.edu) that explains our mission, describes the services we provide, gives Virginia Tech users access to our data models, and provides contacts for obtaining further information or access.

**Data mart additions.** Several modifications and additions were made to existing data marts to provide additional information to users. The new race and ethnicity codes were added to the entity table. IWA created flags and provided ways to make reporting easier, providing a way to easily report all races for a single entity. IWA also created checks that run after the nightly load that identify incorrect combinations.

**Upgrades.** Both the Banner 8.0 and Banner 8.1 upgrades required significant changes to Data Marts and the Web Job and Web Distribution utilities. To minimize the impact of frequent future releases, IWA implemented changes in the nightly load by supplying a global variable to support our ability to continue development on the current release, while we test a new one.

The warehouse was successfully upgraded to Oracle 10.2.0.4. IWA assisted in the identification and debugging of problems during this process.

**Expanded user base.** With our assistance, the Virginia Bioinformatics Institute began using the Finance data mart to provide their researchers and their management with reports.

**Dashboards.** IWA also developed several new dashboards in addition to making changes and additions to existing dashboards. These include:

- The Fralin Life Science Dashboard which will support the monitoring of research and financial activities across the Institute
- The Athletic Financial Affairs Dashboard which supports the ability to compare the burn rate in specific funds and accounts across 4 years of data, improving their ability to identify accounts that need more scrutiny, and provides them with comparative data to determine whether they are on track in the current spending rates
- The Virginia Bioinformatics Dashboard, allowing John Rudd and Jim Stoll to develop an application that would allow them to measure research performance, particularly focused on extramural funding with proposal and grant summaries and comparisons for the past 5 years
- University Unions and Student Activity Dashboard (in progress), providing departmental managers the ability to better manage the burn rate of funds and account for revenue developed in their operations

- Dashboard modifications to add additional functionality for the College of Agriculture and Life Sciences, the Office of the Vice President for Research, and the Corporate Research Center and the River Course.

**Training.** IWA provided training on the data warehouse, the Hyperion Intelligence Client, query building, and dashboard navigation to the following areas for a total of 121 users. Note: training is provided for individuals who have been granted access to a data mart by the appropriate data steward. IWA continues to receive high marks for content, pace, and presentation on the instructor evaluation forms.

More than 300 requests for assistance were received. In most cases, answers were provided immediately in response to the questions asked. IWA continues to hold a reputation for excellent customer service and responsiveness to user requests.

Training materials have been updated and provide illustrations and step-by-step instructions. They serve as handy references for warehouse users. Several users have been provided with electronic copies, and some of the materials are available on the IWA website ([www.iwa.vt.edu](http://www.iwa.vt.edu)).

## Customer responses

A part of the mission of IWA is to help users get the data they need to do their jobs. IWA received compliments for their customer service from several of their users.

"Thank you so much for your help today! ... I know it's difficult to have to stop what you are doing when someone calls with a problem, but you certainly were very kind today, and fixed the problem efficiently."

Jo Johnson, Accounting Supervisor, Planning and Business Services for Student Programs

"Just wanted to thank you this morning for the help with the data project. 10 minutes talking to you is always worth 8 hours of my trying to figure things out."

Rodd Hall, Associate VP for Research

"I realize it's very rare that folks hear of appreciation of their work, and that management knows whether or not their programs are helpful. I am still truly amazed that your department stepped up and basically asked 'how can we help you do your job better?'

That's almost unheard of around here... Thanks again for all your time and effort – I am already using this [a dashboard] on a regular basis!"

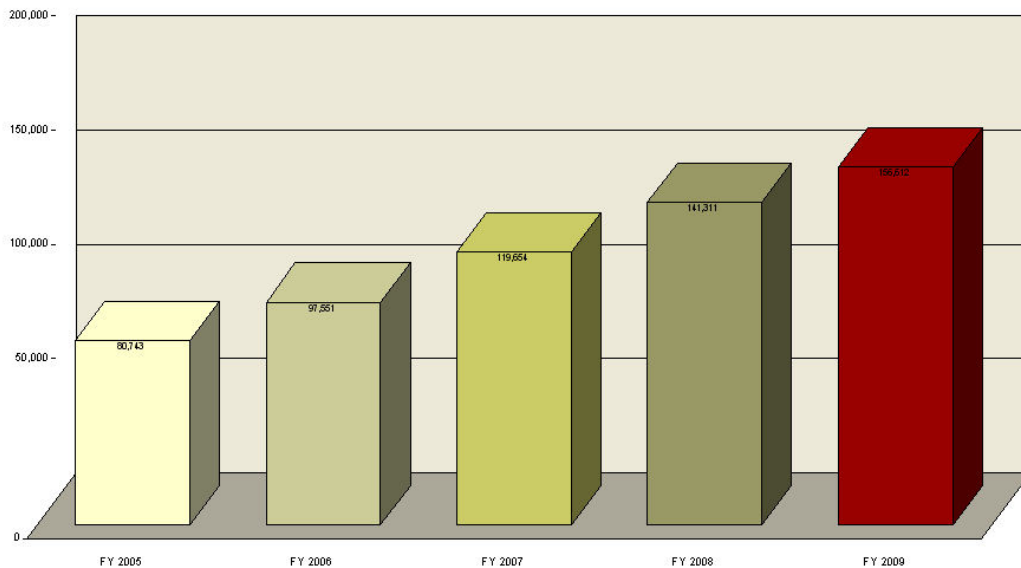
Lisa Rudd, Assistant Director of Athletics for Financial Affairs

## Operational statistics

The use of Web Job Submission and Web Distribution continues to grow. Both of these services increase the efficiency of retrieving and receiving information. Web Job allows the user to select from specified parameters and submit reports to run when they need them for the information subset that they choose. Web Distribution notifies the user via e-mail that a report is ready, and gives them a link to the report that is displayed in a web application. A user can schedule a report to run at the same time every month, and distribute the output to others in their area. The report is automatically run, and users are automatically notified when it is available. Data files can also be requested.

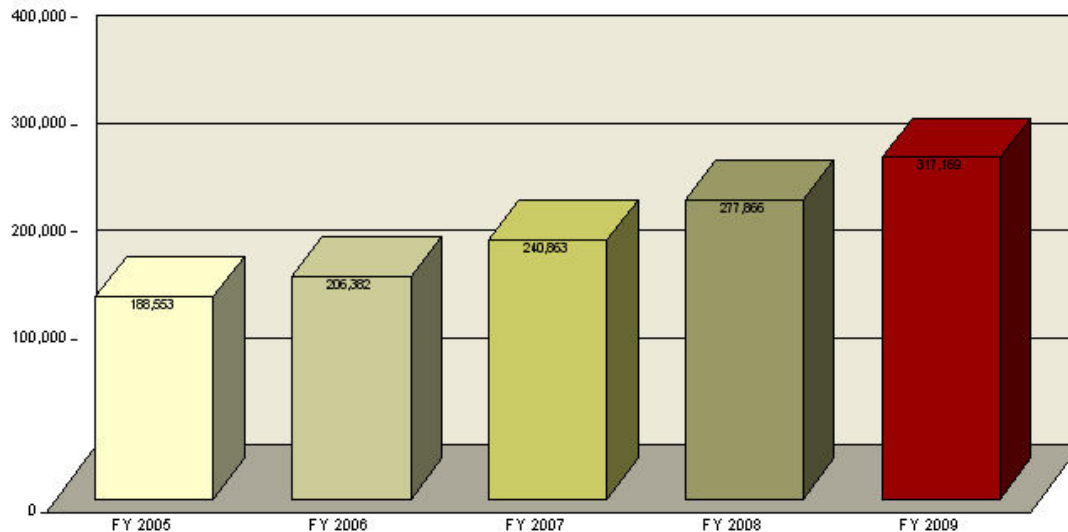
### Web Job statistics

Report Submission												
Type	Start Date	Day	Total Executions	Warehouse Executions	Banner Executions	Interactive	Logins	Total Submits	Scheduled Submits	Folder Submits	Definition Submits	Saved Submits
Year	Jul 1, 08		156612	137517	18774	37140	94461	156338	28375	7837	100232	56106
Year	Jul 1, 07		141311	121419	19687	38953	92564	141494	19670	6828	96727	44767
Year	Jul 1, 06		119654	105975	13622	28307	75506	119656	16687	6381	81770	37886
Year	Jul 1, 05		97551	93882	3665	9246	55669	97473	11096	6412	68717	28755
Year	Jul 1, 04		80743	80529	214	14	43480	80750	6143	5171	60294	20455



### Web Distribution statistics

Report Distribution																
Type	Start Date	Day	Reports	Sessions	Logins	Views	View Text	View Postscript	View PDF	View EXCEL	Zip	Docuprint	Labels	Local Printer	Distribute	Release
Year	Jul 1, 08		317169	667109	57554	484292	228198	58374	164480	20277	4949	1	195	766	6107	1601
Year	Jul 1, 07		277866	418472	53743	423305	205639	45725	143048	13815	3200	3	206	629	5403	2258
Year	Jul 1, 06		240863	380353	49789	388042	204716	35771	124168	11547	3634	4	263	809	4677	2138
Year	Jul 1, 05		206382	334146	40441	334841	187005	21417	112885	8090	3335	35	289	709	5429	2244
Year	Jul 1, 04		188553	290808	35888	291260	170680	11499	98134	6832	2459	429	348	835	5205	595



## Improving the quality of university data

IWA participates in the monthly Data Quality meetings. As part of the design process of each data mart, IWA works with the data stewards to identify checks that become part of the nightly extract, transform, load (ETL) process' quality control (QC) checks.

As the last step of loading the nightly data, these checks compare the data in banner with the data in the warehouse to ensure that it matches. This process is done with counts (employees by employee type, number of offers, accepts, total dollar amounts, etc.) and also with matching data—comparing majors loaded from Banner with the majors loaded into the warehouse.

IWA continues to improve the quality of data in the warehouse and in the data source (Banner in most cases). The proposal QC checks to make sure that the percent effort of Principal Investigators totals 100% for each proposal and each grant. It checks to make sure the proposal amount requested matches the proposal budget amount. Checks were added with the implementation of the new race and ethnicity codes to identify conflicting fields: The philosophy used is to identify the problem, correct it at the source, and load the corrected data into the warehouse. IWA continues to add QC checks to improve the nightly process, and ensure the validity of the data that is loaded into the warehouse.

## **Outreach—working with other universities**

IWA shared our experiences and knowledge with several other colleges and universities including the University of Pittsburgh. We were contacted for advice about ETL tools, the construction of a student data mart, and data mart security and access.

## **Training and staff development**

### **Vicky Shaffer**

Serves as Treasurer on the Executive Board for HEDW

Attended the HEDW 2009 Conference at the University of Indiana, gave the Treasurer's report at the business meeting, and made a 'Lightening Talk' presentation on the Virginia Tech solution for storing new race / ethnicity information for IPEDS and University reporting

Participates in monthly conference calls with HEDW Board members and attended the annual Board meeting at the University of Indiana

### **Georgiy Kolomiyets**

Attended a 6 day Security Essentials class provided by the System Administration, Networking and Security (SANS) Institute

Attended VASCAN annual conference at Virginia Tech

### **Sonj McCoy**

Attended a Java self paced training class taught by IT personnel

### **Alan Moeller**

Attended the HEDW 2009 Conference at University of Indiana where he delivered a presentation about our data warehouse, the training we provide, and the dashboards we build and maintain for our users

### **Tim Moore**

Attended a Java Class taught by Carl Harris at Virginia Tech

## **Impacts**

The Data Warehouse continues to grow in terms of volume of data and range of subject areas. It is the definitive reporting resource for the university. Dashboards are proving to be a popular technique for providing departmental and central office managers with easily obtained business information that helps in day-to-day management decisions.

The Web Job and Web Distribution applications provide easy access to information through a convenient interface that our users find to be intuitive. Job scheduling and e-mail notification when the results are ready for review allows users to continue to work on tasks instead of watching and waiting for their reports to return.

## Database and Application Administration

DBAA provides the necessary controls, oversight, performance monitoring, and 24 x 7 on-call responses to ensure a stable and auditable production environment for critical enterprise information technology services.

### New application software

- Implemented Oracle Advance Security option for database network encryption
- Installed Sungard Higher Education Workflow software into production instance
- Installed Sungard Higher Education Disk Extender, Banner Document Management System (BDMS), and Banner Enterprise Identity Services (BEIS) software in developer instances
- Moved the Confluence and JIRA software from ED Tech servers to Enterprise Systems servers and migrated the software to current releases
- Installed and configured the VTLs Vital and Valet software in a development environment.
- Implemented Sungard Higher Education E-Invoice software
- Developed and implemented the Application Manager software allowing authorized personnel to deploy web apps and view log files
- Assumed the Apache/Tomcat support for Webdist, MyVT, PIDGen, and VT Search

### Application software upgrades

The Banner system was upgraded to new releases of Banner8 during the year. The upgrades were applied to six Banner databases and four Banner foundation databases to support the Banner environment.

Additional upgrades include the following:

- Replaced aging monitoring software with software providing more functionality and flexibility
- Enhanced software for the tracking and scheduling of production updates for better security and functionality.



- Redesigned, rewrote, and replaced the aging JCS application with new software with more security, functionality and flexibility
- Worked with Learning Technologies to migrate the Blackboard application to a new release including a hardware and OS upgrade
- Added content management software was upgraded to new releases
- A new release of the Harvest source code manager was evaluated and installed in a test instance for user testing
- Installed new releases of the e-procurement (LDI) software

## **System software migrations**

More than 24 Oracle database were migrated to new releases of 10g during the year to support international character sets. These databases support a host of administrative system throughout the University. Quarterly security patches were applied to all databases.

## **Web Hosting and Filebox**

The Web Hosting service provides significant support to academic and administrative areas. The service provides a secure and stable infrastructure that supports over 1000 web sites including the [www.vt.edu](http://www.vt.edu), and support for many registered student organizations. Each website potentially represents a Web server that does not have to be maintained by faculty members, graduate students, or staff members. Filebox provides individual web sites for over 25,000 faculty and staff members, and students, and is used by faculty for class projects.

Highlights over the past year include the continued restructuring of the environment for load balancing resulting in improved performance, reliability, and stability. In addition, server software was upgraded to new releases, security software was implemented with improved filtering, Apache software was upgraded, web sites were reorganized to improve performance and security, and old Filebox accounts were purged.

## **Training**

Several of the DBAA staff took JAVA development classes during the year. Two staff members took the SAN security class and are working on their certification. We also had staff members take the Sungard Higher Education workflow, Banner Document Management, and Banner Enterprise Identity Services training.

# Integration and Portal 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. IPS currently provides design, development, management, configuration, and maintenance support for the following technologies and services: Banner General module, My VT Portal, VT Search, PIDGen, Guest Account Management Service (GAMS), and Enterprise Directory Group Manager.

## Application upgrades

- Installed Banner General 8.1 and re-applied all modifications
- Developed new release of My VT based on the open source uPortal 3 portal framework
- Developed new release of VT Search based around new custom Google search engine
- Performed minor updates on PIDGen, GAMS, and Group Manager
- Implemented Google Analytics for My VT and VT Search

## Software research and development

- Evaluated SunGard Higher Education's Luminis Platform 4 as a solution for a research administration system
- Evaluated platforms for development of mobile applications
- Evaluated project and portfolio management software

## Automation and process improvement

- Automated the process of moving student pictures from the Hokie Passport office to Faculty Access/Hokie SPA
- Centralized all static web content used by My VT
- Began work on automating the Enterprise Systems service request process

## Professional development

- Developed in-house training course for self-paced Java programming
- Linda Hedrick, Ken McCrery, and Rick Murray completed self-paced Java programming course
- Victor Bagley and Andrew Olson completed Advanced Java Training for Web Development course

## Outreach

- Ken McCrery served on the Jasig board of directors. Jasig promotes open source software and collaboration in higher education.
- IPS worked as liaison between Jasig and two Virginia Tech professional writing classes on case study writing project.

## Document Management Systems

Document Management Systems (DMS) provides information technology support to the university in the area of secure electronic document and information routing and storage. DMS currently provides access, management, configuration, coordination, enhancement, and maintenance support for the following systems:

- Web Content Management Services
  - [Ensemble](#), the Virginia Tech Web Content Management System powered by [Percussion Software](#)
- Information Technology Acquisitions Systems
  - Computer Purchasing Office
  - Departmental Software Office
  - Student Software Distribution Office
  - Laptop Leasing Program
- Enterprise Document Imaging Services
  - [Banner Document Management Suite](#) from [Sungard Higher Education](#)
  - [Nolij Web Document Imaging](#) from [Nolij Corporation](#)
- Enterprise Workflow Services
  - [Banner Workflow](#) System from [Sungard Higher Education](#)
- [Confluence Enterprise Wiki](#) Service from [Atlassian](#)
- [JIRA Bug and Issue Tracking](#) Service from [Atlassian](#)

## Web Content Management Services

Ensemble is the Virginia Tech Web Content Management System provided by Enterprise Systems in collaboration with University Relations. The system is the Virginia Tech implementation of the Percussion Content Management System ([www.percussion.com/products/cm-system/](http://www.percussion.com/products/cm-system/)). Ensemble provides Content Management for over 85 Virginia Tech organizational web sites.

The Database and Application Administration (DBAA) group in collaboration with DMS provide system design, development, administration, and maintenance services for Ensemble.

	Ensemble CMS client list
Launched:	University Relations Virginia Tech We Remember Ensemble CMS College of Science Human Resources ADA Information and Resources Work/Life Resources Human Resources Restructuring University Organizational Development Office of Recovery and Support Board of Visitors Office of the President University Governance SACS Reaffirmation of Accreditation Office of University Scholarships and Financial Aid Virginia Cooperative Extension Virginia Tech Carilion School of Medicine and Research Institute Department of Chemistry
In process	The Arts Initiative at Virginia Tech  Office of Export and Secure Research Compliance Leadership and Professional Development Office of Equity and Inclusion University Libraries Undergraduate Admissions Undergraduate Honor System University Relations University Honors & Awards University Relations Virginia Tech News Virginia Tech Identity Standards and Style Guide Virginia Tech Podcasts University Leadership Development Department of English

**Major accomplishments for 2008/2009**

- Upgraded the CMS application to version 6.7
- Improved product security, reliability, and usability
  - Installed vendor supplied patches
  - Integrated Virginia Tech ED-Auth and ED-ID LDAP for user authentication and authorization
  - Implemented Thawte SSL Certificate for better end-user experience

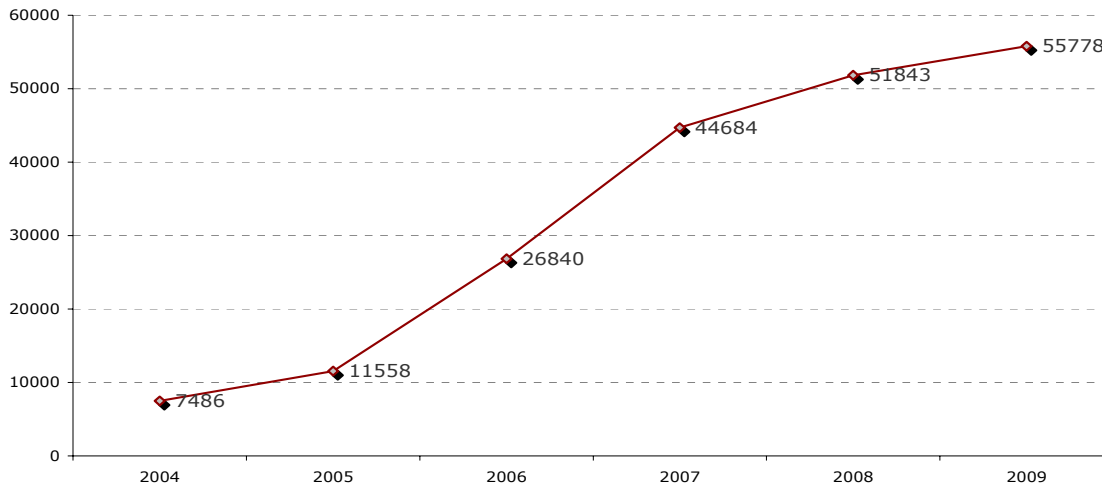
- Implemented Virtual Machine environment
- Implemented and integrated Subversion source code management into the CMS application to aid in the management of web site assets
- Integrated web server custom error pages within the CMS
- Implemented ability for end-users to redirect pages without having to modify overall web server configuration
- Integrated JSP for Java memory monitoring and management
- Developed and maintained scripts that synchronize the VT Alerts system with the Virginia Tech homepage
- Coordinated and hosted the VT CMS User Group meeting on September 17, 2008
- Coordinated and hosted the VT CMS User Group meeting on August 5, 2009
- Implemented the use of JIRA for bug tracking and feature/service requests
  - 361 tasks/issues resolved within the last year
- Created documentation and user guides and provided them on-line (*ensemble.cms.vt.edu*)
- Wrote Knowledge Base Articles for *answers.vt.edu*
- Implemented using scholar.vt.edu to make announcements to the CMS communities
- 85 sites currently in the CMS, either migrating or migration complete

## Information Technology Acquisitions Systems

Information Technology Acquisitions (ITA) provides information technology procurement services for departments and software distribution to both departments and students. DMS supplies technical support for these ITA functions through application development, maintenance, and system administration.

**Software Sales activity.** DMS provides online software download capability to students, and to faculty and staff members for fast and easy software acquisition. In most cases, downloads eliminate wait time and the need to obtain physical media. The software server system also checks and enforces licensing requirements ensuring Virginia Tech is in complete software license compliance.

Software Server Fiscal Year Activity



### Major accomplishments for 2008/2009

**Website migration.** The ITA website was migrated to the Ensemble Content Management System. Approximately 600 content items were migrated to the CMS resulting in 125 web pages. DMS staff also provided training to ITA staff responsible for web content. The new ITA CMS went into production in August 2009 ([www.ita.vt.edu](http://www.ita.vt.edu)).

**Upgraded software servers.** Thirty-six new product downloads were added in the last year and 111 total software titles were provided on network.software.vt.edu. The software server responded to over 55,000 software requests in fiscal year 2009.

**Maintained eligibility rules.** The group maintained and updated the software server access and product sale eligibility rule set. ITA's point of sale student software application and the network software server both rely on Oracle-based rule logic to determine eligibility for software. Ongoing maintenance involved with new product introductions and licensing changes required rule changes and additions.

**Java reporting tool.** We developed a Java reporting tool for Departmental Software Sales. The reporting tool was created primarily to provide spreadsheets of software license information to departments that request license reports from ITA.

**Service request tracking.** We implemented the use of JIRA system to track service requests. Over 300 service requests have been handled since system startup in December 2008.

**Student orientation software distribution.** During the summer of 2009, ITA distributed the Microsoft Campus Agreement software to over 5,000 incoming students. This new process required significant changes to the billing and sale procedures. These non-enrolled students were pre-billed for their software package and DMS staff worked closely with the Banner Student team to obtain student lists for billing and sale.

**HokieMart integration.** The DMS staff worked to integrate ITA Departmental Sales into HokieMart. DMS began working with the Office of the Controller and with ITA staff to design processes for future HokieMart integration into ITA departmental sales. An October 2009 target is set for project completion.

**Ansys/Fluent.** DMS assumed responsibility for the management of the Ansys/Fluent license server in December of 2008. Recent Ansys software upgrades have consumed substantial DMS resources.

**Labview license server maintenance.** Because the Mathworks Matlab license is renewed annually and new, user-specific license information must be supplied to all campus users, DMS uses applications to streamline this process. The yearly transition requires application updates and Flexlm license server changes.

**Faculty Development Institute (FDI) 2009 software distribution.** 1538 software licenses were provided to FDI participants through online, automated processes maintained by DMS. DMS worked closely with FDI to coordinate the appropriate software packages for each of the 400 faculty participants.

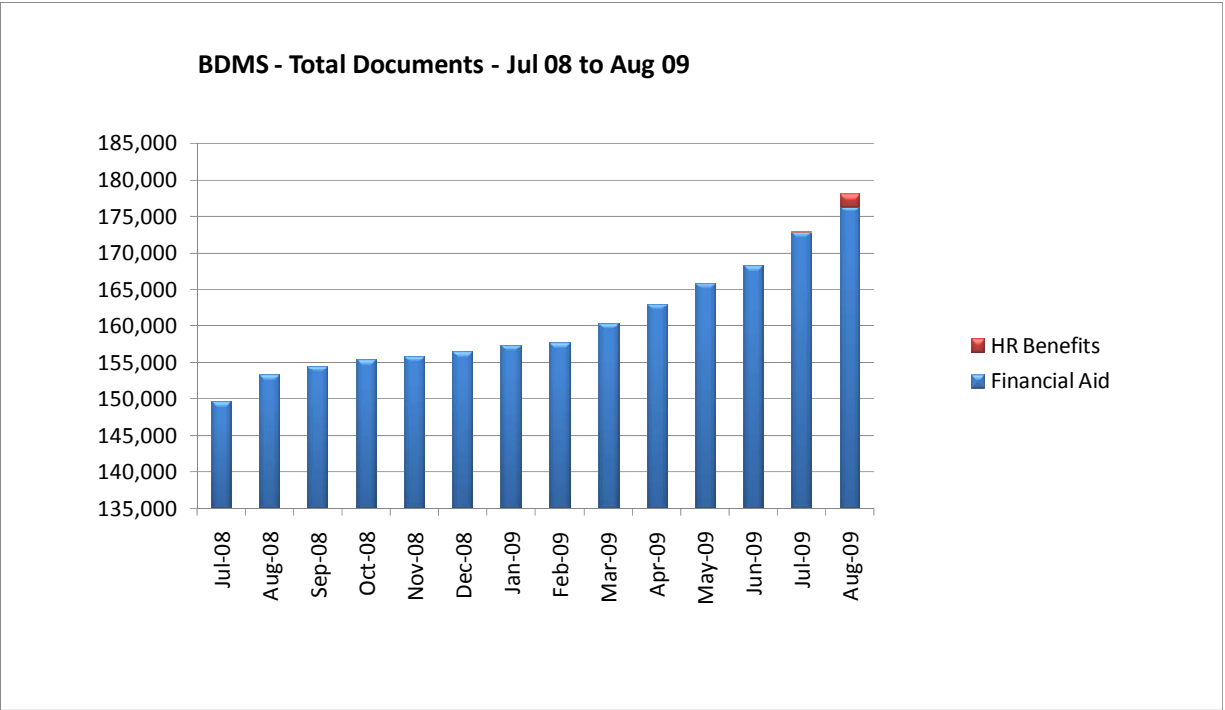
## Enterprise Document Imaging Services

### Banner Document Management Suite

The Banner Document Management Suite provides imaging, document management, data capture, storage management, and output capture and report management for individual departments and for the entire institution.

The Banner Document Management Suite (BDMS) currently serves as the Document Management System for the Office of Scholarships and Financial Aid and the Department of Human Resources.

DMS provides design, development, administration, and maintenance support for BDMS.



**Major accomplishments for 2008/2009**

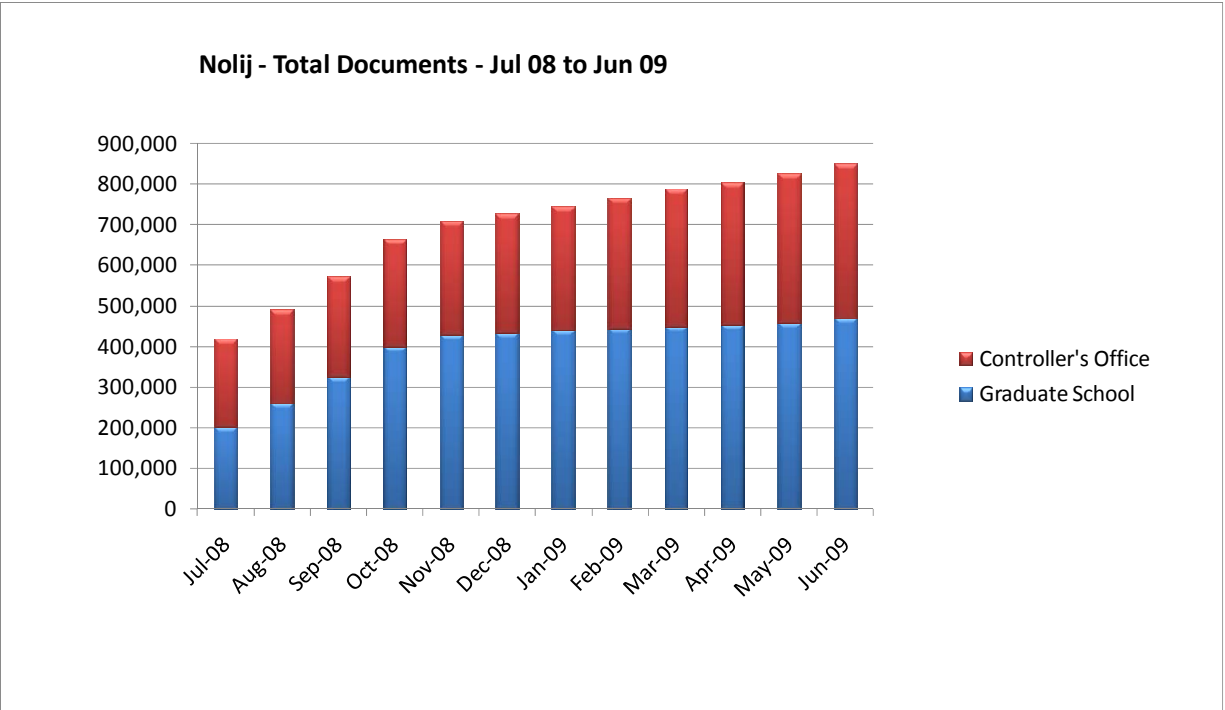
- Assumed full responsibility for the administration of the BDMS system
- Completed training in integrating BDMS with Banner and Banner Workflow
- Implemented and documented improved permissions schemes to enhance multi-departmental document security
- Implemented new Human Resources Benefits document storage solution
  - Analyzed and designed indexing scheme for HR Benefits documents.
  - Integrated with Banner Workflow allowing electronic capture, processing and storage of benefits forms
  - Trained HR department on BDMS and scanning technology
- Created and organized a documentation resource library for BDMS

**Nolij Web Document Management System**

Nolij Web is the document management tool for the Virginia Tech Graduate School admissions process and the international student check in process.

DMS provides design, development, and maintenance services for Nolij Web.





**Major accomplishments for 2008/2009**

- Provided consulting services to the Graduate School to improve image quality while reducing image file sizes to reduce storage space requirements
- Analyzed and improved image storage scheme to increase performance and reliability of the Nolij system

**Banner Workflow**

Banner Workflow automates and directs the flow of information through the enterprise. Business events trigger user notifications, business process logic, emails, and automated activities.

DMS provides design, development, administration, and maintenance services for Banner Workflow.

**Major accomplishments for 2008/2009**

- DMS completed training on the Banner Workflow system and the methods to integrate Banner Workflow, Banner, BDMS and other external systems
- Implemented a fully integrated workflow for the Office of Human Resources to automate the process to capture, process, validate and store HR benefits documents

## Confluence Wiki Service

Confluence is a wiki system that allows users to quickly and easily create and share web pages, documents, and rich content with others.

- DBAA provided resources to help DMS upgrade the software to the most current version.
- Future projects include:
  - Implement enterprise central authentication and authorization services to the wiki service
  - Merge wiki services with NI&S to improve resource usage

## JIRA

JIRA is a software system that allows users to create, prioritize, assign, track, report and audit issues. Issue' can be almost anything that users need to keep track of, such as software bugs, help-desk tickets, project tasks and change requests.

- DBAA provided resources to help DMS upgrade the software to the most current version.
- Future projects include:
  - Implementation of an Enterprise Systems Service Request and Work Order tracking system
  - Implement enterprise central authentication and authorization services to the wiki service

# information technology acquisitions

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Information Technology Acquisition (ITA) has a twofold mission. 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 the fulfillment of campus-wide requirements for information technology, including computers, software, systems, storage, maintenance, service, and negotiation of end-user license agreements. The office establishes new competitive contracts, utilizes existing internal and external contracts, and solicits competitive quotes 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 and business solutions. These solutions are often modular, extremely complex, often hosted and involve security and legal considerations. Security is essential for Virginia Tech computers and networks. Considerations include such topics as secure Web-based logon, userid and password security and control, system access control, data integrity, personal identifiers, and multi-system interface. Legal soundness and compliance is essential for all agreements related to information technology systems, including licenses, maintenance, and order agreements.

Fulfilling information technology requirements involves a variety of approaches, each with defined legal and procedural requirements. Where research shows contracts are available, they are usually the most efficient and appropriate tool. Otherwise, there are multiple potential approaches. In order of complexity, these include request for proposal for broad outcomes-based solutions with multiple evaluation criteria beyond price, sealed invitation for bid (IFB) for orders over \$50K, unsealed bid, competitive quote, and sole source.

To efficiently and effectively meet the growing demand for information technology-related commodities, Computer Purchasing issued solicitations, negotiated and established new competitive contracts, utilized existing internal and external contracts, and solicited competitive quotes.

Strategic advancements were achieved by Computer Purchasing in fiscal year 2009.

**New contracts.** Twenty new contracts were awarded to fulfill emerging, continuing, and expanding demands for product and services. Several contracts were renewed and other solicitations continue in process.

**Savings.** The new contract with Fujitsu will save the university \$1M over the contract term compared with prior educational pricing.

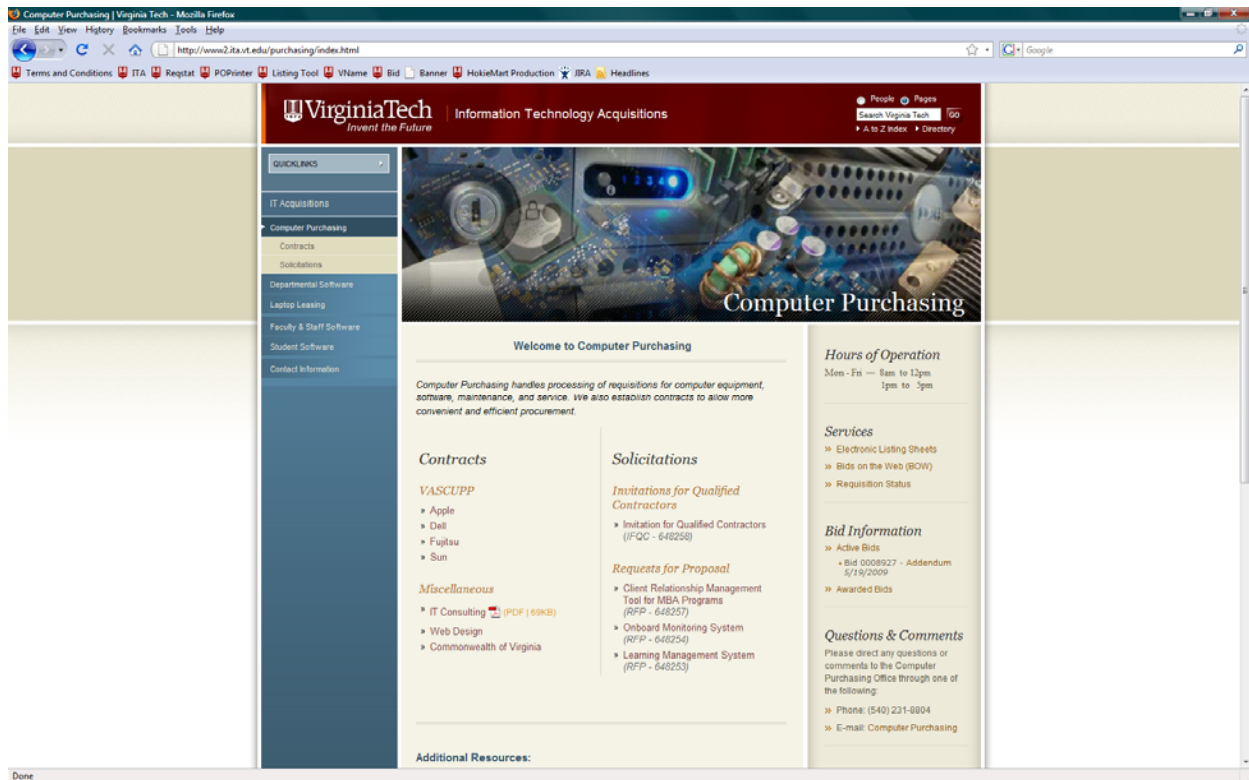
**Data accessibility.** A new data repository for contract and license agreement e-files was created to support increased research capability using spreadsheet summaries and document scans.

**Intellectual property.** A second application of two-stage competitive procurement was completed to accommodate confidentiality of Virginia Tech intellectual property while remaining open for competitive procurement.

**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.

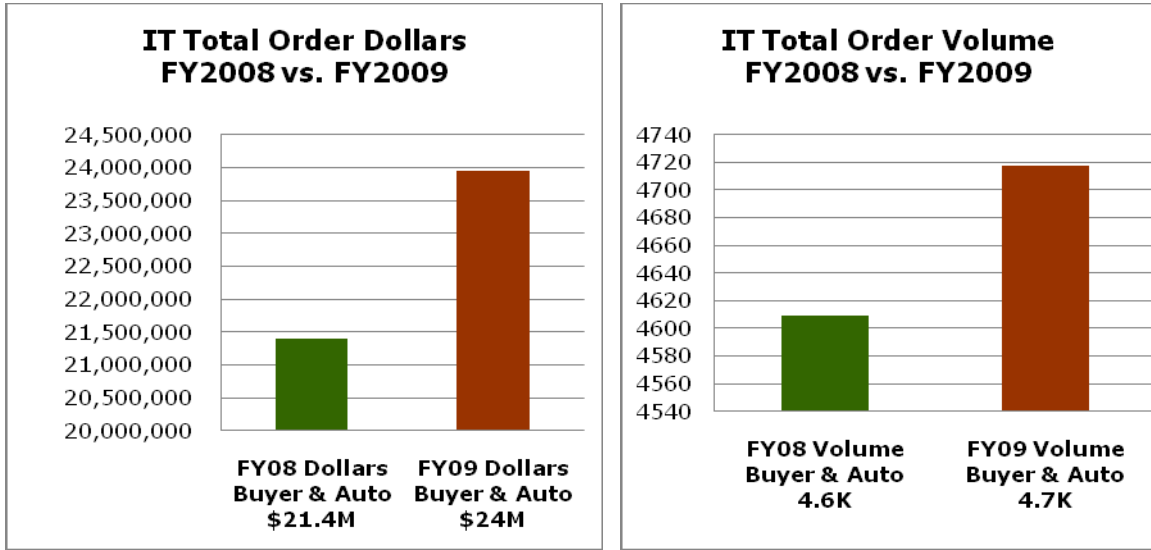
**Commitment to competition and diversity.** A new contract to cover the Microsoft Campus Agreement software purchases was awarded to a minority vendor based on the results of an IFB. This contract will provide the best available pricing to the university and support the university's efforts in increasing participation by small, women, and minority-owned business enterprises.

**Updated website.** The ITA website, including Computer Purchasing, was updated using the Ensemble content management system and is now easier to navigate and more consistent with other university websites ([www.ita.vt.edu](http://www.ita.vt.edu)).

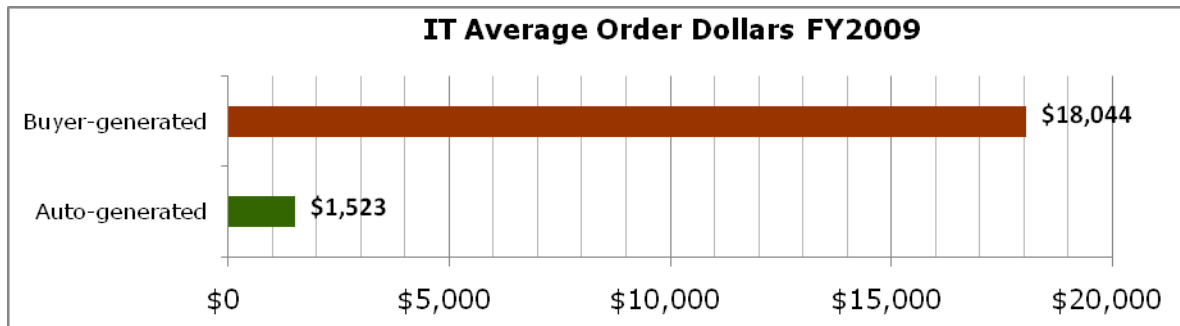


HokieMart completed its second year as the university's single point of entry for procurement. This e-system enabled both Purchasing and Computer Purchasing to manage increased volume by automatically generating smaller dollar orders and many contract orders. Combined FY 2009 buyer-generated and HokieMart auto-generated information technology orders issued totaled 4,717 purchase orders for nearly 24 million dollars.

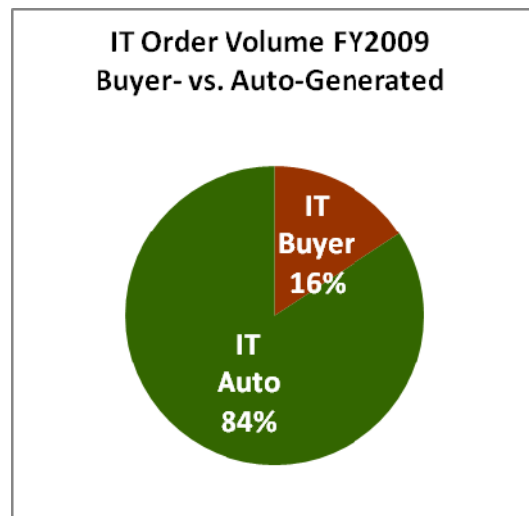
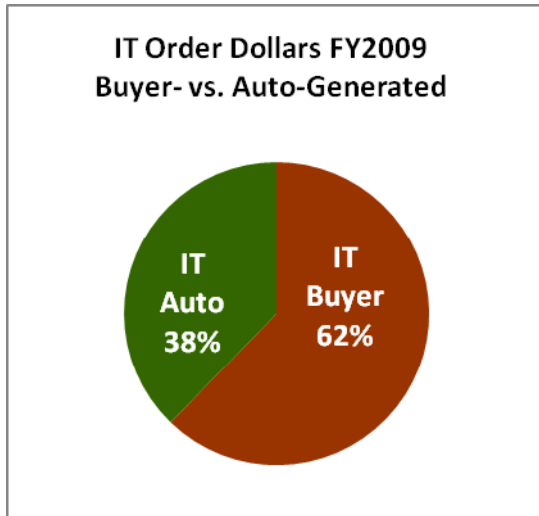
The figures below reflect strong growth in FY 2009 for information technology-related acquisitions, particularly a \$2.6 million increase in order dollars (12%). The data is for combined buyer-generated and HokieMart auto-generated information technology orders for FY 2008 and FY 2009.



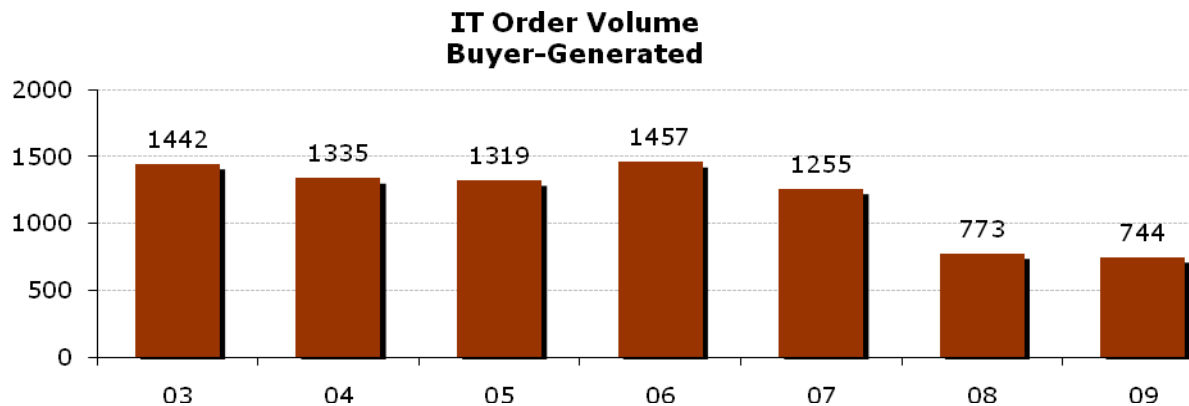
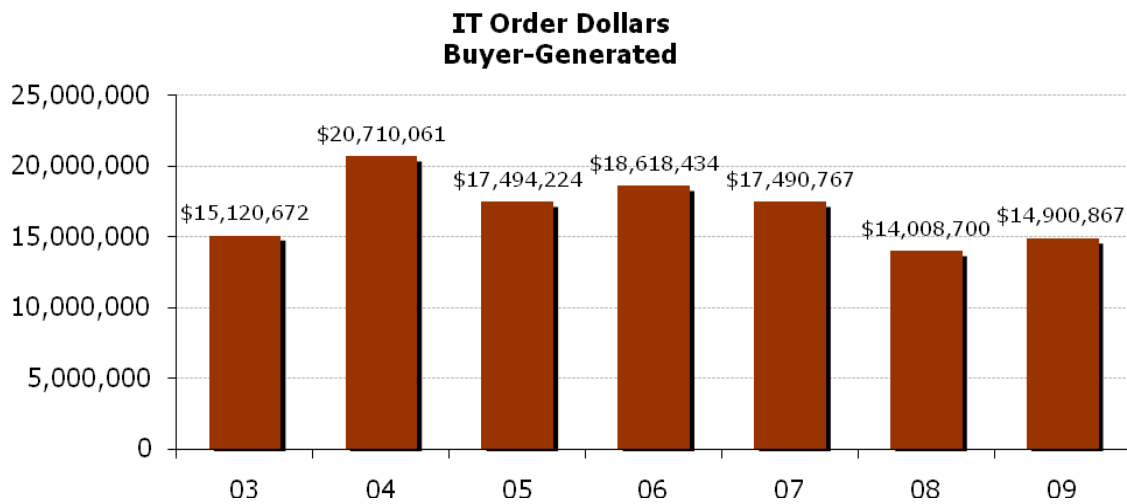
The average order dollar value is one of the key differences between buyer-generated and HokieMart auto-generated orders, at \$18,044 and \$1,523 respectively. Other differences are that buyer-generated orders often require competitive bids or proposals, negotiation of legal agreement terms and conditions, or involve special processes.



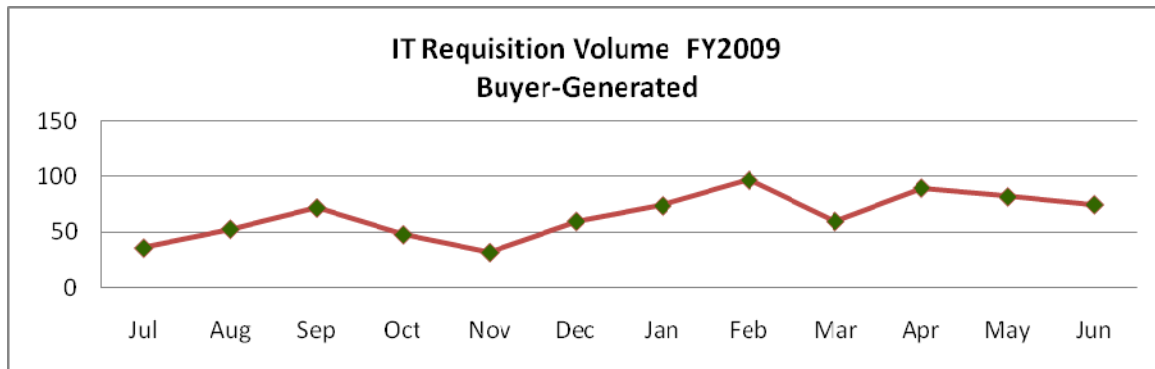
Buyer-generated orders focus on higher dollars at 62% of total dollars, while HokieMart auto-generated orders focus on higher volume, at 84% of total volume. The two processes complement each other and allow each to utilize their strengths to best advantage. Analytical skills and legal and procedural processes are more heavily mandated in the higher dollar orders, and these require the buyer's value-added knowledge, skills, and experience.



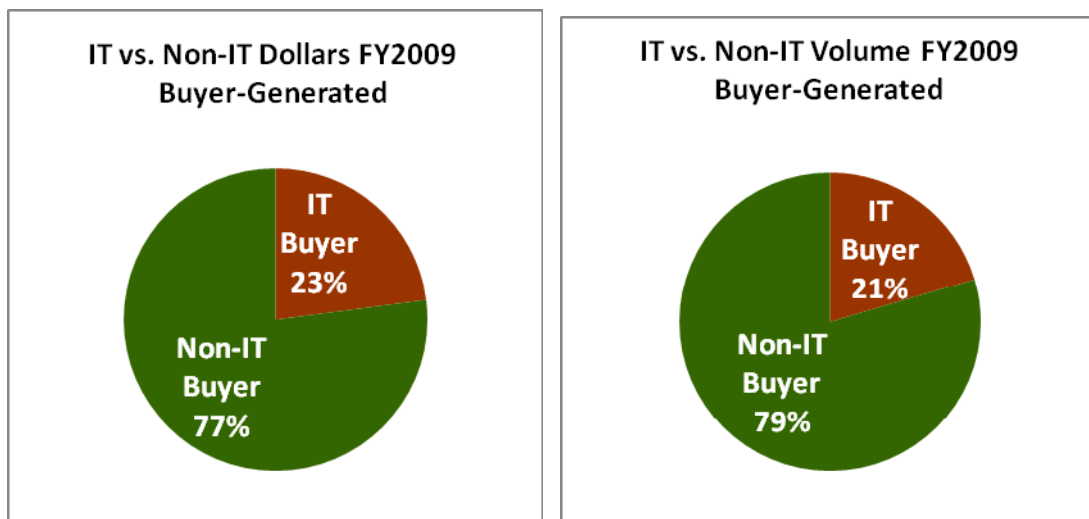
The figures below, reflect a buyer-generated dollar increase of \$890K (6%) and a slight decrease of 39 in volume between FY 2008 and FY 2009. HokieMart was fully implemented in FY 2008, and therefore prior year orders were all buyer-generated, as reflected in the higher buyer-generated numbers for FY 2007 and earlier.



The next figure charts the monthly volume of requisitions received by Computer Purchasing throughout FY 2009. The peak month was February, followed by April, May, June, January, and September.



The percentage of buyer-generated order dollars and volume for information technology-related orders processed by Computer Purchasing compared with non-information technology orders processed by the University Purchasing Office. Buyer-generated orders for information technology commodities of hardware, software, systems, and services are one-fifth to one-quarter of Non-information technology, which includes all other commodities combined except capital outlay. Non-information technology includes equipment, supplies, and services for scientific, medical, office, facilities, food services, and agriculture, as well as travel.



Computer Purchasing continued to provide quality value-added service in FY 2009, particularly for the more 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.



## 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 faculty and staff members of Virginia Tech. Software distributed by Departmental Software Distribution includes software purchased through major contracts or site licenses (for example, Adobe, Microsoft Select, 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. The only form of payment Departmental Software Distribution accepts internal to the university is payment using the interdepartmental service request (ISR) process. Total recoveries include billings to other universities for their share of the Virginia statewide ESRI education license that we manage.

Over the last year, Departmental Software Distribution 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. Through our initiatives, we were able to add several departments to Microsoft's Campus Agreement. New additions to this year's departmental Microsoft Campus Agreement family include the Virginia Tech Police Department, University Computing Services, Information Warehousing and Access, Integration and Portal Services, Undergraduate Admissions, Accounting and Information Systems, and the Office of the Vice President for Information Technology. As departments discover the benefits of our software management capabilities, more seek ITA services. This year, new members to the collection of applications that ITA manages were added. These include Ansys, Dyknow Vision, Granta CES EduPack, and an expanded Web hosting application for SNAP Surveys.

ITA also undertook the task of recreating and standardizing both our departmental and student websites over the last several months. Our focus was content, usability, and navigation. Content was reorganized for better delivery of information. Usability was enhanced by the clustering of product sets by topic area and navigation was designed to be more intuitive for the end user. Additionally, to make the website more accessible to our clientele, ITA removed the authentication restrictions.



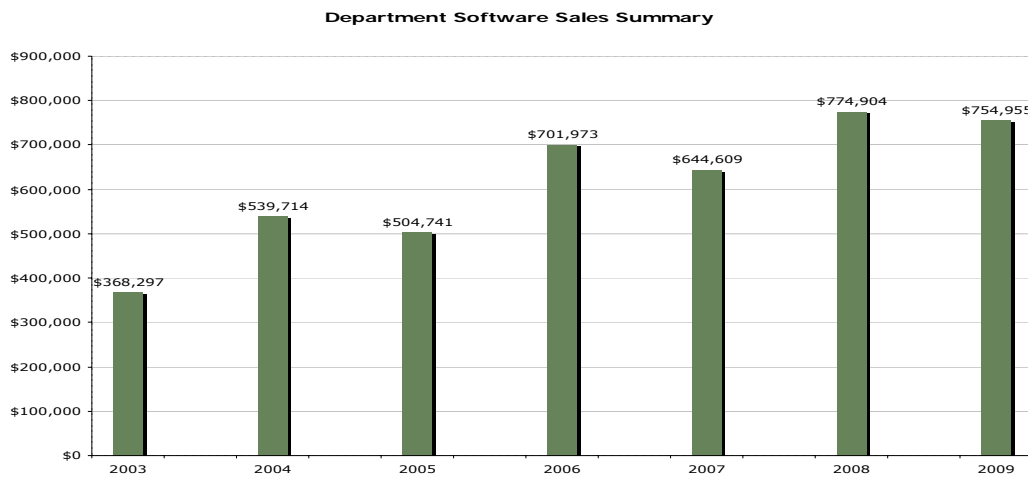
The following graphs show totals per fiscal year of ISRs processed in regard to sales, total items distributed, new products added, and distribution of software by server. Sales billings to departments vary each year based on the mix of products that are purchased by departments. FY 2003 was down due to an Information Technology security initiative to provide Microsoft Window XP and Office products at no charge to reduce the number of vulnerable systems. The sales drop in FY 2005 reflects a change in product mix and a drop in price for Adobe, Macromedia, and Mathworks products. Volume increases and the addition of the Department of Education to the ESRI statewide education license led to the increases in FY 2006 and FY 2007. Sales include all ISRs processed for departments. The higher value for total recoveries include ESRI billings to other colleges and universities in the state. In FY 2008; we saw an increase in overall revenue as well as an increase in products distributed. Much of this increase came in the form of new releases from Microsoft and Adobe, new Campus Agreement subscriptions, as well as new titles that were added to our distribution list such as SNAP Surveys, NVIVO, and Spaceclaim.

Individual products distributed include licenses, 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 between FY 2006 and FY 2007 results in large part from a redesign of the naming convention of many of our products in FY 2006 and a significant increase in the distribution of Microsoft products on our network server in FY 2007. The decrease in new product offering has come about as departments

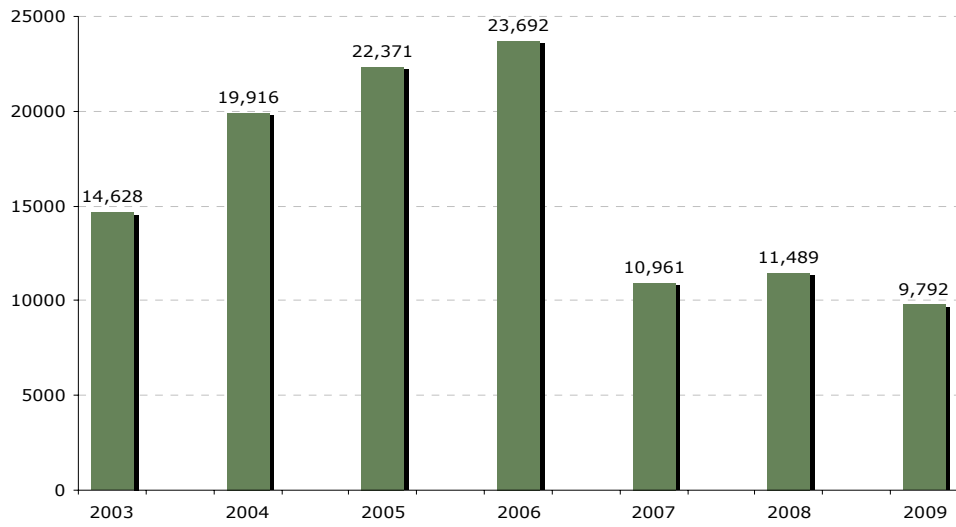
establish base product “staples” within their programs, changes in the way products were distributed (for example, conversion of several CDs to one DVD), discontinuation of back releases, and a change in product naming conventions (annual releases instead of individual product descriptions). Additionally, in FY 2006 Adobe purchased Macromedia and began clustering their product sets in an effort to encourage the suite purchase of Adobe products. As in previous years, the clustering of products continued in FY 2008 and FY 2009 as companies such as Adobe made it more difficult for departments to purchase individual products due to price hikes. In FY 2009, 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 offering increased slightly in FY 2009. This past year saw new releases from our core vendors. These included Adobe Creative Suites 4 Design Premium, Adobe Creative Suites 4 Web Premium, Adobe Photoshop CS4 Extended, Adobe Dreamweaver CS4, Adobe Photoshop Elements 7, Adobe Acrobat 9, PDF Annotator 2, SAS, Matlab, and Microsoft Windows Servers 2008.

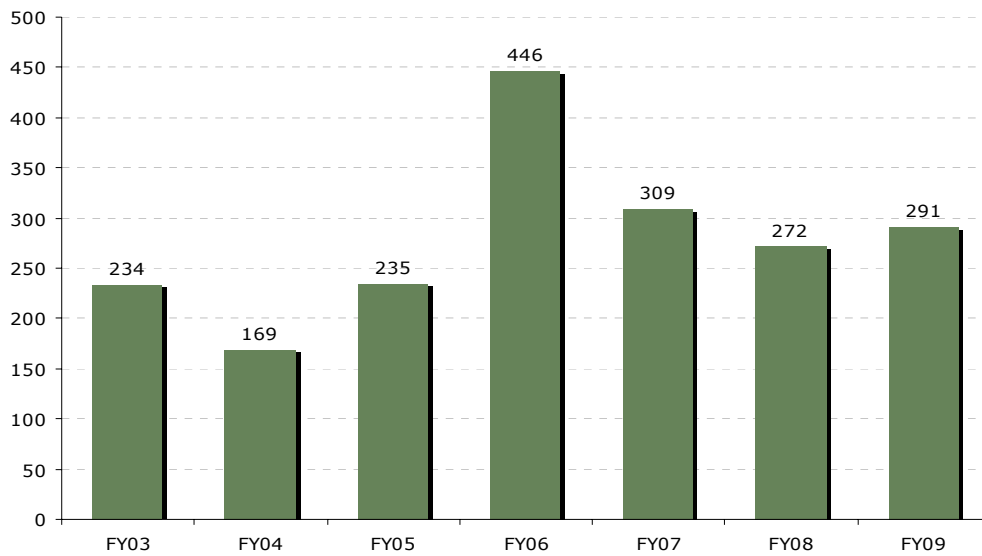
In FY 2009, we continued to see an increase in the amount of software that is being distributed by download all across the university compared to previous years. While several departments were added to Campus Agreement last year, it is the satisfaction with the program that has been impressive. The technology and those that maintain the system have made the just-in-time program successful. To date, we are serving more than 4000 faculty and staff members across campus. There has been successive increase in network connections. While the Campus Agreement program accounts for the majority of the connections, each year ITA receives more requests to manage specialized software using 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. This year’s additions to our network downloads included Ansys, Dyknow Vision, and Granta CES EduPack.



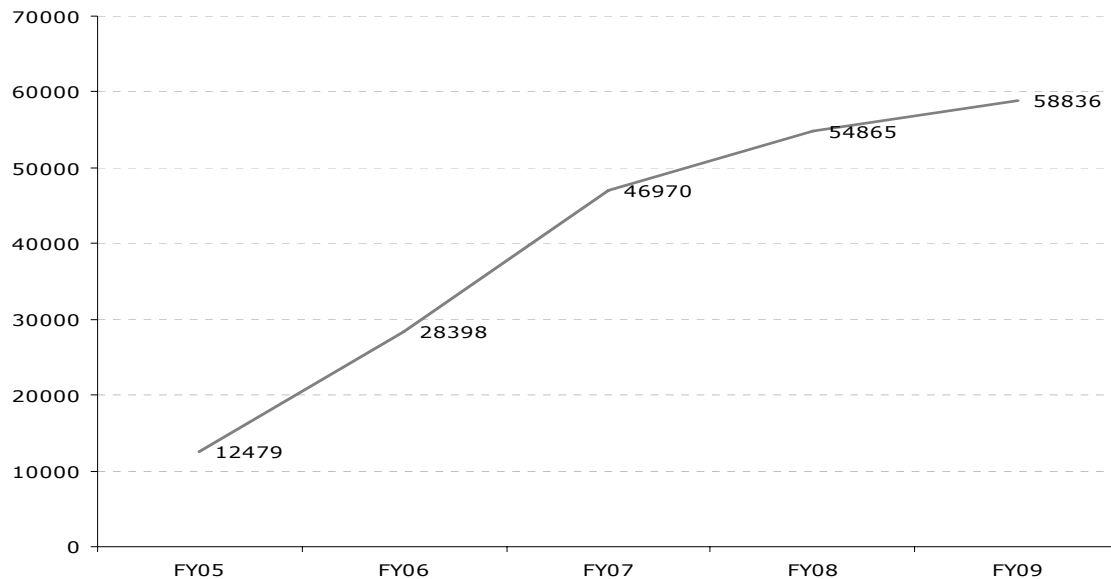
**Department Software Products Distributed**



**Department Software New Products Introduced**



### Software Server Total Connections



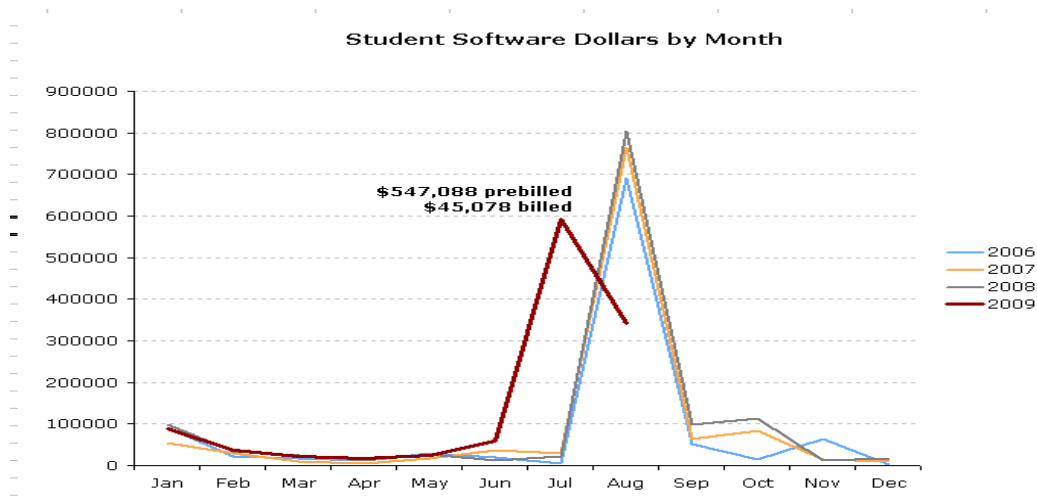
## Student Software Distribution

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 handles bundle requirements for seven academic areas. Student Software also distributes software to other students, primarily Microsoft Office and Adobe releases. It 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. The software must be obtained for students at a price that is significantly lower than otherwise available.

In April 2009, a decision was made to require a new Microsoft Campus Agreement software bundle by the university for all incoming undergraduates. Once fully implemented, all freshman and transfer undergraduate students will be 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. ITA's initial task was to systematically coordinate services with those departments most affected by the new requirement. Representatives from the Offices of Orientation, Undergraduate Admissions, Bursar, Financial Aid, and Budget, the College of Engineering, and ITA met to address implementation and communication concerns.

Billing and communication were two main obstacles that had to be specifically addressed before ITA could proceed with implementation. The billing issue was resolved by, for the first time, deciding to pre-bill student accounts for the software bundle as part of the initial tuition and fees

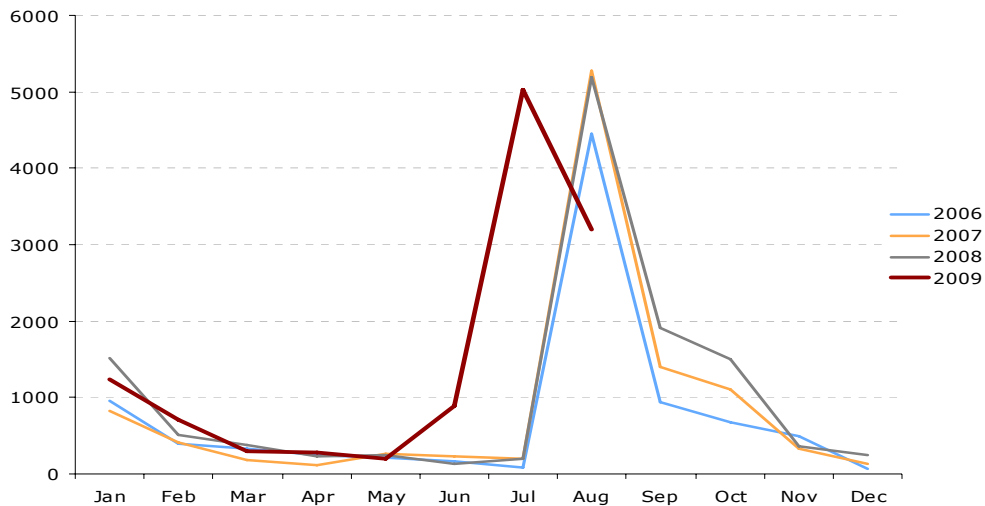
bill. Incoming fall students as of June 11 were pre-billed for the bundle. Those accepted after this date would have their account billed at time of delivery. The figure below illustrates how students were charged for the desktop bundle. The development of the communication piece was more complicated given the lateness of the decision for implementation of the requirement. In conjunction with the Offices of the University Provost, Orientation, University Computing Support, and various academic areas across the university, websites and literature were developed and posted before the beginning of first summer session when the requirement went into effect. Additionally, ITA crafted a simple informational piece in the form of an e-mail message and sent it to almost 6000 incoming students that clearly explained the requirement. The e-mail also addressed fundamental distribution questions concerning location, time, and delivery method.



One major concern with the new software requirement was how to handle the current bundle sets that we provide. During the planning phase, it was decided to remove the desktop software bundle and classify additional pieces of software as add-on components. Once this decision was made, new academic bundles had to be constructed. The result had incoming students with college-specific requirements purchasing both the undergraduate bundle and their respective college add-on bundles.

Full implementation took place during the three days of transfer orientation in June followed by three full weeks during freshman orientation in July. The next figure shows how the distribution of the incoming undergraduate software bundle affected overall sales of software. Overall billing remained relatively stable as a result of the separation of the desktop bundle from the core bundles that we distribute. However, as expected, sales of the incoming undergraduate bundle reduced the number of total sales during August.

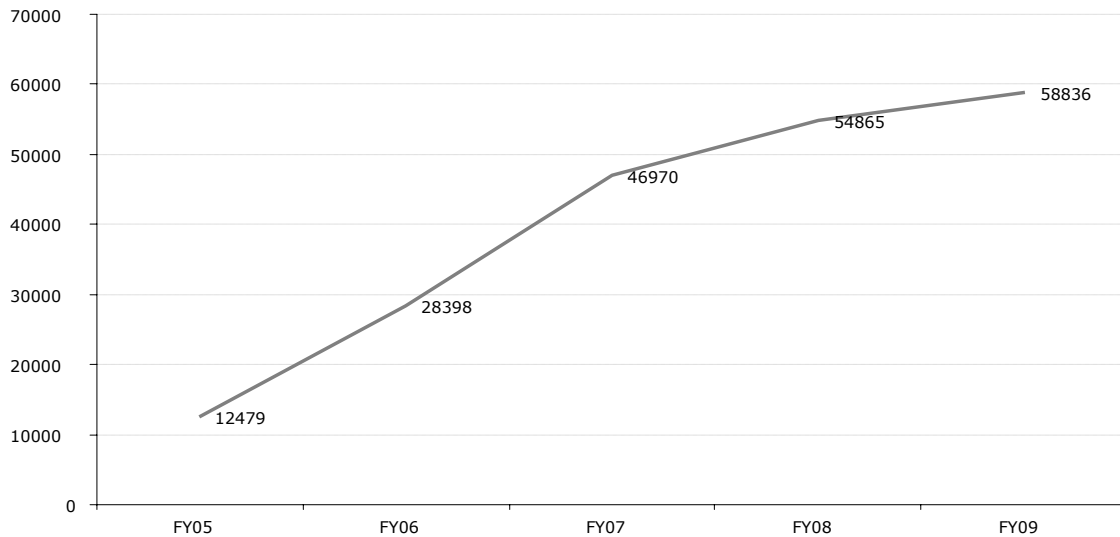
**Student Software Sales by Month**



The figures below show total sales by fiscal year and total products distributed through those sales. The sales drop in FY 2005 mirrored the decrease in price of the engineering freshman software bundle. Since FY 2002 the price of the bundle has dropped from close to \$500 to \$280 in FY 2009. This reduction was accomplished through better pricing obtained on the components of the bundle. The sales increase in FY 2006 is attributable to an increase in the number of engineering bundles, the new architecture bundle and brisk sales of Adobe Creative Suites. Total units distributed have continued to rise in FY 2003-FY 2009, thanks to both the factors noted above and an increase in the number of free upgrade trade-ins processed. The decrease in distribution shown in FY 2007 resulted from a delay between our ability to acquire Microsoft's new release of Office and the last date to purchase the previous version. In FY 2008, we saw a considerable growth in sales compared to previous years. Some of this 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. FY 2009 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.

*Software server total connections* shows the explosive growth we have experienced in distributing software to students and departments via downloads or virtual mounts. We offer 82 software titles encompassing more than 833 GB on the Network Software Server. We continue to invest in new hardware and software to stay ahead of this demand.

Software server total connections



In FY 2009, 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 4000 licenses was accomplished with few problems. In the summer of 2009, we renewed the TAH contract and were required to do more planning and research to ensure the students could continue to utilize Matlab. We worked with Mathworks to ensure a smooth transition in providing renewal licenses along with new licenses. This new contact has also been successful in being more cost effective for our department as well as the student population.

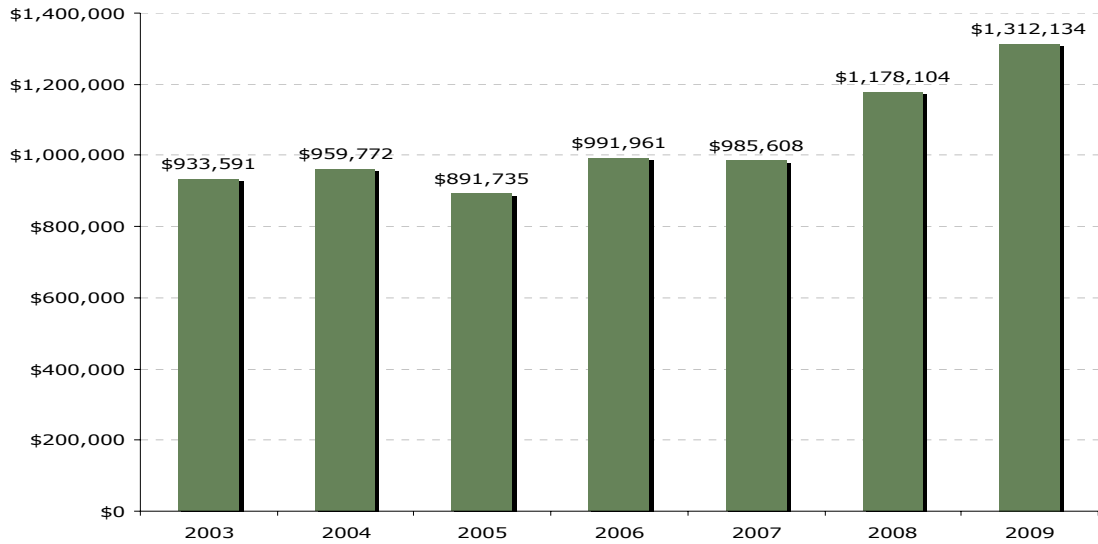
Mathworks also changed their licensing mechanism used to provide licenses to faculty and staff members. Much more work is required to administer this license but we have full license accountability so there is less concern with software piracy or license misuse. The extra work involved will also help us keep costs down for the end-users.

FY 2009 brought about several new product releases. Adobe released new versions of Creative Suites, Photoshop, and Dreamweaver. Other new releases included PDF Annotator 2, SAS, Matlab, LabView, and ESRI ArcView 9.3.

Once again in FY 2009, ITA served as a valuable resource to departments that were in need of product negotiation with vendors. Products such as Granta 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**



**Student Software Total Items Distributed**



## Contract Management, Licensing and Billing

The Contract Management, Licensing and Billing section of ITA has responsibility for managing the various contracts and licenses that are used for distributing software to the university and the state of Virginia. Virginia Tech continues to hold the contracts for ESRI's GIS software on behalf of the Virginia Association of State College and University Purchasing Professionals—known as VASCUPP. This contract is now available to all middle and high schools in the commonwealth. This year we also added Washington and Lee University to the site license. This

once again helped reduce everyone's cost by spreading the annual fee more broadly across institutions. The Contract Management, Licensing and Billing section handles billing for both Student Software and Departmental Software. This section also manages most of the technical aspects related to software distribution. These activities include developing various software distribution methods. Students and faculty members are able to access software via direct download of ISO images, as well as through the creation of virtual mounted drives. The section creates and manages license codes such as the yearly Matlab activation keys that terminate on a specific date. Management of license servers includes managing and hosting the license manager for LabView and SNAP, and accessing the license managers hosted by MathWorks and Minitab to generate license files. The group troubleshoots software installation and activation problems, and acts as a liaison to departments regarding access to software and services specified in contracts, including Microsoft download products and volume license keys.

This year the Contract Management, Licensing and Billing section of ITA worked on the university's Campus Agreement renewal, and creating and testing of builds for SAS, Matlab, JMP, Mathematica, EndNote, and WebDrive.

# information technology security office

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The Information Technology Security Office (IT Security Office) has three operating entities—the IT Security Office, the IT Security Lab, and Identity Management Services (IMS). This report is in a format that shows the mission statement for each entity, the goals and objectives for the identified period, and the major accomplishments for each entity within their areas of responsibility.

## IT Security Office

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

### Goals and objectives

1. Work with university management to ensure educational and promotional programs on technology security are made available to the entire university community
  - a. Design, develop and implement training materials and classes (in-person and online) for the general user community
  - b. Work with departments on and off-campus to increase their security awareness, and ensure that developed and purchased software meets minimum security standards
  - c. Participate in the Faculty Development Institute programs with security presentations
  - d. Incorporate various awareness programs into daily user activities
  - e. Assist in providing technical training with the IT Security Lab
2. Work closely with the Office of the Vice President for Information Technology to ensure opportunities to enhance the technology security environment are considered and incorporated into plans as appropriate
3. Ensure departments under the Vice President for Information Technology annually complete a continuity of operations plan
4. Incorporate the continuity of operations plans into an appropriate structure for disaster recovery plan(s), and ensure each plan is up-to-date with contact information and organizational changes

5. Maintain a central security web site that can be used as an informational tool and provide university users with access to security-related policies/procedures, informational/educational resources, critical notices, and security-based tools for use at the departmental and individual levels
6. Work with other university security personnel to evaluate current policy and procedures, and recommend updates and define areas needing new policy and/or procedures
7. Follow-up Internal Audit reports that deal with technology issues and ensure the college/department understands what needs to be corrected, and offer assistance as needed to satisfy audit comments
8. Coordinate and manage the Virginia Tech Computer Incident Response Team (VT-CIRT), and coordinate and maintain the Virginia Higher Education CIRT mailing list (VA-CIRT)
9. Function as the Root Certificate Authority for Virginia Tech in the area of digital signatures
10. Provide a technology security review service to all departments on campus and at remote locations to ensure they are operating in a secure and safe technology environment
  - a. Perform daily system scans to identify potential exposures and take appropriate actions to correct
  - b. Provide tools to identify sensitive data, to remove and/or protect, and to ensure individual machines are meeting the minimum security standards
  - c. Work closely with Internal Audit and the Controller's Office to identify critical areas that need security reviews
11. Provide other Information Technology departments with goals and guidance in ensuring that computer and network security is designed and integrated into the development and implementation of applications
12. Provide leadership and direction for IMS and the IT Security Lab, securing appropriate funds and assist them in planning efforts and obtaining their goals

## **Major accomplishments and ongoing activities**

### **Education and awareness**

The IT Security Office was involved in presentations, training sessions, and informative talks throughout the year, reaching a large number of individuals:

- FDI—approximately 520 faculty members
- Human Resources training—approximately 160 staff members
- Academic classes—approximately 3800 students
- Departmental presentations—an additional 100 faculty and staff members
- Other presentations to on-campus professional groups, administrative areas, and non-university groups

Additional activities of the IT Security Office for the year include the following:

- Participated in all Faculty Development Institute sessions during the spring and summer, and in selected groups during the past months
- Provided resources for technology security awareness to orientation sessions

- Consultation to the Information Technology staff responsible for awareness training during summer student orientations
- Made a presentation to the Get Connected group during their orientation for “Move-In” assistance
- Presented security session at several student orientations: foreign students (twice), new graduate teaching/research assistants, College of Engineering freshman, Corps of Cadets
- Presentation for new faculty during their orientation
  - Provide security awareness materials for new employee orientation on a regular basis
- Coordinated presentation of several compliance sessions for federal requirements to bursar’s staff, the financial aid office, student health services, the controller’s office and athletics
- Maintained and improved the security website to provide users with easy access to security tools and references for the latest security news—<http://security.vt.edu>
- Received a grant from the university Parent’s Fund to promote technology security in the printed and online versions of *Collegiate Times*, as well as with security-related posters distributed to student housing
- Used other publications to promote security issues for the Virginia Tech community
  - Continued publication of the *IT Security Quarterly Hot Sheet* newsletter to keep the university abreast of news related to the IT Security Office
  - Provided materials for the ITELL monthly newsletter
  - Edited and approved section on technology security for the fall *Information Technology Reference Guide*
- Utilized student interns in the IT Security Office to reach out to the student population using technologies commonly used by those users, and developing other methods to reach students, including posters and tent cards
- Continued to initiate awareness initiatives for the 2009 academic year
  - Continued distribution of the IT Security mouse pads that were funded the previous year
  - Distributed technology security-related materials to departments, university residence halls, and individuals
  - NOTE: Also the awareness that was done throughout the year mentioned above for the Parent’s Fund

Several other outreach efforts in the area of security awareness are reflected in the IT Security Lab section

### **State and federal interactions**

- Continued active participation in the Virginia Alliance for Secure Computing and Networking (VA SCAN) through participation at bi-monthly meetings and consultation with other Virginia institutions
- Hosted the VA SCAN conference in October 2008 at The Inn at Virginia Tech and recorded the largest attendance since the conference has been held
- Worked with the SANS Institute in hosting video broadcasting for a six-day class
- Attended the EDUCAUSE Security Conference in Atlanta and participated in planning meeting for VA SCAN activities

- Worked with Virginia state agencies through VA SCAN to provide a technology security presentation to all security offices for the Virginia Community College System

### **Risk assessment/business impact analysis (RA/BIA)/COOP**

- Oversaw the process for Information Technology organizations to develop individual RA/BIA and COOP plans
  - Met with Internal Audit about combining the two of these for university departments
  - Began reviewing materials in the emergency management area of the university to suggest changes for this process
- Worked with campus departments to ensure they have an updated assessment with necessary information
- Have begun initial effort to look at developing a data analysis document similar to the risk assessment

### **Disaster recovery plan (DRP)**

- Utilized the COOP structure to eliminate redundant data in the current disaster recovery plan
- Updated team members in the current DRP and had each team leader update their procedures to include in the plan
- Worked with other Information Technology offices to ensure each recovery plan interacts in the proper manner
- Worked with Network Infrastructure and Services team to ensure the two DRPs are compatible
- Provided direction for the development of two emergency action plans for Andrews Information Systems Building, and sections of Torgersen Hall

### **Security review program**

- Provided resources and direction for the security review program for continuation as a university-wide program
- Secured necessary funding to expand tools used in daily efforts to identify vulnerable areas within the university community
- Received a copy of the Internal Audit plan in order to schedule critical areas for review
- Worked closely with the Controller's Office to obtain a listing of departments to review for compliance to the payment card industry standards

### **Identity Management Services**

- Obtained approval and officially renamed the Information Resource Management department to Identity Management Services (IMS)
- Assisted the IMS director as needed to ensure they have sufficient resources and direction
- Ensured that IMS has the necessary resources to assume production responsibilities

## **Enterprise Directory (ED) initiative**

- Worked closely with Secure Enterprise Technology Initiatives and IMS to ensure releases of ED updates are done in an orderly and timely manner

## **Staff professional development**

Staff members attended EDUCAUSE Security Conference in Atlanta, local SANS classes, VA SCAN conference, and local professional meetings/training. The security officer represented Virginia Tech at local, state, and national meetings. Aaron Kroll, undergraduate intern with the IT Security Office, presented his research project at the ACC Meeting of the Minds in April.

# **IT Security Lab**

The IT Security Laboratory's mission is to test computer hardware and software for security vulnerabilities under the direction of the Information Technology Security Office. It will actively design, develop and implement computer and network security training materials, classes (in-person and online) to university technical and general users. The lab also is responsible for the security review process that works to identify vulnerable systems and to make recommendations. It will act as a testing facility for cooperative research project between the IT Security Office and academic researchers, as well as provide testing services to external entities according to a fee schedule.

## **Goals and objectives**

1. Develop and provide technical education related to technology security concerns for system and network administrators within the university
  - a. Coordinate training opportunities with distance learning initiatives at the academic and continuing education levels
  - b. Provide similar offerings outside the university through professional organization, conferences and various state and federal agencies
2. Support the IT Security Office in providing general awareness training for groups associated with the university (faculty, staff, students, and guests)
3. Direct efforts to provide a technology security review for university departments to help ensure a secure and safe operating environment, and prevent potential data disclosures
  - a. Special emphasis placed on sensitive data issues and providing tools for user community
  - b. Use scanning tools and work with the Controller's Office and Internal Audit to identify critical and vulnerable areas at the university
  - c. Response as appropriate to requests received directly from departments and/or other areas
4. Assist the IT Security Office as a key member of the Virginia Tech Computer Incident Response Team by providing necessary technical assistance

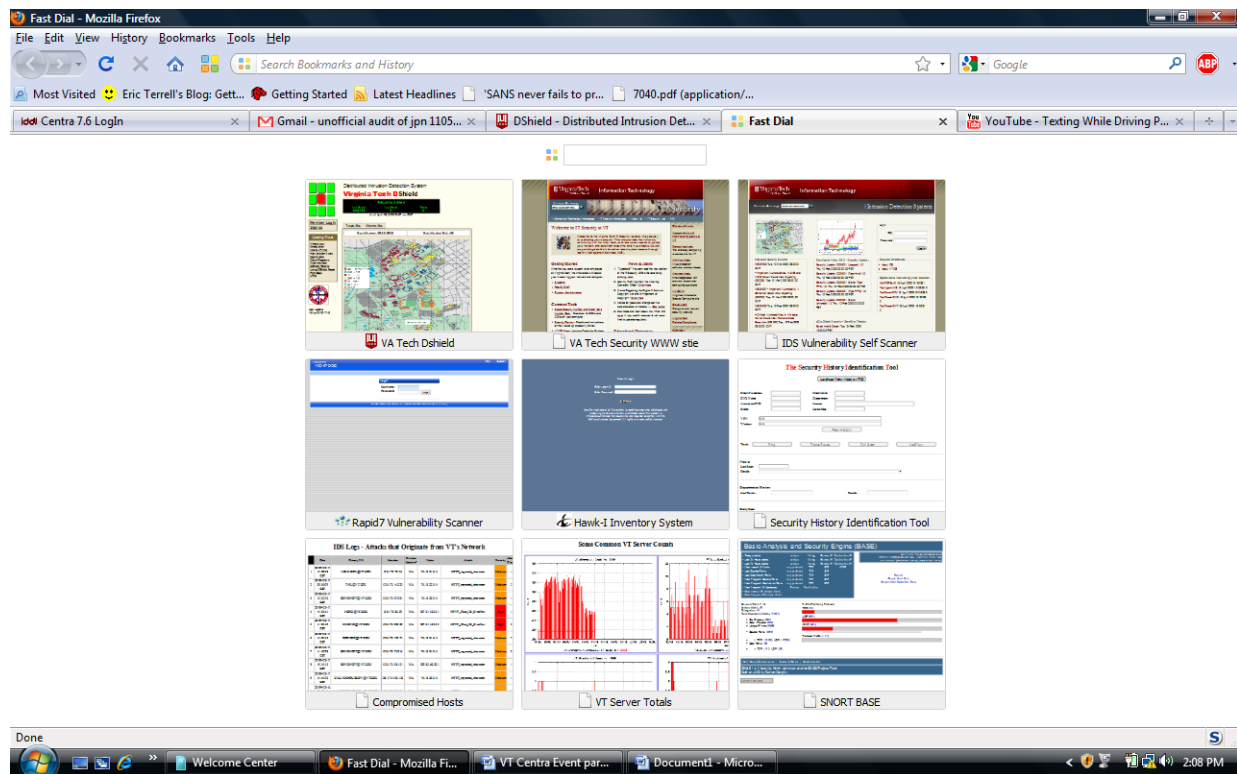
- a. Define guidelines and procedures for the six phases of computer incident response—preparation, detection, containment, eradication, recovery and follow-up
5. Maintain and continually improve a lab environment that will support academic and research efforts for the institution
  - a. Course offerings dealing with technology security and course materials as needed for both undergraduate and graduate classes
  - b. Research in the IT Security Office and also other departments on campus that have significant interest in cybersecurity areas
6. Maintain a security testing and certification lab environment that can be used internally for testing network capable devices, and can be contracted with for certification of compliance of vendor security software with Center for Internet Security benchmarks
  - a. Utilize a “teaching hospital” model that will also support the academic/research efforts
7. Maintain the Cybersecurity Operations Center to provide detail, up-to-date information on possible intrusions, and provide a toolset for the user community in doing more self-evaluations on machines and traffic
8. Provide forensics support for detail analysis when requested by appropriate authority within the university
9. Be active in professional associations at the local, state, regional, national and international level on computer security issues

## **Major accomplishments and ongoing activities**

### **Cybersecurity Operations Center (CSOC)**

The center provides detail, up-to-date information on possible intrusions, and provides a toolset for the user community in doing self-evaluations on machines and traffic at the departmental level.





Main CSOC display

The graphical display for the CSOC is shown above with components (left to right, top to bottom)—Virginia Tech Dshield, IT Security Office website, IDS vulnerability self scan tool, Rapid7 vulnerability scanner, HAWK-I asset and risk management system, Security Information Tool, IPS-to-Remedy ticket submission tool, Common VT Server Count, and the Snort BASE database lookup tool.

- VT Campus Dshield collects firewall logs from systems around campus and displays them in a manner that gives an overview of intrusion activity on campus.
- The IT Security Office website provides information for everyone from the general user to the system administrator, and easy access to a large number of tools and services.
- IDS Vulnerability Self Scan tool allows the individual users to scan their systems for well-known critical vulnerabilities. This utility requires university PID authentication.
- Rapid7 Vulnerability Scanner
- HAWK-I Asset & Risk Management System is an inventory tracking system with additional features that are used in risk assessment processes.
- IPS-to-Remedy ticket submission tool. The attack record extracts from the IPS are parsed to form trouble ticket information for submission to the Remedy trouble ticket system.
- Common VT Server Count. This service provides daily counts of the number of servers on the campus network and can assist in locating problem areas.
- Snort BASE database lookup tool
- Security Log Lookup Utility is another tool available from the CSOC that can help track the source of an attack down to the wall port of a suspected machine.

## **Partnering with Geographical Information Systems (GIS) group**

- Working with the GIS group to merge their technology with the CSOC tools described above to provide visual tools to help manage the security of the technology infrastructure
- A future component for this will be to build on the initial effort and add a more detailed floor plan for buildings identified in the campus map.

## **Next-generation intrusion detection system**

- Working with Network Infrastructure and Services to develop and open source intrusion detection system
- Prototype has been tested as a sensor that can be placed at strategic points on the network to monitor activity and detection of potential attacks on the network.

## **Technical education, awareness, and outreach**

- Hosted SANS SEC 401—Security Essentials—using the interactive video conference (IVC) tools with three remote sites connecting to the Virginia Tech campus  
From all sites there were approximately 100 staff attended.
- Had 25 Virginia Tech staff members attend a course (SEC 422—Web Application Security) taught remotely from Indiana University campus
- The IT Security Office is an active participant in the US Cyber Challenge Competition ([www.sans.org/uscc](http://www.sans.org/uscc)) set for high school students
- Provided basic awareness training to undergraduate classes, graduate classes, various orientations, and specific university personnel
- Spearheaded technical awareness sessions for various groups on the Virginia Tech campus
- Also see the list provided in the last section for professional presentations outside the Virginia Tech community

## **Academic support**

- The lab provided full classroom support for the following classes:
  - ECE4560—Computer and Network Security Fundamentals – Fall semester with 32 students—taught via IVC with locations in Blacksburg, Northern Virginia, and Charlottesville
  - ECE5984—IT Security and Trust I—taught with 43 students from all over the world

## **Technology security reviews**

- Conducted security reviews for university colleges, individual departments, compliance requirements, and administrative areas
  - Conducted reviews for some major areas such as Budget and Financial Planning which took significant resources
  - Payment card industry reviews for all departments listed by the controller's office as handling credit card transactions

- Compliance reviews completed in several areas to ensure they were in line with industry standards (for example, Office of the University Bursar and Gramm-Leach-Bliley regulations and health services with HIPAA)
- Worked with areas within the Information Technology organization to complete reviews for Enterprise Systems, and Banner Document Management Systems
- Continued to enhance Rapid7 tool, Find\_SSN, and other tools to provide the IT Security Office with up-to-date resources, that can also be shared with other departments (system administrators)
- 1430 downloads of Find\_SSN tool from 7/1/08-6/30/09—approximately 60% being off-campus
- Assisted departments in a “consultant role” to correct any shortcomings and improve security environment

### **Locating sensitive data**

The IT Security Office scans the entire university network daily to classify and identify the following servers—Appletalk servers; BitTorrent servers using default ports for P2P; Filemaker Pro servers; FTP Servers; WWW servers, HTTPS servers; Windows MS-RPC, MS-SQL, and NetBios servers; Postgres DB servers; e-mail (SMTP) servers; SSH servers; Telnet servers; Oracle servers; and Mysql servers.

The IT Security Office uses this information to find the locations of campus database servers that may be storing sensitive data as defined by university policy. This is an important step in determining the extent and type of computer and network security defense mechanisms. This information is available at <http://candi4.cirt.vt.edu/netscan>

### **Incident response team members**

- Staff members in the IT Security Lab serve as members of the Virginia Tech Computer Incident Response Team.
- Provided leadership in preparing (and maintaining three documents associated with this effort)
  - Defense-IN-DEPTH SECURITY Architecture document
  - Sensitive data exposure incident handling checklist
  - Computer incident response procedure checklist

### **Teaching hospital model (research support)**

- Facilities available for masters and PhD research in cybersecurity
  - Designed for experiments to be run in a controlled environment
- Lab director serves as a member of graduate student’s committee
- Colonel Tim Buennemeyer, US Army, completed his Ph.D. in electrical and computing engineering and now commands the Army Command and Control Support Agency in the Pentagon
- Lab is configured to allow students to observe, “treat” and immunize systems in a real world setting

- Lab is using virtualization software (VMWARE) to create virtual network that allows students to observe and defend against live attacks without compromising real systems
  - Lab graduate students created IT Audit Toolkit consisting of virtual machines configured with various vulnerabilities, an auditor system running Backtrack.
  - ECE4560, ECE5984 students used the IT Audit Toolkit CD to run the virtual systems on their laptops.
  - ECE4560, ECE5984 students use these virtual systems to gain live experience in network offense and defense.
- Student “pipeline” continues from university academic departments
  - Currently 3 graduate research assistant positions
  - New Ph.D. student (US Army) started Fall 2009
  - Graduate students have published 5 papers at various international and national academic and research conferences in 2008-2009
  - Students designed, built, and are maintaining an SQL database of vulnerabilities discovered by the scanners

### **Computer forensic support**

- Acquired hardware and software to assist in providing forensic work for internal use and external requests
- Lab staff assisted Internal Audit with several investigations that required forensic copying of computer disks
- Worked with Network Infrastructure and Services in e-discovery to create disk image copies as requested by University Legal Counsel

### **Security metrics**

- The IT Security Office is a member of the EDUCAUSE Security Metrics Working Group and helped develop the matrix currently being used by EDUCAUSE.
- Metrics being collected in the following areas and will become part of the CSOC
  - Compliance
  - Executive
  - Incidents

### **Professional presentations, classes, initiatives**

- Guest lectures: IS Audit class; College of Business Information Technology class; Internet Law class; College of Engineering Freshman orientation; Virginia Tech Outreach; FDI classes; 4HELP staff, Get Connected staff; AF ROTC orientation, Schiffert Health Center staff orientation, Graduate Student orientation, International Graduate Student orientation
- Wake Forest IT Security Seminar, Winston-Salem, NC
- IT Audit Class for Tennessee Chapter of the Institute of Internal Auditors
- University of Richmond Cybersecurity Seminar, Richmond, VA
- VITA Security Office monthly meeting, Richmond, VA
- VT-IDEAS presentation—this group is composed of alumni who are, or have been, CEO, CIO or CTO of major corporations, McLean, VA

- New York State Office of Information Technology Security Conference, Albany, NY
- EDUCAUSE Security Professionals Conference, Atlanta, GA

## Identity Management Services

Under the direction of the IT Security Office, Identity Management Services (IMS) 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.

### Goals and objectives

1. Provide a support structure for administering authorization, authentication, and security access controls to information technology resources to the university community
2. Facilitate the review of security and access processes to improve the effectiveness and efficiency of services provided to the university community
3. Make authorization rules and access information accessible for review to appropriate levels of management within the university community for decision-making and strategic planning
4. Continually research and provide information technology solutions and standards for administrative operations
5. Identify management issues to address for future implementation
6. Establish a long-term strategic plan for investigating emerging-technologies that will affect security and access control issues related to information systems and computing
7. Inform the university community of security procedures through open communication

### Major accomplishments and ongoing activities

#### IMS office

- Recognized as a production office responsible for electronic user identities at Virginia Tech, it oversees all aspects of the production environment
- Continues to have the goals listed above and be involved in defining requirements for access and enforcing rules for Virginia Tech resources

#### Enterprise Directory (ED) Project

- IMS continues to sponsor the Enterprise Directory project and define requirements for implementations, and provides database programming support for the project.
- IMS director leads a bi-weekly meeting of an ED technical group and a bi-weekly meeting of an ED policy group.

## **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.
- Implemented formal process for requesting new ED-ID services—the IMS director coordinates a review of the request
  - A security review is done by the IT Security Office on the application that will be accessing ED-ID.
  - The data stewards of identity data for faculty and staff members and for students review the requested identity attributes for appropriateness.
  - The review culminates with a meeting of IMS, IT Security Office, the data stewards and the requestor 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.
  - IMS sets up the requested service after approval.

## **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 began phase 2 of the group management tools project by reconvening the focus group and soliciting feedback on likes and dislikes of the current implementation and desired new functionality.

## **Central Authentication Service (CAS) project**

- IMS continues to sponsor the CAS project and define requirements for implementations.
- IMS director leads a bi-weekly meeting of a CAS technical group.
- Under the direction of IMS, CAS version 3.3.3 will go into production in September 2009 enabling the use of authorization attributes via CAS.

## **Banner Enterprise Identity Services (BEIS) project**

- IMS director is serving as the project leader for integrating Sungard's BEIS product into Virginia Tech's current identity management infrastructure.
- Sungard provided onsite BEIS training to IMS director and staff in late July 2009.
- IMS completed the integration architecture design in August 2009.
- Changes to enable CAS to front-end Sungard products will be put into production in October 2009.

## **Public key infrastructure (PKI)**

- IMS tested and made recommendations in the areas of security, usability, and administrative functionality on the new EJB CA platform.

- IMS staff members will continue to serve as both RA administrators and CA administrators for the Class 1 Server CA and the Middleware CA, and will continue to serve as the role manager for the Virginia Tech User CA.
- IMS assisted in the project to issue personal digital certificates on eTokens to Virginia Tech personnel located in Northern Virginia.

### **Vasco Digipass one-time password devices**

- IMS developed and implemented the infrastructure and administrative interface to support the issuance and maintenance of Vasco Digipass devices that generate one-time passwords.
- Administrative Information Systems integrated the one-time passwords as the second authentication factor for securing the distressed student information repository.
- IMS issued Digipass devices to personnel in the Office of the Dean of Students and the devices were used successfully during Virginia Tech's most recent tragedy.

### **Guest Access Management System (GAMS)**

- IMS wrote the functional specifications and provided technical leadership for the Virginia Tech electronic guess access system.
- GAMS is currently being successfully used to allow Virginia Tech parents to have secure online access to view their student's financial aid information.
- IMS has been working with the AIS Student team, the Offices of Undergraduate Admissions, and the Graduate School to expand GAMS to allow Virginia Tech student applicants to use guest credentials to check the status of their applications.

### **Google e-mail project**

- As part of the implementation team for the Google e-mail project, IMS has provided expertise in the areas of eligibility based on affiliations, workflow, and user support impact.
- When Google e-mail for alumni goes live in Fall 2009, IMS will perform the initial load of participants and provide second-level support.

### **Enterprise GIS account management**

- IMS director contributed to the development of a service level agreement for departments using GIS.
- IMS creates and manages Oracle accounts for the GIS database.
- IMS migrated the self-service password management routines to the GIS database.

### **VT Alerts**

- IMS director served on the University Relations committee to help define a VT Alerts deprovisioning process and to design a solution to allow certain non-university affiliates to sign up for VT Alerts as appropriate.

## **Virginia Tech partnerships**

- Carilion
  - Set up sponsored access for some Carilion employees
  - Plan to create Carilion affiliations and incorporate into the existing identity management processes
- Virginia College of Osteopathic Medicine (VCOM)
  - IMS continues to support VCOM via the workflow, load and update identity management processes that IMS developed.
  - IMS worked with VCOM to develop a way to incorporate students enrolled in the new post-baccalaureate program into current identity management processes.

## **Consultation**

- Provided consultation to other groups within Information Technology and beyond on authentication and authorization issues
- Worked with departments purchasing vendor software in defining requirements to have it work with enterprise credentials
  - Coursewhere—a Web-based course registration product that the Office of Human Resources purchased to handle registration for faculty development courses—IMS working with the vendor to implement CAS authentication
  - SACS accreditation—IMS made recommendations to Institutional Research on a secure way for members of the SACS accreditation team that were not Virginia Tech affiliates to access SACS data.
  - Digital Measures—Software purchased by Institutional Research to assist in faculty assessments; recommended REST Web services technology as a secure way to transfer data to and from the Digital Measures site; trained members of the AIS HR and Student teams in the use of REST Web services so that they could transmit Banner data in that manner

## **Daily support and production work**

- Maintained and provided access capability for Virginia Tech systems
  - PIDs (approximately 144,500 active PID accounts)
  - UNIX
  - Banner/Oracle access (approximately 3100 production accounts)
  - Virginia Information Technologies Agencies access
  - Distance learning access
  - Active Directory (Hokies domain)
  - Other special needs
- Provided support for the Hokie Nation social network and the online transcript request application by verifying alumni identities and reinstating credentials when appropriate
- Responded to Remedy trouble tickets for any “access” issues—there have been over 6500 trouble tickets in the past year



- Manually creating Hokies accounts while the Hokie Self-Service application has been disabled due to the migration to Exchange 2007
- Currently maintain and enforce most of the access policies/procedures

### **Professional efforts**

- IMS director and an IMS staff member attended the Sungard Summit 2009 conference.
- IMS director is a member of both the EDUCAUSE and Sungard SCT Identity Management groups.
- IMS director helps lead the ED Liaison Group and is a member of the SAMS group which reviews Information Technology implementation dates to assess dependencies and potential conflicts.
- IMS director leads three standing bi-weekly meetings:
  - Enterprise Directory policy/project planning meeting
  - Enterprise Directory technical issues meeting
  - CAS technical meeting

# learning technologies

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Learning Technologies is a multi-faceted organization dedicated to supporting the tripartite mission of the university: teaching and learning, research and discovery, and outreach and engagement. This report covers these efforts from July 2008 through June 2009.

The mission of Learning Technologies is to provide a teaching and learning infrastructure that meets modern needs for integrating technology across content areas. We seek to create and support robust environments for teaching, learning, and discovery for 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. We seek these aims in several ways:

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

Building on its record of achievements as demonstrated by several national awards received over the past few years, Learning Technologies continues to have a significant impact on the instructional mission of the university. Major activities include

- Faculty Development Institute (FDI), a model program recognized at the national level, is a continuously improving effort designed to have a long-term effect on the integration of instructional technology as a critical, enabling component of the university's mission;
- open source software development, which involves participating in national initiatives for course management systems, online course evaluation systems, and ePortfolios;
- Graduate Development Institute (GEDI), a partnership with the Graduate School that increases graduate students' opportunities for professional development.

Other work includes the following:

- Technology support for faculty members and students by the Innovation Space
- Technical expertise, leadership, and coordination for disability accommodations from Assistive Technologies
- High quality scanning and repository services for the library, the faculty, and special projects from Digital Imaging and Archiving
- Opscan processing for exams and research projects by Testing and Data Services
- Support for computer-integrated classrooms and ongoing research on pervasive computing

# Major operational programs and initiatives

## Faculty Development Institute

FDI provides the teaching and pedagogy knowledge, skills, and tools needed by faculty members working at a 21<sup>st</sup>-century university. The nationally recognized FDI program continues to have a transformative impact on Virginia Tech's instructional program by ensuring that the faculty has the opportunity to provide the most efficient and effective learning environment for our students. There continues to be a clear demand across campus for FDI's training and development offerings, which suggests that adopting sound principles of learning as part of our curricular objectives resonates with the university community.

During the spring and summer of 2009, 538 faculty members participated in short courses and workshops associated with receiving a computer and software. This marked the fourth year of the fourth cycle (2006-2009) of FDI programming, bringing the total of all participants to approximately 6500 since 1993.

In 2008-2009, our aim was to strengthen the program's value to the faculty by providing a wider range of content, including topics that are consistent with the university's renewed emphasis on research excellence. We also significantly increased our training to support large-scale deployment of Scholar and ePortfolio. Program improvements led to a 14% increase in participation, from 4,854 in 2007-2008 to 5,524 in 2008-2009.

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

### **FDI track offerings**

- New Faculty Computing
- Teaching with a Tablet PC to Engage Students in the Learning Process
- Using the Web for Instruction with Scholar and Other Tools
- New Horizons: Emerging Strategies and Tools for Teaching with Technology
- Interdisciplinary Problem Solving: Improving Pedagogies through Computational Thinking
- Planning, Developing, and Delivering Online Instruction
- Improving Online Instruction: Strategies, Pedagogy and Best Practices for Advanced Online Instructors
- Improving Instruction using Technology – Strategies, Pedagogy, and Best Practices

- Fostering Student Engagement, Learning, and Development
- Community of Practice: A Development Opportunity for Librarians
- Faculty Inquiry Group: Problem-based Learning (PBL) and Case-based Teaching Across the Discipline
- Statistics: Statistical Data Exploration, ANOVA, and Regression using JMP
- Advanced Statistics: Design and Analysis of Experiments using JMP
- Managing Sponsored Research Projects and Programs at Virginia Tech
- The New Age of Interdisciplinary Projects
- Using the Virginia Tech Enterprise GIS System
- Using Virginia Tech HPC (High-Performance Computing)
- Visualization and Research Computing: Deep Media for Research and Education
- Creative Technologies: Arts in the Digital Age
- Survey of Essential Summer 2009 FDI Content
- Independent Study / Project Development

#### Faculty development classroom usage summary

Torgersen classrooms 1120, 3060, 3080	FDI sessions 451	VT class meetings 236	Meetings/other workshops, etc. 214	Total number of events 901
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#### Summary of FDI computer distribution Summer 2009

	Apple	Dell	Fujitsu	Totals	Percentage
Desktops	46	71	0	117	23%
Laptops	177	120	1	298	57%
Tablets	0	2	101	103	20%
Totals	223	193	102	518	
Percentage	43%	37%	20%		

## Electronic portfolios

The Electronic Portfolio Initiative (ePI) saw significant growth in 2008-2009 across the university. From 18 programs cited as early adopters of portfolios in 2007-2008, the ePI is now actively engaged with 55 different programs in almost all colleges. More than 20 of these projects arose in Summer 2009 and will be in pilot phases during the 2009-2010 academic year. A dozen programs moved into full production for their students in the past year, including the Department of English's BA program; the Office of Sponsored Program's training program; the Didactic Dietetics program; Plant, Pathology and Weed Sciences; Materials Science Engineering; the Earth Sustainability and LIKES "VT Pathway" programs; the Center for Student Engagement and Community Partnerships; Residential Leadership Programs; Management; Music Education; English Education; and Social Science Education. Taking

current projects into account, approximately 1000 students are working on ePortfolio efforts currently, such as uploading materials into a portfolio “matrix” for departmental assessment efforts. Beyond that, more than 650 different students have created around 750 different Web-based electronic portfolio presentations.

We also created a site in Scholar to provide open access for all faculty and staff members and students to a “generic template” for building ePortfolios. The site was begun in June 2008, and as of July 2009, there are approximately 500 members in the site. Many faculty members on campus have decided to adopt this general ePortfolio template for their use in courses. Programs such as Theater Arts; Apparel, Housing, and Resource Management, and Horticulture are using the site with their students in courses.

The ePI project has also been active in the Quality Enhancement Plan to be submitted as a part of the SACS accreditation review. The focus of the QEP is on the first-year experience, and electronic portfolios will be an integral part of this effort, for both enhancing student learning and easing the assessment of that student learning. Marc Zaldivar joined the QEP Implementation team in late 2008 and will be continuing to serve as a committee member throughout the implementation phases.

Finally, the ePI project has been involved in research efforts. Several of the projects presented their portfolio programs at local and national conferences, including the Sakai Regional Conference in Blacksburg, VA; the Conference on Higher Education Pedagogy; and the North American Colleges and Teachers of Agriculture conference. Five groups on campus are participating in a more formal research project affiliated with the International Coalition of ePortfolio Research. Virginia Tech is also an early member of the Association for Authentic, Experiential, and Evidence-Based Learning. Two undergraduate English majors, Caitlin Laverdiere and Brittney Davis, have begun Honors theses on ePortfolios, with Teggins Summers serving as their faculty sponsor. Ms. Davis was also the recipient of a McNair Summer Scholarship, in which she completed the first stage of her ePortfolio research on leadership portfolios.

To further the dissemination of the electronic portfolios, several workshops were given during the year. In the Fall and Spring terms, three workshops were offered each semester for the FDI curriculum as an “Overview of ePortfolios at Virginia Tech.” A second, more advanced session in “Folio Thinking” was offered in Spring 2009. In addition, two workshops were given with the Office of Academic Assessment, as “ePortfolios for Assessing Student Learning Outcomes.” Finally, more than 20 classes were visited to talk directly to the students about the uses of ePortfolios for learning and professional development.

## Online Course Systems

### Scholar

Provost McNamee and Vice President for Information Technology Erv Blythe announced on April 20, 2009, that Scholar will become the university's online system for learning and collaboration in Fall 2010, replacing Blackboard.

Scholar is the Virginia Tech label for the community source software known as Sakai, developed jointly with at least 10 other universities. Designed by higher education for higher education, Scholar offers tools in support of teaching and learning, research and collaboration, and assessment/accreditation. In addition to supporting announcements, assignments, discussion forums, chat tools, tests and quizzes, gradebook, and other traditional aspects of a course management system, Scholar also offers electronic portfolios, wikis, blogs, podcasts, polls, RSS feeds, a timeline tool, and an appointment tool for office hours, with more under development.

Scholar achieved significant growth during 2008-2009, as shown in the tables below.

Number of Scholar sites created by type

	Summer 08	Fall 08	Spring 09	Summer I 09
Course sites created/modified	112	188	419	552
Project sites created/modified	57	178	267	178
Total	169	366	686	730

Scholar users who have logged in by type

	Summer 08	Fall 08	Spring 09	Summer I 09
VT users logged in	1,560	5,855	29,797	12,025
Guests logged in	139	460	580	465
Total	1,699	6,315	30,377	12,490

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

To support the transition to Scholar, Learning Technologies offers training workshops, one-on-one assistance, knowledgebase articles, other documentation, and software tools, as shown at <https://learn.vt.edu/transition/>.

In June 2009, Learning Technologies upgraded the production Sakai software to the community source version 2.5.4. This, in concert with a change to Unicon for third-party technical support, offers more flexibility and closer alignment to the global community of Sakai developers.

## Blackboard

During 2008-2009, the Blackboard system continued to be heavily used by the majority of faculty members. The Blackboard software was augmented with several service packs, but no major upgrades were done.

### Blackboard usage

	Summer 2 2008	Fall 2008	Spring 2009	Summer 1 2009
Course sections	215	2580	2503	307
Faculty & GTAs	466	2426	2414	307
Students	4,141	31,490	29,985	6,489
Total	4,822	36,496	34,902	7,103

## DyKnow Vision

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

### DyKnow usage

	Summer II 2008	Fall 2008	Spring 2009	Summer 1 2009	Totals
DyKnow courses created	17	93	51	8	169
Users	373	3,858	3,258	101	7,590

## Online Course Systems Helpdesk

The OCS Helpdesk continues to be the department's primary means of providing in-depth application support to faculty and staff members and to students, as well as serving as a valuable channel to receive feedback and rapidly detect issues of growing importance. 4Help continues to be a valuable partner and collaborator by receiving support requests and answering front-line, first-level questions, particularly for Blackboard and DyKnow. The majority of Scholar questions come directly to OCS in order to maximize OCS's knowledge of Scholar use and issues as it becomes more heavily used in the transition away from Blackboard. Over time, we anticipate 4Help will respond to first-level Scholar issues, much as they do for Blackboard now.

During 2008-2009, we saw a rise in helpdesk problem tickets that can generally be attributed to new users of Scholar. Last year Scholar only had 412 questions; this year it had 1,544. Blackboard users generated 2,447 questions. We expect that as Scholar replaces Blackboard, the number of Blackboard queries will decline.

#### OCS Helpdesk questions by category

Blackboard	2,447	ePortfolio	15
Scholar	1,544	Element K	9
Dyknow	169	InnovationSpace	5
Course evaluation	127	No category	148
Courseware	35		

Total OCS Helpdesk questions 4,499

### OCS training

The OCS staff played an active instruction and supporting role in FDI, reaching hundreds of faculty members who use the systems supported by OCS. Staff members paid visits to several classrooms and faculty groups to do hands-on training for ePortfolio and Scholar. In conjunction with the recent upgrade of Scholar to version 2.5, 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 new handouts.

### Evaluation system (course evaluations) development

The Application Development group originally collaborated with Columbia University to modify and extend a course evaluation system. The system developed out of that effort is continuing in limited production mode at Virginia Tech, and is integrated with the paper evaluation system so that all results from either system end up in a secure database. Student responses are anonymous; the system prevents multiple responses from students, and is designed with safeguards for confidentiality and authentication of responses. The online system offers many advantages, including:

- 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 reporting system (administrators and faculty)
- Improved security

The limited production phase expanded this year and over 50,000 students 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, produced response rates of more than 70%, which is comparable to the response for the paper-based system.

The Application Development group also contributed to the development of the Sakai 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 was piloted by three universities during the 2007-2008 academic year. Members of the team also assisted in documenting the tool, and OCS provided quality assurance for the project.

During the upcoming academic year, the legacy evaluation system will continue in limited production mode. There will also be increased effort in the development of the Scholar course evaluation tool with the ultimate goal of introducing this tool as the basis for an all-university student rating system.

	Online course evaluations			
	Summer 2 2008	Fall 2008	Spring 2009	Summer 1 2009
Courses	14	786	948	67
Number of students	302	32,823	32,288	1,521
Completions	179	27,355	25,946	1,067
Completion	59.2%	83.3%	80.3%	70.1%

## Courseware

Courseware is a legacy Web-based file sharing service used by a rapidly decreasing number of faculty members to store their course materials. It will be discontinued on August 21, 2009, and remaining faculty members are being helped to migrate their content to Scholar.

# 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 to students, and ensure products are available meet diverse needs across the university.

**Scholar development.** Scholar is the Virginia Tech version of Sakai, a community source software development effort to design, build and deploy a new collaboration and learning environment for higher education and research. (See <https://scholar.vt.edu/>).

More than sixty issues were addressed in 2008-2009, including the development of an application that allows users to create their own sites, creation of an import tool to upload paper test results created by Testing and Data Services, and customization of features. We also worked with our other university partners to correct numerous software bugs. These examples illustrate a tangible advantage of implementing an open source system: 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 (if at all).

Local development work also included the Course Content Copy tool (<https://learn.vt.edu/coursecopy>), a stand-alone website that allows Blackboard users to select courses for automatic migration to Scholar. Since its launch in Spring 2009, the tool has migrated the contents of 1631 courses, easing the transition from Blackboard to Scholar.

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 a new, more fine-grained distinction between users' roles within the university and their own departments.

## 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.

**Infrastructure improvement.** The Systems Support team coordinated efforts to transition to a new Scholar database server, complete the upgrade of our private network in the Andrews machine room to gigabit Ethernet, and set up network redundancy to minimize the risk of outages.

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

**Server virtualization and consolidation.** To improve flexibility and efficiency in using systems resources and to speed deployment of new systems, Learning Technologies deploys all new systems to a virtualized server environment. In addition, several existing systems have been migrated to virtualized platform as well, including the FDI administrative system and the Oracle database for Scholar. The hardware efficiency gained by virtualization has allowed us to continue to reduce the number of physical machines, and thus space, power, cooling, maintenance, and replacement costs required to provide our services.

## The Graduate Education Development Institute

In 2008-2009, there were approximately 150 graduate and professional students from nearly every college on campus who took the central Graduate Education Development Institute (GEDI) course, “Pedagogical Practices in Contemporary Contexts.” The GEDI staff (director, assistant director, and two GTAs) worked closely with these students to better prepare them to use technology-enhanced active learning methods in their current and/or future teaching. The GEDI staff worked on revising the curriculum to integrate more exploration of contemporary technology tools throughout the course.

In addition to working with individual students (under the GRAD 5974 Independent Study rubric), the GEDI program also launched its pilot practicum 2-credit course, “21<sup>st</sup>-century Strategic Pedagogies Practicum.” Throughout the fall term, ten students refined their teaching skills by creating two teaching demonstrations for their peers. The demos were videotaped and garnered significant peer feedback. Each of the pilot participants indicated that the course provided a useful place to put theory into practice as they broadened their skills sets as teachers.

The GEDI Fellow GTAs also taught over 300 graduate students in Blackboard workshops throughout the fall semester in support of the Graduate School’s GTA Orientation course, GRAD 5004. During the spring, we began revisions of the workshop curriculum to prepare for the shift to teaching GTAs how to use Scholar for the Fall 2009 orientation course.

**Assessment data.** Assessment data for the GEDI pedagogy course suggests that the Graduate Education Development Institute continues to create the opportunity for graduate students to explore technology-enriched, learner-centered pedagogy, in an environment that supports

multidisciplinary engagement. GEDI plays a vital role in their professional development as current teachers and future faculty members.

#### 2008-2009 sample data

91% of participants in the fall and 95% in the spring indicated that the GEDI course improved their awareness of the teaching and technology resources available to them. 60% of participants in the fall and 52% in the spring indicated that they would likely use Wikis, blogs, and other Web 2.0 tools in their current or future teaching. 49% of participants in the fall and 68% in the spring indicated that they were interested in using ePortfolios in their current or future teaching. 79% of participants in the fall and 70% in the spring indicated that they were likely to incorporate problem-based learning and/or case studies into their teaching.

See [www.gedi.vt.edu](http://www.gedi.vt.edu)

## Classroom technology integration

All Learning Technologies technology upgrades are a collaborative effort with Video/Broadcast Services and Classroom AV Services.

In addition to major renovations, an ongoing computing technology refresh program continued this year to systematically replace existing technology supporting presentations in the classroom. A concerted effort is made to ensure that high capacity auditoriums are kept up to date. Eighty-eight percent (163) of all currently centrally scheduled classrooms (186) on campus are equipped with projection systems and fifty-three percent (99) are equipped with full Crestron units. All stations have network connections providing access to the Internet for downloading information.

In 2008-2009, thirteen classrooms in Pamplin were upgraded to Crestron Control systems. Classrooms in War Memorial (3), Hutcheson (1), Litton Reaves (1), and McBryde (3) were upgraded this summer to Crestron Control Systems and new teaching stations.

## Computer-Integrated Learning Spaces (CILS)

The CILS unit provides support for all central IT administered computer-integrated classrooms on campus, including approximately 1000 computing stations. Other services include application and server support for the international collaborative efforts of Dr. Jan Helge Bøhn in Mechanical Engineering, and TimeClock System Administration and Training.

**Computer upgrades.** During Summer 2008, we replaced approximately 170 computers at the Math Emporium. The systems removed from the emporium were used to upgrade other classrooms on campus or were given to other departments to extend their usefulness to the

university. We also upgraded Hahn 305 and Shanks 180 to new Intel-based iMacs and configured them as dual-boot systems with Mac OS X and Windows XP.

At the end of Spring Semester 2008, we dismantled the computer lab in Ambler-Johnston 4102 to make way for the start of the building renovations. At this time there is no plan to include a computer lab in the renovated building when it reopens. However, we are in discussions to create a "Business Center" with a limited number of computers and a printer.

**Pay-for-print service.** For fiscal year 2008-2009, we switched to a single price model of \$0.10/page for black and white or color laser prints rather than \$0.10 for black-and-white and \$0.20 for color. This change decreased the number of trouble calls and refund requests without significantly increasing costs or lowering revenue. Approximately 70,000 print jobs were processed in 2008-2009, with 260,000 pages, for a total charge of \$26,000. This represents a 13% increase in usage.

## Digital Imaging and Archiving

Digital Imaging and Archiving supports research and instructional activities of the university by providing

- a comprehensive range of scanning services in support of image archiving, research, and repository development projects;
- development for the university research digital repository initiative;
- support for preparation of supplemental class materials through the online E-Reserve;

Service is provided to faculty members or departments at Virginia Tech who offer projects that require a high degree of image scanning precision and network accessibility. Since 2003, over a million scans representing 86 projects have been created at resolution settings required for standards based image archiving. These standards represent best practices for digital file construction and preservation. Our overall goal is to create a baseline for master file development with a capability for use within a long-term preservation strategy, without the need to rescan the original material at a future date.

For the fiscal year represented in this report, Digital Imaging produced a total of 370,297 individual digital files associated with 15 projects, scanning documents for electronic reserve, reserve annex, as well as bound dissertations, image collections, and books.

We also continue to investigate ways that enhance our contributions to the university in support of research and outreach. One area where our efforts are already contributing is with repository development for online discovery. With the recent addition of the VITAL repository software, preparations are underway to increase our support for developing images for networked delivery.

A pilot project currently underway will demonstrate this capability and ultimately develop a research site for the Center for Civil War Studies dealing with Civil War era newspapers. With the completion of this pilot project, nine additional newspapers will be added to complete the Civil War site, making this newspaper collection a resource for historians well into the future.

Another area where support also increased involved the University Libraries. Working closely with Digital Libraries and Archives, our digitizing support was expanded to accommodate a steady flow of bound documents targeted for addition to the Electronic Thesis and Dissertation project. As part of this effort, we were better positioned to investigate several other factors related to these documents that potentially impact the long-term preservation for this collection of valuable research assets.

## **Technology improvements**

Our department's evolution gained momentum in the fiscal year 2008-2009 as we continue to move away from our origin as a service unit providing walk-in photography services and on-demand graphic design support. The transition to a project-oriented digital repository organization supporting research and instruction was aided by enhancements to our technology infrastructure, additions to our archival scanning capabilities, and the installation of repository software and training.

The installation of new server equipment this year was a crucial improvement that fortified our efforts and increased the capacity we have for archival scanning in support of digital repository initiatives. The additional storage space and enhanced local networking this equipment provided made the transfer of output from our scanning devices faster and the products of our staff's work much more secure.

Another component in our effort to provide the most complete and highest quality digitizing support to projects was added late in the year. We are now able to archive audio material from cassettes and vinyl records as a result of our addition of the Cube-Tec Quadriga professional digital audio solution. The Quadriga system captures analog audio streams in archival quality while also generating metadata about the original material and the digitization process that's critical in making the audio data a valuable digital asset.

Key staff members participated in an evaluation of repository software undertaken by the University Libraries this fiscal year. Testing of the CONTENTdm repository solution allowed us to consider features and experiment with processes and workflow procedures in preparation for developing our own digital repository projects.

In cooperation with Enterprise Systems, our department's instance of the VTLS Vital repository software was installed this year and staff members received two days of specialized training from VTLS on its features and usage. The stage has now been set for building our pilot repository project with the Department of History's Virginia Center for Civil War Studies featuring the digitized version of the Macon Daily Telegraph from 1860 to 1865 mentioned previously. Over

5800 pages of the Macon, Georgia newspaper from this period will be made available for online searching and viewing as a result of this collaboration with History professor William C. Davis.

## Testing and Data Services

Testing and Data Services (TDS), formerly known as Test Scoring Services, supports the collection of data by members of the Virginia Tech faculty and staff by processing optical mark reader forms, providing analysis of the data, and promoting and supporting innovative technologies that improve data handling efficiency.

**Opscan processing.** Primary uses of opscan forms at Virginia Tech are exams, course evaluations and collection of research data. Volume varies slightly from year to year, but shows no consistent direction of change. Statistics for the 2008-2009 academic year show the following:

Number of different clients served	784
Jobs processed	6,200
Exams	5,100
Final exams	1,100
Course evaluations	500
Research data capture jobs	600
Total sheets processed	790,000

While opscans remain a popular, cost-effective information gathering method for many applications, TDS also provides support for other methods using new technologies. Testing and Data Services continues to work with other units in Learning Technologies to assure the new online course evaluation system is compatible with current policies and supports provision and merging of data gathered via opscans.

**Web design.** TDS staff also took responsibility this year for revamping the Learning Technologies website in collaboration with other Learning Technologies units. The design, created using the university's Ensemble content management system, provides a comprehensive view of Learning Technologies activities while also offering a convenient gateway to individual departmental sites.

The Testing and Data Services website was also enhanced with additional information and redesigned under Ensemble.

## 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 projects include a presence-based Bluetooth communication model of a stationary service beacon and multiple mobile devices, and a Javaspace-based messaging prototype of a "waiting-line" application

## Assistive Technologies

**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 for university accessibility standards, promotes AT related research, supports AT software and accessibility services, and provides 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 Research Lab

The AT 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 research programs in the university; working to obtain grants or sponsored funding from government, industry, or the private sector; and providing expertise and support for projects that may benefit individuals with disabilities.

## Sponsored Research

**Innovative Flexible Experimental Environment for Learning SCIENCE (I Feel SCIENCE).** *I Feel SCIENCE* research involves an interactive learning environment to support science education for students with blindness. The primary goal of this effort is to integrate haptic feedback into *I Feel SCIENCE* by implementing the sense of touch in science instruction for students with blindness when studying heat, temperature, and intermolecular forces. This approach supports students' formation of knowledge, reduces their misconceptions, and



improves their attitudes towards learning science. AT Lab participation included advising 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 include Virginia Tech, University of Arkansas, Arkansas School for the Blind, and the Virginia School for the Deaf and Blind. Funding Source: National Science Foundation (NSF) for 3 years.

**Community Living Connection (CLiC).** The Community Living Connection (CLiC) research proposal addresses the need for helping people with acquired brain injuries (ABI) in rural settings to live within their community and home environment. During Phase I of the CLiC project, the AT Lab was subcontracted by Brain Injury Services of SWVA (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, is conducting a one-year telehealth research study using the Internet, educational videoconferencing, and assistive technologies for the delivery of rehabilitative services. Results of CLiC research and the cost effectiveness of this innovative approach will be published in the first quarter of 2010. Funding Source: *The Jason Foundation* and BISSWVA sponsors for 1 year.

## Independent research

**Opening new doors with assistive technology.** 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, very few of today's assistive technologies can effectively interpret science, mathematical formulas, and engineering terms. This long-term independent study offers student researchers from multiple disciplines the opportunity to investigate methods for improving this situation. This year team members continued worked in the AT Lab on relevant tools, document-analysis systems, and ways to improve an existing prototype engine for translating mathematical formulas into Math ML with goals that included using synthesized speech. The work will continue in the Fall 2009. Academic supervisor: Lynn Abbott, Associate Professor in Electrical Engineering.

**Smart dorm rooms for college students with disabilities.** Although college dormitories are constructed using accessible designs, opportunities exist to explore the application of new technologies to these living spaces. Students for one semester researched the design of smart devices and/or prosthetic living spaces supporting the needs of college students with disabilities. Concentrating on a theme of "aids for daily living," the independent research studies focused on environmental controls, furniture design, notification systems, daily activities, and the marketing of these devices. Academic supervisors: Associate Professor Tom Martin, Bradley Department of Electrical and Computer Engineering; Associate Professor Ed Dorsa, assistant director of School of Architecture and Design; Associate Professor of Marketing Eloise Coupey, Pamplin College of Business.

## Special Services

Special Services, in Newman Library, provides individualized training on the software, hardware, or AT equipment when requested by customers as a disability accommodation. Customers include students, faculty members, and employees formally approved for specific accommodations by the Office of Services for Students with Disabilities (SSD) or University ADA Services in Human Resources.

Special Services also serves the regional On-Campus Transition Program (OCTP), which 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 an alternative format. In addition, AT continues to assist in scanning textbooks at Special Services and training students to use text scanners so they can quickly and independently scan multiple pages, such as class notes, for assistive reading using synthetic speech. AT also continues to support Braille production for educational or research purposes of the university.

**Student referrals for disability accommodations and training.** Special Services improved 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 change helps 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.** Some 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 (Computer Labs) and the Innovation Space, helps coordinate AT software support for computer workstations across campus. Although providing ubiquitous networked AT support for all university computers is a goal, constantly changing customer

demands, AT equipment, computer devices, operating systems (e.g., Windows, OS X), and AT software makes this a continuous and challenging effort.

AT Central Services supplies local and university-wide licensing of specialized computer software, accessible computer hardware and devices, and services for the university community that include maintaining 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.

## Accessibility Standards Committee

In addition to chairing the university Accessibility Standards Committee (ASC), the AT department supplies university licensed software, training materials, and open-source software used for evaluating accessible Web design. 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 movement into new content management systems for academic (Scholar) and administrative websites (Ensemble) has resulted in the AT department considering a more cost effective approach to achieving overall website compliance. These possible changes will be taken up with Learning Technologies management, the ADA Executive committee, and the Accessibility Standards Committee early in the upcoming academic year.

## InnovationSpace

The InnovationSpace provides a central campus facility that supports the integration of technology in teaching and provides the opportunity for students to use technology in support of learning. The InnovationSpace supports the faculty through classroom presentations, scheduled lab time, consultations on emerging technologies, and technical support for student projects. A new teaching with technology lab was created in Torgersen 1120.

The InnovationSpace, formerly the New Media Center, underwent a name change in August 2008. The InnovationSpace name was chosen to better represent the mission and purpose of the center. The purpose of the InnovationSpace includes exploring new technologies with a focus on teaching and learning. The director position was revised to include not only the management of the InnovationSpace, but also to grow teaching and learning with technology. This new position,

director of Emerging Technologies and New Ventures, is also charged with developing strategic partnerships.

The table below displays total InnovationSpace use for the past 3 years. The number of users continues to increase each year. Strategic partnerships, the support of the Scholar transition, support of the ePortfolio Initiative, and increased visibility of the center have all contributed to the increased usage.

InnovationSpace trend data

	Year			Total
	2007	2008	2009	
3D	5	1	2	8
Audio	420	590	702	1712
Authoring	118	78	16	212
CD/DVD burning	82	58	116	256
Desktop publishing	444	262	487	1193
ElementK	6	6	2	14
ePortfolio/Scholar	0	32	59	91
Equipment loan	551	781	1138	2470
ETD	6	3	3	12
Flatbed scanning	926	1049	881	2856
Graphics	1197	1768	2283	5248
Maintenance	0	96	50	146
PowerPoint	62	44	20	126
Slide scanning	175	224	144	543
Video	1880	2684	3572	8136
Web development	326	599	667	1592
Total	6,198	8,275	10,142	24,615

**New Technology Teaching Lab.** Torgersen 1120 was remodeled this year to include the latest technology. A grant from the Virginia Tech foundation funded the installation of four additional projectors, an interactive white board, a fully integrated sound system, a touch-screen control panel for the projector, lights and audio, and a new podium. The lab has mobile desks and chairs, along with multiple interactive technologies including wireless slates, digital notepads, and digital audio and pens kits that encourage dynamic grouping and active learning. The new lab offers a space for faculty members to learn about new technologies, test technologies in a classroom setting, and deliver courses. Several courses were held in the lab throughout the year. All mobile equipment is available for checkout by faculty members.

**Classes and teaching support.** The InnovationSpace continues to directly support classes. Audio and video podcasts were facilitated for HNF and ENG 2614. Staff provided digital design services for the English ePortfolio initiative and developed ePortfolio headers and logos. They also worked one-on-one with faculty members to include additional technology within courses, including assistance with video to DVD conversions and slide scanning. InnovationSpace taught several FDI workshops and facilitated a summer session.

Software for all FDI classrooms was updated on a weekly basis as needed by workshop facilitators and tablet PC carts were maintained and made available.

**Strategic partnerships.** The InnovationSpace works to develop strategic partnerships between university departments and IT. This year, we worked with Civil Engineering and the GIS group to develop an interactive website for the CHAMPS program. Additional partnerships were formed between the virtual server group of IT and CIDER and Engineering Education.

**Outreach programs.** In support of the university mission of community outreach, the InnovationSpace provided time, talent, and computer resources to the Upward Bound program, Blacksburg Stories Project, Progeny Film Festival, Digital Media Sandbox Consortium, and the Swiss International Teacher's Program.

**Department projects.** The open lab space was converted to dual-boot Macs that allow users flexibility in operating systems and software. Still and digital cameras were upgraded to ensure cutting-edge technology for student and faculty checkout.

## Learning Technologies professional activities

### Courses taught

Fowler, S. GRAD 5114 Pedagogical Practices in Contemporary Contexts, two sections, 75 students

Fowler, S. GRAD 5984 21<sup>st</sup>-Century. Strategic Pedagogies Practicum; 10 students

Fowler, S. GRAD 5974 Independent Study in Advanced Technologies in Teaching and Learning, 4 students

Plymale, W.O. ECE 4994 Application of Pervasive Computing Concepts to Teaching and Learning, Fall, 2008 and Spring, 2009

Watson, C.E. IDST 3114 Special Topics in Interdisciplinary Studies: On Becoming an Agent of Change, Spring 2009, 23 students

Watson, C.E. IDST 3114 Special Topics in Interdisciplinary Studies: On Becoming an Agent of Change, Summer I 2009, 17 students

Zaldivar, M. ENGL 4944 Undergraduate Research: Special Topic on ePortfolio Leadership Development, 15 students, co-taught with Dr. Nancy Metz, English

Zaldivar, M. ePortfolios for Assessing Student Learning, classroom lecture in two courses—EDCI 5784 Research and Assessing Student Learning and GRAD 5114 Contemporary Pedagogy

### Workshops taught

Evans, A. D. Workshop leader, Faculty Development Institute, Summer 2008-Summer 2009, more than 160 short-course workshops in technology and pedagogy with enrollments in

excess of 1800 faculty and staff members, and graduates at Virginia Tech in the following topics

- Blackboard
- Scholar
- GTA seminar
- Pedagogy (Student-centered learning, Community of Practice)
- Technology planning and evaluation
- Web design
- Multi-user virtual environments (Second Life)
- Train-the-trainer—Scholar
- Collaborative technologies/Web 2.0

Evans, A. D. Track facilitator, Faculty Development Institute, Spring 2009-Summer 2009, Facilitated one Spring track of 7 sessions and 4 three-day Summer tracks on the Scholar and pedagogy training, with enrollments in excess of 125 faculty and staff members

Evans, A. D. Track facilitator, Faculty Development Institute, Summer 2008. Facilitated 4 three-day summer tracks on the Blackboard LMS and pedagogy training with enrollments in excess of 85 members of the faculty and staff

Evans, A. D. Summer Veterinary Student Research Program, May 2009. Short courses on computer-based graphics, reports and presentations

FDI, “PBL & Case-based Teaching Across the Disciplines,” four-week Faculty Interest Group

FDI, New Faculty Orientation, “Rethinking Learning in the 21<sup>st</sup> century

McPherson, D. Faculty Development Institute workshops taught:

- DyKnow: Utilizing Tablet PCs to Increase Student Engagement and Organization
- Scholar: Tests, Quizzes, Feedback, and Gradebook
- MS Excel for Grading
- Scholar: Creating Your Course and Content (Which Tools do I Use?)
- Scholar: Something for Everyone (An Overview)
- Scholar: The Instructor's Tools for Teaching
- Scholar: Unpacking After the Move from Blackboard.

Plymale, W.O., FDI Summer 2009 Track Y: Creative Technologies: Arts in the Digital Age

Schwartz, E. Workshop leader, Faculty Development Institute, Fall 2008, Spring 2009 and Summer 2009. Workshops taught:

- Overview of campus computing resources,
- Student response systems,
- Wikis
- Computer security.

Schwartz, E. Track facilitator, Faculty Development Institute, Spring 2009 and Summer 2009. Tracks facilitated:

- Track X: Independent Study / Project Development
- Track Y: Creative Technologies: Arts in the Digital Age

Schwartz, E. Office 2007 Training for Human Resources, December 2008, short courses on using the new interface in Office 2007 for Windows users

Schwartz, E. Summer Veterinary Student Research Program, May 2009, short courses on computer-based graphics, reports and presentations.

Sparrow, J.L.V. Workshop leader, Faculty Development Institute, Spring and Summer 2009.

Workshops taught:

- Concept Maps: Using Concept Mapping Software to Teach Complex Concepts
- Google Earth: Digital Fieldtrips for Digital Natives
- Ten Teaching Technology Tools to Use Today
- Scholar One-on-one Training Sessions
- InnovationSpace: Partnerships and New Technologies
- Geo-tagging and Geo-location in the Classroom
- Concept Mapping
- Collective Intelligence
- Web Personalization

Sparrow, J.L.V. Workshops facilitated:

- New Horizons: Emerging Strategies and Tools for Teaching with Technology

Watson, C.E. Faculty Development Institute, Tracks facilitated or co-facilitated:

- Track A—New Faculty Computing Orientation
- Track D—New Strategies and Tools for Teaching with Technology
- Track J—Fostering Student Engagement, Learning, and Development
- Track Z—Refresher Track—Survey of Summer Content

Watson, C.E. Faculty Development Institute, Workshops taught:

- The Horizon Report: Seeing Tomorrow’s Classroom Today
- Technology and the 21<sup>st</sup> Century Student
- An Overview of Emerging Technological Trends
- Technologies and Strategies which Support Student Engagement
- Podcasting: Creating Podcasts for Higher Education using Audacity
- Podcasting: Creating Podcasts for Higher Education using GarageBand

Zaldivar, M. Workshop leader, Faculty Development Institute Summer 2008, Fall 2008, and Spring 2009. Workshops taught:

- “Scholar Everyday”
- “Scholar Encore!”
- Scholar Overview
- Scholar for Researchers
- Overview of ePortfolios
- ePortfolio: Virginia Tech’s ePortfolio system within Scholar
- ePortfolios for Assessment
- ePortfolios for Learning
- ePortfolios for Professional Development
- Scholar: Something for Everyone (An Overview), May 22

Zaldivar, M. Workshop leader. Office of Academic Assessment. Fall 2008 and Spring 2009, workshops taught:

- An Overview of Assessing Student Learning
- The ePortfolio as a Program Assessment Tool

Zaldivar, M. Classroom training leader, ePortfolio Initiatives, Fall 2008 and Spring 2009—courses or groups within these programs were visited for purposes of training students

- English Department
- Office of Sponsored Programs
- Theater Arts Department
- Social Studies Education

- Health, Nutrition, Food, and Exercise: Didactic Program in Dietetics
- Engineering Education, Ph.D. Program

## Workshops attended

Zaldivar, M. Online Assessment. TLT Group. Oct 4, 2008. Online.

Zaldivar, M. International Coalition of ePortfolio Research. Cohort V meeting. January 25-27, 2009. San Francisco, CA

## Graduate committees

Fowler, S. Dissertation committees—two defenses (Educational Research and Evaluation and Marriage and Family Therapy)

Moore, A.H. Two dissertation committees—one candidate successfully completed requirements in Environmental Design and Planning, Spring 2009; one candidate in process in Planning, Governance, and Globalization with preliminary exams completed and dissertation underway

Sparrow, J.L.V., One Master's committee, Civil Engineering

## Publications

Adams, D. and Moore, J. Storage capacity issues and forecast for learning, portfolio and collaboration systems; internal white paper, April 2009

Moore, A.H. "Framing Assessments of Technology-Assisted Learning Outcomes to Benefit Students in the 21<sup>st</sup> Century." In Patricia Rogers et al. (eds.) *Encyclopedia of Distance and Online Learning*. IGI Global, December 2008.

Cole, R., and Schwartz, E., editors. Virginia Tech Multimedia Music Dictionary—  
[www.music.vt.edu/musicdictionary/](http://www.music.vt.edu/musicdictionary/)

Diaz, V., Garrett, P.B., Kinley, E.R., Moore, J.F., Schwartz, C., and Kohrman, P. (May/June 2009). Faculty Development for the 21st Century. *Educause Review*, 43(3).

Watson, C.E., Zaldivar, M., Summers, T. (in press). ePortfolios for learning, assessment, and professional development. In R. Donnelly, J. Harvey, and K.C. O'Rourke (Eds.), *Critical design and effective tools for elearning in higher education*. Hershey, PA: IGI Global.

Zaldivar, Marc. "ePortfolios for Learning, Assessment, and Professional Development." [In Press.] Co-authors: C. Edward Watson and Teggins Summers. *Critical Design and Effective Tools for E-Learning in Higher Education: Theory into Practice*. IGI Global



## 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 5554 Educating Exceptional Learners Across the Lifespan
- EDCI 5784 Science Education” Graduate Seminar
- FIN 3055 Legal Environment of Business
- FIN 4014 Internet, Electronic and Online Law
- ISE 5604 Human Information Processing

Evans, A.D., Gordon, P., McPherson, D. “UVa and VT: Cross Campus Collaboration”. 2009 ACCS Conference, March 2009, Charlottesville, VA.

Evans, A.D., Hubbard, J., Mays, J., McPherson, D. “Supporting VT's Large and Diverse Campus”. 2009 ACCS Conference, March 2009, Charlottesville, VA.

Fowler, S.B. “ePortfolios at Virginia Tech: Reflections on Cultural Change and Open Source Development,” co-presented with Anne Moore, Patrick Guilbaud, and Marc Zaldivar, Campus Technology conference, Boston, July 2008.

Fowler, S.B. “Pedagogical Strategies for Preparing 21st-century Engineers,” invited by Don Taylor, Dept. Head of Industrial Systems Engineering to present at their ISE Fall Faculty Retreat, Aug. 2008.

Fowler, S.B. “Integrating Technology into a 21<sup>st</sup>-century Teaching Practicum,” co-presented with Jeshua Pacifici and Laura Levi-Altstaedter, International Society for Exploring Teaching and Learning, Las Vegas, Nevada, Oct. 2008.

Fowler, S.B. “Institutionalizing the ePortfolio: Addressing Assessment, Pedagogy, and Professional Development Issues for Widespread Adoption,” co-presented with Eddie Watson and Marc Zaldivar, Educause Learning Initiative (ELI), Orlando, Jan. 2009, and another shorter version for the EdTech Alliance, VT webcast, April 2009.

Fowler, S.B. Citizen-Scholar Engagement Seminar guest lecture, Feb. 2009

Fowler, S.B. “Integrating Technology into the Arts,” panelist for the Imaging America conference, VT, Feb. 2009.

Fowler, S.B. “Sexual Orientation Issues in Higher Education,” guest speaker/panelist, ELPS 5334, Feb. 2009.

Fowler, S.B. EDRE 6704, guest lecture, April 2009.

Fowler, S.B., Watson, C.E., and Zaldivar, M. (2009, January). *Institutionalizing the e-portfolio: Addressing assessment, pedagogy, and professional development issues for widespread adoption*. Paper presented at ELI 2009 Annual Meeting, Orlando, FL.

Head, J.T., Emery, L. Zeckoski, A., and Borkowski, Ellen. “Deploying an Open Source, Online Evaluation System: Multiple Experiences.” Paper presented with the University of Maryland, the University of Michigan, and Cambridge University. EDUCAUSE 2008. October 31, 2008. Orlando, FL.

- Moore, A.H. "New Technologies and New Learning." May 25 – June 2, 2009. International Seminar: Building Sustainable International Partnerships for the Promotion of Educational Technology in Tertiary Institutions. Virginia Tech (host) and the University of Virginia.
- Moore, A.H. "Developing a Valid Assessment Plan." March 2009. Redesign Alliance Annual Conference. Orlando, FL. With Peter Ewell, Jim German, and Dennis Pearl.
- Moore, A.H. "Higher Education Challenges and Policies: The Implications for Technology and eLearning. March 2009. SIIA EdTech Government Forum. National Press Club. Washington, DC. With Kevin Carey and Jacqueline King.
- Moore, A.H. "New Technologies and New Learning: Are We FIT For Our Age? February 2009. 5<sup>th</sup> Teaching and Learning with Technology Conference: Spotlight on Innovation. Center for Instructional Technology. James Madison University. Harrisonburg, VA.
- Moore, A.H. "Framework for Assessment: Technology-Assisted Learning and Collaboration." September 2008. Common Solutions Group Meeting. Ithaca, NY.
- Moore, A.H. "E-Portfolios at Virginia Tech: Reflections on Cultural Change and Open Source Development." July 2008. Campus Technology Annual Conference. Boston, MA. With Shelli Fowler, Patrick Guilbaud, and Marc Zaldivar.
- Moore, J.F. Virginia Tech status reports. Learning Technology Consortium, Gainesville FL and Chapel Hill, NC.
- Plymale, W.O., Seventh Annual IEEE International Conference on Pervasive Computing and Communications, "Pebbles and Urns: A Tangible, Presence-Based Messaging Service", March, 2009, Galveston, Texas.
- Watson, C.E. (2008, December). *How change models for higher education inform rollout strategies for Sakai and OSP*. Paper presented at Fall 2008 Sakai Regional Conference, Blacksburg, VA.
- Eke, K., Watson, C.E., Fenlason, C., Clouser, S., and Gordon, T. (2008, December). *Planning pilot programs and production: A panel*. Paper presented at Fall 2008 Sakai Regional Conference, Blacksburg, VA.
- Zaldivar, M. "ePortfolios at Virginia Tech: Reflections on Cultural Change and Open Source Development." Campus Technology '08. July 29-31, 2008. Boston, MA.
- Zaldivar, M. "Measuring and Analyzing Student Learning Outcomes." Co-Presenters: Steve Culver and Ray Van Dyke, Office of Academic Assessment. Sakai Regional Conference. Nov 11-12, 2008. Blacksburg, VA.
- Zaldivar, M. "Student Team Collaborates to Design an Assessment-based Electronic Portfolio at Virginia Tech." Co-Presenters: Susan Clark, Janice Bailey, Ashley Holmes, Melissa Hendricks, Gabrielle Willis, Rachel Miller, Erin Griffin, Amanda Eskew, Hannah Goff, Hannah Goff, and Hannah Goff. Sakai Regional Conference. Nov 11-12, 2008. Blacksburg, VA.
- Zaldivar, M. "Crafting ePortfolios: The Role of Student Leaders in Developing Models of Reflective Practice." Co-Presenters: Nancy Metz, Brittney Davis, Alexandra Ford, Liz Hardwick, Caitlin Laverdiere, Bristol Lowder, Patrick McCarthy, Sara Musick, Alexandra Orchard-Hays, Sarah Puckett, Lorelle Stephanski, and Katie Stitt. Sakai Regional Conference. Nov 11-12, 2008. Blacksburg, VA.
- Zaldivar, M. "Institutionalizing the ePortfolio." Co-Presenters: Eddie Watson and Shelli Fowler. ELI 2009 Annual Meeting. January 20-22, 2009. Orlando, FL.
- Zaldivar, M. "Showcase on Student Growth: Development of the English Studies ePortfolios." Co-Presenters: Leigh Ann Benson, Lindsey Brookbank, Alexandra Ford, Lindsey George, Lizzie Hardwick, Caitlin Laverdiere, Patrick McCarthy, Nancy Metz, Jared Rowan, Alex

Orchard-Hays, Lorelle Stephanski, and Katie Stitt. Conference on Higher Education Pedagogy. Poster Session. Center for Excellence in Undergraduate Teaching. February 18, 2009. Blacksburg, VA.

Zaldivar, M. "Student Team Collaborate to Design an Assessment Based Electronic Portfolio." Co-Presenters: Susan Clark, Janice Bailey, Ashley Holmes, Melissa Hendricks, Gabrielle Willis, Rachel Miller, Erin Griffin, Amanda Eskew, Hannah Goff, Hannah Goff, and Hannah Goff. Conference on Higher Education Pedagogy. Center for Excellence in Undergraduate Teaching. February 18, 2009. Blacksburg, VA.

Zaldivar, M. "ePortfolios as a Sustainable Computing Activity." Co-Presenter: Teggin Summers, Ph.D. Computers and Writing Online Conference. February 16-March 1, 2009. Online Wiki-based Conference Activity.

Zaldivar, M. "Institutionalizing the ePortfolio." EdTech Alliance Webcast. April 15, 2009. Online.

## 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. Youth Leadership Forum (YLF-VA) "Empowering Young Leaders for the 21st Century" (A four-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 educators"

Brackett, H.J. and Holbach, W.H. Upward Bound Talent Search "Encourages first-generation college students to pursue a college education"

Brackett, H.J. and Holbach, W.H. NASA INSPIRES (Interdisciplinary National Science Project Incorporating Research and Education Experience) Students came to the AT Lab for hands-on experience with assistive technologies

Brackett, H.J. and Holbach, W.H. C-Tech<sup>2</sup> "Computers and Technology at Virginia Tech" High school junior and senior girls experienced the range of assistive technologies

Brackett, H.J. and Holbach, W.H. Kids' Tech University "Kids between 8 and 12 years old interacted with a range of assistive technologies"

Fowler, S.B. Co-Organizer for the Electronic Campus of Virginia (ECVA) conference at VT. Invited Michael Wesch and Sarah Robbins Bell to campus, and introduced Wesch prior to his campus lectures, Sept. 2008.

Moore, A.H. Sponsor – EdTechAlliance webcast, April 2009.

Moore, A.H. Sponsor, Center for Digital Discourse and Culture, Invited luncheon speaker and afternoon forum on copyright and new media. February 2009.

Moore, A.H. Sponsor – CEUT Annual Conference on Higher Education Pedagogy @ Virginia Tech. February 2009.

Moore, A.H. Sponsor – Electronic Campus of Virginia (ECVA) conference at VT, September 2008.

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

Moore, A.H. Oman University Development Team, October 2007 –  
 Plymale, W.O., Judge, FIRST Lego League 2008 State Competition  
 Schwartz, E. Swiss International Teachers' Project (SITP), " Innovative Computing at Virginia Tech". July 2008.  
 Schwartz, E. Teaching and Technology Workshop for trainers from the U.S. Army Training and Doctrine Command (TRADOC). September 2008.  
 Sparrow, J.L.V. InnovationSpace lab was available for 159 non-Virginia Tech affiliated community members.  
 Sparrow, J.L.V., Upward Bound Multimedia Course.  
 Watson, C.E. Taught professional development workshop for US Army – TRADOC  
 Zaldivar, M. Overview of ePortfolios with OSP. Talk given to Radford's Learning Technologies and Assessment groups. Aug. 28, 2008.

## University service

Brackett, H.J. and Holbach, W.H. Hosted an Open House for Disabilities Awareness Week  
 Brackett, H.J. and Holbach, W.H. Hosted an Open House for Family Day  
 Fowler, S.B. Earth Sustainability Pedagogy Consultant  
 Head, J.T. Member of the University Committee on the Evaluation of Teaching. The committee issued a report this spring that offers recommendations for improvements and revised practices including a new questionnaire for student ratings of instruction.  
 Moore, A.H. Assembled *ad hoc* advisory group related to large-scale, technology-assisted, undergraduate course design, consultation related to pedagogy, technology integration, and learning outcomes, December 2008-  
 Moore, A.H. University Leadership and Professional Development Team, 2007-09  
 Moore, A.H. University Strategic Planning for the Arts Initiatives, Roanoke Art Museum and University Performing Arts Complex, 2006-  
 Moore, A.H. Advisory Committee, Center for Creative Technology in the Arts, 2008-  
 Moore, A.H. Affiliated Faculty, Institute for Governance and Accountabilities, 2005-  
 Moore, A.H. University director, Center for Innovation in Learning; Coordinates annual XCaliber Award, 1998-  
 Moore, J.F. Member, Center for Innovations in Learning xCalibur Award committee  
 Moore, J.F. Member of CEUT internal grants committee (under Terry Wildman).  
 Moore, J.F. Member, Leadership and Training Committee, University Employee Development.  
 Moore, J.F. Member, University Computing Requirements Committee.  
 Moore, J.F. Member, Search Committee for director of information technology for the College of Engineering.  
 Moore, J.F. Chair of purchasing review committee, new LMS state contract  
 Plymale, W.O., Technology advisor, Assisted Center for Creative Technologies in the Arts (CCTA), 2008-  
 Plymale, W.O., Member of IT PKI Policy Management Authority (PMA)  
 Plymale, W.O., Member of IT Converged Security Taskforce  
 Schwartz, Ed. Member of the Center for Creative Technologies in the Arts working committee, 2008-

Watson, C.E. Served on CLAHS' Strategic Planning Committee.  
Watson, C.E. Served on the Office of Academic Assessment Advisory Board.  
Watson, C.E. Chaired FDI Panel Discussion entitled "Teaching with Scholar"  
Watson, C.E. Chaired FDI Panel Discussion entitled "Faculty Life at Virginia Tech"  
Zaldivar, M. Quality Enhancement Plan Management Committee. March 2009-present.  
Zaldivar, M. English Department Summer Assessment Group. May 2009.

## Professional service

Fowler, S.B. Named co-director of the EDUCAUSE Learning Technology Leadership Institute for 2009 and 2010. [http://net.educause.edu/content.asp?SECTION\\_ID=430](http://net.educause.edu/content.asp?SECTION_ID=430)  
Holbach, W.H. Advisor to the Montgomery County Public Schools High School/High Tech program  
Moore, A.H. Program Advisory Committee, The OPEN Forum, December 2008.  
Moore, A.H. rSmart Innovators Program, Advisory Group, April 2008 –  
Moore, A.H. Pearson Strategic Advisory Board, November 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  
Moore, A.H. Commons Solutions Group, 2005-  
Moore, A.H. EDUCAUSE Center for Applied Research, Institutional Representative to ECAR, 2003-  
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. Invited candidate for board of directors, Sakai Foundation.  
Moore, J.F. Conference organizer, Sakai Regional Conference at Virginia Tech.  
Moore, J.F. Member, Learning Technology Advisory Committee, SCHEV.  
Moore, J.F. Reviewer, 2009 Virginia Outstanding Faculty Awards, Teaching with Technology category, SCHEV.  
Moore, J.F. Participant, Educause national conference, Orlando.  
Moore, J.F. Participant, Vision2020 symposium on mobile technologies, University of Cincinnati.  
Moore, J.F. Consultant on Sakai implementation, Miami University.  
Moore, J.F. Participant, Virginia virtual computer labs planning meeting, Richmond.  
Watson, C. E. Co-chaired the first Regional Sakai Conference, held at The Inn at Virginia Tech, including all conference planning as well as proposal review, schedule development, conference room details, etc.

Watson, C.E. Actively served on the Review Board of the International Journal of Teaching and Learning in Higher Education.

Watson, C.E. Served on Cengage Learning's Advisory Board.

Watson, C.E. Served as judge for the DMSC Governor's Challenge Academic Media Tournament.

Sparrow, J.L.V., Served on the Review Board of the International Journal of Teaching and Learning in Higher Education.

## University and community service

Dustin, J., Lieutenant for Blacksburg Fire Department

Dustin, J., Provided technical support for VT Engage

## Research

Brackett, H.J. and Holbach, W.H. Advisors to 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. Technical and assistive technologies support for the Community Living Connection (CLiC) sponsored research project

## Awards

Dustin, J., Virginia Tech Employee of the Week.

Dustin, J., Nominated for Governor's Customer Service Award and President's Award for Excellence.

Evans, A. D. M.S. in Instructional Design and Technology at California State University, Chico.  
May 2009.

Evans, A. D. Finalist for Virginia Tech's XCaliber Award for Exemplary Teaching with Technology Project (Team Award) – Scholar Course site, "Urbanization and Development."  
March 2009.

# network infrastructure and services

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Network Infrastructure and Services reports to Associate Vice President Judy L. Lilly, 1770 Forecast Drive (0506), Blacksburg, VA 24061. The departmental website is [www.cns.vt.edu](http://www.cns.vt.edu). Judy Lilly may be reached at 540/231-2599.

Network Infrastructure and Services (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 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. In response, NI&S continually invests in innovations and improvements that directly support university programs that enhance Virginia Tech's reputation as a research university in an increasingly competitive, global, and digital environment. 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; and improve the quality of life for citizens of the commonwealth.

## **Infrastructure and access**

NI&S participates in and supports the deployment of wide-area, high-performance computing and communications to provide the university with ubiquitous and direct access to high-speed, national and international, research networks and facilities.

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 for tomorrow’s unified communications infrastructure. Based on a diverse, survivable, optical core with ubiquitous wireless and wired access, the enhanced network will provide a pervasive, leading-edge, technology infrastructure to support the vision and mission of the university well into the future.

**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 to improve delivery of services and accelerate the deployment of new technologies.

Staffing by unit

Unit	2005	2006	2007	2008	2009
Communications Network Services	110	113	114.5	114.5	113.5
Systems Support Services—Help Desk/4 HELP	21	21	16	21	23
Systems Support Services—Server Administration	12	11	12	12	13
Systems Support Services—E-Communications Clients	8	8	9	7	8
Video/Broadcast Services	14	14.5	14.5	15.5	15.5
University Printing and Digital Imaging	26	26	2	26	*N/A
University Mail Services	19	18	18	19	*N/A
Total staffing (faculty and staff)	210	212.5	210	215	173

\*Effective July 1, 2008, University Printing and Digital Imaging and University Mail Services and their employees report through the Office of Transportation and Campus Services.

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. 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. In so doing, the organization has always emphasized financial integrity and stability, administered a balanced budget, and ensured financial resources are available for reinvestment in 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.

## Organization

### 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. For example, 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-Atlantic Broadband Cooperative and LENOWISCO Fiber-optic Project.** The Mid-Atlantic Broadband Cooperative (MBC) and LENOWISCO Planning District Commission are regional infrastructure projects designed to connect to National LambdaRail and expand economic development and commercial innovation in far Southwest Virginia. 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 is led by Carl Harris. The 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. They recommend new technologies and manage the integration of those technologies into the university's local and wide-area communications environments. Team members perform a variety of theoretical and practical research in network protocols, standards, services, methodologies, and best practices. The team acts as a liaison to research faculty in defining advanced network and application requirements to meet their needs.

Activities for Research, Development, and Technology Innovation include the following:

- 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
- 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
- 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 the following:

- IP address assignment. Every host (computer) in the Internet has an IP address. This unit manages the IP addresses assigned to Virginia Tech.
- IP domain name service (DNS). DNS associates host names with IP addresses.
- Dynamic host configuration protocol (DHCP) service. DHCP automatically configures network connections for registered hosts that allows 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

John Pollard leads Network Engineering and Management that includes Network Engineering, Switch Engineering, Telecommunications Facilities Management, Field Engineering, and Safety.

**Network Engineering.** 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. Network Engineering (NE) is led by Brian Jones.

The NE team implements, manages, and operates the university network. Team members utilize and manage new protocols, identify and test new products, 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; systems and applications integration, utilization, and administration.

Infrastructure planning and upgrades. Appropriate physical facilities, up-to-date cable plant, and constantly upgraded network systems are essential elements of the university's communications infrastructure. NE's comprehensive planning includes the re-engineering of pathways and building wiring as well as the design of quality network architecture and support equipment upgrades.

Network services planning and implementation. NE provides analysis and evaluation of proposed new systems and develops related operational guidelines and procedures to ensure timely deployment of services. 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, NE 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.

Systems and applications integration, utilization, and administration. NE develops, integrates, utilizes, configures, and manages a wide variety of software to efficiently and effectively manage 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.

**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 Barry Linkous, 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, 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 Virginians 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 staff from the Information Technology Security Office and/or personnel 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, 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. ECS-WAS staff respond to Internet abuse complaints, function as members of the Computer Incident Response Team, and provide e-discovery services in support of civil, criminal, and regulatory investigations.

**Storage Management Team.** The Storage Management Team (SMT), led by Wanda Baber, provides self-managed storage and backup 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 equipment administered by SMT staff.

**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, Silicon

Graphics Incorporated [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 IBM 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](http://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 consistently 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 develops 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](http://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, Eclipse Rich

Client Platform, 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 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, manages NI&S reception services, and Web design and documentation. Public Relations staff provides information and assistance to NI&S 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 in one facility that proactively monitors 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 (UCS) is comprised 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 multiple formats (PDF and HTML).



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.

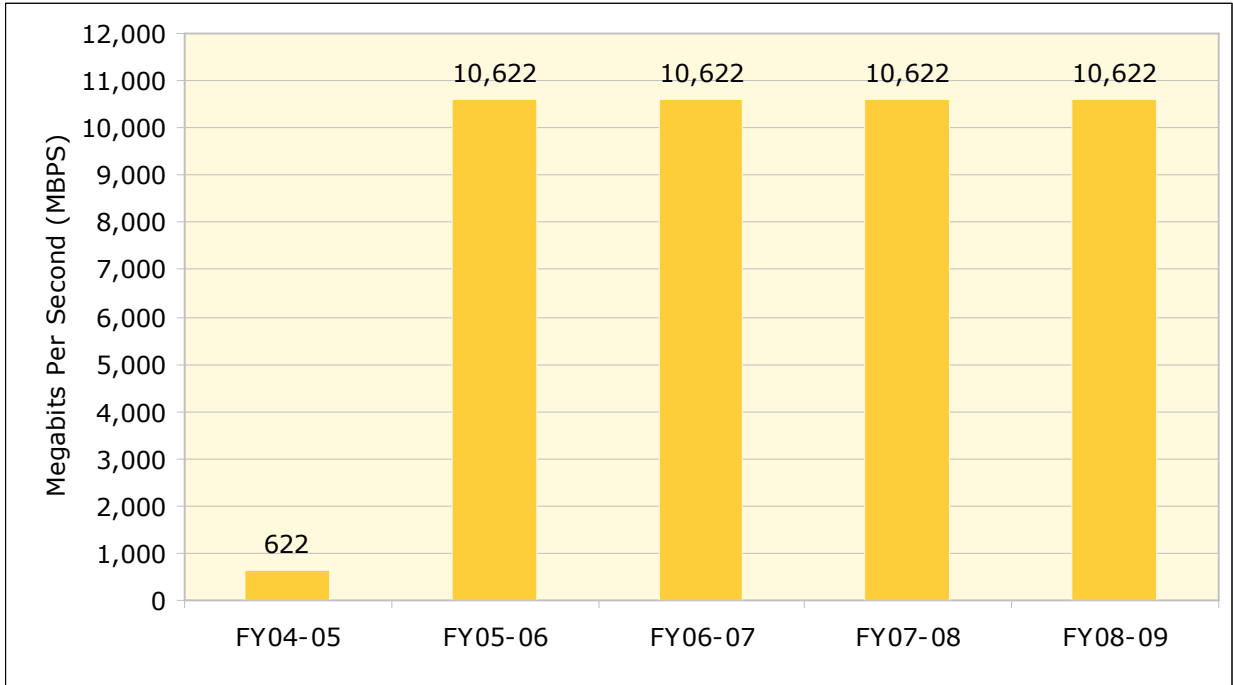
**Network Administration.** Network Administration provides administrative coordination among diverse entities involved in delivering telecommunications services to the university. The group's duties include relationships with other government agencies and vendors, long-term planning, evaluation of new technologies and services, network design assistance, cost analysis, contract negotiation, communications with customers, and problem resolution.

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.

## Performance and productivity metrics

### Strategic initiatives

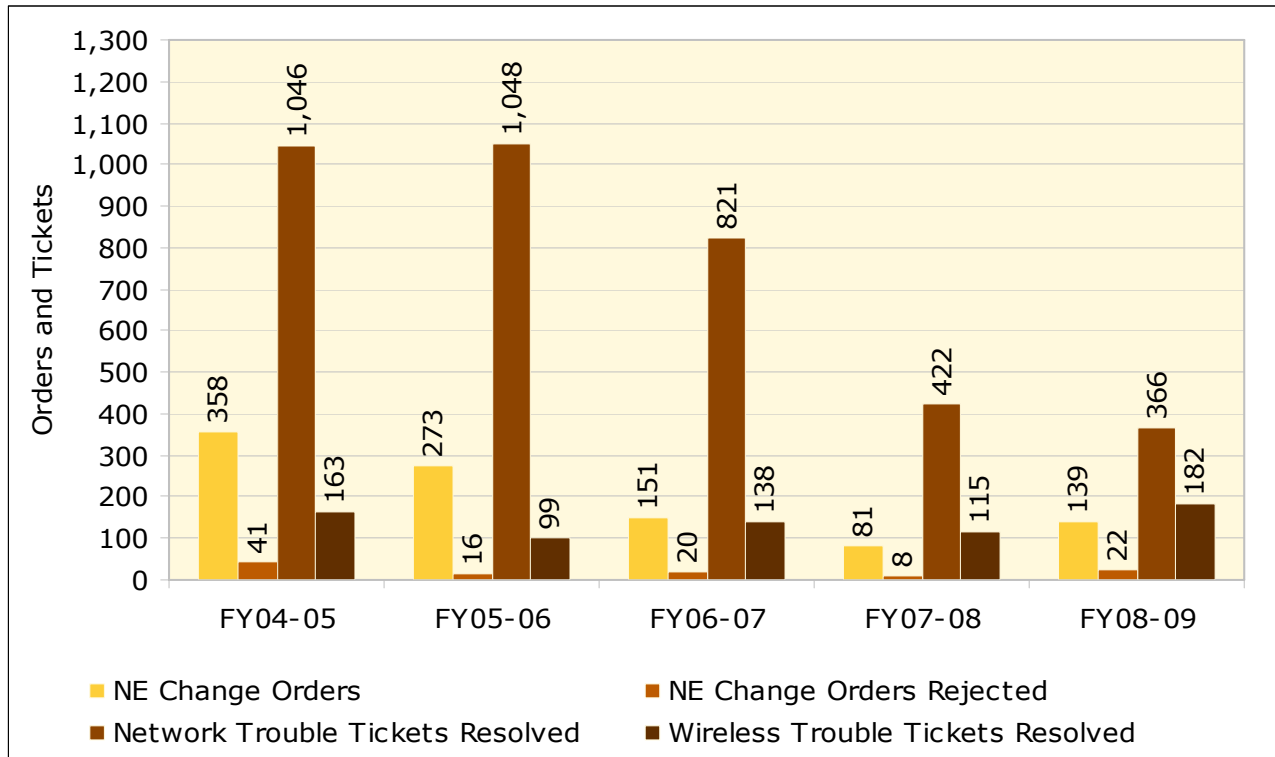
The *campus capacity* graph depicts the aggregate capacity of Virginia Tech's campus connections to the Internet and to national and global research and education networks. Capacity requirements have trended upward with the increased utility of the Internet and the demand for related services. High-performance connectivity for computational research, coupled with increased requirements for visualization and collaborative tools, resulted in a dramatic increase in capacity requirements.



Campus capacity to Internet, Internet2, NetworkVirginia, and National LambdaRail

In 2006, the university implemented VORTEX, a new fiber-optic-based link between the campus in Blacksburg and the National Capital Region Aggregation Facility that is operated by NI&S. VORTEX augmented Virginia Tech's connection to NetworkVirginia, previously the highest capacity link operated by any Virginia university. While VORTEX was expected to provide adequate capacity for three to five years, Virginia Tech anticipated the need to add diversity for reliability and to continue to increase capacity tying the university to the global research community. Additional capacity is expected to be added during the 2009-2010 fiscal year.

## Network Engineering



Change orders and trouble tickets

Network Engineering (NE) change orders are submitted to make changes to existing network configurations or to introduce new equipment and configurations into the network.

The graph's *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* represents 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.

Overall, NE change orders have increased in number this fiscal year due to changes in network software, including security updates. In addition, some core routers were upgraded with new hardware to increase bandwidth capabilities and CPU/processing power.

The number of network trouble tickets has increased during 2008-2009 as a result of the installation of many new wireless access points. However, the number of wireless trouble tickets resolved has also increased from last year.

*Rejected engineering change orders* have increased 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, 19 academic and administrative facilities have received wireless LAN service. As building renovation projects continue to reshape our campus, access points are continually 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, staff, and students choose to use the wireless LAN for mobility and convenience.

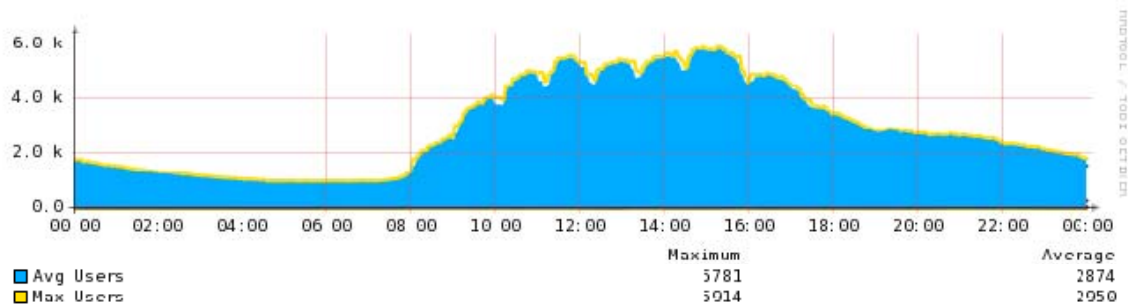
Wireless LAN service

	FY06	FY07	FY08	FY09
Number of on-campus buildings with Wireless LAN Service	106	109	114	129
Number of off-campus buildings with Wireless LAN Service	16	20	29	33
Total number of deployed wireless access points	1,179	1,248	1,359	1,769
Total number of Wireless LAN registrations	23,167	26,358	29,885	32,089

**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 a business day when classes are in session—April 8, 2009.

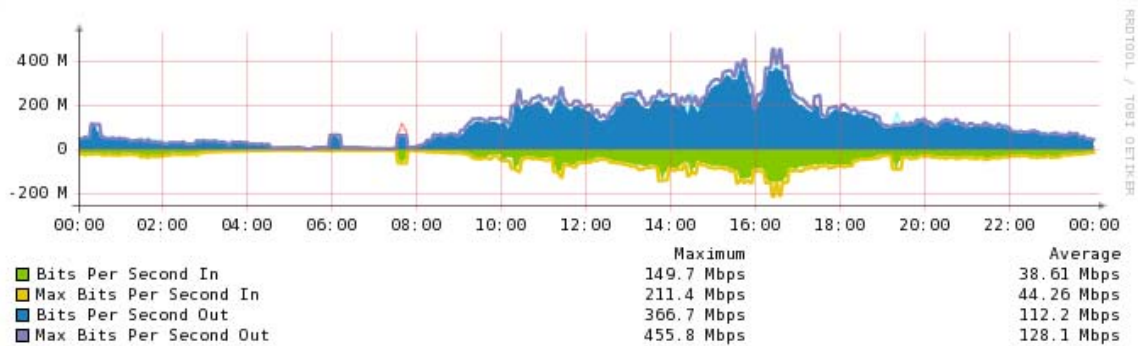
The first graph shows the number of users connected to the wireless service throughout the day. The second graph shows the aggregate bandwidth utilization over the period.

Wireless users—April 8, 2009



Trend analysis of a typical day shows heavy utilization of the service during business hours, peaking at close to 6000 users during the middle of the business day. 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.

Aggregate bandwidth—April 8, 2009

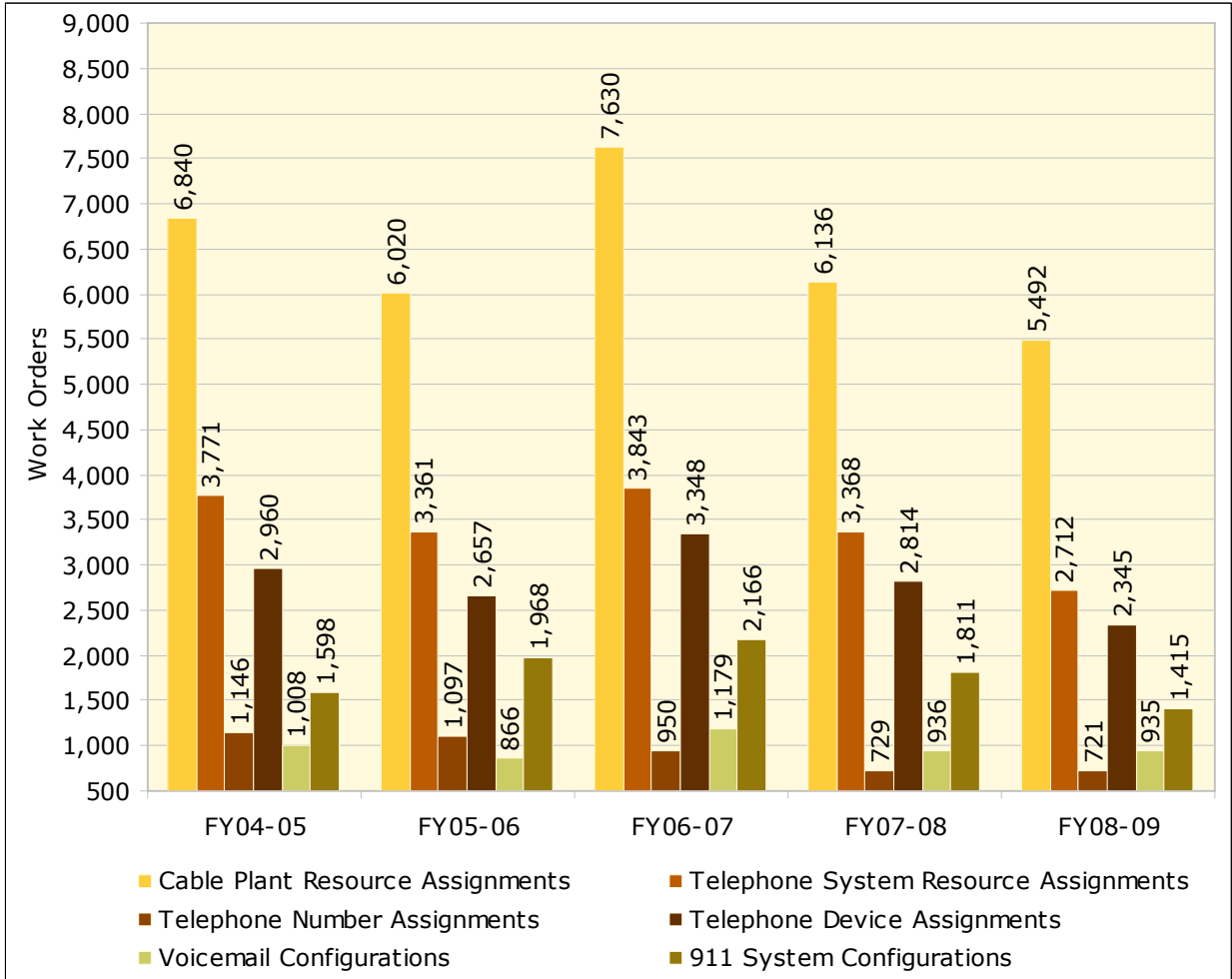


*Bits per second out* represents the amount of bandwidth that the wireless users consumed (downloaded). *Bits per second in* represents the amount of bandwidth generated by the wireless users (uploaded).

The average bandwidth consumed is three 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 below 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.

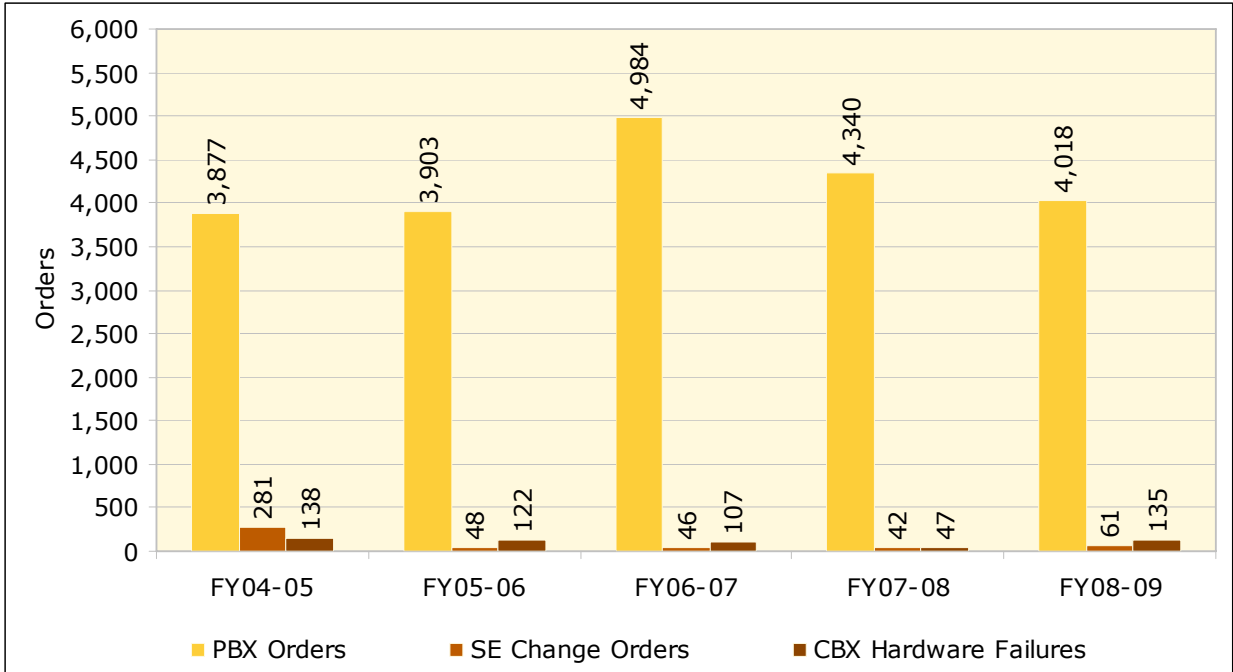


Work order processing

*911 system configurations* tracks 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.

The increase in *cable plant resource assignments* in FY 2006-2007 can be attributed to the service and support efforts in response to the events of April 16<sup>th</sup>. CNS was able to deploy new service and relocate existing services to meet the communications requirements of the university community and law enforcement agencies in the hours and days following the event.

In the graph below, *PBX order* statistics represent the total number of move, add, and change (MAC) 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.



Orders and failures

Switch Engineering (SE) *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 large jump in the quantity of PBX orders in 2004-2005 is associated with the orders required for the new telephone system for The Inn at Virginia Tech and the relocation of a voicemail node to the Northern Virginia Center.

The university’s telephone system is aging but remains highly reliable. The number of *CBX hardware failures*—previously quite low—has begun to increase. As the CBX ages, it is more difficult to repair as dependable replacement parts are difficult to locate. 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 significantly increased due to normal card failures and replacement hardware/cards from the vendor not being as reliable as they were in the past. Currently, when there is a system failure, the magnitude of the problems is much greater; there is a greater potential for user impact; and the time for problem resolution increases.

Telephone system operation and maintenance

	FY06	FY07	FY08	FY09
System availability	99.999%	99.999%	99.999%	99.995%
System hardware failures resolved	0	2	3	2
Operating system and application patches	0	0	0	0
User-reported failures resolved	756	591	412	869
Hardware architecture modification projects	2	2	4	6
Software architecture modification projects	46	49	41	35

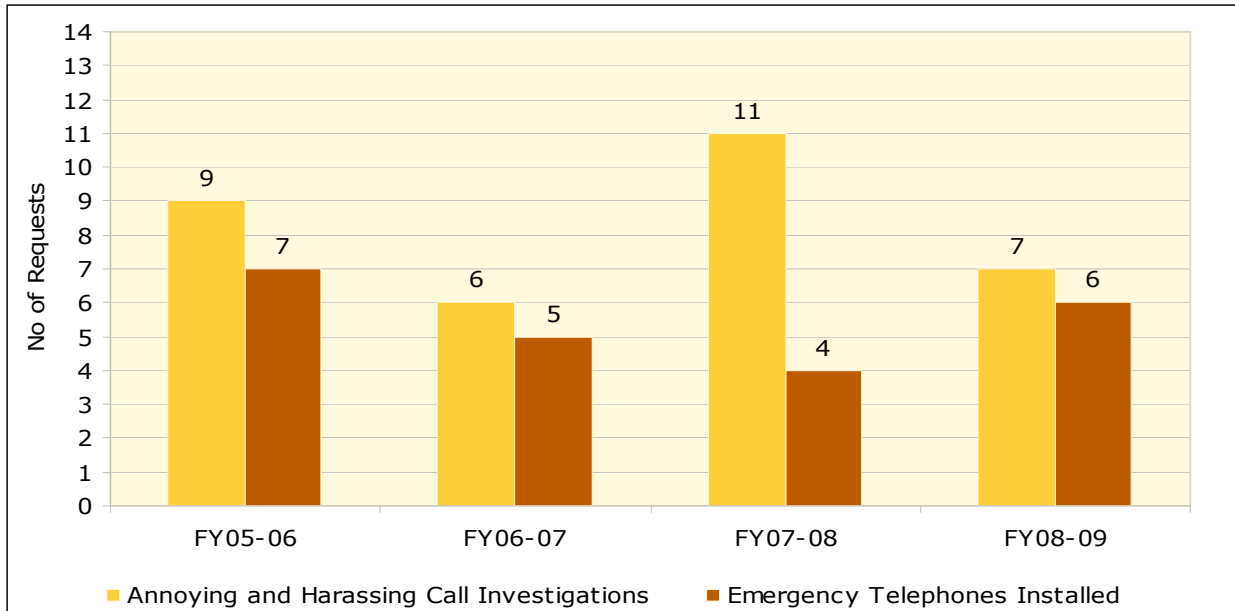
Voicemail system operation and maintenance

	FY06	FY07	FY08	FY09
System availability	99.982%	99.999%	99.999%	99.999%
System hardware failures resolved	3	2	1	2
Operating system and application patches	0	0	0	0
Hardware architecture modification projects	1	2	0	0
Software architecture modification projects	1	2	1	3

The campus telephone system was designed and is maintained to ensure a high level of service availability. The statistics in the preceding tables illustrate the effectiveness of engineering, maintenance, and monitoring efforts of the Switch Engineering group.

We believe the large increase in user-reported failures this year is related to the phone instruments reaching end-of-life and requiring replacement rather than overall system failures.

The graph below 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.



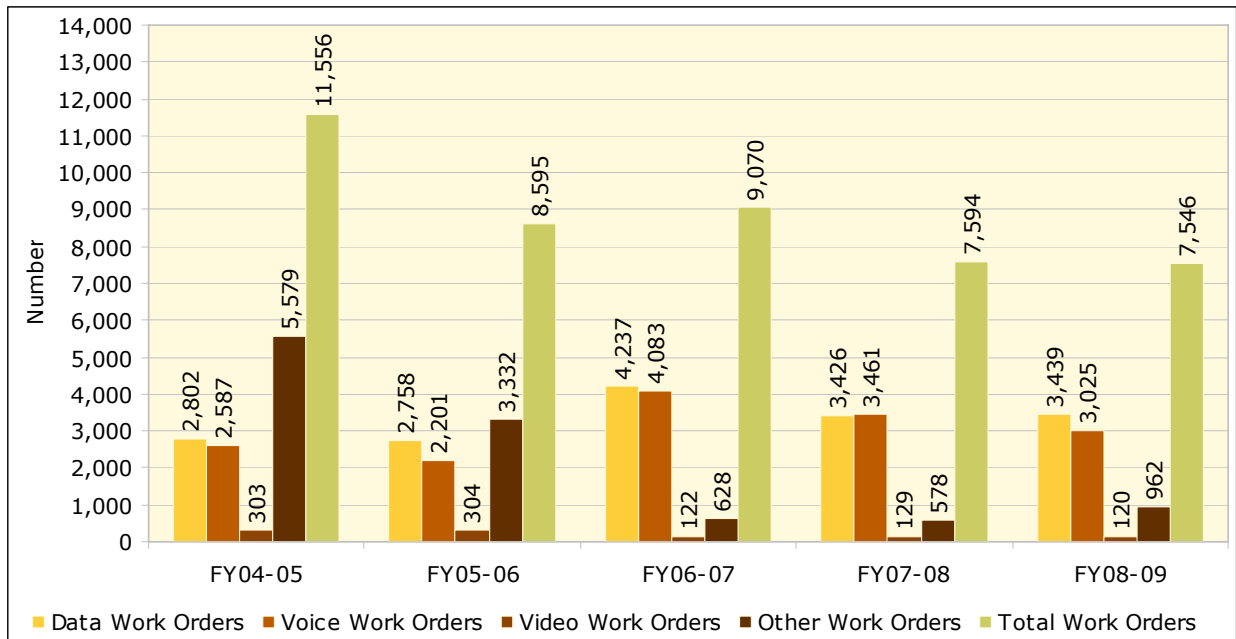
Public safety and regulatory compliance



*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.

## Field Engineering

This graph indicates the number of completed work orders of various types as well as the total of all types of orders completed.



### Work orders

The increase in voice/data orders in 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 16<sup>th</sup> 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.

Note: In 2004-2006, the graph illustrates total work orders processed and worked by the *department*. Beginning in fiscal year 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.

### Capital projects

	FY05	FY06	FY07	FY08	FY09
Total RJ-45 jacks installed (each)	5,548	4,400	1,923	1,639	2,368
Total Cat 6 station cable installed (feet)	818,400	1,101,000	415,700	312,460	443,000
Total Optical fiber fusion splices (splices)	1,776	1,656	1,136	768	1,704

The table above 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.

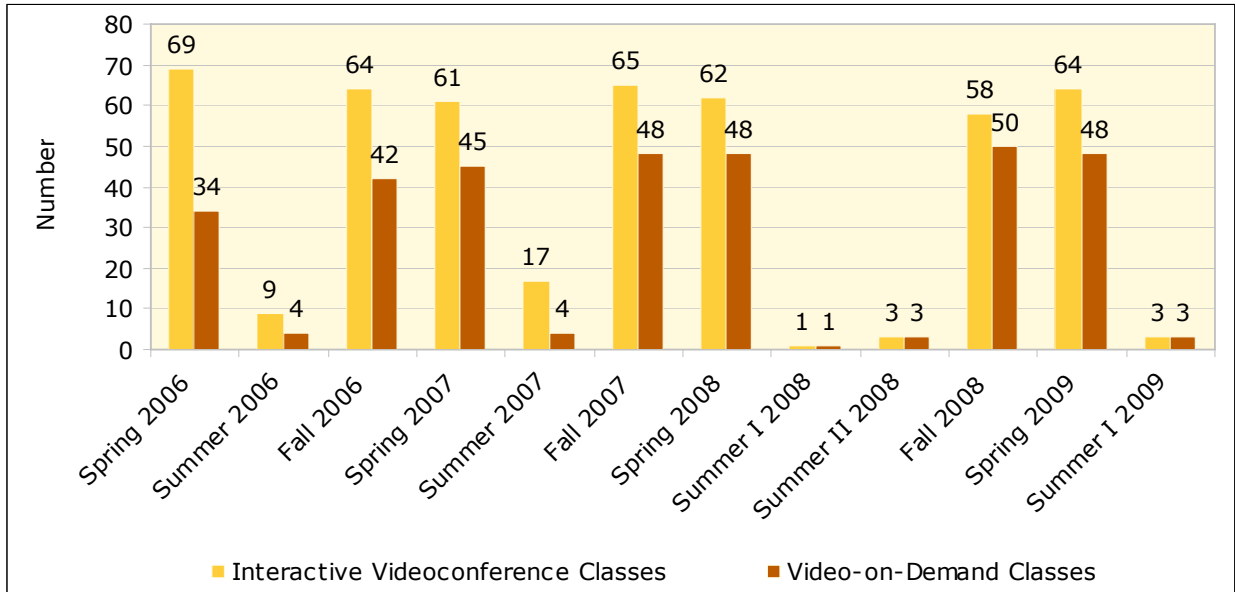
Capital project statistics are compiled for projects completed between July 1 and June 30 of each year. However, these projects typically have a construction duration of one to four years. Field Engineering is frequently engaged in capital project installations where statistics of work performed are 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.

During the past fiscal year, some of the buildings for which new network connectivity was completed are Life Sciences I, Cowgill renovation, Agnew renovation, and the Institute for Critical and Technical Applied Science.

### Video/Broadcast Services

The graph below shows the total number of *interactive videoconference classes* and *video-on-demand classes* supported by Video/Broadcast Services (VBS).

Interactive videoconference and video-on-demand classes

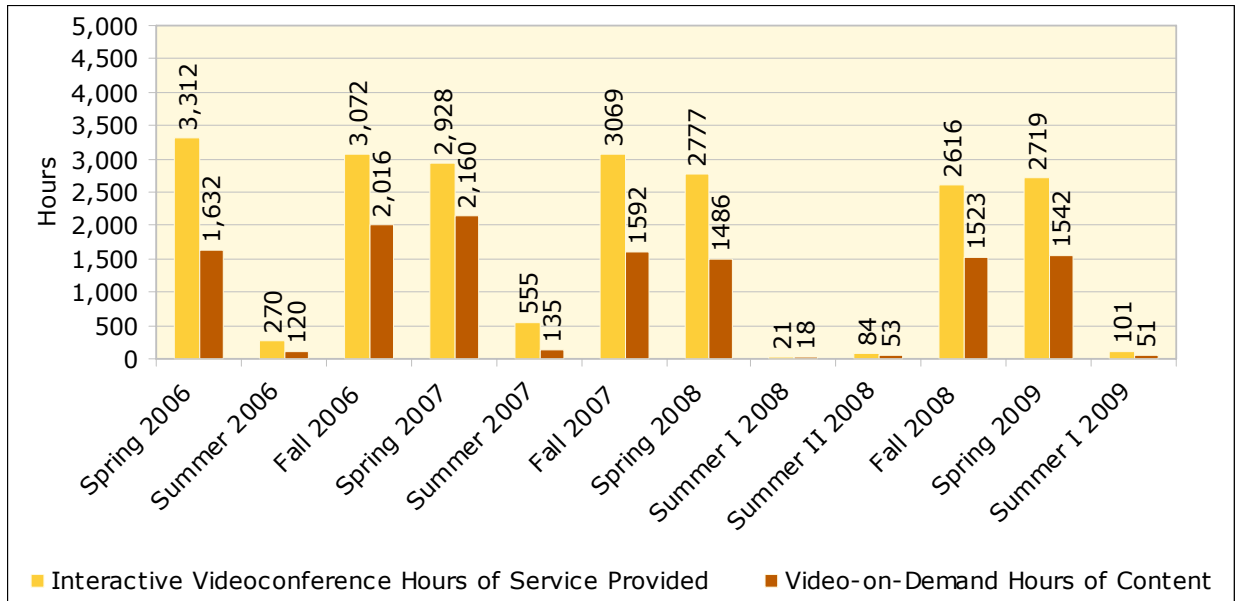


VBS maintains and operates Virginia Tech’s 32 interactive videoconference (IVC) classrooms throughout the commonwealth. VBS coordinates the scheduling of on- and off-campus IVC classrooms, provides video bridging services, and hosts class lectures as video-on-demand files.

Since the technology upgrade in our IVC classrooms over the summer of 2006, there has been a corresponding increase in the demands on the streaming media capabilities.

Note: The number of classes reported for Summers 2006-2007 included those for both Summer Sessions rather than only those through the end of the fiscal year/Summer Session I.

### Interactive videoconference class and video-on-demand hours



This 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.

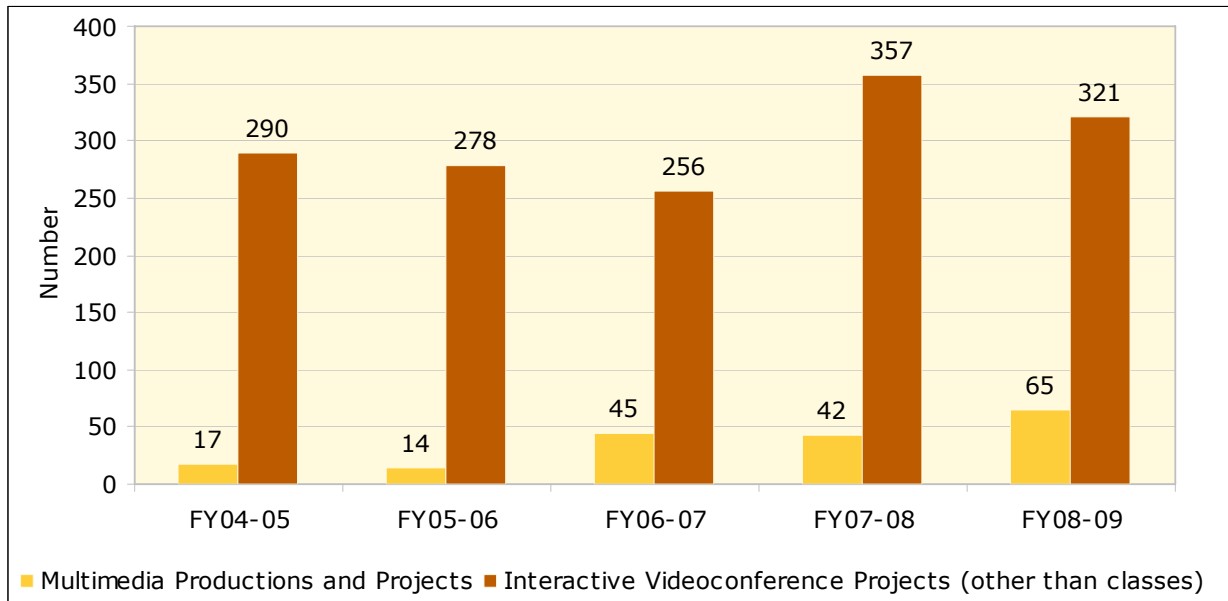
VBS IVC classrooms have the capability to broadcast two separate channels of information simultaneously (dual video). VBS also developed a process to capture and stream dual video content in a single video-on-demand file. The 2006 implementation of dual video in the IVC classrooms and streaming media led to an increase in the number of faculty members requesting that their courses be archived as video-on-demand files.

NOTE: The number of hours reported for Summer 2006-2007 included those for *both* Summer Sessions rather than only those through the end of the fiscal year/Summer Session I.

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.

Depicted in the graph below is the tally of completed multimedia productions. New efficiencies in equipment setup and on-location preparations have been realized, resulting in the capacity to accept on-location production requests with less lead time.

Multimedia and interactive videoconferencing projects



VBS put a new facility into operation in 2007—a fully capable production truck equipped to meet the requirements for on-location video and multimedia production. Equipped with the technology to connect with Virginia Tech’s existing network infrastructure and the Network Operations Center in RB XIV, the new production truck gives VBS an additional video production resource capable of broadcast via satellite uplink and Internet protocol.

The video/multimedia production arm of Video/Broadcast Services produced over 60 projects this year. Of this number, 43 were relatively simple productions such as recording an interview for DVD delivery or uplinking a faculty member’s participation in a national news program. However, there were more than 20 productions that were longer, more complex, and more labor-intensive. 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.

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. The ATM facilities and video bridges were converted to IP facilities during the summer of 2006. ATM videoconference systems and ATM video bridges were decommissioned upon completion of the IP conversion project.

### Interactive videoconference facilities

	FY05	FY06	FY07	FY08	FY09
VNOC—ATM video bridges	2	2	0	0	0
VNOC—IP video bridges	0	2	3	3	3
VNOC—IP VCRs	0	2	3	3	3
ATM origination sites	23	23	0	0	0
ATM receive sites	18	17	0	0	0
IP origination sites	0	0	22	22	22
IP receive sites	0	0	10	10	10
RAID 5 streaming media storage server (terabytes)	1.1	2.2	7	10	10

In 2006, VBS operated two Codian IP Video Bridges and two Codian IP VCRs. In early 2007, VBS added a video bridge and an IP VCR dedicated to research and development. This arrangement gives VBS the capacity for offline testing of videoconferencing software upgrades and patches without jeopardizing the integrity of the machines used in daily productions.

During 2007-2008, a portion of the VNOC's research and development (R&D) infrastructure was moved from the Corporate Research Center (CRC) to Whittemore Hall. The core of the new R&D area consists of a multi-conference unit (MCU) and an Internet protocol videoconference recorder (IPVCR). The new on-campus infrastructure provides a redundant system to maintain operations in case of an emergency at the CRC location.

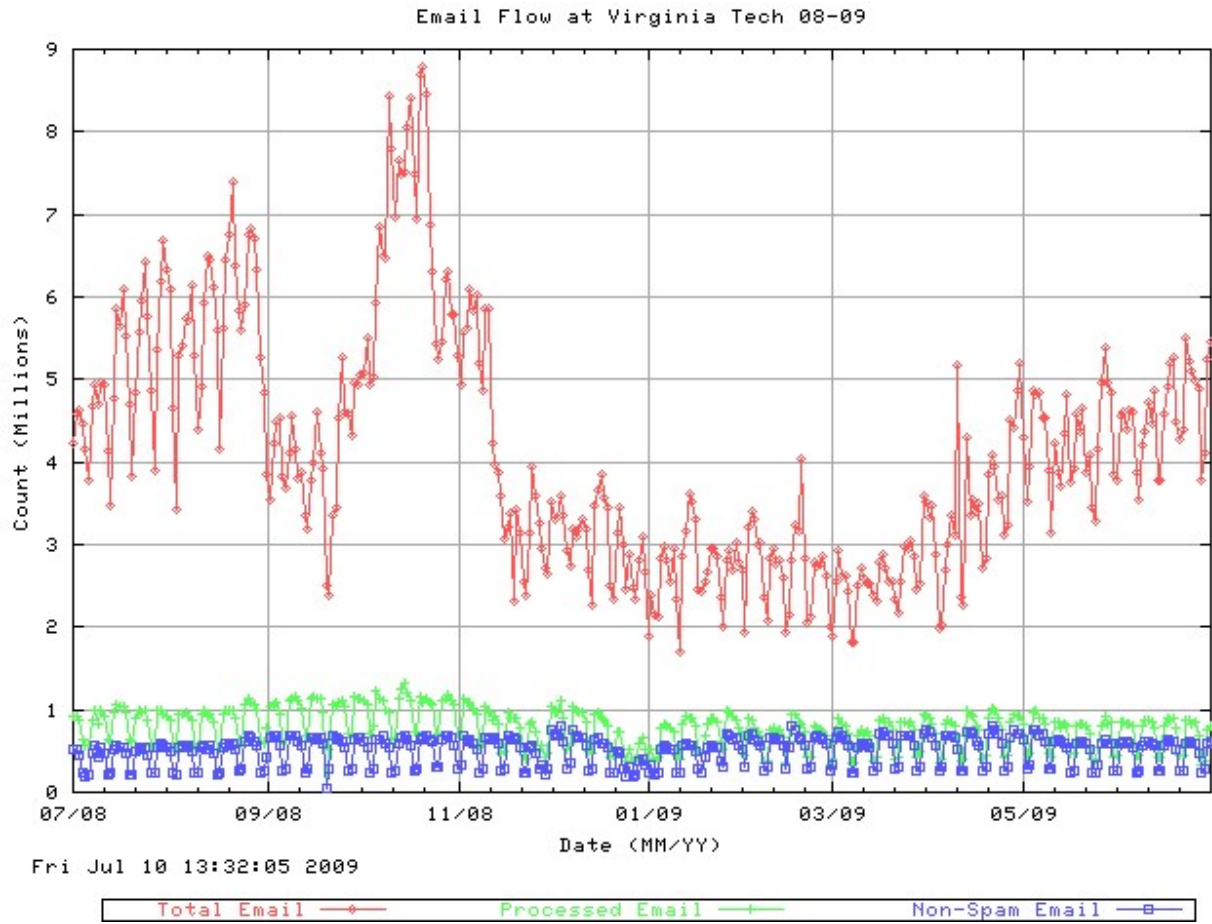
### Service calls by VBS engineer

	FY06	FY07	FY08	FY09
Off-campus calls resolved by remote access or telephone support	65	53	51	61
Off-campus calls resolved by on-site visit	17	10	8	11
On-campus calls resolved on-site	21	26	27	29

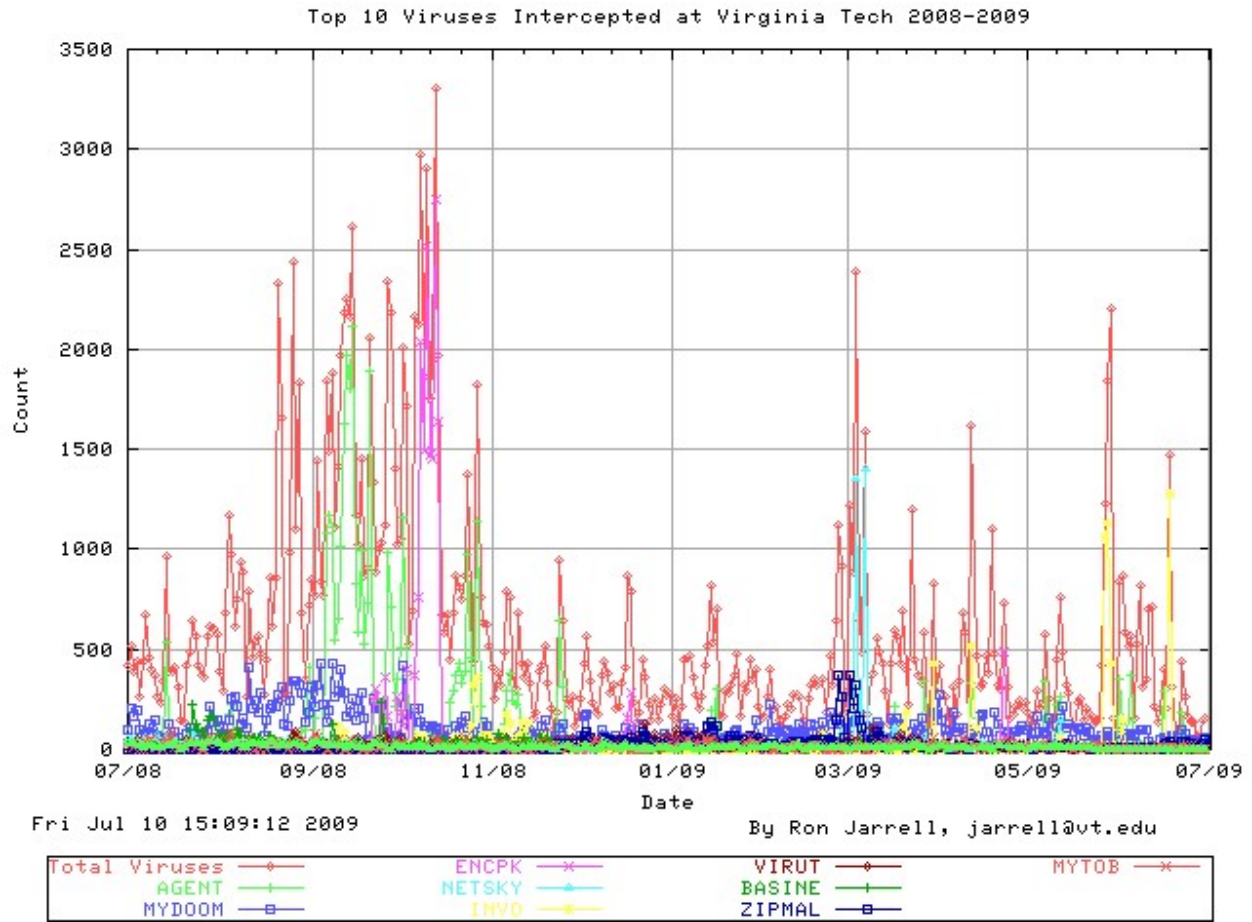
VBS Field Engineering provides planning, installation, and maintenance services for Virginia Tech's interactive videoconference facilities located on the Blacksburg campus and across the commonwealth. VBS Field Engineering handles routine and preventive maintenance of video systems, providing a fast response for the repair or replacement of broken equipment and coordinates efforts with the VNOC to resolve communication problems.

## Systems Support

This graph illustrates the flow of e-mail into the Virginia Tech domain from July 2008 through June 2009. The red line hovering between 1 and 9 million represents all e-mail messages received. The green line (in the 300,000 to 1.5 million range) represents messages actually processed through the system (not blocked or rejected due to viruses or suspected spam). The blue line (between 100,000 and 600,000 messages) represents those messages that were delivered and not tagged as being potential spam



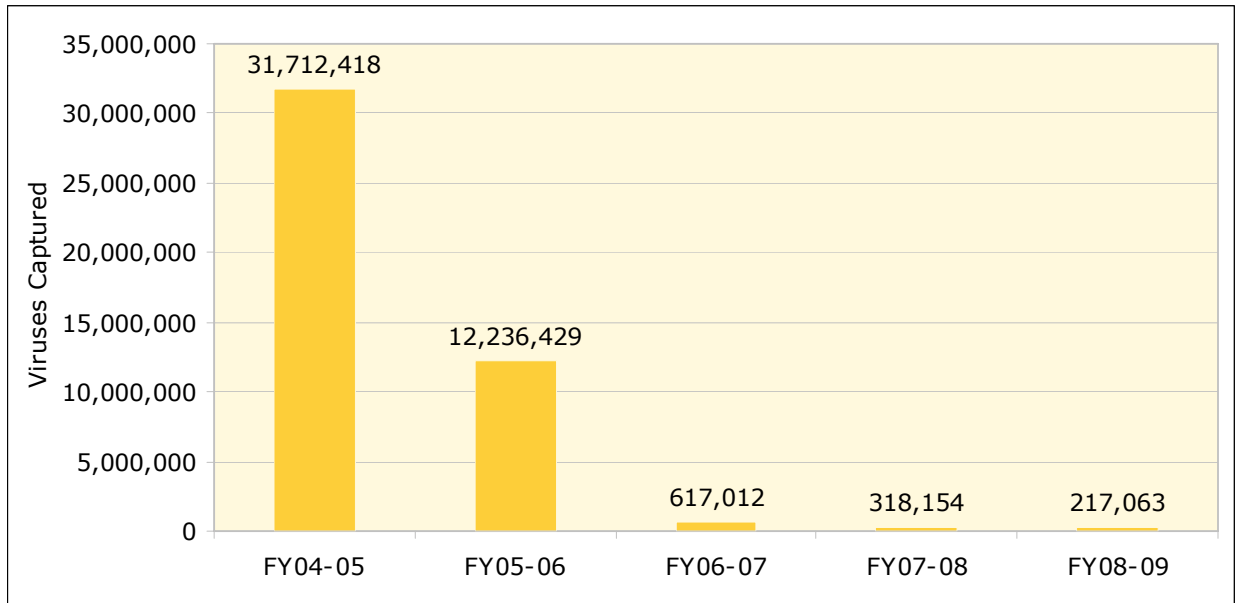
The next graph represents the “Top Ten” viruses received at Virginia Tech during the year. All of these viruses were intercepted by the virus scanners.



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.



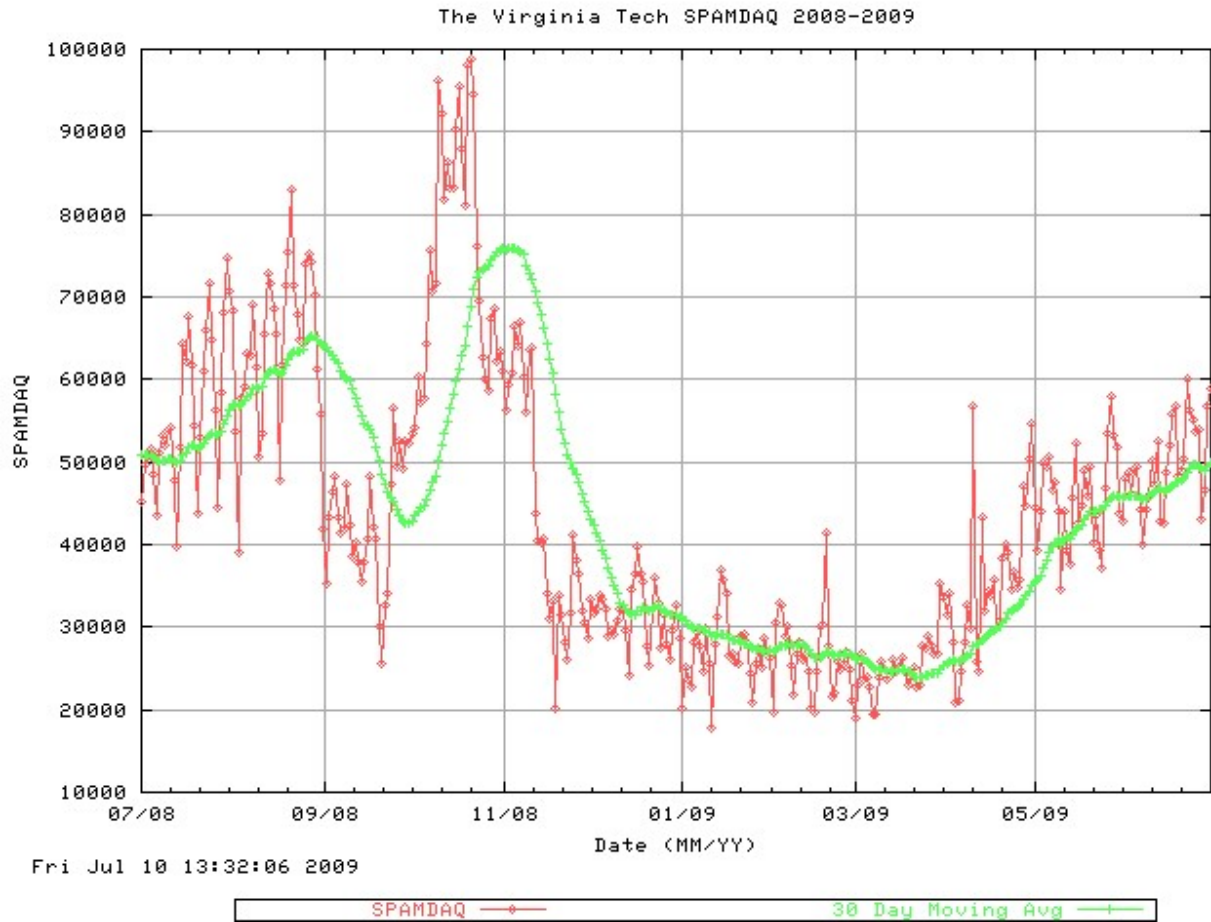
### Viruses captured



This graph 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.

The dramatic decrease in fiscal year 2006-2007, and continued decrease in fiscal year 2007-2008 and beyond, are 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, including college students.

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 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 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.

This chart illustrates the number of complaints received through the [abuse@vt.edu](mailto:abuse@vt.edu) account about events not related to unsolicited e-mail (or spam).

This chart illustrates the number of complaints received through the [abuse@vt.edu](mailto:abuse@vt.edu) account about events not related to unsolicited e-mail (or spam).

Abuse complaints requiring immediate corrective action

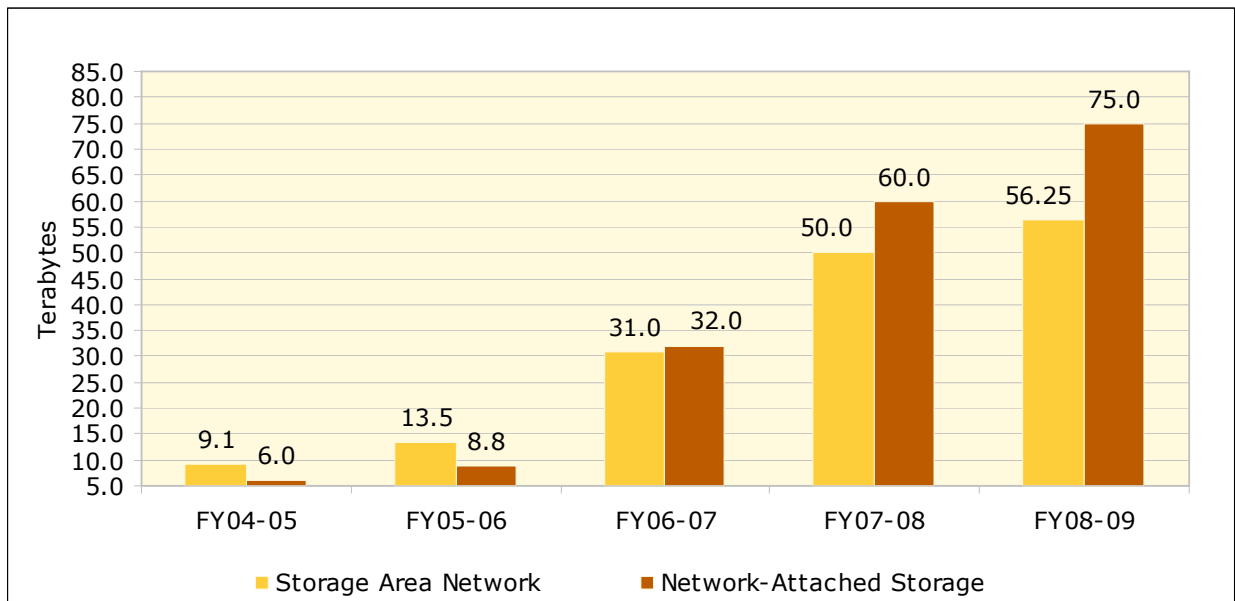
	Total received	Threats	Harassment	Abusive	E-mail break-in	Bot/Trojan activity
July 2006-June 2007	11,604	2	3	1	0	0
July 2007-June 2008	12,108	2	3	5	1	0
July 2008-June 2009	12,209	0	4	3	0	200

The table shows, of the 12,209 messages received during fiscal year 2008-2009, only 207 related to matters requiring immediate corrective action.

Semester breaks (including winter and summer) impact the volume and type of traffic/complaints considerably.

The *Storage added* graph illustrates the amount of data stored on the centrally managed storage resources (SAN and NAS). Gradual increases occurred, as expected, over the 2004-2006 period 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.

Storage added (terabyte)

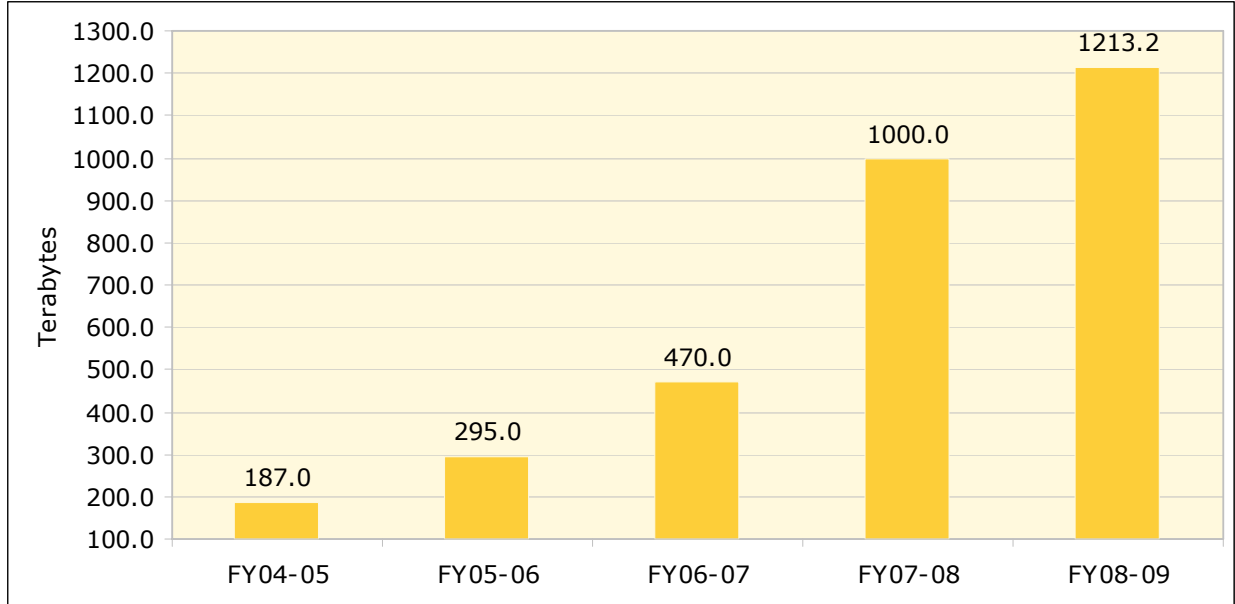


The dramatic increase in 2007 is a direct result of data preservation requirements associated with the events of April 16<sup>th</sup>. Continued attention to the need for centralized storage accounts for the increases in the past two years.

The *Network backup storage* graph illustrates the amount of data stored on the centrally managed backup service (disks and tapes). Gradual increases occurred as expected over the 2004-2006

period 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.

Network backup storage (terabyte)



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.

The table below displays the availability of servers managed by the UNIX Administration Services Team.

UNIX administration services—managed systems

Group	Availability	Number of Hosts
Content Management system	99.98720 %	
- Production	99.98535 %	2
- Development/preproduction	99.98905 %	3
Integration and Portal Services	99.96312 %	
- Production	99.95173 %	11
- Development/preproduction	99.97452 %	12
DBMS/Banner systems	99.94847 %	
- Production	99.94693 %	21
- Development/preproduction	99.95001 %	11
Digital Repository	100.00000 %	
- Production	100.00000 %	1
- Development/preproduction	100.00000 %	1
Ed Fox research project	99.93257 %	
- Production	99.93257 %	4
eProvisioning/eToken systems	99.97575 %	
- Production	99.97342 %	7
- Development/preproduction	99.97809 %	7
Filebox	99.95577 %	
- Production	99.95577 %	2
GIS system	99.96669 %	
- Production	99.96669 %	6
Web Hosting system	99.95911 %	
- Production	99.94996 %	8
- Development/preproduction	99.96826 %	4
Information Technology Acquisitions	99.99679 %	
- Production	99.99358 %	8
- Development/preproduction	100.00000 %	3
Information Warehousing System	99.96083 %	
- Production	99.94703 %	2
- Development/preproduction	99.97464 %	2
Knowledge Base system	99.98836 %	
- Production	99.97672 %	1
- Development/preproduction	100.00000 %	1
Legal archive system	99.98420 %	
- Production	99.98420 %	2
Learning Technologies	99.96160 %	
- Production	99.96118 %	23
- Development/preproduction	99.96203 %	6
Enterprise Directory/Middleware	99.95229 %	
- Production	99.95759 %	18
- Development/preproduction	99.94699 %	23
Advanced Research Computing	99.96969 %	
- Production	99.96969 %	24
SETI Systems	99.99879 %	
- Production	100.00000 %	1
- Development/preproduction	99.99758 %	4
UNIX Administration services	99.97173 %	
- Production	99.96401 %	5
- Development/preproduction	99.97945 %	6

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 2008-2009 fiscal year is extremely small. Using the Information Technology Acquisitions production hosts as an example, 99.99358 percent of 8760 hours (24 hours x 365 days) means those production servers were down for less than one hour during the entire period.

## Blacksburg Electronic Village

The Blacksburg Electronic Village initially worked with seven counties to construct and host community development websites with support from a Department of Commerce Technology Opportunities Program (TOP) grant that ended in 2004. One county has elected to continue the service over the years.

TOP: Registered "villagers" and "organizations" FY2008-2009

County	Villagers	Organizations	Organization directory listings
King and Queen	500	16	280

The number of domain names supported dropped again in 2008-2009 as one TOP county discontinued service and some Sprint/NetworkVirginia customers moved to alternate providers.

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 when BEV decommissioned a number of lists originally configured as part of Community Connections packages but no longer in use by those customers.

E-mail volume continues to climb, in part due to spam leakage. Although our spam-detection ability has remained about the same, the total amount of spam has increased significantly.

### Blacksburg Electronic Village services

	FY05	FY06	FY07	FY08	FY09
Domain names supported	227	296	281	274	254
Websites (full service)	63	66	56	62	52
Websites (Community Connections)	125	123	130	113	110
E-mail boxes	503	504	479	481	468
E-mail lists	128	157	155	142	56
E-mail volume per week (valid messages)	17,000	23,000	30,000	36,000	43,000
E-mail volume per month (valid messages)	74,000	100,000	130,000	156,000	186,000
E-mail volume per year (valid messages)	884,000	1,196,000	1,560,000	1,872,000	2,236,000

BEV's Web Support Services project, using undergraduate staff to provide at-cost Web development service to campus organizations and area nonprofits, has seen an increase in project scale for new websites and major redesigns. In addition to Dreamweaver template-based sites, Web Support now develops sites based on Drupal, an open source content management system.

#### Web Support Services projects

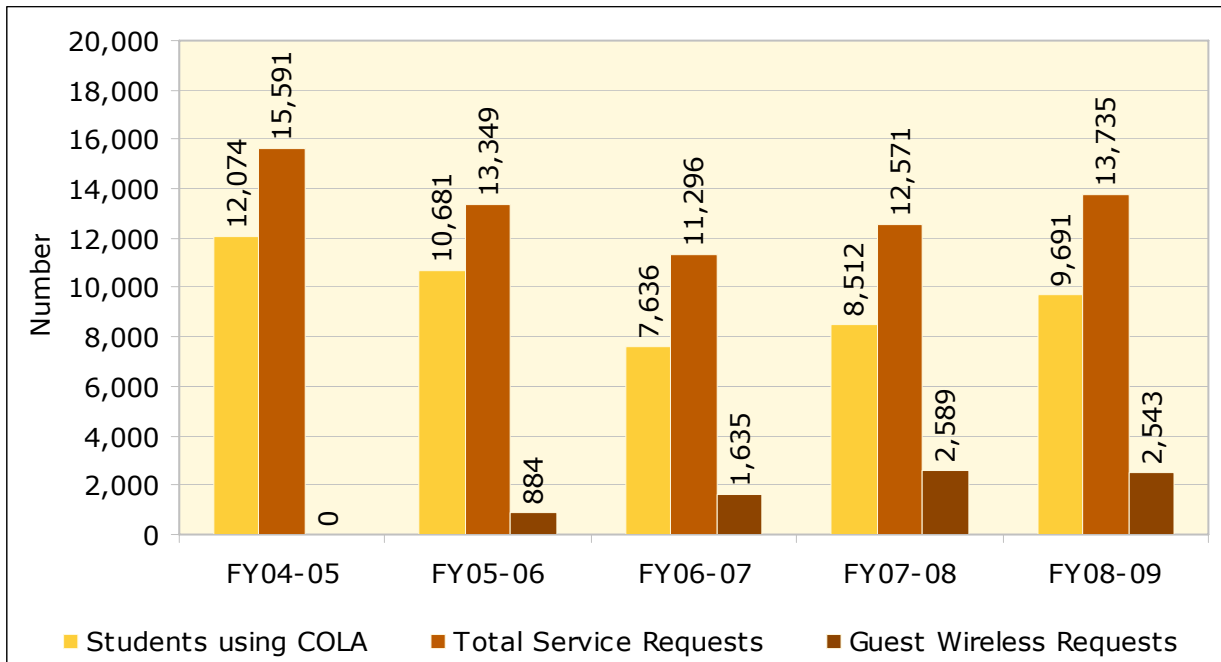
	FY07	FY08	FY09
New websites or major redesigns completed	10	6	4
Site maintenance or assistance projects completed	6	8	5
Projects in progress as of June 2009	4	4	4
Proposals in development as of June 2009	1	4	1

## Systems Development and Administration

Customer Online Access (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

### Customer Online Access



Trend analysis of the two student statistics indicates the use of COLA by students peaked in 2005. Lower usage 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. Second, beginning with on-campus Summer Orientation in 2006, the Student Telecommunications staff has registered many students for wireless LAN service and long distance authorization codes. These numbers would not be reflected in COLA's *total service requests*.

Student Telecommunications implemented an increased awareness campaign aimed at new students this year. The campaign encouraged them to register for wireless service before coming to Summer Orientation resulting in almost 1,000 more students visiting COLA in the month of June 2009 as compared to June 2008.

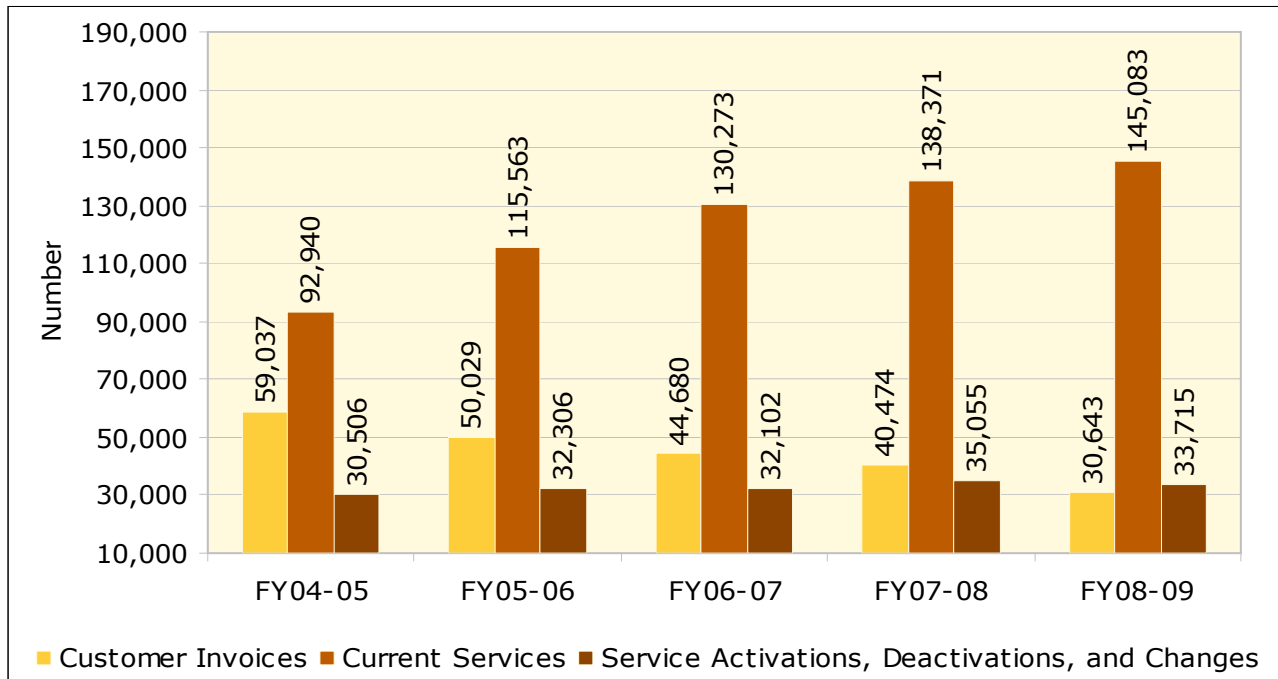
The third statistic relates to guest wireless LAN—a service that has only been offered via COLA since 2006. The numbers since that time are related to the significant growth in use of that service offering by those visiting campus.



## Business Operations

The graph below depicts, by fiscal year, the number of customer invoices issued by Network Infrastructure and Services, the number of current services billed to customers, and the number of service activations, deactivations, and changes.

Services overview



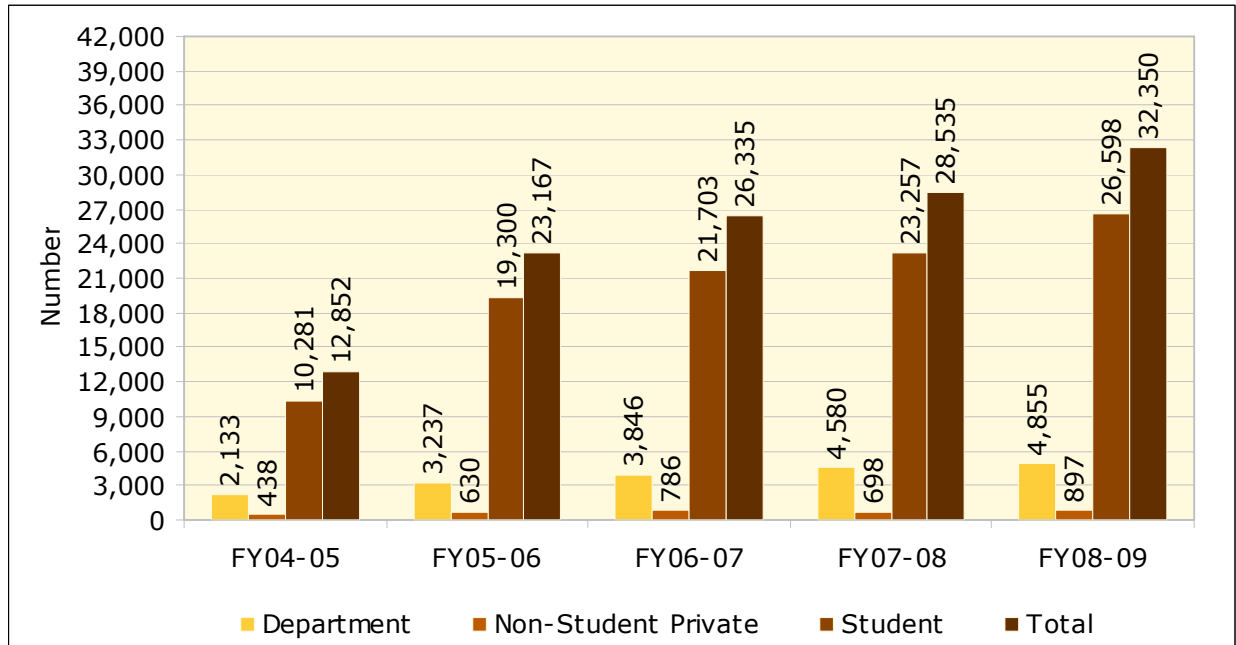
The decline in the quantity of customer invoices is the result of the decreasing numbers of student telecommunications customers requesting modem pool services and long distance authorization codes and a decrease in the number of customer invoices to non-student private accounts. The number of invoices to departments has decreased as well. The decline is also attributed to the transition of Mail Services and Printing Services from NI&S to the Office of Transportation and Campus Services. NI&S continues to invoice customers for Printing's Copier Management Program.

The increase in the number of current services billed to customers is primarily the result of the constantly changing cellular and cellular data service, equipment, and accessory offerings. These changes result in an ever-increasing number of departmental customers ordering new cellular services and equipment. New and existing customers can change service plans or equipment more than once in the course of one fiscal year resulting in multiple service activations/deactivations/changes.

The number of service activations, deactivations, and changes represents the number of moves, adds, and changes to *departmental* telecommunications services. Such changes are often a result of moves to new or renovated office space and the resulting domino effect when another

department relocates to the space previously vacated. Student orders for modem pool service and long distance authorization codes are also reflected in these totals.

Wireless LAN (local area network) customers

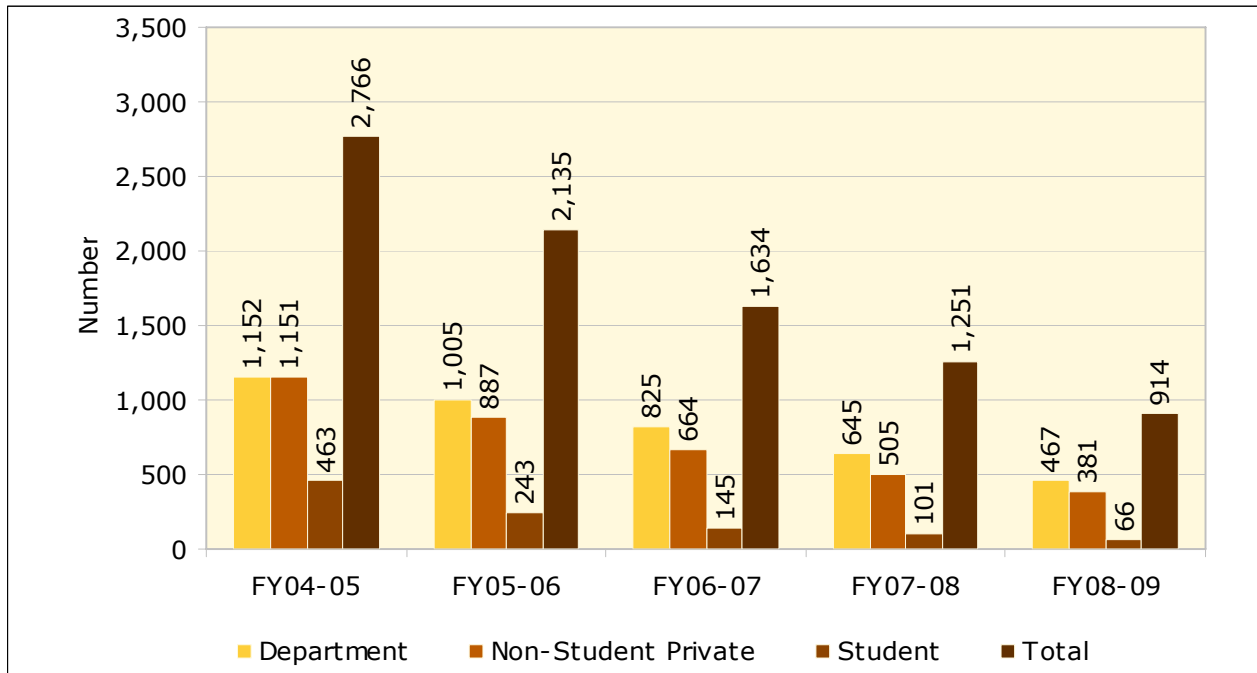


The graph above depicts, by fiscal year, the number of wireless LAN subscribers by customer type—department, non-student private, and student.

The increase in the number of wireless LAN subscribers is attributed to transitioning the service from a “pilot” offering to a billable production service in 2004, the continuous/ongoing network expansion making the service available to the academic and administrative spaces across campus, and the availability to campus visitors via a university sponsor.

Students represent 82% of the total number of subscribers.

### Modem pool customers



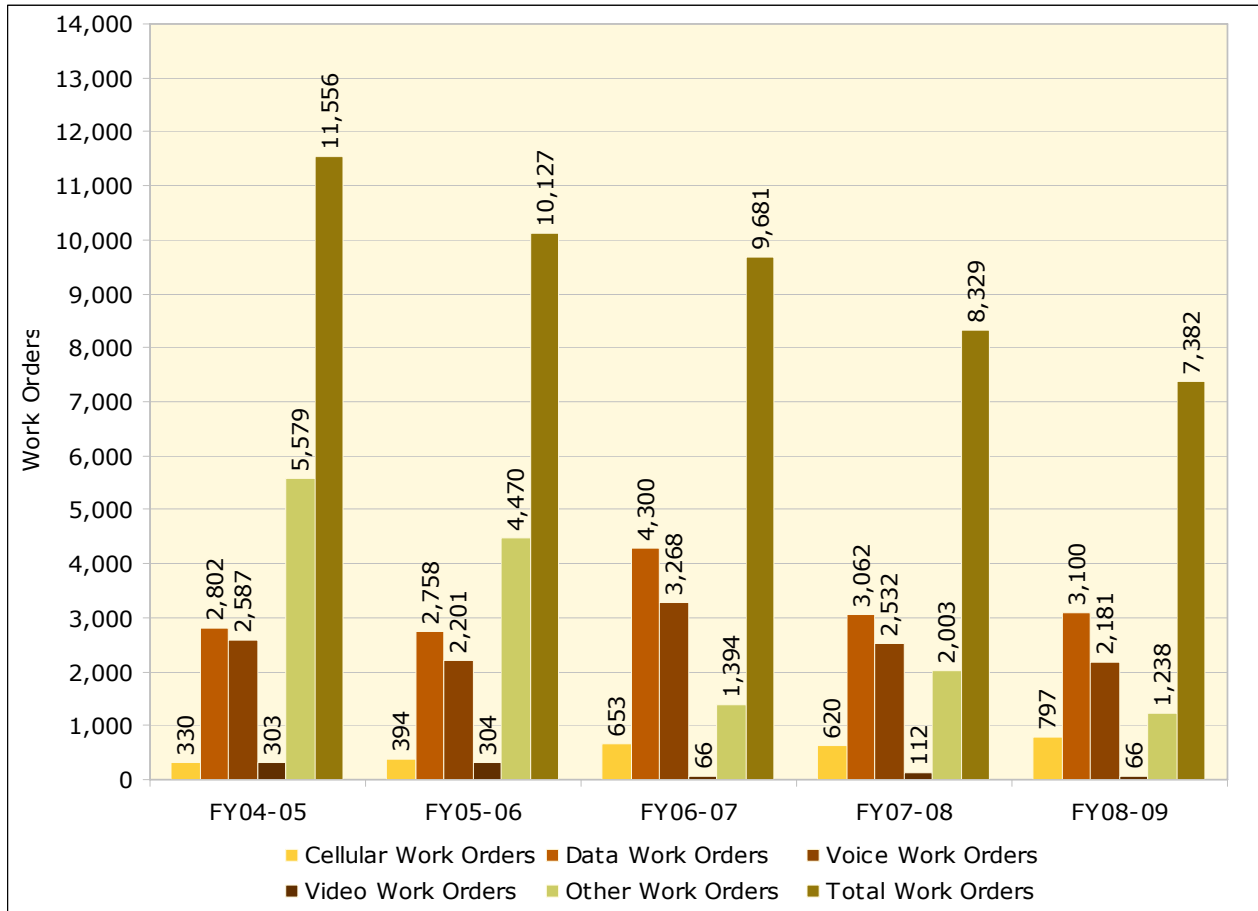
The graph above depicts, by fiscal year, the number of modem pool subscribers by customer type—department, non-student private, and student.

The decline in 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.

### Ordering and Provisioning

This graph represents the distribution by work order type and the total number of work orders completed the past five years.

## Work orders



*Voice orders* are for digital or analog service. *Data orders* include those for 10BaseT, 100BaseT, or 1000BaseT Ethernet connections. *Video orders* are associated with campus CATV service, and *cellular orders* are for voice or mobile messaging services. *Other* work orders include those for PBX software only, Time and Materials, cable plant only, NetworkVirginia, fiber channel, internal fieldwork, message boards, and the installation of wireless access points.

CNS began processing orders for cellular services in 2003. During 2005, CNS began offering mobile messaging services resulting in a gain in cellular orders. Migration to mobile voice and data has continued. The number of orders for cellular data service has remained constant as faculty and administrators request mobile access to e-mail and calendaring.

The higher quantity of video orders during fiscal years 2004-2005 and 2005-2006 is directly related to two capital projects: The Inn at Virginia Tech, Skelton Conference Center, and Holtzman Alumni Center Complex, and the Westside Lane Stadium Expansion.

During 2004-2006, 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 additional projects contributing to the

increased number of orders in this category during 2004 and 2005 are the Edward Via Virginia College of Osteopathic Medicine building and hotel rooms at The Inn at Virginia Tech.

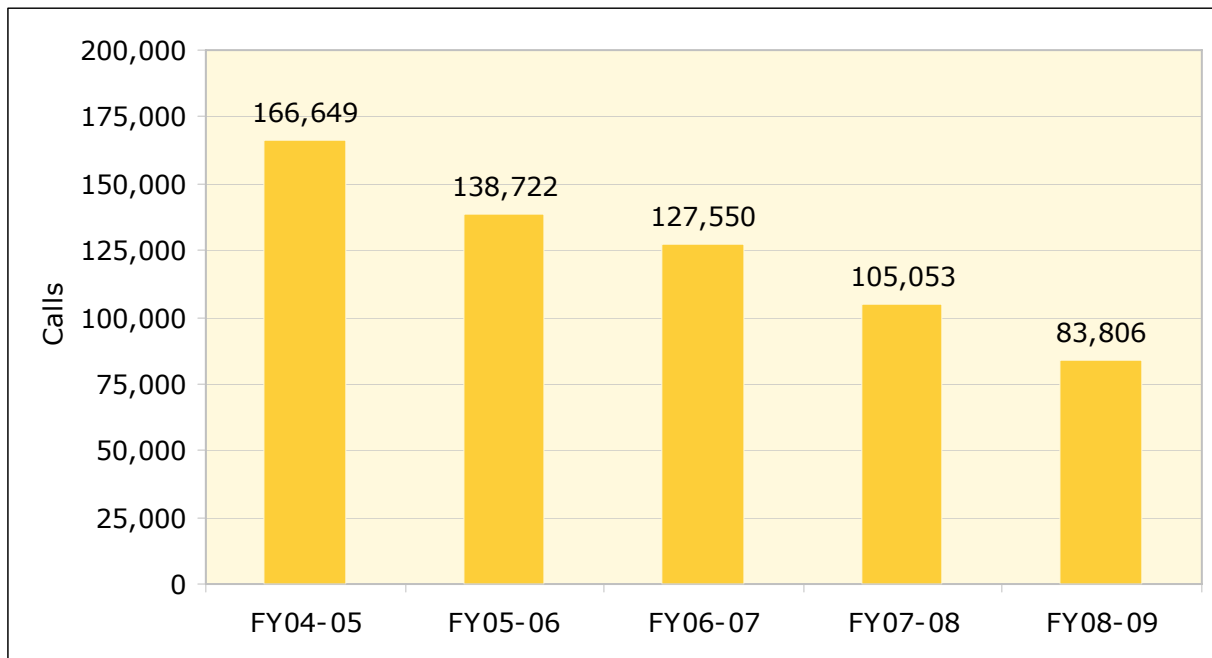
In 2006-2007, increases in data and voice work orders are attributed to several projects. Many renovations occurred on campus including changes in Burruss Hall that displaced several departments. As these departments moved, other groups relocated. After the renovation was completed, another round of moves occurred to facilitate the Henderson Hall renovation. In addition, 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 16<sup>th</sup> tragedy, and completion of the University Gateway Center.

Increased use of wireless data and cellular services has led to a decline in the total number of orders processed during the last couple of years. In addition, departments are scaling back on telecommunications services due to budget reductions.

## Public Relations

The volume of telephone calls received at the University Switchboard during the period reflects a continued decline over several years. 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 only between 12 a.m. and 5 p.m. each day.

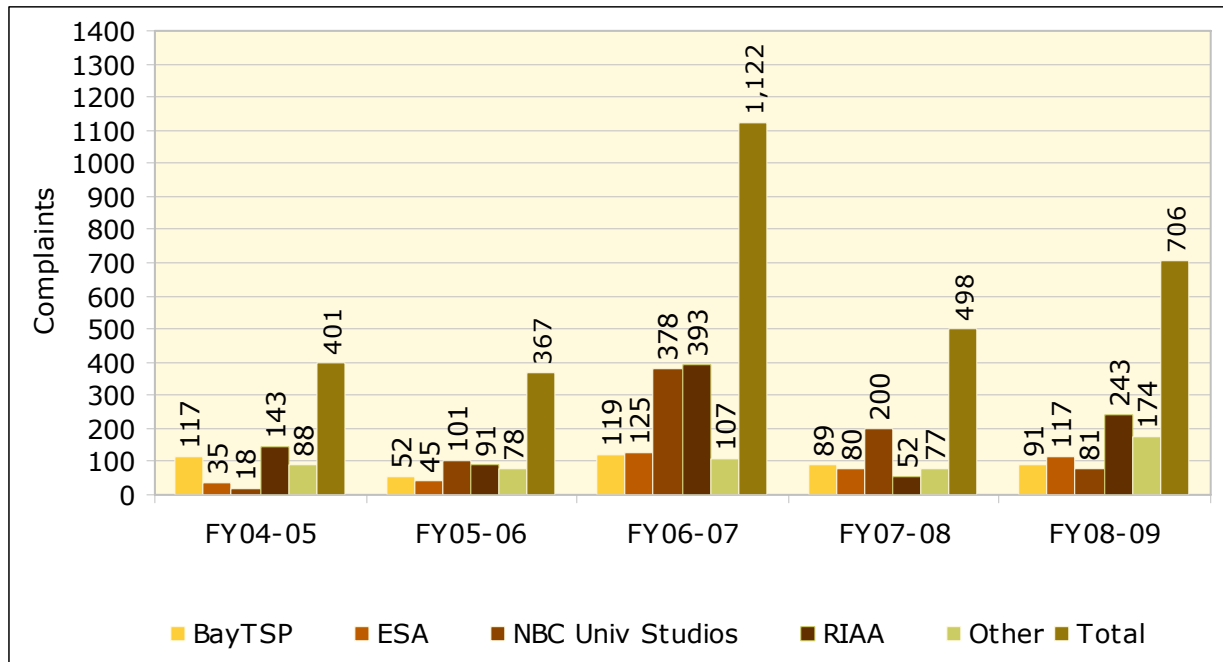
Calls to the University Switchboard



Though the Switchboard is designed to provide only on-campus telephone numbers, the amount of time spent per call can be lengthier as operators work with callers to identify the best office to which the call should be transferred. The kind of inquiries received adds to the handling time per call, while resulting in increased caller satisfaction. Increasingly, the university operators receive requests for campus information as opposed to simple inquiries for telephone number listings.

The University Switchboard is also one of the key components of Virginia Tech's emergency communication system.

Internet copyright infringement complaints (ICIC)



The Digital Millennium Copyright Act (DMCA, 1998; [www.copyright.gov/legislation/dmca.pdf](http://www.copyright.gov/legislation/dmca.pdf)) 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, 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.

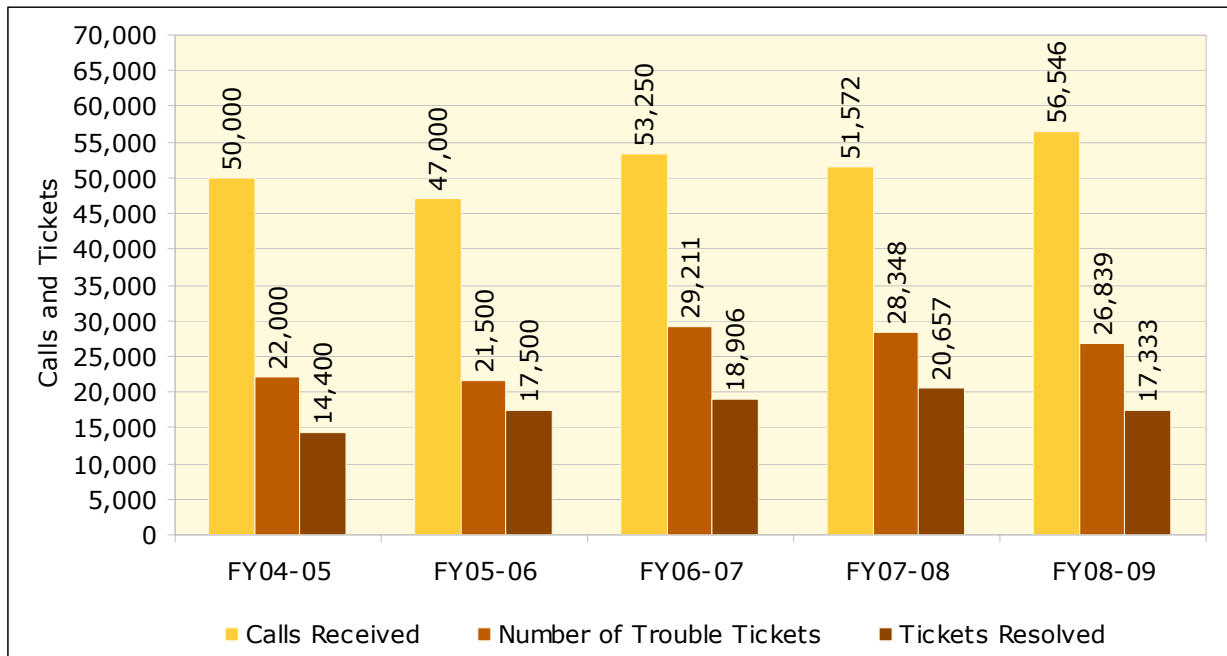
Virginia Tech has received a fairly consistent number of these notices each year. However, volume tripled during the 2006-2007 academic year compared to prior years. The increase was largely due to intensified efforts on the part of copyright owners and agents to address and publicize the illegal file-sharing problem.

Over the period of 2004-2009, the principal originators of ICICs received by Virginia Tech have been BayTSP, the Entertainment Software Association (ESA), 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.

## Virginia Tech Operations Center

The graph below shows the total number of 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 excludes calls for Video/Broadcast Services.

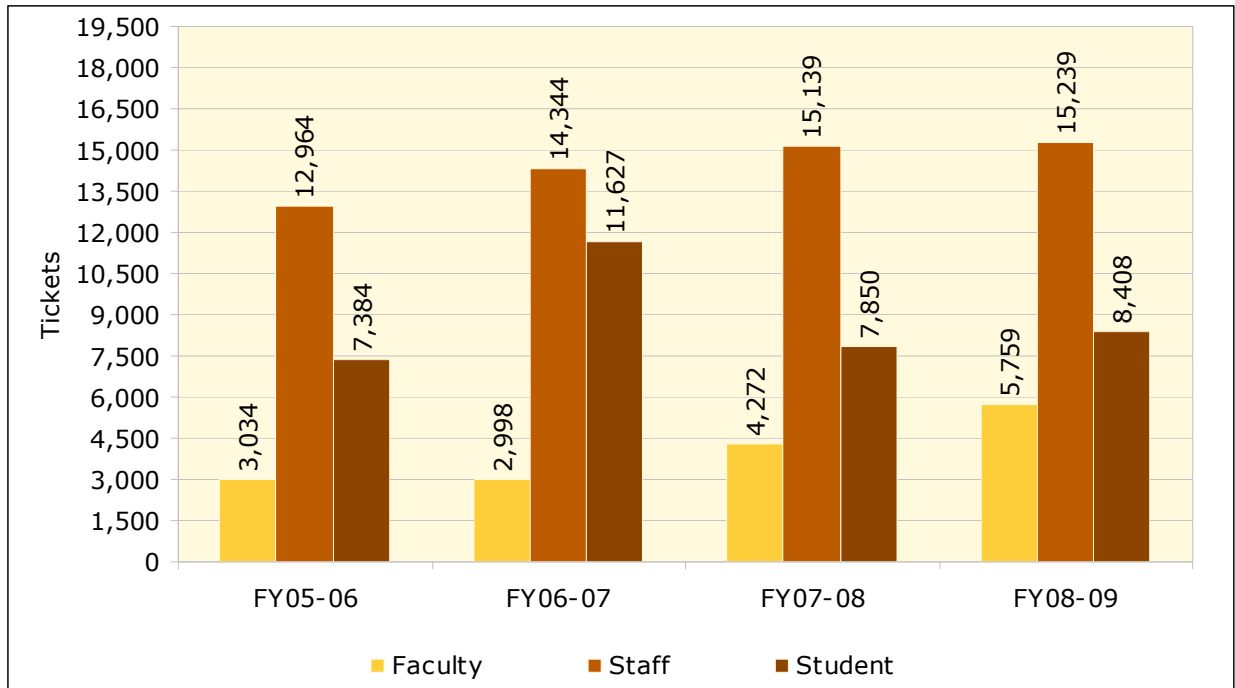
Total calls and problem reports



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 constant 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. During the 2008-2009 fiscal year, over 35,000 PIDs were deactivated, and all inquiries about those PIDs had to be transferred to Identity Management Services for resolution.

Tickets by affiliation



This graph shows the distribution of the majority of the problem tickets received in the VTOC by the affiliation of the caller. (The quantities of calls from some affiliates—alumni, retirees, etc.—are not included here.)

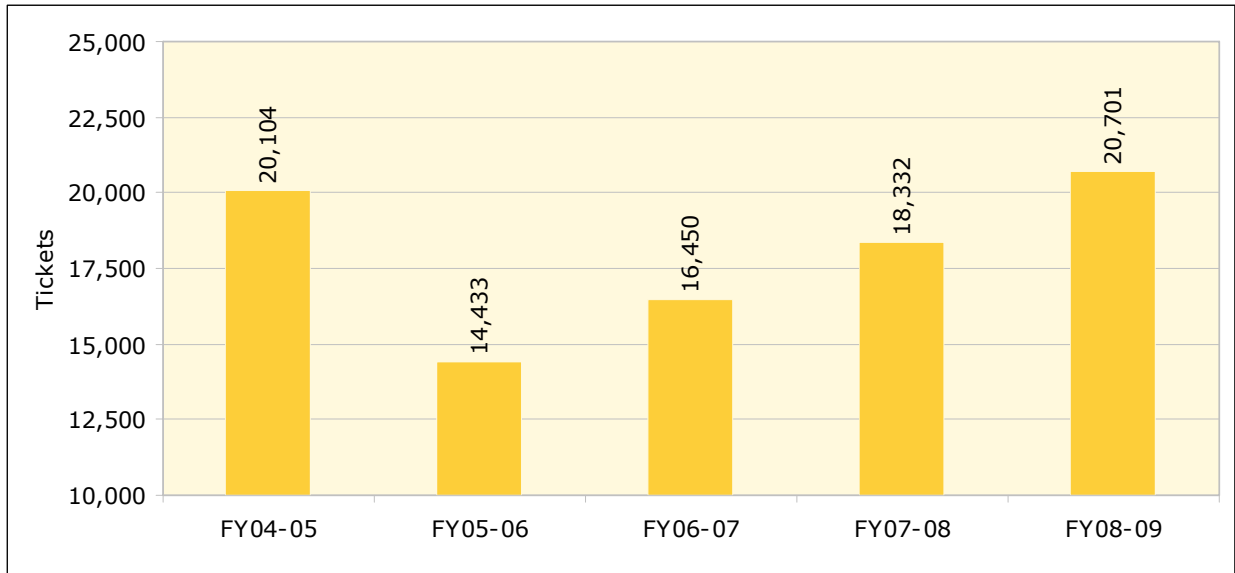
The spike in the number of student tickets during fiscal year 2006-2007 is most likely due to the introduction of the Microsoft Vista operating system.

## University Computing Support

The graph below shows the number of tickets opened by University Computing Support (UCS)/4Help over the past five years.

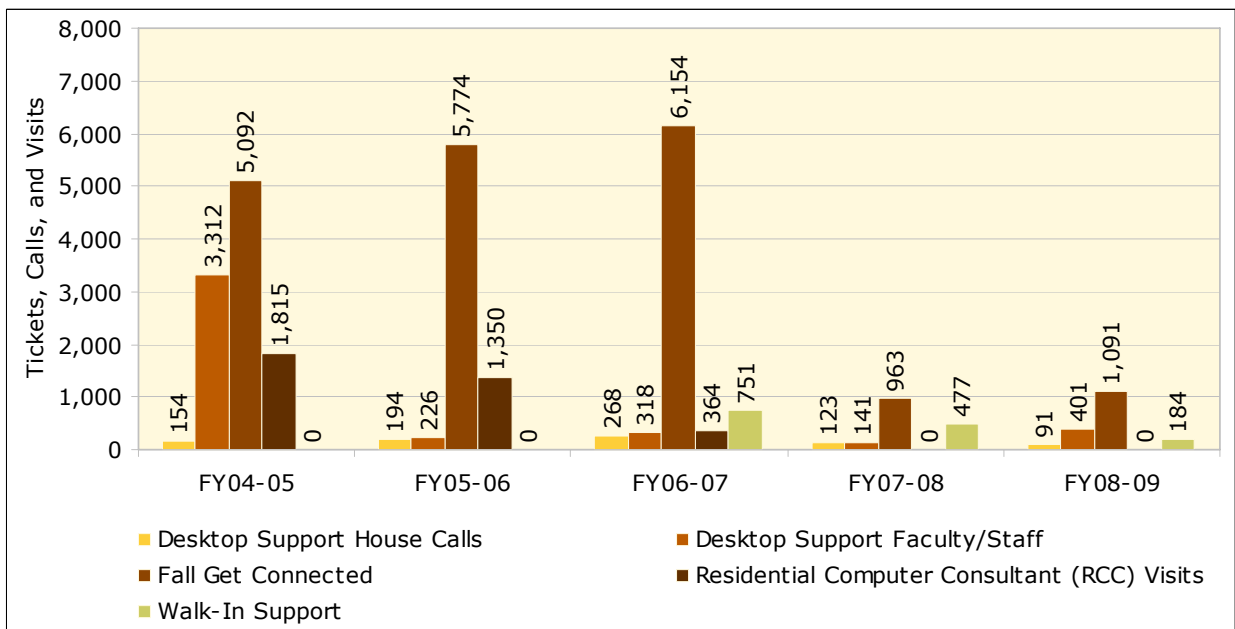


### Help Desk tickets



4Help saw a slight increase in ticket volume again this year due to the continued implementation of VT Alerts and additional collaboration with Online Course Systems (OCS). OCS has added a new course management system, Scholar, which has contributed to an increase in ticket volume as faculty members make the transition from Blackboard to Scholar. 4Help also saw an increase in the number of questions related to networking as CNS implemented the new VT-Wireless service.

### Support tickets, calls, and visits



The graph above shows the distribution of support tickets, calls, and visits by type.

As shown, the numbers for *desktop support to faculty and staff* show an increase due to additional support required for the increasing number of mobile computing users.

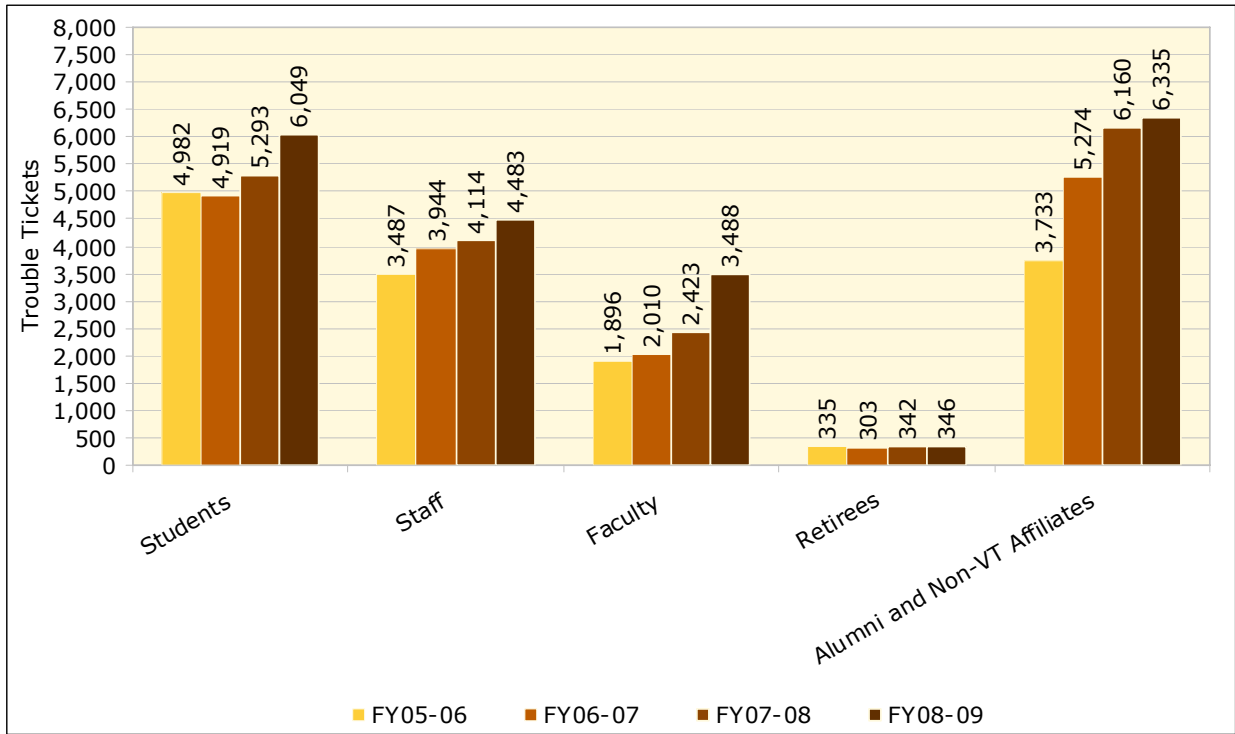
(NOTE: The large number of desktop support faculty/staff tickets for 2005 is the result of counting all visits of any kind to a faculty/staff office. This number is now computed by counting only visits where a full-time staff member goes to an office and provides on-site assistance.)

The number of students requiring assistance during the Get Connected period increased slightly this year because additional support was necessary for problems introduced by a new tablet computer model required by the Department of Engineering and the need to extend the program for an additional week. The support model has shifted to one of calling 4Help for assistance prior to dispatching a Get Connected staff member to the residence hall. 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.

In 2006-2007, 4Help replaced the Residential Computing Consultant program with a walk-in support model, assisting 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 a significant decrease in the number of walk-in services performed as a result of a streamlined program to better utilize phone support. An updated antivirus page also allows users to solve many problems without a walk-in appointment and contributed to the need for fewer walk-in services.

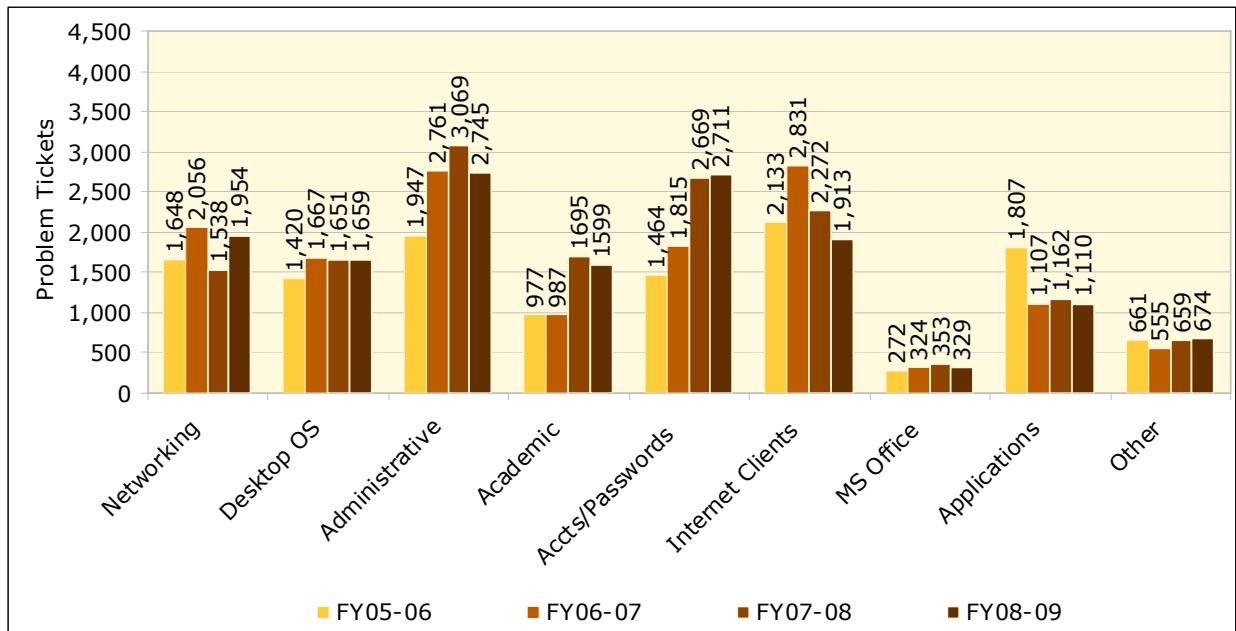
Tickets by affiliation



The graph above 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. All categories showed another increase during the 2008-2009 fiscal year, including the number of questions from those without an active Virginia Tech affiliation such as alumni, prospective or admitted students, and parents. Tickets from these callers are categorized as *alumni and non-VT affiliates* in the graph above. There were 18,332 tickets in 2007-2008 and 20,701 tickets this past fiscal year—an increase of 13 percent. The overall increase in the number of tickets was primarily due to the continued implementation of VT Alerts, the collaboration with OCS to provide first-level support for their applications, and questions related to the new VT-Wireless service.

Tickets by cause of problem



The graph above displays the various causes associated with problem tickets.

The most significant increase during the 08-09 fiscal year was in the *networking* category, which includes calls related to deployment of VT-Wireless, Virginia Tech’s new, certificate-based, wireless networking service.

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. The number of administrative tickets during the 2007-2008 fiscal year increased due to the implementation of VT Alerts.

Tickets in the *academic services* category, which includes Hokie SPA, LISTSERV, and Blackboard, increased significantly during 2007-2008 as a result of UCS handling first-level support for Online Course Systems. In addition, 4Help began accepting first-level support calls for Auralog software used by the foreign language department at Virginia Tech during that time.

Due to the implementation of the new Alumni Online Directory, there was also a slight increase in the number of calls related to accounts and passwords in fiscal year 2008-2009.

## Projects

### New information environment for research and innovation

For the university to realize its mission, a reliable, leading-edge, information environment must be available—anytime and anyplace—to students, researchers, faculty members, and staff members. Over the past decade, Virginia Tech’s information environment has grown more complex. Each successive surge in innovation creates new challenges. Successful programs, such as NetworkVirginia, National LambdaRail, and the Blacksburg Electronic Village, have helped Virginia Tech fulfill its objectives for outreach, education, and technology transfer. Locally, approximately 28,500 students, 5,900 faculty members, and 3,800 staff members are supported by an elaborate infrastructure encompassing approximately 200 buildings.

In 2007, Network Infrastructure and Services initiated a project, focused on transforming the university’s technology environment, for the six-year capital outlay plan. The university will draw on expertise and research in computer science and engineering, electrical engineering, the Mobile and Portable Radio Research Group (MPRG), pervasive computing, high-performance computing, and high-performance networking to develop a customized infrastructure integral to future learning, discovery, and engagement efforts. In addition to many research and instructional uses, Virginia Tech will leverage the new environment to develop technologies and strategies for emergency and crisis response. Other areas of focus will be cybersecurity and cyberforensics.

This capital project will provide new infrastructure to deliver integrated, optical and next-generation, mobile technologies. Through our engagement in national and international networks and through partnerships with progressive industry leaders, we will extend pervasive access to our campus environment with enhanced, worldwide mobility and ease-of-use. The new environment will connect members of the university community to any person, information source, or computational resource required.

The project will provide a comprehensive, underlying infrastructure to support the new Virginia Tech information environment now and in the future, and it includes re-conceptualization and replacement of legacy spaces and components.

The new environment will focus on four key areas: access spaces, distribution, intelligent infrastructure, and pervasive access. New and redesigned telecommunications access spaces will take in to consideration (1) current and future infrastructure, (2) sufficient electrical, air conditioning, and heating capacity requirements, (3) pathway requirements, (4) safety and security, and (5) accessibility. The project forecasts a net decrease of approximately 100 spaces.

The project proposes a new in-building distribution that will address approximately 50 percent of the campus to enable development of the high-performance information environment and will support potentially hundreds and thousands of access devices. The proposed between-building distribution system will be based on an innovative, carefully planned architecture designed to offer next-generation performance, reliability, survivability, and flexibility. Key project components will include (1) replacement or repurposing of utility tunnel pathways for fiber, (2) diverse routes from each building to at least two information centers for redundancy, and (3) spare capacity and scalability to provide for future needs.

The new environment will also consist of new intelligent infrastructure, which will help to connect a future array of access devices including personal mobile communicators, high-resolution displays, desktop systems, and high-performance research computing. It also includes interconnection of all the campus devices to global networks as well as ancillary devices that help implement network policies and facilitate operations. This complex information environment, requiring research-class expertise and operational management and development, will attract more and more critical research, teaching, and learning applications. It must be constructed to respond dynamically to changing requirements and drive new forms of collaboration.

The proposed environment will consist of emerging and proven technologies, allowing more pervasive access to the system. The centralized mobility controllers, communicating with each other and with devices located throughout campus building and outdoor spaces, will incorporate the use of developing, pervasive technologies. The infrastructure will provide enhanced radio features, allowing the system to dynamically adapt to a changing environment as well as providing quality-of-service mechanisms and the ability to intelligently redistribute clients. These capabilities are necessary for the successful adoption of learning and instructional tools where students and lecturers are seamlessly collaborating. This proposed infrastructure will leverage the new pervasive access, the systems, and the distribution infrastructure to deliver enhanced fixed and mobile support. Deploying applications on a converged infrastructure provides opportunities for reduction in implementation costs and operational expenses. The new information environment will reduce barriers to advanced and constantly changing applications.

The funding plan for this technology environment project includes full, non-general fund support. At the meeting of the Virginia Tech Board of Visitors in June 2007, the capital plan was reviewed at a joint session of the Finance and Audit Committee and the Building and Grounds Committee. The funding plan includes revenue bond authorization that will be repaid by revenue generated from auxiliary enterprise operations.

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

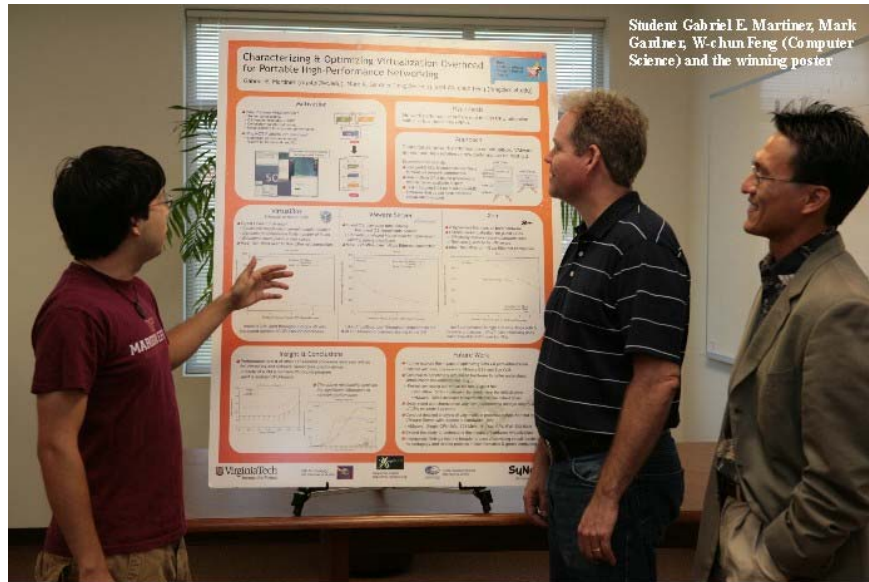
research activities on campus. Gardner is working with NI&S personnel, research faculty members, and other Virginia Tech information technology professionals to develop and implement solutions enabling high-performance computer communications and computing projects.

**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. 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.

Many 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. Furthermore, a team co-led by William Dougherty and Gardner began deployment of virtual machines supporting important computing services for the campus. Nine services have been virtualized to date, the most visible of which are an instant messaging service, an authenticated mail transport service, Microsoft Windows authentication service, Internet authentication services, and the digital repository.

Virtualization has also been a vehicle for providing students with research experience. Gardner, along with Wu Feng, associate professor in the Departments of Computer Science and Electrical and Computer Engineering, obtained a grant to fund two undergraduate students to investigate issues surrounding the use of virtual machines in education: Gabriel Martinez, William Gomez, Wu Feng, and Mark K. Gardner, "Virtual Ecosystems for K-12 Pedagogy in Science, Technology, Engineering, and Mathematics," CREU/CRA-W grant, awarded Fall 2008.

The work on virtual machine network performance by Gabriel Martinez, a sophomore, was submitted as a poster to ACM/IEEE SC|08: The International Conference on High-Performance Computing, Networking, Storage, and Analysis (Supercomputing 2008) where it was not only accepted but also nominated for a best undergraduate poster award. At SC|08, Gabriel delivered a 20-minute presentation to an audience of around 60 people followed by 10 minutes of questions and answers. His poise, coupled with the quality of his work, 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 Supercomputing 2008.



Student Gabriel E. Martinez, Mark Gardner, W-chun Feng (Computer Science) and the winning poster

In addition to Gabriel Martinez and William Gomez, undergraduates Adam Herr, Drew Budwin, and David Mazary are investigating the use of virtual machines to make the task of deploying the Storytelling Alice environment (for teaching computer programming) easier for elementary and middle school teachers.

Dr. Gardner also gave a presentation on virtualization and cloud computing at the IBM Cloud Computing Summit: Wu Feng and Mark K. Gardner, "Cloud Computing at VT," IBM Cloud Computing Summit, March 26-27, 2009.

The key personnel associated with this project are Mark Gardner, William Dougherty, and Wu-chun Feng, with assistance from many others.

**PlanetLab.** The PlanetLab project, [www.planet-lab.org/](http://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 the resources that are centrally managed by staff 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.

In the past year, Gardner obtained an equipment grant, doubling the number of campus PlanetLab nodes. Professor Ali Butt of the Computer Science department obtained a National Science Foundation (NSF) Faculty Early Career Development award utilizing the PlanetLab infrastructure: "A Scalable Hierarchical Framework for High-Performance Data Storage," publishing a number of important papers.

The personnel associated with this project are Mark 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.



**Desktop grids.** Institutions like Virginia Tech have a wealth of untapped computing power in the form of idle time on desktop systems. The desktop grid project hopes to harness the idle cycles across campus to form a virtual computer. Even when systems are being actively used, the need for computing capacity comes in brief bursts. During low use or idle periods, the computing capacity already paid for, but currently unused, can be harnessed to provide a virtualized computing resource to the university community.

The Desktop Grid project is related to the virtualization project discussed earlier. The raw capacity of the otherwise idle desktop systems on campus can be harnessed to run virtual machines for teaching or research.

Key personnel leading this work are Mark Gardner and Wu-chun Feng.

**Advanced networking.** The primary goals of the advanced networking area have been to identify research topics, seek funding, and mentor students. Three research topics were pursued this year: hybrid packet- and circuit-switched networking, composable protocols, and proactive adaptation of wireless infrastructure.

Information in the Internet is divided into small chunks called packets. Each packet is delivered independently allowing packets to take different paths and adapt to varying conditions. As a result, packet-switched networks are typically very robust to problems in the network. However, because the core elements of the network are required to make decisions for each packet, it is difficult to provide uniform and predictable service. In contrast, circuit-switched networks are like a passenger train continuously running between two destinations in which chunks of information related to the same conversation are assigned the same seat in the same car each time the train passes. As the train moves around the track, chunks get on, take a seat, ride to their destination, and get off, all in a very smooth and consistent manner. Each approach has its strengths and weaknesses. Combining the strengths of each leads to improved network characteristics and user satisfaction. See Malathi Veeraraghavan and Mark Gardner, "IHCS: Towards Increasing End-to-End Communication Rates by Two-to-Three Orders of Magnitude," proposal submitted to the National Science Foundation.

Network protocols have traditionally been implemented in a monolithic way. As the number of networked applications grows and as the needs of those applications become more diverse, it is no longer sufficient to try to design a single protocol that is everything to everyone. The composable protocol project is designed to make it easier to develop network protocols specifically tailored to the needs of an application. By identifying and implementing functionalities in an orthogonal way, a multitude of custom protocols can be assembled from a few basic building blocks to meet the distinct needs of individual applications. Support for this project is being sought through a proposal: Wu Feng, Eli Tilevich, and Mark Gardner, "Automated Synthesis of Network Protocols for Distributed Petascale Environments," submitted to the U.S. Department of Energy.

Wireless networking is a challenge, particularly where there are conditions with many users such as large lecture halls. Wireless transmissions collide when many users attempt to use the network at the same time causing poor performance. Gardner and Eric Brown, along with Allen

MacKenzie, assistant professor, Department of Electrical and Computer Engineering, assisted Cognitive Radio Technologies LLC in preparing a Small Business Innovation Research proposal: James Neel, “Proactive Adaptive Channel Reconfiguration (PACR),” Army SBIR Topic A09-085. Communications Network Services personnel will help identify busy classroom settings and acquire data that will be used to develop cognitive algorithms for wireless access points to reduce interference and improve performance.

**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 to monitor the behavior of the computers and to analyze and tune them to achieve high performance on scientific applications. The difficulty of monitoring such systems is growing as processor counts of one million or more are thought necessary to achieve a quadrillion calculations per second. In collaboration with the Renaissance Computing Institute in North Carolina, a proposal was submitted to the Department of Energy to address this issue: Robert Fowler, Wu Feng, Mark Gardner, Alan Porterfield, and Daniel Quinlan, “Multi-source Event Generation and Analysis for Performance Understanding in Large-Scale Environments (MEGA-PULSE).”

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

## National Capital Region Aggregation Facility

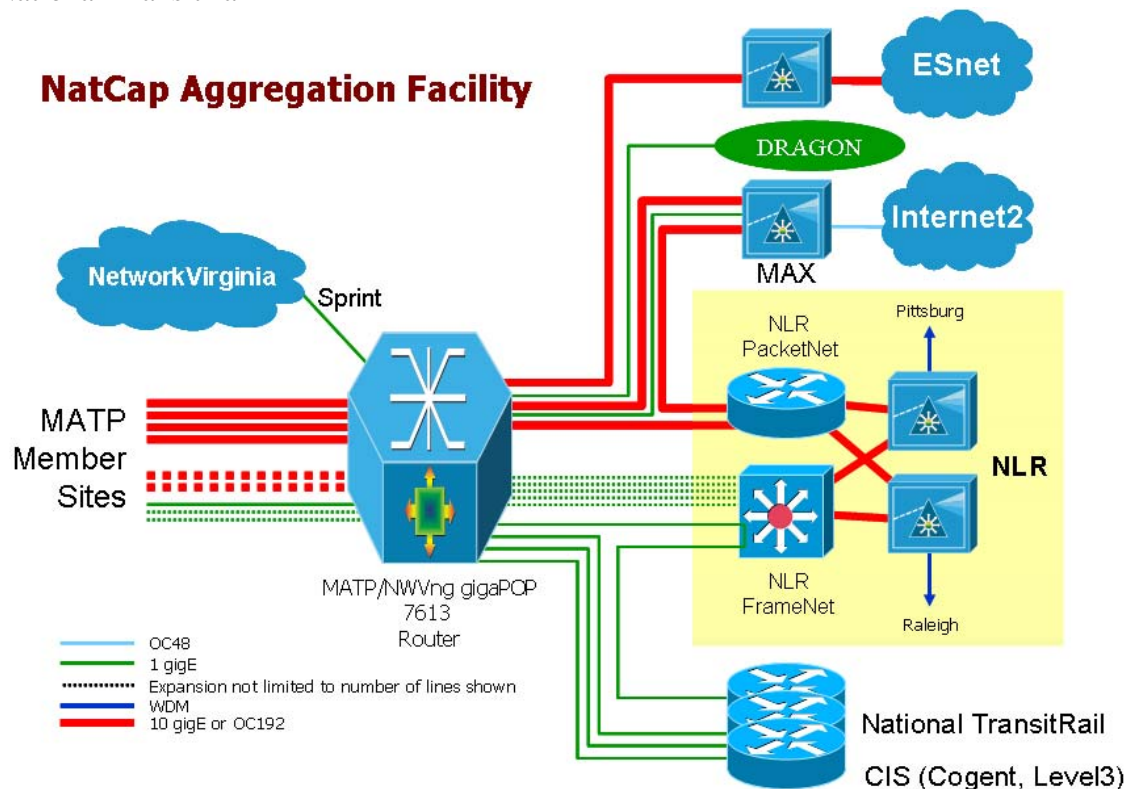
Virginia Tech operates the National Capital Region (NatCap) Aggregation Facility, previously referred to as the NOVA Aggregation Facility, to provide a high-performance, research and education network aggregation and exchange point for institutions located in the mid-Atlantic region.. NatCap evolved 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. The facility 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



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.

NatCap sustained reliable, high-performance operation during the 2008-2009 fiscal year with availability exceeding 99.999 percent. Several milestones were achieved this year as the facility continues to expand and improve.

The facility offers bulk commodity Internet service (CIS) to higher education clients. Participants include Virginia Tech, the University of Virginia, Virginia Commonwealth University, Old Dominion University, and the College of William and Mary. CIS gateway capacity was doubled for the second consecutive year, to 4Gbps. Two new participants, Radford University and New River Community College, were added.

Construction was initiated on a second NatCap node that will be located at the Equinix Exchange in Ashburn, Virginia. The new node will provide additional reliability through diversity and access to a rich array of new services and providers.

NI&S plans to continue the development and expansion of the National Capital Region Aggregation Facility. Through the Mid-Atlantic Terascale Partnership, one goal is to aggressively increase use of the planned upgrade to the National LambdaRail network. Through relationships with our connectors—including the Mid-Atlantic Crossroads and Mid-Atlantic Broadband Cooperative among others—we will extend regional collaboration and access. The CIS and National TransitRail services will continue to expand and drive down costs for Internet access.

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

## MAX-MATP agreement

In 2008, NI&S negotiated an agreement enabling collaboration and cost sharing between two major, regional, optical research networks—the Mid-Atlantic Terascale Partnership (MATP) and the Mid-Atlantic Crossroads (MAX).

Both networks were formed by university collaborations that included Virginia Tech, which operates the MATP programs. The University of Maryland operates the MAX programs. The agreement expands collaboration and connectivity among universities and labs in the Virginia, Maryland, and Washington D.C. region and expands the region's access to the National LambdaRail (NLR) and Internet2 networks.

MAX participants now have direct access to NLR's full spectrum of WaveNet, FrameNet, and PacketNet service offerings ([www.nlr.net/about/](http://www.nlr.net/about/)). This expansion adds more than 40 of the nation's leading research universities, federal laboratories, government agencies, and corporate research partners to the hundreds of institutions nationwide and around the globe already connected to National LambdaRail. The agreement also provides for continued aggregation of MATP and MAX members to reach the Internet2 network through the MAX Internet2 connector.

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

## 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 the fall of 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 (NRV) Mall. 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 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 Virginia Tech Operations Center in NI&S.

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

## National Capital Region projects

This year, NI&S 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 to be built in Ballston, Virginia. This facility will be located near major, federal, research facilities in Ballston and is an integral component of the university'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.

Going forward, 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.

For more information, contact John Pollard, [jpollard@vt.edu](mailto:jpollard@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 worked with University Relations to install an additional 33 boards in the spring of 2009. NI&S also developed software systems to integrate the classroom sign network with the Virginia Tech Emergency Notification System. The system performed flawlessly in numerous public tests in the fall of 2008 and spring of 2009, delivering test messages to all classrooms within 10 seconds of the test alert activation.

In May 2009, we were notified by University Relations that the Security and Safety Policy Committee had approved the

installation of message boards in approximately 264 additional classroom spaces. Once these installations are completed, every space routinely used for classes, including all non-general assignment classrooms, should have a message board.

CNS issued an invitation for bid for the purpose of establishing a contract to purchase sufficient message boards to meet these needs, at the best possible price for the university. A contract is being established that is within the budget established by University Relations. CNS will continue to organize and coordinate 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.



Installation of message boards will be according to the priority established by University Relations, in conjunction with classroom scheduling considerations. By the fall of 2010, approximately 500 message boards will be installed in university class spaces.

For more information, contact Pat Rodgers, [prodgers@vt.edu](mailto:prodgers@vt.edu).

## Virginia Tech Emergency Notification System

The need for a single, user interface to send urgent notifications to the university community using all available communications channels was identified in the Security Infrastructure Working Group Report after the April 16, 2007 tragedy. The Virginia Tech Emergency Notification System project to develop this capability was initiated in June 2008 and completed on time and within budget in October 2008. In its initial implementation, the system supports simultaneous emergency notification to the university homepage ([www.vt.edu](http://www.vt.edu)), electronic message boards in classrooms, phone/SMS via Everbridge (formerly 3n), and e-mail via LISTSERV distribution.

For more information, contact Carl Harris, [ceharris@vt.edu](mailto:ceharris@vt.edu).

## Information and Communications Infrastructure Group report and recommendations

In the wake of the April 16, 2007, tragedy at Virginia Tech, there were many recommendations made to improve or augment existing systems and infrastructure on a university-wide basis in order to address emergencies that could occur in the future. Network Infrastructure and Services has been involved in numerous improvements to communications infrastructure and information systems since the tragedy. Details on these improvements can be found in the 2007-2008 report and in specific project information described in this report.

NI&S has implemented or continues to develop and implement many information technology initiatives and recommendations from the university's Policy Group. For the reporting period, these improvements include Government Emergency Telecommunications Service (GETS)/Wireless Priority Service (WPS); enhancements to VT Alerts, including the installation of additional message boards and the integration of message delivery via other methods; E911 system planning and design; and improved efficiency on campus and in the office with mobile computing solutions for the Virginia Tech Police Department. These projects are described in detail within this report.

Under the leadership of the Office of the Vice President for Information Technology and Chief Information Officer at Virginia Tech, collaboration continues with administrative services departments across campus to enhance safety and security through the convergence of physical

and data security. The merger of information technology infrastructure with the actions of the Offices of Environmental, Health and Safety Services, Facilities Services, and Emergency Management; real estate activities; and law enforcement will continue to enhance campus safety and the ability to serve the university community.

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

## Google e-mail for alumni

The Alumni Association has been searching for a solution to allow Virginia Tech alumni to continue using the @vt.edu e-mail domain “for life.” Maintaining an ever-growing number of mailboxes and the computing and storage resources they consume is a problem. The goal of this project is to provide Virginia Tech alumni the ability to use the @vt.edu domain for their e-mail address without having to provision mailboxes and storage on the Virginia Tech central e-mail servers.

Google has agreed to create a mail store—on their servers—exclusively for the vt.edu domain. Virginia Tech would route, not forward, all alumni e-mail to Google. This process will allow Virginia Tech to maintain control of these addresses.

The project team includes representation from Systems Support’s Messaging team, Identity Management Services, Secure Enterprise Technology Initiatives’ Middleware group, University Computing Support, Alumni Relations, Administrative Information Systems’ Alumni Development, and Enterprise Systems’ Integration and Portal Services. The team has met and established a project plan and task list. Code development and modification is underway. The domain on both the Virginia Tech and Google portions of the network has been configured, and test accounts for the various development and support groups have been established.

The target date for migration of over 84,000 existing users from the local Virginia Tech system into the @vt.edu domain hosted by Google is Fall 2009. After this project is completed, a review of procedures and processes will be conducted to determine if other affiliation groups—such as retirees and students—could also benefit from migration to such a service.

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

## NI&S Systems Support work related to deployment of April 16th archives

As part of the negotiated agreements with families of victims who were lost and those who were injured during the tragedy of April 16, 2007, Virginia Tech prepared a digital archive of pertinent documents related to those events.



Using a combination of vendor-supplied software and in-house user account provisioning, database creation, and equipment installation, the task was accomplished by NI&S Systems Support according to the ambitious deadline set by the agreement. In less than six months, the archive was loaded with data, all data was reviewed, and the system's availability was tested in preparation for the first online visitors.

Access to the data was restricted based on established criteria so some information was available to be viewed by all, while other sections were only accessible to family members of the specific victims.

The portion of the information that is considered to be in the public domain—basically data that would be subject to a Freedom of Information Act request—has been loaded into a separate archive. Access to this archive, while open to anyone, is currently only available at two locations: the Newman Library on the main Virginia Tech campus in Blacksburg and the Virginia State Library in Richmond. Opening the archive to anyone with Internet access is under discussion now.

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

## E-discovery and preservation

As a follow-up to efforts necessary to support e-discovery tasks associated with the events of April 16, 2007, a comprehensive program to ensure the university is prepared for all similar requirements in the future was begun.

A “standard operating procedure” document, providing guidelines and information for use by all university employees, was developed in consultation with the Office of University Legal Counsel and the Information Technology Security office. Eight other cases, in addition to April 16<sup>th</sup>, have been handled during the past fiscal year including responses to subpoenas, internal human resources matters, and other possible cases of litigation.

Because these efforts produce volumes of unstructured data that require review, indexing, redaction, and presentation, a new project to manage this type of data has been initiated to better equip the university to face these issues in the future.

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

## Government Emergency Telecommunications Service and Wireless Priority Service

Network Infrastructure and Services successfully completed the implementation of Government Emergency Telecommunications Service (GETS) and Wireless Priority Service (WPS) for the university's Policy Group. The services are also available to other members of the university

community who are in leadership positions responsible for critical functions in an emergency. GETS/WPS is a federal government program designed to overcome network congestion when used by authorized federal, state, and local government personnel if they are unable to complete emergency calls through normal means using the public telephone network. The Department of Homeland Security's National Communications System is responsible for its administration. This service was implemented at Virginia Tech as one of Information Technology's initiatives following the April 16, 2007 tragedy.

Each subscriber received information from Communications Network Services containing a Government Emergency Telecommunications Service personal identification number (PIN) card, user guide, wallet guide, new subscriber instructions, and a Wireless Priority Service fact sheet. In addition to the GETS card, most subscribers also had a Wireless Priority Service added to their cellular phone. This feature, combined with the use of Government Emergency Telecommunications Service, will increase the likelihood of emergency call completion during periods of network congestion when normal calling methods may fail.

New requests for Government Emergency Telecommunications Service and Wireless Priority Service will be handled through the Office of the Director of Emergency Management. The GETS/WPS point-of-contact is in CNS and serves as the university's program administrator.

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

## Cellular infrastructure request for proposal

Network Infrastructure and Services has worked with many of the cellular service providers to understand their planned coverage improvements in the existing macro-cell networks that serve the Blacksburg area. A request for proposal (RFP) has been developed to establish contracts with cellular service providers to improve outside cellular coverage on the main university campus in Blacksburg.

The RFP will be limited to outdoor antenna systems, and following implementation, in-building coverage will be addressed. In many cases, the proximity of new cellular sites to campus buildings will improve usable in-building coverage, but the construction material of walls, the placement of cell sites, and the locations of users within buildings will determine where additional improvements will be made.

NI&S will work with the cellular service providers to enhance the usefulness of existing cellular service for the broad university community in Blacksburg, while looking for ways to support and promote the ability of university researchers to develop innovative mobile and wireless applications. It is anticipated there will be integration with the university's 802.11 wireless network.

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

## Cellular transition statewide contracts

In May 2009, new statewide contracts for cellular voice and data services were announced, and subsequently, 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 that 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.

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.

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 Richard Hach, [rhach@vt.edu](mailto:rhach@vt.edu)

## Java bootcamp classes

Carl Harris, chief technology architect and director for research, development and technology innovation, developed and presented course materials for a series of lectures and laboratory exercises on Java-based Web application development. Development staff in Enterprise Systems, Database and Applications Administration, University Development, and Communications Network Services received instruction. Course content included current best practices in Web development using inversion of control, dependency injection, persistence, and model-view-controller-based designs.

For more information, contact Carl Harris, [ceharris@vt.edu](mailto:ceharris@vt.edu).

## University audits and reviews

During the 2008-2009 fiscal year, Network Infrastructure and Services participated in, and successfully completed, four internal audits and one fixed assets equipment verification.

**Communications Network Services.** The objective of the audit was to evaluate the control systems management has in place to mitigate potential risks and exposures in technical and business processes.

**Wireless local area network.** The objective of the audit was to evaluate the control systems management has in place to mitigate potential risks and exposures in administering the wireless network and providing wireless network access to faculty, staff, and students.

**Compliance review.** [part of the compliance issues review of the Office of the Vice President for Information Technology] The objective of the audit was to help improve risk management of the controls systems, implemented by management, by evaluating compliance with the following university policies and procedures: fiscal responsibility, employee compensation and leave, expenditures, fixed asset management, funds handling, university key control, and health and safety. Controls were rated as effective in these areas.

**Printing Services.** This audit was requested by the Associate Vice President for Network Infrastructure and Services when the responsibility for Printing Services was transferred to the Office of Transportation and Campus Services.

The objective of the audit was to help improve risk management of the controls systems, implemented by management, by evaluating compliance with the following university policies and procedures: fiscal responsibility and reconciliation of financial activities, employee compensation and leave, expenditures, fixed asset management, funds handling, access and key control.

In addition, Internal Audit reviewed the budgeting process performed by CNS and Printing Services and the building security at the “Old K-mart Building” where Printing Services is located.

**Fixed assets equipment verification.** The Virginia Tech Controller’s Office completed a successful fixed assets equipment verification at Network Infrastructure and Services in the fall of 2008. This review included CNS, Video/Broadcast Services, Systems Support, University Computing Support, and the Virginia Tech Operations Center.

The review was significant because over 2,000 assets assigned to NI&S were located and verified by the Office of the Controller. In addition to the large number of items involved, there was additional complexity because these assets are physically distributed across many facilities

at various university campuses, primarily those in Blacksburg and Northern Virginia. While NI&S has substantial controls in place to track these assets, the time required to physically view each asset, as proof of its existence and verification of its location, during such review is considerable.

NI&S continues to work with the controller's office to develop alternative methods to verify the existence and locations of assets.

For more information, contact Pat Rodgers, [prodgers@vt.edu](mailto:prodgers@vt.edu).

## E911 telephone system planning and design

The existing, campus, E911 telephone process provides limited features and functionality and is tightly linked to the legacy campus telephone system. Planning and design for the installation of a new E911 system is in progress. The enhanced process will facilitate the transition to the new campus telecommunications environment and will support emergency services operations for both the legacy and the new campus telephone systems during the transition period.

The new E911 process is designed to be consistent with established industry standards and will provide Virginia Tech Police Department dispatchers with a more robust set of communications tools for handling emergency services requests. The new method will support the processing of requests for emergency services from non-traditional telephony clients (SMS, instant message etc.) as the standards for those services evolve.

This project is designed to improve the ability of the campus 911 dispatchers to quickly and accurately send officers in response to emergency events. The dispatchers will have the ability to receive calling number and location information for wireless 911 phone calls in addition to those from landlines. The first phase of the project will provide this information for the existing transfer-based call flow. The new system will provide the police department with the technology and connectivity to receive wireless 911 calls directly in the future.

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

## Consolidated dispatch 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 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.

The working group applied for and received a grant through the Virginia Wireless E-911 Services Board for a consolidation study to be conducted by AECOM Design/CTA Communications. The feasibility study is designed to answer the following questions:

- Should a consolidation take place?
- Who should participate in a consolidation?
- How should it be organized, governed, and staffed?
- How should policies be made and changed?
- What services should it perform?
- What equipment, systems, software, and hardware are needed in the combined center?
- Where should a consolidated center be located?
- How should it be funded?
- What is the timetable for the consolidation to occur?

CTA Communications presented the final version of the report on August 6, 2009.

Source: CTA Communications, New River Regional 9-1-1, Emergency Communications, Consolidation Feasibility Study

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

## Mobile computing for the Virginia Tech Police Department

The existing technology infrastructure utilized by the Virginia Tech Police Department (VTPD) to support communication, coordination, and dispatch functions is limited to audio communication using radio and telephone technology. A project to provide the VTPD's field officers with wireless-enabled computing devices has begun.

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.

The mission of the VTPD is “...to enhance the safety and quality of life for students, faculty, staff, and visitors through effective law enforcement and proactive crime prevention in partnership with the university community.” A group of information technology engineers and consultants has been formed to work in cooperation with representatives from the VTPD. The group is tasked with assessing the technology landscape and developing an appropriate strategy for equipping VTPD’s field officers with the appropriate computing and communications resources required to accomplish that mission.

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

## Enhanced 911 processes at the Northern Virginia Center

The scope of this project was to provide location information for emergency calls received at the local public service answering point from the Northern Virginia Center (NVC). Previously when 911 personnel responded to emergency situations at the NVC, they did not know the specific location within the building from which the call originated.

NI&S personnel from the Systems Development and Switch Engineering areas worked together to develop and populate a document that was presented to NVC personnel for distribution and management. This document provides extension and room information to enable emergency personnel to respond to the specific location within the Center from which a 911 call has originated. Previously, 911 personnel would have information with only the extension number and the address of the NVC building itself.

The extension/room number information is maintained by the Switch Engineering area. Updates are triggered by completed orders to move, add, change, or disconnect a telephone. At that point, personnel responsible for the documentation at the NVC are notified about the changes.

As next-generation telecommunications services become available at the NVC, further 911 enhancements should be available as part of the core operational system.

For more information, contact Barry Linkous, [linkousb@vt.edu](mailto:linkousb@vt.edu).

## Rate reduction

A major goal of NI&S is to anticipate the university community’s technological needs, and, through sound fiscal management, provide the leadership to create innovative and cost-effective solutions with the best combination of price, performance, stability, availability, and reliability.

Maintaining and enhancing an advanced communications infrastructure and providing leading-edge technology services require an up-to-date and evolving funding model. In the fall of 2007,

Communications Network Services (CNS) initiated an effort to better align overall telecommunications rates for services with the capacity consumed by university departments. As a result, departments experienced reductions in various voice and data recurring telecommunication service costs effective July 1, 2008.

To continue this realignment, effective July 1, 2009, additional rate reductions for departments were implemented. It is hoped the savings realized by this second round of telecommunications rate reductions will provide additional relief to departments as they face further budget reductions.

CNS will continue to work with the university administration to align the department rates for services with the capacity used. We anticipate continuing the telecommunications rates restructuring over the next several years.

For more information, contact Pat Rodgers, [prodgers@vt.edu](mailto:prodgers@vt.edu).

## IPv6 backbone upgrade and campus-wide availability

Internet protocol version 6 (IPv6) is the next-generation protocol for the Internet. Virginia Tech began deployment of IPv6 on parts of the campus network in 1997. This year, we completed deployment of IPv6 on all the major segments of the campus network. As part of our ongoing goal to promote state-of-the-art technology, IPv6 is available in the Data Center, academic and administrative buildings, and the residence halls. Our network supports IPv6, and Virginia Tech has one of the most extensive deployments of IPv6 in the United States .edu community.

In January 2009, Virginia Tech registered with Google for "Google over IPv6" that enables IPv6 clients on the university's network to access Google services via IPv6. Use of popular remote services over IPv6 shows Virginia Tech's commitment to this next-generation protocol for production use. Several central services, including our instant messaging (IM) server and inbound mail service also support IPv6. Ongoing work includes IPv6 enabling more services and integration of IPv6 with our network management and provisioning systems.

During the past year, Virginia Tech's IPv6 backbone was moved from IS-IS routing to OSPFv3 routing. This change was made to optimize and normalize our IP and IPv6 routing across campus. We already use OSPF for our IP traffic so we moved our IPv6 routing to the OSPFv3 version. OSPF is a familiar routing protocol for most of our network engineers, and its use increases our ability to recognize and resolve any routing issues with our IPv6 network more easily.

We expanded and extended our IPv6 routing across all campus networks and added some IPv6 routed links to locations that required IPv6 connectivity, such as the Virginia Tech Transportation Institute. We also enabled IPv6 to include all academic and residential networks. Previously we had only partial IPv6 availability in academic networks. We implemented IPv6 network monitoring capabilities to our EMC-Smarts enterprise fault management system as well



as enabling the application itself to use IPv6. AAAA records were added for ntp.vt.edu and for inbound.smtp.vt.edu. Google over IPv6 was enabled for our primary DS resolvers.

Almost all of our IPv4 addresses are assigned. The block of IPv6 addresses we currently use is part of Internet2's allocation and could hinder us from being able to fully peer via IPv6 routing with some Internet Service Providers. Work on the IPv6 address space request application for Virginia Tech is in progress but will not be submitted to the American Registry for Internet Numbers until 2009-2010.

### **Some IPv6 timeline highlights for fiscal year 2008-2009**

- November 2008—all 802.1x wireless Virginia Tech networks were IPv6-enabled
- November 2008—im.vt.edu (Jabber Instant Messenger) available via IPv6
- November 2008—First enterprise fault management IPv6 alarms received in EMC-Smarts
- November 2008—All academic networks IPv6-enabled
- November 2008—AAAA record enabled for ntp.vt.edu (network time server)
- November 2008—Residence halls IPv6 enabled
- December 2008—Remaining vestiges of IS-IS IPv6 routing disabled (OSPFv3 replaced IS-IS for VT networks)
- December 2008—IPv6 enabled for the VTTI-routed link
- January 2009—Google over IPv6 enabled for our primary DNS resolvers
- March 2009—EMC-Smarts enterprise network fault management system reachable via IPv6
- April 2009—AAAA added for inbound.smtp.vt.edu (inbound SMTP server)

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

## The Quilt

Virginia Tech is a member of an association of advanced, regional networks based in Seattle, Washington, called “The Quilt.” The members come from the advanced, research and education network community and draw on each other’s experience 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 that represent leading edge technology and best value from the participating vendors. As a NetworkVirginia participant and member of the Quilt community, Old Dominion University was able to obtain discounted pricing for Juniper products because Qwest and AT&T participate as network facilities vendor partners with the Quilt.

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

## Network core routing upgrade

During 2008-2009, network core routing improvements included upgrades in six of our major routing/switching nodes in the campus gigabit Ethernet core. Switchrooms in Burruss, Cassell, Hillcrest, Andrews Information Systems Building, Owens, and Shanks all received supervisor hardware upgrades along with new Internet operating system code to support new features and configuration command sets. The hardware upgrades allow the CPU to handle more interrupts—processing more input with a richer command feature set. 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.

The new hardware in the core permits better management of our network traffic by giving us the ability to enable Netflow analysis and export data flows to our network management platforms. Due to hardware limitations, we previously had this ability only at the campus edge. Analyzing network traffic Netflow 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. In addition, the new supervisor hardware allows us to expand our network data switching capacity to 40Gbps per slot.

These equipment enhancements have greatly increased our ability to continue to provide the university community with the data network services and bandwidth they require. At the same time, our ability to "view" network performance and analyze bandwidth utilization characteristics for capacity planning and troubleshooting purposes has been improved.

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

## Building network distribution upgrades

Building distribution switches and routers handle network traffic between the buildings they serve and the core routers. They also provide connectivity to the edge devices, or devices to which users are directly connected. Service requirements for these switches or routers are always increasing as the numbers of users grow, applications change, and the general need for more bandwidth multiplies.

Each part of the network must scale to meet new needs. During the past year, 12 campus building distribution switches or routers were upgraded to provide increased bandwidth and redundancy in the building(s) served. Prior to the upgrade, each building had either 100Mb or 2 x 100Mb connectivity to the core and 100 Mb to each edge device in the building. The new equipment is providing one or two gigabits to the core.

Below is a list of the buildings that were upgraded during the 2008-2009 fiscal year.

Burchard Hall	Derring Hall	Patton Hall
Davidson Hall	Randolph Hall	War Memorial Gym
Collegiate Square	Norris Hall	Robeson Hall
Pamplin Hall	Whittemore Hall	Hahn Hall

Building network distribution upgrades will continue as funding permits.

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

## Server and storage backup infrastructure upgrade

As part of the ongoing, life-cycle review of all equipment administered by the Systems Support department, server and storage assets were evaluated during the past fiscal year on their age, use, maintenance costs, and possible upgrade feasibility. Generally, servers have a useful life of between three and five years, while centrally maintained storage and backup equipment can last five to seven years without a major technology refresh.

Servers were further evaluated in light of the applications and services they provide as possible candidates for migration to the virtualized server environment being developed. Resources on the storage area network (SAN), network-attached storage (NAS) and the backup subsystem were also increased to support expansion of users and new initiatives.

This ongoing process has proved immensely useful in ensuring adequate resources are available to support operations, and it will be continued. Movement of servers to the virtualized environment, where applicable and practical, will be stressed in the future.

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

## Server virtualization

Estimates for the utilization of most administrative application servers on campus are between five percent and 30 percent—leaving a high percentage of free cycles. However, the university must still pay for electricity and cooling even if the machines are idle. Research equipment is, on average, 70 percent to 95 percent busy. By “virtualizing”—making the application and service less dependent on a specific physical host—and consolidating the computing environment, the resource utilization rates will rise overall, and the total infrastructure costs will be reduced. The virtualization process will allow us to procure and install high-performance computing resources to support additional research and administrative computing applications at lower cost.

During the past fiscal year, feasibility testing conducted in conjunction with the high-performance/high-volume storage project showed promise. Additional equipment was purchased to begin the transfer of production applications and services in phases. Part I of Phase I of the server virtualization project is underway at this time.

After completion of the initial phase of the project, best practices and lessons learned will be documented, and the next part of the project will be planned. Plans for future equipment purchases and scheduling of the next applications and services to migrate to the new environment will be developed at that time.

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

## High-performance storage project

It is critical to procure and install high-performance/high-volume storage for the researchers at the university and to meet the needs of administrative computing for university business operations. The immediate and fundamental requirement is for substantial increases in data storage technology supporting data-intensive research programs and enabling new research opportunities.

During the 2008-2009 fiscal year, over one petabyte (PB) of raw storage was purchased, installed, and tested. A petabyte is a unit of computer storage equal to one quadrillion bytes or 1000 terabytes.

The new storage is now in use for general research purposes through the university's Advanced Research Computing group. It is also being used for specific projects being performed by the Virginia Bioinformatics Institute and Virginia Tech Transportation Institute.

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

## Virginia Tech Transportation Institute storage project

The Virginia Tech Transportation Institute (VTTI) is Virginia Tech's largest university-level research center. Cutting-edge research in the transportation field is conducted at VTTI with the goals of saving lives and effecting significant change in public policies through the use of state-of-the-art tools, techniques, and technologies.



NI&S has worked with VTTI to establish a framework and procedures to provision high- volume/high-performance storage for use by their researchers. This framework includes the utilization of IBM's general parallel file system (GPFS) software to interface with Windows-based servers and workstations using the common Internet file system (CIFS) protocol. The new system was successfully implemented and tested during the past fiscal year.

In addition, storage has been provisioned for use with a grant-funded 2000+ vehicle study on “Naturalistic Driving Habits” that VTTI has undertaken. This project will continue through the next two years.

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

## Virginia Bioinformatics storage project

Systems Support and the Virginia Bioinformatics Institute (VBI) want to evaluate the performance and usability of SAN access to high-volume IBM storage. The primary mechanism for testing involves attaching a VBI-owned server to the storage facility and serving data out via Samba, an open source suite of software that allows users on UNIX/Linux systems to access resources on Windows-based hosts.

This project is a valid use case for production, and it will also provide information to help set directions for the future—such as how to store and access databases, archival data, etc.

The stress testing conducted demonstrated that the IBM storage performed as well or better than other options, including locally attached and networked-attached storage.

VBI has chosen to place servers in the Andrews Information Systems Building Data Center to utilize assigned portions of the storage in support of ongoing operations and research projects.

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

## Investigating database architectures and infrastructures for large datasets

The Virginia Tech Transportation Institute and other areas within the university have special needs related to collecting, indexing, storing, and presenting large quantities of unstructured data. In VTTI's case, this need relates to studies in which audio/video and telemetric data is collected by sensors within vehicles. Data collected as part of the university's e-discovery requirements can be similar in nature, but could include e-mail, Banner, Blackboard/Sakai, and Web-based data as well. Our goal is to develop systems and provide sufficient computing and storage resources to meet the challenges inherent in managing this type and volume of data.

Product evaluations and interaction with potential vendor partners have begun for this project. Grant funding is being sought to assist in supporting this effort.

This project will continue to receive a large amount of attention and resources over the coming years as it could become a major focal point for research at the university.

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

## Wireless initiatives

**Wireless ticket scanning for UUSA.** The University Unions and Student Activities organization purchased a handheld, ticket-scanning system for use at Burruss Hall venue entrances. Utilizing the handheld scanners will help increase the speed with which customers are able to enter various ticketed events. The scanners provide real-time alerts related to ticketing problems, including counterfeiting.

In order to provide these real-time services, CNS installed a private wireless network in Burruss Hall in February 2009. The wireless network will be expanded to serve events in Squires Student Center for the fall of 2009.

**802.1X with NetCerts.** 802.1x is a standards-based protocol for network access control. 802.1X requires all connected, authorized devices to authenticate with an authentication server before being allowed to utilize any network resources. Virginia Tech's wireless network, known as VT-Wireless, utilizes a form of 802.1X called extensible authentication protocol-transport layer security (EAP-TLS). EAP-TLS uses a unique client-side, digital certificate (Virginia Tech's branding is NetCert) to authenticate a user to the wireless network without the need to login through a webpage. The NetCert allows the device to automatically login to the network whenever it is connected. An authorized user may generate, install, or revoke a NetCert via a

secure website developed by CNS software developers at <https://netcert.cns.vt.edu>. NetCert authentication was made available campus-wide and fully supported for the start of the fall semester 2008. The service was made available at the Northern Virginia Center in Falls Church in November 2008.

**Wireless 802.11n research and testing.** 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 is still in a “proposed” status with the IEEE, although it is expected to be finalized in December 2009. A number of manufacturers are selling pre-draft products in both enterprise and consumer markets. It is anticipated the demand for wireless service will continue to increase and academic and research applications will require more bandwidth. CNS engineers have researched and conducted several evaluations that led to a pilot deployment of an 802.11n wireless service in Research Building 14. This pilot will provide valuable lessons in anticipation of production deployments.

**Residential wireless expansion.** The Virginia Tech community has extensively adopted wireless technologies. It is anticipated this trend will continue to increase with each incoming class. Since January 2006, NI&S has provided a pilot wireless service in 23 residential lounges in 10 different buildings. Based on the popularity of that pilot, Student Programs requested additional locations for the service.

CNS and Student Programs collaborated and identified 62 additional lounges and common areas for wireless service in 20 residential buildings. The project has been planned and funded. Installation is scheduled to occur in 2009-2010.

In addition to the lounge expansion, NI&S is now providing wireless service to student living areas in the recently completed New Residence Hall. This building will be the first residence hall equipped with “network access” enclosures in each room. These enclosures will provide network connectivity for wireless access points and are scalable for future network requirements for residential living. This design will provide improved wireless coverage in these rooms while maintaining the physical security of the network hardware.



**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 160 buildings comprising approximately 95 percent of all academic and administrative spaces on campus. The service is also available to a limited number of common areas within residential halls and will soon cover approximately 80 locations in 25 residential buildings. On a daily basis, the network serves 15,000 unique users peaking at over 6000 simultaneous users. The installed base of wireless access points is approaching 1800 and continues to grow.

In order to effectively maintain, manage and support a network of this scope and size, NI&S procured a Centralized Wireless Controller System. This new system and its underlying network architecture will provide a reliable, scalable service to better 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 architecture provides the capability for users to roam seamlessly across campus while connected to the network. This feature is required for future location-awareness and voice-over-IP applications. It also provides enhanced, dynamic, radio features, allowing wireless access points to actively avoid interference and intelligently distribute clients to less utilized access points. These features are necessary to support the adoption of collaborative educational tools in classroom settings. Finally, the architecture provides significantly reduced labor and time to provision new equipment while simplifying the underlying network configuration required to deploy the service.

The system was purchased and the architecture was designed and thoroughly tested in the 2008-2009 fiscal year. The new wireless architecture will be in production in time for the start of fall semester 2009.

For more information, contact Steven Lee, [stlee@vt.edu](mailto:stlee@vt.edu).



## Disaster recovery plan

This year, NI&S began updating our disaster recovery plan. Our pre-existing plan was a 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 in order to be a useful tool during an emergency— particularly if the content experts who work on those systems on a regular basis were unavailable to assist in the recovery effort.

A team met periodically this year to outline a new plan. The new plan assumes the content experts who manage essential systems on a regular basis may have been injured during the disaster or are otherwise unavailable to assist in the recovery effort. The plan is designed so persons with appropriate technical skills and experience can recover essential systems in the absence of the content experts. It is based primarily on documentation of system requirements and/or features and not solely on the manufacturer and part number of the existing system. In the event of a disaster where there is a need to purchase or re-purpose replacement hardware to recover essential systems, 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 plan 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 will remain a component of the new plan.

During the 2008-2009 fiscal year, the outline of the new plan was developed, and data documenting a small number of our essential systems has been compiled. We intend to complete the plan during the coming year.

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

## Public key infrastructure

In late 2006, the Virginia Tech Policy Management Authority approved policy and operating procedures for the issuance and management of personal, digital certificates. These electronic certificates are installed on eTokens and can be used for authenticating to Web applications as well as sending or receiving secure e-mail. Leveraging business systems technology to increase efficiency and effectiveness, the public key infrastructure initiative continues to be an important

step toward the achievement of the Information Technology strategic goal of implementing systems to secure critical data.

Ultimately, certificates will be issued to all Virginia Tech students and faculty and staff members, and additional applications for use will continue to be identified. (See [www.pki.vt.edu](http://www.pki.vt.edu) for more information.) Student Telecommunications is the group responsible for issuing personal digital certificates to members of the university community. During the 2008-2009 fiscal year, over 500 certificates were processed by Student Telecommunications staff. It is planned that Student Telecommunications will continue to issue certificates as the program expands.

For more information, contact Pat Rodgers, [proddgers@vt.edu](mailto:proddgers@vt.edu).

## Kestrel—the next-generation telecommunications management system

Project Kestrel was established to build the next-generation, telecommunications management system for NI&S. Eventually, it is expected to replace current legacy systems such as ATLAS and NEMISYS. The primary goals of the Kestrel project are to improve organizational effectiveness through better application usability, reduced reliance on proprietary software, and enhanced software reliability, maintainability, and extensibility.

Project Kestrel delivered two applications this fiscal year—a copyright infringement management application and a project management portfolio application. Significant progress was also made toward a replacement and redesign of the engineering change order application.

**Copyright infringement management.** The copyright infringement management application was developed to improve efficiency in the management of cases related to the Digital Millennium Copyright Act. The DMCA addresses the protection of copyrights for content that can be stored, played, copied, or transmitted in a digital format. Over the past several years, the university has averaged over 600 complaints a year from various investigative agents and must investigate and respond to each complaint to curtail reported illegal sharing of copyrighted files on its network.

The Kestrel copyright infringement management application provides a Web-based portal designed to notify and inform the network user implicated in copyright infringement and to accept response information. In the first four months after release, the system successfully handled over 300 complaints. The application has saved significant staff time previously spent dealing with DMCA issues.

**Kestrel project management portfolio application.** The Kestrel Project management portfolio application provides the organization's project management team with a system to manage and document information about the organization's many activities. In addition, it provides upper management with a dashboard-style interface to monitor those projects.

**Engineering change order application.** The engineering change order (ECO) is a workflow process and application used by the organization's network engineers to plan and manage changes to the university's network infrastructure. Design and most of the implementation of the Kestrel ECO application was completed this year, and the system is expected to be moved into production in late summer 2009. The Kestrel ECO will replace a proprietary Remedy-based system with an open source technology focused on improving the ECO process.

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

## Customer Online Access

Customer Online Access ([cola.cns.vt.edu](http://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.

This year, the Customer Online Access (COLA) Interdepartmental Communications Request (ICR) application was completed and released to all departments after a lengthy pilot implementation. COLA ICR replaces a static HTML forms system and allows departments to order and manage their telecommunications service. The system improves productivity of departmental users by allowing them to directly access existing service inventory and provides online access to current and historical orders. COLA ICR significantly streamlines the ordering and provisioning process within the NI&S organization by automating order entry.

To ensure a smooth transition to the new ICR system, the development team (including Ordering and Provisioning and Public Relations) collaborated with a group of pilot departments. Training sessions for new users and a series of Web-based training videos were provided.

A second COLA release this year was the initial version of the COLA Departmental Manager launched in late June 2009. The initial release of this application provides departments with the ability to download call detail information for office phone, cellular, and calling card calls. Future releases of this application will allow departments to download billing transaction detail as well as service inventory information.

For more information, contact Morgan Allen, [allenm@vt.edu](mailto: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, and work order functions of the organization.

This year, the ATLAS development team completed a multi-year project to convert over 200 forms from Oracle Forms Version 4.5 to Oracle Forms 10g Web Forms, incorporating many significant improvements during the migration. Additionally, the team finished moving the reporting function from a proprietary Oracle platform to an open source platform by converting over 150 Oracle Reports applications to Jasper Reports applications. During these migrations, significant effort was put into application redesign to improve usability and standardization as well as consolidate functionality. These improvements help to improve organizational efficiency and empower system users to make rapid and accurate decisions.

Another important ATLAS customer service enhancement was the implementation of automated customer e-mail notifications sent upon the completion of service orders. These notifications provide confirmation on what work was completed and when it was done allowing our customers to confirm the service order was completed as expected.

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

## Oracle 11g migration

The organization's database administration team manages 12 Oracle databases and 13 PostgreSQL databases that support all NI&S business processes. The 12 Oracle databases store a total of just over 230Gb of data. Databases support as many as 140 named users and numerous applications that serve the organization, students, staff, faculty, departments, and university guests.

During the 2008-2009 fiscal year, the team migrated seven of nine existing Oracle 9i databases to Oracle 11g and new hardware. The change resulted in improved performance, reliability, and security. As part of the process, the team migrated to Oracle's RMAN backup and recovery tools and began the implementation of Oracle Advanced Security features.

Additionally, the team has deployed several new PostgreSQL databases to establish an open source alternative to proprietary database technology when appropriate.

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

## Web-based student hiring tool

University Computing Support (UCS) needed to formalize the hiring process for student help desk consultants. Since student employee hiring is not managed through Virginia Tech's Office of Human Resources, each group hiring students develops their own procedures. In the past, UCS asked applicants to send e-mail messages to the help desk manager to be reviewed. This method had several limitations including mailbox space limits as resumes are sent as attachments

and difficulty sharing an applicant's information and reviewer comments with others involved in the hiring process. In addition, UCS may have several different positions being advertised simultaneously, and some applicants applied for multiple positions.

To address these limitations, UCS decided a Web-based hiring tool was needed. The project was started with several design goals in mind:

- Use a modular design to allow many different jobs to be posted simultaneously
- Ability to accept file attachments in any format
- Ability to accept multiple attachments for one application
- Ability to ask pre-interview screening questions of all applicants
- Utilize Virginia Tech Web Hosting service to minimize cost and maintenance requirements

From this baseline, <http://studentjobs.it.vt.edu> was developed. This site allows students to login and complete an application form for any job currently available. Applicants can attach a resume, recommendation letter, and available work schedule. Managers login, and access controls allow them to view the applications available for the positions for which they are hiring.

This tool is still evolving, and there are several projects pending to enhance this website:

- Ability for an applicant to view status of pending or previous applications
- Ability for an applicant to easily apply for multiple positions
- Administrative tools to archive old applications and manage applications in bulk
- Implement a hiring pool where interested students can maintain up-to-date resumes, and managers with an immediate need could easily fill positions
- Expand the site to include other Information Technology groups with student hiring needs

For more information, contact Kevin Davis, [kevin.davis@vt.edu](mailto:kevin.davis@vt.edu).

## Virginia Tech Knowledge Base

This fall, University Computing Support unveiled a new tool, KBPublisher, for the [answers.vt.edu](http://answers.vt.edu) knowledge base. The Knowledge Base is an online, self-service, university help system, and KBPublisher is an open source, knowledge base, workflow solution.

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](http://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 1800 solutions, [answers.vt.edu](http://answers.vt.edu) provides 24 x 7 online support for a wide variety of computing problems. The majority of the articles are actual answers given by 4Help consultants to 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, faculty, and staff in regard to computer use.

The new look and underlying structure of the Knowledge Base is the first major overhaul since development of the original system. The changes are still in progress, and there will be continued improvements on the website. [www.computing.vt.edu/help\\_and\\_tutorials/4answer/](http://www.computing.vt.edu/help_and_tutorials/4answer/)

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

## Collaboration between University Computing Support and Systems Support

4Help has always had a close, working relationship with Systems Support. The Virginia Tech Operations Center (VTOC) provides 24 x 7 monitoring of systems administered by Systems Support. University Computing Support (UCS) provides first-level support for all services provided by the Systems Support Department including Virginia Tech messaging products, Windows server administration, storage, and backup management, and UNIX administration services.

In early 2008, Systems Support and 4Help/UCS initiated a project to improve the support model for both groups. 4Help had a 24 x 7 call center in place, 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 Systems Support to administer critical university systems. As a result, a collaborative personnel and communications network that ties together broad-spectrum support from the 4Help group and more narrow expert knowledge held by Systems Support was developed.

During the first phase of collaboration, members of Systems Support became part of an instant messaging chat room devoted to support issues. Both groups realized the value of having a method to quickly discuss problems and provide answers to questions. Members representing both groups met regularly over the course of the next few months to discuss how to move forward. Systems Support provided training on issues such as Virginia Tech e-mail and blacklisting. At the same time, UCS staff worked with members of Systems Support to develop and test the use of 4Help's trouble ticketing system.

In September 2008, Systems Support began using the Remedy trouble ticketing system as an escalation mechanism for problems from UCS. They also began the process of contributing content to [answers.vt.edu](http://answers.vt.edu), 4Help's Knowledge Base.

The end result of the collaboration has been beneficial for all groups involved, especially Virginia Tech faculty, staff, and students. End users now have one place to get answers to their questions, and basic questions are answered more rapidly. Customers can refer to a single website, [answers.vt.edu](http://answers.vt.edu), for FAQs and topical information—written by members of both UCS and Systems Support—on a variety of subjects. In addition, Systems Support is able to devote more time to working on second-tier problems, documentation, and the deployment of new systems while 4Help personnel can quickly gain access to specialized knowledge for the systems they support.

For more information, contact Joyce Landreth, [jlandreth@vt.edu](mailto: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 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](http://answers.vt.edu), 4Help's Knowledge Base.

Throughout the second phase, 4Help began to take all calls and trouble tickets for OCS and provided first-line support for faculty and students for Blackboard. 4Help provided answers based on OCS-contributed knowledge to [answers.vt.edu](http://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 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](http://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](mailto: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 the university's technology concerns 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 respond to user needs in a timely and effective manner and to ensure the university community is able to access the university network and resolve any difficulties. Some of the recent changes and enhancements implemented in the VTOC to support these goals and objectives are listed below.

**Quality assurance.** The management and leadership group of the (VTOC) instituted a formal quality assurance (QA) process to ensure consistent information is provided in response to trouble tickets across all shifts and staff. Tickets are reviewed using a special template. The template is calibrated among staff members contributing QA feedback to ensure the consistency of the evaluation, and the staff receives the results on a weekly basis. The area of focus is adjusted as required (e.g., types of reported trouble, monitoring performance, or time of semester).

**Building inspections.** VTOC staff members perform building inspections of Research Building 14 during non-standard business hours. The reporting process associated with these inspections has been moved entirely online utilizing the wiki. Staff members use a calendar sign-off process to indicate the date/time checks were performed. This procedure contributes to cost savings, has less environmental impact, and has reduced administrative overhead associated with the previous paper-based process.

**Wiki enhancements.** The Customer Support Center (CSC) space on the wiki was redesigned based on function rather than one laid out organizationally. Functional areas are shown in a table-of-contents fashion that provides drill-down access to all available documentation. Areas of overlap are connected by referring links so documentation has one source, and duplication is reduced. This process also helps to improve documentation .version control.



**Electronic message board installation.** The VTOC diagnosticians provided network configuration and ATLAS documentation assistance for the installation of new electronic message boards in classrooms. Network devices were configured and ATLAS updated according to the installation schedule. Field staff called to make any necessary adjustments if circumstances resulted in schedule changes. The VTOC tracked the field crews' reporting documentation to enable management to monitor progress on a field team and/or building level.

**Remedy trouble tickets.** Remedy speed-of-ticket creation was improved in two areas by the use of macros. First, a template was created to assist in gathering required information to report to University Relations regarding the success of the VT Alerts system. Data was gathered regarding vendor (Verizon, AT&T, Sprint, Yahoo, AOL, etc.,) and technology (SMS, e-mail, IM) performance. Second, a "probing questions" macro was created to support the internal quality assurance process.

**Team building.** The VTOC began a series of team-building social events for staff with no cost to the university. Examples include management providing breakfast during selected weekly training or meeting events, potluck lunches, a spring picnic, and an awards program including a free meal for a shift or "lunch-on-the-boss" for the employee of the month.

**RSS feed.** The VTOC implemented an RSS feed for Information Technology status updates. The wiki is updated with outage or degraded service messages as unplanned events occur. These messages are published on the CNS homepage and the [computing@vt.edu](mailto:computing@vt.edu) website.

**Documentation enhancements.** Wiki training at a more advanced level was provided to call center staff. The goal of this training was to enable staff participation in a project to document all centralized Information Technology services. Documentation templates are used for faster and more complete access to the information needed to aid the support process.

**Emergency cable locates.** Miss Utility—the nonprofit organization created by Virginia's utilities to protect underground facilities—changed the notification procedure for emergency cable locates this year. Affected parties are now notified via e-mail, and only one e-mail is permitted. To accommodate this change, the VTOC e-mail distribution list is used as our point of contact. The VTOC staff takes appropriate steps to notify NI&S outside plant personnel to ensure rapid response to cable locate requests.

**Training opportunities.** VTOC management has taken steps to ensure all staff members are able to participate in the new courses offered by University Organizational and Professional Development. The courses provide customer service training, further staff development, and performance, and lead to certification from this university program.

**Hardware and software lab.** Windows operating systems are constantly changing, and it is critical for support staff to have access to the same basic software as the constituents being served. The VTOC must also have robust, proven, operating systems running on the PCs used for support to ensure near-constant uptime and minimal maintenance and overhead. A lab has been set up with Vista and Windows 7 systems to support our service and staff development.

**Continuity of operations planning.** VTOC management was involved in the design and planning phase of the contact lists for after-hours support and the NI&S continuity of operations planning. Contact information is maintained online and periodically printed for appropriate staff. This effort is on going.

**VT-Wireless.** Diagnosticians assisted several NI&S engineering teams with identification and resolution of access point naming and configuration inconsistencies.

**Information Technology implementations.** The VTOC is involved, either explicitly or implicitly, in all new Information Technology production implementations. VTOC personnel work in concert with other groups to define, plan, and implement the required support. This fiscal year, the implementations included the following items:

- Planned machine room power disruption in January 2009
- Network certificates for VT-Wireless
- Directory Access Tool (DAT) enhancements
- Guest Access Management System
- PID deprovisioning process for "inactive" alumni
- The Edward Via Virginia College of Osteopathic Medicine support review
- Internet Copyright Infringement Complaint process
- For phishing scams, secure the account, contact and educate respondents



For additional information, contact Rob Sprague at [icanhelp@vt.edu](mailto:icanhelp@vt.edu).

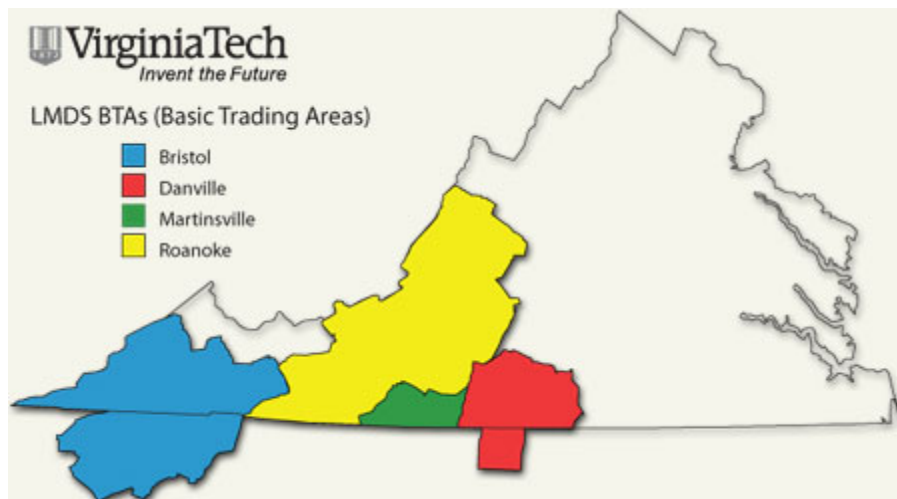
## Local Multipoint Distribution Service

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 license areas



**Roanoke BTA.** Bath County, Rockbridge County, Alleghany County, Botetourt County, Craig County, Bedford County, Roanoke County, Roanoke City, Giles County, Montgomery County,

Franklin County, Pulaski County, Floyd County, Wythe County, Carroll County, and Grayson County

**Martinsville BTA.** Patrick County, Henry County, and Martinsville City

**Danville BTA.** Danville City, Pittsylvania County, Halifax County, South Boston, and Caswell County, N.C

**Bristol BTA.** Smyth County, Grayson County, Washington County, Bristol City, Russell County, Dickenson County, Wise County, Scott County, and Lee County. The following Tennessee counties are also included in the Bristol BTA: Hawkins County, Kingsport City, Sullivan County, Carter County, Johnson County, Johnson City, Washington County, Greene County, and Cocke County

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 that brought together licensees, equipment manufacturers, and research laboratories to develop and promote LMDS technology. The university's wireless research groups ([www.wireless.vt.edu](http://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 ([www.bev.net](http://www.bev.net)), and eCorridors ([www.ecorridors.vt.edu](http://www.ecorridors.vt.edu)) 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.



Harris-WavTrace LMDS multipoint hub 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.

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-Nextlink—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 2009. Also, during summer 2009, three links are planned for the Bristol BTA and one for the Martinsville BTA. A link for the Danville BTA is still to be determined.



LMDS Links at the Virginia Tech Campus and in Blacksburg in June 2008

The photo below 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 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](mailto: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,. It is a nonprofit, private corporation initially funded through several foundations that were 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 founded 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 research with Virginia Tech. VCOM is located in Virginia Tech's Corporate Research Center ([www.vcom.vt.edu/](http://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 eight 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 last year, CNS has worked closely with VCOM to provide new telecommunications services to meet their needs in their new facilities at the Knollwood Building and Research Building 25.

For more information, contact Pat Rodgers, [prodgers@vt.edu](mailto:prodgers@vt.edu).

## Campus cabling infrastructure upgrades

In preparation for deployment of the first university-owned digital telephone system, Communications Network Services began installing the main campus telecommunications cabling infrastructure in 1987. Before then, most telephone cabling on campus was installed by telephone companies. AT&T placed the 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 as Verizon) installed backbone cables from wiring closets to their switching center in downtown Blacksburg, provided local telephone service, and delivered long distance calls to AT&T to be completed.

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 they terminated their services. Virginia Tech extended the telephone company lines over Virginia Tech cabling infrastructure to communication outlets in buildings. This modification has saved the university millions of dollars and provided greatly enhanced telecommunications services.

Over the last 20 years, different levels of inside building cabling and telecom equipment room infrastructure on campus have resulted based on when a building was last cabled and what product technologies were available at the time. For example, the infrastructure in some buildings only supports 10Mbps (megabits per second) Ethernet, some support 100Mbps Fast Ethernet, and newer cabling can carry gigabit Ethernet. The latest cabling technology can support up to 10gigabit Ethernet, but the cost is relatively high. Another critical factor is that power provided over Ethernet cabling has become desirable for voice over Internet protocol telephone sets, wireless access points, alert panels, and other devices.

In the last few years, wireless access needs for portable devices have dramatically increased. Most academic areas now have wireless access. End-user wireless data speeds have increased from a few megabits per second to tens of megabits per second. The newest wireless access products may support end user speeds up to 100Mbps, but these have not yet been deployed at Virginia Tech. The campus-cabling infrastructure must be updated to provide the backbone connections needed for the wireless access networks of the future.

Requirements for outside communication cabling to serve buildings have changed as well. Until now, copper wire cables have been used to connect analog and digital telephones to campus switching centers. Multi-mode and single-mode fiber-optic cables have connected building local area network (LAN) Ethernet switches to campus switch centers. Fiber-optic cables also interconnect campus telephone and LAN switches between campus switch centers. Due to increased speeds of backbone links between buildings, multi-mode fiber cables are obsolete, and additional single-mode fiber cables are needed. Since future voice, data, and video communications are converging for transport over single-mode fiber, we need to provide additional paths for fiber-optic cables into many buildings for redundancy and reliability.

In May 2009, renewed project planning began to design the 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 the review of existing infrastructure in each building and between buildings, determining what changes are needed, and preparing to upgrade the infrastructure. The work accomplished thus far has involved gathering existing documentation—including database information, CAD drawings, GIS drawings, demographics, university master plans, product information, and other data needed for planning. Any missing information will need to be obtained. Depending upon funding, it may take several years to complete the required infrastructure upgrades.

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

## Campus heat plant steam distribution upgrades—protect in place

This year, the Office of Facilities Services completed a major upgrade to the steam distribution systems in the tunnels between Owens Hall and Cassell Coliseum. Owens and Cassell each house one of our campus cable and telecommunications switching centers. Cabling connecting these centers and ring cabling connecting all six campus cable and switching centers runs through the steam tunnels affected by this project.

The work associated with the steam distribution upgrade posed substantial risk to our cabling in these tunnels. Damage to that cabling could have resulted in long-term disruption of telecommunications services to the main campus, including the interruption of access to the Internet and to mission-critical services in the Andrews Information Systems Building Data Center.

NI&S personnel worked closely with Facilities and contractors' personnel during this multi-year project to develop procedures to “protect in place” the cabling in these tunnels. Protective measures, such as rigid barriers affixed to the walls where cabling is racked, fireproof wrapping around cabling crossing the ceiling of the tunnels, and steel “bridges” and fireproof-wrapping covering cabling crossing the floors, was utilized to protect our cabling from impact or damage from welding activities. A two-person NI&S team was assigned to monitor project activities for the entire duration of the project to ensure prescribed protective measures were properly and



rigorously installed and utilized. This team worked with the contractors and with Facilities personnel on a daily basis to protect mission-critical cabling.

Due to our combined efforts, the project was completed this year with no damage to the cabling in the affected steam tunnels.

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

This system is being installed in the Data Center during the summer of 2009. Equipment is on hand and awaiting deployment.

For more information, contact Eric Brown, [eric.brown@vt.edu](mailto:eric.brown@vt.edu).

## Situational awareness video for campus safety

As an additional element of campus safety and security, the Virginia Tech Police Department and the Office of Emergency Management want to install video cameras to monitor large public gatherings. The video system is expected to increase situational awareness of any such event and allow a limited on-site police presence.

While the cameras may serve to minimize personnel expenses, the system's primary purpose is to increase public safety without creating an intimidating police presence. In addition to installing new cameras, the VTPD wishes to gain access to cameras already installed on campus

by other groups. Successful completion of this task will result in a campus policy for the installation of cameras, specifically outlining how they can be used in a public safety capacity when appropriate.

The role of Information Technology personnel in this effort is to advise on appropriate technical protocols, technologies, and strategies to be used, as well as to guide and inform policy-making efforts. In the production phase of the system, Information Technology will provide servers and storage resources required for video archival, system management, troubleshooting, access control, and telemetry. Information Technology will also develop a method to allow the VTPD to quickly and easily select the appropriate camera for use in specific situations.

Initial investigations into available products have just begun. This system will be studied more extensively and developed in fiscal year 2009-2010.

For more information, contact Eric Brown, [eric.brown@vt.edu](mailto:eric.brown@vt.edu).

## Net@EDU Converged Communications Working Group

The purpose of the Converged Communications Working (CCWG) is 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 provides information to Net@EDU members during the annual meeting in February and the EDUCAUSE national meeting in October. The CCWG also provides topic-specific information to participants through day-long sessions offered at both meetings. The content of these sessions is developed by a core group that forms a steering committee. John Nichols and Richard Hach are members of the Converged Communications Steering Committee (CCSC). The steering committee chooses topics based on current importance to the community, e.g., emergency communications notification, or of general interest to the members, such as leveraging converged infrastructure and services in difficult financial environments.

The CCSC completed a “Peer Survey on Emergency Communications Notification and Management in Higher Education.” The results of the survey were tabulated and released to Net@EDU members in a feature-length article written by Mike Staman of Macon State College, Mark Katsouros with the University of Iowa, and Richard Hach with Virginia Tech for the *EDUCAUSE Review*. “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](mailto:rhach@vt.edu).

## NetworkVirginia initiatives

NetworkVirginia is an outreach program of Virginia Tech that promotes early access to advanced network technology and services throughout Virginia. The goal is to improve the quality of life of Virginia's citizens and enhance economic competitiveness.

NetworkVirginia 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 laboratories. Scientists, educators, economic developers, government agencies, 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 22 to the NetworkVirginia agreement with Verizon Business was successfully completed to resolve outstanding billing issues and pricing discrepancies along with the continuation of a technology refresh. A project to leverage NetworkVirginia and drive broadband access and advanced network services to every K-12 school in Virginia is currently underway under the National Telecommunications and Information Administration (NTIA) Broadband Technology Opportunities Program (BTOP) in collaboration with service providers and the Virginia Department of Education.

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

## Spectrum optimization

A new project is underway at NI&S—a collaborative effort with Real Estate Management and Environmental, Health and Safety Services to gather data regarding campus antenna installations. Goals of the project include the following:

- updating and augmenting FCC wireless license information
- addressing concerns regarding radio frequency emissions and abandoned equipment
- providing guidance to the university community regarding the future use of radio spectrum on campus, antenna installations, changes or transitions being planned by regulatory agencies
- enabling research

Survey application development and operational procedure development activity is currently taking place. The final results will address both licensed and unlicensed spectrum. The Office of Environmental, Health and Safety Services is working on general roof safety issues, and, with Facilities, will provide specific guidance to those accessing roofs regarding fall protection and the hazards of chemical exhaust, radio frequency emissions, and other biosafety issues. NI&S plans to implement a pilot project in the fall with the initial survey and procedure distributed during September 2009. The survey instrument will be revised based on the pilot and distributed to the campus at large. Field work will take place to confirm survey findings and to complete an inventory of antenna installations.

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

## Center for the Arts

This year, NI&S has become integrally involved in the Arts Initiative at Virginia Tech with particular focus on the Center for Creative Technologies in the Arts (CCTA).

Bill Sanders assumed a split appointment as the director of the Blacksburg Electronic Village and the director of the CCTA. The arrangement is 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 and is tracking the design of the Center for the Arts to be sure NI&S is appropriately involved in the design of the facility from the beginning 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 critically 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.

Bill Sanders is serving as the first director of the Center for Creative Technologies in the Arts for which he provided the following description:

The Center for Creative Technologies in the Arts will operate across disciplines and at the intersection of the arts, education, and technology to help develop and integrate learning environments, models, methods, and materials in collaboration with teachers in PK-12 schools. The resulting collaborative products and experiences—many of which will be available in digital formats—will be designed to educate the whole person and will be available to schools across the commonwealth. Such an approach—integrating the arts and technology with education and based in 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 both in the STEM curriculum and 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.

In support of the CCTA program development, NI&S staff members are engaged wherever there is a need to think about the technological implications of grant proposals, projects, or potential programs. Most recently, Learning Technologies held the first Faculty Development Institute track on creative technologies. The workshop was attended by 22 faculty members from various disciplines including, in addition to the arts, engineering, computer science, and building construction. The closing session of the three-day workshop included NI&S and Information Technology staff members with expertise in networking, centralized hardware/software, and services to listen and talk directly with faculty about ideas created in the workshop. Some faculty participants asked not only for more workshops of this sort, but also for mechanisms to allow them more ready access to our staff in order to discuss the technical aspects of ideas they might have.

It is obvious that statewide outreach programs envisioned as part of the CCTA—clearly, a technology-based embodiment of the Virginia Tech 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.

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

## SANS computer and information security training

The SANS (SysAdmin, Audit, Network, Security) Institute provides intensive, immersive, training sessions designed to help information technology personnel master the practical steps necessary for defending computer systems and networks against the most dangerous threats—the ones being actively exploited. Each year, SANS programs educate more than 12,000 people worldwide.

SANS training can be taken in a classroom setting from SANS-certified instructors, through self-paced courses over the Internet, or in mentored settings in locations around the world. In July 2007, Virginia Tech supported its first SANS training course. Others have been held since that time, and approximately 1350 participants have attended these conferences. The use of interactive videoconference technology provides the opportunity to teach courses to large audiences without travel expenses or disruptions to participants' work schedules. Video/Broadcast Services' (VBS) administrative and technical support of the SANS conferences is considered an integral part of successful program delivery.

The SANS Institute has scheduled VBS support for two conferences during the summer of 2009, one of which is a six-day “boot camp-style” introduction to network security. Three additional conferences are in the planning stages for the 2009-2010 fiscal year with a potential for even more to be scheduled in the future.

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

## Installation of new burglar alarm system

The university’s burglar alarm system, installed several years ago by SimplexGrinnell [www.simplexgrinnell.com](http://www.simplexgrinnell.com), had reached its capacity to provide panic button and burglar alarm connections to campus locations. No additional alarm connections could be provided. The goal of this project was to expand and enhance the alarm services offered by the Virginia Tech Police Department across the Blacksburg campus. The enhanced system was obtained through a sole source procurement and installed by SimplexGrinnell. All of the existing, operational equipment was able to be reused. The enhanced system allows for expansion and for the deployment of remote cabinets that would terminate connections from university customers with specific needs and applications. Training for VTPD personnel on the new features available will take place in the near future. The new alarm system will allow the VTPD to update the contact information for each alarm they monitor to ensure that information is current and accurate.



For more information, contact Barry Linkous, [linkousb@vt.edu](mailto:linkousb@vt.edu).

## HokieMart and ATLAS integration planning

Currently, HokieMart is the portal being used for purchases from most (non-university) vendors. HokieMart is an on-line marketplace. In addition, HokieMart is the Virginia Tech brand for software licensed from SciQuest for the electronic control of document processing. This software is integrated into the university’s Banner financial system. HokieMart provides a structure for the processing of all purchasing requirements.

Many departments providing goods and services to the university community have developed order processes and documents that currently do not interface with HokieMart. An

interdepartmental communications request (ICR), developed by CNS, must be completed and signed by an authorized party to order any voice, data, or video service.

Systems Development and Administration and Business Services have been meeting with a university team appointed by Vice President for Finance and Chief Financial Officer to determine how to best integrate the CNS ICR ordering process into HokieMart.

For more information, contact Pat Rodgers, [prodgers@vt.edu](mailto:prodgers@vt.edu).

## Trunk optimization: analog-to-digital conversion

Optimizing the inventory of inbound and outbound trunks connecting the campus telephone system to the public switched telephone network (PSTN) is an ongoing objective.

During the past several years, the composition of the university's inbound trunks has changed from 312 analog, direct-inward-dial trunks to 276 digital, integrated services digital network (ISDN) trunks. The conversion from analog to digital technology promotes more efficient utilization of trunk resources as the digital trunks can carry both inbound and outbound traffic. The ISDN trunks are provisioned as the primary inbound trunk group and the secondary outbound trunk group. The trunks are allocated dynamically based on current demand for inbound and outbound connectivity to the public network.

The conversion from analog to digital also provides enhanced voice quality, faster call setup time, improved diagnostics and audit capabilities, and CallerID service.

Additional changes to the PSTN connectivity strategy include the reprovisioning of the modem pool remote access trunks to serve as overflow resources for inbound and outbound connectivity to the PSTN during high call volume situations. This project was made possible by an investment in an ADTRAN ATLAS integrated access device. The equipment serves as an intermediary switch terminating circuits from PSTN, the campus telephone system, and the modem pool by dynamically allocating trunk resources on demand.

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

## IVR and speech recognition projects

The technology currently utilized to provide interactive voice response (IVR) and auto attendant applications at Virginia Tech is antiquated, provides limited features and functionality, and is highly coupled to the campus telephone system. A project to refresh the infrastructure in order to develop and host traditional IVR and speech-enabled IVR applications is underway.

Speech-enabled IVR applications are characterized as utilizing text-to-speech and/or automatic speech recognition technology. This project will enable the migration of existing university IVR and auto attendant applications from the legacy systems and will facilitate the development of new applications to leverage enhanced speech capabilities.

The IVR and speech recognition project involves the procurement, installation, and configuration of the hardware and software resources to support the development of speech-enabled, voice applications. The project's components include IVR software, speech services software, application servers, and telephony gateways.

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

## Innovative technology in Field Engineering

During the past year, Field Engineering (FE) technicians began using a new software application to improve the timeliness of documentation when a work order had been completed.

In the past, technicians reported work order completion dates on a paper copy of the order. The work group managers later updated multiple work orders using an online, ATLAS application. However, the batch update was usually completed at the end of the week. As we continue to improve work-flow processes—including ongoing monitoring to ensure timely completion—this delay in updating work orders in ATLAS sometimes resulted in reports erroneously indicating work orders were not being completed on time.

Field technicians use the new application to update the work order completion date themselves, rather than waiting for the workgroup manager to make the updates. A small test group of technicians has been issued personal digital assistants (PDA's) in order to make real-time updates from the field, while other technicians update their work orders when they return to the office at the end of the day. The new application does not implement full ATLAS functionality on a PDA or desktop PC; it is limited to updating work order completion dates.

In the coming year, we will experiment with issuing “netbook” computers to key personnel to enable them to perform more real-time activities from the field. The devices to be tested initially



are inexpensive and include a hardened case, but they will allow access to more ATLAS functionality, such as submitting inventory “pick lists” to our warehouse, from the field. We anticipate this further extension of innovative technology in FE will increase operating efficiency and will continue to expand this type of capability in FE over time.

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

## Blacksburg Electronic Village technology initiatives

Blacksburg Electronic Village technology initiatives this year have focused on raising the profile of telecommunications infrastructure in the Town of Blacksburg planning process and the adoption of more powerful and staff-efficient tools for system security, website development, and client support.

**Town of Blacksburg infrastructure assets.** The BEV director continues to serve ex-officio on the Blacksburg Telecommunications Advisory Committee working with the town's Technology Manager to assist in the GIS mapping of town network infrastructure assets. The data were used to produce a map that has been forwarded to the Planning Commission for inclusion in the town's comprehensive plan. Also included were recommendations that telecommunications infrastructure (conduit, fiber, etc.) be taken into consideration as parts of the town's planning and permitting processes in the same way that water, sewer, and other utilities are evaluated. This action has raised the visibility of infrastructure and led to discussions among the BEV, the town administrators, and Town Council concerning projects and investments Blacksburg might make to its infrastructure to increase operational efficiencies and for purposes of economic development. We expect such planning to expand next year with BEV support for a “visioning process” to help the town solidify specific goals and objectives in this arena and identify candidate projects. These activities may well be closely related to the Arts Initiative involving both the university and the town.

**Web services.** BEV provides Web hosting and Web application services to a large number of clients ranging from university departments to small community organizations. In addition to the operating system-level firewalls we run to protect our servers against network attacks, this year BEV implemented Web application firewalls using two open source tools, Apache ModSecurity and PHP Suhosin.

**Workstation security.** BEV has improved office workstation security using an open source, host-based, intrusion detection system, OSSEC. The product provides remote logging, file integrity checking, and rootkit detection, with a real-time log analysis and alerting capability. This system allows us to monitor an increased number of workstations more closely with less effort on the part of the system administrator.

**Web Support Services.** BEV's Web Support Services (WSS) is a team of three to six carefully selected undergraduates performing website development under the supervision of full-time BEV staff. Our not-for-profit clients' needs increasingly include sophisticated, dynamic, web and

cascading style sheet (CSS) features that are extremely difficult to deliver within budget constraints. In the past year, Web Support has fully adopted the open source Drupal Content Management Platform and 960 Grid CSS System, allowing us to deliver professional-quality websites on time and within budget. The result has been increased participation in higher-profile projects including development of FIT Extension ([www.fitextension.ext.vt.edu/](http://www.fitextension.ext.vt.edu/)), a Virginia Cooperative Extension site. The site enables hundreds of people throughout Virginia to improve their health with physical activity and better nutrition.

More sophisticated client-editable websites can lead to increased client confusion and additional support costs for the WSS team after implementation is complete, and a site moves into the maintenance phase. In the past year, Web Support began experimenting with screen videos as a documentation tool. They were found to be so successful that we have adopted screen flash-videos as our primary client-documentation medium. They save time when creating documentation for complex sites and have been very well received by our clients who find a "show me how" video much easier to follow than a written description.

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

## Video/Broadcast Services production

The video/multimedia production arm of Video/Broadcast Services produced over sixty projects during 2008-2009. Of this number, 43 were relatively simple productions such as recording an interview for DVD delivery or uplinking a faculty member's participation in a national news program. However, there were more than 20 productions that were longer, more complex, and more labor-intensive. These productions generally required 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 from the past year are listed below.

**“Plaid Avenger.”** The “Plaid Avenger” is a characterization developed by geography instructor, John Boyer. The Avenger discusses current world events and explains them in the contexts of history, geography, politics, and economics. Because of Boyer's unique approach to the subject matter, the class is one of the most popular at Virginia Tech. It meets twice each week in Burruss Hall with an average attendance of over 2000 students. VBS recorded Professor Boyer's lectures and posted the classes to the VBS web server for video-on-demand viewing.  
[www.plaidavenger.com/page/2](http://www.plaidavenger.com/page/2).

**“Social Skills.”** The purpose of the project was to demonstrate to clinic professionals certain behaviors of teenagers as they react to stressful situations. Seventeen scenes—using teenage actors—were written, directed, photographed, and edited by VBS Production staff for delivery on DVD. The client was Dr. Susan White of the Department of Psychology.

**“Matrix Math.”** In association with the Pamplin College of Business, the client for this project was the Institute for Distance and Distributed Learning. The objective was to offer remedial help

to students who have difficulty with certain components of matrix algebra. VBS recorded approximately 20 lectures delivered by two Math Emporium instructors. The resulting files are available for video-on-demand viewing.

**“Kid Tech U.”** This production was completed for the Virginia Bioinformatics Institute. The intent was to give children, ages 8-12, a detailed introduction to certain areas of scientific instruction—genetics, computer science, wildlife biology, and space exploration. The lectures were delivered by renowned scientists from universities across the United States to approximately 450 children and their parents. VBS Production staff recorded the lectures on four Saturdays during spring semester 2009 and posted them to a VBS video server for video-on-demand viewing ([www.vbs.vt.edu/content/adhoc/spring2009/KidTechU/Christensen/](http://www.vbs.vt.edu/content/adhoc/spring2009/KidTechU/Christensen/)).

**Choices and Challenges.** For the 23<sup>rd</sup> year, the Choices and Challenges forum ([www.choicesandchallenges.sts.vt.edu/past.htm](http://www.choicesandchallenges.sts.vt.edu/past.htm)), hosted scholars who discuss the issues that arise when changing technologies collide with the public good. The November 2008 discussion concerned information technology and American politics.



**Day of Remembrance.** VBS Production provided video coverage of the events on April 16, 2009 as Virginia Tech remembered those who died on April 16, 2007. The programs were recorded and posted for video-on-demand at [www.weremember.vt.edu/2009-events/video/2009\\_video.html](http://www.weremember.vt.edu/2009-events/video/2009_video.html)

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

## Courtside cable infrastructure upgrade in Cassell Coliseum

The demand for media coverage at Virginia Tech athletic events has expanded since the university became a member of the Atlantic Coast Conference. Live media coverage is expected, and the existing communications infrastructure at Cassell Coliseum court was deemed inadequate to provide the appropriate services. CNS was asked to develop an adaptable, scalable,

cabling distribution system within the arena to serve the pervasive telecommunications needs of the Athletics department and provide enhanced audio/video services for media outlets.



A cabling distribution system was designed and installed underneath the courtside floor. Game-operations cabling was pre-installed with hinged-access floor panels strategically located around the court to simplify connectivity for various operational requirements. All cabling is consolidated at a multimedia, consolidation rack. The project also included specifying and installing an outdoor communications pedestal. This pedestal will provide high-speed connectivity for uplink trucks for televised events.

For more information, contact Steven Lee, [stlee@vt.edu](mailto:stlee@vt.edu)

## Current capital and renovation projects

Field Engineering 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 capital projects.

Life Sciences I. This new facility provides office space and state-of-the-art laboratories for research in biology.

Cowgill Renovation. This project involved major upgrades of the mechanical, electrical, and telecommunications infrastructure and a retrofit of existing design labs to provide wet and dry service areas.

Agnew Renovation. This renovation involved the installation of a new elevator and upgrades to the electrical and telecommunications infrastructure. This building is now occupied by Biological Systems Engineering (BSE).

Institute for Critical and Technical Applied Science. This new facility provides laboratory and office space for engineering-related research.

Work on the following capital projects is currently in progress:

- New Hall West
- Henderson renovation
- Basketball Practice Facility
- Ambler Johnston renovation
- VT KnowledgeWorks 1



According to the University Planning Design and Construction schedule, the following projects will start during the 2009-2010 fiscal year:

- Materials Management facility
- McComas Hall addition
- Institute for Critical and Technical Applied Science II
- Virginia Bioinformatics Phase III
- Infectious Disease Facility
- Parking structure
- Visitor Center/Undergraduate Admissions
- Jamerson Athletic Center football locker room

Within the past year, FE has installed telecommunications infrastructure for the following building renovation projects:

- Norris Hall
- McComas Hall
- Ambler Johnston Hall
- Cowgill Hall

- McBryde Hall
- Fleet Services facility

For more information, contact Doug Jones, [jonesd@vt.edu](mailto: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 2008-2009 fiscal year, the following significant projects involving the installation of outside plant were completed.

**NRV Mall fiber meet point.** A permanent concrete pad was constructed and powered and air-conditioned cabinets were installed in a Virginia Department of Transportation right-of-way near the New River Valley Mall. This installation allows CNS to interconnect with other fiber-optic carriers present at this location and allows Radford University and New River Community College a direct, low-cost, high-speed link to Virginia Tech networks.

**Ramble Road fiber meet point.** CNS constructed a permanent concrete pad and cabinet in a Town of Blacksburg right-of-way for the purpose of creating additional locations from which CNS could interconnect with other fiber-optic carriers that have a nearby presence. 48 single-mode fibers are installed and connected to the Information Systems Building switch center. Future plans are to connect this installation to our existing South Main Street fiber network that will offer a shorter pathway to the Virginia Tech Transportation Institute and free up fiber resources to provision our leased warehouse on Landsdowne Street and eliminate expensive, monthly, trunking charges from outside vendors.

**Hardee's point of presence fiber.** A short, fiber link was completed between our existing South Main fiber and an established collocation facility. This connection allows us to reach the collocation facility from both the Information Systems Building and the Owens switch centers on campus.

**Corporate Research Center (CRC) bypass duct bank.** Approximately 3800 linear feet of direct-buried duct bank was constructed along Kraft Drive and Ramble Road. The purpose of the construction was to establish a new pathway around CRC-owned duct bank that was at capacity.

Voice and data services to VCOM, Knollwood, and Research Building 25 are provided via the new route with capacity for additional future use as needed.

**Hillcrest to Cassell fiber.** CNS installed a 144 single-mode fiber cable between the Cassell and Hillcrest switch centers. This fiber was installed to provide additional circuits from Cassell to a Plantation Road meet point. A DWDM circuit between the main campus and a collocation facility in Ashburn, Virginia, will be provisioned via this installation.

**Cassell to Owens fiber.** Two 48 single-mode fiber cables were installed between the Cassell and Owens switch centers in order to provide additional capacity between the two centers. The existing route between the centers was via steam tunnel and access to this route is scheduled to be blocked with the addition of a new, large steam pipe. Additional fiber circuits between the centers would not have been possible until alternate pathways could be established.

## Ordering and Provisioning activity and initiatives

**COLA ICR.** An anticipated release of the new interdepartmental communications request (ICR) tool was completed during the year. The Ordering and Provisioning group worked extensively with Systems Development and a pilot group of departmental communications liaisons to develop an online service ordering system. In the new system, a communications liaison can “see” their existing services and make the necessary changes to those services without difficulty. Buildings, rooms, and outlets can easily be selected for departmental moves and new installations. Each service request now contains accurate billing information and the online inventory gives each communications liaison the ability to audit their existing records.

During development, Ordering and Provisioning worked as a conduit between the pilot users group and the system developers. Existing records were audited for accuracy and corrections were initiated. This effort also provided an opportunity to develop a better relationship with a broader segment of departmental communications liaisons. Many departments place very few orders per year, and during these contacts, departmental records were updated.

An unintended benefit of this project was the face-to-face meeting with many of our communications liaisons during ICR training sessions. During the training, we received valuable feedback that was quickly integrated into the system by the developers. Ongoing development progresses as we continue to improve telecommunications service management for university departments. We look forward to working with Systems Development and our ICR originators to continuously improve and elevate our customer support.

**Wireless LAN reconciliation.** The concept of a no-cost, bundled, service created an opportunity to offer a service based on the association of a faculty or staff member with an Ethernet connection paid for by the department. Ordering and Provisioning has worked diligently with Systems Development to review the demographic and service records for every department on campus. The goal was to ensure the integrity of the existing service records before we implemented new management tools for bundled wireless LAN services.

During this process, we worked with software designers to institute an application where a communications liaison can manage wireless LAN access for the faculty and staff in their department. University faculty and staff turnover and the appropriate departmental association present a formidable challenge to the maintenance of accurate records. By moving this responsibility to the individual departmental liaisons, the incentive to keep the data up-to-date and responsibility to provide the bundled wireless LAN service has shifted back to each department. Controls were put in place to keep one department from providing service for another non-related department or group.

**Major Project Synopsis.** Ordering and Provisioning worked on the following major projects during the past fiscal year:

Surge Building classroom project  
Wireless ticket scanners at Lane Stadium  
McBryde Hall renovation  
Leesburg Equine Medical Center  
Ethernet over local area network  
Cowgill Hall renovation  
Agnew renovation  
Life Sciences Building at the Corporate  
Research Center  
VCOM space at Knollwood on Ramble  
Road  
Sterrett Facilities Building Ethernet  
upgrade  
Message boards  
Old Grand Piano Building LMDS  
upgrade

Laundry Net  
National Public Radio broadcast – “Talk  
of the Nation” from The Inn at  
Virginia Tech  
Panic button system upgrade  
Load balancing at the Information  
Systems Building machine room  
Storage network project at the  
Information Systems Building  
machine room  
Norris Hall renovation  
Institute for Critical Technology and  
Applied Science Building  
HokieMart approvals (nearly 2000)

**Cellular Telephones and mobile messaging.** The trend towards cellular mobile communications continued at a robust pace during the past year. Mobile messaging accounted for an almost 75 percent increase in the number of cell phone users over the past year. Mobile messaging is available on the combined voice and data cell phones referred to as smartphones, PDAs, and Blackberries. The university offers support for many mobile devices through an agreement with Good Technology. Mobile messaging users can check e-mail, schedule and accept meetings using Outlook, and use Web browsers on the Internet. Many of these mobile data devices also can utilize the Virginia Tech wireless network for data access. Cellular carriers are beginning to expand their voice and data networks both domestically and internationally. Blacksburg currently has two major carriers offering 3G data network access.

For more information, contact Bill Blevins, [blevins@vt.edu](mailto:blevins@vt.edu).



## Redesign of Communications Network Services website

As a step in our continuous effort to improve accessibility of information regarding the services and activities of Communications Network Services , a comprehensive redesign of the CNS public website, [www.cns.vt.edu/](http://www.cns.vt.edu/), was undertaken.

The site redesign simplifies navigation, updates information, incorporates university-standard, Web-design features, and creates a contemporary look for users. In addition, the site is printer-friendly on all pages, with several pages having mobile versions for use with handheld devices.

The site has received positive feedback, and we continue to make improvements. Further integration with University Computing Services and other groups on campus will provide more information about maintenance schedules and system performance updates to the community.

For more information, contact the CNS Webmaster at [CNSWebmaster@vt.edu](mailto:CNSWebmaster@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. The Commonwealth established qualification and training standards—developed by the Virginia Information Technologies Agency (VITA)—for information technology project managers. (See [www.vita.virginia.gov/oversight/projects/](http://www.vita.virginia.gov/oversight/projects/) for more details.)

Information technology project managers are qualified for projects within certain project categories. The Commonwealth of Virginia does not certify project managers. Project management certification must be obtained from other organizations.

To be qualified, a project manager must meet certain requirements and have the required amount of prior project management experience including team building, leadership, education, and necessary technical skills. It is desirable for information technology project managers to attend the Commonwealth Project Management Overview Training class. In addition, two project management qualification tests—core processes and the facilitating processes—may need to be taken depending on the project category.

The project categories are:

- non-major information technology projects costing less than \$100,000;

- non-major information technology projects with a total cost greater than or equal \$100,000 and less or equal to one million dollars;
- major information technology projects—including those that are mission-critical, have statewide application, and have a total estimated cost of more than one million dollars.

Network Infrastructure and Services currently has six staff members who are “qualified” by VITA to manage projects. One individual is in the process of becoming project management-certified. Several other individuals are waiting to take the appropriate training to become qualified. The department recognizes the importance of project management and has created a working team to assist the project managers. In addition, a project management portfolio has been developed to provide NI&S management the ability to review the status of projects as needed.

For more information, contact Christine Morrison, [imsvs@vt.edu](mailto:imsvs@vt.edu).

## Data Center power systems upgrade

The Andrews Information Systems Building (AISB) Data Center 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 continual 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 UPS capacity in the Data Center by replacing the 240 KW UPS with a larger UPS or by installing another power feed to the facility.

During the year, we have monitored the power use of the AISB and Data Center to determine if we can upgrade the 240 KW UPS. In addition, we have worked with the contractor to get the work and cost estimates for an upgrade and a new power feed. Work will continue on this project in 2009-2010.

For more information, contact Marshall Fisher, [mfisher@vt.edu](mailto:mfisher@vt.edu).

## Uninterruptible power system upgrades for CNS switchroom locations

CNS provides uninterruptible power (UPS) for its Ethernet systems and for CNS switchroom locations classified as major switching centers. The goal is to provide reliable, up-to-date, UPS equipment that will support the next-generation Ethernet switching applications and equipment.

During the 2008-2009 fiscal year, the CNS Facilities group was able to acquire and install UPS equipment to meet the demands of the Ethernet and other CNS operational systems in three switchrooms—Burruss, Hillcrest, and Owens. Completion of this work means only two of six CNS switchrooms need UPS equipment upgrades. Those upgrades are scheduled for completion during the 2009-2010 school year.

CNS Facilities plans to upgrade the two remaining UPS systems—one in the Andrews Information Systems Building and one in Shanks Hall—with advanced equipment similar to what is operational in the other four CNS switchrooms.

For more information, contact Barry Linkous, [linkousb@vt.edu](mailto:linkousb@vt.edu).

## Contract for on-campus cable TV services

The cable television system at Virginia Tech provides wide-ranging educational, informational, and entertainment programming for students, faculty and staff members, and The Inn at Virginia Tech and Skelton Conference Center. Each residence hall room is served by the system, and premium sports programming is provided to common areas in the residence halls during the fall and spring semesters. The Inn at Virginia Tech and Skelton Conference Center also provides several premium HBO channels for their guests. The regular programming lineup includes satellite and off-air, locally originated instructional and public access channels.

On June 30, 2008, the educational and entertainment programming for a cable television system contract with Campus Televideo, a division of Lamont Digital Systems, Inc., expired. This contract was extended until August 31, 2008.

A request for proposal (RFP) for educational and entertainment programming for a cable television system for Virginia Tech was issued on May 2, 2008. The purpose of the RFP was to award a contract to a vendor that would deliver specified video programming to the Virginia Tech cable television system. Two vendors, Campus Televideo and NWC Communications, responded to the RFP. Each vendor's response to the RFP was evaluated based on pricing plan, plan for providing services, experience, qualifications and technical support, references, and small, women-owned and minority-owned business (SWAM) utilization.

Upon completion of the evaluation of the responses, a two-year contract with three one-year renewals was awarded to Campus Televideo. The new contract and provisioning of video content went into effect on September 1, 2008.

For more information, contact Roy Smith, [smithroy@vt.edu](mailto:smithroy@vt.edu).

## Ghiza system handles copyright infringement complaints

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 the Systems Development team.

A Web-based system was developed to accelerate case research using the Internet protocol (IP) address and the reported date and time of the alleged infringement. Once the case reviewer is satisfied that case details and the implicated user are properly correlated, the system generates an e-mail notice. The e-mail provides pertinent details for each case and, at the same time, informs the implicated individual(s), the university Judicial Affairs staff (for student cases), and the university copyright coordinator.

The initial implementation of Ghiza was placed into production in March 2009. Cases processed via Ghiza numbered 285 through the end of May 2009.

The time required to process a routine case implicating a residence hall Ethernet connection dropped from approximately 12-15 minutes each to about two minutes each. For wireless cases, “hands-on” time required to address each case has been decreased by approximately fifteen minutes per case.

Due to enhancements to the university’s wireless network service during the report period, processing of wireless cases is semi-automated. As network upgrades are completed, network session data will be available on a more automated basis. It is projected that cases that originate via a wireless network session will be processed within the same two-minute timeframe as for wired, residence hall cases.

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](mailto:kiddj@vt.edu).

## Improved inventory processes at the CNS Warehouse

Inventory control and accuracy is an ongoing objective at Communications Network Services. Expansion of the bar-coding technology currently used in the warehouse to the other NI&S departments is being explored by the Systems Development and Administration group. Radio frequency identification (RFID) is another inventory control tool that has been explored during the past fiscal year.

This past fiscal year, the “pick list” method of inventory control was introduced. Orders for needed job materials are electronically sent to the warehouse 24 hours prior to the time the materials are required. The pick list method promotes improved inventory accuracy. It also increases efficiency by allowing materials to be staged for pickup and eliminates the need for CNS engineers to wait while their order is assembled.

CNS is in the process of installing a security camera system at the off-site location near the Virginia Tech Electric Services facility. The new security system will provide constant monitoring and will be used to help identify perpetrators in the event of vandalism or theft.

Although no significant changes were made in the perpetual inventory system during the past fiscal year, migration of this system to the various locations across campus remains an objective. The potential benefits include reduced audit time, increased inventory accuracy, and improved security.

For more information, contact Jerry Surface, [jesurfal@vt.edu](mailto:jesurfal@vt.edu).

## Judy Diane Albert Memorial Scholarship Fund

Judy Albert was a special person who touched the lives of so many people. Regretfully, Judy was taken from us in October 2007 in a tragic accident. She was a local girl who grew up and wanted to remain in the New River Valley. She attended New River Community College and continued to educate herself throughout her twenty-year career at Virginia Tech. She was working in Systems Support at the time of her passing. Judy was self-motivated and able to cross professional boundaries within the Information Technology organization. She was open-minded, personable, conscientious, thoughtful, and always treated others with respect and courtesy.

To honor Judy and promote her dedication to learning, the Virginia Tech Information Technology family has established a needs- and merit-based endowed scholarship fund through the Virginia Tech Foundation. The scholarship will assist local area students who wish to pursue an information technology curriculum at Virginia Tech. ([www.cns.vt.edu/jdamemorial/](http://www.cns.vt.edu/jdamemorial/)) At the end of the 2008-2009 fiscal year, more than a third of the \$50,000 goal had been reached.



In October 2008, a ceremony was held on the west lawn of Research Building 14 to dedicate a bench, plaque, and tree in memory of Judy Albert and to dedicate a plaque in memory of other Information Technology colleagues.

For more information, contact Dan Cook, [wdcIII@vt.edu](mailto:wdcIII@vt.edu).

## 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, 2008 through June 30, 2009.

### Seminars and academic course support

Eric Brown, October 2008, substitute teacher, high school pre-calculus and calculus; April 2009, guest lecturer for Allen MacKenzie's ECE 4616, Telecommunications Networks Class  
William Dougherty and Jeff Kidd, February 2009, presented as part of "While you're away" program on Internet abuse and copyright infringement, to Dr. Sonja Schmid's Science and Technology in Society class  
Patsy Galliher, Ludwig Gantner, Nancy Gibson, Mark Harden, Taikara Peek, and David Schuh, Virginia Tech/Wake Forest School of Biomedical Engineering & Sciences Videoconference Tech Support Team

Ludwig Gantner and Taikara Peek, supported nationwide SANS training  
Mark Gardner, Wu Feng, Gabriel Martinez, and William Gomez taught after-school computer programming to fifth grade students at Blacksburg New School and at Harding Elementary using Storytelling Alice deployed on virtual machines.  
Mark Harden, Commonwealth Graduate Engineering Program (CGEP) Desktop Instruction Workshop; Commonwealth Graduate Engineering Program (CGEP) Annual Directors and Administrators Meeting  
Joyce Landreth and Julia Mays, September 2009, presented an overview of Central Information Technology Services and 4Help to the 2008 Freshmen Engineering Class, hosted by SWAT (SoftWare Assistance Triage team) and the Engineering Department  
Taikara Peek, supported statewide Department of Health Water Quality Seminars

## Degrees/certifications/classes and training

Five University Computing Support student consultants graduated from Virginia Tech.  
Four student workers at Video/Broadcast Services, December 2008 and May 2009, graduated from Virginia Tech.  
Thirty staff members, February 2009, completed Asbestos Operations & Maintenance training.  
Thirteen staff members, January, March & April 2009, completed CPR training.  
Thirteen staff members, January, March & April 2009, completed first aid training.  
Two staff members, April 2009, completed hearing conservation training.  
Fourteen staff members, March 2009, completed lead awareness training.  
Four staff members, October 2008, completed OSHA 10-Hour Construction Outreach training.  
Two staff members, January 2009, completed Powered Industrial Truck (forklift) training.  
Morgan Allen, Dan Cook, Brian Early, Richard Phipps, Robert Roberts, Luke Ward, October 2008, attended Virginia Alliance for Secure Computing and Networking (VA SCAN) Conference.  
Morgan Allen and Ray Stell, October 2008, attended Virginia Oracle Users Group.  
Wanda Barber, Mike Gano, Valdis Kletnieks, Eliza Lau, Roy Vickers, and Eric Wonderley completed IBM GPFS training; IBM 9550 training; IBM 4800 training.  
Jeff Bolling, Shane Kemp, Clay Scott, Danny Thorn, and Dewey Williams, completed Siemon Certified Installer training.  
Jeff Bolling, Joseph Graham, Shane Kemp, Clay Scott, Danny Thorn, and Dewey Williams, completed Siemon XLR8 Fiber Termination training.  
Randy Broome, July 2008, completed Respiratory Protection training.  
Eric Brown, February-April 2009, completed Java Web Applications Bootcamp in-house course; summer 2008, attended MPLS workshop at the Internet2, JointTechs workshop.  
Jason Christian and Joe Hutson; February 2009, Eclipse RCP training  
Dan Cook, attended the 2009 "James D McComas" Staff Leadership seminar.  
Dan Cook, Carol Hurley, Richard Phipps, and Luke Ward, August 2008, attended SANS Mac OS X Security Essentials training.  
Dan Cook, Richard Phipps, Luke Ward, and Danny Wright, June 2009, attended SANS SEC401 Security Essentials Bootcamp Style training.

Kristen Copenhaver, completed 48 hours of Continuing Professional Education for renewal and maintenance of CPA license

Jeff Crowder, completed Virginia Tech's Executive Development Institute training

Jeff Dalton, Ludwig Gantner, Nancy Gibson, Mark Harden, and Sam Tressel, Fall 2008, attended performance evaluation training for supervisors

Jeff Dalton, Fall 2008, Adobe Photoshop training

Kevin Davis, May 2008, awarded Bachelor of Science Degree, Electrical Engineering, Virginia Tech

June 2008, SANS GIAC Security 401: Security Essentials Bootcamp Style training

June 2008, Microsoft: Supporting System Center Operations Manager 2007 training

Jacob Dawson, December 2008, attended "Identity-Based Networking Services," Cisco Techchat

January 2009, attended Juniper On-Site training

William Dougherty, Incident Command System (ICS; part of FEMA's National Incident Management System) certification. This training and certification was recommended by Mike Mulhare, the director of Virginia Tech Emergency Management

Doug Edmonds, completed Microsoft's Security Center Operations Manager 2007 training

Russ Eller, April 2009, attended VoiceCon in Orlando, Florida; May 2009, completed "IT Careers and Cyber Ethics," New River Community College; May 2009, completed "XHTML Web Development," New River Community College

Henry Floyd, May-June 2009, completed Project Management Certification Course by TheCourse

Patsy Galliher and Mark Harden, January 2009, Performance Planning Workshop; March 2009, HokieMart update

Patsy Galliher, June 2009, Travel Regulations update; July 2008, HR Information Session

Ed Holohan, December 2008, attended "Identity-Based Networking Services," Cisco Techchat; January 2009, completed Juniper on-site training; March 2009, completed NOAA basic Skywarn Spotter training; April 2009, presented at DCSS

Joe Hutson, January 2009, Sun Certified Java Programmer (SCJP)

Ron Jarrell, Mike Moyer, and Bill Ranck, attended SANS/GEAC Security Essentials class.

Kerry Johnson and Josh Ogle, June 2009, completed "JUNOS (Routing & Switching) Training from Juniper."

Brian D. Jones, December 2008, completed Photoshop III

Ron Keller, completed "Lifesavers Course"

Bruce Kemp, Certified for PCI CISP compliance for payment card industry security standards; completed Security 401, Security Essentials Bootcamp

Jeff Kidd, completed courses toward Master's in Corporate and Professional Communication, Radford University; December 2008, Seminar in Organizational Communication; May 2009, Seminar in Public Relations; June 2009, Visual Communication; August 2009, Computer-Mediated Communication-Generational Privacy Study

Steven Lee, January 2009, completed Juniper on-site training

Brian Maloney and Tim Rhodes, completed IBM GPFS training

Bill Marmagas and Mike Snow, completed IBM GPFS training; Attended IBM AIX Installation class; Attended SANS Mac OS X Security Essentials class

Mathew Mathai, completed graduate class, User Interface Design, at Virginia Tech

Chris McNabb, completed IBM GPFS training; attended IBM AIX Installation class



John Nichols, recertified Master Telecommunications Engineer by iNARTE (The International Association for Radio, Telecommunications and Electromagnetics); recertified Asbestos Inspector; April 2009, completed Electrical Safety training  
David Schuh, October 2008, 1st Lieutenant in Civil Air Patrol  
Roy Smith, November 2008, attended “Leading for Service Excellence” workshop, Virginia Tech, December 2008, completed “Virginia State and Local Conflict of Interest Act” training  
Jason Snow, Obtained training in Adobe Captivate, Dreamweaver, and Photoshop; completed, Web 2.0 and Beyond workshop; obtained training in JavaScript, XHTML, and CSS  
Bryant Sparks, Fall 2008, completed “Corning Fiber Optic Splicing” and “Optical Time-Domain Reflectometer” training  
Ray Stell attended PostgreSQL East 2009 Conference, Oracle Database 11g: Administration Workshop II computer-based training  
Douglas Whorley, Attended Standard First Aid Training seminar hosted by Virginia Tech, attended CPR course ADULT/AED seminar hosted by Virginia Tech  
Daron Williams, May 2009, Master of Arts degree in Communications from Virginia Tech  
Danny Wright, November 2008, Microsoft Certified Professional (MCP); February 2009, CompTIA Project+ Certified Professional

## Military service

Ron Keller

Active member, Army National Guard

Selected by National Guard Bureau to participate in the “Command Sergeants-Major Program”

Member, Camp Dawson “Morale-Welfare and Recreation” Board of Directors

Patrick Meier, active member, United States Coast Guard

Robert Roberts

Active member, United States Army Reserve

February 2009, completed United States Army Total Army Instructor Course

## Presentations/papers/publications

Eric Brown, August 2008, invited speaker for Get Connected staff training

Jeff Crowder, December 2008, presented workshop entitled "National TransitRail and the New River MSAP Project; Making Global Content Local" at the Virginia Department of Education "Educational Technology Leadership Conference"

William Dougherty, August 2008, presented on E-Discovery with Mary Beth Nash of the General Counsel’s office at the Institute for Computer Policy Law, Cornell University  
October 2008, DCSS presentation on server virtualization; January 2009, Common Solutions Group presentation on server virtualization at the University of Colorado, Boulder, Colorado

April 2009, DCSS Presentation on alumni e-mail moving to Google; May 2009, participated in webinar for REN-ISAC on E-Discovery. (Research Education Network-Information Sharing and Analysis Center; February 2009, with Andrea Coles, "Hang together or Hang separately: Improved Information Services through communication and culture," *College and Research Libraries News*, (Vol. 70/no. 2) published by the Association of College and Research Libraries; "Print on Demand: The future of publishing?" *Journal of Academic Librarianship*, (Vol. 35/no. 2) published by Elsevier, North America; "Virtualization and Libraries: The future is now (or Virtualization: Whither libraries or libraries wither?)" *Journal of Academic Librarianship*, (Vol. 35/no. 3) published by Elsevier, North America; "Managing Technology During Times of Economic Downturns: Challenges and Opportunities." *Journal of Academic Librarianship*, (Vol. 35/no. 4) published by Elsevier, North America; "Integrated Library Systems: Where are they going? Where are we going?" *Journal of Academic Librarianship*, (Vol. 35/no. 5) published by Elsevier, North America.

Amber D. Evans, Carol Hurley, and Ed McPherson, March 2009, presented "Finding the Knowledge to Support Learning in the Classroom and Beyond" at the ACCS of Virginia conference, Charlottesville, Virginia

Mark Gardner and Wu-chun Feng, March 2009, presented "Cloud Computing at VT," IBM Cloud Computing Summit

Mark Gardner, G. Martinez, and Wu Feng, "Characterizing and Optimizing Virtualization Overhead for Portable High-Performance Networking," ACM Best Undergraduate Student Poster and Presentation at Supercomputing 2008

Richard Hach, "The Multi-Dimensional Nature of Emergency Communications Management," *EDUCAUSE Review*, vol. 44, no. 1 (January/February 2009)

Jason Hubbard and Julia Mays, March 2009, presented "Virginia Tech's Open Source Knowledge Base Solution" at the ACCS of Virginia conference, Charlottesville, Virginia.

Carol Hurley and Joyce Landreth, March 2009, (with Steve Broaddus of George Mason University and Lori Kressin of the University of Virginia) presented on a panel "How to Support An Ever-changing Mobile Computing Environment" for the Association of Collegiate Computing Services (ACCS) of Virginia conference, Charlottesville, Virginia.

Carol Hurley, March 2009, co-presented with Amber Evans and Ed McPherson of Virginia Tech Online Course Systems "Finding the Knowledge to Support Learning in the Classroom and Beyond" for the Association of Collegiate Computing Services (ACCS) of Virginia conference, Charlottesville, Virginia.

Cindy Kelley, September 2008, attended Virginia Accounting & Auditing Conference; December 2008, attended 2008 TechFest Winter Conference

Mathew Mathai, October 2008, presented "Guest Wireless Management System" at VA SCAN 2008.

Julia Mays, David McPherson, Ed McPherson, and Nate Smith, March 2009, presented "Supporting VT's Large and Diverse Campus" for the ACCS of Virginia conference, Charlottesville, Virginia.

David McPherson and Ed McPherson, March 2009 (with Trisha Gordon and Tim Sigmon of the University of Virginia), March 2009, presented "UVa & VT: Cross-Campus Collaboration" for the ACCS of Virginia conference, Charlottesville, Virginia.

Robert Roberts, May, 2009, presented "The BEV Web Support Service's Web Development Process" for the Third Thursday Society.

Daron Williams, April 2009, Top paper panel, Kenneth Burke Society division of Southern States Communication Association for "Athlete as Agency: Motive in the Rhetoric of NASCAR." Same paper accepted for publication in KB Journal; Second place, Collegiate Column Writing, Virginia Press Association, 2009.

## Consultation and outreach activities

Dan Cook

Member, Virginia Tech Staff Senate  
Member, President's Award Selection Committee  
Pledged and gave over 200 volunteer hours through VT ENGAGE  
Judge, Eastern Elementary & Middle School Academic Fair  
Selected for and served on the Information Technology Advisory Committee for the Division of Business & Technologies of NRCC  
Member, "GHS Class of '82" Scholarship Committee  
Member, Judy Albert Scholarship Criteria Committee and signatory for the accounts  
Member, GIAC Advisory Board  
Member, Data at Rest security committee  
Member, NI&S Emergency Action Plan Committee  
Cubmaster and Pack Committee Training Chairman, Pembroke Scout Troop 460  
Member, InfraGard (Richmond Chapter) [www.infragard.net](http://www.infragard.net)  
Appointed to Averett University Alumni Association Executive Board

Jeff Crowder

June 2009, appointed to National LambdaRail Board of Directors, representing the Virginia Tech Foundation and the Mid-Atlantic Terascale Partnership  
Board Member, for The Quilt, a national non-profit organization of Regional Optical Networks for research and education  
Committee Member, Quilt Commodity Internet Services

Nola Elliott

Treasurer, Church World Service Annual Blacksburg Crop Walk Against Hunger  
Chairperson, Town of Blacksburg's Housing and Community Development Advisory Board  
Volunteer Advocate, AARP 9th Congressional District

Henry Floyd

Committee Member, Project Management Standard Development for Information Technology Projects

Patsy Galliher, March 2009, Judge, County Academic Fair

Ludwig Gantner

November 2008, technical support/advisor at Virginia Tech for Megaconference  
June 2008/January 2009/June 2009 SANS conferences at Virginia Tech, primary technical support and advisor

Mark Gardner, Gabriel Martinez, William Gomez, and Wu Feng, taught after school computer programming to fifth-grade students at Blacksburg New School and at Harding Elementary using Storytelling Alice deployed on virtual machines.

Nancy Gibson, Spanish tutor for Upward Bound/Talent Search

Richard Hach

Member, Sprint Higher Education Advisory Board

Member, Net@EDU Converged Communications Working Group

Member of Converged Communications Working Group steering committee;

developed conference programs for EDUCAUSE 2008 in Orlando, Florida and Net@ EDU 2009 in Tempe, Arizona

With the Net@EDU Converged Communications Working Group (CCWG), completed a Peer Survey on Emergency Communications Notification and Management in Higher Education as part of EDUCAUSE's Net@EDU Policy Initiative

Consulted with peer institutions regarding best practices, service, policies, procedures, and regulatory issues including colleagues at Radford University, University of Iowa, Macon State College, University of Richmond, Old Dominion University, and Princeton University

Ongoing work with Virginia Department of Education and Verizon Business under auspices of

NetworkVirginia to evaluate opportunities for broadband service under the American Recovery and Reinvestment Act (ARRA), develop statement of need, and scope of work.

Coordinated with University Controller's Office AT&T accounts affected by DOA Comptrollers Debt Setoff Program. With AT&T, arranged for service restoration and halted collection activity on university accounts.

June 2009, 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, at the NLR board meeting in Denver, Colorado

Executive Liaison to Internet2 as a Research and Education Network Member representing NetworkVirginia

Program director for NetworkVirginia and member representative to the Quilt on behalf of NetworkVirginia. Served as primary point of contact for vendors regarding contract management.

Served on the Quilt, Inc. board of directors representing NetworkVirginia

Negotiated major addenda to the NetworkVirginia agreements with Verizon Business

Member, Network Infrastructure and Services Advisory Board of the Information Technology Advisory Committee, Commission on University Support

Participated in Region 6 Regional Preparedness Advisory Committee (RPAC) meeting and Statewide Comprehensive Plan for 911 in Roanoke, Virginia sponsored by the Commonwealth Interoperability Coordinator's Office

Program Administrator for the Government Emergency Telecommunications Service and Wireless Priority Service

Edmund Holohan, Brian E. Jones, and Steven Lee, February 2009, attended "Joint Techs Internet2 Conference," College Station, Texas

Cindy Kelley, Vice President/President Elect, New River Valley Chapter of the Virginia Tech Alumni Association

Jeff Kidd

Educational Media Company @ Virginia Tech, Executive Board Member

Americans with Disabilities Act Executive Committee, Virginia Tech, Member

Kathy Kobza

Texas Future Problem Solving, Evaluator

Lubbock ISD Council of PTAs, Scholarship Chairman (awards scholarships to graduating high school seniors)

Joyce Landreth, Member, Virginia Tech Scholar Advisory Board

Patricia Rodgers, December 2008, Judge for First Lego League (FLL) competition for the state of Virginia

William Sanders

Consulting services to the Blacksburg Telecommunications Advisory Committee, resulting in a town "Fiberways" map for telecommunications infrastructure planning related to economic development

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, including co-developing a Faculty Development Institute track on creative technologies for summer 2009

David Schuh

February 2009, qualified as a Virginia Dept of Emergency Management (VDEM) Ground Branch Director

December 2008, Search and Rescue Ground Team Leader with Human Tracking Certifications

Roy Smith, July 2008, attended joint Virginia Tech-Radford University Information Technology Services Symposium

Doris Stock

Consulted with peer institutions including colleagues at University of the South (Sewanee), Lehigh University, and the University of Virginia regarding service, policies, procedures, and regulatory issues

Member, Legislative and Regulatory Committee, Association for Communications Technology Professionals in Higher Education (ACUTA)

Diane Whitlock

Member, NI&S Commonwealth of Virginia Campaign Committee

Member and Chapter Officer, National Society Daughters of the American Revolution

Member, P. Buckley Moss Society

Laurie Zirkle

Member, SANS Institute Advisory Board

SANS GIAC Proctor

Website administrator for the non-profit Greater Roanoke Area USBC (Bowling Association)

# secure enterprise technology initiatives

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Secure Enterprise Technology Initiatives (SETI) develops and supports secure applications, middleware, and interfaces to support the university's computing and network services. SETI includes eProvisioning, the Microsoft Implementation Group, Middleware, and the Test Team. Each unit contributes to the strategic goals of the Information Technology organization by providing secure, robust and highly functional authentication, authorization, and directory infrastructure components that integrate with teaching, learning, research and outreach services. SETI works closely with the Information Technology Security Office to ensure that policies and procedures are properly considered during development cycles. Programming code developed by SETI is offered to the open source community.

Notable highlights of work this year are advances in the university's public key infrastructure (PKI), a major upgrade to the Central authentication Service (CAS), creation of virtual Windows servers (VDWS), and work on self-service password reset.

## PKI

Version 2.0 of the Token Administration System (TAS) was deployed by eProvisioning. TAS allows authorized administrators to issue Virginia Tech personal digital certificates onto USB eToken devices. The certificates are used for secure multi-factor authentication and trusted digital signatures. Enhancements to TAS included inventory control and extensive reporting capabilities. Issuing Virginia Tech certificates is made possible through the implementation of a public key infrastructure for the Virginia Tech Certification Authority (VTCA). Key VTCA infrastructure components were migrated to the open source Enterprise Java Beans certificate authority (EJBCA) during the summer of 2009. EJBCA enhances eProvisioning's support posture, and should facilitate expanding certificate services in the future.

## CAS

Middleware supports the Central Authentication Service. CAS is a secure enterprise authentication system and single sign-on service sponsored by the [Jasig](#) open source consortium. While preparing for a new release of CAS that supports passing attributes in a Secure Authentication Markup Language (SAML) payload, it became evident that clients needed to be developed to recognize and take advantage of CAS Version 3.3.x features. SETI's Middleware group stepped up to the challenge and contributed SAML1.1 support to mod\_auth\_cas (Apache), ASP.NET cas and phpCAS open source projects. Their development efforts not only helped Virginia Tech use the new CAS features, but provided a valuable contribution to the entire CAS community.

## VDWS

Responding to a year of budget shortages and the need for greener technology environments, information technology units across campus began looking at ways to conserve power, people, and hardware dollars. Enter Virtual Dedicated Windows Servers (VDWS)! VDWS was the brainchild of SETI's Microsoft Implementation Group leader, and was deployed into production in the summer of 2009. VDWS allows departments to run Microsoft Windows-based operating systems and applications without purchasing or maintaining server hardware. Virtualization can save time and money, and VDWS offers a low cost, flexible virtual configuration, with the physical hardware maintained by MIG.

## Self-service password resets

All SETI units participated in requirements-gathering sessions for a self-service password reset initiative. The project to implement a password reset tool is sponsored by 4Help and Identity Management Services (IMS), in hopes that the vast majority of support calls for PID password resets will be replaced by a self-service process that is at least as secure as that which is used today. Research into various password reset strategies continues.

## SETI Test Team

One of the most important components of the software development cycle is testing. Since the mission of SETI is to develop and maintain secure enterprise software solutions, it is critical that those solutions be thoroughly tested prior to deploying them into production. Preliminary testing is done by software developers, but many times, the person writing the code is too close to it to catch all possible mistakes. There is great value in testing and verification being performed by people whose primary function is to test, and it helps the developers to have a middle ground between their own testing and that of the end user. The testing unit provides a common quality assurance testing service for products developed by SETI. The group also supports the deployment process, providing input regarding schedules, standards, and documentation for production implementations.

**Testing for eProvisioning.** Testing for the eProvisioning group constituted the bulk of the team's work again this year. Testing the Aladdin installers for the various supported platforms is an ongoing task, as is the related update review for the webpage instructions. The Token Administration System was tested, including verifying that the certificate profile for the eToken does not allow encryption. Testing was conducted for all parts of the registration authority and certification authority for server and middleware certificates as eProvisioning transitioned from OpenCA to EJBCA.

**Testing for Middleware.** The Middleware group upgraded JBoss and OpenLDAP in their Enterprise Directory (ED) 2.2 deployment, requiring testing and verification of the Directory Access Tool (DAT) used by IMS and 4Help for identity management, the Group Manager, Guest Access Management Service, MyVT, PIDGen, LDAP functionality on the Enterprise Directories, Active Directory replication, and the scheduler. The ED 2.2 testing prompted many appreciated improvements to the DAT. The team also verified that the Banner acceptance of UTF-8 characters would not break any systems that consume Banner data. Testing is currently underway for the Central Authentication Service 3.3 deployment, scheduled for September 13.

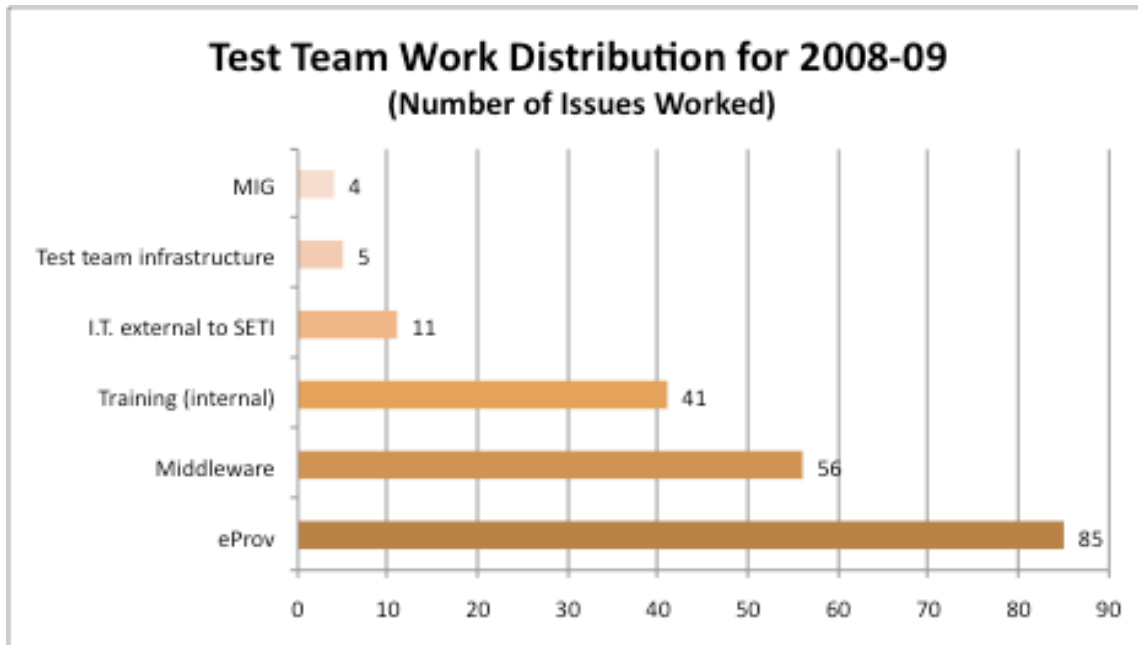
**Testing for MIG.** Testing MIG's Hokies Self-Service redesign for the Exchange 2007 migration was begun and will continue through that deployment. The test team subscribed to the VDWS service because it is far more economical than maintaining their own state-of-the-art Windows systems.

**Other testing.** The test team conducted some security, functionality, and usability testing when requested by other Information Technology groups. The team leader tested Financial Aid's Guest Access system, and recommended a browser reconfiguration for Faculty Access users who could not view their students' pictures on the Macintosh platform. Work began on a Jira workflow that would incorporate the service request process of other groups. Usability studies were initiated for the Sensitive Data Verification Form and self-service password resets. One team member compared the Virginia Tech-developed Find\_SSN with a commercial product and conducted some cross-site scripting tests on MyVT.

**Test Team training and infrastructure.** With the departure of one employee, utilizing VDWS should reduce the need for Test Team hardware expertise. The testing group will strive to configure the test bed for accessibility and use by Information Technology staff members who may need to test on a different platform or browser. The team leader established standard operating procedures for desktop computer maintenance and created a set of orientation tasks to help new employees. The student intern learned to use Dreamweaver and Web hosting to post relevant documentation on the team website.

**Staff changes.** There was significant turnover of the testing group's wage employees during 2008-2009. Two electrical engineering graduate students initially shared the position formerly occupied by a 1500-hour wage employee. When both students received job offers more in keeping with their career goals, another graduate student continued their work, but is currently filling an internship with Qualcomm in San Diego, with plans to return to the group in December 2009. Another Electrical Engineering graduate student had a brief term of employment. A student who had been an intern with the group for two years, graduated, but thanks to the intern program, another student is expected to be hired this fall.





## e-Provisioning

The university budget reductions affecting Information Technology during fiscal year 2009 presented some major challenges for the e-Provisioning unit, which was impacted by the loss of key personnel through attrition. The unit has adjusted and continues to provide the same level of technical support for operation and maintenance of the Virginia Tech Certification Authority. After reviewing and evaluating their PKI support model, the e-Provisioning unit implemented new strategies to address the short and potential long-term budget reductions affecting their support role. The strategies focused on upgrades to the underlying hardware and a migration of VTCA core services to EJBCA, a more easily maintained and feature-rich open source certification authority than the previous OpenCA software. The EJBCA system provides a high-performance, platform-independent enterprise solution, capable of meeting the current and future requirements for implementing public key technology at the university. The active EJBCA open source development community is backed by PrimeKey Solutions ([www.primekey.se](http://www.primekey.se)), a company offering optional commercial support and professional services for EJBCA and solutions built around it. The efforts by the e-Provisioning unit have been greatly effective and will help to ensure the longevity and quality of the certificate services provided by the VTCA over the next several years.

## Project summary

**Certification Authority.** The e-Provisioning unit successfully completed its migration of the VTCA from OpenCA to Enterprise Java Beans Certificate Authority. EJBCA is an advanced enterprise class open source PKI implementation of a certification authority that runs in a Java/J2EE environment. EJBCA's powerful graphical user interface for system administrators has allowed the e-Provisioning staff to adapt the VTCA infrastructure to effectively meet departmental as well as university PKI requirements for Virginia Tech-branded certificates.

**PKI website.** The e-Provisioning unit completed its work to publish an updated PKI website ([www.pki.vt.edu](http://www.pki.vt.edu)) to accommodate changes introduced with the implementation of EJBCA's online certificate service. The PKI website is the primary public interface used by subscribers for requesting and downloading their VTCA server and middleware certificates. The updated website also provides a new enhanced search facility that allows users to easily locate and download certificates from the EJBCA certificate repository.

**VTCA hardware upgrades.** The e-Provisioning unit upgraded its certificate authority servers and hardware security module (HSM) equipment to ensure continued reliable operations of the VTCA. HSMs used to securely store and administer the RSA private keys for the VT Root, Class1 Server, Middleware and User Certification Authorities were upgraded from LunaCA3/LunaSA 2U models to SafeNet's new LunaSA 1U network HSM appliance. These upgrades were critical due to the approaching end of life of maintenance and support contracts for the LunaCA3/LunaSA 2U HSM equipment by SafeNet.

**VTCA policy updates.** In order to ensure that implementation of EJBCA did not introduce inconsistencies or conflicts with VTCA operational policies, the e-Provisioning unit spearheaded a Policy Management Authority (PMA) workgroup to review the VTCA certificate policy (CP) and certification practices statements (CPS) documents. The workgroup identified those sections of the documents needing modification and published recommended changes to a wiki for review by the PMA. The recommendations provided by the workgroup were approved by the PMA and incorporated into the VTCA CP and CPS documents for publication to the PKI website.

**Root key signing.** Due to funding uncertainties during the fiscal year 2009, plans for implementation of a root key signing service by the e-Provisioning unit were temporarily postponed. However, the e-Provisioning unit plans to pursue a root key signing solution during fiscal year 2010. With the prospect that funding will be available, the e-Provisioning unit is hopeful that a root key signing service for the VTCA can be implemented during the second quarter of 2010.

**TAS 2.0 deployment.** The e-Provisioning unit completed the development of the Token Administration System v2.0 and deployed it to production during the third quarter of 2008. TAS

2.0 added several new enhancements including inventory control, a reporting facility, and improved administrative interface. The deployment included an updated TAS 2.0 user guide and training for TAS operators.

**Web services.** The e-Provisioning unit completed its development to implement PD4ML (HTML to PDF converter utility) to enhance the performance of its PKI Web services. The updated Web services were deployed to production during the third quarter of 2008 to help streamline the conversion of HTML to PDF for the digitally signed leave report application.

**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.

Valid VTCA certificates as of 8/19/2009

540 Personal digital certificates  
307 SSL Class 1 server certificates  
71 Middleware application certificates

## Microsoft Implementation Group

The Microsoft Implementation Group (MIG) is responsible for maintaining the Hokies Active Directory (AD) and developing secure AD-enabled and AD-enhanced applications. The focus is to ensure that Virginia Tech's Microsoft computing environment is stable, secure, and scalable. During 2008-2009, MIG expanded its focus to include economical and environmentally friendly Microsoft services.

### VDWS

The Virtual Dedicated Windows Service emerged from MIG's internal use of virtualization. After gaining several years of expertise in managing a virtual environment for development and testing, the MIG leader thought a centrally supported windows virtualization environment might be a useful service to offer to the rest of the university. A pilot service began in fiscal year 2008 with a collaborative arrangement between MIG and the College of Agriculture and Life Sciences. The pilot was a quick a success, was expanded to include other departments, and was developed into a production service in 2009 that offers the following:

- Reduction in power consumption—helping to save the environment and reducing costs
- Efficiency—utilizing the host server hardware to its maximum
- Scalability—bringing up a new guest in 10-15 minutes—build baseline, patch
- Portability—easily moving guests from host to host
- Recoverability—having the ability to undo and difference guests, each simply being a file

- Flexibility—quickly and easily adding more RAM, more CPUs, more hard drive space to guests
- Security—fully patching preconfigured guests, with firewalls enabled and security policies hardened
- Manageability—using Microsoft System Center support software
- Affordability—starting at only \$200 per year for preconfigured guests

VDWS operates on a fully supported Microsoft Hyper-V host platform, and MIG is committed to 24x7 hardware support and continuous improvements.

## **Active Directory administration**

The Hokies Active Directory remained secure with patches, hotfixes, and auditing for child domains. MIG's Windows 2008 servers were upgraded to Service Pack 2. Discussions with other departments explored possibilities for building inter-forest trusts and using the Advanced Group Policy Manager. The Active Directory rules of engagement were updated and published, and a transition was begun from physical to virtual environment for the root domain controllers.

## **AD Admin**

Good progress was made on the Active Directory Administrator (AD Admin) project, with the goal of providing better tools for Organizational Unit (OU) administrators and IMS staff to manage objects in the Active Directory. The current business logic and workflow was documented. A prototype user interface was built and presented to the SETI test team. Discussions with IMS and the OU administrators were held to ensure the desired functionality was included for stakeholders. Microsoft's Identity Lifecycle Management (ILM) was implemented, and ILM code was developed and reviewed. Development is expected to continue, with production AD Admin planned for fiscal year 2010.

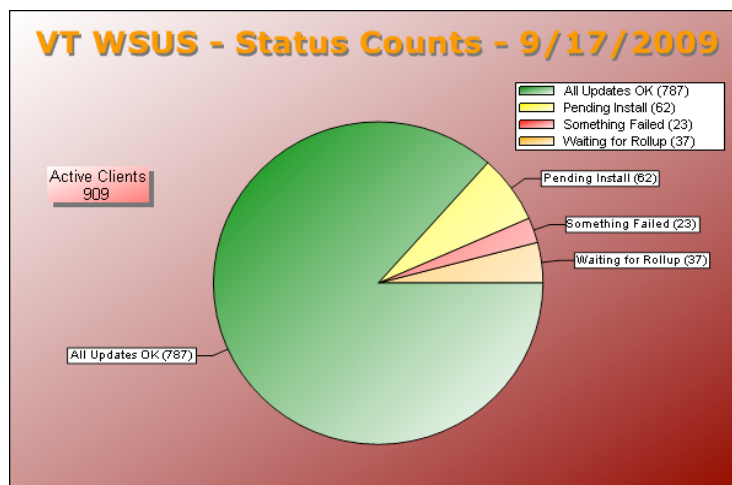
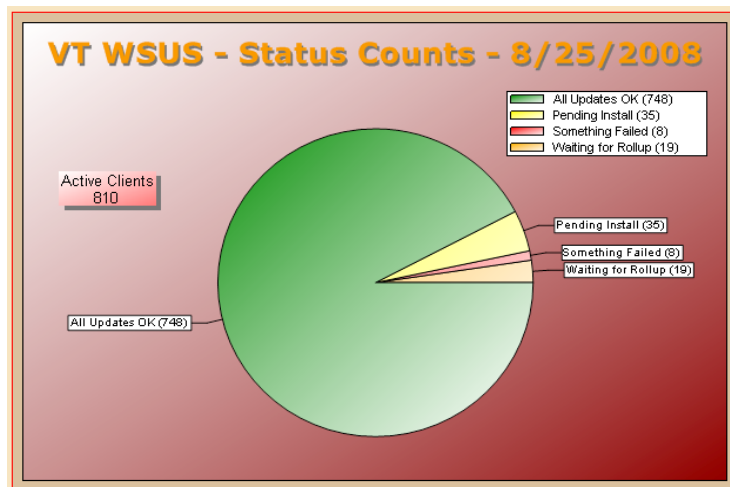
## **Other MIG activities**

- Prepared the domain for Exchange 2007 and put changes into production
- Assisted in evaluating solutions for alumni e-mail and self-service password reset
- Hosted the campus Windows Users Group
- Supported Business and Management Systems (BAMS) Windows Right Management Services and facilitated conversation with BAMS, Microsoft regarding Internet Security and Acceleration server
- Updated 4/16 SharePoint site
- Consulted with faculty member in support of Miserware research project
- Managed Synchro v4.1 upgrade
- Managed MS Premier Service Technical account

- Assisted University Development with migration to new VTDEV domain
- Demoted GRADS domain
- Discussed VT WSUS 2.0 project planning with sponsor and built Project Initiation Form
- Reviewed investment simulator model for the Human Resources staff
- Debugged and resolved Dell server hardware issues
- Discussed project for Windows VT Alerts client
- Researched iSCSI in relation to NetAPP; researched Microsoft SQL clustering
- Worked with the Office of the Controller on funds handling and compliance—random audit
- Discussed SNAP server virtual machine with Information Technology Acquisitions and Institutional Research
- Reviewed IIS environment for potential vulnerability assessment

## Statistics

Comparing 2008 and 2009 shows an increase of nearly 100 active clients for VT WSUS.



Opensource.w2k.vt.edu download statistics indicate the value of MIG development efforts to the open source community.

	2008	2009
authad_v1.4	173	180
daisy_v2.2	3225	3367
DictionaryFilter_v2.1	669	748
Faith_v1.01	471	488
Ivy_v1b22	223	235
OUadmin_v1.0	146	155
Portinator_v1.0	182	187
SafetyNet_v1.0	627	656
SelfService_v2.3	412	483
VTwsus_v1.0	93	306
Win32_perms_v0.2	60	65

## Middleware

IBM once described middleware as “the sweet, nougaty center of infrastructure.” The software that connects applications and facilitates the exchange of data between systems is called middleware. Any application that uses a Virginia Tech PID for authentication relies on the Enterprise Directory infrastructure and middleware that was developed, maintained, and supported by SETI’s Middleware group. Secure PID-based authentication is best accomplished using CAS or the Shibboleth Identity Provider, and both services are supported by Middleware.

### LDAP

Middleware continued to maintain and support the production environment of lightweight directory access protocol (LDAP) directories. The LDAPs facilitate retrieval of demographic information about people using applications like People Search. LDAP authentication is supported for applications such as instant messaging, Web Hosting, Scholar, and Blackboard learning management systems. CAS and Shibboleth use LDAP to retrieve authentication and authorization information and securely pass it back to client applications. LDAP overlays and replication processes were improved during this reporting period. A gender attribute was added for use by authorized viewers. OpenLDAP 2.4 was tested in preparation for an eventual upgrade.

### DAT

The Directory Access Tool (DAT) is used by authorized university personnel—4Help and Identity Management Services—to view and update information about people in the Enterprise Directory Registry database. Although most of the Registry data is sourced in Banner, the DAT offers a user-friendly view of the information that is replicated to the LDAPs, where it is made

available to authorized applications such as those mentioned above. During this period, the following enhancements were made to the DAT:

- Improved consistency of display and workflow for all screens
- Updated query interfaces with pagination support
- Added affiliation to person query interface
- Added display of gender to person information for Help Desk support
- Added audit query and display interface for both authentication and Registry data modifications
- Added person comments for administrative metadata to be attached to a person
- Created suppressible attribute management interface

## **CAS**

CAS, with its single sign-on features, is the preferred PID authentication method at Virginia Tech. CAS increases security over LDAP authentication by ensuring that the password is never made available to the application in clear text. During this reporting period, the Middleware group maintained and supported the production CAS environment while developing enhancements for a release of CAS that supports authorization in addition to authentication. Middleware contributed SAML 1.1 support to the `mod_auth_cas` (Apache), phpCAS and ASP.NET opensource projects in support of the new CAS release.

## **Shibboleth**

The Middleware group maintained and supported Virginia Tech's Shibboleth Identity Provider in a full production environment starting in 2008. Shibboleth is being used for federated identity management, and allows services to offer a secure common authentication interface to multiple institutions of higher education. An increasing number of vendors have embraced federated identity management, making Shibboleth the preferred method of authenticating with PID to a vendor-provided service such as Google e-mail. One of Middleware's developers submitted enhancements and fixes to uApprove, a SWITCH ([www.switch.ch](http://www.switch.ch)) tool that would allow users to consent to Shibboleth attribute release.

## **Opensource**

Middleware has continued to foster open source development, and made their projects available to Google code: <http://vt-middleware.googlecode.com>. The developers performed a code review on each project before its transition.

## Professional development

All SETI staff members participated in a customized University Professional Development workshop on Personality and Effective Communication

Staff from all SETI units attended the fall and spring Distributed Computing Support Symposium (DCSS)

MIG staff attended Microsoft System Center Operations Manager training

Marvin Addison was a lead developer for the Jasig CAS project

Ismael Alaoui attended the RSA conference, April 2009

Marc DeBonis presented on VDWS at DCSS

Marc DeBonis attended FDI, Overview of VTIP: Capturing the Value of Technology Transfer

Marc DeBonis attended the McComas Staff Leadership Seminar

Marc DeBonis, Steve Warrick, and Randall Price attended SANS GSEC 401 class

Marc DeBonis, Kimberley Homer, and Mary Dunker attended the Information Technology session on harassment prevention

Marc DeBonis was a member of the Microsoft Macintosh Business Unit Council

Mary Dunker co-chaired the Educause/Internet2 Security Task Force Effective Practices Working Group

Mary Dunker was a member of the Metrics and Encryption subgroups of the Effective Practices Working Group

Mary Dunker drafted overview template for Educause [Effective IT Security Practices and Solutions Guide](#) and organized content for [Information Systems Acquisition, Development and Maintenance](#).

Mary Dunker attended the Educause Annual conference 2008, served as session chair, met with the Security Task Force Leadership Team

Mary Dunker attended the Educause security Professionals Conference, served as session chair, roundtable discussion leader, and met with the Security Task Force Leadership Team

Mary Dunker was the InCommon Administrative contact and liaison

Mary Dunker co-chaired a group (with Wayne Donald) to provide security-related input to the Commission on University Support from the Office of the Vice President for Information Technology

Mary Dunker presented an update on eTokens at DCSS

Mary Dunker presented “Leveraging PKI for Digital Signatures at Virginia Tech” at the VA SCAN conference, October 2008.

Brian Long and Cathy Winfrey attended JBoss Portal training

Laurel Neidigh, intern for the SETI Test Team, received her B.S. in Psychology

Jack Noll attended FDI training on Microsoft Projects, February 2009



# strategic partnership initiatives

The Office of Strategic Partnership Initiatives serves the Information Technology organization at Virginia Tech by executing on several key strategic objectives through its multiple programs and units. These include the eCorridors program and Virginia Tech Geospatial Information Sciences, a new geospatial initiative of Virginia Tech—launched July 1, 2009. Virginia Tech GIS consists of the Enterprise GIS group and the newly restructured Center for Geospatial Information Technology.

## Virginia Tech Geospatial Information Sciences

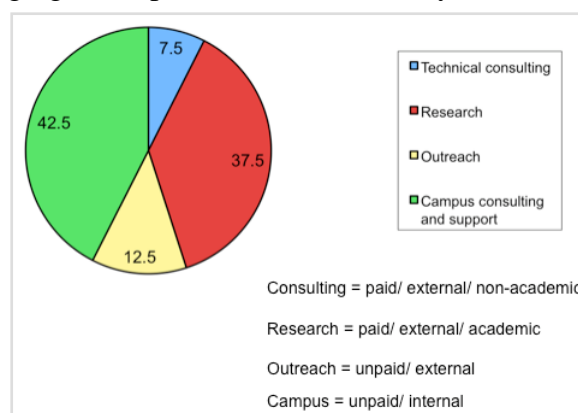
During the 2008-2009 fiscal year, planning for the new entity—Virginia Tech Geospatial Information Sciences (Virginia Tech GIS)—took place, with Strategic Partnership Initiatives representing Information Technology.

Aimed at advancing geospatial science and research at Virginia Tech, Virginia Tech GIS was created through a partnership between Erv Blythe, Virginia Tech's vice president for information technology, and Randy Dymond, founding director of the Center for Geospatial Information Technology (CGIT).

Virginia Tech GIS serves as an interdisciplinary resource providing integrated GIS support to geospatial research, teaching, outreach, and administrative functions. Collaborations of Virginia Tech faculty members and administrators, research centers, local, state, and federal agencies, and external partners make the resource possible.

As part of the restructuring, CGIT and Enterprise GIS are housed together at 2060 Torgersen Hall and function as a single unit. CGIT focuses on sponsored research projects and Enterprise GIS focuses on GIS data hosting and storage leveraging the expertise of the university's information technology organization. GIS applications development and GIS training are also provided as a collaborative effort of the merged entity.

Virginia Tech GIS applies geospatial technologies and analytical methods to address key strategic objectives in the areas of research and collaboration; safety and security; community broadband; energy and sustainability; health information technology; and lowering barriers to the use of GIS tools and data.



## Center for Geospatial Information Technology

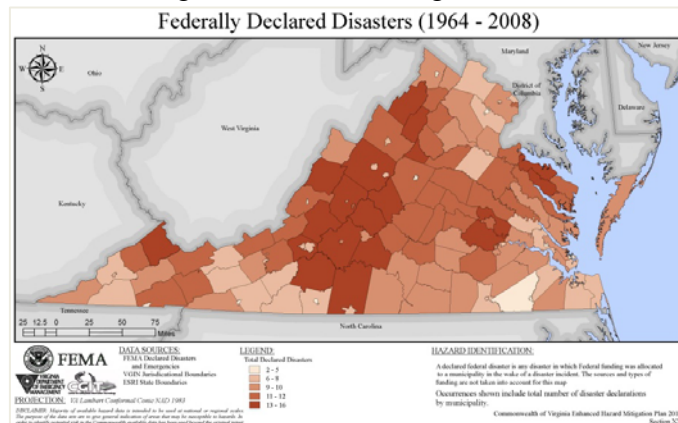
CGIT is an interdisciplinary center that stands ready to partner with university researchers, government agencies, and the private sector to research and develop advanced uses of geospatial technologies. The center consists of two locations, each with its own dedicated director—Peter Sforza serves as co-director of the Blacksburg office, and Kitty Hancock serves as co-director of the National Capitol Region office.

CGIT serves as a focal point for Virginia Tech faculty and staff who specialize in or use geospatial information technology as a part of their research, teaching, and outreach mission. The Center has been working to bring discipline-specific researchers and clients together with geospatial experts to develop new ways to collect and analyze data, perform simulations and present results in visual contexts in the commonwealth and the nation. CGIT's staff, students, and affiliated faculty are involved in innovative applications-based tasks that are oriented specifically toward client needs, such as Web-enabled decision support system; geospatial data layer conversions; programming and systems integration for client or client/server geospatial applications; automated data collection; database development; complex spatial analysis; sensor-enhanced information systems integration; digital image processing and remote sensing; and needs analysis.

In support of the organization's goals, CGIT seeks collaboration with many partners across disciplines as diverse as electrical and computer engineering, archaeology, history, forestry, fisheries and wildlife, biomedical, chemistry, political science, and sociology, to name a few.

**Decision support database for Virginia's bikeways.** Among the projects active during the planning year for the Virginia Tech GIS entity undertaken by CGIT was the Virginia Bikeways support. This project facilitates the information retrieval and decision-making efforts for the Virginia Department of Transportation, the Virginia Department of Conservation and Research, and other stakeholders with regards to bicycle and pedestrian infrastructure. Some of the activities included support information and literature review, development of a data model and database, geospatial application design, and marketing efforts and training.

**2010 hazard mitigation plan for Virginia.** For this project, CGIT has performed data development and analysis for the hazard assessment and vulnerability analysis, and developing mitigation strategies. The center has contributed to the plan, which assesses the risk to state facilities from different hazards including flooding, fire, wind, hurricane, earthquake, and drought.



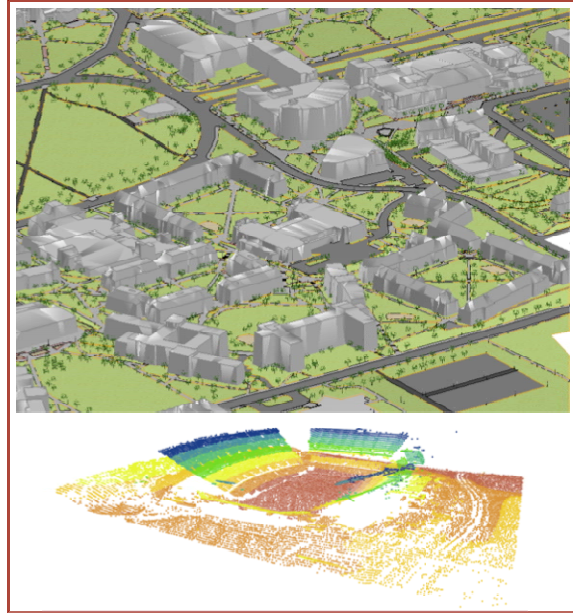
Example of map created for the hazard mitigation plan

**Veteran's services.** In another area, CGIT is working with university Institute for Policy and Governance to assess the efficiency and

effectiveness of the distribution of veteran’s services representatives in the Commonwealth of Virginia. The Center for Survey Research is conducting survey of the veteran population in Virginia. CGIT will provide mapping of veteran populations, benefit services, and auxiliary service programs, ranging from health care centers, employment services, and training.

**3D Blacksburg.** The 3D Blacksburg Collaborative was formed in 2008 to enhance collaboration and research-to-operations needs for various users and producers of spatial data and 3D city models. The initial phase of the project is focused on the facilities life cycle using the university’s Blacksburg campus and town of Blacksburg as the prototype. Applications of a 3D virtual model include planning, emergency mgmt, nightscape, energy, information technology security, and transportation.

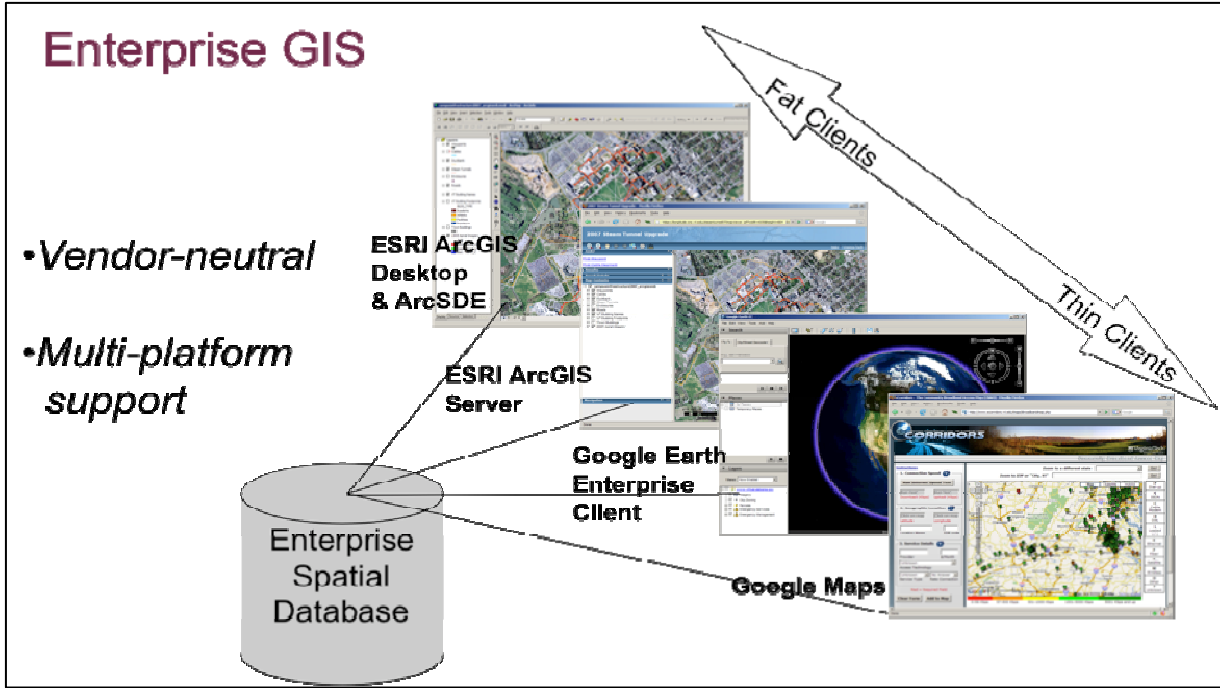
**Virginia viticulture.** Through funding of the Virginia Wine Board, CGIT works with the state viticulturalist to re-assess the viticultural suitability of the state. The project will account for climate, topography, soils, and risks posed by pests and diseases. Results will be presented as an interactive web map, which will serve to inform and educate vineyard managers and the public.



Interpolated building models and an example of Lidar point clouds showing Lane Stadium for the 3D Blacksburg project.

## Enterprise GIS

As an administrative unit, Enterprise GIS provides centralized storage and hosting of GIS data, Web-mapping applications hosting and design assistance, and a centralized base map for the campus and the Commonwealth of Virginia. Services include GIS data hosting and storage, Google Earth hosting, GIS Web application hosting (ArcGIS Server, Google Maps), GIS Web application development, enterprise GIS software training, and ESRI license payment for all university departments. Enterprise GIS was established as a formal organizational unit of Information Technology in September 2008. Project management and service-level agreement procedures were put in place to provide client assurance mechanisms and internal compliance. In August 2009, it was restructured as a division of Virginia Tech Geospatial Information Sciences.



Enterprise GIS supports enterprise-wide GIS applications.

The Enterprise GIS base map is made up of layers owned by various units of Virginia Tech with an aim to support the university’s research, teaching, and engagement missions as well as select outside partnerships. Through Enterprise GIS, Virginia Tech GIS can provide efficiencies of scale and significant cost savings to university departments seeking access to GIS data relevant to their research, and for services of GIS data hosting and storage, freeing them up to focus on their research area of interest. Enterprise GIS currently has service-level agreements in place for eight departments or colleges and 14 active storage or Web application development projects.

Enterprise GIS serves a diverse base of clients, including the College of Agriculture and Life Sciences Human and Natural Resources Information Technology, the Center for Assessment Evaluation and Educational Programming, the Virginia-Maryland Regional College of Veterinary Medicine, the Center for Student Engagement and Community Partnerships, Virginia Cooperative Extension Northeast and Northwest districts, the College of Architecture and Urban Studies, the Center for Highway Asset Management Programs, offices reporting to the vice president for administrative services, the Virginia Tech Transportation Institute, the Virginia Assistive Technology Center, the Conservation Management Institute, Civil Environmental Engineering, the College of Natural Resources, the Department of Geography, Virginia Tech Police; and the IT Security Office.

## Projects and activities

### **Virginia Tech Police Department incident map.**

The project prototypes an incident mapping application using geographic information systems for the Blacksburg campus. The system will provide law enforcement with the capacity to query particular information and then compare and display spatial information about incidents and physical environments, enhancing safety and crime prevention strategies.



Enterprise GIS is working with VTPD to produce an incident map

**Information Technology Security Office.** This project identifies trends and vulnerabilities. In addition to analyzing relationships, mapping security incidents can better communicate to decision-makers about prioritizing decisions to improve security.

**Virginia Cooperative Extension (VCE).** Enterprise GIS hosts multiple projects for VCE, including Community Foods and Sustainable Agriculture and demonstration forestry projects at Shenandoah Agricultural Research and Extension Center. These projects involve both data storage and application hosting components, including a pilot deployment of ArcGIS Server JavaScript API.

**The Center for Student Engagement and Community Partnerships.** Providing a searchable database and interactive map of engagement activities by Virginia Tech faculty and staff members, students, alumni, and friends, this project is a partnership with the Office of Outreach Information Services.

## eCorridors Program

Virginia Tech's eCorridors Program has over 3 years of experience in measuring broadband speeds and over 10 years in researching broadband issues including wireless technologies, optical fiber architecture and design, policy and business models. The program continues to grow in its information technology outreach effort, aimed at facilitating and promoting 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.

eCorridors has continued to build its national reputation as a reliable guide in the development, planning, and optimization of advanced telecommunications systems. The program has worked alongside communities throughout Virginia to expand advanced network and communication infrastructure and services. Similarly, among private sector collaborators, Virginia Tech is a

respected player in rural and community networks. The eCorridors team has worked with the public, state and national policymakers, and communities in rural regions, on a variety of projects.

This past fall, the eCorridors program in cooperation with CGIT has submitted three proposals related to broadband mapping: Virginia statewide broadband mapping, "National User-Generated Data," and Mid-Atlantic Broadband Cooperative's middle mile project.

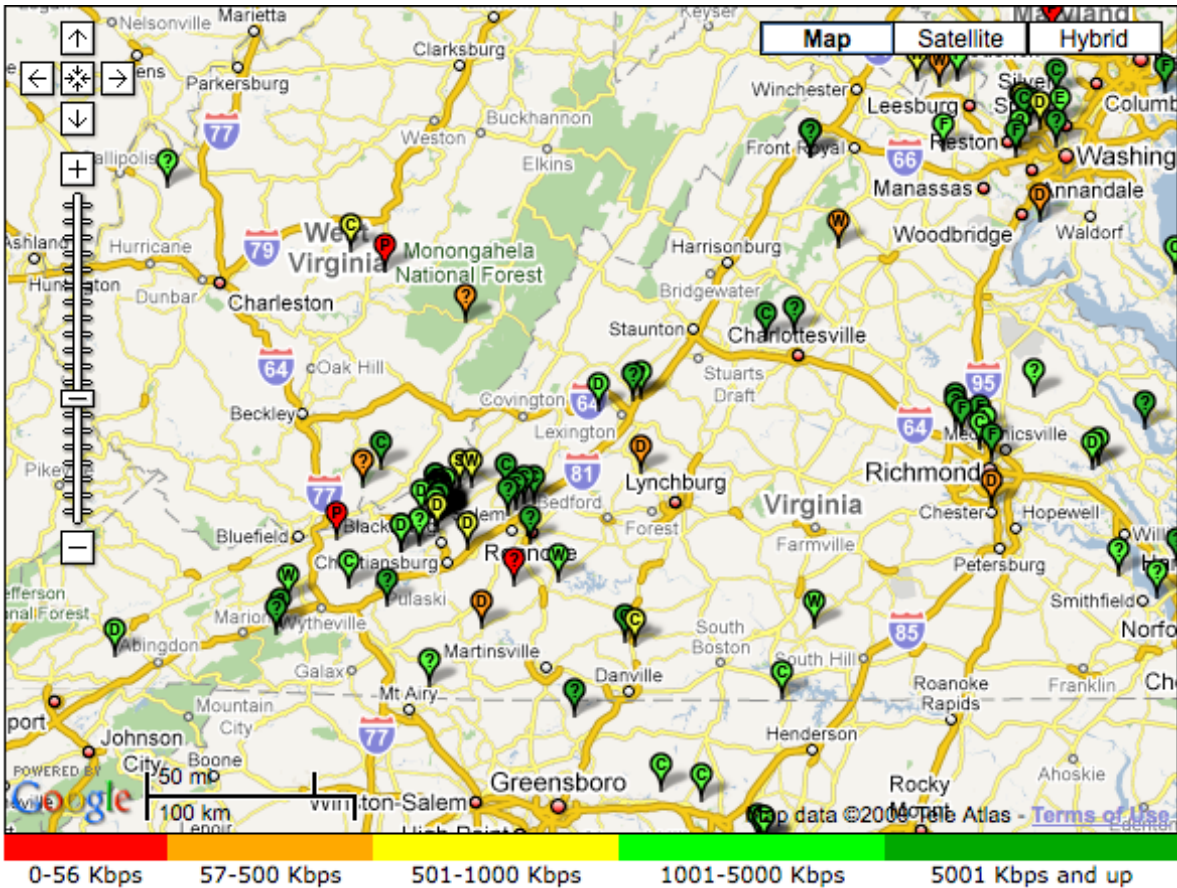
As a subcontractor to Virginia's Center for Innovative Technology (CIT) and partnering with Virginia Information Technologies Agency/Virginia Geographic Information Network, the eCorridors Program through CGIT is a member of Virginia's statewide broadband mapping team for five years starting September 2009. Virginia Tech's portion of the proposal entails a cost share total of \$259,250. The funding amount provided to the university over the five-year period will be a total of \$1,259,797 for eCorridors and CGIT tasks related to the collection, verification, and dissemination of broadband data as well as the development of an architecture and model for an ongoing data inventory consistent with the National Telecommunications and Information Administration (NTIA) and Federal Communications Commission specifications.

eCorridors along with CGIT is partnering with an organization called BroadbandCensus.com to submit a proposal under NTIA's Broadband Technology Opportunity Program Public Computing Center funding, entitled "National User-Generated Data." The CGIT portion of the proposal is for \$256,000 with cost-share being waived by the lead entity, BroadbandCensus.com.

eCorridors and CGIT staff and graduate students assisted Jeff Crowder and the Virginia Tech Foundation in preparing the justification and background materials for a proposal in partnership with Mid-Atlantic Broadband Cooperative (MBC) to deploy a "middle mile" fiber route covering a region of six counties in Virginia in the Ridge and Valley portion on the edge of the Allegheny Highlands. This project entails a total of nearly \$7 million in proposed funding for the Foundation and MBC.

## **Projects and activities**

**Health IT.** One of the NTIA proposals is with CIT and the Institute for Critical Technology and Applied Science (ICTAS) and is focused on training for use of electronic health records. The period of performance is 2009-2011 and the funding requested is \$347,495. The group is working with ICTAS to compile a database of university health information technology expertise and faculty interests to be positioned for upcoming opportunities. Patrick Butler, a graduate research assistant advised by Naren Ramakrishnan, is developing data mining techniques related to electronic health data and ways to integrate geospatial data and visualization tools and processes.



eCorridors' CBAM has been collecting data since August 2006

**The eCorridors community broadband access map (CBAM).** In response to the need for information regarding geographic location of telecommunications infrastructure and services, as well as connection speeds, and local level pricing, the eCorridors Program developed this consumer-driven approach to determining regional broadband service availability. The CBAM has been collecting connectivity data since August 2006. It is driven by the voluntary contribution of connectivity information by broadband customers. The application allows deeper insight into the state of regional broadband availability, performance, and pricing at the local level. eCorridors uses these factors to produce a number of analyses aimed at understanding broadband trends and issues.

**K-12 and public libraries broadband map.** Conceptualized by Virginia's then-Secretary of Technology Aneesh Chopra (now Chief Technology Officer in the Obama administration) and developed by engineers from the eCorridors program at Virginia Tech, the broadband speed map allows school administrators to test their school's Internet speed capabilities and easily report findings to the Office of the Secretary of Technology. The information collected through this process assists government leaders in assessing the needs of each public school and targeting resources accordingly. The eCorridors Program followed up this project by working with the Virginia State Libraries to perform a speed test and data collection for all the libraries, and to illustrate that data on a Google map interface. Secretary Chopra has praised both of these mapping efforts.

**Alaska broadband speed test.** The eCorridor's program was selected by the Northwest Arctic Broadband Task Force to conduct a weeklong experiment in an effort to provide a snapshot baseline assessment of broadband conditions in Alaska. The primary purpose of the data collection project was to better understand various aspects of broadband access methods available in Alaska. The Virginia Tech eCorridors Broadband speed-mapping tool was chosen to collect data for this effort because of its successful implementation since 2006, incorporating data from sources worldwide, and proven ability to collect the kind of data that serves Alaska's purpose.

Alaska's Broadband Speed Test map provided by eCorridors



## Converged security

The director of Strategic Partnership Initiatives, Brenda van Gelder, convened the Converged Security Retreat on May 19, 2009. The purpose of the information technology-focused retreat was to discuss ways in which the Information Technology can leverage existing campus infrastructure for enhanced security and safety and to generate initiatives in the area of cyber-security/ physical security where they intersect and can leverage each other. Representatives from Facilities Services and the campus police also attended to listen and provide feedback since there was potential overlap with their areas and initiatives. The half-day meeting, facilitated by Jesus Villahermosa, a nationally known crisis response expert, resulted in five initiatives that involve physical and network security.

**Identity Management Planning Committee.** Vice Presidents Sherwood Wilson and Erv Blythe are driving this initiative. A written charge for a university committee has been developed and the intent is for Dwight Shelton, Sherwood Wilson, and Erv Blythe to be the executive management sponsoring and overseeing this major project. The charge to the committee is to examine identity management issues in detail, and to develop recommendations addressing systematic deficiencies, and the most serious adverse exposures to information systems, facilities, and personal safety. They are proposing that the committee complete its work by March 2010. The committee is being asked to develop a strategic master plan with the final report addressing national and international standards, along with emerging standards, with which we should comply and monitor, and a *long-term* systems architecture to guide the evolution of current systems and the selection of new systems, central university organizational considerations, and process scenarios. There will be an interim report in mid-December.

**Mobile data terminals (MDT) for police cars.** Brenda van Gelder and Judy Lilly have been the primary drivers for MDTs, working with Wendell Flinchum and Denise Linkenhofer. The hardware and software have been specified and selected; quotes obtained; and funds identified to acquire mobile data terminals, along with a number of PDAs for officers away from their vehicles.

**Video surveillance policy.** Michael Mulhare is driving this policy development. He is drafting a policy for the acquisition and deployment of video cameras on campus.

**GIS for safety and security.** Members of the VT GIS group under the direction of Brenda van Gelder and Peter Sforza have met with Mike Mulhare, Lance Franklin, and members of the police department to assist in providing geospatial tools and resources for safety and security. There is also interest from students in participating on the integration of GIS resources for campus safety and security. These students have been interacting with the faculty and staff of VT GIS to learn how they can get involved.

**Devices and mobile application development for safety and security.** Geof Allen of the police department is leading this effort. He is working with a number of individuals from Information Technology and with students to develop new ways of utilizing mobile devices for enhanced security on campus. There is also interest in developing new mobile applications for safety and security at Virginia Tech.