

# **Information Technology**

## **Virginia Polytechnic Institute and State University**



IT Staff Photo

**2002-2003**

**Annual Report**

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Cover photograph by Ken Wieringo

# **Information Technology: 2002-2003 Annual Report**

Information Technology supports Virginia Tech's mission and goals in instruction, research, and outreach. Information Technology works to maintain the security and privacy of the online environment for the faculty, staff, students, alumni, friends, and business partners of the university.

This report covers the eighteen months from July 2002 through December 2003. It is organized into two sections: first, some highlights from across Information Technology; second, reports from individual units within Information Technology.

## **I. Highlights**

### **Highlights of accomplishments in Information Technology**

Information Technology (IT) at Virginia Tech works with the faculty, the academic support offices, and the administration to carry out the university's missions in instruction, research, and outreach. This annual report focuses on accomplishments of the organization over the past 18 months in serving these missions. Recent times have mandated a heightened awareness of the needs for security and privacy. Throughout all the work of Information Technology, security is an essential concern. Specific actions have been taken to improve security and privacy.

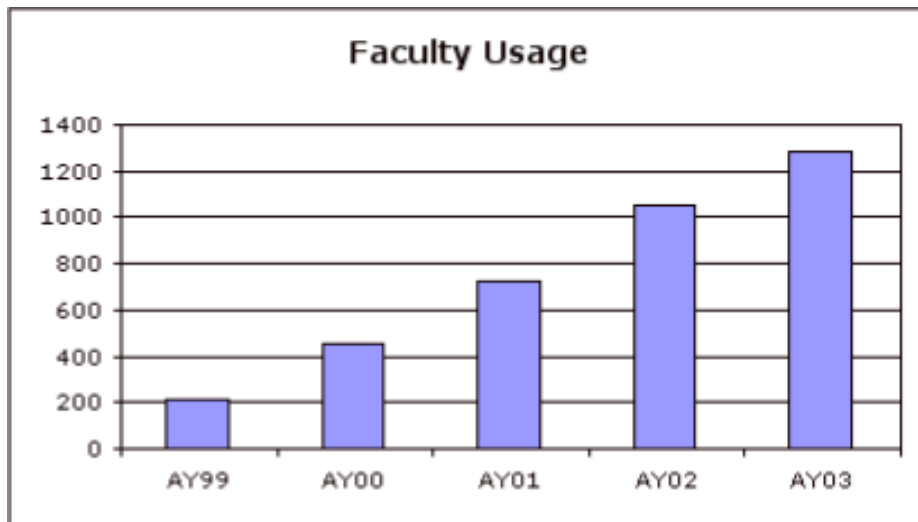
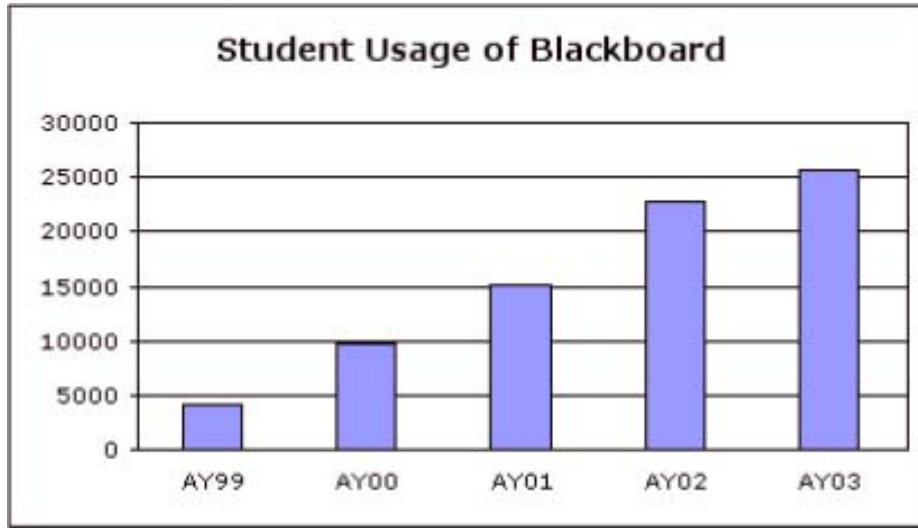
The first section of this report highlights some of the accomplishments in the service of instruction, research, and outreach, along with accomplishments in the security/privacy arena.

The second section includes the annual reports from the organizational units within Information Technology.

## **Instruction**

**Online instruction** at Virginia Tech continues to grow, both as the primary course delivery system and as a supplement to classroom instruction. About 1500 courses and 25,000 students now use the Blackboard system each semester, including all distance learning credit courses. Online Course Support answered about 7000 questions last year. An online knowledge base extends that personal support.

Trends in usage over time are presented below.



A special relationship between Virginia Tech and Wake Forest University provides instruction in the School of Biomedical Engineering and Sciences. Students may take courses on either campus and through distant learning while residing on their home campus in either Blacksburg or Winston-Salem. Support for the network infrastructure for this program marked Virginia Tech's first foray into utilizing Next Generation Internet resources for delivery of academic coursework via videoconferencing.

***Instructional support.*** Virginia Tech leverages support for teaching and learning through learning technologies. Attracting faculty to workshops that assist them in effective use of teaching technologies offers an opportunity to focus on teaching and learning. In addition, the program provides a method to refresh their desktop computing environment. In August 2003, the award-winning Faculty Development Institute (FDI) concluded the third year of its third four-year cycle. In the fall semester, the concept was extended to graduate students, in collaboration with the Graduate School. The attendance for all FDI workshops during fall, spring and summer 2002-03 was 2027 faculty, graduate students and staff. In the past ten years, more than 4000 members of the faculty have participated in FDI. The participants have valued the opportunity to explore instructional issues with their colleagues in a supportive context and discover the potential of technology for enhancing their teaching. Participants have indicated that these resources are critical if they are to adapt to the needs of today's students.

***Learning support.*** While the focus over the past decade has been on support for teachers, Information Technology also offers support for learners. One example is the new project in 2003 of e-Portfolios. These collections of digital materials document student accomplishments. Users may easily save, organize, review, reflect upon, and selectively share personal and professional records and documents via the Internet. The Learning Technologies staff researched needs with faculty and program areas, and selected an open source portfolio product originally developed by the University of Minnesota and released through the Open Source Portfolio Initiative. In collaboration with Virginia Tech's Center for Excellence in Undergraduate Teaching, a pilot e-portfolio was implemented in fall semester of 2003, including 12 faculty and 275 students. The e-portfolio system will be available to all students, faculty and staff beginning summer 2004.

Online support for learners extends to the answers.vt.edu knowledge base. This repository of questions and answers is available to the entire university community and beyond. Questions and answers that were update and created in the past year include those dealing with accessing the Blackboard learning management system, and finding one's courses on the online student web management system—"Hokie Spa."

Members of the Information Technology workforce also assist in teaching and curriculum support. The Director of Information Technology Acquisition, John Krallman, presented in sessions in Information Systems Audit & Control and Database Technology for E-Business in the College of Business. Randy Marchany of the IT Security Office taught a course on cybersecurity in the College of Engineering, and assisted in curricular planning with the Department of Electrical and Computer Engineering. Shelli Fowler, Learning Technologies, taught courses that provided opportunities for graduate students to develop pedagogical skills while integrating technology into teaching and learning.

***Advising support.*** Through single sign-on to MyVT—the Virginia Tech portal, students, their advisors, and their instructors gain access to class schedules, unofficial transcripts, registration, and related information and transactions in the Hokie Spa. A major enhancement to the Hokie Spa this year has been the advent of online transcript requests. Students—and former students—may request and pay for official transcripts through this system. Support for online access by former students has been enabled by the new Enterprise Directory.

***Admissions.*** With the training on reports offered by the data warehouse group, both Graduate Admissions and Undergraduate Admissions are able to use the admissions data marts in the warehouse. These reports permit them to analyze trends and student credentials, permitting in turn, more effective and efficient admissions processes, and enhanced admissions of students most likely to succeed. For the Graduate School, the analysis has improved processes geared toward the goal of larger graduate and doctoral program admissions.

## **Research**

***Research collaborations*** include the Terascale project and National LambdaRail. The Terascale—Virginia Tech's System X ("System Ten")—officially ranks as the 3rd fastest supercomputer in the world on the 22nd TOP500 List ([www.top500.org](http://www.top500.org)) released in November 2003. The project is a collaboration between the College of Engineering and Information Technology, under the research leadership of Srinidhi Varadarajan, Assistant Professor of Computer Science. In less than three months, the project was planned, installed, and tested, compared to a more typical scenario for creating this class of computer of 1-2 years. The system was also far less expensive, costing \$5.2 million, or about one-tenth of the average cost of such computers. A departure from the monolithic mainframe supercomputing, the design consists of a 64-bit InfiniBand cluster using existing, off-the-shelf industry components.

System Ten was created by a team of engineers, computer scientists, and officials from Virginia Tech working with partners Apple Computer, Cisco, Liebert, and Mellanox Technologies. It uses 1,100 new Power Macs Dual 2 GHz G5 computers.

National LambdaRail, Inc. (NLR) is a consortium of U.S. research universities, regional and national advanced networking organizations, and Cisco Systems. NLF is deploying a new transcontinental optical networking infrastructure. It fosters advancement of networking research and next-generation, network-based applications in science, engineering, and medicine, and re-energizes innovative research and development into next-generation network technologies, protocols, services, and applications. Vice President Earving Blythe serves on the Board of Directors.

Virginia Tech participates through its involvement with MATP—the Mid-Atlantic Terascale Partnership. MATP is a consortium open to higher education institutions and other research institutions in Virginia, Maryland, and the District of Columbia formed to support research activities that require next-generation high-performance network connectivity.

In another collaboration, the staff of the Assistive Technologies (AT) Lab is collaborating with faculty in the Bradley Department of Electrical and Computer Engineering (ECE) on wearable computers or e-textiles for people with and without disabilities.

Learning Technologies is also collaborating with ECE in the area of research into pervasive computing, where users can access services anytime and anywhere through computers embedded in the environment. Learning Technologies staff helped acquire funding from Microsoft for a study of pervasive embedded networks for *ad hoc* environments.

***Support for research*** included a major project by the Information Warehouse and Access team in creating a datamart of contracts and grants, working the Office of Sponsored Programs. In addition to creating the management support required for grants and contracts, the datamart makes it possible to track yield rates for granting agencies and proposal types, thereby enabling university personnel to focus their efforts more productively and to improve in areas where success rates are lower.

The enterprise administrative information system supports the flexibility required to manage grants and contracts. During the 2003 fiscal year, nearly 7000 funding changes were supported by the system, reflecting the varied sponsored programs through which faculty and staff are paid. The Human Resources and Finance Information Systems teams support the tracking of grants and contract funds for payroll and expenditures. The teams have enhanced data quality, added to the usefulness of reports, and streamlined and automated related processes. In support of the university's goal to increase its research standing, efforts to attract excellent graduate students resulted in changes to their employee benefits. The Human Resources Information System team saw that the changes were made in the administrative structure to support these benefits.

## Outreach

Extending Virginia Tech's information technology expertise to the communities of Virginia, the United States, and beyond took several forms during the reporting period.

The ***e-Corridors Program*** is an example of outreach with a clear research component. The Program assists Virginia communities in deploying advanced network infrastructure, with the purpose of improving inter-regional connectivity and economic well-being. The eCorridors Program also enables research and development of network technologies and



solutions for business, education, and other programs on a 'real world,' large-scale network. In March 2003, the program released a series of studies on issues surrounding the investment and development of strategic telecommunications infrastructure for communities. This series of reports, entitled "Strategic Technology Infrastructure for Regional Competitiveness in the Network Economy" utilized the Southside and southwest Virginia regions as a model for a low-cost Geodesic Mesh network design and viable financial model that could be replicated in any region of the United States. The overall premise of the studies is that investment in advanced, "next generation" telecommunications infrastructure is an essential and achievable component of a region's economic development and quality of life.

The ***Faculty Development Institute***, now in its eleventh year, included faculty from Averett University, Hollins University, and several institutions in the Appalachian College Association. The participation of these faculty make it clear that the program fills needs that faculty have in reaching students in the 21st century. Faculty participants value the opportunity to explore instructional issues with their colleagues in a supportive context and discover the potential of technology in their teaching. They believe these resources are critical to adapt to the needs of their students.

***NetworkVirginia*** is a nationally recognized model for a public-private partnership to develop advanced communications infrastructure. A next generation core network system that better supports demanding new applications provides an 800% increase in capacity between backbone, a 1200% increase in commodity Internet capacity, and substantial improvements in diversity and reliability. NetworkVirginia reaches an estimate 1.4 million people statewide at nearly one thousand network access points.

NetworkVirginia provides the lowest cost access to Internet2 for Virginia universities, compared to other states. In addition to Virginia Tech, Network Infrastructure and Services provides Internet2 access to other Virginia universities: University of Virginia, Old Dominion University, George Mason University, Virginia Commonwealth University, William and Mary, the Virginia Institute of Marine Science, the University of Richmond, Hampton University, and Norfolk State University.

***Virginia Tech Summer Training Academy for Rising Students—VT STARS***—is a program that reaches out to high school students, and is affiliated with the e-Corridors endeavors. Fifty-two at-risk high school students participated in the 2002 edition of the VT STARS summer residency program, and a similar number participated in summer 2003. Focusing on science, technology, engineering and mathematics, the program encourages participants from the economically depressed Southside Virginia region to develop skills they will need to thrive professionally in the knowledge economy. Developed as part of the larger Southside e-Corridors economic development and community revitalization initiative, the program has been a visible model for civic engagement and parental involvement in school reform dialogue.

The *Edward Via Virginia College of Osteopathic Medicine* (VCOM) is a new educational venture in Blacksburg. Network Infrastructure and Services provided the work to cable the new facility and SETI worked to provide electronic credentials for faculty, staff, and students of VCOM to carry out their agreed-upon relationships with Virginia Tech-provided services. Since VCOM is a private institution, Virginia Tech's expenses have been recovered through a contractual agreement with the college.

## Security

Security was a major focus in the reporting period, with a three-pronged effort: networks and operating systems; authentication and authorization; and data security.

### *Networks, operating systems, and applications*

The first phase of the Universal Payment Gateway (UPG) was developed by the Middleware Team so that students and alumni could request and pay for copies of their transcripts online. The UPG lies between Web applications—such as the transcript request system developed by the Banner Student Team—and payment processing solutions. The UPG protects payment information, reducing the potential for identity theft.

To promote and enhance desktop computing security, Information Technology funded two initiatives. The first provided upgraded operating systems free of charge during fiscal 2003, and the second supplied personal firewall products

A new release of Daisy, a tool developed in the Secure Enterprise Technology Initiatives team, was developed this year. Daisy provides an automated Windows OS patching tool, and is recommended to users to keep their desktop environments secure.

The Virginia Alliance for Secure Computing and Networking—VA SCAN—is a collaboration among four Virginia universities: James Madison, George Mason, the University of Virginia, and Virginia Tech. The Security Lab has taken the lead on Virginia Tech's participation. The alliance combines the varied strengths of the member institutions' security programs for the benefit of the Commonwealth and its colleges and universities. Services include consulting, a web-based toolkit, a self-assessment checklist, an online discussion list, tracking of new threats, and availability of cybersecurity research.

Additionally, *VTnet CD* has been made available to students, faculty and staff. *VTnet* is a CD that allows users to configure their computer to connect to the university network, and includes the latest anti-virus software and appropriate operating system patches.

## ***Authentication and authorization***

The development and implementation of a new Enterprise Directory included a new schema for authentication and authorization for Virginia Tech electronic login credentials (“PIDs” and their associated passwords). The program implemented a secure, highly available LDAP-compliant authentication service for campus applications and provided Java libraries to developers that could be used to convert existing applications. Collaboration across units ensured the conversion of selected central applications, including Blackboard, the administrative system self-service applications, and the My VT portal.

The Virginia Tech certificate authority (VT CA) was put in place by the e-Provisioning team. A Certificate Policy Statement guides management of the VT CA. Certificates set the stage for expanding the use of digitally signed services and documents at the university.

## ***Data security***

To improve privacy practices, the university moved to decrease the visibility of Social Security numbers. The first steps to replace Social Security numbers with Virginia Tech-specific identification numbers took place for newly admitted students. Collaboration with New Student Orientation, and the admissions offices led to all new students having Virginia Tech numbers on their identification cards and in their records.

International students and visitors came under new security requirements with the national SEVIS system. The teams within Administrative Information System and the central offices that deal with international students, employees, and other visitors collaborated to implement the new procedures and reports.

The risk of fraudulent checks was reduced with a new “positive pay” system, developed by the Administrative Information Systems staff and the Controller’s office and Payroll.

## ***Beyond Virginia Tech***

Network Infrastructure and Services’ CNS unit contributed to the Center for Internet Security (CIS) benchmark for Cisco’s Internet Operating System. The benchmark is the “Gold Standard” and will establish the baseline to be used by the United States federal government.

## ***Personal security***

Information Technology extends beyond digital security and into the realm of personal security with the “Blue Light” phone project of Network Infrastructure and Services

Telephone Engineering (TE) unit. TE managed the design, installation, documentation, and maintenance of thirty-two new locations for emergency telephones located throughout the Blacksburg campus.

Several staff members of Information Technology who are involved with issues of abusive use of the communications and computing resources of the university participated in a seminar on cyberstalking funded by a grant to the Women's Center. The seminar led to additional collaboration to provide support to victims of stalking, and to take measures to decrease the risk of cyberstalking.

## **Organization of Information Technology**

During the year, Vice President Earving Blythe announced organizational restructuring. One change reflected the focus on research computing, particularly the high performance computing project. The High Performance Computing project—the Terascale Project—has completed initial benchmarks, ranking third in the nation and first among universities. The project has captured the imagination of the public, and press reports have followed the milestones of the project.

Another major focus was on security. A new unit, Secure Enterprise Technology Initiatives (SETI) is charged with developing secure applications, middleware and interfaces to support the university's computing and network services, and to work with the IT Security Office to enforce security standards that preserve privacy. An objective is an appropriate balance between system usability and system security. SETI conducts research and deploys initiatives using leading-edge technologies to enhance and expand Virginia Tech's instruction, research, and outreach activities.

Generally, the goals of restructuring have been:

- A re-invigorated emphasis on security and privacy;
- Better integration with the university's Top 30 research institution goal;
- Separation of duties between development and operations; and
- Scalability in all endeavors.

The major organizational units within Information Technology are:

### **Enterprise Systems Support**

Enterprise Systems Support consists of two units:

- Administrative Information Systems
- Data & Information Access Services

## **Learning Technologies**

Learning Technologies includes:

- Educational Technologies
- Online Course Systems
- New Media Center
- Digital Imaging Center
- Computer Lab Support
- Assistive Technologies
- Test Scoring and e-Survey Services
- VT Summer Training Academy for Rising Students
- Center for Innovation in Learning

## **Network Infrastructure & Services**

Network Infrastructure & Services (NI&S) includes the following units:

- Blacksburg Electronic Village
- Communications Network Services
- Mail Services
- NetworkVirginia
- Printing Services
- Video Broadcast Services
- Virginia WiNS (LMDS)
- Systems Engineering & Administration

## **Research Computing**

Research Computing focuses on the high performance computing initiative.

## **Secure Enterprise Technology Initiatives**

- Internet Application Development
- Testing and Deployment

## **Strategic Partnerships Initiatives**

Strategic Partnerships Initiatives includes a focus on the eCorridors Project.

## University Information Security Office

The University Information Security Office includes the functions of the office itself, along with

- The Security Lab
- Information Resource Management (IRM)

### Office of the Vice President

Units reporting directly to the Vice President or his staff include:

- University Computing Support
- Information Technology Acquisition
- The office fiscal, administrative, and communications support.

**Financial Summary.** During fiscal 2003, the organizational units of Information Technology (IT) provided resources totaling \$50,497,693 in support of university academic, research, administrative, and outreach goals.

Information Technology provided academic, research, and administrative support activities totaling \$16,438,074 and Learning Technologies provided academic support totaling \$5,245,345. Network Infrastructure provided telecommunications, video, data, and networking services of approximately \$17,390,541 plus \$1,545,306 in mail services. Services totaling \$1,261,000 was provided for classroom connectivity for distance learning (data and video services). Additional services totaling \$821,000 was provided in support of the Advanced Technology Learning Center (Math Emporium).

IT also provided specialized digital imaging and volume printing to university departments. University support provided by Printing Services totaled approximately \$4,760,000.

Funding to support the activities of IT was provided by:

E&G	\$26,584,110
Equipment Trust Fund	931,090
Auxiliary Operations	15,166,846
Self Supporting Operations	4,759,867
Sponsored Grants	2,964,525
Overhead	<u>91,255</u>
Total	\$50,497,693

## **II. Detailed annual reports from Information Technology units**

# **Enterprise Systems**



# **Enterprise Systems**

Enterprise Systems consists of two major units—Administrative Information Systems and Data and Information Access Services.

## **Administrative Information Systems**

The Administrative Information Systems area is composed of five teams that support Banner, and the Enterprise Systems Support team. The Banner supported is composed of the Alumni/Development Team, the Finance Team, the General Team, the Human Resources Team, and the Student Team. The accomplishments of each are given below.

### ***Alumni/Development Team***

- Completed 707 service requests for application programming support.
- Resolved 345 duplicate person problems and 50 corporate duplicates.
- Completed 104 production control service requests.
- Implemented Banner A/D 5.3 in October 2002 and Banner A/D 5.4 in March 2003.
- Assisted with Oracle 9i upgrade in June 2003.
- Updated degree information for all majors impacted by academic restructuring, over 29,000 records.
- Participated in planning group for campaign reporting, including site visits to UVA, UNC-CH and Duke.
- Developed a solicitor organization for each fundraising unit in Development
- to report hierarchically fundraising achievements by unit.
- Developed a training curriculum for all new IT staff members. Hired and trained 2 programmers and 2 senior programmer analysts using this curriculum.
- Began a 12-month project to re-write the DRWeb reporting tool.
- Successfully defended against 3 major Internet worm/virus infestations in the UNIVDEV domain.

### ***Finance Team***

For the 2003 fiscal year, we processed 355 service requests. This is a 16% increase over last year. The breakdown is:

- 107 Data Repair/Fixes/Bug Corrections (22% increase)
- 24 Maintenance/Patches/Problem Solving (35% decrease)
- 172 Modifications/enhancements (25% increase)
- 52 New applications/reports/processes (13% increase)

Major projects this year include:

- Installed Banner 5.3 and reapplied all local mods
- Developed an interface from Banner to the new state electronic procurement system (eVA)
- Developed a new Third Party Billing system
- Developed a new 'positive pay' system in conjunction with our bank to reduce check fraud
- Developed a new Overhead calculation and distribution system
- Installed a new release of the Touchnet payment gateway
- Lead the development of an e-commerce payment gateway (University Payment Gateway)
- Developed a set of reports to automate Accounts Receivable to Finance reconciliation
- Developed a Depreciation History system
- Several significant modifications to the Account Receivable Monthly/Quarterly Aging reports
- Created a new AR/Finance Reconciliation report and enhanced an already existing report
- Upgraded our two servers from Windows NT 4.0 to Windows 2000 Server (Also eliminated AIS-FINANCE Domain)
- Migrated from version 5.1 to version 5.3 of JetForm Central (Purchase Orders/Statements/1099s/1098-Ts)

### ***General Team***

- Worked with the Middleware group to facilitate the replacement of the old authorization system to the new LDAP system.
- Installed three versions of the Banner General system.
- Worked with the Graduate school to get Visa Manager up and running.
- Modified SPBPERS audit trigger to facilitate the migration to generated id numbers.
- Data clean up on the General Tables.
  - Clean up of invalid Social Security Numbers.
  - Clean up of duplicate sequence numbers on address rows.
  - Clean up of Canadian zip codes.
- Miscellaneous and varied maintenance to the Banner General system and the Budget Tuition system.
- Added new some new audit tables to the Banner system.
- Modified the Budget Tuition to facilitate the removal of an old server (Delco).
- Implemented new SQR general include modules.
- Implemented new auto burst distribution for web distribution.

### ***HRIS Team***

- Completed approximately 290 service requests
- Modified, tested and installed Banner HR 5.3 and HR 5.4
- Modified, tested and installed the year-end tax and W2 releases. Wrote a new interface to allow end users to easily issue W2 and 1042 reprints.
- Assisted Learning Technologies and Squires with the installation of the TimeClock Plus software for tracking wage employees' hours.
- Moved from only a printed earnings and deduction statement to notifying employees via email their pay stub information was available in Employee Self Service. Created a printer friendly version of this page. Also allowed employees to opt in to receiving a printed E&D statement using Banner Employee Self-Service. We are saving approximately 9300 forms every 2 weeks.
- Paid graduate assistants a reimbursement of the university's cost of health insurance in the fall of 2002 and the spring of 2003.
- Automatically create the financial aid records required for paying a work-study student when the student is hired. This saves the department from having to enter these records by hand.
- Worked with Controller's Office to supply to the bank all checks written or voided in the payroll system with the amount to decrease the risk of fraudulent checks charged to the state.
- Implemented the new state requirement that IT employees be charged to a different set of object codes for state reporting.
- Wrote several programs to change disability plans and health care plans due to changes required at the state level and to meet new VRS and VEC reporting requirements.
- Continual changes to the system to improve data quality, system performance and customer satisfaction
- Integrating new applicant tracking software (PeopleAdmin). Facilitated discussions between the vendor and Middleware so that the system could use the enterprise directory.

### ***Student Team***

During the past fiscal year, the Student Project Team continued the implementation of modules associated with Banner Student and Banner Financial Aid. Since the systems went live, the team has not only been dealing with what processes are left to implement for functional areas but also with the maintenance of production processes. Throughout the year, corrections have been made to those, which are not performing as the functional area requires. Over 240 service requests for modifications/enhancements were submitted during the year.

## **Corrections and Maintenance**

- Participated in the testing and verification of a new release of Banner – 10/2002
- Ongoing daily support of student/financial aid processes as required
- Continued the enhancements of the routines used to create the files associated with census processing
- Ran the processes to clear pidms no longer needed thus reducing the size of several General tables
- Enhanced student organization programs due to organizational changes in that area so that reports could be generated more efficiently
- Expanded the distribution of self-service data extracts from the Student Data Warehouse.

## **Enhancements and Expansions**

- Implemented a transcript request system using a web interface that integrates with the University Payment Gateway for customer payments
- Implemented autoburst with webdist for a number of processes in student area in support of disseminating reports for the Registrar's Office
- Implemented a set of encyclopedia tables to manage and maintain the data associated with majors, colleges, dean names, minors, etc.
- Developed and are in the final stages of implementation of tables to more appropriately support primary majors, secondary majors, minors, and concentrations
- Implemented the housing room assignments process and began work on the capture of housing assignment information via the web
- Participated in the migration to generated ID numbers for the primary access point of Banner
- Performed the necessary updates required of the system in support of the University restructuring
- Developed for the Graduate School the processes required to allow graduate applicants to view the status of their application via the web
- Assisted the Graduate School in improving data flow and processes within their office
- Worked with HR team and the General team to implement the new forms and procedures associated with SEVIS, including providing new reports to support required reporting
- Corrected and enhanced the reasonable academic report process for Financial Aid
- Developed audit tables and associated data base triggers to address OSFA audit comments
- Developed and implemented budget component minimum and maximum amounts for OSFA to address audit comments
- Continued to enhance the Web for Student and Faculty/Advisors capabilities

- Continued work on the Student Data Warehouse, using Undergraduate Admissions and Graduate Admissions as the first areas of data to migrate to the warehouse

### ***Enterprise Systems Support Team***

Accomplishments of the Enterprise Systems Support Team (ESS) during the reporting period include:

- Setup an electronic datadrop for ISR charges from Software Distribution, eliminating paper transfers to the Controller's Office and re-keying of ISR info.
- ESS staff, working with SEA staff, moved the main ITA file and web server to a SUN 280R. Approximately 1 million files were moved, machine mounts reconfigured, and web services re-established.
- A web-based software ordering shopping cart was designed and coded. The project is currently on hold until payment and ordering procedure design is clarified.
- ESS staff spent 30+ hours meeting with ITA staff to discuss software contract information. (Joyce Randall)
- A Solaris-based software server was created to provide CD images for students and VT employees over the network. The system uses the ITA Oracle software database to verify student purchases and the ED-AUTH and ED-Lite directory to verify student and employee status. Access is controlled by both PID and IP security for all software shares. 17 products and over 50 CD images are currently available on the server.
- The Computer Purchasing fax server was upgraded and moved to a UNIX machine during the past year. The fax server manages three analog fax lines and provides digital images of all incoming faxes.
- Provided a contract history and recommendation document to ITA administration for the Microsoft Campus Agreement and Mathworks VT contracts.
- Worked with the Banner Desktop support group to preload Dell computer information and provide database services and reports for Banner installations.
- Developed new scanning procedures for the Computer Purchasing office to scan purchase order documents on new scanning hardware (the HP digital sender.)
- Configured and set up new workstations for the staff in the Computer Purchasing office and Software Distribution office.
- Participated in Centralized Student Software check in for Student Software Distribution and provided technical and application support for ITA during CSS.
- Participated in design meetings with ITA to map out new applications and procedures needed when the NeXT platform is eliminated. Started programming and system changes to move away from all dependency on the NeXT.
- Performed miscellaneous tasks for ITA administration such as sending out bulk emails directed to specific software license holders, web site enhancements, ad-hoc reports, and data correction tasks of software records.

- By invitation of ITA management, ESS staff participates in bi-weekly ITA staff meetings.
- Provide day-to-day support of all ITA offices to diagnose problems and provide hardware and software support.

## **Data and Information Access Services**

Data and Information Access Services consists of three units: The Information Warehousing and Access team, Content Management and Knowledge Management, and DBMS.

### ***Information Warehousing and Access***

The Information Warehousing and Access (IWA) mission 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 to develop the 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.

Each night transactional data from the previous business day is extracted from the Banner transactional processing system and added to the Data Warehouse. The data is restructured in the Warehouse so it is easy to understand and use. The Data Warehouse contains data current as of the previous business day, and also accumulates historical data that can be used for trend analysis. The data marts in production at the time of this report are: Accounts Receivable, Alumni Development, Employee, Finance, Foundation, Graduate Admissions, Payroll, Position Control, and Undergraduate Admissions. The Sponsored Programs (proposals and grants) data mart is ready for rollout and training. IWA works cooperatively with the Data Stewards in the various business operational areas to provide data and tool training for the users of each data mart.

IWA supports a compliment of Web enabled tools for accessing data. Brio is supported for interactive ad hoc queries over the web. Additionally, a number of in-house written applications are maintained and supported by IWA including: Report Job Submission for submitting parameter driven batch query jobs; Report Distribution for disseminating output from batch query jobs via a web URL in an e-mail notification; Metadata Viewer for authorized Data Warehouse users to view data models and the data definitions for each data mart; Service Request which provides a web interface for submitting service

requests and a data base for tracking man-hours; Problem Tracking which tracks man-hours by problem occurrence and serves as a reference of fixes for problems.

### **Data Warehouse Development and Maintenance**

During the reporting period IWA continued to be involved in developing new data marts while at the same time sustaining the existing data marts. For data marts under development, project meetings are held weekly to plan and coordinate effort. For established data marts, monthly meetings are held with each business area to coordinate necessary warehouse changes due to evolving business processes, software upgrades, or data correction. Between July 1, 2002 and June 30, 2003 such warehouse changes were reflected in the completion of 136 service requests for a total of 630 man-hours. Additionally, during that same period 271 problems were reported and 592 man-hours spent resolving them. Hardware and software upgrades during the reporting period made a significant positive impact on Data Warehouse reliability and scalability. A list of the most notable development and maintenance work during the reporting period follows:

- Completed rollout and training of the Undergraduate Admissions data mart.
- Completed development and implementation of the Graduate Admissions data mart.
- Completed analysis, design, and the extract and load procedures for the Sponsored Programs data mart.
- Enhanced the Foundation Finance data mart to update invoice transactions referenced by payment transactions, providing a feature not previously supported.
- Modified the end-of-year tables in the Finance data mart to by-pass all future-dated values and reflect what is truly in effect at year-end.
- Added user-defined Chart of Accounts attribute tables to the Finance data mart.
- Modified nightly extract and load processes to simplify reporting of Extension employees.
- Added a historical organization key to relevant tables so users can view data before and after a re-organization.
- Removed social security number from warehouse views to protect individuals' privacy.
- Analyzed handling of duplicate person records in Banner for each administrative area and designed a streamlined process for propagating corrections in the Warehouse and maintaining a history of those corrections.
- Migrated to the SAN (storage area network) computer, a strategic upgrade to take advantage of new technology thereby providing important redundancy and back-up options and generally improving the reliability of the Data Warehouse.
- Upgraded the Warehouse databases to ORACLE v.9i in order to take advantage of new data base management features.
- Made the case for and implemented Oracle Partitioning to address performance requirements related to the mass of data accumulating in the Data Warehouse.

- Coordinated with the DBMS group to use the same calendaring and notification system for scheduling warehouse maintenance and upgrades.

### **Data Warehouse User Support**

The Data Warehouse is accessed and used by over 1200 users across the University. The vast majority of these users submit monthly status and reconciliation reports that run against the Finance data mart. Support for these users is primarily through maintenance and upgrades of the Report Job Submission and Report Distribution web applications. Additionally, there are 200 licensed users who have been trained to use the Brio query tool to report from the Warehouse. Approximately 50 of these users are considered “power users” who develop and run ad hoc queries on nearly a daily basis. During the reporting period IWA offered the following user support:

- Provided training classes on using the various data marts. 70 people were trained during the reporting period. Training evaluations consistently noted excellent instruction, preparation, and benefit to the students.
- Provided individual assistance in query development or answers to questions pertaining to the Warehouse on more than 100 occasions. Many of these involved going to the requestor's office to work directly with them at their computer.
- Prepared and presented warehouse query demonstrations for Human Resources staff, Undergraduate Admissions staff, and Graduate Admissions Staff.
- Developed requested enhancements to the in-house written Report Job Submission and Report Distribution applications. These applications are used for disseminating the departmental monthly finance reports, as well as other administrative reports that run against the Data Warehouse or Banner.
- Developed two new executive information dashboards for management and upgraded two existing executive information dashboards.
- Offered weekly query development sessions for support staff from three areas (Graduate Admission, Undergraduate Admissions, and Alumni Development) to respond to business questions and as a means of knowledge transfer.
- Kept up-to-date on the Brio query tool and trained on SQR in order to better serve and support the Warehouse user base.

### **Data Management**

IWA continues to advocate for conscientious data management to insure that the data that moves from the source administrative system (Banner) into the Warehouse and ultimately into users' hands is accurate and useful. To this end, IWA has continued to promote data stewardship in the business operation areas in support of timely data correction, consistent and logical data access procedures, development of standards as needed, and adherence to the Administrative Data Management and Access Policy (<http://www.vt.edu/administration/policies/2005.pdf>).



IWA participates in the regular Administrative Information Systems Data Quality and General System meetings. IWA makes a concerted effort to conform all data marts to established standards so they can be fully integrated across business functions. Finally, IWA provides leadership and advocacy for activities related to the on-going creation and maintenance of Data Warehouse metadata, i.e., business definitions and published data models.

### **Professional Information Exchange**

Virginia Tech has been at the forefront among its peer institutions in developing a Data Warehouse. In the past IWA representatives have presented workshops at EDUCAUSE and CUMREC on how to build a Data Warehouse. While such travel this year was financially prohibitive, IWA staff continued to make a professional contribution as follows:

- Participated and made presentations at regional Brio Users Group meetings.
- Per requests, participated in three conference calls with other universities.
- Met with representatives from several universities who visited our campus.
- Responded to a variety of e-mail requests for info about our Data Warehouse.
- Revised the structure and updated and expanded the content for the IWA and Data Warehouse web pages.
- Recommended enhancements and coordinated the transfer of maintenance of the EDUCAUSE sponsored informational “warehouse configurations” web page.
- Coordinated with vendor representatives from Ascential Software and the Virginia Tech Information Office to produce a joint press release about our use of the DataStage software to create the Data Warehouse.
- Met with vendor representatives from Computer Associates to discuss the use of the ERWIN data modeling software, specifically for Data Warehouse development.
- Met with vendor representatives from BRIO to discuss strategies for leveraging their software for economic Data Warehouse reporting solutions, specifically in a University environment.

### **Summary of Accomplishments**

From a power-user who has been doing ad hoc queries against the Warehouse for some time, the following comment is typical and telling of our success: “We find the Warehouse useful in accessing with SAS, Brio, SQL, and MS Access. It truly is a blessing to have the data so ready at our hands.” Another user pointed out that producing a newly requested series of reports from the Data Warehouse took only 30 minutes. She went on to say that without the Warehouse, she would have run 190 reports against Banner, extracted the relevant information, plugged it into a spreadsheet, and then done additional processing with Excel. She said it would have taken hours, if not days, and been fraught with opportunity to overlook relevant information or to miss-key data.

It is worth noting that Virginia Tech is recognized as a leader in Data Warehouse development. Other schools look to us for guidance and advice as they embark on similar projects. We have fine tuned our data mart project planning process, identifying the make-up of a project team, the steps for development, and a delineation of who does what. The result is a project agreement template that we re-use and that we can share. Other schools have also benefited directly from our in-depth analysis and design as noted by a colleague at George Mason University who wrote us: "The payroll earnings and deductions data marts (data models) you sent are working out beautifully and we are implementing those as is." GMU later also implemented our Finance data models.

During the reporting period IWA successfully sustained the existing data marts, added three new data marts, improved the Warehouse stability, enhanced the web-enabled tools, and expanded the user base. One result has been enthusiastic users. Another result has been increased demand for simple and visually rich dashboard type access for departments. Finding an economical and scalable solution to meet this need is perhaps the greatest challenge for the coming year.

### ***Content Management and Knowledge Management***

The Content Management and Knowledge Management Organization consists of two groups. The first group, the Virginia Tech Knowledge Base ([answers.vt.edu](http://answers.vt.edu) and [computing.vt.edu](http://computing.vt.edu)) provides information and solutions to our user community. The second group, the Virginia Tech Web Hosting group maintains the web server infrastructure necessary to support both individual web sites (Filebox) and organizational web sites (web hosting).

#### **Knowledge Base Accomplishments 2002-2003**

The role of the KnowledgeBase team grew this year as the group added the [computing.vt.edu](http://computing.vt.edu) Web site and Office of the Vice President for Information Technology Web site to their existing duties as editors and publishers of the [answers.vt.edu](http://answers.vt.edu) knowledge base. This combination has allowed for increased usability of Virginia Tech's information technology publications partly resulting from reduced redundancy of content and unified publication procedures. CKM now oversees approximately 2500 Web publications. Several IT areas contributed new or updated information allowing CKM to publish 429 new documents this year. In addition CKM updated 673 existing publications. Specific projects were dedicated to coordinating and improving the Network Attached Storage, Exchange Mail and Calendaring, VT Mail Service, Secure Sockets Layer, and Getting Started with Computing pages. CKM also reviewed and expanded its Web publishing and editing guidelines to provide greater clarity, consistency, and usability for Virginia Tech affiliates.

## **VT Web Hosting Services Accomplishments 2002-2003**

The Web Hosting Services group added dynamic hosting to the services that they offer departments and organizations through the addition of support for PHP scripting and MYSQL databases. The number of College, Department and Organization sites that the web hosting group supports grew to over 200 this past year. With the system administration provided by the SEA Unix area, and the Web server and application support provided by the Web Hosting group, this ensures that security patches are up to date, and it also saves departments the expense of having to purchase and maintain hardware and software to support their web site. One user commented that she loved web hosting because it saves her lots of time. Before the department moved to web hosting, she had to maintain many different IIS web servers, and was spending all of her time keeping the systems patched.

Additional accomplishments this past year include integrating authentication with the new Enterprise Directory, moving the content to Network Attached Storage and the addition of an event calendar that hosting clients can tailor for their website. This is used by [www.vt.edu](http://www.vt.edu) and several other sites.

The Web Hosting group also supports Filebox which supports individual web sites for students, faculty, and staff. Filebox has grown to approximately 27,000 users this year. Accomplishments this past year include the migration of Filebox to a new hardware platform (Linux) which is providing much better performance and reliability for users. The disk storage for Filebox was also converted to Network Attached Storage. Authentication for Filebox was also integrated with the new Enterprise Directory, and the use of FTP was phased out, and replaced by the WebDAV protocol for security reasons.

## ***DBMS Team***

### **Application Software Upgrade**

The Banner system was upgraded to new releases of 5.x during the year. Forty-Seven (47) different Banner and Banner Web upgrades were installed to the Banner databases during the year. The upgrades were applied to six (6) Banner databases and four (4) Banner foundation databases for a total of more than 200 installs done to support the Banner environment. All FMXs were regenerated since we moved to Oracle developer 6i patch 13. In addition numerous patches were downloaded and applied at the request of the functional and technical leads.

SQR was upgraded to release 8.0.2. SQR is a specialized programming language for data access, data manipulation and reporting.

The credit card payment gateway Touchnet was upgraded to release 4 for Solaris and moved to a Solaris platform.

Banner XtenderSolutions/OTG interface allowing document imaging was upgraded to a new release. This application primarily supports imaging for the Financial Aid office. The task required setup and installation on multiple servers specifically purchased for the application. It also involved the installation of a Banner interface.

### **New Application Software**

Software allowing users to schedule production jobs was developed and implemented.

DBMS staff researched, evaluated, defined and implemented an environment for the deployment of Banner forms in a web environment (web enabled).

DBMS staff developed and implemented software to improve quality and efficiency of the Banner installs.

Enhanced monitoring software.

### **System Software Migrations**

Oracle database were migrated to a new release (9.2.0.2) during the year. A total of ten (10) Oracle databases to support the administrative system were migrated to the new release. All of the Banner and VT application programs were recompiled for the upgrade. Estimated total number of compiles for C, COBOL and SQR for these upgrades is approximately twenty thousand (20,000).

System software supporting the Development and Production Banner web applications was migrated from OAS 4.0.8.2 to 9ias. These web servers house web applications such as Hokie Spa and the Banner web allowing access to employee data, student course request, drop/add, class schedules, grades, etc. This upgrade was necessary to move the environment to a supported release.

### **Databases**

Four (4) new databases were defined to support the Registry initiative.

Production , develop and read-only databases moved to SANS freeing up space on the E10K platform.

Read-only databases changed to Flash technology. Under the Flash process the databases in available at 3am each morning instead of at 7am. This process saved approximately 3 hours in the read-only database create process.

### **SQL Scripts**

The DBMS team is responsible for running all scripts developed by the technical teams to insert, update, delete, replace, etc. data in the prod key databases (5). The DBMS team handled over 3600 requests annually. In addition more than 6,000 objects are promoted through the Automated Application Promotion process annually. Without the AAP, these would have been handled manually.

### **Hardware Upgrades**

The Banner development and production web servers were moved from the E10k to separate machines.

The monitoring and forms generation servers were moved to rack mounted servers.

### **Personnel Replacement**

Recruited replacement staff for a DBA position left vacant due to staff turnover.

# **Learning Technologies**

## Learning Technologies

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 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:

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

Learning Technologies plays a critical role in the university's plans for creating a modern, technology-enriched, advanced learning environment. A long-standing function of Virginia Tech's technology-support division, the Instructional Development Initiative (IDI), is large-scale effort to invest in faculty, providing them with opportunities to investigate and adopt appropriate technologies that might improve teaching and learning. To this end, for more than a decade, Learning Technologies' staff members have provided state-of-the-art instructional technologies, at the same time offering knowledge and skills development programs in using technology and assistance in overcoming obstacles along the way. As educational content becomes increasingly linked to and created with technology, programs like IDI become ever more critical to Virginia Tech's aims for effective learning and discovery.

Moreover, the Office of Information Technology works in partnership with individuals, informal groups and organized entities to provide technical infrastructure, staff support and coordination for the university's technology-enabled activities. Through collaborative relationships, Information Technology provides a supportive foundation and technical infrastructure for faculty, staff and students working in modern environments of learning and discovery. For example, Learning Technologies provides e-learning infrastructure and staff support for the Blackboard course management system, including licensing and server costs, and for the WhizQuiz and WhizQuest online testing services. Advanced Network Infrastructure and Services supports the university's two-way video classrooms, the video network operations center, H.323 desktop videoconferencing systems, streaming video servers, and network connectivity through NetworkVirginia and Internet2, with Learning Technologies supporting the telecommunications costs of numerous activities. Administrative data (e.g., grades,

courses and other student information) providing security, databases, archiving and other services that support faculty, staff and students engaged in technology-enriched teaching, research and outreach are linked by the IT organization. Close collaboration between the university's robust infrastructure and related support activities and its academic programs and administrative services are at the center of Virginia Tech's contemporary successes.

### **New Initiatives, Task Forces and Special Events in 2002-03**

Learning Technologies launched several activities this year that leveraged its broad and deep experience with instructional development. While providing services vital to modern technology-enriched learning environments, the new initiatives and task forces were designed to have long-term effects on both the climate for and practice of integrating technologies to benefit the university's teaching, research and outreach aims for a new age. A special event showcased the university's technology-enrichment efforts to an international audience.

#### ***Graduate Education Development Institute (GEDI)***

Leveraging over a decade of experience working with the Faculty Development Institute (FDI), Learning Technologies partnered with the graduate school to extend the FDI model to graduate students in the Graduate Education Development Institute. This multidisciplinary institute will include technology training, but will also address contemporary career and professional development issues related to the roles and responsibilities that aspiring faculty and professionals will encounter as they enter the academy or the workforce at large. GEDI's discussion topics include such challenges as social justice, diversity, globalization and ethics in a world made smaller by transportation and telecommunications advances. A pilot course in fall 2003 gives graduate students opportunities to examine pedagogical praxis and to use e-portfolios to document their process and store products of their professional development.

#### ***Virginia Tech Electronic Portfolio (VTeP)***

Electronic portfolios are digital collections of materials that document and demonstrate accomplishments. Portfolio systems allow users to easily save, organize, review, reflect upon, and selectively share personal and professional records and documents via the Internet. Universities may use these systems across a wide spectrum of activities such as storing learning or research materials, organizing career services dossiers, tracking advising processes, developing faculty promotion and tenure packages, and documenting university accreditation requirements.

Learning Technologies planned and implemented its electronic portfolio project during 2002-03. Staff conducted research with faculty and program areas to determine scope requirements and undertook a benchmarking exercise to determine what other institutions



were learning from early work with portfolios. A decision was reached in April to use an open source portfolio product originally developed by the University of Minnesota and released through the Open Source Portfolio Initiative (OSPI). Virginia Tech is a charter participant in the OSPI project and is one of the first universities in the world to beta test and successfully implement the OSPI software.

Six faculty who self-selected to participate in a Fall 2003 pilot test participated in a process of significant development, critical analysis and evaluation. In collaboration with the Center for Excellence in Undergraduate Teaching (CEUT), frequent meetings were held May-August 2003 to determine adequacy of the software for course integration, an evaluation strategy, and faculty and student support requirements. Software was tested, modified, and implemented on new servers. The fall 2003 semester pilot test grew to 12 faculty and 275 students. Several events were conducted in October 2003 to announce the VTTeP system to faculty across the university. Current plans include making this e-portfolio system available to all students, faculty and staff starting in summer 2004.

### ***Research Task Force***

Learning Technologies' research task force was created to advance and support research on existing and emerging technologies by scanning the environment, forming liaisons with appropriate stakeholders, discussing issues, and proposing points of focus and action for the division. To further assist the university in achieving its research aims, the task force will assist other departments attempting to acquire support for research as well as participate in academic research where appropriate. The task force will also evaluate and encourage the use of emerging technologies that offer potential to enhance research and teaching. The task force has several projects underway:

#### **Collaborative Learning Environments**

A pilot study of the collaborative learning environment, Silicon Chalk, is investigating its utility for classroom and remote learning. Features such as presentation annotation, interactive feedback and collaboration support are seamlessly integrated, and all interactions are recorded in such a way that the learning experience may be repeated as though it were live, including follow-up interaction with a facilitator. Distance learning, in particular, may benefit from such a system as it promotes learning communities by allowing asynchronous students to share experiences similar to those in traditional classroom settings.

#### **Grid computing**

Computer Lab Support, working in conjunction with Virginia Bioinformatics Institute, has established a high-throughput grid computing system that utilizes idle time in Learning Technologies' computer labs and classrooms. This system, still undergoing

testing and enhancement, will be made available to the research community when it becomes production-ready.

### **Wearable Computers/E-Textiles**

The Assistive Technologies (AT) Lab has discussed potential uses for wearable computers (e-textiles) for people with and without disabilities with the Bradley Department of Electrical and Computer Engineering (ECE). There is also interest in providing students with meaningful design experience by producing custom devices and software to aid specific individuals with disabilities. The AT Lab and ECE are reviewing NSF proposal requirements for funding student projects while the AT Lab locates potential participants. In a related application, the task force initiated exploratory discussions about producing e-textiles that could be used for medical, communications or defense purposes, with production occurring in Southside Virginia.

### **Smart Learning Spaces - Embedded Systems**

Learning Technologies is also working with ECE in the area of pervasive computing, where users can access services anytime and anywhere through computers embedded in the environment. LT staff helped acquire funding from Microsoft for a study of pervasive embedded networks for ad hoc environments and is currently evaluating systems and devices.

### **Mobile Computing in the Classroom**

Computer Lab Support is supplying installation, maintenance and administrative support for the Computer Science Department's grant for Microsoft tablet computers. This study is investigating the value and potential for tablet computers in the classroom with expectations to expand the investigation to engineering departments.

### ***A Special Event --New Media Consortium International Conference***

Virginia Tech's New Media Center showcased Torgersen Hall, a modern facility specially designed for technology-enabled research and learning, when it hosted the 2003 New Media Consortium Conference June 11 - 14. Planning for this four-day event began in August of 2002 and culminated with approximately 400 participants attending conference sessions. This best-attended conference in the consortium's 10-year history also offered plenary sessions that were streamed live from the Donaldson Brown Auditorium to larger audiences still. These sessions are still available for viewing at <http://www.nmc.org/events/2003summerconf/webcasts.shtml>

## **Educational Technologies**

The mission of Educational Technologies is to lead, manage and facilitate the comprehensive adoption and effective application of instructional technology throughout the university, by providing a variety of strategically targeted programs and services to enhance teaching and learning.

Educational Technologies is responsible for the following areas:

- Faculty Development Institute – recurring comprehensive faculty training on the application of instructional technology for curricular change, and recurring provision of computer hardware and software to faculty participants.
- Electronic Portfolio – enables students to easily create, manage and share web-accessed electronic portfolios that document their knowledge, skills and achievements from both course and extracurricular activities.
- Online Course Systems – provision, applications support, and integration of Blackboard course management system.
- New Media Center – provides university community with access to high level computers, software, consultants and training for development of digital content.
- Computer-Assisted Teaching Stations – networked computers, podiums and projection systems used by faculty teaching in classrooms and auditoriums.
- Educational Technologies continues to license online software tutorials from Element K. The web-based computer skills tutorials are provided free to Virginia Tech students, staff and faculty and include 550 courses plus online reference manuals. Up to 2500 users were registered for courses over the year.

### ***Faculty Development Institute***

In August 2003, the award-winning FDI program concluded the third year of its third four-year cycle. During spring and summer 2003, about 425 members of the faculty participated in the workshops and received computers. A special workshop was held at the Northern Virginia Center in September. In the past ten years, more than 4000 faculty members have participated in FDI workshops, with most participating at least three times.

FDI programming was offered in several formats this year. Both instructor-led and online learning modules were offered year-round to faculty, graduate students and staff. A new internally developed online registration system, based on Oracle technology, presented an improved view of the workshops available. Participants could directly register for workshops, place themselves on waiting lists if necessary, get email reminders of upcoming workshops, and enter evaluation comments. The registration system provided significant management capabilities as well. It continues to be improved.

The attendance for all FDI workshops during fall, spring and summer 2002-03 was 2027 faculty, graduate students and staff. During Fall 2002, 53 workshops had 430 participants. Spring 2003 had 74 workshops, with 1154 participating, many in up to seven workshops as part of the new Spring Alternative Tracks described below.

In response to faculty conflicts that prevented participation in the summer FDI, a non-traditional FDI program was developed: the Spring Alternative Tracks. About 100 of this year's 425 faculty participated in the spring program instead of the summer program.

The Spring Alternative Tracks were modular versions of summer Tracks C, D, E and H (see below). Program requirements included attending seven short coordinated workshops during a seven-week period. Scheduling flexibility was emphasized, with 74 workshops taught across the four Tracks. Additional learning modules were included from the ElementK library of online software training. The Spring Alternative was praised by most faculty attendees who said they had regained more control of their summer research time. An unexpected bonus reported by many participants was an opportunity to immediately apply what they were learning in FDI to the courses they were teaching that semester.

During Summer 2003, a total of 23 three-day workshops were conducted. Nine content tracks were offered, including two tracks emphasizing research-oriented coverage:

- Track A-New Faculty Computing Orientation
- Track B-Presentation Tools for Research and Teaching
- Track C-Using the Web for Instruction
- Track D-Developing Web Course Interaction
- Track E-Creating Media Content for Instruction
- Track F-Using MatLab
- Track G- Developing and Delivering Online Instruction at a Distance
- Track H-independent Project Development
- Track J-Tools and Resources for Faculty Research
- Track K-Northern Virginia Center

Sessions were also conducted for the federally funded McNair Scholars program and workshop seats not requested by Virginia Tech faculty were marketed through Continuing Education to 27 faculty members at Averett University, Hollins University, and several institutions in the Appalachian College Association.

Computers and software were offered in Windows XP Professional and Macintosh OS X formats. Eleven standardized computer choices were offered, in both desktop and laptop versions. About twenty requests for custom configurations were also honored. All laptop computers were equipped to access the campus wireless network. Laptop computers are offered at faculty request in order to enable more use of laptops in the classroom and to

improve personal productivity. Forty seven percent of participating faculty selected a laptop.

Evaluation of the workshops by the faculty attendees continues to be positive. The faculty clearly values the opportunity to explore instructional issues with their colleagues in a supportive context and discover the potential of technology for enhancing their teaching. They have indicated that these resources are critical if they are to adapt to the needs of their students. Quotes from faculty attendees are given below:

Excellent design of the workshop; good opportunity to chat with other faculty about teaching and technology. I also appreciated the flexibility that allowed exploration of particular interest areas.

Joan Watson's presentation helped me to see how important it is to choose technology that enhances learning as a primary goal; it also helped me to see that simple technology may do this just as effectively as something more complicated. My technical skills are limited, so this was encouraging to me.

This has been an eye opening and amazingly useful workshop. You all do a great job and made those us from other schools feel very welcome. I have learned a lot and am ready to go back home and give it a try.

The security information was frightening, but also very important.

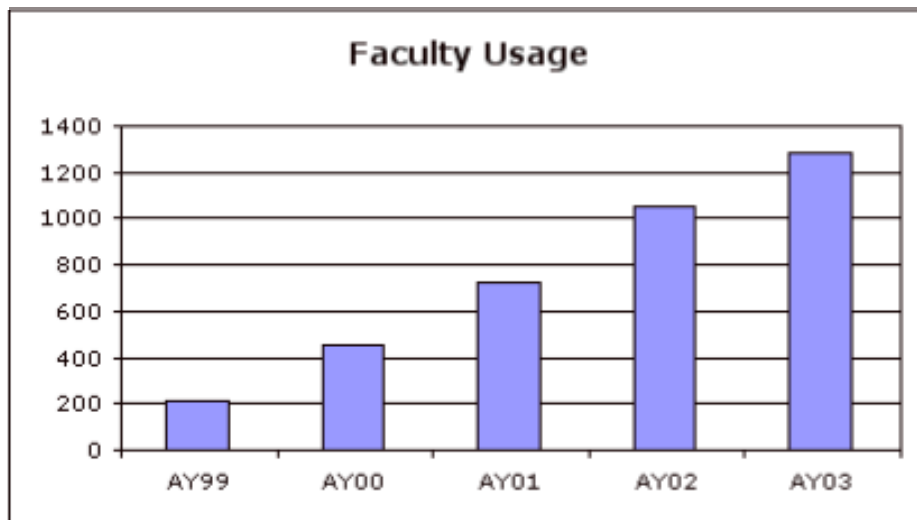
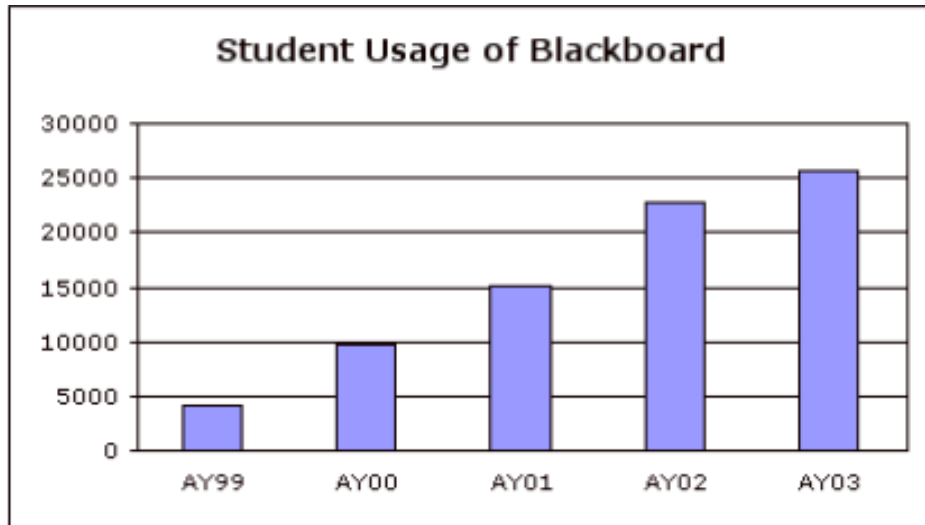
### ***Online Course Systems***

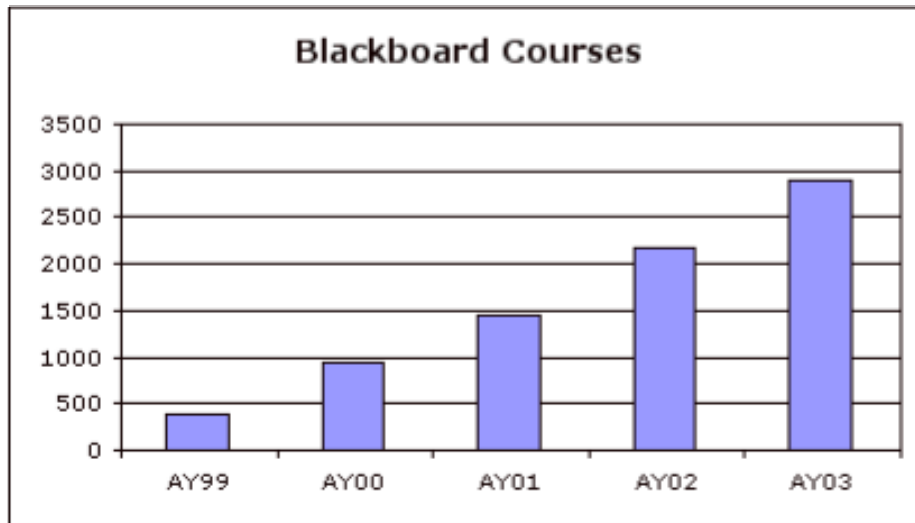
Since the beginning of the Cyberschool project in 1995, Educational Technologies and Information Technology have provided an increasingly robust infrastructure to the university for online course development and implementation. These advanced learning systems have evolved from supplying servers and HTML development tools to the current integrated Blackboard course management and portal system. The provisioning, integration with administrative information systems, user support and training for these systems is a major responsibility of the Online Course Support and Instructional Systems staff of Educational Technologies.

Usage of the Blackboard course management system continues to grow. About 1500 courses and 25,000 students now use the system each semester, both on and off campus, including all distance learning credit courses. An online knowledge base augments support provided by staff members who have in-depth knowledge of the software. OCS answered about 7000 questions last year.

Blackboard hardware was upgraded this year to five Sun file servers in a redundant and load-balanced configuration to provide maximum performance and reliability for users worldwide. Planning for further redundancy in the server cluster is underway. Significant

investments were also made for system licenses, improved network connectivity, file backup systems, and vendor support contracts to increase reliability and capacity.





### *New Media Center*

The mission of the Virginia Tech New Media Center (NMC) is to provide a showcase of high-quality multimedia resources to regional communities. The Center will be free and open to the public and will provide reasonable access to all segments of the community.

In addition to providing up-to-date hardware and software, the center offers personal assistance to patrons using the equipment and supported services such as Electronic Thesis and Dissertation (ETD). It also plays a critical role in directly supporting all aspects of the Faculty Development Institute, including significant support of the FDI website. The three reasons most often cited for using the NMC are access to high-end hardware and software, on-site assistance, and the central location.

The New Media Center facilities, in Torgersen Hall, include the following:

- 20-seat classroom with cross-platform training capabilities intended to be used for FDI training, other campus classes and other entities needing a short-term lab setting,
- 20-seat open lab with 10 Mac OS and 10 Windows OS computers (most connected to specialty peripherals such as scanners), intended for walk-in use in the development of multimedia objects and basic computing consulting,
- 8-seat digital video development lab with a high-capacity network attached storage system that provides a unique solution to the campus digital video development needs,
- suite of small special-use rooms containing high-end workstations for digital video production, digital audio production, and QuickTime Virtual Reality production, and
- 3-D modeling workstation and a handful of computers for non-specific multimedia development.

The Center also schedules and maintains two 25-seat classrooms with Windows computers that support the FDI Short Courses. One of these classrooms also supports staff training activities with the Executrain classes through University Leadership and Development.

The table below shows traffic in the NMC during 2002-2003. The figures reflect the transactions in the Torgersen Hall first floor NMC facility and the two FDI classrooms that the Center supports.

Month	Classes	Class Attendance	Walk-In Transactions	Total Patron Transactions
July	37	325	615	940
August	21	140	551	691
September	56	894	872	1,766
October	96	1,203	1,069	2,272
November	18	281	803	1084
December	8	271	689	960
January	60	479	646	1,125
February	94	1,579	967	2,546
March	50	837	843	1,680
April	38	858	1,587	2,445
May	51	308	376	684
June	34	479	444	923
<b>TOTAL</b>	<b>563</b>	<b>7,654</b>	<b>9,462</b>	<b>17,116</b>

This year, undergraduate students comprised 64% of the users of the Center, with 5% staff, 7% faculty, 21% graduate students, and 3% from the public, numbers that are consistent with past years. The use of the large-format flatbed scanners continued to be the Center's largest area of usage, comprising 24% of patron transactions. The next highest area of use is now video digitizing/editing, at 22% of the Center's transactions. This was a significant increase over last year and was expected since computer upgrades, the addition of a 2-terabyte server and a high-speed intranet between the video computers and the server created a friendly environment for video work. The third highest area was equipment loan, primarily digital still cameras (19%). Digital still and video cameras were borrowed 1,527 times last year. Other areas of use were graphics creation (11%), web development (5%), desktop publishing (5%), CD-ROM burning (4%), and slide scanning (4%).

The largest area of growth continues to be video equipment usage. Two years ago video comprised 11% of the transactions while last year it was 17%.

The Electronic Thesis and Dissertation (ETD) project is also supported by the NMC, with six two-hour workshops for 280 graduate students offered this year. About 150 students



were also assisted individually with their ETD's as walk-in patrons.

### ***Presentation Classroom Upgrades***

Twenty classrooms in Williams, Randolph, Cheatham and Robeson, for a total of 680 seats, were upgraded to state-of-the-art projection systems, improving performance and ease of use.

### **Digital Imaging Center**

Digital Imaging provides high-resolution technology resources along with professional imaging expertise to all areas of the university and to agencies of the Commonwealth of Virginia in support of the educational mission of Virginia Tech.

Support is available for research imaging and course development projects associated with the academic departments and related research centers at the University.

Over the past year, Digital Imaging observed a steady decline in the number of requests received for services traditionally provided through analog technologies. This decline in service requests was first noted in 1998-99, and, in response, the department began implementing a strategy to phase out support for analog service and focus on technologies related to converting existing materials to digital format.

In redirecting the center, services related to photographic processing were eliminated altogether. Film processing, slide production and photography are all available through local businesses. Walk-in support for scanning and digital output was eliminated and so was the customer service desk.

Digital Imaging now supports academic activities and research on a project basis only. Traditional charges have been reduced to cover only the cost of materials and supplies and this reduction is allowing many departments to convert existing analog materials to digital format. With limited budgets in many departments, this is a mechanism by which Digital Imaging can make an immediate impact on academic support. With cooperation from University Libraries, many more materials will be made available for electronic access to both students and faculty for teaching and research. Response has been extremely positive. Requests are submitted through a proposal process and an annual volume of around 30,000 images is anticipated, along with the numerous pages represented by document scanning.

Digital Imaging continues to provide a valuable service in support of faculty and students' teaching, learning and research activities. By implementing changes, the unit is better able to provide services that support the academic needs of the university in a way that parallels and leverages the use of digital technology on campus. Future efforts will

continue to include investigation of technologies that enhance the quality of the services Digital Imaging provides as well as address the expanding needs of customers.

## **Computer Lab Support**

The mission of Computer Lab Support (CLS) is to provide the highest quality and most reliable computer-integrated classroom environment to enable faculty to transform teaching and learning at the university.

CLS provides support for all computer-integrated classrooms (CICs) on campus, comprising approximately 1000 computing stations. Services include software/hardware installation, maintenance and troubleshooting. CLS also provides training to faculty & staff on the use of computer teaching stations and A/V equipment in CICs, as well as assistance to other departments on request.

A laptop loan program is administered for students, faculty or staff from the TechConnect Lab in Torgersen 3250, and a new mobile classroom consisting of 30 Dell laptops in a mobile cart is available for loan for classes and events that may not be able to meet in a computer-integrated classroom.

CLS is also involved with several research projects including development of a grid computing system to utilized idle capacity in labs and support for a tablet computing project.

The following facilities are managed by CLS:

<b>Lab</b>	<b>Macs</b>	<b>PCs</b>	<b>Operating System</b>
AISB Classroom		20	WinXP
Ambler-Johnston 4102		50	WinXP
Architecture Annex 1		25	WinXP
Art Design Learning Center	16		Mac OS X
Davidson 123		20	WinXP
Derring 2069	25		Mac OS X
Henderson 23A	22		Mac OS X
Major Williams 502	24		Mac OS X
Math Emporium	520		Mac OS X
Mobile Classroom		30	WinXP
Price 301A	15		Mac OS X
Randolph 114E		19	Win2000
Saunders 101		25	WinXP
Shanks 160	30		Mac OS X
Shanks 180		25	WinXP
Shanks 360	25		Mac OS X
Torgersen 1010		33	WinXP
Torgersen 1080		36	WinXP
Torgersen 3250	18	18	WinXP, Mac OS X
Ware 103		7	Win2000, WinXP
Totals	695	308	1003 stations

## **Assistive Technologies**

Assistive Technologies (AT) is dedicated to researching, training, supporting, and consulting on assistive technologies that can empower people with disabilities for a lifetime of learning, teaching, and work. To accomplish its mission, the AT Lab and Special Services assume a leadership role in: coordinating assistive technologies, computer-related accessibility, and disability accommodations; conducting multidisciplinary research and development of new assistive technologies and better uses of existing technologies; and raising awareness about disabilities and the benefits of assistive technologies for all individuals through instruction, demonstrations, consulting, and outreach.

### ***AT Support and Special Services***

AT works to continuously improve classrooms, computing labs, administrative offices, etc. by supporting accessible computing workstations, reviewing new or improved assistive technologies, and working on university accessibility standards and procedures. Facilities offer adjustable ergonomic tables, monitors, keyboards and trackballs, software magnification, color filtering, and a wide range of assistive technologies software such as synthetic speech. Training on university supported assistive technologies and disability

accommodations is provided to individuals with documented disabilities who are referred to AT by Services for Students with Disabilities, Personnel Services, etc.

### ***Research and Development***

The AT Lab encourages corporate, government or private funding of multidisciplinary research, and development and dissemination of results. Research explores universal design and accessibility principles that will benefit all individuals. Current projects include a partnership with the Department of Industrial and Systems Engineering on the user interface of cellular phones, a proposal to serve as lead evaluator for an avatar multimedia authoring system that synchronizes signing animations, synthetic speech, and captioning to digital media for web sites, and consultation with the Bradley Department of Electrical and Computer Engineering on the potential uses of wearable computers (e-textiles) for people with and without disabilities as well as an NSF proposal for student projects to assist individuals with disabilities.

### ***Instruction, Outreach and Consultation***

The AT Lab is maintained as a model classroom, conference/training facility and accessible distance-learning site to demonstrate assistive technologies. Personnel participate in a wide range of one-time classroom instruction, university presentations, consulting and advisory activities and outreach.

This year's activities include:

- Real World Day: A consortium project of Virginia Tech, Radford University, New River Community College, and Virginia Assistive Technology System for Southwest Virginia, Real World Day gives students, consumers, and teachers an opportunity to learn about and try a variety of assistive technologies. AT was responsible for recruiting presenters who displayed products at the "AT Buffet". Estimated attendance: 143 students, and 63 parents, teachers, or consumers.
- Workshop for Professionals Serving Individuals with Disabilities in Ukraine: The AT Lab, in cooperation with a U.S. Department of State program for national internship experience, provided a workshop on serving individuals with disabilities. Attendance: 10 professionals from L'viv, Ukraine.
- 2003 NMC Summer Conference: The AT lab sponsored two events, an "Accessibility Tour" where attendees were invited to try their hand using a variety of assistive technologies to access alternative multimedia content in the AT Lab, and a lecture on "Web Accessibility Reforms and Federal Regulations" with a guest lecturer from George Mason University. Estimated attendance: Accessibility Tour 80, Web Access Lecture 30.
- College Bound "Preparing students with disabilities for a collegiate experience": This two-day conference for students with disabilities preparing for college and their

parents included a lecture on the use of assistive technologies in higher education and a hands-on workshop involving assistive technologies and computing. Estimated attendance: 50 students and 60 parents in one lecture and six workshops.

- Youth Leadership Forum (YLF-VA) "Empowering Young Leaders for the 21st Century": The YLF-VA program seeks to empower young people with disabilities to further develop their leadership skills. Students, serving as delegates from communities throughout Virginia, participated in a wide range of activities and learning experiences during a four-day conference set on a university campus. Estimated attendance: 80 students in one panel discussion and five workshops.
- C-Tech<sup>2</sup> Computers and Technology at Virginia Tech: Sponsored by the College of Engineering, the initiative focused on preparing Virginia high school women for college and careers in engineering, math, or science. Estimated attendance: 60 students in four workshops.
- Imagination 2003 "Imagination with a purpose": This College of Engineering program offers minority eighth and ninth grade students from Roanoke and Montgomery County access to information and technology to help them prepare for college and careers in technology, science, and engineering. Estimated attendance: 60 students in four workshops.
- High School/High Tech: This national initiative of the President's Committee on Employment of People with Disabilities focuses on students with disabilities at the secondary level and encourages them to take the necessary training to pursue high tech careers. Estimated attendance: 30 students from the Montgomery County Public Schools in two workshops.
- TRAIN IT: The information technology (IT) employment initiative funded by the U.S. Department of Labor provides both IT training and rehabilitative services to participants at home or at potential work locations such as Virginia Tech. The AT Lab advised/assisted TRAIN IT on job-related disability accommodations for two participants, one of whom was hired by Virginia Tech. The AT Lab also helped mentor the regional TRAIN IT employee who served program participants at Virginia Tech and elsewhere in western Virginia.
- Virginia AgrAbility: The AT Lab serves in an advisory role to this USDA grant obtained by Robert Grisso, Ph.D. of Biological Systems Engineering at Virginia Tech. The grant delivers services such as public education, rehabilitative therapies, assistive technologies, in-home health care, peer counseling, farm equipment modification, independent life skills training, and accidental disability prevention for the agricultural community.

AT provided presentations for the following courses: CS 3604: Computer Science, "Professionalism in Computing", EDCI 5554: Special Education, "Educating Exceptional Learners Across the Lifespan", and EDCI 5474: Special Education, "Adapting Curriculum & Instruction for Students with Disabilities". The AT Coordinator also works with the ADA Executive Committee to address university compliance with the Americans with Disability Act (ADA) as well as the Electronic Information Access

Task Force (EIATF) in several positions involving accessibility standards, training, and support issues. The counseling staff at the Cook Counseling Center in Student Affairs also received AT hands-on experience and training.

## **Test Scoring and e-Survey Services**

Test Scoring supports the collection of data by 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. Services include test scoring, faculty/course evaluation and data capture. In addition, the department offers support for Element K (online software tutorials) and [survey.vt.edu](http://survey.vt.edu) (online survey software).

Statistics for the 2002-03 academic year show the following:

- Number of different clients served: 800
- Jobs processed: 6,000
- Exams: 5,000
- Final exams: 1,000
- Course evaluations: 500
- Other data capture jobs: 600
- Total sheets processed: 760,000

Test Scoring saw an increase in the number of clients last year, even though the number of jobs decreased slightly. Most of the change is reflected in the increased use of other technologies for data capture, a trend Test Scoring has encouraged through support of online survey software. The number of final exams stayed about the same, however, requiring the department to perform the critical task of processing over 500 exams in five days before fall and spring graduation.

## **Virginia Tech Summer Training Academy for Rising Students (VT STARS)**

Fifty-two at-risk high school students participated in the third annual VT STARS summer 2003 residency program on the Blacksburg campus. Activities were designed to strengthen students' academic and technical skills and improve their motivation and ability to attain a college degree. Focusing on science, technology, engineering and mathematics, the program encourages participants from the economically depressed Southside region to develop skills they will need to thrive professionally in the knowledge economy. Activities continue throughout the year to foster not only academic achievement, but also viable civic relationships and entrepreneurial spirit. Developed as part of the larger Southside e-Corridors economic development and community revitalization initiative, the program has also been a visible model for civic engagement and parental involvement in school reform dialogue. Program partners, participants and parents are very positive and encouraging in their assessment of the initiative.

### ***VT STARS Phase II***

Learning Technologies is exploring ways to build on the success of VT STARS and extend the initial three-year pilot. A conceptual model was developed to guide refining, assessing and expanding the program to as many as 400 participants in eleven high schools. Targeted regions have populations of African-American, Caucasian and Hispanic students from low-income or impoverished families who are not likely to have histories of college attendance. Several community service projects are underway to increase local ownership and support of the initiative, an aspect critical to long-term sustainability. Local civic alliances have indicated a desire to support the program; other external funding sources are also being explored.

### **Center for Innovation in Learning**

The Center for Innovation in Learning (CIL) aims to develop online courses and provide related infrastructure, technical support and assessment of results in targeted curricular areas. The center also serves as an umbrella for coordinating communications and developing partnerships focused on integrating technology in learning.

The mission of CIL is to achieve the learning outcomes that describe independent, critically thinking and technologically literate learners across content areas. The center's awards are focused on particular parts of the curriculum. Faculty are invited to submit proposals to integrate technology into teaching in four curricular areas:

- Distance learning programs for graduate and professional students
- Core curriculum courses that currently have little or no integration of technology
- Upper level undergraduate and professional courses with high student demand
- Multiple use courses that could be used for graduate and professional continuing education (e.g., course modules, certificate programs)

Proposals are evaluated for:

- Active learning
- Interactive communication
- More self-directed, self-paced learning
- Computer literacy integrated with content
- Access to course materials and supplemental resources
- Access to course information, announcements, news

The center also assists in the coordination of assessment, technical support and equipment needs of successful grantees. By strategically targeting areas of the curriculum for development, the university can realize more efficient and effective use of human, physical and financial resources. Communities of scholars and instructional development faculty and staff can develop, assess and communicate the results of their activities.

Opportunities exist for cost sharing across parts of the university on strategic activities. Research on teaching and learning can accompany online course development more systematically. New uses of space and technology for experimentation and development of new approaches to teaching and learning can emerge. Outreach to other learning communities can grow strategically as well.

The following table lists grants awarded by CIL for 2002-2003:

<b>Faculty</b>	<b>College</b>	<b>Award</b>
1 Jones	Arts & Sciences	39,400
2 Mack	Agriculture	51,400
3 Bourdon	Arts & Sciences	35,435
4 Bevan	Arts & Sciences	25,000
5 Badinelli	Business	13,513
6 Downey	Arts & Sciences	10,875
7 Magliaro	Human Resources & Education	19,711
		<b>195,334</b>

CIL also coordinates the XCaliber Award, conferred annually for excellence in teaching with technology.



## **Information Retrieval, Analysis, and Management (IRAM)**

IRAM was closed on June 30, 2003 due to declining funding provided by the Center for Innovation in Technology (CIT), the source of a significant portion of the cost recovery funds for the unit.

## **Executive Forum on Information Technology**

Moore, A.H., Coordinator

State-of-the-Art Learning Environments: The Pew Grant Program in Course Redesign – Round III Results. Sponsored by the Center for Academic Transformation and C0-sponsored by the Executive Forum in Information Technology at Virginia Tech. December 6, 2002. Atlanta, GA.

“The Last Mile to Virtual Communities.” Fourth seminar in a series sponsored by the Virginia Institute for Government, Virginia’s Economic Development Partnership, the Innovation Group and the Executive Forum in Information Technology at Virginia Tech. December 11, 2002. Williamsburg, VA

## **Active Grants**

John Moore, Kim Gausepohl and Eddie Watson, along with faculty and administrators at Florida Community College at Jacksonville, continued design, development and production during the second year of a \$328,000 FIPSE grant, “CREOLE: Creating Online Learning Environments.” The three-year project will create, evaluate and market an online system designed to acquaint higher education faculty in eight disciplines with basic research in learning and motivation and facilitate their application of pedagogical tools based on the research. Four Virginia Tech faculty members are contributing content. The materials are being developed in a graduate-level course format for institutions lacking robust faculty development resources, such as small colleges and community colleges.

Moore, A.H. U. S. Department of Education. Grant Consultant/University Coordinator. Magnet School Grant Program. (Dianne Locker, Principal Investigator)

Moore, A.H. U.S. Department of Education. Grant Coordinator/University Coordinator/Consultant. Technology Challenge Grant. (Nancy Franklin, Principal Investigator)

## **Publications**

Head, J.T., Lockee, B.B., & Oliver, K.M. Method, Media, and Mode: Clarifying the Discussion of Distance Education Effectiveness. *The Quarterly Journal of Distance Education*, Volume 3(3), 2002, pp. 261-268, Information Age Publishing Inc.

Moore, A.H. "Great Expectations and Challenges for Learning Objects." Essays on Teaching Excellence. Vol. 15, No. 4. The Professional & Organizational Development Network in Higher Education, 2003-2004.

Moore, A.H. & Head, J.T. "Philosophy of Faculty Development at Virginia Tech." In David G. Brown (ed) Developing Faculty To Use Technology. Anker Publishing Company, Inc., 2003.

Moore, A.H. "Lens on the Future: Open Source Learning." Educause Review. September/October 2002.

Moore, J.F., & Head, J.T. Supporting Faculty in the Use of Technology. (Chapter 41) *Faculty Development Strategies That Work*. Brown, D. G. (ed), Anker Publishing Company, Inc., 2003

Schwartz, E. & Phillips, S. -Supporting Faculty in the Use of Technology. (Chapter 26) *Faculty Development Strategies That Work*. Brown, D. G. (ed), Anker Publishing Company, Inc., 2003

## **Selected Presentations**

Head, J.T. (October 2003) "Virginia Tech Instructional Technology Update". Presentation at the annual meeting of the Learning Technology Consortium at Indiana University, Bloomington Indiana.

Moore, A.H. "Institutionalizing Public Making Space in Higher Education." April 2003. Research Workshop of the Kettering Foundation. Dayton, OH.

Moore, A.H. "Major e-Knowledge Initiatives: What Impact Are They Having on the Enterprise?" April 2003. Annual Showcase Conference: Teaching in Higher Education Forum. With Phil Long and Anne Margulies. Baton Rouge, LA.

Moore, A.H. "Community Partners for the Knowledge Age." January 2003. Annual Conference of the National Learning Infrastructure Initiative. With Nancy Franklin. New Orleans, LA.

Moore, A.H. "Leveraging New Resources: Catalysts for Regional Change." November 2002. Sorensen Institute for Political Leadership. Blacksburg, VA.

Moore, A.H. "Bringing e-Learning to Disadvantaged Regions." November 2002, Annual Conference of the Western Cooperative for Educational Telecommunications. With Nancy Franklin. Denver, CO.

Moore, A.H. "Improving Quality and Reducing Costs: Redesigning Campus Learning Environments." October 2002. Educause Preconference Workshop directed by Carol Twigg and Carolyn Jarmon. Panelist with John Harwood and Steve Acker. Atlanta, Georgia.

Moore, A.H. "What E-Learning Students Should Know and Be Able To Do." September 2002. 11<sup>th</sup> Northeast Regional Teaching Workshop. Amherst, Massachusetts.

Moore, A.H. "Walking to the Future Together." August 2002. District 10 Distance Education and Technology Conference, Texas A & M Research and Extension Center. Uvalde, Texas.

Moore, A.H. "Faculty Development and Rethinking the Faculty/Technology Relationship." July 2002. Institute for Managing and Developing e-Learning. Western Cooperative for Educational Telecommunications. Park City, Utah.

Moore, A.H. "Faculty Development and the Math Emporium." July 2002. Invited presentation at the University of Virginia. Charlottesville, VA. With John Rossi.

# **Network Infrastructure and Services**

## **Network Infrastructure and Services**

Network Infrastructure and Services (NI&S) acknowledges that a state-of-the-art communications infrastructure is mission-critical to Virginia Tech. In concert with the university's long-term strategic goal to become a top-thirty research institution, Network Infrastructure and Services constantly researches and evaluates emerging telecommunications technologies to identify and adopt those providing the optimal blend of price and performance. This careful, yet persistent, approach assures Virginia Tech students, faculty and administrators have ready access to high quality, stable and secure networks and infrastructure. Services currently supporting academics and research include an array of network capabilities including gigabit Ethernet, wireless local area network access, voice and cellular communications, video, media and related services, broadcast-quality teleconferencing services, and a cable television system.

Over the past year, NI&S has maintained its network technology leadership role as a key partner in the development of high-performance research computing and communications networks, including the National LambdaRail and the Mid-Atlantic Terascale Partnership.

Network Infrastructure and Services has an annual operating budget of approximately \$23 million and has a highly skilled workforce of 235 employees distributed among Communications Network Services (CNS), Video Broadcast Services (VBS), University Printing and Digital Imaging Services, and University Mail Services.

## **Research and Development**

Network Infrastructure and Services' Research and Development group has maintained a strong emphasis on innovative implementation of telecommunications technology throughout the university community—stretching beyond Virginia Tech's borders into local, regional, and national levels of discovery and of achievement.

The following innovative Research and Development projects address a wide array of goals that will pave the way for future growth in areas such as distributed computing, wireless networking, telecommunications models for communities, regional and national networking infrastructure, and network security.

### ***Terascale Computing Facility***

Research and Development (R&D) designed and developed a gigabit network infrastructure allowing simplified facility installation, configuration, and testing. R&D assisted in the development and implementation of the network management

infrastructure and assisted in the specification of facility support and construction logistics.

### ***Access Grid Facility***

Research and Development designed and constructed an Access Grid Node or “AG” at Virginia Tech. The AG is an ensemble of resources providing group to group collaboration through a variety of large-format and presentation devices. Researchers and others can use the AG to collaborate with other similar facilities in an immersive environment with the ability to see and hear all participants at the same time, and with each participant enabled to send multiple images at the same time. Virginia Tech’s facility can provide four simultaneous full-motion video channels plus graphics.

### ***Virginia Tech Operations Center***

In Spring 2002, Network Infrastructure & Services (NI&S) successfully established the Virginia Tech Operations Center or “VTOC”. The Center merges traditional call center and computing help desk functions with network operations, video operations, and systems support in a single integrated operations center. The center is the nexus for information technology trouble reporting and resolution services for the campus and for remote locations around the Commonwealth—twenty-four hours a day, seven days a week.

*Putting It All Together: An Integrated Approach to Network Management* - The Operations Center is supported by a state-of-the-art system known as NEMISYS that monitors and manages the network infrastructure and server environment. This system was developed and integrated by the NI&S Research and Development team and is based on world-class software products from Systems Management Arts, Remedy Corporation, and Oracle.

NI&S researchers evaluated various network management systems for nearly two years before concluding that the vast majority of enterprise network management products on the market are not cost effective, have exorbitant licensing fees, and don’t address the unique needs of the university computing and network environment. Research and Development decided on an alternative approach, identifying smaller and less expensive network management components that offered “open interfaces” that would allow solutions from different vendors to interoperate. This strategy proved highly effective and led to an integrated solution that was greater than the sum of its parts. Software engineers on the NI&S team developed the “glue” software components that would allow the component systems to be plugged together in a seamless manner. These “glueware” components provide extraordinary flexibility and extensibility, allowing NEMISYS to readily adapt to the changing needs of the university telecommunications and communications environments.

NEMISYS provides all the functions essential to the success of the Operations Center at a substantial cost advantage over traditional enterprise network management systems, and supports the unique needs of the university computing and network environment. Additionally, NEMISYS is tightly integrated with the ATLAS Enterprise system, tying in inventory, cable plant documentation, billing, and other facets of NI&S decision support.

Previously, computer users were presented with a confusing array of telephone numbers to call for assistance; one number for desktop computing support, a different number to report a network service outage, and so on. The goal of the Call Center is to provide a single point of contact for information technology, or IT, support. Call Center staffers receive calls or e-mail from faculty, staff, and students, and open problem reports to track the diagnosis and resolution of each reported problem from start to finish.

*Call Center: Single Point of Contact for Information Technology Support* - Crucial to the successful, cost-effective use of information technology at the university is a user support organization that is well trained, well equipped, and always available. The Call Center component of the operations center provides ready access to information technology assistance for the extended university community on a “24x7” basis.

### ***Remedy Action Request System (ARS)***

Remedy is the trouble reporting and tracking system used by most of Information Technology, as well as other areas. Administration of this system involves performing routine maintenance of the hardware and software, including applying patches and updates, user additions/removals, and form/workflow modifications.

Research and Development consulted with various Information Technology customer-support groups to design and develop forms and workflow processes that enable them to track and monitor problems, resulting in a major expansion of the Action Request System (ARS). By adding 4Help, Information Resource Management, Residential Computer Consultants, On-Line Course, the Edward Via College of Osteopathic Medicine and “Get Connected” support groups to those using the ARS, the trouble-reporting and tracking system features are leveraged to yield more efficient and effective support to the university’s telecommunications technology users.

### ***Windows Administration/Technical Support***

Research and Development helps maintain Microsoft® (MS) Windows system administration and technical support for the CNS domain controllers/servers and desktop machines for Network Engineering, Research & Development, Telephony Engineering, and the Virginia Tech Operations Center. System administration is also provided for the Microsoft® Windows CNS domain, a child domain of the Virginia Tech HOKIES domain. This includes applying patches and updates to approximately forty computers,

including domain controllers and various other servers and workstations in the domain, as well as providing technical support for users and desktop machines in the CNS domain utilizing resources in the CNS/HOKIES domain.

In addition, R&D evaluates, develops, and implements environmental monitoring systems located in CNS telecommunications equipment rooms around campus.

### ***Distance Learning, Distant Outreach***

*H.323 pilot project for course delivery with Wake Forest University*—As Virginia Tech continues to develop ways to increase its ability to teach students at remote locations, we develop and test various communication and collaborative technologies. One such case involves Wake Forest University and Virginia Tech's School of BioMedical Engineering. A shared teaching load and enrollment between our universities and across state boundaries brings new challenges in maintaining our high technical standards while traversing several networks managed by disparate groups. This collaboration marks Virginia Tech's first foray into utilizing Next Generation Internet resources for delivery of academic coursework via videoconferencing, reaching students no matter where they are located.

*US Forest Service H.323 videoconferencing bridge*—Virginia Tech entered into a relationship with the United States Forest Service to manage centralized videoconferencing resources. The primary resource is a videoconferencing bridge (a common connection point when more than two parties wish to conference) capable of connecting sites via ISDN (telephone circuits), ATM (advanced network services provided on NetworkVirginia), and through the Next Generation Internet. This benefits Virginia Tech by providing a testing ground for advanced videoconferencing delivery.

*Network design and deployment for Hampton Roads Agricultural Research and Extension Centers (AREC)*—The network upgrade for the newly renovated facilities at the Hampton Roads AREC was designed by CNS R&D, and installed by R&D, Network Engineering and Video Broadcast Services. The upgrade facilitated the migration of the Virginia Tech Hampton Roads Center to a shared location with the AREC. This network upgrade involved moving, reinstalling, and testing three interactive video conferencing systems and a small computer lab, as well as the installation of additional ATM video conferencing and LAN facilities, yielding substantial improvements to both network availability and performance.

### ***Dial-up and Wireless Services***

*Virtual Private Network (VPN) Pilot* - Open and secure VPN services were researched, developed and deployed in test mode. With VPN, remote users can access university



campus computing resources as though the user were on campus. It also ensures securely encrypted communications between remote and on-campus users.

*V.92 pilot for modem pool*—The latest in dial-up modem technology, the V.92 standard allows users to have a single phone line and still receive call-waiting service while connected to Virginia Tech's remote access modem service, virtually eliminating any need for a second telephone line for voice use. V.92's compression technology improves the fidelity of dial-up performance. The "Quick Connect" feature shortens connect time by one-half. The V.92 standard was implemented with negligible interruption to users.

*Wireless LAN development and deployment*—Wireless network access allows members of the university community to access university and Internet resources in many locations without the need for a wired connection. The university's Wireless Local Area Network (WLAN) grew by one-third over the past academic year, increasing the total deployment to 154 Wireless Access Points (WAP's) in thirty-nine buildings. Research continues in higher speed wireless technologies and various security methods.

Engineers Clark Gaylord and Steven Lee published "[Securing Campus Wireless Networks](#)", which provides a framework for both academic and nonacademic network engineers to secure their wireless networks.

*Continued development of the Blacksburg Multimedia Services Access Point (MSAP)* - The Blacksburg MSAP, a regional Internet exchange point, connects several Internet Service Providers, or ISPs, in the Blacksburg area. Most connections to the MSAP are Gigabit Ethernet over fiber, providing exceptional performance and reliability. Virtually all local apartment complexes connect to this faster, more reliable facility.

*Development of "check net" concept*—The "check net" concept would separate computers that have not recently been on the campus network from those that have. A separate network would ensure a "new" computer is free of viruses, worms, or other potentially harmful configurations. If problems were identified on the computer, it would remain isolated from the main university network until appropriate remedial action can be taken.

*Center for Internet Security (CIS) Benchmark* - Substantial contributions were made to the Center for Internet Security (CIS) benchmark for Cisco's Internet Operating System (IOS) security. Engineers from CNS have been active in developing the latest version of the CIS benchmark and tool for Cisco IOS security (see [http://www.cisecurity.org/bench\\_cisco.html](http://www.cisecurity.org/bench_cisco.html)). The new version, soon to be released, is to be the "Gold Standard" benchmark and will establish the baseline to be used by the United States federal government. The federal government has a license agreement with CIS to distribute the benchmarks and scoring tools to all federal agencies, departments, and authorized federal contractors.

*Deployment of Network Time Protocol (NTP) server with GPS time acquisition -* Accurate time is critical to many computers and network devices to allow for synchronization of an array of services across varied platforms, yielding efficient system administration and security incident response. Accurate local time references are required to minimize errors incurred over network links. The Global Positioning System (GPS) provides an extremely accurate reference for our local system. For redundancy, our implementation includes two complete systems receivers installed in widely separated campus locations.

### ***E-Communications/Windows Administration Services***

*Meeting Maker phase-out* – This phase-out opened the way for standardization of calendaring for faculty and staff through a broader deployment of MS Exchange. This eliminated the need to upgrade machines and freed up personnel resources, as three older computers were decommissioned and associated staff time was reallocated to other projects. Funds associated with licensing and support for Meeting Maker were made available for other needs.

*Webmail upgrade to Infinite Mobile Delivery (IMD)*—The IMD product provides an up-to-date messaging product for users of POP (or non-Exchange) e-mail. It also corrected reported bugs and allowed the administrators to upgrade the server to Windows 2000 on a new machine.

*Silo replacement (Source for Banner forms)* - As part of the effort to better secure Windows based servers, all production servers were upgraded from Windows NT to Windows 2000. The hardware replacement further benefited users via a performance boost that was realized from installing a newer, faster processor.

*Implementation of spam filtering software on virus scanning hardware*—With the deployment of this software and hardware, campus e-mail users are now able to set client side rules to filter unsolicited e-mails into a “Junk Mail” folder. It also provides administrators with additional log entries and tools to quickly identify users and sites which habitually send unsolicited e-mail to VT.EDU e-mail addresses.

*Assist Middleware with conversion from VTLDAP to Enterprise Directory or ED*—This extensive conversion allows for the initial “decoupling” of e-mail and Directory/Authentication services. This will provide further flexibility in granting authorization to use services and will no longer require an e-mail account for all users who require a PID.

*Edward Via Virginia College of Osteopathic Medicine setup for Email/ Exchange* - As part of the new “Managed Services” initiative, this project benefits the new college by providing “IT” expertise, including hardware and software setup based on MS Exchange

platform, as well as taking over Active Directory maintenance. Revenues generated from the project could assist in providing training and travel opportunities for Virginia Tech staff.

*SunONE testing* - This combination of hardware and software upgrades provides better performance on a supported and up-to-date software platform. The new SunONE Messaging Server will allow for increased functionality for users, such as Internet Message Access Protocol access to the mail store.

*Machine room movement/Keyboard Video Mouse setup* - By consolidating hosts in racks and providing a single keyboard, mouse, and monitor access, space was recovered to allow placement of the Terascale project computers as well as for future growth. Servers were also congregated by service type to enable easier maintenance and monitoring.

*MS Project Server* - A project server was set up to enable users of non-Windows-based systems to interact with the project plan developed for the Terascale Project. The server also provides a Web interface and accommodates multi-user input without the need for specific software to be loaded by the users.

### ***Unix System Administration/Technical Support***

In June 2003, Network Infrastructure and Services (NI&S) assumed responsibility for a large portion of the university's information technology services infrastructure. The former Systems Engineering and Administration group of "Information Systems & Computing" has been reorganized under the management of NI&S. This group is responsible for the server hardware and operating system software on which the university's enterprise applications operate. Additionally, this group administers the campus e-mail services. By moving these functions into NI&S, the server hardware and operating system environment has now become a part of the network infrastructure, and can be managed in a manner similar to that used for other components of the network. Economies of scope and scale have been realized by converging the management systems and approaches, and adopting a common set of best practices for system operations. Below is a brief summary of each of the services supported by this group.

The *Content/Knowledge Management Group* provides Unix system administration services for two servers. Under this group, the Knowledge Base (KB) server was migrated to a Debian Linux-based computer, and a backup/cloning procedure is being developed.

The *DBMS Team* provides Unix system administration for fifteen servers and manages their respective databases. This year, DBMS supported the migration of the Banner database from locally attached storage to the Storage Area Network (SAN). DBMS also assisted in the replacement of the Read-Only Banner database creation with a SAN flash

copy. Creation time has been reduced from an average of three hours to roughly five minutes. Several software packages have been upgraded, including upgrading the database server to Solaris 8, upgrading the E10000 SSP software to version 3.5, and upgrading several third-party software packages to support the Oracle 9.2 upgrade. Currently administration is pursuing solutions to disk space needs, including adjusting disk layouts and structures for more optimal use.

The Unix Administration group provides system administration services for:

*The eCorridors Project, eProvisioning, Middleware, and the Portal groups.*

The *Information Warehousing Group* tested SAN/TSM LAN-free backups.

The *Educational Technologies Group* assisted in migrating the Black Board application to more powerful servers and the Black Board NFS services to Sun Solaris-based servers. It also set up systems for the ePortfolio project.

The *Information Technologies Acquisition Group* set up systems for the Software Download service.

The *Web Hosting/Filebox Group* supported the migration of Web hosting and Filebox content to Network-Attached Storage space. Currently it supports the migration of Web Hosting and Filebox services to Linux-based servers.

During the past year, Unix Systems Administration provided expert support for other key Information Technology projects. Their most important efforts included the following:

- Evaluated the Apple X-RAID storage unit attached to Sun Solaris and Linux systems.
- Participated in planning for the Virginia College of Osteopathic Medicine and Virginia State University service provision
- System Monitoring (Big Brother/VTTrack)
- Set up backup Big Brother/VTTrack server
- Set up offsite clone of VTTrack database

## **National LambdaRail and Mid-Atlantic Terascale Partnership**

Virginia Tech has assumed a key role in the development of the latest advanced network infrastructure initiatives at the national and regional levels.

The National LambdaRail (NLR, <http://www.nationallambdarail.org/>) is a collaborative effort among the nation's leading high performance research computing and communications organizations to build and operate a national optical network system dedicated to "big science" and network technology research.

The Mid-Atlantic Terascale Partnership (MATP, <http://www.midatlantic-terascale.org/>) is a consortium open to higher education institutions and other research institutions in Virginia, Maryland, and the District of Columbia formed to promote the research competitiveness of the region through collaborative development of terascale computational and network infrastructure.

### ***National LambdaRail, Inc.***

Virginia Tech, through its Foundation (VTF), is a founding Class A Member of the National LambdaRail (NLR) with explicit responsibility to facilitate access to NLR for research institutions in Virginia, Maryland, and the District of Columbia. In order to effect implementation of NLR and to facilitate access, VTF licensed NLR network access rights and responsibilities to Communications Network Services with a charge to carry out all tasks necessary to ensure the success of the initiative.

The NLR network is a fiber-optic DWDM (Dense Wave Division Multiplexer) network that can provide many 10-gigabit per second channels for connectivity between major research universities.

Communications Network Services (CNS) employees are participating in all facets of NLR design, engineering, and operations. CNS will ensure campus network facilities and regional access networks continue to receive technology enhancements to enable researchers, educators, and students at Virginia Tech to take full advantage of the capabilities of NLR as they develop. CNS will also provide appropriate support to university research efforts.

From the NLR Web site:

National LambdaRail (NLR) is a major initiative of U.S. research universities and private sector technology companies to provide a national scale infrastructure for research and experimentation in networking technologies and applications. NLR aims to catalyze innovative research and development into next generation network technologies, protocols, services and applications. NLR puts the control, the power and the promise of experimental network infrastructure in the hands of our nation's scientists and researchers.

### ***Mid-Atlantic Terascale Partnership***

Virginia Tech initiated the founding of the Mid-Atlantic Terascale Partnership (MATP) in conjunction with the University of Virginia in order to 1) carry out the commitment to facilitate access to the NLR for institutions in the region and 2) to create a venue to promote emerging, collaborative "GRID" models for distributed, high performance

computing in support of research. The purpose of MATP is to promote the research competitiveness of institutions in the region with the intent to accomplish the following:

- Provide a forum for cooperation among participating institutions to implement terascale research computational and communication infrastructure reaching participating institutions in the region to support research requirements described in the Cyberinfrastructure report published by the National Science Foundation (<http://www.cise.nsf.gov/evnt/reports/toc.htm>).
- Support a National LambdaRail (NLR) node location in the Washington, D.C., metropolitan area and facilitate use of NLR for research.
- Cooperate for implementation of state and regional optical research network infrastructure connecting participating institutions to one another and to the NLR, initially with multiple 10 Gbps channel capability and ultimately capable of scaling to terabit capacity.
- Collaborate, where appropriate, to establish Teragrid infrastructure by acquiring and combining computational and storage resources and to pursue related research funding opportunities.

CNS serves as the operation “agent” for MATP, providing technical and management services in support of the organization. By joining MATP, each participating institution gains a share of the NLR rights and responsibilities afforded CNS through the use agreement with the Virginia Tech Foundation. CNS serves as the pivot point between MATP and NLR.

Through direct, aggressive support for the National LambdaRail and the Mid-Atlantic Terascale Partnership, Communications Network Services is playing a crucial role supporting the research competitiveness of Virginia Tech and the Commonwealth of Virginia.

### ***SURA Network Infrastructure Initiative***

Virginia Tech is a member of SURA, The Southeastern Universities Research Association. It is a consortium of sixty universities and colleges throughout the United States. SURA operates the U.S. Department of Energy’s Jefferson Lab and promotes initiatives in nuclear physics, information technologies, and coastal research. NI&S engineers serve on SURA task force working groups to recommend and evaluate fiber-optic infrastructure to support high-speed communications and research between member sites. The working group wrote and published a fiber-optic network design guide published by SURA. NI&S wrote a major section on network design for the report. Over the last year, the group worked with AT&T to determine the feasibility of using Velocita fiber-optic and DWDM (Dense Wave Division Multiplexer) infrastructure to interconnect SURA member sites and the southern region of the US with each other and with the National LambdaRail network.

## *NetworkVirginia*

NetworkVirginia (NWV) is an advanced, broadband network delivering Internet and intranet services statewide. It is the result of an ongoing project led by Network Infrastructure and Services (NI&S) at Virginia Tech to develop universal access to competitive, advanced digital communications services for all of Virginia.

NWV today connects over 1.4 million people to the Internet, to Internet2, and to each other.

NetworkVirginia is a nationally recognized model for a public private partnership to develop advanced communications infrastructure. Rather than building a private Research and Education network, Virginia Tech provided leadership to aggregate demand and buying power of higher education and state government to pull through investment in infrastructure from the private sector. Because there have been no state subsidies in this infrastructure, it is available to ALL Virginians. Today, businesses as well as schools, libraries, municipalities, and government agencies have access to advanced network services throughout the Commonwealth they would not have without NetworkVirginia. Other states are seeking to replicate this approach.

With nearly a thousand access points in every corner of the state, NWV offers access to an incredibly rich array of educational and information resources. Participants include four-year colleges and universities, the Virginia Community College System, private schools, and K-12 school systems. Also, many state agencies use the advanced capabilities of NetworkVirginia including the Department of Health, the Virginia Employment Commission, the Department of General Services, the Virginia State Library, the State Police, the Institute of Marine Science and others.

The network has very high capacity and can deliver simultaneous transmission of fully interactive voice, data, and video services. An Internet gateway is included which is available to all participants. A single connection to NetworkVirginia can be used to support different types of multimedia connections simultaneously. The bandwidth can be flexibly allocated and reallocated as needed. Virtually any type of application or communication service can be transported across NetworkVirginia.

The NetworkVirginia program at Virginia Tech has resulted in extraordinary cost savings to the Commonwealth and to Virginia businesses. A conservative calculation reveals an aggregate cost savings in excess of \$100 million per year!

Virginia Tech provides leadership to ensure NetworkVirginia performs effectively and continues to evolve both technically and from a cost perspective. Essentially, NI&S does whatever is necessary to make things work the way they should.

A unique aspect of NWV is service delivered by more than twenty telecommunications companies who must all act in concert. Virginia Tech provides a “Provider Coordination” function to facilitate the needed cooperation. An order for new service actually flows through a design team within NI&S who works with the ordering party to understand application requirements, translate those requirements into configuration specifications, and then communicate those specifications to all involved providers.

Virginia Tech’s Operations Center (VTOC) provides 24x7 monitoring and fault resolution for the aggregate network to ensure problems are resolved across provider boundaries.

When the backbone network came due for a technology overhaul in 2000, Sprint asked NI&S’ Research and Development engineering team to undertake a sponsored project to design, specify, and implement a next generation core network system. Dubbed NetworkVirginia NG (NWVng), the new core network greatly increased capacity and enhanced support for new Internet-based applications like IP videoconferencing, high definition video, and greatly improved reliability and performance for Internet access. NWVng also supports upgraded access to Internet2's Abilene network and other regional and national research and education networks. NWVng will offer the capability to support demanding new applications such as Virginia's Standards of Learning online testing.

Benefits of the program:

- Universal access with level prices statewide.
- Capability to support interactive, multimedia applications.
- Range of access options with very high capacity available.
- Capability to support very high performance computing applications with guaranteed quality of service objectives.
- Scales to match increasing demands.
- Advanced digital communications services at reasonable cost.
- Inherent Internet access.
- Founded upon public network services owned and operated by the communications industry:
- Lever for economic development
- Promotes competition
- Ubiquitous availability of advanced digital services to serve all sectors

The Vision Alliance, a consortium of local exchange companies in Virginia led by Verizon, provides local access and intraLATA switching services. Verizon is the prime contractor for these services and coordinates all network management and order processing within the consortium.



An interLATA backbone is provided by Sprint. The legacy NWV backbone is still operating with three ATM switches strategically located around the state providing interconnection points for Vision Alliance switches. During 2001-2002, Virginia Tech, under contract to Sprint, implemented the NWVng (next generation) backbone comprised of Cisco 12016 GigaSwitch Routers interconnected with a diverse mesh of OC12c packet over SONET (PoS) links. NWVng offers support for next generation Internet-based applications. Sprint also provides Internet backbone gateways in Washington, Roanoke and Richmond each at OC12c capacity for a combined aggregate Internet access capacity of nearly 2 gigabits per second. This Internet service is open to all participants.

Since 1998, the primary communications access method for schools, colleges, and universities to connect to Virginia's high-speed backbone network infrastructure has been IP over ATM (Asynchronous Transfer Mode). Almost 1000 sites serving 1.5 million people connect to the network. There are many daily problems and issues that have occurred, but there has been no convenient method for network administrators and technicians to communicate and capture the knowledge information. To address this issue, threaded discussion forum software was evaluated. The ATM User Forum funded BEV to host the software for one year. This type of advanced discussion forum software can be used to improve collaboration for educational and community applications.

Virginia Tech negotiated the contracts that comprise NetworkVirginia and continues to hold those contracts on behalf of the state. Through aggressive, competitive negotiations with multiple providers, VT was able to achieve very low prices that are postalized statewide. Prices as well as technology continue to be refreshed at a rapid pace through continual negotiations resulting in multiple addenda to the agreement.

Current prices for access service are reflected below:

Type	Capacity	Applications (from list)	Installation Cost	Annual Cost *
DS1	1.5 Mbps	1 - 4	\$500	\$10,320
DS3	45 Mbps	1 - 8	\$1,000	\$53,124
OC3	155 Mbps	1 - 10	\$2,000	\$133,716

\*Costs shown are based on prices for representative services applicable to educational sites and state agencies. Other services are available and different prices may apply.

Communications Network Services (CNS) upgraded and revamped the Order and Design System (ODS) database and designed, developed and implemented Version 2 of NetworkVirginia Order and Design System. Version 2 provides standardization of code,

faster operation, additional features and improvements. ODS is provided for and utilized by NWV Operations, VTOC, Sprint LD, and Verizon employees.

CNS also upgraded IOS on the NetworkVirginia backbone to address critical security vulnerability. There was a CERT advisory issued for Cisco products with certain versions of Internet Operating System. We discovered that the core of NWV was vulnerable to this type of attack and that a software upgrade was needed. During the upgrade procedure, we determined that some hardware was not equipped with sufficient memory to perform the software upgrades, so memory upgrades had to be performed as well. Working with Cisco and Sprint LD, all necessary upgrades were completed.

We converted the Internet2 connection from Abilene to Mid-Atlantic Crossroads, or MAX. This required the involvement and coordination of NWV Operations, Abilene, MAX, Quest, Metromedia Fiber Networks and Sprint LD staff. This monumental undertaking went relatively smoothly.

Over the course of the year, we have installed or disconnected a total of 218 sites in NWV for an average of one site every 1.67 days. Equal amounts of documentation and configuration are required to install or disconnect a site from NWV.

### ***NetworkVirginia NG***

NI&S recently completed an overhaul of the NetworkVirginia backbone under contract to Sprint. Virginia Tech has been in a leadership position for driving the technology and effective management of NWV since its inception. Sprint asked the university to undertake a compensated development project to design, configure, implement, and initially manage a new, next generation Internet core network consistent with Internet2 capability. The resulting, state-of-the-art, statewide network system extends gigabit scale access throughout the Commonwealth with capability to support new multimedia IP-based services. The new network includes an 800% increase in capacity between backbone nodes, 1,200% increase in commodity Internet capacity, and substantial improvements in diversity and reliability. Virginia Tech successfully completed this work during the 2002-03 fiscal year.

NI&S negotiated several addenda to the NetworkVirginia agreements with the involved service providers to continue to update and improve services offered. A Verizon addendum offers an innovative, flexible new Full Service option enabling customer tailoring of specialized Customer Premises Equipment to be included within the service offering. In a separate negotiated addendum, a whole new class of Ethernet-based access services ranging from 10 Mbps to 1 Gbps dubbed "Transparent LAN Services" was added.

Contract work with Sprint to overhaul and upgrade the interLATA backbone facilities was also completed during the 2002-03 year.

NetworkVirginia continues to operate effectively with moderate growth now reaching an estimated 1.4 million people statewide at nearly a thousand network access points.

### ***NWVng Internet2 gigaPOP***

Virginia Tech operates the Internet2 gigaPOP for Virginia providing access to national and international research and education networks for all institutions in the state. This connectivity is absolutely critical to the research competitiveness of Virginia Tech and the other research institutions in Virginia. The NWVng gigaPOP initiative is the preeminent program in Virginia in support of high performance networking for research and education.

Through the NWVng gigaPOP and NetworkVirginia, Virginia's research institutions have the lowest cost access to Internet2 compared to any other state. All costs for operation of the NWVng gigaPOP are recovered through cost shares distributed among the participating universities and other entities. In addition to our own university, Virginia Tech currently provides Internet2 access to the University of Virginia, Old Dominion University, George Mason University, Virginia Commonwealth University, William and Mary, the Virginia Institute of Marine Science, the University of Richmond, Hampton University, Norfolk State University, IMED Inc., and AEL Inc.

Virginia Tech's NWVng gigaPOP represents Virginia for the following:

- Connector for Virginia for the Internet2 Abilene network
- Mid-Atlantic Crossroads (MAX)
- Southeastern Universities Research Association Research Infrastructure Initiative program;
- the national Quilt organization of gigaPOPs
- Educause
- National Laboratory for Advanced Network Research Joint Techs
- Peering with federal research networks
- The National LambdaRail Initiative, and others.

Recently the gigaPOP has been engaged in the support of a resolution proposed by Governor Mark Warner to the Southern Governors Association to promote a terascale Grid network infrastructure throughout the southeast.

Since 2001, the NWVng Internet2 gigaPOP (NWVng I2) has grown substantially from connecting eight institutions to the Internet2 Abilene network to forty-nine campuses statewide. Leveraging the increased cost share among participants, NWVng I2

negotiated, acquired, and implemented a substantial upgrade to the Abilene gateway facility with a 400% capacity increase. NI&S continues to manage the NWVng I2 gigaPOP on behalf of the Virginia research and education community on a cost recovery basis.

During 2002 – 2003, NWVng implemented a new private, fiber-optic, metropolitan area network in Washington D.C. This facility is based on an agreement negotiated by NI&S with Metromedia Fiber Networks for construction and an Indefeasible Right of Use for dark fiber in the Washington, D.C., metropolitan area. Initially, the fiber interconnects the NWVng core router node in D.C., the Abilene router node in D.C., a MAX router node in D.C., PAIX East in Arlington, and a new physical gigaPOP node Arlington. Plans are underway to extend the fiber to include the National LambdaRail node in McLean, the Equinix facility in northern Virginia, and other strategic points. These resources position NWVng I2 to take advantage of extremely cost effective scalability and flexibility over the next several years.

Through careful management and aggressive negotiation, NI&S' NWVng I2 continues to move ahead of the Internet2 technology curve and to provide to all Virginia institutions the most cost-effective Internet2 access in the country.

### ***Internet2 K20 Initiative and Sponsored Educational Group Participant***

NWVng I2 successfully implemented an Internet2 Sponsored Educational Group Participant (SEGP) initiative to broaden opportunity for access to Internet2 to more educational institutions. Participants added under the SEGP include the entire Virginia Community College System, the University of Richmond, Hampton University, the Virginia Institute of Marine Science, the Virginia Science Museum, Norfolk State University, and AEL, Inc.

Virginia's K20 Initiative was selected as the first state program to be featured as a "spotlight program" during the summer of 2002 on the [Internet2 K20 Web site](#) earning positive national recognition for Virginia Tech and the state.

### ***EDUCAUSE Net@edu Wireless Networking Group***

"EDUCAUSE is a nonprofit association whose mission is to advance higher education by promoting the intelligent use of information technology." Virginia Tech is a member of EDUCAUSE and serves on several associated working groups. For the last three years, Virginia Tech individuals have served as the Chair of the Wireless Working Group, which researches and disseminates wireless technology information to members. Wireless technologies have become more affordable and offer higher communications speeds. As a result, they are increasingly used to provide Internet access for portable applications and for local access applications. Wireless has become an important access

technology in many areas, including rural areas where broadband cable infrastructure may not be available for quite some time.

### ***LENOWISCO Economic Development Project***

The LENOWISCO Planning District infrastructure initiative is an economic development project that received assistance from eCorridors to plan the development of advanced communications infrastructure serving Lee, Scott, and Wise counties, plus the City of Norton. Along with eDan, it is serving as an important model for other counties in the deployment of fiber-optic transport and cost-effective Ethernet access technologies.

### **Blacksburg Electronic Village (BEV)**

Launched in October 1993, as a public-private partnership between Virginia Tech, Bell Atlantic (the local telephone company which is now Verizon), and the Town of Blacksburg, the Blacksburg Electronic Village (BEV) is celebrating ten years of service to communities across the Commonwealth of Virginia, nationally, and worldwide. It is one of the oldest and best-known community network programs in the country and has been a pioneer in the incorporation of beneficial information technologies in community development projects. BEV has a proven record of positive outcomes in developing community-based technology strategies and has a national reputation for sharing information and expertise on utilizing technology for community service projects. Where appropriate, the BEV partners with other agencies to provide technology education and services of interest to communities. It currently provides services to over a hundred community groups, faith-based organizations, artists, citizen groups, and other civic organizations.

### ***Technology Opportunities Program or TOP grant funded project***

In 2001, the Department of Commerce awarded the BEV and Virginia Cooperative Extension (VCE) \$375,000 through its Technology Opportunities Program (TOP) initiative for the “Getting Rural Virginia Connected” project. The goal of this project was to permanently increase the capacity of rural communities in Virginia to use technology for economic and community development. The BEV provides the leadership and technology resources needed for this project which includes communities in Accomack, Craig, Cumberland, Dickenson, King and Queen, Louisa and Northampton counties of Virginia. Implementation of this project began in 2002 with VCE agents in each county assembling a technology leadership team that consists of interested volunteers.

Technology leadership teams in some counties went through a consensus building process called “Take Charge” led by VCE personnel. The “Take Charge” process enabled the team to understand the existing situation in their county, to develop a vision

for where they want to be, and to allow them to outline steps for how they wanted to bridge the gap between where they were and where they want to be. Some counties had gone through a similar visioning process as part of the development of their Comprehensive Plan and used the outcomes of their plan in lieu of the outcomes from the Take Charge process. BEV staff worked with technology leadership teams in each county and provided training on the effective use of Electronic Village (community network) services that include a Web site, Community Organization and Business directories, online calendar and online discussion forum.

The BEV also has incubator services that are designed to allow businesses and community organizations that do not have a Web presence an opportunity to establish one. Businesses in each county will receive assistance and the necessary tools (Web hosting, two email address, online mailing list) to get their businesses on line as part of the Virtual Business Incubator services. Non-profit organizations and other community organizations within these counties can utilize Community Connections services which include Web hosting, two email addresses and an online mailing list to allow them to use the Internet to publicize their work and increase awareness in the communities they serve. Additionally, the project has a technology assessment and master plan component that will allow each county to receive a professionally developed master plan geared towards the deployment of broadband networks in the county. Technology managers and engineers from Virginia Tech's Information Technologies Network Infrastructure and Services will work with technology teams and other groups within each county to perform assessments of the existing infrastructure within each county. Data from the assessments will be used to develop a technology master plan for each county. More information about this project can be found at <http://top.bev.net>.

### ***Client Information, Referral and Management Service (CIRMS)***

The Blacksburg Electronic Village has developed the Client Information, Referral and Management Service (CIRMS) for use by human services agencies. These agencies refer individuals to programs that have the resources available to help them. Before CIRMS, these programs may have inadvertently offered duplicate services to the same client, since different agencies provide similar kinds of services. CIRMS makes it possible for agencies to manage client data by assisting them in gathering and sharing information about clients, gauging client progress, and generating referrals for them. This helps agencies to use their limited resources more effectively.

#### **Key Features**

*Client Intakes* - CIRMS provides online data entry forms for human services agencies to enter personal and housing information about individuals who are seeking assistance. Agencies that have received a client's consent can view information provided by the

client to the intake agency. This eliminates the need for the same individual's information to be entered by each agency that provides the desired assistance.

*Referrals* – CIRMS allows agencies to refer a client to themselves (self-referral). Referred-to agencies are notified by email when an individual has been directed to the agency for assistance.

*Management* – Once data has been entered, agencies can view, add to, or modify information that pertains to a client and his or her household, consent status, and household history.

*Assessments* – Agencies can conduct assessments of clients and determine the level of assistance needed. The score from each assessment is recorded. Prior assessment scores and dates of the assessment are displayed. An accompanying bar graph provides a visual reference for agencies to determine a client's progress over time.

*Consents* – Agencies can use an online consent form, a paper copy of which is signed by the client, to allow other agencies to view an individual's data. Consent may be modified by the original intake agency only. Referred-to agencies can view or print the consent agreement, but they cannot change it. Clients choose when they want the consent to expire and have the option of revoking the consent at any time. An agency that has not been designated by the client cannot view client information.

*Reports* – Reports provide information on client demographic data, intakes, referrals, assessments, and use of the public 'Online Resource Guide'. Data for some reports can be downloaded in a format that can be opened in a spreadsheet program by the agency.

*Online Resource Guide* – This is a guide containing assistance programs that are administered by participating agencies. The Online Resource Guide is accessible to both the public and human services agencies. Clients and agencies can search the Online Resource Guide by keyword, agency, category, description, or program name. Information provided by the Online Resource Guide includes name of the agency administering the program, contact information, hours of service, eligibility requirements, and fees.

The capabilities of the CIRMS package can be modified and licensed to a variety of organizations, each of which can offer the service in their communities using a different brand name. One such example is the proposed use of CIRMS in Virginia's Ninth District as part of Congressman Boucher's One Care initiative where it will be referred to as COSMOS.

## ***BEV Health Initiatives***

The BEV was involved in public health initiatives during the course of the last year.

*The New River Public Health Partnership (NRPHP)* is a collaborative effort of regional organizations with interests in bringing public health and health care resources to the people of the New River Valley. The BEV and the NRPHP were featured in the *Public Health Grand Rounds*, a show broadcast nationally via satellite and as a [Webcast](#), in January 2003.

*The Edward Via Virginia College of Osteopathic Medicine and the Montgomery Floyd Regional Library System* partnered with the BEV on a project sponsored by the National Libraries of Medicine to promote access to health-related information through the use of the Internet. The Health section on the BEV site is used for this effort.

## ***NetworkVirginia Domain Name Service (DNS)***

BEV continues to provide DNS services to NetworkVirginia, a nationally recognized statewide service that utilizes a public-private partnership to provide an advanced, broadband network delivering Internet and intranet services statewide. NetworkVirginia is the result of a project led by Virginia Tech in association with Old Dominion University and the Virginia Community College System to develop universal access to competitive, advanced digital communications services for all of Virginia.

## ***Town of Blacksburg Neighborhoods program***

The BEV and the Town of Blacksburg completed a pilot project to provide three Blacksburg neighborhoods with access to a neighborhood Web site. Each neighborhood uses the Web to foster closer ties between neighborhood residents. As a result of the pilot, the Blacksburg residents involved in this project agreed that, with some modifications, this program would be beneficial to other neighborhoods in Blacksburg. Town planners involved with this project are expected to recommend to Town Council that this program be offered to other interested Blacksburg neighborhoods in a phased manner.

## ***Community Connections***

The BEV provides low-cost packages for non-profit groups, artists, and other community groups to allow them to use the Internet to keep in touch with their clients, members and residents of the community. The package includes a Web site, two email addresses and an electronic mail list. Organizations and groups wishing to register their own domain can upgrade to the Premium Community Connections Package for a small additional fee.



## **Comprehensive Study for: “Strategic Technology Infrastructure for Regional Competitiveness in the Network Economy”**

Network Infrastructure & Services assumed a leadership role in the development of a series of reports on issues surrounding the investment and development of strategic telecommunications infrastructure for communities. This study was a nine-month effort for the organization.

This comprehensive eleven-volume document investigates and, ultimately, endorses the idea that investment in advanced, “next generation” telecommunications infrastructure is an essential and achievable component of a region’s economic development and quality of life. The NI&S staff, representing a wide range of organizational management, business management, network engineering and planning expertise, collaborated on and authored five of the eleven volumes of this report. The following sections summarize these volumes.

### **Volume 2 - Connecting the Regional Infrastructure to National and International Networks**

Volume 2 addresses the investment in and development of strategic telecommunications infrastructure for communities. This volume provides the rationale and approaches for connecting the Tobacco Regions’ infrastructure to key network access points in major markets and to key high-tech resources surrounding the region.

*Rationale* - Regional and local infrastructure must be connected to facilities and services concentrated in large metropolitan areas strategic to the region to reach national and international networks.

The Tobacco Regions should leverage the fiber to connect to technology resources, including universities, technology centers, and research laboratories surrounding the region to drive high-tech economic development.

*Approach* - Multiple alternatives exist:

- *Construction and Ownership* - where adequate facilities are not available at reasonable cost to reach target resources, construction may be warranted. Partnership for joint ownership with qualified entities may represent an attractive solution offering high degrees of control and flexibility.
- *Fiber Lease/IRU* - A surplus of fiber interconnecting large metropolitan areas creates attractive opportunities to lease existing fiber. A temporary opportunity to acquire distressed assets may exist. Several such fiber routes pass through the Tobacco Regions. This opportunity, which we believe will be short lived, suggests aggressive action, but due diligence is required.

- *Managed Transport Services* - Most owners of existing facilities will prefer to offer turnkey, managed services. Managed services provide the least control and flexibility but may offer a cost-effective solution depending upon pricing, especially for initial deployment. A barrier to reasonable pricing for high capacity services, particularly new optical wave services, is that for most providers serving the region, capability to offer such services requires significant new investment and there are relatively few initial customers. Thus, pricing for a single wavelength for the first customer may reflect nearly the entire capital cost to construct a system capable of offering many wavelengths. A highly effective approach may be to partner with one or more providers to implement high capacity optical services by serving as the anchor tenant for such services offsetting financial risks and promoting early availability for all types of customers in the region. Regardless of methodology, the objectives of route diversity and scalability must be applied. Facilities should terminate in metropolitan areas at so called carrier hotels or other exchange facilities that maximize the choices of available service providers and interconnection opportunities.
- *High-tech Economic Development: A Virginia Region Grid* - The Tobacco Regions will generate early anchor tenants for development of the most advanced optical applications by extending links to area research institutions including Virginia Tech, the University of Virginia, Old Dominion University, Oak Ridge National Laboratory, the University of North Carolina, North Carolina State University, the North Carolina Supercomputing Center and NC Biogrid, and Duke University (a single link to MCNC will reach all North Carolina institutions).

The Tobacco Regions' fiber infrastructure could then be leveraged to create a regional computational and collaborative "Grid" system creating opportunities for high-tech economic development, education, health care, and workforce development everywhere the fiber reaches.

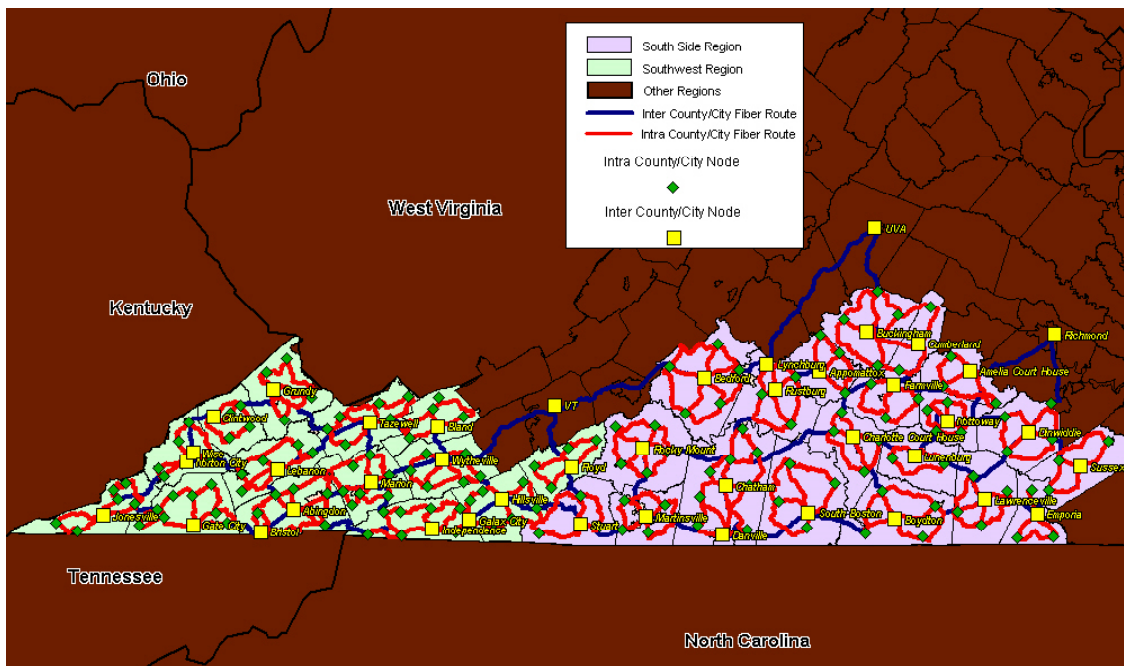
According to a Milken Institute report entitled America's High-Tech Economy: Growth, Development, and Risks for Metropolitan Areas, "Research centers and institutions are undisputedly the most important factor in incubating high-tech industries. A side effect of the technical capability and scientific research activities of these institutions is the training and education of the skilled labor that will be critical to the expansion and reinforcement of regional high-tech industries."

- *Providers With Existing Long Haul Facilities* - This section identifies most of the providers with long-haul fiber facilities that pass through the Tobacco Regions. For most providers, a map of existing fiber is provided along with contact information.

### *Volume 3 - A Fiber-optic Infrastructure Design for Southside and Southwest Virginia*

This 228-page report provides preliminary fiber-optic network designs for backbone infrastructure to serve thirty-four counties and eight cities in Southside and Southwest Virginia. Geographic Information System (GIS) technology was used to create detailed maps with fiber-optic cable routes along streets and highways. Spreadsheets were included that estimate costs for material and labor to do the work. Each county seat and city is designed to be a major hub point for higher tier and lower tier fiber networks—see figures 1, 2 and 3 below (represented by a square, yellow icon). Figure 2 shows that the typical distance between inter-county nodes is within the distance supported by off-the-shelf fiber-optic transceivers, which minimizes system cost. The higher tier inter-county fiber backbone links all major nodes together in a mesh network. The lower tiers are the intra-county fiber backbones that link all towns and cities together within each county/city region—see an example in Figure 3. Backbones within towns and cities aggregate local access from homes and businesses—see Figure 4 for a generic example. With this overall network architecture, any subscriber premise could be connected to any other premise, or a service provider, via fiber anywhere within the entire region.

The fiber network is designed to support most transmission methods in use today, including wave division multiplexing (WDM), synchronous optical network multiplexing (SONET), Gigabit Ethernet, 10 gigabit Ethernet, and higher speed services when they become available. This network architecture is the most future-proof design possible, which is important for long-term support of business, government, education, health, and other applications. To support end user services, the fiber-optic infrastructure should be overlaid with state-of-the-art IP over Ethernet over Optical network layers—see a conceptual drawing in Figure 5.



**Figure 1 -- Fiber-optic Network Backbone Design for Tobacco Growing Counties**

## Virginia Fiber Backbone Scenario

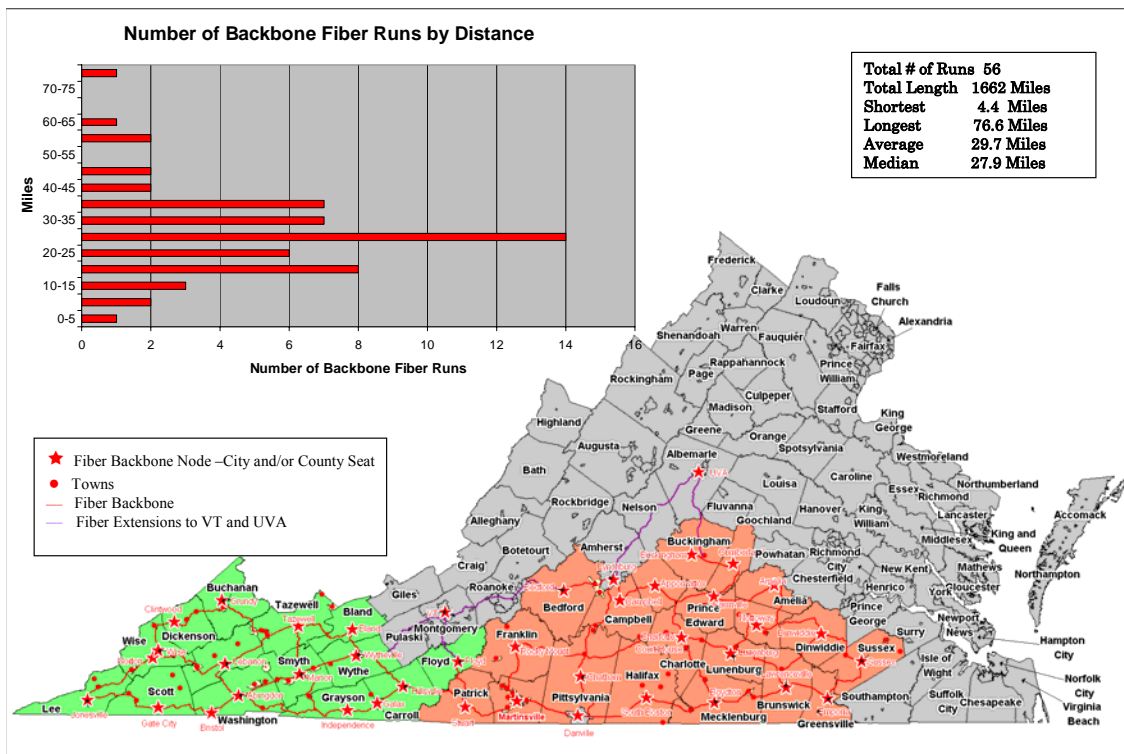


Figure 2 – Graph of Distances Between Inter-County Fiber-optic Nodes

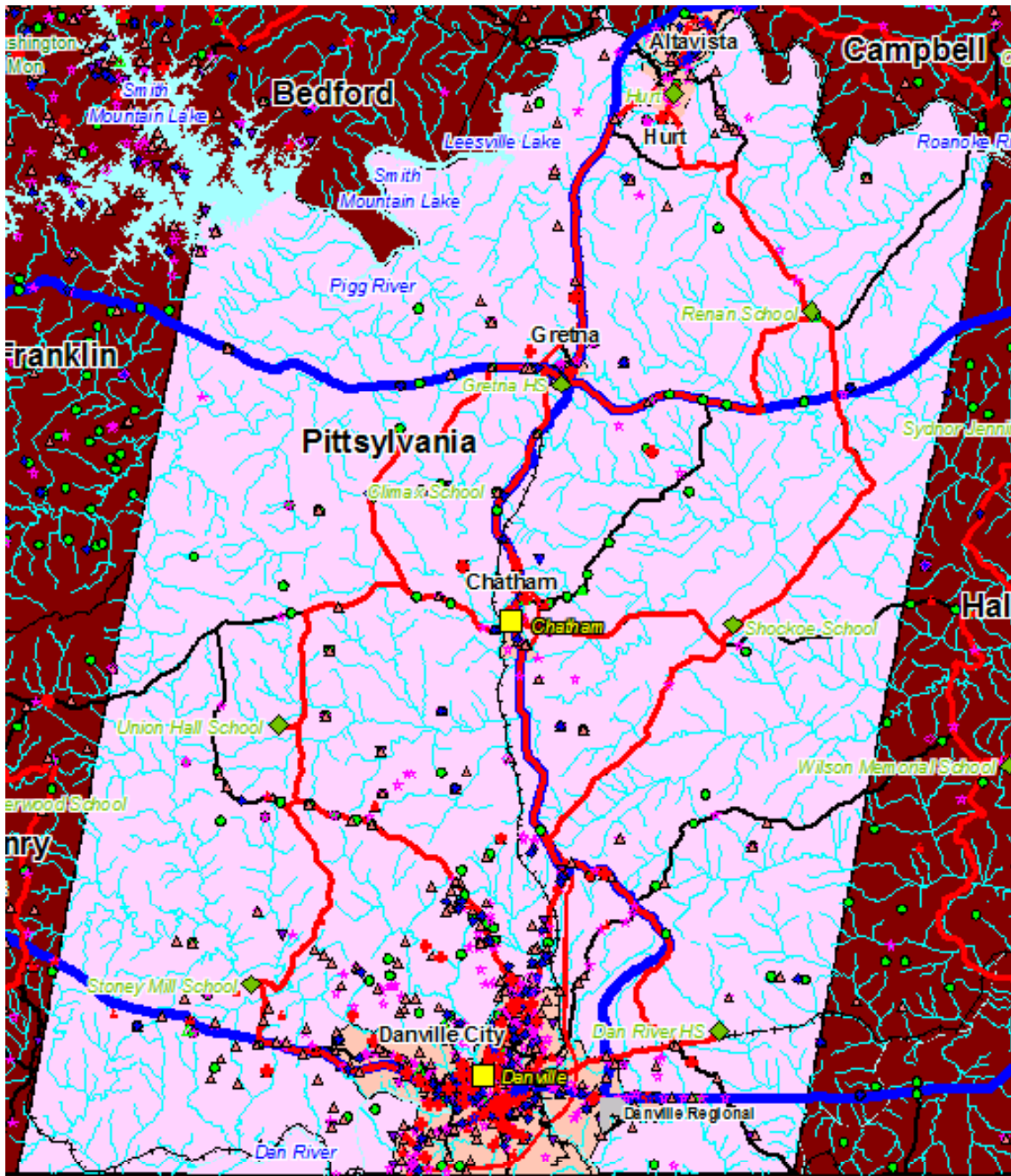
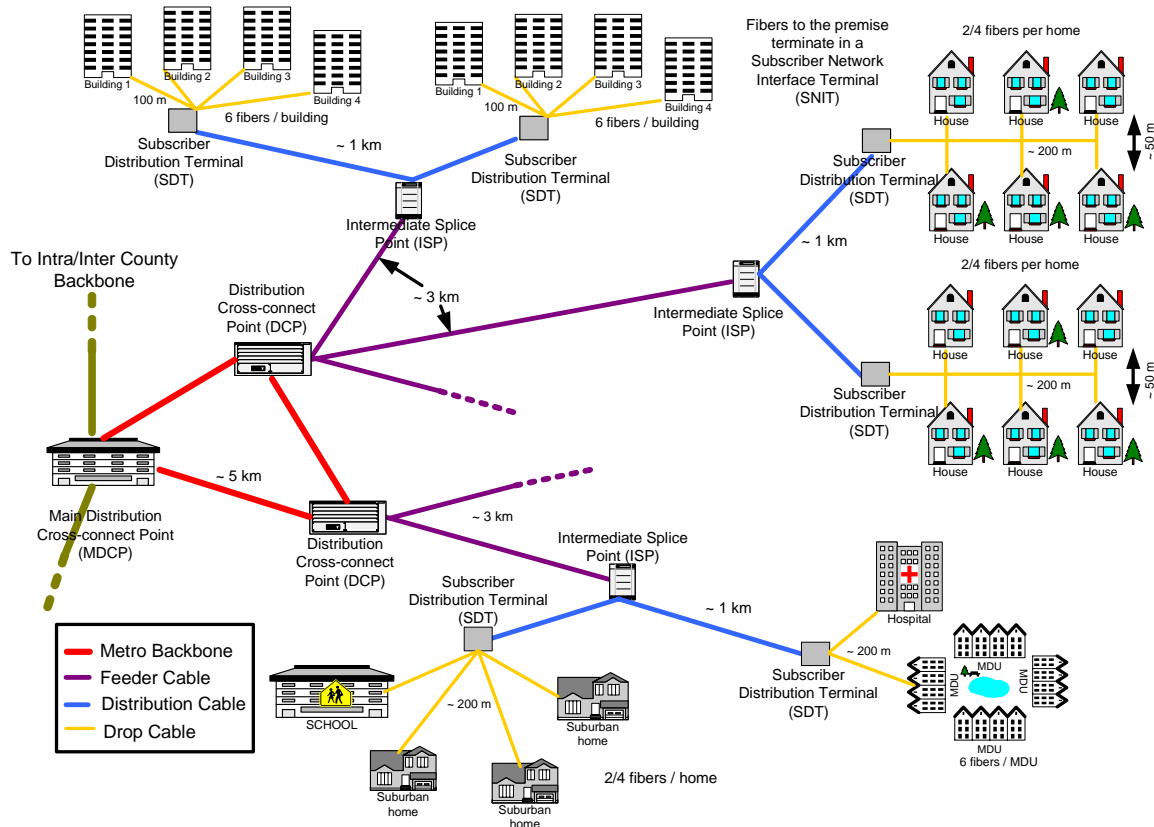


Figure 3 -- Example Intra-County Fiber-optic Backbone

In Figure 3, the blue lines represent inter-county backbone fiber to/from adjacent counties and the red lines represent intra-county fiber backbones. Some routes overlap and appear as red lines with blue fringes, such as along highway routes 29, 58, and 460 in the figure. The yellow squares are major inter-county network hubs, or MSAPs, and the green diamonds are other hub sites within the county. The many smaller icons represent real business points such as schools, hospitals, motels, shopping centers, parks, etc.



**Figure 4 -- Generic Fiber-optic Metro Network**

In Figure 4, at least two fibers are needed from each subscriber premise through drop cables and feeder cables to reach a Distribution Cross-connect Point (DCP). At the DCP, circuits may be connected to transmission equipment, or patched to backbone fibers and on through the network to some other point.

## Example Network Layers for an Advanced Statewide Fiber Optic Network

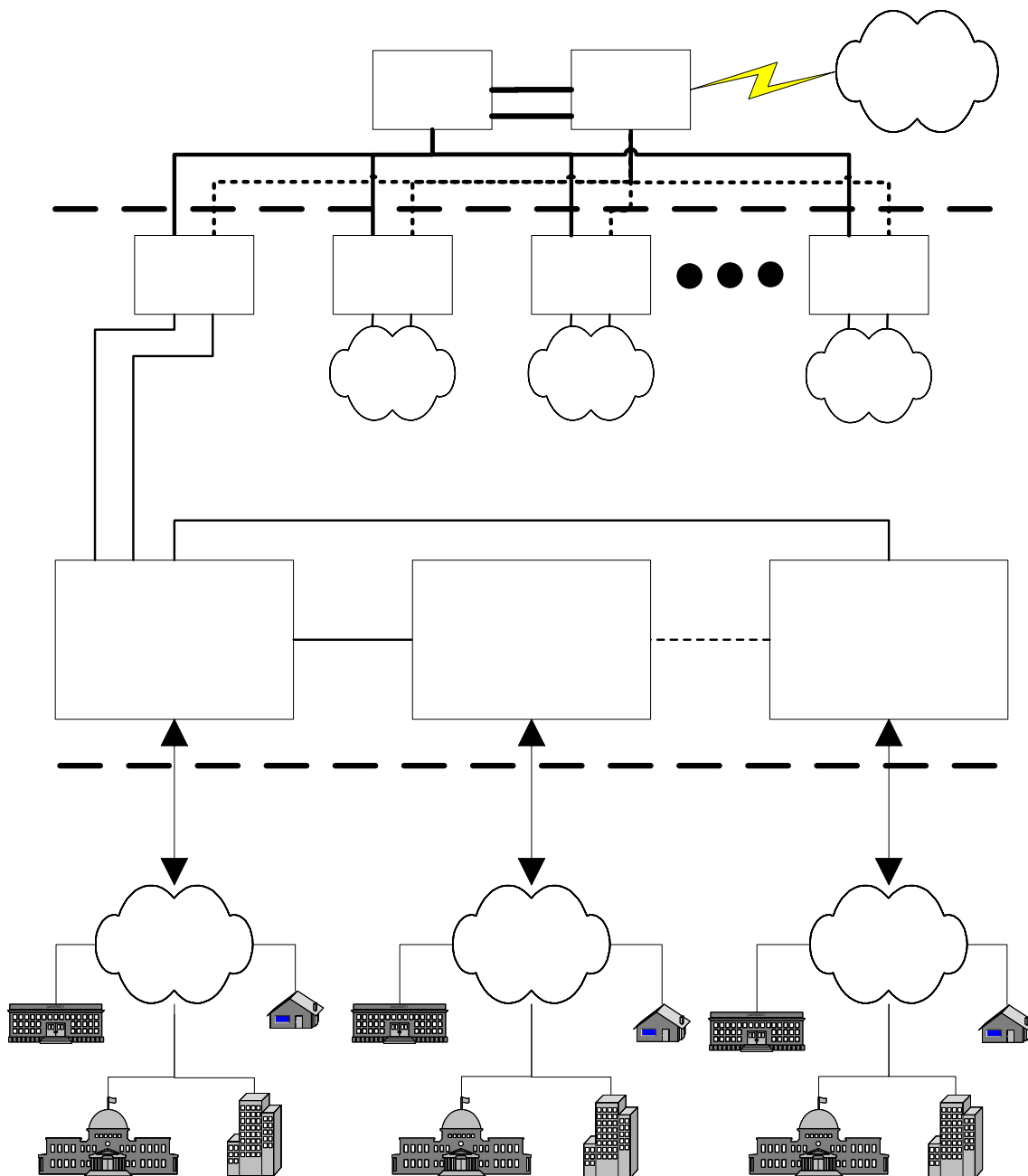


Figure 5 -- Network Layers for an Advanced Statewide Fiber-optic Network



In Figure 5, notice that the intra-county and inter-county network architecture should be designed to provide redundancy and diverse routes where possible for reliability and disaster avoidance.

#### ***Volume 4 - Fiber-optic Infrastructure Design Guide***

This 70-page guide provides practical design information and specifications for planning, engineering, and construction of fiber-optic infrastructure. It also provides extensive references to additional guidelines and standards. Many vendors, contractors, and manufacturers provided information incorporated into the report.

Topics covered in the *Fiber-optic Infrastructure Design Guide* include:

- Steps for planning and building fiber-optic cable plant
- Standards
- Type and Number of fiber to use
- Cable construction, ordering considerations and specifications
- Types of cable route construction
- Cable lengths to use
- Example costs for fiber-optic cable plant construction
- Examples of materials and work
- Geographic Information System tools
- Sources of detailed information for planning and engineering
- Quality assurance
- Cable plant facilities design and management tools
- Partial list of vendors and comparisons of fiber-optic cable brands

#### ***Volume 5: - Financial Feasibility and Investment Rationale***

This volume provides a business model for creating an inter-county/-city dark fiber backbone and an intra-county/city dark fiber backbone. It offers a detailed model for the fiber build and describes an entity that could plan, implement and promote the infrastructure. It emphasizes that access to advanced network infrastructure is vital to economic and educational growth and asserts that the Tobacco regions are isolated from advanced infrastructure. It states that Telecommunications carriers are generally not expected to invest in new infrastructure in the regions, but communities and municipalities could facilitate the construction of broadband networks.

*Asset Based Telecommunications* - Broadband networks are not more commonly in use because legacy, monopoly-based firms are unable or reluctant to build them. Broadband technology is becoming more affordable and less expensive than copper-based alternatives to implement, and fiber-optic infrastructure is capable of meeting needs now



and in the future. With these developments, municipal-based networks and customer-owned asset-based networks are possible today. Similar to rural electrification projects of the 30's, customers themselves pay the up-front costs of a fiber build and view the telecommunications infrastructure as a marketable asset, rather than a service.

Traditional business models in the telecommunications sector will not accomplish deployment of next-generation infrastructure. End-users should move from legacy phone companies that control both content and transport, to asset-based telecommunications where users control and manage resources. Customer dissatisfaction with existing choices has prompted municipal governments to build networks. Less concerned about profit, local governments have stepped in where telecom companies were reluctant. Examples include Grant County, Washington, Bristol, and others.

Return on Investment is looked at differently when building roads and sewers, in the same way, broadband infrastructure projects are taken on principally for the public good. A Utility model is based on "patient money" with a reasonable expectation that the money will be earned back, but is "normal" to be uncertain when the payback will come. The revenue stream should be simple and predictable, perhaps over a twenty-year period, with emphasis on the infrastructure not service revenues.

*The Entity-* In order to deploy the advanced network infrastructure, a recommendation was made that the Tobacco Commission facilitate the creation of a politically neutral, trusted organization, which would promote participation in the network infrastructure. It would, at a minimum, be non-profit, but tax-exempt would be preferable. It would separate the ownership of the infrastructure from the services provided, attract service providers, and avoid conflicts of interest. It would likely be viewed as a trusted partner, and be more attractive to Federal and National research efforts. The Entity would focus on planning and implementation, remain a lean organization with responsibility for program management, project management and quality assurance, and it would acquire funds, build infrastructure and collect revenues.

*Business Model Assumptions -* The Business Model outlined in this volume assumes the on-going operations, administration, provisioning, and marketing costs are recovered as a portion of the rates established for use of the dark fiber. The maintenance for the dark fiber strand mile is recovered on an annual basis from the consumer, and the plan also assumes that a portion of the capital investment will be recovered from the consumer and used to sustain continued development of the network in the regions.

Funds for inter-county/city dark-fiber build-out will be in the form of loans and grants to the entity, with defined deliverables from the entity. Funds for the intra-county/city dark fiber build-out will be in the form of loans to the entity. The reinvestment of funds is critical to the long-term value of the infrastructure and the continued economic growth

for the regions. The Tobacco Commission should not anticipate 100% direct recovery of the capital investments from the consumers of the fiber assets.

Market demand should drive the build-out plan.

*Inter-County/-City Dark Fiber* - To be successful and derive “quick value” from the network infrastructure, it is critical to consider strategic locations in the overall build-out. Planning activities must always consider the “big picture” and desired impact of a strategically deployed dark fiber infrastructure. Care should be taken to avoid creating “network islands.”

As proposed, the dark fiber build includes 1700 miles of fiber (60 strands), 102,000 strand miles, with an average cost per mile estimated at \$26,762. The build-out will consist of 50% aerial fiber & 50% directly buried fiber, including the access nodes.

During the first year, it was anticipated that 250 to 300 miles of dark fiber could be installed, including eight to ten network access points. Build-out of the entire dark fiber inter-county/city backbone should be no greater than five years, and should always include parallel processes and construction occurring at the same time.

Capital costs for 1700 miles of inter-county/city dark fiber backbone and related access nodes are projected at \$45.5 million, this does not include electronics. A detailed engineering design, marketing, and project management costs are projected at \$6,000,000.

The model proposes fifty-seven fiber segments or legs, with as many as forty segments under construction at a given time. The segments will route through fourteen additional jurisdictions outside the regions. These fourteen jurisdictions include the counties of Amherst, Albemarle, Chesterfield, Montgomery, Nelson, Pulaski and Roanoke, and the cities of Charlottesville, Colonial Heights, Petersburg, Radford, Richmond, Roanoke and Salem. If these fourteen Virginia jurisdictions elect to become early participants in the proposed anchor tenant scenario for municipal governments, it could generate between \$5–6.5 million for twenty-year IRU's.

*Scenario for Funding to the Entity* - The Financial model for the inter-county/city dark fiber build-out assumes the funds for this phase would be in the form of “patient money” based on a to-be-negotiated combination of loans and grants to the entity. The plan also suggests that certain Anchor Tenants will contribute to the early adoption of applications on the network infrastructure. Development of the anchor tenants for the dark fiber should be approached much like a capital funding campaign, and two anchor tenant scenarios are illustrated. One, for Municipal governments where 42 cities and counties in the regions commit to a twenty-year IRU for four fibers throughout the network generating approximately \$5.1 million over 20 years. And another scenario with Higher

Education and research where a twenty-year IRU for two dark fibers totaling 1800 miles yields \$2.7 Million over twenty years.

*Pole Rental* - The model for the build-out assumes that 850 miles of the fiber will be aerial. The average distance between each pole is 200 feet, and that will require approximately 22,500 poles for the inter-county/city build-out of aerial fiber. A thirteen dollars annual pole attachment fee is assumed in the plan, contributing an annual cost of \$292, 825 at full deployment.

*MSAP's* - The proposed infrastructure includes physical locations where the dark fiber network would connect to local, state and national networks. These locations are called Multimedia Service Access Points (MSAPs). There are forty-two inter-county/city and 197 intra-county/city MSAPs proposed, with an average cost to build of \$85,000. There is normally a charge for use of a facility for collocation, and collocation space could be provided for \$600–800 per month per equipment rack. Co-location fees per MSAP could generate \$2.1 million annually.

*Intra-County/-City Dark Fiber Build-out* - Again, assumptions made in the dark fiber build-out include Tobacco Commission funding in the form of loans to a trusted entity. It is also anticipated that a program management entity would generate \$22.5 million in funding from external sources. Jurisdictions electing to have their intra-county/city dark fiber segment constructed would agree to pay an annual participation fee of approximately \$10,000 to the entity.

As proposed, this part of the infrastructure includes 260 fiber segments, 3,400 fiber miles, 201,600 strand miles, and 197 access hubs. The cost for build-out was estimated at \$100 million or \$29,600 per mile. The estimate was based on using 50% aerial fiber and 50% direct buried fiber in construction. For the aerial fiber, 44,520 poles will be required.

*Conservative Model* - The business model provides \$99.5 million needed to construct 260 fiber segments and the related access nodes. The program would begin to realize a return on the intra-county/city dark fiber leases/IRU's in the third year. Projections in the model assume a maximum of 50% of the fiber leased, and the overall project model uses fifteen years as the term of a participation fee agreement. Participation fees would generate \$59.8 million over twenty-five years. Reinvestment of prior year's net could also be used to calculate the participation fees, and this would generate an additional \$12 million over twenty-five years.

*Participation Fee Justification* - Counties and cities must invest in the project through financial commitment. Without the full, long-term political commitment of key entities in the counties and cities, the project will most certainly fail. With the engaged commitment of these key entities, over the life of the project, it cannot fail.

*Combined Inter-and Intra-County/City Dark Fiber - Financial Summary* - The total cost for construction is projected at \$145 million. Funding resources for construction include Tobacco Commission Funding of \$110.5 million (this is a combination of Tobacco Commission securitized funds and repayments to the Tobacco Commission from the entity), reinvestment of Prior Year's Net of \$12 million, and securing additional outside funding of \$22.5 million.

Combined operating costs for the inter- and intra-county/city dark fiber infrastructure, over the thirty-year project, are estimated at \$144.5 million. This amount includes the Detailed Engineering Design, Project Management, Administration, Provisioning, Marketing, and Maintenance. The financial model projects the entity's net after operating costs at approximately \$89 million. The financial model is self-sustaining.

In addition to being self-sustaining, the financial model projects that over the thirty-year period, \$290 million dollars would go into the economies of the regions with the construction and operation of the Geodesic Mesh Network.

During the first twelve years, the model projects the region's economies should realize benefits of \$170.8 million dollars from construction and operation of the dark fiber network.

This *very conservative* thirty-year business model demonstrates a net, after construction and operating costs, of approximately \$89 million. As innovative, forward-thinking regions, with successful management of these funding resources, this model establishes a path to meet today's requirements and ensure a "long life-line" for the regions' future generations.

*Additional Anchor Tenants* - As discussed above, it is anticipated that the existing base of business and industry in the regions will participate as early adopters of the infrastructure. They will become "anchor tenants" with applications to justify the fiber-build. Higher education, health care organizations, corrections, law-enforcement, on-line retailers, and research communities inside and outside the region would all benefit from being initial customers of an advanced network infrastructure.

*Entity Support* - The report also outlines some of the outputs and activities required to implement and support study recommendations. They include recommending an immediate start to infrastructure development, possibly through a Project team at the Institute for Advanced Learning and Research (IALR), to make the fiber build a reality. The IALR would contract with the Tobacco Commission, and the Commission would provide funding, establish performance requirements and monitor projects. The IALR would approach the build-out like a capital development program, and educate, negotiate and project-manage.

## *Volume 6: Leveraging Advanced Optical and Ethernet Technologies*

Co-authored by CNS Network and Field engineers as well as vendor colleagues, the premise of this volume is that by leveraging some of the most advanced Ethernet and network technologies, it is possible for special interest entities to create special-purpose networks that fully utilize the proposed optical infrastructure at reasonable cost for health, education, research, and/or specific private sector purposes. It provides a technical analysis of the advantages, limitations, and management issues related to utilizing Ethernet technologies in wide area networks. Also examined in this volume are the multi-media services access point or MSAP network architecture and the advantages of 'metro' Ethernet services as a network interconnect technology.

The full eleven-volume report may be reviewed on the Web at...

[http://www.ecorridors.vt.edu/research/papers/stircne/index\\_flash.shtml](http://www.ecorridors.vt.edu/research/papers/stircne/index_flash.shtml)

## **Service and Operational Support Units**

### *Video/Broadcast Services*

Video/Broadcast Services (VBS) produces broadcast quality instructional video, advanced multi-media instructional materials, and operates and maintains network-based systems to deliver live presentations, both interactive and one-way, and pre-recorded materials to our on-campus and distance-learning students. VBS also utilizes these capabilities to support the Continuing Education activities of the university.

### **Key Projects**

*Media Production* - A variety of traditional audio/video and emerging multimedia services are offered. Among these services are design, development, coordination, and production of audio/video programming for dissemination through tape, multimedia, Internet, videoconference networks, and direct satellite broadcast. Video configurations range from VHS camcorders and complex multi-camera electronic field production, to broadcast quality full-studio productions and multimedia authoring. Additional services available include script development, instructional design, and set design. High quality graphic and animation creation are also available in the full-service, post-production editing and compositing facilities.

*Interactive Video Conference (IVC) Room Operations* - VBS coordinates scheduling of on- and off-campus interactive videoconference and video bridging services and the use of non-Virginia Tech distance-learning classroom facilities. Similarly, the unit schedules support staff for videoconference room setup, room operation, and opening/closing facilities each day, as well as for setup of network and presentation equipment, and operational testing. VBS interacts with clients daily, providing training for faculty, staff,

and students in the effective use of interactive videoconference presentation equipment. Daily network and remote system monitoring and fault notification services are provided for six Virginia Cooperative Extension IVC sites.

*Video Network Operations* - Scheduling coordination, connectivity, monitoring, and diagnostics support are provided by VBS for the interactive video conferencing network and terminal locations. "Help Desk" services provide a one-call trouble reporting center where problems are resolved or escalated to the next level of technical support. Diagnostic services include live monitoring of videoconferences, diagnosis, and if possible, resolution of problems occurring during the conference.

Video bridging services provides connection of multiple two-way interactive video conferencing systems in one conference. Interoperability services include speed conversion, standards conversion, and connection of sites that have different communication speeds, different compression, communications protocols, or networks in the same conferences. Conference problems are minimized (especially with new or out-of-network sites) through qualification procedures, which establish technical and scheduling contacts, site pre-testing and ensure proper protocols, algorithms, and any necessary conversion facilities are in place prior to a scheduled conference.

*Multi-Conferencing Unit Hosting for US Forest Service and the Wood Education Resource Center* - The United States Forest Service and the Virginia Tech Wood Science and Forest Products Education Resource Center purchased an "Accord MCG 100 Multi-Conferencing Unit (MCU)" which can support several network video-conferencing protocols: H.320, H.321 and H.323. The MCU is located at the Virginia Tech Operations Center (VTOC). As part of the MCU hosting agreement, Virginia Tech installed, hosts, operates and maintains the MCU in a collaborative distance learning arrangement with the USDA Forest Service Wood Education and Resource Center. The hosting agreement establishes a distance learning partnership between the Forest Service and Virginia Tech for developing and delivering information and training content utilizing advanced telecommunications and information technologies. In December 2002, VBS facilitated a two-day, on-site training session for MCU operators and network engineers. In April 2003, initial instructional design and conference facilitation services were provided for two multi-site videoconferences that introduced key US Forest Service Administrators to interactive video conferencing concepts and capabilities.

Highlights of other important projects:

Interactive Video Conferencing - Class Support

5 courses	Second Summer/Extended Summer Session 2002
51 courses	Fall Semester 2002

57 courses      Spring Semester 2003  
6 courses      First Summer/Extended Summer Session 2003

#### Streaming Video on Demand - Class support

Additional production and delivery method for live interactive video conferencing classes.

2 courses      Second Summer/Extended Summer Session 2002  
12 courses      Fall Semester 2002  
20 courses      Spring Semester 2003  
2 courses      First Summer/Extended Summer Session 2003

#### **Interactive Video Conferencing - Events Outside the Classroom**

VBS provided interactive videoconference support for more than 200 instructional, administrative, and outreach events on an ad hoc basis during the Academic Year 2003, including the following:

##### Entomology 2004

Audio recording/file encoding, streaming on demand, audio production, file digitization and encoding, and audio on-demand hosting support was provided for Tim Mack's on line Entomology course in Fall 2002 and Spring 2004.

##### Leadership Development 1015

This on line course was produced during Spring and Summer 2003, and incorporated studio recording, multimedia production and streaming video on demand.

##### DVD authoring

Two Mountain Lake Workshop documentaries were retrofitted into DVD format for Ray Kass of the Art Department. The DVD was authored for easy navigational access to various component pieces.

##### Lecture recordings

Twelve lectures were recorded and copied to VHS tape for the Center for Power Electronics Systems.

### Black Women's History

VBS assisted Center for Interdisciplinary Studies class with editing of a video/slide show.

### Interdisciplinary Studies IDST 2985 Guest Speakers

VBS provided TV studio production of presentations by eight guest speakers. The materials will be archived for future academic uses.

### VHS on-location recordings

VBS provided services for fourteen various short-term projects requiring VHS on-location recording.

*Engineering Cultures* - Video Broadcast Services was a co-recipient of the XCaliber Certificate of Excellence in 2002 and the XCaliber Award of Excellence in 2003 for their work on "Engineering Cultures". The main goal of the Engineering Cultures multimedia project is to help engineering students learn to work with people who define problems differently than they do. Through the use of multimedia CDs, streamed audio and video, and Web-based course management, Engineering Cultures travels around the world, examining how "an engineer and engineering knowledge" vary over time and place. In addition to a CD-based "Welcome" and "Introduction to Engineering Cultures," the five modules currently available introduce students to engineers in France, Germany, Great Britain, Japan, Soviet Union/Russia, and the United States. Engineering educators at other institutions have expressed significant interest in the modules.

*Water Quality Interactive Video Conferences* - Continuing Education project for the Virginia Department of Health provided monthly interactive video conference training for water treatment utility owners, managers, and operators. These workshops are broadcast simultaneously to fourteen locations throughout the Commonwealth. The use of interactive technology offers the opportunity to engage in discussions and to ask specific questions of the presenters and participants. Because these courses are offered simultaneously at several convenient locations around the Commonwealth, the use of interactive video technologies allows these professionals convenient access to live, high quality instruction with a minimal disruption to their work day by reducing travel time.

### *Promotional CD-ROM for Program Development of Outreach and International Affairs (Continuing Education)*

VBS provided audio/video recording, graphics, and multimedia authoring services for the creation of new promotional media for use in small group presentations. Customer testimonials, project examples, and graphics were designed and integrated into a



multimedia-based promotional and marketing tool that is easily portable and adaptable to various audience needs. The multimedia design and navigational layout allows presentations to be more easily tailored to audience size and area of interest. The final product will be used as a "digital business card".

### *Choices and Challenges Forums*

The Choices and Challenges project at Virginia Tech was established in 1985 as part of the Humanities, Science and Technology concentration and represents a unique, ongoing effort to encourage the humanistic components of science and technology to be identified and addressed — and to engage public audiences as key participants in this process.

### *January 2003 Post Production of Choices and Challenges: Food Frights*

A two-hour live event was edited into a one-hour program with graphics and effects, and was broadcast on the PBS Adult Learning Service program in June 2003.

*Forum synopsis* - Because food is an important part of our culture, concerns about it range from contaminants to the effects of genetically modified content to possible problems with dietary supplements to worries about possible bio-terrorism. Food Frights looks at the ethical, environmental, and policy aspects of food safety.

### *March 2003 On-Location Production of Choices and Challenges: Big Brother Technologies*

Multi-camera location recording at Donaldson Brown. The program will be post produced and edited for later broadcast on the PBS Adult Learning Service in Spring 2004

Forum synopsis - As citizens of the United States, and as international visitors to this country, we value our privacy and cherish the freedom to live our lives without intrusion or interference from others. Yet technology is providing a variety of new tools that can alter our sense of privacy. Surveillance devices can follow our movements and eavesdrop on our conversations. DNA tests can identify people through their genetic makeup. Computer-based data sharing can provide information to doctors about our medical conditions - and to telemarketers about our likes and dislikes. How much privacy are we willing to give up? When is this invasion of our privacy acceptable - and when does it pose a threat? How can we resolve the tension between personal privacy and public security in the post-9/11 world?

## ***Field Engineering***

Field Engineering (FE) designs, installs and maintains state-of-the-art telecommunications cabling distribution systems that support the dynamic voice, data and video needs of the university. FE develops and deploys the most advanced systems available, often working closely with leading vendors in this industry to develop new products required to meet the demanding requirements of a leading research university. The systems that FE installs are designed to be flexible enough to meet the evolving needs of the university over a 10 to 15 year period. FE consistently deploys these systems at a fraction of the cost that a comparable quality commercial company would charge the university.

Field Engineering's work on projects such as the Danville Institute for Advanced Learning and Research, the Edward Via Virginia College of Osteopathic Medicine, and the Terascale computing cluster directly support the university's outreach and research missions.

### **Completed Projects**

*Edward Via Virginia College of Osteopathic Medicine (EVVCOM)* - Cabling for the Edward Via Virginia College of Osteopathic Medicine was completed in July of 2003. The college opened its doors Fall semester 2003. It provides a state-of-the-art facility and focuses on a holistic approach to diagnosing and treating human illnesses and ailments. In addition to its mission to provide osteopathic primary care physicians for this region, the college offers new academic and research opportunities to the Virginia Tech community. Field and Network Engineering teamed to install the telecommunications infrastructure, digital voice, 100BaseT Ethernet, and wireless local area network services for the college. The facility has a robust fiber backbone that can support many enhanced medical graphic and digital imaging applications.

*Student Services Building* - Field Engineering installed all telecommunications infrastructure equipment and provided extensive voice, data, and video services to this facility, which houses the Bursar's Office, the University Registrar, Financial Aid, Hokie Passport, Student Telecommunications, Student Insurance, Parking Services and Accounts Receivable. By housing all of these student services in one building, students can efficiently take care of their university business needs, and this is especially true when checking in at the start of each semester. Efficient university business processes contribute to an overall positive college experience for students.

*eDanville - Institute for Advanced Learning and Research (IALR)* - This institute is an economic development project designed to teach advanced technologies and to offer research facilities to Southside Virginia. The City of Danville and Pittsylvania County partnered with Virginia Tech for development and operation of this facility. "The

Institute for Advanced Learning & Research (IALR), a partnership between the region's educational, governmental, and private leadership institutions, is an economic development, education, research, technology-access, and community development initiative designed to enable the Dan River Region to compete more vigorously in the global marketplace and to enhance the residents' quality of life."

CNS engineering provided consultation to the IALR management team, leading the technical design of this facility's telecommunications infrastructure. Communications Network Services installed the inside plant telecommunications infrastructure in the facility. Category 6 station cabling was used throughout along with a robust optical fiber backbone. The facility will use voice over IP (VoIP) as well as digital and analog services provided by Avaya switches.

*Terascale Cluster Computing* - Communications Network Services was involved with the design, assembly and installation of the terascale super computer cluster. This project involved the installation of more than 1,100 G-5 Macintosh computers all connected to a very robust Mellanox Infiniband backplane and high end Ethernet switches. The resulting system has been benchmarked as one of the top three super computers in the world! This project, which was funded by the National Science Foundation, also required extensive electrical and HVAC upgrades. Teams of CNS field engineers and VT students were responsible for the installation of over 2,400 network patch cords. This facility will be accessed via the new National LambdaRail network and will be utilized by leading research universities and top researchers worldwide.

*Wireless Local Area Network (WLAN)* - WLAN installs to the public areas of campus and some private areas further improved the mobile computing capability of students and faculty for meetings and classroom activities. This also improves the students' capabilities to receive assignments from and respond to faculty using wireless devices in public campus spaces.

*Capital Projects-New Construction & Renovation* - Lane Stadium South-End-zone, GEOTECH Lab, Williams Hall, Student Services Building, EVVCOM, Southgate Addition, Cheatham Addition, Recreation Fields ductbank and buildings.

*Installed high-end Ethernet switches* – New switches enable the provision of 1000BaseT connections necessary to support server computing platforms.

*Buildings upgraded to switched 10/100 Mbps Ethernet* - Davidson, Hahn, Math Emporium, ISB offices, War Memorial Gym, Agnew Hall, Litton-Reeves Hall, Sterrett Facilities Center, and Lane Stadium benefited from this upgrade project

*Upgraded Building Backbone Feeds* – The upgrade effort increased network capacity from 10Mb/s to 100Mb/s in all the Special Purpose Housing area of campus, improving

their network accessibility and performance. The project resulted in a more efficient use of the campus fiber-optic infrastructure.

### **Ongoing Projects**

Projects that are currently being cabled by Field Engineering and will also be supported by Network Engineering include the following:

- Terascale computing
- VT Electric Service Facility
- Danville Institute for Advanced Learning & Research
- Chemistry/Physics Building
- Virginia Bioinformatics Phase I
- VetMed Cat 6 Upgrade

### **Future Projects**

The following are buildings/facilities currently under construction which will be served in the next year(s):

- Alumni Hall and Conference Center
- Dairy Barn
- Livestock Arena
- Ag Forestry
- Career Services
- Virginia Bioinformatics Phase II

### **FE Work Order Statistics**

Total Moves, Additions, Changes (MAC) orders worked: 10,651  
These orders consisted of:

- 3,248 PBX orders
- 5,258 Network orders
- 397 T&M orders
- 1,748 other order types

### ***Network Engineering***

Network Engineering (NE) incorporated software and configuration enhancements in campus switch equipment to limit the misuse of network resources and provide protection against end-user hardware failures, which could potentially deny service to other users.

NE provides software and hardware support and timely critical security enhancements and improvements to the university's network systems. NE helps users of the university's networks and other related network resources learn about security needs by improving users' knowledge of how machines can become infected and how to immunize machines against future infections. To ensure overall network functionality, NE will quarantine infected machines by deactivating their network ports and by providing necessary port security on the edge of the network.

Software patches and upgrades implemented in the last year include the following:

- IDS (Incremental Device Support) for SMARTS Fault Management Systems and Network Health trend analysis and capacity planning software. Incremental device support patches are necessary to keep our monitoring systems current as we deploy new hardware platforms in the network. New hardware often adds new features, ports, and capabilities that our monitoring systems would not understand without IDS patches.
- Software Enhancements/Upgrades for SMARTS and Network Health. Software enhancements provide "bug" fixes and often include feature requests, which have improved our system efficiencies. Network discovery times have decreased and network mapping support, as well as reconfiguration impact on system administration, have improved with these updates. Network Health enhancements include new and easier reporting methods and improved access to reports. Administration and configuration of the system has also been simplified, reducing our management overhead by allowing engineers to perform more engineering changes to systems in less time.
- Operating System Security Patches to Windows 2000, Windows XP, Solaris 5.8, FreeBSD. Timely application of security patches allows us to keep critical machines operational for managing, troubleshooting, and problem reporting and, helps protect valuable information resources used in managing the network.

Network backbones were upgraded to further enhance network reliability. Along with these upgrades, bandwidth management Quality Of Service parameters were implemented to distribute available bandwidth to the Internet more evenly among students, faculty and staff.

### **Completed Projects**

*e-Dan Engineering Design* - Network Engineering teams from Communications Network Services planned and designed the forty-mile fiber-optic network connecting network hubs, or MSAPs (Multimedia Services Access Points), in Danville, Chatham, and Gretna. The associated fiber-optic network, MSAP collocation spaces, and gigabit Ethernet switches provide an initial backbone network to support high-speed connectivity for the regions' communities, towns, the City of Danville, schools, IALR and other entities.

*Upgraded CNS digital subscriber line or DSL service* - Replaced obsolete equipment to provide more bandwidth to off-campus DSL customers. The new system has substantially reduced operating costs and has yielded higher reliability.

*Provided network security for Virginia Bioinformatics Institute* - CNS has a commitment to provide advanced, highly secure services to protect valuable research. This year, we worked closely with the Virginia Bioinformatics Institute (VBI) to implement a firewall solution that protects all VBI information technology assets from many kinds of network attacks. The solution implemented does this while providing a very high level of network throughput, as required for VBI's advanced computer application framework.

*Converted departmental switches to align with CNS management standards* - This conversion simplified and reduced our network management overhead by changing over some departmental switches to adhere to CNS network management standards. This allows for easier access to equipment, faster problem resolution, easier code upgrades, and better configuration management.

*Upgraded remaining shared Ethernet hardware to switched hardware* - Bandwidth management was improved locally by improving Network Engineering's capability to monitor and manage the equipment remotely. New hardware enhanced security, improved configuration management, and lowered inventory requirements by utilizing our standard hardware switching platforms.

*Hardware Upgrades* - Replaced many Catalyst 5000 switches with Cat2950 and Cat3550 switches. These upgrades improved the quality of the network by providing more redundancy, higher availability, improved manageability, and added security, in addition to adding improved bandwidth capability.

- Upgraded memory in Virginia Tech Transportation Institute router which improved performance and manageability.
- Upgraded Hotel Roanoke router memory and the Internet Operating System to improve performance and align it with CNS standards for production router implementation.

*Provided backup/redundant network connectivity* – Backup facilities were installed for the Fiber Electro-Optic Research Center on Plantation Road using existing copper circuits. The addition of a DSL backup for the primary fiber link improves our ability to maintain critical network computing activities in the event of a fiber-optic cable failure at this remote location.

*Out-of-Band Management installations* – Out-of-band management installations allow us to quickly troubleshoot and restore network services especially when a network outage prevents access to the equipment from the network. Out-of-Band also allows us to

operate, manage, upgrade, and perform network intrusive commands that are otherwise impossible without onsite engineers at equipment locations. This improves our efficiency and allows more equipment to be managed with less engineering support.

## **NE Statistics**

- Installed or configured switch ports for nearly 2,000 new network connections
- Changed switch configurations on nearly 1,800 existing network connections
- 3,163 Remedy trouble tickets were resolved—of those, 1,981 were repair orders
- Completed 845 Move/Add/Change or MAC orders.

## ***Telephony Engineering***

Telephony Engineering (TE) supports configuration and maintenance of the university telephony systems for on campus and remote VT locations. These systems are comprised of a 14 node Siemens 9751 Model 70 CBX operating with release 9005.6.84 software for large CBX applications, Siemens 9751 Models 10 and 50 also operating with 9005 software, one HiCom Model 30e operating with Siemens 9006 software release and the VoiceMail system consisting of 11 nodes servicing all Faculty/Staff, Students, and the Northern Virginia Center.

These systems support a base of over 14,000 extensions servicing both digital and analog devices, and 600 CBX data connections. The main objective of TE is to offer the expected “five nines” of reliability (99.999%) for delivering telephony services to the university. As advances in technology are implemented, the same expectations will be present and TE will strive for that same level of dependable service.

## **Key Projects**

### ***VT Burglar Alarm System***

Telephony Engineering developed, designed, and installed applicable equipment and provided Project Management for the installation of a new University Burglar Alarm System. CNS is responsible for complete and up-to-date installation and documentation of all alarm devices located throughout the university community. CNS is also responsible for the maintenance of the user alarm devices and the main computer system that runs the alarm program. This newly installed system uses an advanced computer technology and interfaces with newly installed user alarm devices connected to the main Burglar Alarm system. Telephony Engineering was responsible for the acquisition and installation of the new system.

### *New Voice System Implementation and Evaluation*

Telephony Engineering has installed voice switch equipment and applications from various vendors to enable evaluation and documentation of its performance.

Various 'end points' are being evaluated such as digital sets, voice-over-IP (VoIP) devices, and SoftPhone clients. Also under evaluation are call detail record applications, computer-telephony integration applications, voice messaging systems, and associated servers and routers. These evaluations will provide the requisite information needed to support Communications Network Services' decision-making process for obtaining a new and state-of-the-art telephony application for the University.

### *Installed new PhoneMail System at the Northern Virginia Center.*

Telephony Engineering proposed and completed the relocation and installation of a Siemens 7652 VoiceMail System at the Northern Virginia Center (NVC) in Falls Church, Virginia. PhoneMail now operates on the NVC campus in the same manner as it does on the main campus in Blacksburg.

TE also provided on-site training for NVC personnel covering all features of the PhoneMail, telephone sets, and telephone systems currently at that location.

### *Emergency "Blue Light" Phones*

Telephony Engineering, at the request of the Virginia Tech Police Department, made proposals for the replacement of the university emergency phones located throughout campus. The older phones used radio frequency (RF) transmission for their basic operation. This mode of operation became unstable due to the unprotected RF frequency range that the remote phones used. TE managed the entire project and assisted in the identification of sites and selection of telephony devices and mounting cases, including installation and documentation of thirty-two new phone locations. CNS provides any required maintenance on these devices.

### *Increased CBX Operating Efficiencies*

In an attempt to increase operating efficiencies of existing CBX hardware located in several switchrooms, Telephony Engineering began consolidating CBX nodes where feasible. One three-node switchroom location was consolidated to two nodes. Further reductions of hardware are anticipated.



#### *New Voice application for delivery of voice services to Tidewater area*

Telephony Engineering investigated and deployed a new method of delivery of voice services to university sites in the Tidewater area. This new service resulted in the removal of existing CNS equipment at a remote location and established provisioning of long distance services using local vendor equipment. Increased economy and efficiency were realized from the change.

#### *Upgrade from analog to digital trunk facilities*

Telephony Engineering, after using analyzing of current traffic statistics, proposed and implemented the downsizing of under-utilized trunk facilities providing local and long distance calling services to the university. The reduction increased CNS's overall operating efficiency. The reconfiguration of most analog trunks in conjunction with their replacement by digital facilities further enhanced operations enabling CNS to receive more detailed call information from vendor billing, while allowing for more complete billing back to the university's end-user. TE provided these new and enhanced applications to serve the local Roanoke area (including Blacksburg, Christiansburg, and Salem).

#### *Establishment of CNS Disaster Recovery and Training Applications*

Telephony Engineering established specific sites as Disaster Recovery locations providing telephony and voicemail applications to the designated facilities. In the event of a major disaster, one facility would potentially be a Command Center.

One site also serves as a telephony training facility during routine operations. Training is offered to the university community at no cost. Training includes all areas of telephone set operations (sets of various types) along with PhoneMail training and applications. For users desiring additional instruction, training is also offered at local campus sites when it is more convenient for them.

#### *Emergency "By-pass" Application for the Northern Virginia Center*

Telephony Engineering is currently working with Northern Virginia Center personnel to establish a telephony "by-pass" application in the event of a complete power failure at the Center. This service would provide local telephone company dial tone to key locations throughout the Center in the event the entire telecommunications facility was inoperable. This service offering is also being explored for the Blacksburg campus.

### *Developed offering for Emergency numbers for CNS*

Telephone applications were made available to CNS management to provide emergency notification to CNS personnel in the event of an emergency or other situation requiring rapid distribution of information to all staff. In Blacksburg, a local exchange number was established. For redundancy, a local Falls Church number was established at the Northern Virginia Center, should the Blacksburg Central Office ever become unavailable for distribution of information.

### *University Relations PhoneMail Broadcast application*

Telephony Engineering recommended and worked with the office of University Relations to develop and install the PhoneMail Broadcast Message capability. This application allows University Relations personnel to compose and deploy emergency information to the university community in Blacksburg and at the Northern Virginia Center.

### **Campus Cable Television System (CATV)**

High availability of the campus instructional playback, uplink/downlink of classes, and the campus CATV system is a priority concern for our video engineering group. To improve cable television service for Virginia Tech, CNS developed a survey tool to gauge student interests in programming. Responses were stratified, which enabled us to design a programming lineup to more broadly serve all members of our academic environment and to most effectively utilize available delivery resources.

The survey also culminated in the introduction and installation of new entertainment services to CATV system. Several of the most-requested programming choices were added to the campus CATV system for the Fall 2003 semester. MSNBC, Fox News, E!, IFC, Tech TV, National Geographic, Animal Planet, Research Channel, TBN, ZTV, ESPN News, and Fox Sports are among the additions.

During another successful year of broadcast operations there was no downtime and there were no errors in either broadcasting or programming. The high level of availability of CATV services confirms the dedication of our engineering team to a remarkably high quality of service standard.

### *Other CATV Developments*

- Oversaw the relocation of our off-air-receive location to Research Building 14 (RB 14), our new home offices site, to improve quality of reception when the off-air signal is needed and to better accommodate the move of the CATV system operations functions to RB14.

- Oversaw the destruction of the old microwave tower at the uplink area. This improves the aesthetics of the area and removes facilities no longer used to provide Video/CATV services to campus.
- Expanded CATV plant to include the university football stadium's new south end-zone unit and the Student Services Building. Collaboration on new construction projects and new service requests for buildings not currently served by the existing cable plant has contributed to the continued expansion of the campus's CATV service area.

### ***Enterprise Information Systems and Business Services***

Over the past fifteen years, Network Infrastructure and Services has gained a strong strategic advantage by developing its enterprise management systems internally. This philosophy has allowed the organization to adapt quickly to the rapidly changing telecommunications environment. It significantly reduces implementation time, effort and cost for the delivery of new networking technologies, allowing for sophisticated networking initiatives to move quickly from the organization's Research and

Development teams into production. The organization's Systems Development and Administration team is responsible for the in-house development and maintenance of these systems and works closely with every area of the organization.

#### **ATLAS**

The organization's primary enterprise management system is ATLAS. ATLAS provides integrated billing, accounts receivable, accounts payable, materials inventory, cable plant inventory, service management, budgeting, purchase order, call-detail accounting and work order functionality for the organization. The system generated and managed over \$15 million in billable charges last year. The inventory systems manage over 88,000 active services, more than 400,000 cable segments and processed in excess of 52,000 materials inventory transactions last fiscal year.

The ATLAS system is an Oracle-based client-server system developed primarily in Oracle Forms (180+ applications), Oracle Reports (125+ applications) and PL/SQL (100+ applications). Support functions are also developed in C, Java, Perl and Expect. The system serves 60+ concurrent users and provides rapid access to over 36Gb of enterprise information including over 68 million call-detail records and over 27 million modem pool accounting records.

ATLAS is tightly integrated with the organization's mission critical NEMISYS network management system, as well as University administrative systems included in the Banner suite.

### *The Development Cycle*

Developers and users work together to continuously improve the organization.

As stated earlier, the organization's commitment to internal development has been an important strategic advantage over the years. Systems Development members continue to serve as project leaders for numerous on-going development teams that include representation from all areas of the organization. These teams manage the continuous improvement that allows the organization to continually become more efficient and react to the changing business environment. As a result of these efforts, the Systems

Development team made 620 code modifications this year. This commitment to continuous improvement and increased automation has been very important as the organization reacts to the impact of budget reductions.

An example of the organization's ability to adapt quickly to change was the successful implementation of the cellular telephone service program this year. The implementation relied on the adaptation of a significant portion of the ATLAS management systems, including Work Order, Call-detail Management and Billing. Developers and users worked together to successfully adapt the ATLAS tools that allowed the organization to implement this plan quickly and efficiently.

Several significant improvements were made to ATLAS billing systems this year. The first was the implementation of "minimum amount-due" bill-generation functionality. Bills are not generated for account balances less than a determined amount. This functionality increases organizational efficiency, reduces operating costs, and improves customer relations. Another improvement in billing made this year was the introduction of yearly, bi-annual, and quarterly billing in order to provide greater flexibility to meet customer needs.

Significant improvements were made throughout the ATLAS system in the areas of Work Order, Billing, Purchase Order, Budget, Cable Plant Inventory and Materials Inventory. These changes increased organizational efficiency and system integrity and met the organization's changing needs. Call-detail management application were modified and developed to support research and pilot project testing for next generation voice systems as well as providing enhanced traffic engineering analysis tools.

### *System Integration*

ATLAS is tightly integrated with a number of systems within the organization, throughout the university and among the organization's business partners. This year, integration with the organization's critical NEMISYS network management system was

improved to support communication between NEMISYS trouble ticket management system and the ATLAS repair work order system resulting in improved repair workflow.

Improvements were also made in ATLAS integration, with both Banner and the university directory systems, improving efficiency and accuracy in data sharing and reducing the reliance on secure information such as the social security number. Additionally, the organization's Web services were migrated to the university Enterprise Directory system. Yet another improvement was made this year in the area of ATLAS integration with university facilities information. Address updates made to the University Capital Design and Construction facilities information are now imported nightly into ATLAS, which greatly improves the timeliness and accuracy of the 911 emergency information as well as the organization's network infrastructure inventory.

#### *E-Business*

A key component of the ATLAS system is the [cola.cns.vt.edu](http://cola.cns.vt.edu) Web site. This site serves as a customer portal that provides electronic access to bills for departments, and provides account and service information for students. It also acts as the primary service provisioning tool for students. This year, functionality was added so that students could establish Wireless LAN service via COLA, improving both organizational efficiency and customer care.

#### *Economies of Scale Support Growth*

The organization's commitment to in-house development has also allowed it to quickly and effectively integrate new organizations into the Network Infrastructure & Services family and the ATLAS system. During the past several years, the organization has integrated Mail Services, Printing Services, Video Broadcast Services (VBS) and the Virginia Tech Operations Center (VTOC) into its ATLAS system. This year, budget management support was added for these organizations and inventory support was added specifically for the VTOC. Additionally, messaging functionality and a Web-based scheduling view were added to the VBS video teleconferencing management system. A printer/copier management application was developed for printing services. Also, management support was provided for Printing Services' Digital Storefront system.

#### *Supporting University Safety*

Members of the Systems Development group as well as representatives from Telephony Engineering and Network Administration teamed with the Virginia Tech Police Department to define, procure, plan, and support a new 911 system. Analysis and design included the ATLAS client's name and location database integration as well as telephony interface design. Additionally, improvements were made in the 911/Emergency Call-

detail Trace application to better serve the VTPD as well as some areas of the VT Operations Center.

*Systems Administration; Focus on Security*

A significant component of the organization's in-house development philosophy is the commitment to securing the organization's information and systems infrastructure. A key advantage to the internal development decision is the ability to choose more secure platforms and operating environments as opposed to being constrained by market trends and availability.

This year, the Systems Development and Administration team continued improvements in UNIX system security including research and use of new security tools and methodologies. The group is actively involved in national and global security organizations such as SANS (System Administration, Networking and Security, [www.sans.org](http://www.sans.org)) and CIS (Center for Internet Security, <http://www.cisecurity.org/>). This team manages approximately 47 UNIX systems supporting Oracle database servers, Web servers, application servers, network management systems, domain name servers, call-detail polling systems, LDAP servers, and file servers. The Systems Development team continues to be very responsive to patch application, applying numerous patches every day.

A key accomplishment this year was the implementation of "ipfilter" firewall software on Solaris machines, dramatically improving security. Also, many improvements were made in system monitoring tools including both operating system and database monitoring. Numerous aging machines were replaced, including several Solaris machines that were replaced with more cost-effective Linux/FreeBSD systems. The organization's Veritas NetBackup system was upgraded and moved to newer hardware. Improvements in disk mirroring methods led to significant improvement in system recovery procedures.

Important progress was also made in the area of Windows systems administration. All eligible remaining Window 95/98 users were migrated to Windows 2000 and moved into the Hokies Domain. Centrally managed group policies were implemented to administer and automate system patch application, enforce system inactivity lockout rules, and apply strict security and auditing rules. Additionally, a system log (syslog) server was implemented.

In an effort to reduce resource consumption in the Information Systems Building computer machine room, Unix and Windows servers were migrated to rack systems. Considering the number and importance of the systems being moved, this was a very complex endeavor and the end result was a transparent migration of services.

### *Calendaring and E-mail Consolidation*

The organization's Systems Administration group successfully migrated the Meeting Maker calendaring function to the new university standard of Exchange/Outlook. The team successfully migrated the majority of the organization's email functionality to Outlook at the same time in order achieve administrative economies and provide users with an integrated e-mail and calendaring solution.

### ***Network Administration***

Within Communications Network Services, the Network Administration (NA) group works very closely with Operations, Telephony Engineering, and Software Development. Network Administration consults with peer institutions throughout the country on telecommunications administration with special attention focused on operations, system design, maintenance, system integrity, legislative/regulatory issues, and resale of student telecommunications services. NA maintains ongoing and regular contact with other higher education telecommunications administrators nationwide.

NA continues to provide information to other higher education administrators about the services Virginia Tech provides, policies and procedures CNS has implemented, our rates, the impact of regulatory issues on our campus, multiple vendor services, and billing. Some of the schools Network Administration assisted this year include George Mason University, University of Virginia, Radford University, Georgetown University, Longwood University, Penn State, Duke University, the University of North Carolina, and Ohio State University

The Network Administration group also reinforced its relationship with peer institutions by representing Virginia Tech at ACUTA Conferences and Seminars, the EDUCAUSE IT Policy Conference in Washington DC, NET@EDU and a Gathering of State Networks in Tempe, Arizona.

Network Administration also assists in developing relationships with both the university community and the local community at large. Projects completed this year with the Virginia Tech Police Department should result in more efficient handling of emergency telephone calls and result in enhanced campus security with improvements to the "Blue Light" Emergency Phone System. Network Administration also works extensively with the multiple vendors who provide the university with telecommunications products and service, as well as with state agencies to resolve problems, provide consulting services, and to develop productive, efficient, "partnering" relationships.

Network Administration also provides information to other higher education institutions and the state's Virginia Information Technology Agency (VITA) about new services being offered by vendors that have the potential to save money and/or provide greater

functionality to both the state and the university. The Network Administration group also regularly consults with Verizon, VITA, and other telecommunications vendors that provide services to the University, to maintain open lines of communication and to ensure efficient resolution of service and billing problems.

Network Administration oversaw the implementation of multiple university network changes this year to save the department money in the provisioning of telecommunications services. Most of these changes have been implemented and will result in ongoing savings of approximately \$205,000 annually. Network Administration also managed the implementation of a new cellular services contract that, for many customers, enhanced service coverage and improved price performance. This was a joint effort that involved the cooperation and collaboration of many groups throughout CNS.

Other projects currently include the investigation of voice-over-IP (VoIP) technologies, ongoing work with vendors to decrease costs and improve service, the development of traffic engineering tools, and the development of alternate plans for routing of traffic in the event of a loss of vendor services. Network Administration continues to conduct research and work with manufacturer and service provider representatives to understand what is possible with wireless technology and how it may complement and supplement the existing wireline infrastructure on campus.

Network Administration also ensures that Network Infrastructure & Services is aware of state and federal regulations governing telecommunications and ensuring compliance with those regulations. They function as the university's primary resource in the investigation and interpretation of FCC and SCC regulatory activity that may impact current and future services.

Network Administration is also the primary resource to protect the university from fraudulent use of its telecommunications network on a local, national, and international level.

### ***Business Operations***

Communications Network Service's Business Operations group is comprised of the Business Services, Ordering and Provisioning, and Public Relations units. In addition to caring for users' daily requests for service or support, Operations provides administrative guidance and fiscal oversight for a variety of projects.

### **Key Projects**

*Cable Television Programming Contract* – The university's five-year cable television educational and entertainment programming contract was renewed at the end of June 2003. To develop and distribute a request for proposals, Business Operations scheduled



and facilitated an orderly review of existing services and end-users' desires. The new contract allows the university to maintain close control of cable television programming costs over a period of five years, to maintain educational programming, to diversify the types of programs offered, and to add several new channels requested by the campus community. The new contract resulted in no need for new university capital investment in the cable television system.

*Cellular Telephone Services* - Network Infrastructure and Services added cellular telephone services to the array of telecommunications service offered. A "Wireless Fulfillment" team, comprised of staff from Communications Network Services' Ordering and Provisioning, Network Administration, and Business Services groups, defined and documented cellular service requirements.

Service factors:

- Order process for cellular service plans, equipment, and/or accessories
- Internal work flow including Interdepartmental Communication Request (work order) requirements
- Vendor interaction, expectations and invoices
- Directory listings
- Support needs for new customers and those of existing Verizon customers to be converted to the new contract
- Service charges to departments for cellular services were consolidated university-wide
- Cellular equipment receiving reports management

*Pager Services* - A new vendor was selected and awarded a contract for university paging services.

*International Mail Courier Services* -At the request of the University Mail Services Manager, Business Operations evaluated vendor proposals for the Mail Services International Courier Service Request for Proposal (RFP). The resulting contract will ensure availability of reliable, cost-effective international mail courier services to the university.

**Business Services**

The daily operations of the Business Services unit encompass administration and accounting of telecommunications accounts for university departments, university administration, on- and off-campus students, as well as outside agency customers of the university-owned telecommunications system. Accounts payable and accounts receivable are also managed for Communications Network Services, the Blacksburg Electronic

Village, Video Broadcasting Services, University Printing Services, and University Mail Services.

Key facts:

- Applied university and state accounting principles to ensure consistency and audit compliance across the \$23 million Network Infrastructure and Services budget.
- Processed approximately 7,000 invoices totaling approximately \$13,800,000.
- Processed 3,000+ Network Infrastructure & Services purchase orders.
- Processed 32,000+ telecommunications users' service changes (activations, deactivations, and fund changes).
- Generated more than 100,000 invoices with over \$18 million in billable charges.
- Set up 484 electronic funds transfer requests for telecommunications service users' accounts, reducing day-to-day operating costs.
- Completed 10,700+ work orders.
- Consistently met or exceeded the State and university prompt-pay expectations for Communications Network Services, University Mail Services, and Video Broadcasting Services.

*Bill-Generation Efficiency* - In conjunction with CNS Systems Development and Administration (SDA), Business Services helped design, test, and implement an application of "minimum amount-due" bill-generation functionality. Bills are not generated for account balances less than a predetermined amount. This feature increases organizational efficiency, reduces operating costs, and improves customer relations.

*Work Order Process Improvement* – Systems Development and Administration and Business Services proposed and implemented a procedure to streamline the work order process by adding a 'service code' drop down menu to the ATLAS Work Order module. Several additional modifications were implemented in the ATLAS enterprise information system, including changes to the workflow process, the management system, and documentation—improving productivity and efficiency.

## **Other Projects**

Business Services contributed to numerous other internal and external projects and provided advice for the enhancement of ATLAS Enterprise System services, which yielded improvements in CNS' business model.

Key factors:

- Developed and implemented the *Office of the University Bursar–Network Infrastructure and Services Memorandum of Understanding* to enable local processing of Network Infrastructure & Services' Accounts Receivable.

- Pursued approval of and implemented several amendments to the Siemens telecommunications switch contract.
- Updated the Business Services Accounts Receivable Operating Procedures Manual and developed a Business Services Accounts Payable Operating Procedures Manual.
- Implemented a promotional campaign to encourage participation in the Electronic Funds Transfer (EFT) program.
- Co-developed, tested, and implemented an application for students to register for Wireless LAN services via the Customer On Line Access Web site.
- Expanded management of university departments' access to their CNS, University Printing Services, University Mail Services, and Video Broadcasting Services bills via the Web.
- Developed the FY 2001-2002 Business Services Year-End report

*Student Telecommunications* - As Network Infrastructure and Services' primary point of contact for students, the Student Telecommunications office staff provides an effective, efficient, and friendly atmosphere for their student clients. Being centrally located, Student Telecommunications staff also fields and supports numerous questions and inquiries from non-students.

Two key services managed by the Student Telecommunications (ST) staff are the "Customer On Line Access" (COLA)—Web-site order processing service and the Student Telecommunications Automated Information Express (STACIE)—an interactive voice-response telephone system that enables student customers to access account and services information around the clock via telephone.

*New Student Services Building* – Student Telecommunications (ST) participated in planning for the new Student Services building. This included coordination with the University architect, locksmiths, builders, and other building tenants to ensure that the new ST offices efficiently support the requirements of our clients and employees. The ST office relocated from Burruss Hall to the new Student Services Building in January 2003.

*Student Orientation* - With the assistance of the Hokie Passport Office, Student Telecommunications distributed postcards to the incoming freshmen during Orientation in July. The postcard and a follow-up e-mail served as a courtesy reminder for students to visit the COLA Web-site to register for campus telecommunications services prior to their arrival on campus for the Fall semester.

## **Ordering and Provisioning**

Ordering and Provisioning (O&P) serves campus users' requirements for telecommunications design, consulting, and support needs. O&P supports more than 230 Virginia Tech departments—tailoring Communications Network Services' offerings to meet their telecommunications needs and enhance productivity. Over 10,600 work orders

were processed during FY2002—2003, an 8.39% increase over the previous fiscal year. This year, our 39,000th work order was processed via the ATLAS system, which was first deployed in 1999.

#### *Key projects*

*Reynolds Homestead* – Ordering and Provisioning consulted with staff and helped develop the specifications for procurement of a new telecommunications system resulting in significant annual savings to the Reynolds group.

*Edward Via Virginia College of Osteopathic Medicine (EVVCOM)* – The Edward Via Virginia College of Osteopathic Medicine Building was completed in July of 2003, and opened its doors for the Fall semester 2003. Ordering and Provisioning coordinated with EVVCOM staff to prepare them to effectively use the array of telecommunications services installed in their new building. This involved on-site training, liaison support with the local telephone company, and implementation of an automatic call distribution group feature.

*College of Veterinary Medicine* – Ordering and Provisioning coordinated with the College's Information Technology director to convert existing 10baseT Ethernet connections to 100baseT connections throughout the college. These connections are widely dispersed and are billed to many different cost centers, necessitating complex system design and order-processing logistics. O&P teamed with Field Engineering to ensure that billing responsibility for each conversion was assigned to the appropriate staff in the various cost centers.

*Cellular Telephone Service* - Approximately 275 work orders were processed as part of our new cellular phone service offering. Ordering and Provisioning guided the collaboration with other Communications Network Services groups to develop cell phone procedures to effectively handle the implementation of this new process. O&P functions as the main point of contact not only with university users, but coordinates with the Virginia Information Technology Agency, as well as AllTel, U. S. Cellular, and other vendors.

*On-line Interdepartmental Communications Request* – The Web-based availability of the On-line Interdepartmental Communications Request (OICR) coupled with electronic storage of user-submitted OICRs enhances the speed of work-order completion and assures maintenance of accurate data. After completing work for Wireless Local Area Network or Modem Pool services, users receive an automatic e-mail confirmation.

*Continuous Process Improvement* - Ordering and Provisioning's continued commitment to improving workflow, management and documentation of projects, as well as

developing communications and team-building, has resulted in more effective workflow management.

## **Public Relations**

The Public Relations (PR) unit ensures the smooth flow of information between Communications Network Services (CNS) and users of the university's telecommunications services. PR professionals in the CNS Reception Area, Web/Documentation, and University Switchboard groups support CNS's users, vendors and representatives from outside agencies each day. One example of Public Relations' support is responding to a student's special telecommunications assistive technology need by providing a voice-message-printing Telecommunications Device for the Deaf, or TDD.

To provide for dissemination of accurate and timely information, Public Relations is closely involved in the development, piloting, and implementation of CNS services. PR's internal and university-wide information campaigns leverage a wide array of information media including "The Spectrum", the CNS public and internal Web services, university-wide email lists, the Virginia Tech cable television informational scroll, and other outlets. PR also provides presentations and conducts discussions on topics of special interest to users, and is a primary contact for matters concerning Internet-based copyright and fair use.

### *Key projects*

*"Strategic Technology Infrastructure for Regional Competitiveness in the Network Economy" Report* - Writing of this multi-volume report was expedited and facilitated by posting drafts on an internal Web site for review and comment. During the course of development, several drafts were submitted each day for various sections of the eleven-volume report. Each draft was punctually posted to the internal site, with a confirming e-mail to the development group, enabling collaborators to immediately access, review and provide comments on the latest version. The process required multiple daily updates to the project Web site and much communication with collaborators. The timely completion of the finished product was enabled by this support.

*Support SANS Institute Seminar* - The SANS (SysAdmin, Audit, Network, Security) Institute conducted a three-day workshop on security at Virginia Tech in March. CNS's Public Relations manager presented a "birds of a feather" discussion on the topic of Internet copyright infringement complaints handling. The session saw a lively discussion and was well received.

*Special Telecommunications Needs* – Public Relations provided support to the CNS Cable Television Request for Proposal development and review team that successfully established a new television programming contract.

*Interdepartmental Coordination* - The CNS Public Relations Manager functions as a liaison between the department and other university departments, groups, and offices. He developed and implemented the 2003 Residential & Dining Programs (now Student Programs) Memorandum Of Understanding, which provided a wider array of cost-effective telecommunications services to the university's summer conference clientele. For the first time, the Memorandum addressed the entire complement of residence halls.

*Outreach and Special Support* - The Public Relations manager functions as a key point of contact at CNS for special needs. This included attending Diversity Training for Trainers in preparation for being a presenter for the 2003-04 academic year and serving as an ex officio representative to the Board of Directors of the Educational Media Company @ Virginia Tech.

Key input was provided to Information Systems & Computing (IS&C) Middleware team that developed the “MY.VT.EDU” Web-based portal. PR also provided extensive input to and collaborated with the IS&C Web Application team responsible for developing and producing the university’s “computing.vt.edu” Web resource. The PR manager continued to support the university’s Americans with Disabilities Act Executive Committee and represented CNS at the University's "Town Meeting" held in Cassell Coliseum, concerning the beginning of the Iraq war.

Other outreach includes attending the Town of Blacksburg’s unveiling of “BlacksburgALERT”, a new emergency notification system that sends coordinated emergency and alert information to multiple communication devices simultaneously. Virginia Tech was represented at a collaborative workshop of Virginia colleges and universities held at Virginia Commonwealth University concerning Internet copyright infringement policies and procedures.

### ***University Printing Services***

Printing Services has continued to provide the university community with quality printing service, supplies and support over the year, and has successfully adapted to new printing technologies and customers’ needs.

During 2002, Printing Services deployed hardware and software that enable faculty, students, and staff, regardless of their physical location, to submit jobs with customizable options through Printing Services storefront Web site. Customer volume for this technology is expected to steadily increase through the next year.

Printing facilities have been converted from older film-based services to newer, digital equipment and technology by installing computer-to-plate equipment. This eliminates the less efficient analog plate process, and is a more forgiving process, since files can be edited before output to plate. This represents a cost reduction mechanism for the university, is more reliable and has better quality than the analog process, and the new equipment motivates employees to learn new skills.

In addition to serving customer needs in a timely manner, Printing Services has expanded to accommodate many different types of customer needs, from digital printing to expanding copy center facilities and equipment to meet higher demand.

*Copier Management Program (CMP)* – A particularly effective achievement was the creation of the Copier Management Program (CMP). The CMP is a three-way approach, addressing management of agreements with a copier vendor, serving as liaison between the copier vendor and university departments, and providing cost savings to the university. Additionally, while most leases require a monthly base cost per machine plus a cost per copy, with the CMP, the department only pays for the number of copies that are made. And, because of the agreement, vendors are obligated and motivated to provide service in an appropriate and timely manner, which ensures that Printing Services can then pass that enhanced level of service on to the customer.

In terms of cost-effectiveness, the CMP allows for just one monthly invoice to be provided to the university for processing by Printing Services, instead of the one-invoice-per-copier method used in previous years by the Controllers Office. This new program is projected to yield overall savings to the university of \$800,000 in the first year.

The CMP now provides an online tool for departments to order service and supplies directly from the Printing Services Web-site. Service requests are sent directly to REMEDY, a database-driven trouble-ticket system that notifies Printing Services when a service call is needed on a specific copier or other printing equipment. Supply requests are generated through an online form that passes departments' requests through an email system to Printing Services employees, who then quickly process the orders.

### ***University Mail Services***

University Mail Services is a two-unit entity, composed of Campus Mail, which processes department mail, and Residential Mail, which handles student resident mail. Campus Mail delivers departmental mail to more than 290 stops a day from all university departments located in Blacksburg, including satellite centers such as the College of Veterinary Medicine, the Math Emporium, and the Virginia Tech Corporate Research Center locations. University Mail processes approximately 100,000 mail items every month.

Residential Mail is responsible for delivering mail and distributing notices for packages to approximately 9,300 students living on-campus. Residential Mail serves students through the use of five staffed mailrooms on campus. Increasing adoption of technological advances has enabled students to receive even incorrectly addressed mail, and the speed at which mail is now processed, even at increased volumes, is enhanced by using automated systems where possible.

University Mail is serviced by vendors DHL, UPS, and the United States Postal Service (USPS). Network connectivity has allowed more efficient use of Mail Services resources and has established an online departmental billing system by leveraging the capabilities of the ATLAS enterprise management system (See ATLAS herein). The online billing system has automated transactions between university departments and University Mail, saving departments and the university paper and printing costs.



# **Research Computing**

## Research Computing

Virginia Tech's System X ("System Ten") officially ranks 3rd fastest supercomputer (in the world) on the 22nd TOP500 ([www.top500.org](http://www.top500.org)) List released November 16, 2003 and the SC2003: Igniting Innovation conference.

The project was a collaboration between the College of Engineering and Information Technology. The project:

- was built in less than three months. Typical design and build process for this class of computer is on the order of 1-2 years.
- is the world's most powerful and cheapest homebuilt supercomputer.
- cost \$5.2 million, including systems, memory, storage, primary and secondary communications fabrics and cables. The price tag represents about one-tenth of the average cost of a supercomputer of this class.
- represents a departure from monolithic mainframe supercomputing and uses a less-expensive but reliable configuration. The design consists of a 64-bit InfiniBand cluster using existing, off-the-shelf industry components.
- was created by a team of engineers, computer scientists, and officials from Virginia Tech working with partners: Apple Computer, Cisco, Liebert, and Mellanox Technologies.
- uses 1,100 of Apple's new Power Mac Dual 2 GHz G5 computers.
- runs on the Mac OS X operating platform.

The supercomputer is housed in the AISB data center. It has 3 MW of power (1.5 MW added), with redundant with backup UPS and diesel generator, and 2+million BTUs of cooling capacity using Liebert's extreme density cooling. This system uses rack-mounted heat exchanges with R-134A refrigerate and an overhead chiller unit. It

- uses Mellanox™ InfiniBand semiconductor technology to supply the primary communications fabric, drivers, cards, and switches for the project.
- was selected Cisco Systems to provide the Gigabit Ethernet switches for the secondary communications fabric to interconnect the cluster.
- represents hundreds of volunteered hours of Virginia Tech faculty, staff and students to help set up the 19.25 tons of computers, routers, and other equipment.
- uses the first comprehensive solution to the problem of transparent fault tolerance, which enables large-scale supercomputers to mask hardware, operating system and software failures—a decades old problem. It is a software program called *Deja vu*, designed by Srinidhi Varadarajan who also integrated the software with the Apple's G5s. This work will enable the terascale computing facility to operate as the first reliable supercomputing facility.

# **Secure Enterprise Technology Initiatives**

## **Secure Enterprise Technology Initiatives**

In July 2003, the Secure Enterprise Technology Initiatives unit was formed within Information Technology. The mission of SETI is to develop secure applications, middleware and interfaces to support the University's computing and network services, and to work with the IT Security Office to enforce security standards that preserve privacy while seeking a balance between system usability and system security. We will conduct research and deploy initiatives that exploit leading-edge technologies to enhance the ability of our users to interact securely with new and existing computing and network services.

The core group in SETI is Internet Application Development.

### **Portal Project**

My VT – in January, the first significant overhaul of the University Portal since the introduction of Campus Pipeline was deployed. My VT provided single sign-on integration with Filebox, web discussion forums, standards-compliant channel aggregation and end user extensive customization. Faculty, staff, students, and alumni each have their own default layouts. A portal to facilitate the activities of the Virginia Tech's Board of Visitors was also introduced. Both portals are based on version 2 of the open source uPortal framework. My VT has been deployed as a high availability service, with production portal services offered from three identical Intel-Linux servers running in a load balanced environment.

- SSO – A new version of our locally developed Web single sign-on framework was introduced with the new portal. This version offers a customization interface within the portal called “My Security” that allows users to determine which portal-integrated applications they wish to access via single sign-on, and which they do not.
- My Library – A new portal tab was developed with representatives from University Libraries. The tab offers direct, interactive access to a number of key library services, and is integrated with the IT-provided Web proxy servers (see next item) to provide better access to off campus users of library resources.
- Proxy Service – IT purchased and installed a pair of Intel-Linux servers and licensed a product called EZProxy to provide portal-integrated access to article databases and ejournal subscriptions offered by University Libraries. These highly available servers provide this access to all members of the University community through the My Library tab, once they have logged into the My VT portal.

## **PKI Infrastructure**

- Research computing pilot – provided a number of digital certificates for small cluster maintained by the computer science department.
- Established VT CA – Established a root Certificate Authority for Virginia Tech. Created a subordinate CA to issue certificates that will be required by the enterprise directory infrastructure, and later will be able to issue certificates for encrypting Web transactions (SSL certificates). Developed a Certificate Policy statement to guide management of the root and subordinate CA's.

## **Enterprise Directory (ED) Project**

- Registry – Designed and implemented a master repository for identity and authorization information for all members of the Virginia Tech community. Implemented a messaging infrastructure to keep this repository in sync with the enterprise business system (Banner) in real time. Developed mechanisms to support account and service provisioning from the registry. Developed mechanism to push updates to LDAP directories that support specific functions.
- ED-Lite – Designed and implemented a new schema for general “directory” white pages data. Implemented an LDAP-compliant highly available directory service that can be queried directly, via an e-mail or LDAP client or Peoplesearch, or through other Web applications by using the XML Peoplefinder API.
- ED-Auth- Designed and implemented a new schema for authentication, limited authorization, and account states for VT PIDs. Implemented a secure, highly available LDAP-compliant authentication service for campus applications and provided Java libraries to developers that could be used to convert existing applications. Worked with departments to convert some key applications including Blackboard, Banner Web for (Hokie Spa, Hokie Plus, etc), Filebox, My VT, and other applications.
- My ID – Developed a comprehensive, Web-based identity management console for end users that provides access to PID attributes such as password, e-mail settings such as forward address and aliases, and general identity information stored in the enterprise directories.
- Name Arbiter – Built a tool that unifies all the disparate namespaces used by core enterprise applications that have the ability to maintain distinct user account information, including Active Directory, the campus mail server, the enterprise directory, and other affiliate directories (e.g. VCOM). This prevents ID collisions between systems, thereby increasing security.

## **University Payment Gateway**

UPG – The first phase of the UPG was developed to support the Board of Visitors' requirement that former students be able to electronically request copies of their transcripts. The UPG is a layer of abstraction between Web applications and payment processing solutions such as Touchnet. Any registered Web application could implement a published API for the UPG if it needed to support E-commerce. The UPG protects payment information that greatly reduces the potential for identity theft. The UPG is designed so that it is relatively easy to add additional payment types such as e-checks.

## **Active Directory (AD)**

- Hokie Self-service – Developed and deployed a Web-based tool that allows end users to convert contact accounts to full-fledged Hokies accounts in the Active Directory. The tool also allows users to change some information associated with their Hokies account (such as password), to join organizational units, and to obtain personal file storage on the NAS.
- Daisy – Developed and released a new version of an automated Windows OS patching tool.
- Other AD tools/utilities – Developed several other tools to enhance the management and security of the Active Directory. OU Admin is a Web-based delegated organization unit administration tool for IT staff across the university with AD-related responsibilities. Synopsis is a server event-monitoring tool that uses a client-server model to collect and report on events from multiple servers. Tripinator is a companion tool to the commercial TripWire product that provides sophisticated reporting and workflow to facilitate monitoring of changes to server filesystems. Both Synopsis and Tripinator automate important tasks associated with monitoring servers for potential break-ins.

## **Other SETI Projects**

- The IS&C Disaster Recovery Plan was updated to reflect the current servers and services in Information Technology. Representatives from all units of the IT organization participated and contributed ideas to the new plan. Scheduled and unscheduled power outages in the Andrews Information Systems Building gave staff members opportunities to exercise portions of the plan.
- A task force is being formed to explore ways to better secure computing and network resources across the University. Representatives from all IT units will collaborate to exchange ideas, to identify methods of securing systems and resources, and propose new initiatives in security. The goal is to provide the most secure environment possible while maintaining privacy and required functionality.

# **University Information Technology Security Office**

# **University Information Technology Security Office**

The IT Security Office has three operating entities – the IT Security Office, the Security Laboratory, and Information Resource Management (IRM). This report is in a format that shows the accomplishments for each of these within their annual reports.

## **IT Security Office**

The mission of the Information Technology Security Office is to provide technology tools, education, awareness, and guidance necessary for Virginia Tech 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:***

- Work closely with all Information Technology departments, Internal Audit, and other security personnel to define models of plans that can be implemented by departments as appropriate to help make a secure computing and network environment.
- Work with university security personnel to ensure educational and promotional programs are made available to the user community.
- Provide technology tools that will help make a secure environment available for specific security personnel and university departments.
- Provide guidance to university departments in security related issues and risk management as they relate to the specific information technology environment.
- Utilize opportunities to review innovative approaches to solving problems related to areas of security and risk management.
- Maintain a central web site that can be used as an informational tool and provide university users access to security-based tools for use at the departmental level.
- Work with other university security personnel to evaluate current policy, and recommend updates and appropriate policy as necessary.
- Provide the Office of the Vice President for Information Technology with plans and needs for a secure environment.
- Coordinate Business Impact Analysis/Risk Assessments and Business Recovery Plans for Information Technology departments, and assist as needed with areas identified as critical University systems.
- Provide assistance to University departments for the Business Impact Analysis/Risk Assessment process as needed, and maintain a copy of all for reference. Assist departments as needed for any Business Recovery Plan for their specific area(s).



- Oversee the IT Security Laboratory and Information Resource Management (IRM), and work to get them necessary resources to carry out their missions.

### ***Major Accomplishments and Ongoing Activities***

#### **Education and awareness**

- Continued to provide security presentations as invited to groups and departments.
- Participated in all Faculty Development Institute sessions during the spring and summer of 2003.
- Assisted orientation leaders in developing appropriate presentation for the new student orientation held during the summer.
- Presented security session at new foreign students orientation and a training session for new GTAs. Also participated in graduate student orientation fair, College of Engineering freshman orientation, and had the opportunity to speak to a new faculty.
- Enhanced the security web site with new links and access to security tools for all users.
- Assisted in hosting professional security-related programs on campus for both technical and non-technical personnel.
- Used publications, both locally and on the national level, to promote security issues within higher education.
- Hosted visitors from other higher educational institutions on our campus to view what is being done for security.

#### **State and Federal interactions**

- Helped in formulating a State organization with JMU, UVA, and GMU call VA SCAN (Virginia alliance for Secure Computing and Networking). Web site can be viewed at <http://www.vascan.org/> - See more details below.
- Have worked with the SANS Institute on educational opportunities for high education, and with the Center for Internet Security on tools and possible training programs.

#### **Business Impact Analysis/Risk Assessment (BIA/RA)**

- Oversaw the process for the Information Technology organizations – four (4) separate BIA/RA reflect the organizational structure in IT.
- Worked with some individual University departments on updating their risk analysis. Also reviewed several risk analysis and recommended appropriate changes.
- Made some minor modifications to the risk analysis forms and updated to the security web site.
- Started preparing to coordinate departmental risk analysis' for year 2004.

## **Virginia Alliance for Secure Computing and Networking (VA SCAN)**

VA SCAN is a collaboration among four Virginia universities - James Madison, George Mason, the University of Virginia, and Virginia Tech. Additionally, the alliance incorporates such resources as JMU's Commonwealth Information Security Center, GMU's Center for Secure Information Systems, and the joint GMU/JMU Critical Infrastructure Protection Project (CIPP).

The purpose of VA SCAN is to:

- Strengthen security programs across Virginia higher education institutions with the integration and availability of field proven tools, best practices, and personnel resources from VA SCAN partners.
- Link existing models and knowledgebase with security research, instruction, and federal/state government initiatives.

The services provided by VA SCAN include:

- Security instructional materials and on-site training.
- Consulting in the forms of an "ask the expert" email service and on-site consulting engagements on a variety of security topics.
- A web-based toolkit of security tools and best practices.
- A self-assessment checklist for Commonwealth of Virginia security standards.

The benefits of the program include:

- Reduces security training costs.
- Information available by VA SCAN will reduce the likelihood of breaches and the consequences if they do occur.
- Takes advantage of economies of scale.
- The exchange of new concepts, practices and tools.

This development will support the strategic goal domain of *Outreach*.

- Progress will be measured as VA SCAN becomes a more broadly used resource by the Commonwealth and its agencies.

The VA-SCAN project members received the 2003 Governor's Technology Silver Award at the 2003 COVITS conference.

## ***Business Plan – IT Security Office***

### **I. Education and Training**

- A. Improve and expand the security awareness programs for the following groups:
  - a. Faculty
    - i. Utilize new faculty orientation through the Provost Office
    - ii. Work with Personnel Services to include in any orientation programs
    - iii. Continue to work with FDI to ensure information is included in their sessions
    - iv. Invite all faculty to information sessions to be held during year
  - b. Staff
    - i. Work with Personnel Services to include in orientation for new employees
    - ii. Invite all staff to information sessions to be held during year
  - c. Students
    - i. Continue to meet with student orientation leaders during their training period
    - ii. Work with orientation leaders to include more education in the new student programs
    - iii. Continue to look at ways to “inform” the new student population to security issues
    - iv. Continue to provide orientation sessions to select groups: such as foreign students, specific colleges, graduate students, etc.
  - d. Off-campus students/personnel
    - i. Investigate how security issues can be incorporated into the distance learning environment
    - ii. Determine students and employees that are covered in this category
    - iii. Determine if policies apply in the same manner
    - iv. Develop plan to reach these individuals with same type of information
- B. Work closely with other groups to determine needs for special security training programs in the general campus community (this would primarily involve the technical training). This might include training for areas such as specific operating systems, network issues, and such.
- C. Develop an outline and determine a schedule to publish an online “User Handbook”
  - a. Provide information about the general user community
  - b. Provide linkages to important information – for example, State and Federal laws, how to be a responsible computer user, and information about exposures that are threats
- D. Where a user can find services and tools to help provide a secure computing environment
  - a. Utilize other resources at Virginia Tech to assist in the general education and training

- b. Special speakers
- c. Videos
- d. Vendor opportunities
- e. Professional organizations (such as SANS)

## **II. Information Technology Business Impact Analysis/Risk Assessment Process**

- A. Responsibility for annual business impact analysis/risk assessment in Information Systems.
  - a. Assemble business impact analysis/risk assessment team leaders in November to begin process
  - b. Obtain completed documents from IT departments and assemble report adequate for auditors
  - c. Review with IS management early in the calendar year
  - d. Updates should be done mid-year and at the end of the calendar year
- B. Maintain the business impact analysis/risk assessment template and monitor the departmental process
  - a. Provide updated tools to complete a departmental business impact analysis/risk assessment
  - b. Provide necessary education and assistance to departments
  - c. Serve as a "collection agency" for departmental business impact analysis/risk assessment – this will only be done every 2-3 years (next collection in 2003 or 2004)
  - d. Work with Executive Vice President's Office to secure all business impact analysis/risk assessment
  - e. Provide ongoing tools and training for departments
- C. Work with Internal and State Auditors to comply with State requirements
  - a. Set up regular meetings with State Auditors when they are on campus
  - b. Submit reports as requested on issues monitored by this office
  - c. Work with Internal Auditing on issues that involve IS areas

## **III. Coordinate the IT Business Recovery Plan and assist Critical Systems areas**

- A. Review the current BRP to determine where and how updates need to be done
  - a. Maintain the necessary copies of the BRP (making sure at least one is secure)
- B. Work with the critical systems areas to make sure they have updated Business Recovery Plans
  - a. Call on responsible individuals in each area to ensure they have reviewed and update plans
  - b. Provide assistance as needed to meet all regulations
  - c. Investigate the development and implementation of a test plan for a specific number of Business Recovery Plans each year (the number of recovery plans

tested each year will need to be determined after the test has been designed and resources are determined)

- d. Determine which areas will be tested with goal of doing 3-4 each year (this would have each plan tested about every 3 years).

#### **IV. Maintain the security web page (<http://security.vt.edu>)**

- A. Ensure the web page is easily accessible for all users
  - a. Get a link to security web page off of the VT home page so it can be easily found
  - b. Include information about web page in any educational offerings and publications
- B. Keep the web page up-to-date and publicize it throughout Virginia Tech
  - a. Monitor links from Security web page to ensure they are operational
  - b. Promote the use of web page (for links, templates, information, tools, etc.) to the entire University community
  - c. Regularly look for new links that will provide the users with helpful information and tools
- C. Work with other State institutions to share and coordinate efforts for web sites
  - a. Set up a state-wide group from higher education for security related issues in IT
  - b. Coordinate efforts and share tools used for security concerns
  - c. Look for opportunities at State-level meetings to share information

#### **V. Review University policies/procedures and consider necessary changes**

- A. Acceptable Use Policy and related materials
  - a. Ensure the Acceptable Use Policy (AUP) reaches all students, and that all faculty and staff are aware of the contents -- promote-promote-promote
  - b. Present the concept that all users be required to sign off (electronically) on the AUP before they can proceed with any processing – this may also need to be considered for other policies
- B. Consider new policies and procedures that are needed with the changing technology environment.

#### **VI. Develop appropriate publicity campaigns/efforts to stress security concerns**

- A. Develop a plan and work with other offices to promote security products and practices at Virginia Tech.
  - a. Establish a contact in specific user groups.
  - b. Incorporate plans into the awareness and education efforts for this office.
- B. Use various materials and techniques to promote proper use of technology
  - a. Utilize the catalogue for students to highlight special issues

- b. Consider the faculty and staff catalogues for security materials
  - c. Design, publish, and distribute posters to emphasize issues and safe computing
  - d. Develop and produce videos on specific security issues
- C. Look at what tools can be used to promote technology security issues
  - a. Consider articles in Collegiate Times and other student publications
  - b. Consider articles and other promotional materials for entire university community
  - c. Discuss the use of pamphlets for distribution to a wide range of users
  - d. Utilize the security web page and consider other web pages that might reach constituents
  - e. Conduct sessions on campus to bring awareness to security issues
- D. Utilize resources in the various areas of the institution
  - a. Instructional technologies and the remote learning
  - b. University Libraries
  - c. Department heads and administrative leaders
  - d. Student orientations and special student programs

## **VII. Develop and Improve Security Efforts with Other IT Offices**

- A. Work with other areas within the IT organization to develop and improve security efforts both internally and within their specific mission. Areas to be considered are:
  - a. Instructional Technologies
  - b. Distance Learning
  - c. Communications Network Services (ANI&S)
  - d. Information Systems & Computing

## **IT Security Lab**

The VA Tech Computer Incident Response Team (VT-CIRT) has been recognized internationally for its work in incident response, system administration training and its work with the Center for Internet Security (CIS), SANS Institute, NSA and FBI. The CIS and the SANS Institute were the sponsors of an initiative to create a testing facility that would determine the security settings of “Network Appliances”. These devices include computers, laser printers, parking gates or any device that is capable of communicating over the Internet. In general, these devices are shipped to customers with minimal security installed and consequently, these devices were used in small scale Distributed Denial of Service (DDOS) attacks at various sites around the country. Management has agreed with the CIRT that a testing facility would be of benefit to VA Tech’s Information Systems initiatives. The laboratory was created on 10/1/01 in 1300 Torgersen Hall.

The laboratory's mission:

Design, develop and implement training materials, classes (in-person and online) to University technical and general users.

Coordinate all technical and general user security issues under the direction of the Virginia Tech Information Technology Security Office.

Test computer hardware and software for security vulnerabilities and provide guidance for addressing these vulnerabilities.

### ***Scope***

All VA Tech affiliated personnel and organizations, State and Federal government agencies and national and international entities.

### ***Project Goals***

1. Technical Education
  - a. Develop and provide computer security guidelines for VA Tech system and network administrators.
  - b. Develop and provide Information Technology Acceptable Use training for general users (faculty, staff and student) with the cooperation of the University Information Technology Security Office.
  - c. Develop and conduct system administration, computer and network security training classes (in-house and online) for system and network administrators within and outside of the University. This includes professional organizations, conferences, state and federal government agencies.
  - d. Coordinate computer and network security training classes and material with distance learning initiatives at the academic and continuing education levels.
  - e. Develop marketing strategies to "sell" computer and network security to the general user community.
2. Computer Incident Response Team and Security Initiatives
  - a. Coordinate and manage all security initiatives with Information Systems & Computing in coordination with the University Information Technology Security Office. Define guidelines and procedures for the six phases of Computer Incident Response: preparation, detection, containment, eradication, recovery and follow-up.
    - i. Coordinate response to system and network attacks
    - ii. Coordinate with external CIRTs.
    - iii. Maintain and manage VA-CIRT.

3. Academic Instruction
  - a. Assist the Electrical and Computer Engineering (ECE) Department develop system administrator intern program.
  - b. Assist the ECE Department in teaching graduate level Computer & Network Security Fundamentals course.
  - c. Serve as adjunct faculty for graduate level Computer and Network Security course. Provide online materials for computer and network security distance learning classes.
  - d. Provide guest speakers for undergraduate and graduate level classes offered by University colleges on computer and network security topics.
4. Security Testing and Certification Laboratory
  - a. Serve in partnership with the Center for Internet Security (CIS). The laboratory is the testing site for certification of compliance of vendor security software with CIS benchmarks.
  - b. Develop methodology for testing security of network capable devices such as printers, data acquisition devices, modems, environment control systems, and medical equipment.
    - i. Create security guidelines for these devices
  - c. Develop methodology for testing security of Unix, Linux, Windows 2000, Windows XP and Macintosh systems.
  - d. Develop and implement forensic kits for Unix and Windows systems.
  - e. Develop and update computer and network minimum security benchmarks for Unix, Windows, Apple and network devices.
  - f. Work on security initiatives with the SANS Institute, FBI, Center for Internet Security, NSA, Federal and State agencies.
5. Professional Society, training conferences
  - a. Provide speaker to local, state, regional, national and international conferences on computer security issues.
  - b. Host regional and national security conferences and seminars for peer organizations.

### ***Major Accomplishments and Ongoing Activities***

#### **Technical Education**

- Co-authored book “Computer and Network Security in Higher Education”, edited by Educause. This is Vol. 8 of their leadership strategies series.
- Worked with the SANS Institute to “donate” 3 days worth of instructor time for seminars on Active Directory Security, Freeware Security Tools, and Computer Forensics. Had 100 technical personnel from Virginia Tech attend, as well as 200 from other institutions in the US – all at no cost.



- Assisted Wayne Donald in Faculty Development Institute security presentations, as well as other presentations during the summer (including several faculty and student orientations).
- Provided technical security seminars with University Leadership for various University departments.
- Completed a 3-day security seminar for CE on securing Solaris.
- Guest lecturer for College of Business undergraduate and graduate courses on Electronic Commerce, IT Auditing.
- Guest lecturer for Mathematics Department graduate cryptography course.

### **Computer Incident Response Team and Security Initiatives**

- Participated on the response team and assisted other Information Systems personnel in determining appropriate problem responses.
- Completed a draft that provides detail procedures for the response team.
- Reviewed and provided input on the State's Information Technology Security Standard.
- Have participated on a committee with security personnel from GMU, JMU, and UVA on the creation of VA SCAN.
- Created the Dshield www site to provide early warning capability to campus system administrators. The Dshield project accepts firewall and security logs from campus systems on a voluntary basis. The project will be expanded to include data from other Virginia institutions.

### **Academic Instruction and Research Support**

- Taught a graduate security class last semester for College of Engineering. Also work with undergrad and grad students doing independent studies.
- Member of a working committee with ECE, CS and Business departments to help VA Tech apply for the NSA Center for Academic Excellence (CAE) in cybersecurity.
- Helped ECE develop a robust computer and network security course plan for graduate students.
- The lab is providing space and equipment support for 4 graduate research theses in ECE and CS. The research topics are:
  - Investigating the Effects of Attacks on Handheld/PDA devices (ECE)
  - Developing a Visualization Tool for IDS (CS)
  - Using biological techniques (epidemiology) to predict and model computer attacks using Dshield data. (CS)
  - Modelling Attack Taxonomies (CS)

## **Security Testing and Certification Laboratory**

- Established the testing lab in 13000 Torgersen Hall. It was created with 16 machines (Linux, W2k, AIX, Solaris, Mac), workbench tools, and printer support.
- All new versions of the Center for Internet Security (CIS) tools are being tested in the lab before release.
- Have tested vendor security tools at the request of the vendor. Vendor products by Symantec, Bindview (twice), NetIQ were tested and certified for CIS compliance.
- Secured a contract with Tripwire that includes several “perks” for Virginia Tech (heavily discounted and research opportunities).
- Purchased security scanning software from Securelogic that will be evaluated as a proactive vulnerability scanning tool.
- Involved in the CheckNet project with CNS and ECE departments. The CheckNet is an isolated network that will be used to scan newly connected systems for common vulnerabilities. If the system fails, it remains isolated from the main VT network until the vulnerability is removed.
- Hired 2 graduate students who developed computer forensic kits for use in investigating computer break-ins. We used one of the kits to retrieve deleted log files on a hacked library system.
- Reviewed and tested personal firewall software configuration guidelines.
- Provide an on demand vulnerability scanning service.
- Helped design Project Hydra IDS in the machine room. Hydra collects IDS logs and provides the data for analysis.
- Moved the lab from 3210 TORG to 1300 TORG.

## **Professional Society, training conferences**

- Given talks at various conferences around the country – ACUA, SANS, NMIA, SecureWorld Conference, FISSEA and Naval Weapons Lab.
- Provided instruction at various SANS conferences, including one in Japan.
- Gave a security presentation to Secretary of Technology during his visit to the Tech campus.
- Spoke to the Secure Virginia Panel (twice) at the request of President Steger about technology security issues.
- Gave presentation to VA Attorney General on Identity Theft (twice).
- Taught pre-conference seminars for Educause Regional conferences in Baltimore, MD, Orlando, FL and Atlanta, GA.
- Gave a presentation to IT staff at Mary Washington University on IT Security Techniques. This was part of the VA-SCAN project.
- Gave a security presentation to the IT staff and upper management of Longwood University.
- Presented lecture on IT security to the Fairfax County Public School IT department.

- Gave a security presentation to the Air Force Material Command at Scott AFB, St. Louis, MO.
- Gave 3 presentations on computer security to members of the E-Danville project.

## **Information Resource Management**

Under the direction of the IT Security Office, Information Resource Management (IRM) 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***

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

### ***Major Accomplishments and Ongoing Activities***

#### **IRM Office**

The IRM Office and associated functions have undergone major changes during the past year.

- The staff has been reduced to two (2) full-time individuals
- It is now recognized as a production office responsible for user identifications at Virginia Tech – it will oversee all aspects of the production environment.
- The office will continue to have the goals listed above and will be involved in defining access and enforcing rules for Virginia Tech resources

**Public Key Infrastructure (PKI)**

The IT Security Office and associated entities (including IRM) will be involved in the production environment for the Certificate Authority (CA) service that provides digital certificates to securely sign documents, secure transactions, and protect identities. The service is the main component of the university's new public key infrastructure (PKI), a system of digital keys assigned to computer users to verify identity. When PKI is widely deployed, it will increase security and make it possible to use digital signatures in situations where a written signature is required today.

**Enterprise Directory (ED) Project**

Very involved in all aspects of this project. It replaces many systems that have been in place for years and has been (and will be) major changes for the user community. IRM will continue to be involved in defining needs and testing systems prior to production. IRM will head a technical group to meet weekly during implementations.

**Consultation**

One of the important responsibilities for IRM is to provide consultation to other groups (within IT and beyond) on user access issues. IRM has done this during the past year with Banner and other administrative applications, as well as with those defined above.

## **Units reporting to the Office of the Vice President**

## **Strategic Partnership Initiatives**

One of the key projects in the Strategic Partnership Initiatives is the eCorridors Program.

### **eCorridors Program**

In late March 2003, the eCorridors Program released the output of a year-long series of studies on issues surrounding the investment and development of strategic telecommunications infrastructure for communities. This series of reports entitled "Strategic Technology Infrastructure for Regional Competitiveness in the Network Economy" and packaged in 11 Volumes, is available at no cost via pdf download or at cost for printed copy at <http://www.ecorridors.vt.edu>. The studies utilized the Southside and southwest Virginia regions as a model for a low-cost Geodesic Mesh network design and viable financial model that could be replicated in any region of the U.S. The overall premise of the studies is that investment in advanced, "next generation" telecommunications infrastructure is an essential and achievable component of a region's economic development and quality of life.

An Executive Summary of the 11 volumes is also available.

### ***Volume Titles and Descriptions***

Volume 1: "Rationale, Environment and Strategic Considerations" – introduces the overall rationale, regulatory and political issues associated with Virginia Tech's "Strategic Technology Infrastructure for Regional Competitiveness in the Network Economy."

Volume 2: "Connecting the Regional Infrastructure to National and International Networks" – explains that the maximum value of infrastructure in a locality is a function of who and what that network is connected to, both locally and externally.

Volume 3: "A Fiber Optic Infrastructure Design for Southside and Southwest Virginia" – utilizes the Southside and Southwest Virginia regions, counties, and cities to specify detailed optical infrastructure designs for each of these localities in order to demystify the technical choices to be made in developing an optical infrastructure and the considerations related to topology and routing.

Volume 4: "Fiber Optic Infrastructure Design Guide" – serves as a guide for use in applying the infrastructure design concepts contained in this report as a replicable model. Much of this material was previously provided to the Southeastern Universities Research Association for its Optical Networking Cookbook ([sura.org](http://sura.org)).

Volume 5: “Financial Feasibility and Investment Rationale” – discusses why critical network infrastructure is not available in rural areas, demonstrates that public intervention in such cases is rational and reasonable, and provides specific “return OF investment” scenarios for the Southside and southwest Virginia regions.

Volume 6: “Leveraging Advanced Optical and Ethernet Technologies” – makes the argument that by leveraging some of the most advanced Ethernet and network technologies it is possible for special interest entities to create special purpose networks that fully leverage the proposed optical infrastructure at reasonable cost for health, education, research, and/or specific private sector purposes. It provides a technical analysis of the advantages, limitations, and management issues related to utilizing Ethernet technologies in wide area networks.

Volume 7: “Speculative and Alternative Technologies” – discusses some of the currently hyped technology choices that are available for communities to develop experimental projects for first mile access to the home or business. It also identifies several alternative deployment techniques that have the potential to effect deployment costs.

Volumes 8-11: “Community, Applications and Services” – discusses ways in which communities, citizens, and businesses can leverage the benefits of advanced network infrastructure for the public good. These studies also identify the types of information and detailed descriptions necessary to develop anchor tenants and applications to leverage publicly enabled developments of regional and local network infrastructure.

### ***Other Activities of the eCorridors Program in 2003 Included:***

Establishment of the Wellness Village concept. This is a collaborative effort with the Department of Marketing to assist communities in developing and implementing health-related network applications for utilizing broadband network infrastructure.

Continued development of a GIS database. The eCorridors team, led by John Nichols and leveraging the GIS tools provided by the Advanced Infrastructure and Services group, is continuing to develop and enhance a large-scale GIS database of network and utility resources of Virginia regions and communities. This database will be useful in the ongoing efforts of eCorridors and other outreach organizations of the university in helping communities to assess what resources are available to them in terms of infrastructure and how the topology and geography impact the types of network service they may wish to consider for their community.

Presentations and assistance to communities. The eCorridors team continues to receive requests from communities to attend technology committee meetings to assist with their technology assessment and planning efforts.

# **Planning and Administration**

## **University Computing Support**

The mission of University Computing Support (UCS) is to provide end-user technical support for students, faculty, staff and other Virginia Tech affiliates. UCS is comprised of four lines of business: Help Desk, Desktop Support, Student Services, and Software & Testing.

This report consists of four parts:

- I. Direct support of Information Technology services, which details the support given directly to users;
- II. Security dimension, which details the proactive, reactive, and instructive role UCS plays in securing desktop computers;
- III. Accessibility, which describes the activities of UCS to ensure that applications and services are accessible to as many users as possible regardless of physical disabilities;
- IV. Testing and development, which summarizes projects to provide infrastructure support to UCS as well as a direct testing service to other IS&C developers and departments.

### ***I. Direct support of Information Technology services***

University Computing Support provides technical assistance to university affiliates through several programs under the 4Help brand name. These programs include Get Connected, Residential Computer Consulting, the helpdesk and Desktop Support. University Computing Support also provides assistance through a prominent presence at New Student Orientation and by developing and distributing the VTnet connection CD-Rom.

#### **New Student Orientation**

New Student Orientation (NSO) provides new students and their families with answers to their many questions about the students' upcoming move to campus and what to expect from the university experience. University Computing Support provides information during NSO regarding the student computer requirement. In July 2003, UCS spoke with approximately 13,202 students and parents.

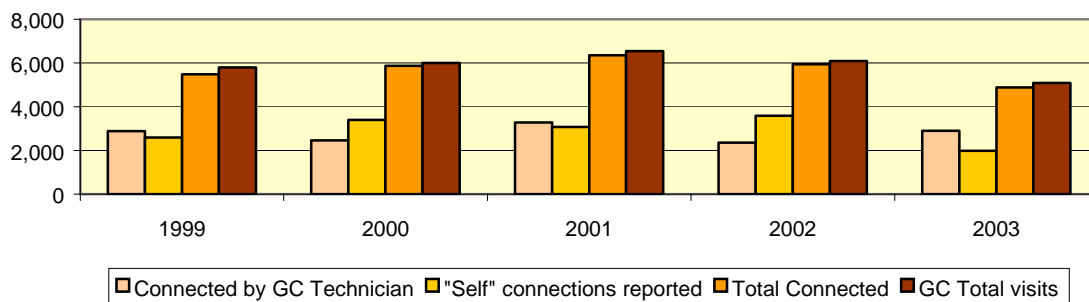
Also at NSO, students meet with their academic advisors to request their fall semester courses. In preparation for the academic advisor meeting, UCS works with students one-on-one, if necessary, to ensure that their PID is activated and authorized for registering



for courses online. In 2003, we worked to ensure 4,724 first year students and 557 transfer students had properly functioning PIDs and passwords.

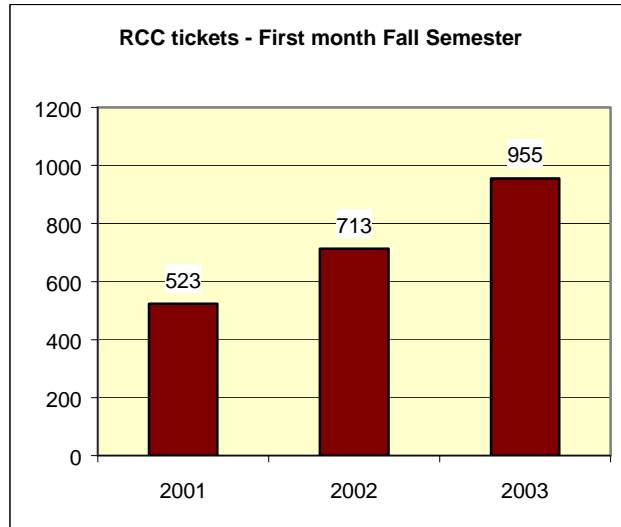
## Get Connected

The Get Connected (GC) program began in the fall of 1998 and is currently in its sixth year. GC staff work to ensure that all residence hall students' computers are connected to the campus network and that basic applications, including email and Web browsers, are working correctly by the start of fall classes. This year a reduced staff of seventy-five students, down from 100 last year, worked during the 4 days of move-in from about 10:00 A.M. to 10:30 P.M., August 20-24. Approximately twenty GC staff and twenty Resident Computer Consultants (RCCs) worked during the first two weeks of classes, completing connections and resolving problems we encountered this year with various versions of the Blaster worm.



## Residential Computer Consultants

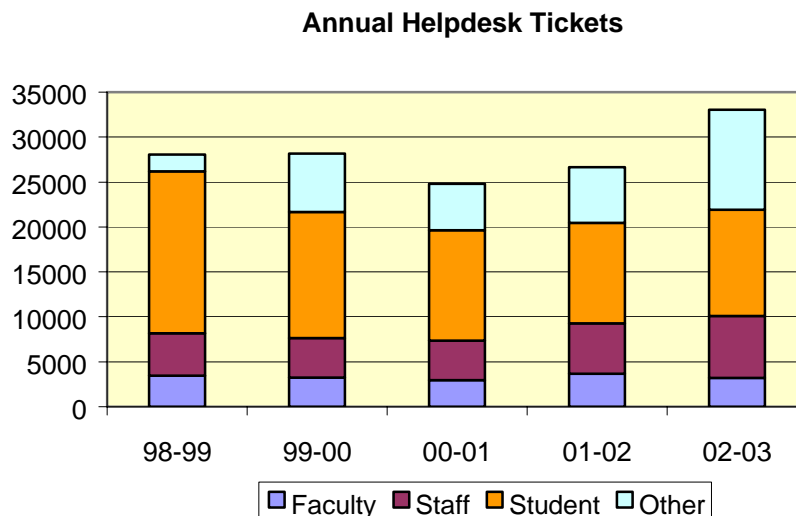
The Resident Computer Consultants (RCCs) are student computer consultants who live and work in the resident halls. The program began in the spring of 1999 and is currently in its fifth year. They provide on-site computer support and educational computer presentations to on-campus residents throughout the academic year. RCCs begin their official duty on the first day of classes for the fall semester. Fall 2003 saw a significant increase over the same time last year (approximately 35% increase).



## Helpdesk

The computer consulting helpdesk provides second-level computing support to faculty, staff, students and other Virginia Tech affiliates. (Immediate, level-one support including password resets and general system information is provided by the integrated VTOC.) Customers may be directed to the helpdesk from a phone call to the VTOC operators, by sending e-mail to [4help@vt.edu](mailto:4help@vt.edu) or by filling out the online problem submission form.

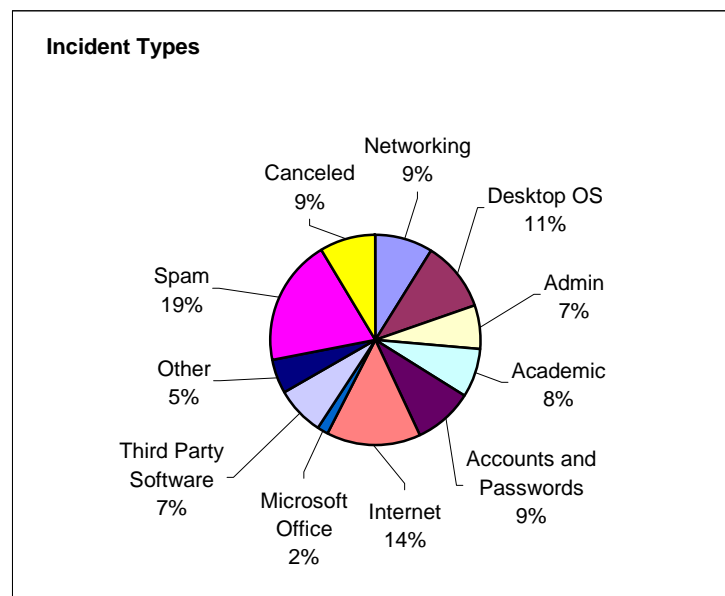
During the past year, the helpdesk moved from using the Peregrine software to Action Remedy. In addition, the helpdesk moved from being a purely callback center to directly taking client calls when consultants were not otherwise occupied.



Consultants provide assistance with Internet connectivity, Internet applications, central computing resources (such as Blackboard, HokieSPA and MyVT), e-mail, administrative systems (Banner, etc.), operating systems and many other topics. This year brought an increase in computing security issues often caused by unwanted programs that are installed when clients download free music or file-sharing applications. Because of the increasing availability of online courses through the Blackboard system, more students contacted the helpdesk about accessing class materials. Customers reported more problems with computer viruses and worms due to the release of the RPC exploit named Blaster.

Infrastructure changes to the authentication and PID generation system, the introduction of the NAS, the WebDAV protocol for Filebox, transcript requests only over the Web, and the mail server machine move with its SSL requirement also generated a large number of calls. Those, along with the Blaster worm and SoBig, plus all the virus notices generated by our own virus scanners, caused the 4Help “rush” period to start August 10<sup>th</sup>, instead of the 20<sup>th</sup>, and extend well into October. Staffing levels were reduced from last year so this change represented a massive effort by both the full time UCS staff and student consultants. Our clients frequently did not get the quick callback we would like to provide and as of this writing UCS was still too busy to resume using the ACD.

Our questions broke into the generally expected categories with the largest growing group being spam tickets. To a large degree this was due to the growing number of email viruses using a fake return email address, like the SoBig virus. Because each ticket must be opened to verify its nature, spam notices to 4Help generate considerable extra effort for the helpdesk staff.



In addition to providing direct support for users, consultants write, update, and review knowledgebase articles that are made publicly available at [answers.vt.edu](http://answers.vt.edu). Due to a shortage of staff, some of the more knowledgeable student consultants also help with testing. For example, Wade Owen did much of the preliminary testing, documentation, and training for VPN.

## **Desktop Support**

From August 1, 2002 to August 1, 2003, the Desktop Support group performed 808 on-site customer service calls. Of these, 718 were troubleshooting for faculty or staff and 90 were new Banner machine installations. In most cases, these were problems we were unable to resolve by phone or email.

## ***II. Security dimension:***

UCS has played a major role over the past year in researching, investigating, developing, testing, configuring and implementing the latest security practices and products. Our approach over the last year has been three fold:

- 1) **Reactive:** Getting a user's compromised system restored quickly, identifying the security exploit, and fixing the exploit. This situation may involve working with the Security office, [Abuse@vt.edu](mailto:Abuse@vt.edu), or campus police.
- 2) **Proactive:** Programmatically implementing specific security precautions for certain users.
- 3) **Instructive:** Developing and publishing to the university community (through the Knowledge Base and [Computing.vt.edu](http://Computing.vt.edu)) best practices, recommended configurations and job aids related to security.

Specific examples are listed below.

### **Reactive**

Procedures are in place to report security issues and restore users systems.

#### **Help Desk/Desktop Support**

- <http://answers.vt.edu/ask4help/general/vtkb1824.htm> - What to do if you are hacked.
- Created Security CD to combat the Blaster worm.
- Continually updating Antivirus web site with the latest virus information.  
<http://antivirus.vt.edu>

## **Proactive**

*Banner Machine Deployment:* In the summer of 2003, 90 PC's were deployed. The objectives of this deployment were:

- Security and standardization.
- Increased security options with W2K.
- Distribute systems with modified security policies.
- Distribute personal firewall with each system.
- Include user tutorial.
- Tested and documented system configurations.
- Standardized systems to reduce support costs.

### *VTnet*

- Norton Antivirus included.
- The Installer automatically looks for Antivirus software and if not found prompts the user to install NAV, as first step.
- Security web page is advertised as a desktop icon. <http://lockitdown.cc.vt.edu/>
- XP firewall is enabled.
- Virginia Tech's root certificate is installed for Internet Explorer.

### *Get Connected*

- Students are told about picking strong passwords during NSO and GC.
- GS staff shows students how to run Windows Updater to get latest security patches.

## **Instructive**

*Security Product evaluation and configuration:* The following KB articles have been published:

- General Firewall article: <http://answers.vt.edu/ask4help/desktop/vtkb1837.htm>
- Simple security recommendations:  
<http://answers.vt.edu/ask4help/desktop/vtkb1829.htm>
- Configuring Tripwire: <http://answers.vt.edu/ask4help/thirdparty/vtkb1807.htm>
- General Security steps: <http://lockitdown.cc.vt.edu/>

### ***III. Accessibility***

- The relocation of the UCS department to Torgersen Hall allows wheel chair access to both Help Desk and Desktop Support office and service areas.
- Our location in Torgersen Hall also puts us in close proximity to the University IT Accessibility lab to allow informal communications and collaborations on appropriate testing and support projects.
- UCS hosted two interns from the Woodrow Wilson Rehabilitation Center. Helping prepare individuals with physical disabilities for a career in IT.

### ***IV. Testing and development***

#### **Completed projects**

*Blackberry*: Configure and test wireless email device with Blackberry Enterprise Server.

*Mac Banner Image*: Creation and testing of the OS 9 and OS X image and associated software distributed with the Mac Banner machines.

*Outlook*: Testing and documenting multiple features of Outlook such as archiving, offline folder synchronization, and SSL security settings.

*POP mail clients*: Testing and documenting multiple email clients for use of SSL security settings.

*W2K Security Templates*: Development and testing of various security templates for Windows 2000.

*VTNet*: Functional testing for VTNet Development.

*W2K Banner Image*: Creation and testing of the W2K image and associated software distributed with the PC Banner machines. Includes substantial security improvements.

*WEBDAV*: Testing of the Webdrive product to replace FTP as the means of access for Filebox. Includes substantial security improvements.

#### **Current projects**

*AD security update*: Development, testing, and documentation of Active Directory security increase to refuse LM authentication.

*BlackIce*: Investigating use of this product with Window XP and exploring any possible conflicts.

*IPSec*: Investigation and testing of the use of IPSec as a desktop personal firewall/intrusion detection application.

*Entourage*: Investigation and testing of the use of Entourage as Mac interface to exchange server.

*Meeting Maker phase out*: Provide a conversion path for current users of Meeting Maker to export and import their data into Outlook exchange calendar.

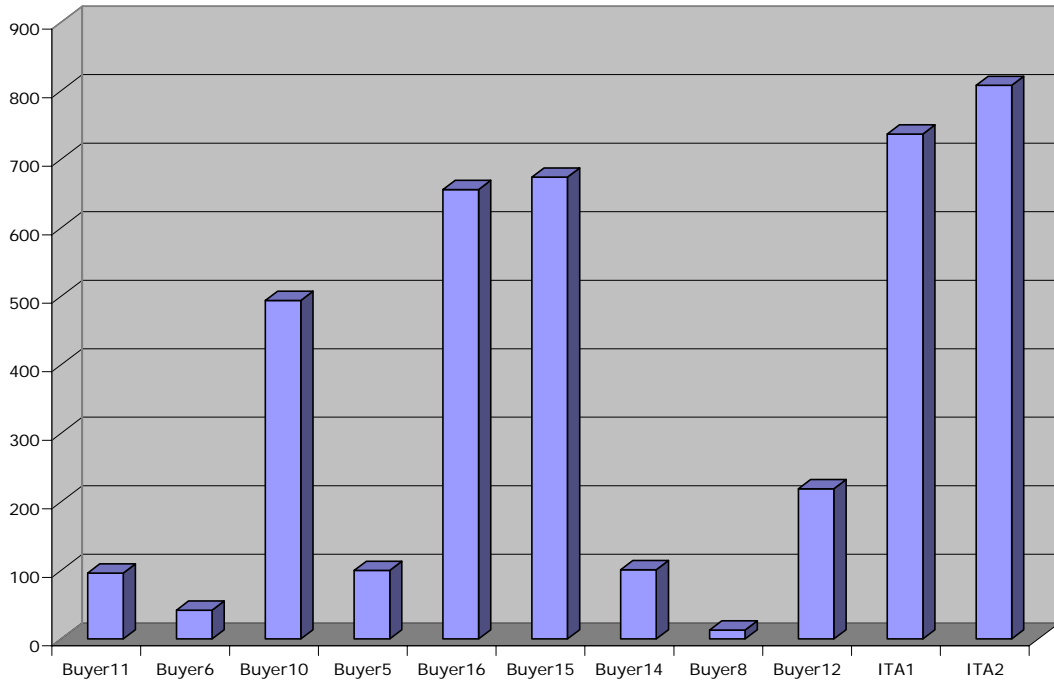
## **Information Technology Acquisitions**

FY2003 was a year of progress and transition for Information Technology Acquisitions. The year brought near record sales in the Student Software Auxiliary, implementation of new control systems and development towards new online capabilities, a revamping of ITA's web site and the expansion and contraction of free security and operating system upgrades to the campus community. It also brought organizational changes as the responsibility for maintenance of ITA's systems was transferred to Administrative Information Systems. Details of each ITA area: computer purchasing, student software distribution, and software sales to faculty and staff, are reported below.

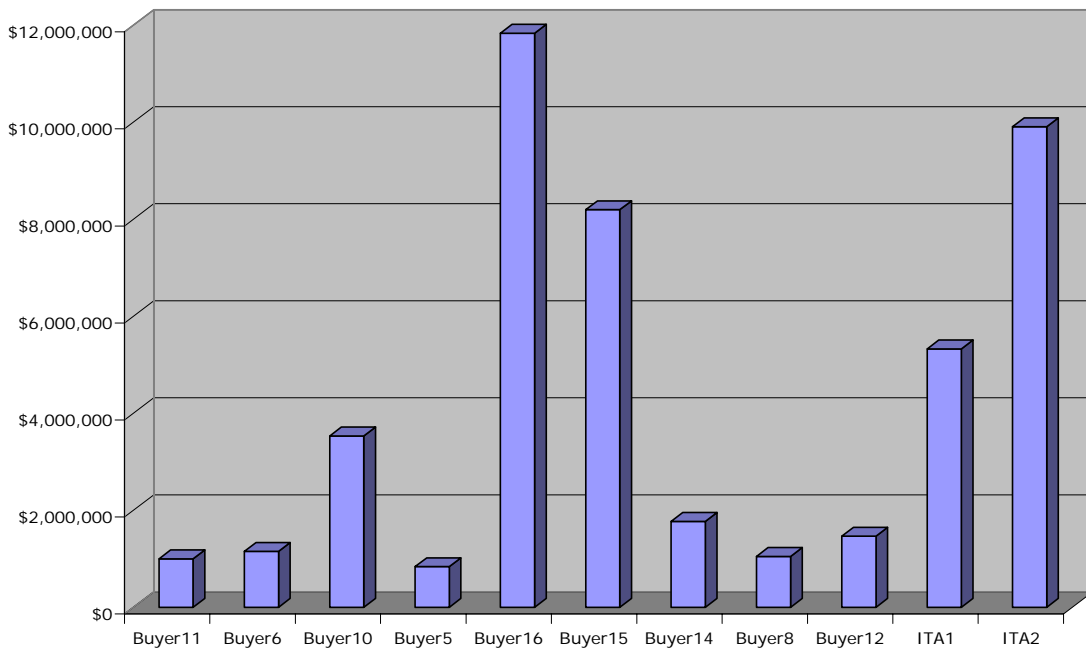
### ***Computer Purchasing***

The Computer Purchasing office issued 1545 purchasing orders and processed \$15.2 million in FY2003 accounting for 40% of the total number of purchase orders issued by the University and 33% of the total value of those orders. These numbers were down from 1770 purchase orders and \$22.8 million in FY2002 but were consistent with the percentage of total purchases for the university. This reduction is a direct result of the significant budget reductions that the university sustained in FY2003. The following graphs show the activity of the two Computer Purchasing buyers, Judy Poff and Vicky Moore, in relation to other buying staff at Virginia Tech. 75 requests for bids were issued in FY2003 to 2170 vendors giving an average bid participation of 29 vendors per bid. 79% of the bids issued in FY2003 were delivered through the ITA-developed *Bids on the Web* or *BOW* application. 17%% were faxed using ITA's automated bid faxing system and the remaining 4% were printed and mailed. In addition, all bids were posted on the state's central bid website. ITA's web based *ReqStat* utility, which provides online computer purchasing information, was heavily used by the university community during the year. Major system changes were made to incorporate Computer Purchasing's orders into orders placed through the Commonwealth's eVa system. This is an ongoing project. It may help the state consolidate purchasing information but has extended one day the average processing time for Computer Purchasing's purchase orders.

**FY2003 Purchase Orders**

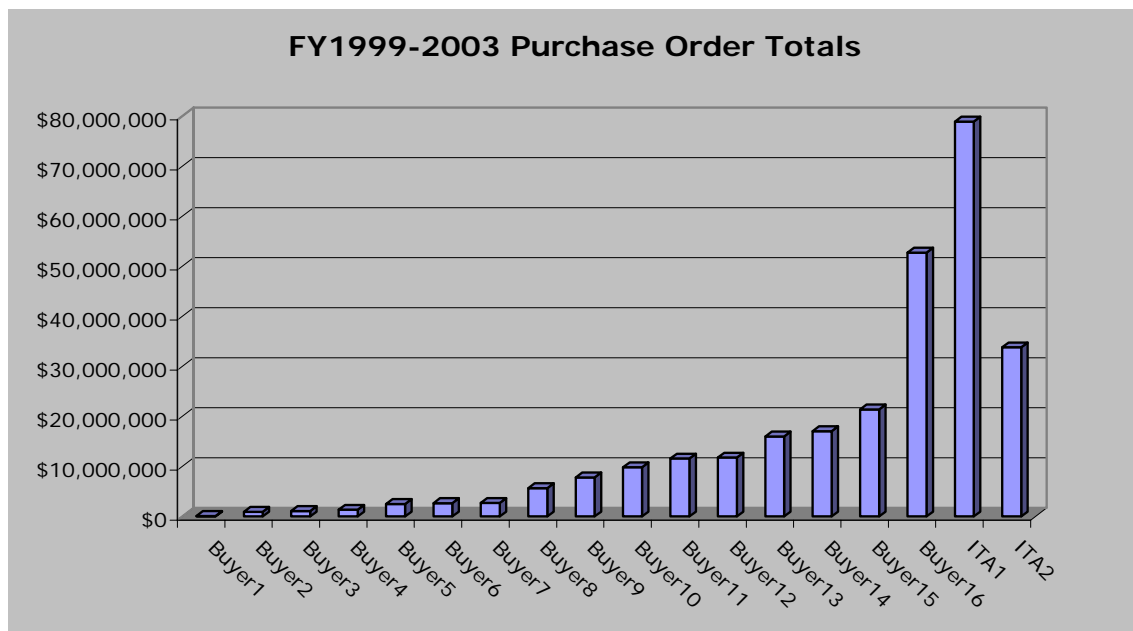
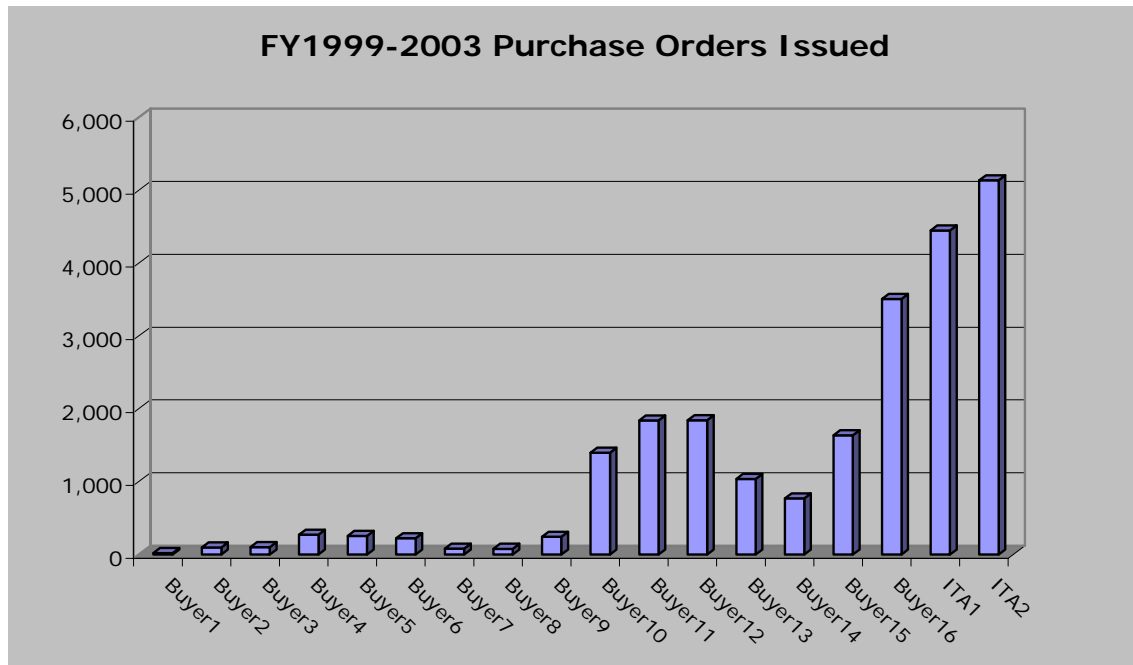


**FY2003 Purchase Order Totals**





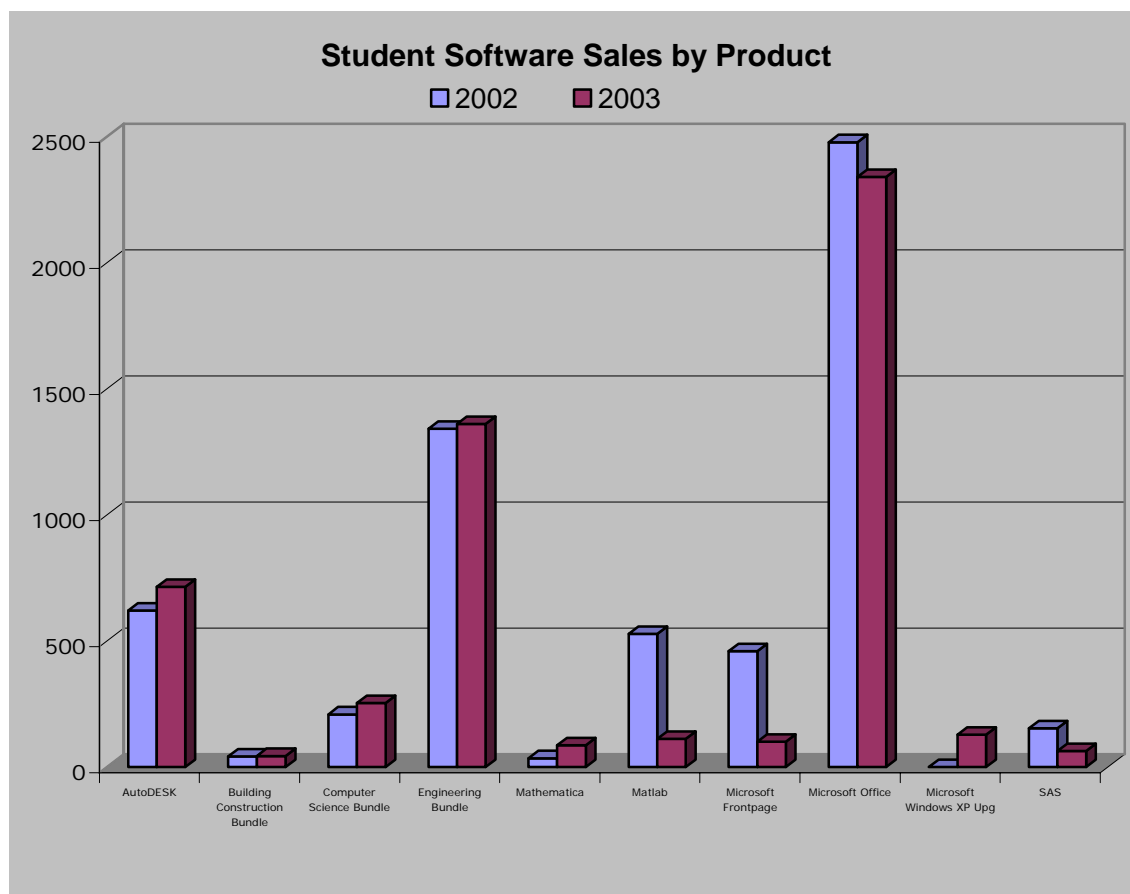
The following charts show collective buyer activity for the past four years.



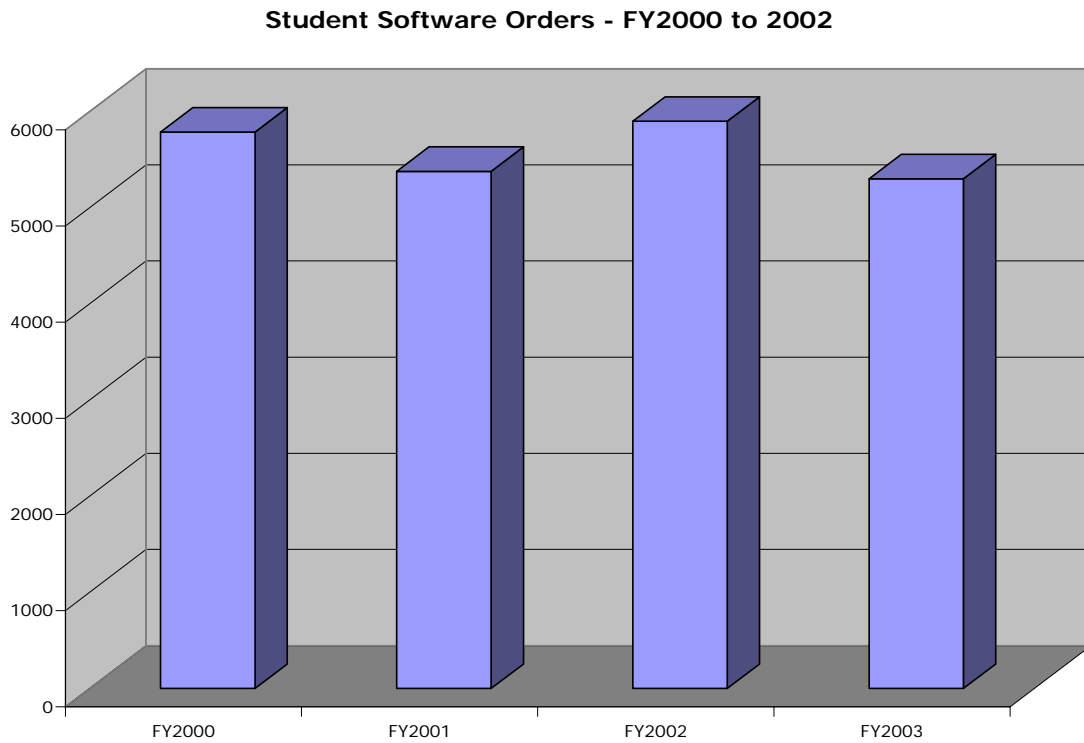
### *Student Software Distribution*

FY2003 marked the second full year for Student Software Distribution on the Torgersen Bridge. A barcode-based inventory control system, implemented in August 2001, and currently in use, provides excellent control of all student license inventory and sales. CSS or Centralized Student Services in August 2002 took advantage of the new facilities on Torgersen Bridge and refined a state-of-the art point of sale ordering and sale system developed by former ITA staff. This system and new processes drastically reduced the waiting time for students and parents during CSS last year. This year saw further wait time reductions and increased customer contact prior to point of sale through the deployment of personnel to greet incoming students and parents and guide them through the process. The Student Software Auxiliary saw a near record year of student orders and ended the year with a budget surplus.

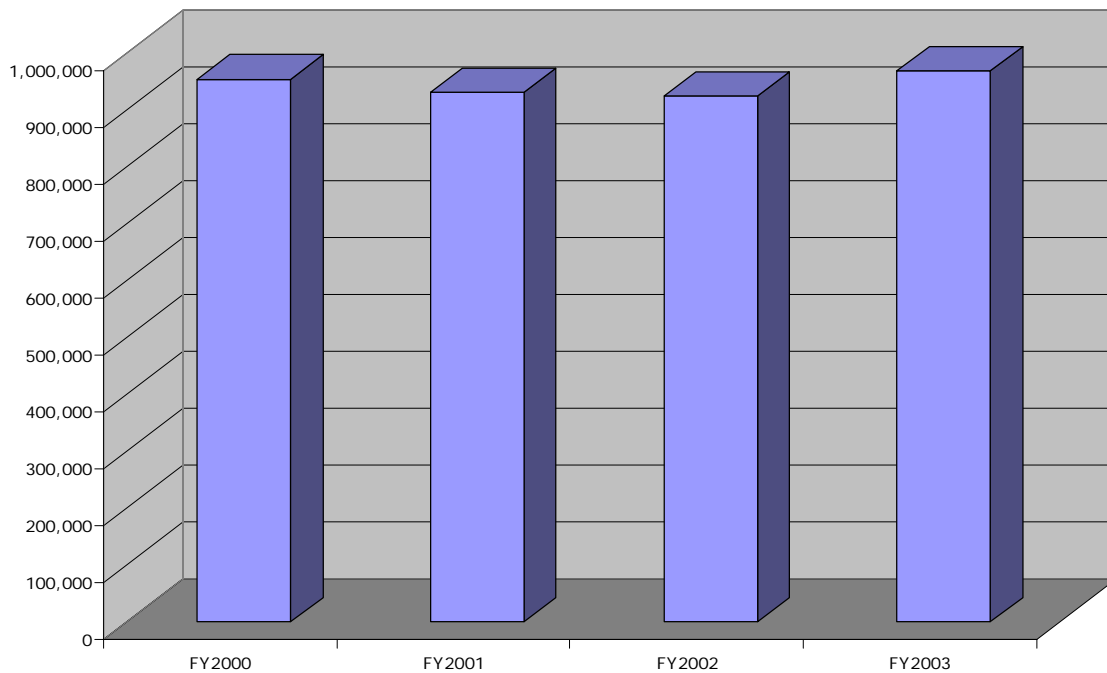
The graph below displays a count of product sales for FY2002 and FY 2003.



The graph below shows Auxiliary activity compared to previous years. During FY2003, Student Software distributed 5,299 software products and collected \$966,144 in sales.



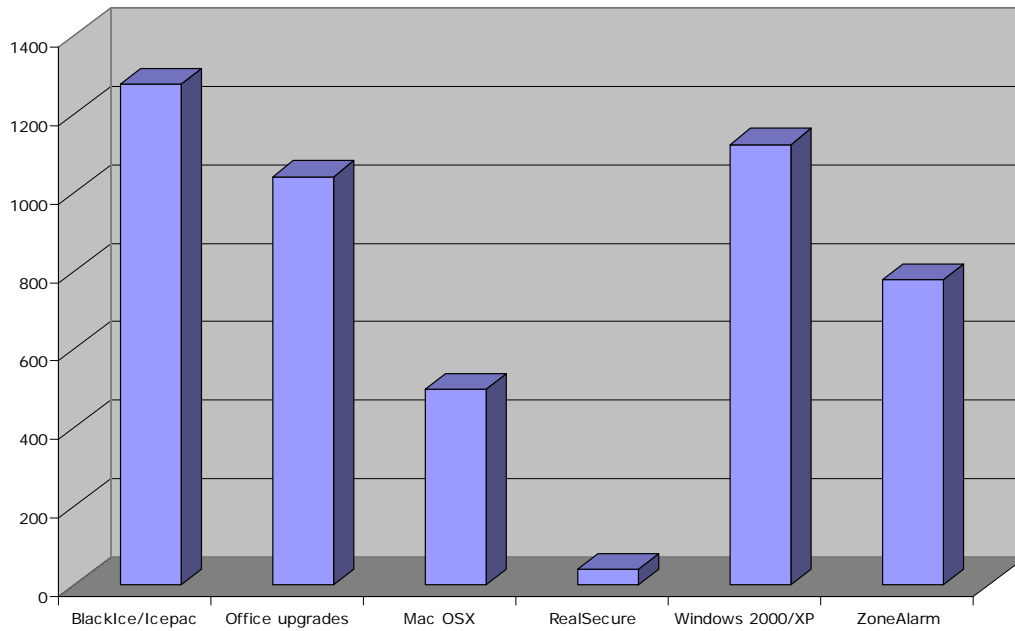
### Student Software Auxiliary Sales



### *Department Software Distribution*

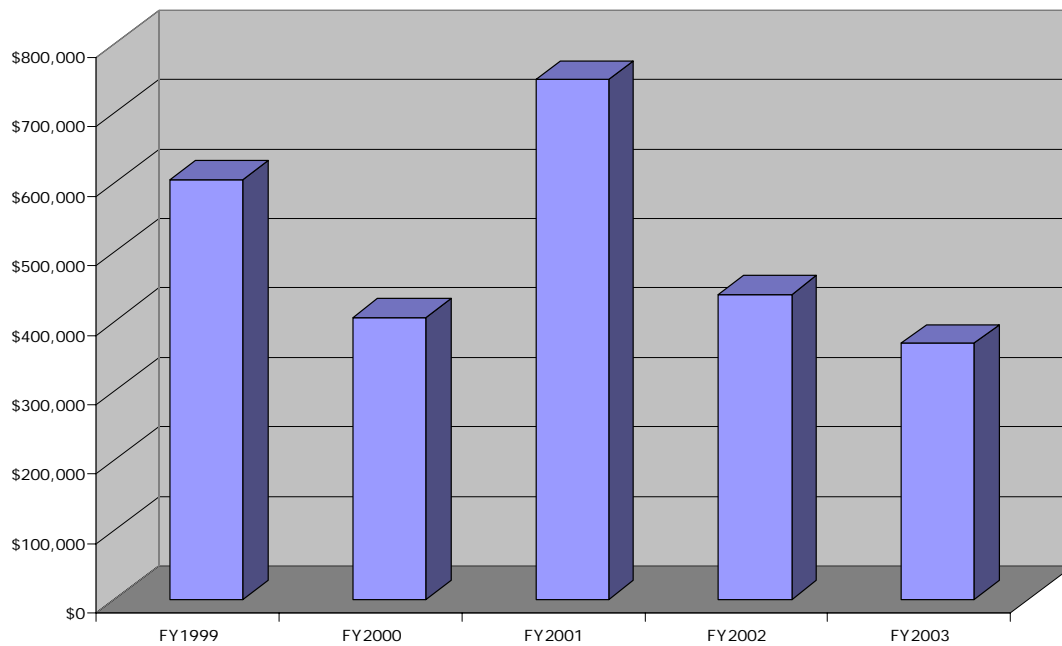
During FY2003, the Departmental Software Distribution web pages were merged into the portal, *MyVT* to reduce the visibility of these pages to non-Virginia Tech users. Two initiatives were continued in FY2003 to improve the security and functionality of computers throughout the entire Virginia Tech campus community. The first initiative provided Windows 2000, Windows XP, Office XP and Mac OSX free of charge to all campus users. The second supplied personal firewall products, namely, BlackIce Defender, ZoneAlarm Pro, and IceCap Manager and Agents, to the university community. The first initiative was drastically scaled back at year-end so only Mac OSX is free of charge. The campus community had two years to upgrade older Windows based machines free of charge. Management believed that most machines on campus are now at least operating at Windows 2000 level so the program could be terminated. Total cost of this program for FY2003 was over \$200,000. Total sales in FY2003 dropped due to two primary reasons: first, the significant budget cuts that the university sustained; and second, the decision to distribute Microsoft Office free of charge as part of the security initiative. The chart below shows security initiative licenses distributed free of charge to the campus.

**Security Initiative Software Distributed in FY2003**



Additional statistics related to Department Software Distribution are provided below.

**Faculty and Staff Department Software Sales**



### Faculty and Staff Department Software Orders

