

Virginia Tech

Vice President
for
Information Technology

Annual Report

2000 - 2001

Information Technology & Services for Higher Education
Virginia Polytechnic Institute and State University

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Mission

The mission for Virginia Tech's Information Technology organization is to serve the university community and the citizens of the Commonwealth by applying information resources to:

- Enhance teaching and learning
- Support research
- Foster outreach and develop partnerships
- Optimize administrative support

Goals

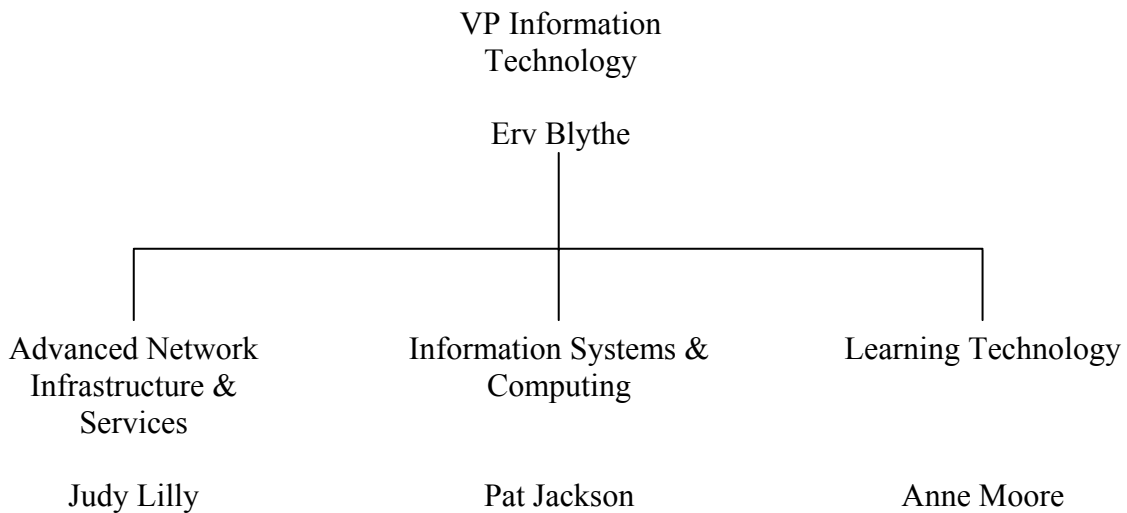
The strategic goals, which serve to focus the information technology organization, are:

- Promote systems that provide the university community with a computer environment allowing them to conduct Virginia Tech's businesses with ease.
- Leverage unique communication technology to give a competitive advantage to Virginia Tech and the citizens of the Commonwealth. Achieving a competitive advantage should not be interpreted as competing with the commercial sector.
- Promote advancements in information technology, which will encourage economic growth in Virginia's communities.
- Foster Virginia Tech's recognition as a world leader in Internet based education, to enhance access to learning, and produce and disseminate instructional material more efficiently and effectively.
- Utilize the advanced information technology infrastructure in support researchers, giving them a competitive advantage, as they strive to reach the university's top-30 research institutional goal.
- Provide leadership and direction to the Virginia Tech community in securing the university's information network and systems. Participate with state and national level organizations in developing and coordinating efforts to improve information technology security issues.
- Use the advanced information technology infrastructure to gain world recognition in all aspects of the university.

Structure

The Vice President for Information Technology, reporting to the University President, manages Virginia Tech's information technologies. The Vice President for Information Technology primary role is the University's Chief Technology Officer (CTO). The duties of the Chief Information Officer (CIO) are also the responsibility of the office, however the daily CIO functions are delegated to three line managers within the Information Technology's organization.

The Information Technology organization is divided into three major line elements, which report to the Vice President for Information Technology. The diagram below depicts the structure, consisting of the Advanced Network Infrastructure and Services division, the Information Technology and Computing division, and the Learning Technology division. Within the organization there are several auxiliaries, the largest being Communications Network Services (CNS). The Information Technology organization consists of approximately 650 salaried and wage employees.



Financial Summary

During fiscal 2001, Information Technology (Information Systems & Computing, Learning Technology, and the Advanced Network Infrastructure & Services) provided resources totaling \$44,049,430 to support university goals and objectives in the areas of academic, research, administrative, and outreach.

Information Systems & Computing provided academic, research, and administrative support totaling \$21,300,000 and Learning Technology provided academic support totaling \$5,400,000. Advanced Network Infrastructure provided telecommunications, video, data, and networking services of approximately \$14,900,000. Mail Services provided approximately \$1,700,000 in support to faculty, staff, and students.

Information Technology also operated two self-supporting units to provide specialized digital imaging and volume printing (Digital Imaging and Printing Services). Revenue and expenditures for these two entities totaled approximately \$4,729,280.

Funding to support the activities of Information Technology was provided by:

| | |
|----------------------|---------------|
| E&G | \$ 27,972,690 |
| Equipment Trust Fund | \$ 2,759,200 |
| Auxiliary Operations | \$ 13,317,540 |

Highlighted IT Individuals

Jeff Bevis

Jeff was the Director of Video Broadcast Services (VBS) when it became a division within Advanced Network Infrastructure and Services (ANI&S) in August 2000. Jeff then moved to the Research and Development group to investigate methods of distributing video over various types of networks (i.e. Voice Over IP) while maintaining a high quality of service. He worked to set standards for the first Novell network on campus (Version 1.x) and helped departments interoperate on a shared campus network. He assisted in the development of one of the first departmental Ethernet networks. Jeff managed the development and implementation of videoconferencing over NetworkVirginia and convinced multiple vendors to modify their equipment for use over ATM. Jeff also chaired the multi-university network based video working group. As the head of VBS, he designed and built a comprehensive Video Network Operations Center and promoted the development and implementation of technologies to allow high quality, standards-based videoconferencing over ATM networks. He redesigned the video production facility wiring in order to increase system flexibility and signal quality. This, in turn, allowed VBS to migrate from a basic industrial facility to a full broadcast quality integrated operation. Furthermore, he has helped to design a near line storage system for streaming videos. After two years of work on this project, the storage system will be implemented during the summer of 2002.

Ray Decker

Ray arrived on campus to attend Virginia Tech in 1959 taking the first Fortran course offered by Tech and graduating in 1963. He looked for a job in computer programming, but the problem was finding a company with computers. He had to go to Northern Virginia to find one, returning to Blacksburg in 1968 to work for the university. Ray's first assignment was working on ASP (IBM's Automated Spooling Program). ASP was IBM's adaptation of Werner Von Braun's computing set of in his research lab. The operating system was PCP (Primary Control Program), which handled one job at a time. Ray comments that this was when you did performance tuning, by watching the lights flicker on the machine console, or putting your hand on a disk drive and feeling the vibrations (lots of vibrations indicated that you had a performance problem). As a systems programmer Ray wrote a set-up code in one week, tested it one weekend, fixed a few problems, ran it the next weekend, and it ran (with few modifications) for 25 years, until the MVS system was eliminated about a year ago. Ray moved on to Virginia Tech's Systems Development group and began developing PC software. In 1991 he moved back to Systems Programming and began

working with the Web, developing a Network protocol, which served as a base for the current Authentication and Authorization system, and is used by several Web applications including the Banner Web products. Ray has never been without challenging projects, since he is willing to take on challenges and produce. He developed a utility, which distributes output to users via the Web. It will notify users of the output via email and provide a web link to the output. This proved to be a valuable way of handling output when the MVS system was shut down. It avoided forcing users to learn how to log into a Unix Machine to retrieve their output. The next challenge Ray undertook was the charge to make sure that the performance for the new Banner Student Web Registration went from very good to excellent. One of the key problems was ubiquitous connectivity and the constraints limiting the number of users who could use the application at the same time. Ray developed a "governor" utility, which would limit the number of logged on users, to guarantee continuous service. It is currently used today, and has prevented problems on key occasions. Ray is the epitome of a life long learner. He has always been able to draw upon his extensive background of developing systems level code for IBM mainframes, and his deep understanding of operating systems, enterprise systems architecture, issues of scalability, to make the transition from ASP on an IBM 360/40 to Java development on the Web.

J. Thomas Head

Tom received a President's Award for Excellence for 2001. This is a Virginia Tech award that is presented annually to faculty and staff for superior service to the university. As the director of Instructional Services, Tom has demonstrated an "uncommon devotion" to serving the faculty and students of Virginia Tech. The success of the Faculty Development Institute (FDI) is due in large measure to Tom's vision and efforts. FDI was begun eight years ago and is now a nationally recognized model of professional development. The integration of instructional technology into the fabric of the university is critical to the long-term vitality of the institution.

Joe Hutson

Joe has been working at Communications Network Services (CNS) since November 1997, and is a member of the Switch Engineering team. He has numerous technical certifications including Microsoft Certified Professional- MCP, MCP+I, MCSE (#1418091); Siemens ICN-9751 CBX Release 9005 Maintenance; Siemens ICN-PhoneMail Release 6.2 Maintenance; Telecommunications Traffic Engineering; Web Site Development and Design; Lucent Technologies-Introduction to Switching Center Maintenance; Lucent Technologies-Switching Center Maintenance and Translation Maintenance; Lucent Technologies-Cell Site Maintenance; Glenayre Electronics-Voice Mailbox Technician Training; and U.S. Air Force-Ground Radio Communication Specialist Training. Joe has been involved in many projects over the years. He has researched, planned, designed, installed, operated, and maintained various telecommunications systems. He has developed a web site to provide access to ACD, diagnostic, and PhoneMail statistics and has also developed programs to provide customers with touch-tone access to account information. He has researched, evaluated and implemented VoIP and VoATM solutions. He has applied traffic-

engineering principles to determine optimal facility requirements and is currently working with a CNS team to develop programs to collect, manipulate and present telecommunications traffic statistics.

Christine Morrison

Christine has been an organizing force throughout the succession of computing systems at Virginia Tech. She wrote the first IMS applications for administrative systems at Virginia Tech in the 1970s. From writing to running programs, she oversaw the MVS system that ran the IMS administrative systems and other applications. When the time came to consider alternatives to renovate the administrative systems, she was a key group member investigating and structuring the Oracle/Banner system. She was instrumental in creating a robust system for a new enterprise information system, at a time when there were few peer resources to draw upon. Christine continues to lead the Database Management Team, seeing to the system's stability and performance. The Database Management Systems (DBMS) group monitors operations, installs new releases, and troubleshoots problems as they affect the 15 databases needed for the university's diverse operations, and for the ongoing development of improvements. Christine's team also ensures the appropriate security is in place by segregating running updates from the duties of developers. Tools have been developed to assist in these processes, including an application promotion manager that ensures that enhancements and new features are tested sequentially in multiple databases and automates that process before the new features become a part of production, and a diagnostic tool that includes paging the on-call personnel outside of regular business hours. The four production databases that Christine and the team oversee are noted for their running time, with very little down time.

John Nichols

John serves as the Information Technology Manager advising on technological evolution, acquisitions and network architecture. He is a recognized expert and advises not only the department and the university, but also other higher education institutions and state, local, and municipal governments. He has over thirty years of information technology experience, including project management, technical personnel management, research, design, specification, acquisition, installation, programming, and maintenance of electronic computer and communications systems. John holds a certification as an Engineer-First Class by the National Association of Radio and Telecommunications Engineers, an FCC First Class Radio Telephone Operator's license, a factory-certified systems engineer on Rolm CBX 9000-9751 telephone systems, and is factory trained on a number of computer systems. He served on the Board of Directors for the Next Generation Internet Forum and participates in network projects for Internet2, SURA, and EDUCAUSE. John has worked for CNS since 1985 and prior to that was employed by the Virginia Tech Computing Center. He directed the design and installation of campus-wide twisted-pair and fiber optic cable systems, including cable centers and telephone switchrooms. He hired and trained approximately fifty employees to perform the work in-house at a substantial savings compared to competitive vendor bids. He

developed a cable wiring database system for the campus and wrote a detailed project report that was a major deliverable for a large research grant from IBM. He participated as a principal engineer in the research and development of the university's local area networks (LANs), wide area networks (WANs), statewide broadband ATM network, and distance learning classrooms. He led the development of the first campus ATM network, including equipment specification and selection. He developed a security monitoring system as well as numerous database applications. He also wrote computer programs to monitor and manage communications systems. John's recent projects include the development of next generation optical networks, multimedia applications, and fixed/mobile wireless communications. In 2000-2001, the majority of John's activities focused on wireless technologies. In particular, he guided the technical development and current direction of the Wireless RFP. In addition, John researched technologies and applications to support development of wireless and optical networks. John provided technical support for CWT's NSF LMDS research grant and provided technical support for the LMDS Service Provider RFP. John helped plan the EDUCAUSE Wireless Conference at Virginia Tech by developing the agenda and suggesting speakers. As a recognized expert in the field, John delivered several wireless technology presentations at major wireless conferences representing the university. John is the lead technical advisor for the eCorridors projects for several grants for rural development. He is also involved in the development of advanced networks and actively participates in Mid-Atlantic Crossroads (MAX) Network Architecture Working Group and the SURA Network Architecture Working Group. Both groups include university, government and industry representatives.

William O. Plymale

Bill is the Instructional Technologies Systems Manager in the department of Educational Technologies at Virginia Tech. In his 22 years with Virginia Tech, his work areas include the Learning Resource Center's Research and Measurement Division, and numerous Information Systems' initiatives. In addition, Bill spent several years as an EDP auditor with the Department of Internal Audit. Bill is Virginia Tech's technical representative in the IMS Global Learning Consortium, an organization developing open specifications for facilitating online distributed learning activities. He is an instructor in Virginia Tech's technology summer academy, VT Stars, teaching robotic concepts to children from area high schools. He also teaches collaborative learning concepts using a MOO virtual environment. Bill serves as a mentor to a team of local middle school students competing in First Organization's First Lego League (<http://www.usfirst.org/FLLIndex.html>). FLL is a robotics design and programming competition based on Lego's Robotic Inventions System, Mindstorms. Bill is currently pursuing a Ph.D. in Computer Science at Virginia Tech, with research interests in human-computer interaction.

Edward Schwartz

Ed is in his fourteenth year at Virginia Tech as an Instructional Designer in Educational Technologies. His efforts focus on the integration of technology into instruction, scholarship and research. Ed splits his time between the New Media

Center, the Faculty Development Institute and faculty consulting. As Director of the New Media Center in Torgersen Hall, Ed provides the vision and direction for this valuable resource. Since its inception in 1994, the New Media Center has served tens of thousands of faculty, staff and students, as well as members of the local community. With over 10 thousand transactions each year, the Center directly supports thousands of students and dozens of faculty each year in the development of multimedia and its integration in instruction, scholarship and research. As Manager of the Faculty Development Initiative, Ed provides continuity and organization to the extremely diverse and ever-changing collection of learning opportunities for faculty. Staying abreast of the latest changes in technology, he is also an active instructor for several of the offerings. With a wide range of knowledge of technology and instructional design, Ed also provides direct consultation to individual faculty to assist them in their teaching, scholarship and research.

Laurie Zirkle

Laurie has almost twenty years of experience in Unix system administration. Prior to coming to CNS in the spring of 1999, Laurie was the Unix Systems Administrator/Security Manager for the Virginia Tech Computer Science Department. She has also held positions at the Virginia Tech Systems Research Center, Bell Communications Research, and Bell Labs. Some of the operating systems she has been responsible for over the years include BSD 4.[1-4], AT&T SVR[2,4], Xenix, Dynix, Ultrix, OSF/Tru64, AIX, and SunOS/Solaris. She is currently a Computer Systems Engineer at CNS and is the primary System Administrator for ten Solaris machines, four FreeBSD machines, four Compaq Tru64 machines, one AIX machine and one Linux machine; she is also a secondary System Administrator for seven other Solaris machines. Laurie's interests have evolved towards System Security, and she is actively involved in various security endeavors. Laurie works very closely with Phil Benchhoff and Randy Marchany tracking probes and scans, system patches, and incident handling. She is a member of the Virginia Tech Computer Incident Response Team (CIRT); she was the driving force behind the "SANS 2000 Security Technology Leadership Award" that was presented to the Virginia Tech CIRT. Laurie was a Technical Reviewer for "Intrusion Signatures and Analysis" by Stephen Northcutt/Mark Cooper/Matt Fearnow/Karen Frederick, and she was a contributor to the SANS Institute's "Computer Security Incident Handling Step-by-Step". She has also been a beta-tester for the Attack Registry and Intelligence Service (ARIS) extractor software and for the Center for Internet Security (CIS) Solaris Security Benchmark software.

Information Systems and Computing

Information Systems & Computing (ISC) is Comprised of the Following Operational Areas:

- Administrative Information Systems (AIS), consisting of the Banner Teams for Alumni/Development, Finance, General, Human Resources, and Student & Financial Aid.
- Database Management Systems (DBMS)
- Systems Engineering and Administration (SEA), responsible for servers supporting email, administrative systems, research, and instruction.
- 4help, which incorporates the Get Connected program and desktop support services.
- Information Technology Acquisition (ITA), consisting of Software Distribution, Student Software Sales, and Computer Purchasing
- Information Resource Management (IRM), responsible for managing and maintaining system access via user accounts and passwords and digital signatures.
- Information Warehouse and Access (IWA), responsible for developing and maintaining a data warehousing system that captures, structures, and delivers University data to support timely, effective decision making.
- Internet Application Development (IAD), consisting of Web Application Research and Development and Middleware Services
- University Security Office, with additional reporting responsibilities to the Vice President for Information Technology

Overview:

Information Systems & Computing covers a variety of work, within the administrative units listed above. This report categorizes work accomplished during 2000-2001 in the following ways:

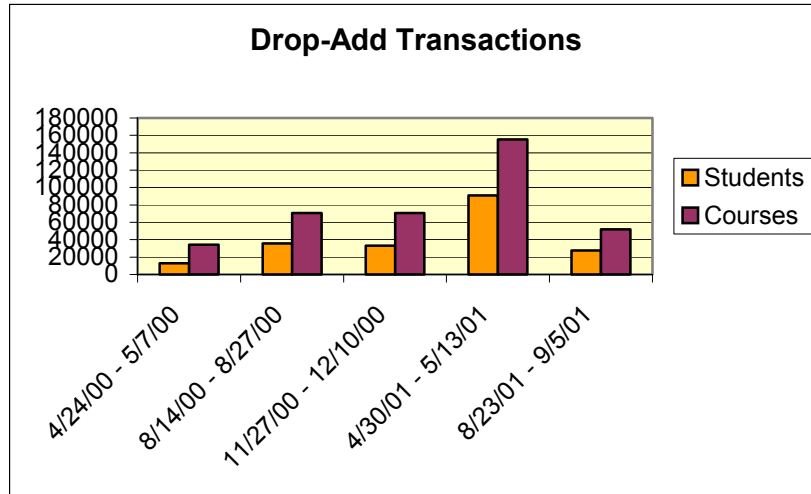
- Direct services to students, to faculty, to staff, and to friends of the university. These services provide ways for individuals to interact with the university in a more accessible, effective, and efficient way. Often, these services also assist the central offices responsible for the interactions by facilitating source-point data capture, through more rapid turn-around between service request and service provision, and by gathering more information about services in order to better manage them in the future. Also included in this grouping are services provided directly by IS&C such as Get Connected each fall, that facilitate a good start to a new academic year for students, their teachers, and their parents.
- Services to university offices. This category includes both services such as the privacy policy generator that make it easier for distributed webmasters to comply with desired statements about web privacy, and services to central functional offices that make possible more streamlined operations.

- Providing better management information ensures that the data being captured by administrative transactional systems can be gleaned and analyzed to improve future operations and service delivery.
- Improving infrastructure is a category that frequently overlaps others. For example, Banner upgrades include enhancements that can improve operations and position the university for future development (web-enabled forms would be an example), along with increased functionality.
- Information technology leadership includes tracking and disseminating information on best practices and in promulgating guidelines.
- As another component of leadership, it is vital that Information Systems & Computing include a component of research and development, monitoring and engaging the emergence of new technologies in order to evaluate them for university utility, to bring them to the attention of others who may find them useful to meeting needs, and to engage in experimental trials before adopting full-scale implementation.

Direct Services to Individuals: Students, faculty, Staff, and Friends of the University

Electronic Services

With new and enhanced tools, **students** can conduct a higher proportion of their routine business with the university online. During 2000-2001, all elements of the Banner Student system experienced their first complete year of operations, including the Hokie Spa with the Student Web as its foundation. Degree Audit Reporting System (DARS) implementation provided both students and advisors with online access to their degree audit reports. An enhanced version of the Web for Student provides online access to unofficial transcripts, graduate plans of study, financial aid awards and entrance interview information. For graduate students, deployment of the self-service web (Hokie SPA) permits them to manage their health benefits. The graph illustrates the number of student registration adjustments, supported by several units within IS&C, including the Student Team, and the DBMS team.

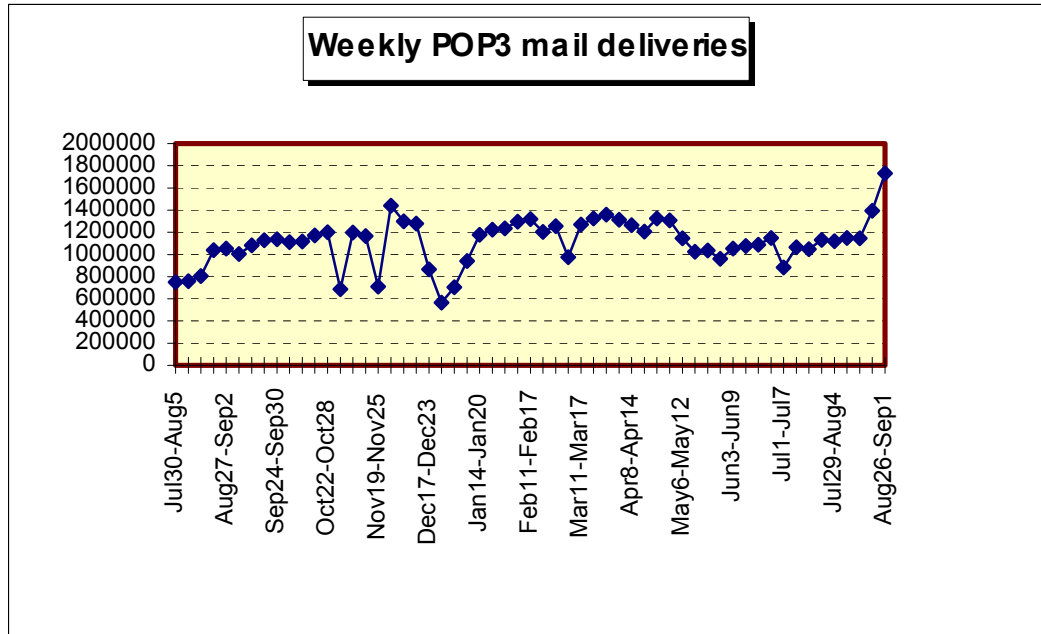


All users have access to a new, more flexible portal, developed by the WARD team, deployed during spring break. Finally, students were among those benefiting from a new version of Filebox to provide collaborative access to online materials.

Alumni and friends of the university were also able to accomplish more activities through the web this year. The Alumni Gateway became available on March 15. This companion to the Alumnet project allows alumni to create their own unique identifiers (PIDs) and then to view and/or update their biographical and demographic information. The Alumnet project provides for online registration in available courses for alumni, and integration of the course management system. The Alumnet project is made possible through collaboration among the Alumni Office, the Institute for Distance and Distributed Learning, and Administrative Information Systems. Alumnet with course units for alumni was launched on December 6, with four “knowledge units,” and 12 students [<http://alumni.iddl.vt.edu/>]. Also, the e-gift web application for Development went live on June 30 [<http://www.givingto.vt.edu/>]

Electronic mail is a vital component of everyday communications. The mail group within SEA manages the centralized university mail system. Growth of the system is illustrated by a total of weekly mail checks on the mail.vt.edu mail server between 2000 and 2001 for April:

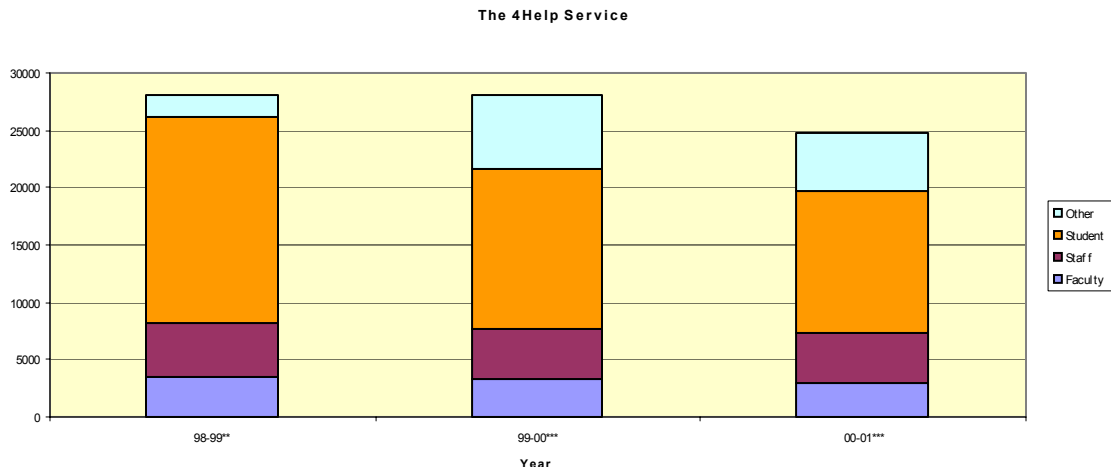
| Year for April usage: | Total per week |
|-----------------------|----------------|
| 2000 | 11,600,000 |
| 2001 | 12,800,000 |



All of the **university community** benefited from a new, customizable university homepage, crafted by the WARD team in conjunction with University Relations. The page was featured in the September 6 Collegiate Times.

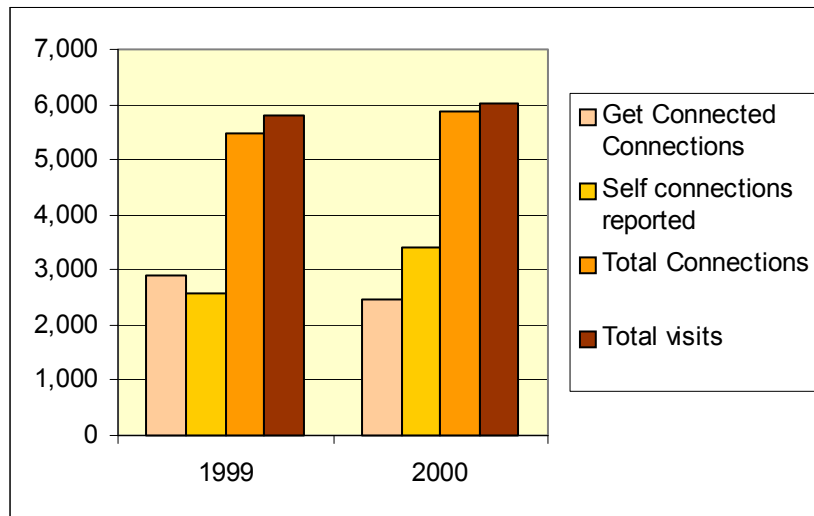
Direct Support of Information Technology Services

4HELP provides ongoing support for user problems and questions regarding their computing needs. Over the past three years, the quantity of questions has remained similar.



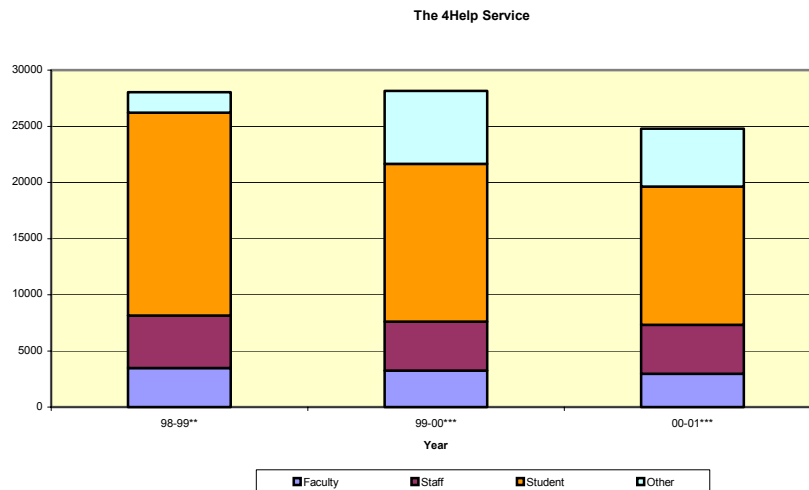
Get Connected (GC) sees that residence hall students' computers are connected to the campus network and that basic applications work correctly. The 97 students hired

for move-in worked from 10 A.M. to 10 P.M., August 17-20. Twenty GC staff worked during the first week of classes, completing connections and resolving problems.



4Help reported fewer problem tickets during move-in Fall 2000. There were no network changes, new computers and software--and users--were better prepared. The VTNet CD installed easily, and Get Connected provided excellent support. The Verizon strike postponed some modem issues. Common questions dealt with Ethernet, Outlook Express, modem configuration, Windows 95/98, printing, PIDs, and hardware.

4HELP also provides ongoing support for user problems and questions regarding their computing needs. Over the past three years, the quantity of questions has remained similar.



Individuals from Computing Center units developed and tested the 2000 VTnet CD. The CD was delivered within budget and on schedule. For the first time, CDs were delivered to apartment complexes in town.

Support for software includes Department Software Distribution. This year, the unit brokered a \$100,000 statewide contract for ESRI's Geographic Information System software, and worked with over 20 other vendors to supply software to faculty, staff, and departments. In FY 2001, 15,137 licenses were distributed, totaling \$746,355 in license costs. Student Software Distribution supplied products to students, in some cases, at a tenth of the retail cost of the software license. Some products are ordered and delivered online. The unit became an auxiliary unit in FY 2001, continuing its tradition of distributing licenses—over 67,000 since 1994. In the year, 5,437 orders valued at \$929,199 were processed.

Computer Purchasing developed and is using an information and document image system to assist departments in tracking their computer orders. Archives include 133,000 tiff images, 70,000 gif images, 24,600 PostScript images, and 5,000 fax images. www.ita.vt.edu

Research Computing

Faculty and research staff were served by upgrades to research computing. The Sun E6500 was upgraded to Solaris 7. Promotion of use of the computing resources came through the creation of the research computing listserv. In other work to support research computing, the IBM AIX research computing environment was reconfigured to remove the aging SP2 hardware.

Input into research computing needs was expanded by having IS&C staff participate in the College of Engineering's Research Computing meetings. IS&C leadership has also met with faculty and with the Research Division staff.

Services to University Offices

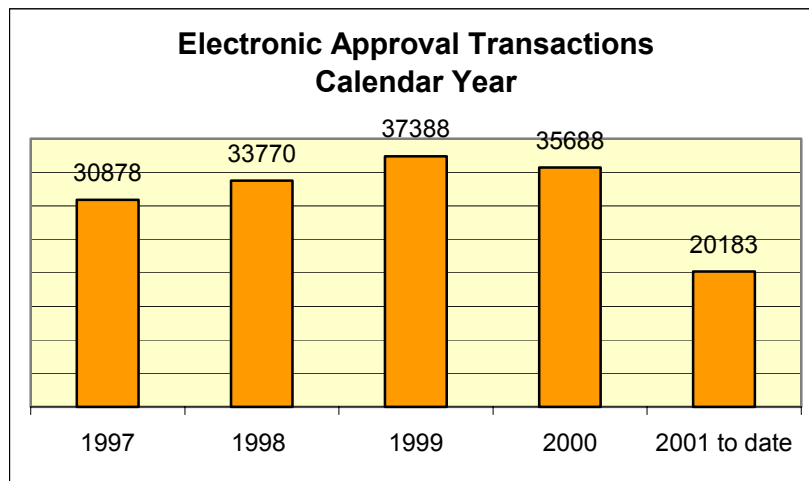
Distributed Use of Administrative Information Systems

Through various additions and enhancements to the administrative information systems, distributed departments benefited from improved work processes, increasing their ability to better serve their student and employees. ***Tuition Remission*** was rewritten to replace a temporary system built when the mainframe was shut down. This temporary system was inadequate and required manual re-entering of data into Banner. The new, rewritten tuition remission system is based in Banner so that data only has to be entered once. The Finance Team made significant improvements that allow more flexibility for departments. Academic departments also benefited from the Student Team development, 'Web for Departments' that permits enhanced access to data about the department's students and courses. Academic departments were also the prime beneficiaries of ***automatic overhead charging for expired funds***. The Human Resources team created processes to automatically change an expired fund or a fund with an insufficient balance to the department's overhead fund for salaries. The process also reduces manual work in Personnel Services to re-code individuals on expiring funds.

The Student Team enhanced and corrected reports associated with the teaching load process used throughout the university. Additionally, academic departments were given access to the VT-developed class rank system that ranks students by grade point average within their major, college, and university.

The Human Resources Information Systems Team assisted the Recreational Sports department in selecting, installing and implementing a time clock system, and then designed an interface for them to send timecards to payroll electronically. This *mass time entry process* saves the re-keying of over 275 timecards each wage payroll. The system was designed and tested in the 2000-2001 year, and the first timecards from this system were processed in production in July 2001. The HRIS team also responded to suggestions from colleges and departments to add and improve web reports, and create additional edits in the electronic job approval forms.

The HRIS team maintains support for the personnel and payroll areas of the university. Each year, the team and the systems support 24 payrolls each for salary, wage, and stipends, along with three summer school payrolls. For January 2001, 19,491 W2s were printed. Approximately 1000 people have been trained in using the system since October 1996. Training of distributed personnel permits departmental hiring of several categories of employees directly, as illustrated in the support of electronic approval transactions.



Central Office Use of Administrative Information Systems

Enhancements to the administrative information systems permitted more efficient and effective processing within central offices, often with the result of better service to distributed departments and/or to students and employees. *Fund freezing* enhanced processes and procedures to allow pending transactions to clear within funds, but no new transactions to be posted to expiring funds. Both central offices and distributed offices could thereby take greater advantage of the administrative information system

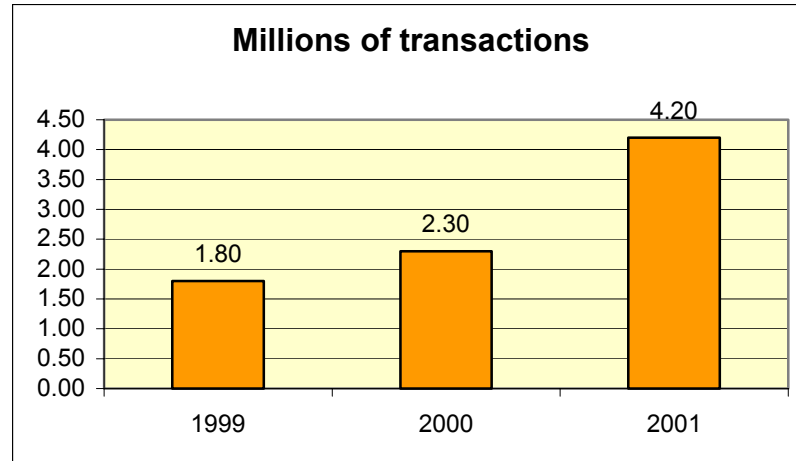
when it prevented inappropriate funding of new transactions. Enhancements in the design of **student statements and bills** decreased student and parent confusion, and decreased telephone queries to the Bursar's Office. **Direct deposit of student refunds and travel reimbursements** streamlined the refund and reimbursement process both for the university offices processing those transactions and for the refund and reimbursement recipients. Both kinds of transactions are now directly deposited to recipients' accounts. If a student recipient does not have an account set up to receive the direct deposit, a Virginia Tech Credit Union account is established and the refund is deposited there. The student is then notified by email of the availability of the funds in the account.

Several projects within Administrative Information Systems made central processing run more smoothly and effectively. The Finance Team developed a system to capture account status data and developed reports of receivables aging. This **accounts receivable aging reporting** allows for longitudinal examination of the outstanding receivables over time. Several **state reporting** processes were re-created with the demise of the mainframe and processes still dependent upon it. All tape based data exchanges with the state were replaced with Internet based file exchange (CARS State Accounting System, Debt Setoff, and checks reconciliation). Although the Banner systems provides for online checking for non-sufficient funds, it did not permit such checking for batch transactions. Since Virginia Tech processes large numbers of transactions by batch, Administrative Information Systems (the Finance Team) developed processes and modifications to the **batch interface to Banner Finance to allow NSF checking**. Yet other enhancements benefiting administrative offices included crafting recommendations for a new **cash receipts system** for the Bursar's office; creating an interim process to handle **unclaimed property**, pending development of a new, automated process next year; modifying the VT-developed **savings bond system** to accept multiple savings bond types with the introduction of the new I-type savings bonds; developing a new set of processes to allow batch loading of encumbrances for the new fiscal year for the Controller's office; and increasing the security and reliability for producing university purchase orders, student statements and bills, and tax forms by installing a **new server for JetForms**. Automated processes were also developed to **feed information from the Accounts Receivable system to the Hokie Passport system**. This data stream is used to determine access to residence halls and for meal plans information for dining services.

Grants billing was migrated from a mainframe based system and implemented in Banner in the Fall of 2000.

The university priority for enhanced inventory control was assisted through the creation of a **fixed assets** system. Data were merged with the Price Waterhouse inventory to populate the new system.

In all, the Finance system, supported by the Finance Team, supports financial transactions. Over 1600 users in the various modules of Finance and Accounts Receivables systems have been trained.



The HRIS Team implemented changes necessary for the 2000 *veteran reporting requirements* and completed over 400 service requests--to add new system functionality, to fix program bugs, to create new reports, and to enhance existing forms and reports. Because of mandates in the Commonwealth of Virginia's *new pay plan*, the HRIS team converted all classified and wage positions to the new classification role codes, building new pay bands, new forms, and numerous reports to verify conversion, report on in-band adjustments, and to notify departments and employees of the changes. In February 2001, the performance evaluation programs were changed to reflect the new pay plan requirements.

During fiscal year 2001, the Alumni/Development team completed over 500 service requests from Banner systems users in the Alumni Association and in University Development. These requests included working with the data warehouse team members to implement the *Giving Data mart* to make reporting on the gifts and pledges--in FY 2001, 53,950 gifts and 22,668 pledges--more efficient. It was instrumental in providing information to create the *Endowment Activity report*. For the first time ever, donors to endowed accounts are receiving a full report on the activity of their accounts, including contributions, return on investment and payouts. A series of *College Benchmarking reports* were created for the Vice President of Development, also using the Giving Data Mart. The technical staff worked in collaboration with *Prospect Research* and SCT to develop a new module for Banner, which stores screening information returned from third party vendors about prospects. This valuable information allows University Development to identify the best prospects for fundraising efforts. Members of the technical team also participated in the Prospect Management Task Force, which was charged with devising a new method for managing the pool of prospects for the university, and recommended the creation of a new prospect management system in Banner. The technical staff has completed the first phase of this 6-month project.

The Student Team developed a new batch scheduler to process course requests, producing the management reports required by the Registrar's Office and academic departments. As the end of the academic year came, the team managed the VT-

developed processes associated with end-of-term processing and with graduation, including the processing of tentative grades for graduating seniors.

Support for Institutional Research includes the special data captures for the on-campus and off-campus *censuses* that requires management by DBMS.

Software Services and Tools

IS&C teams created tools to enhance work in an array of other campus units. The data warehouse team enhanced the data feed to Parking Services, and created the Web Job Submission product to provide a way for SQR developers to make parameter driven reports available to users on the Web for the data warehouse.

Hardware Services

The annual deployment of Banner user desktop machines upgraded about one-third of Banner users' desktops.

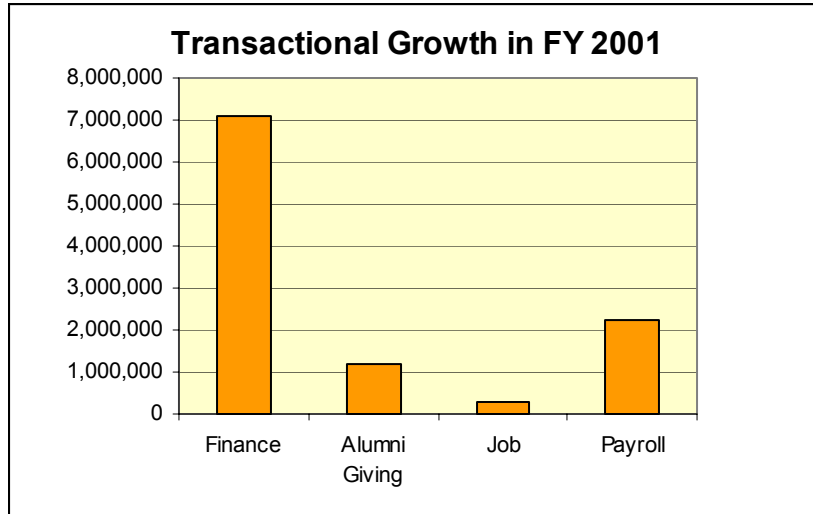
Providing Better Management Information

Data warehouse: New Data Marts

A major initiative requiring collaboration among the Information Warehouse and Access team, the Administrative Information Systems teams, and the appropriate central offices is the data warehouse. With the core Finance data marts previously in place, work this year focused on Human Resources and Alumni/Development, and work began on student system components. The following data marts were implemented:

| | |
|-----------------|---------------------|
| Alumni Giving | Job |
| Employee Status | Position |
| Job Labor | Position Allocation |

The data warehouse as a tool for management information grew during the fiscal year by millions of transactions, facilitating the discovery of trends and patterns useful for planning and analysis.

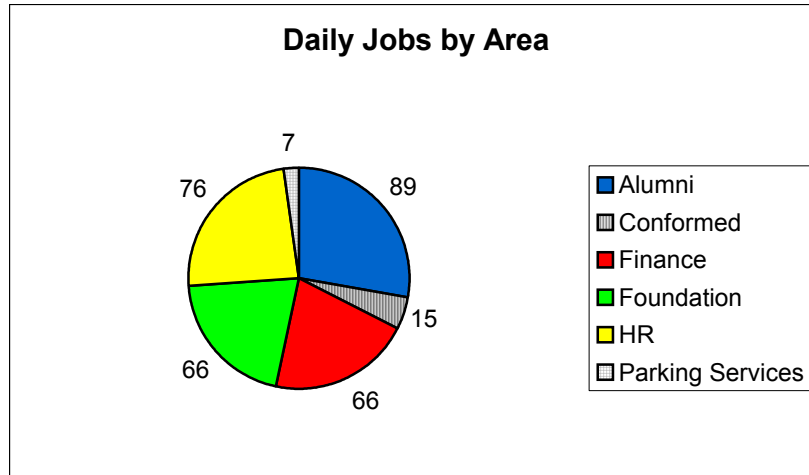


Selection of admissions as the initial piece of the Student Data marts led to planning for that component. Work continued to implement Accounts Receivable and Payroll (the latter implemented early in FY2002.).

The data warehouse team supports the nightly extraction of data from the operational Banner systems, the transformation of data, and the load into the production warehouse.

Nightly Extraction, Transformation and Load for Production Warehouse

| Data Mart Area | Daily Jobs | Total during FY 2001 |
|------------------|------------|----------------------|
| Alumni | 89 | 32485 |
| Conformed | 15 | 5475 |
| Finance | 66 | 24090 |
| Foundation | 66 | 24090 |
| HR | 76 | 27740 |
| Parking Services | 7 | 2555 |
| Total | 319 | 116435 |



User focus: Definitions, Training, and Reporting Tools

Providing university users with better management information is supported by three major efforts: data definitions, training, and tools. IS&C staff have been active in the data definition group chaired by Dixon Hanna to regularize the **definitions** of commonly used university data elements. As university definitions are developed, these will be incorporated as appropriate in the data warehouse, particularly through meta-data tools.

Training was typically focused on the particular areas of the data marts so that data training and ‘tool’ training can be well integrated. Training newly developed this year and then provided was for the new data marts in Human Resources with employee, job, job labor, position and position allocation information.

New **reporting tools** developed this year include an **Executive Dashboard** for top administrators at the university to allow query into filled and allocated position counts, salary averages, head counts, and financial information. Routine departmental **financial reports** were converted by the Finance Team from BRIO to Web.

Improving Infrastructure

Networked Desktop Environments

Various elements in strengthening, enhancing, and expanding the structures to support individual campus users included domain management, and electronic communications and client tools. The HOKIES domain was migrated to Active Directory of Windows2000, and enhancements were made to the electronic communications environment: the POP3 mail server was upgraded from E5500 to E6500; CPU boards were replaced to resolve problems with CPU/memory integrity; the off campus mail server was upgraded; the news server’s disk space was greatly

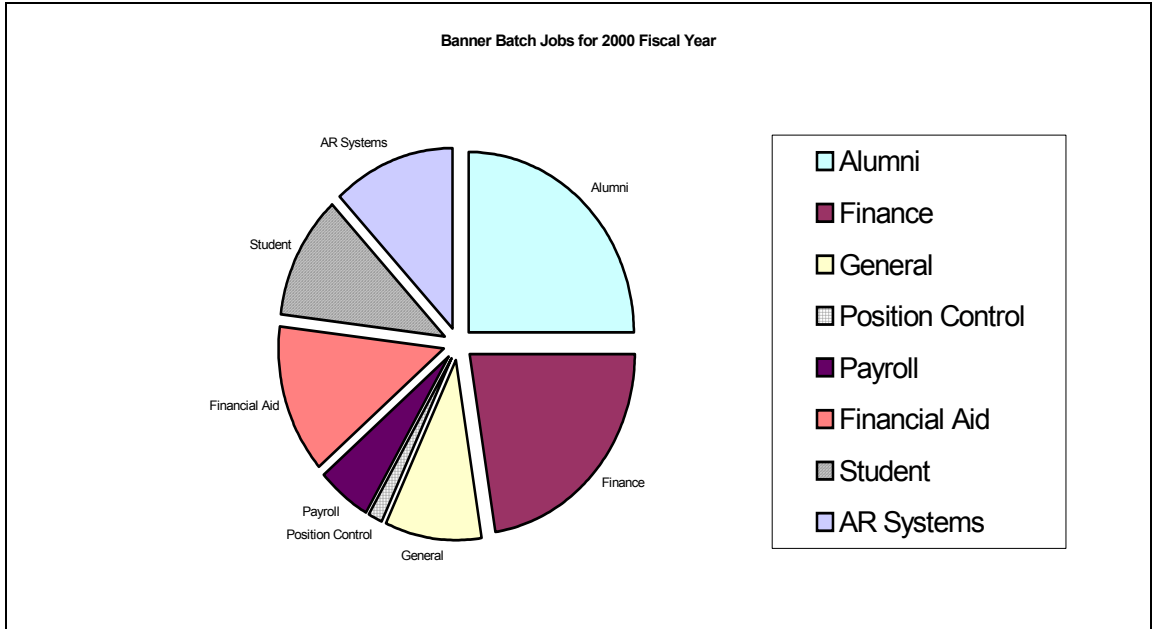
expanded; Meeting Maker servers were upgraded, requiring coordination with distributed Meeting Maker administrators, and hardware upgrades permitted increased capacity on Exchange servers. Important, virus-scanning software was implemented and deployed on the mail systems. Support for distributed staff supporting end users included convening the first Departmental Outlook Technicians meeting.

Server Environments

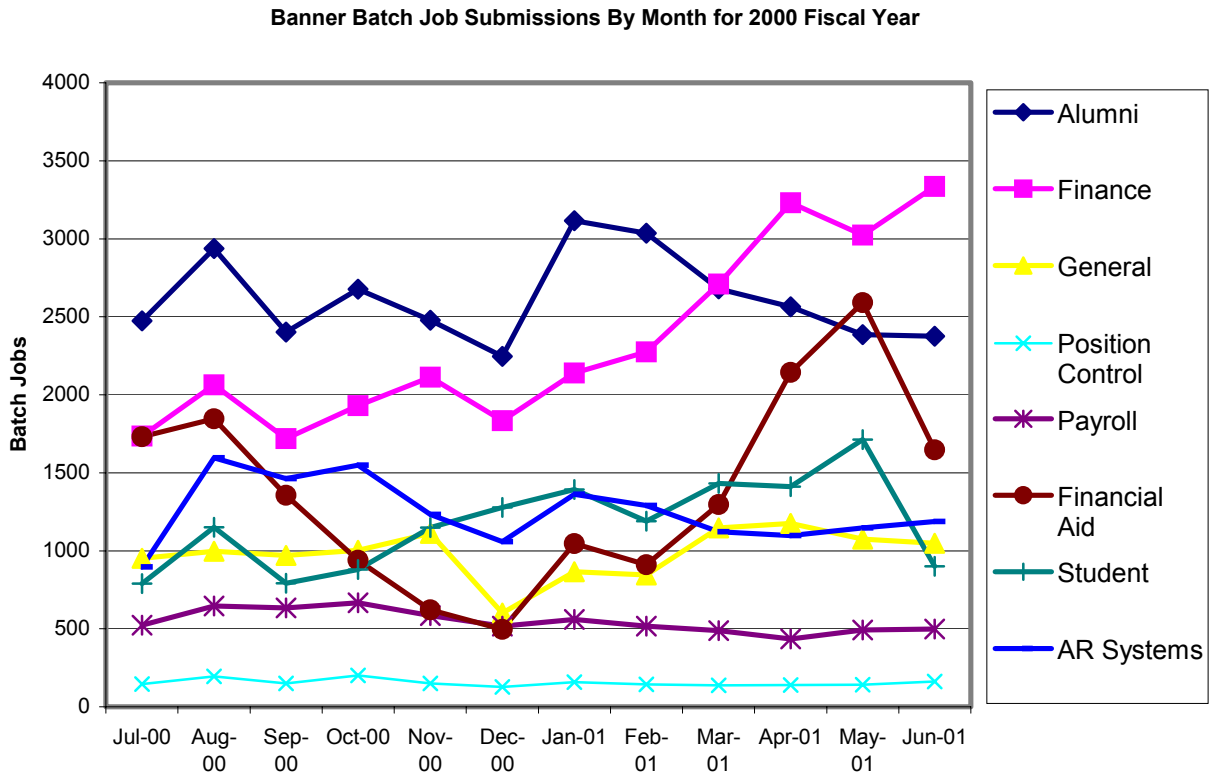
In support of the Banner administrative information systems, new CITRIX servers replaced Winframe with Metaframe. Systems Engineering and Administration also supported videoconferencing by adding administration of MCU and ILS servers.

Administrative Software Upgrades & Tools

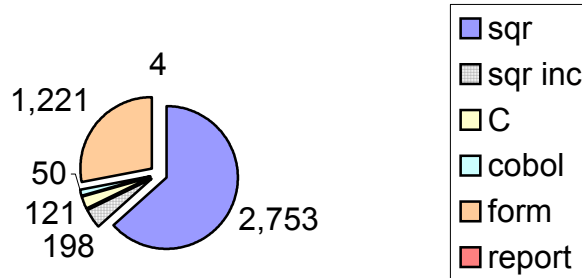
Software upgrades to standard operating software includes both Banner software upgrades, and software tools used by the various IS&C teams, along with upgrades and replacements to VT-developed software. In 2000-2001, Banner software was tested and upgraded to the 4.x releases in October, a process that involves nearly all IS&C teams, and functional offices. The 4.x upgrade was followed by installation of smaller releases to enhance functionality and to stay current with federal regulations. For example, Financial Aid regulatory releases 4.6, 4.6.1, 4.7, 4.7.1, 4.8, 4.9, 4.9.1 were all installed during 2000-2001, and HR 4.2.2 was installed for the year-end tax modifications. FAMIS was upgraded to Oracle 6i. Software tools used by teams included the upgrading of Ardent to version 4.0. VT-developed software changes included the replacement of the HREI extract with the data warehouse HR data marts. The magnitude of the support for administrative information systems is illustrated by the batch jobs, and applications promoted.



| | | | |
|-------------------------|--------------|----------------------|--------------|
| Alumni | 31370 | Payroll | 6563 |
| Finance | 28108 | Financial Aid | 16626 |
| General | 11792 | Student | 14076 |
| Position Control | 1850 | AR Systems | 15001 |



**Application Promotions Into Banner Production for
July 1, 2000 - June 30, 2001**



| | | | | | |
|----------------|-------|--------------|-----|---------------|-------|
| sqr | 2,753 | C | 121 | form | 1,221 |
| sqr inc | 198 | cobol | 50 | report | 4 |

Software tools used by the teams in IS&C were also designed and implemented or improved:

- Designed, developed, and implemented a Web Service request application
- Designed, developed, and implemented a Web Job submission product.
- Enhanced the Web Distribution Utility
- Upgraded the data warehouse to Oracle 8.1.7.1, and IRM to Oracle 8.1.6.3.
- Upgraded the data warehouse ETL tool from Ardent 3.x to Ardent 4.02
- The Systems Engineering and Administration team wrote the interface to VT LDAP directory for ILS
- The Database Management Systems team upgraded SQR to 6.1.3

Authentication and Authorization

Making possible the varied online services is the authentication/authorization server. It averaged 140,000 requests a week, serving over 20 client applications including the administrative web applications (Banner Web), leave reports, and applications for the Extension division and Communication Network Services.

Hardware & Operating Systems

In addition to software upgrade, hardware and operating system upgrades and replacements—often with associated applications—occupied several of the IS&C teams. There were CPU upgrades for the E10000, requiring testing, monitoring, and implementation activities. The shutdown of MVS required replacement of the

applications that it had previously run, including finance and human resources history that had not previously been converted into Banner. The IBM M80 was acquired to replace the VTAIX system. Changes also included burning CDs for critical historical data, porting some processes and data to UNIX, and other Banner conversions. IS&C assisted with a project to convert programs for Institutional Research. Other projects are the upgrade to the network tape backup system, and the testing and implementation of Network Appliance and 735N.

In addition, SEA implemented Big Brother System Monitor for all machines in the ISB machine room; coordinated machine room network upgrade project with CNS, other departments and machine system administrators; and implemented syslog server. Another function is performance and capacity planning. The SEA team responsible for this area evaluated capacity planning software, and is in the process of implementing SAS IT Service Vision.

Information Distribution and Printing

Web Distribution is a system that provides web access to output, with email notification to the requestor/submitter of the information or report. It supplements the Banner processes for output of jobs and reports. Web Distribution averaged 6,000 files a month.

Quality Assurance

To promote quality assurance, the data warehouse team developed problem tracking capture and reporting; and software and processes were established to deal with duplicate persons in Banner. Finally, as a report on quality, the Database Management Systems team was audited with the rare rating of “high satisfactory,” one of only three of these high ratings ever given.

Information Technology Leadership

Privacy Policy

The Vice President for Information Technology approved a policy mandating that Virginia Tech websites post a privacy statement. The policy refers to any website maintained by or under the direction of the university or its departments and other organizational units. The policy is supported by a privacy policy statement generator that automates the process for distributed web masters to create a privacy policy statement for their web pages.

Management and Organization

Patricia Jackson was appointed Associate Vice President for Information Systems & Computing in the Fall 2000. She has over twenty-five years of experience in information systems and government. Her prior position was Director for External Programs in the Office of the Vice President for Information Technology, developing

strategic relationships between Virginia Tech and other colleges and universities, government agencies, economic development groups, K-12 schools, and private industry in areas relating to information systems and telecommunications. She brings extensive experience in advanced information technology systems and infrastructure to the position.

Test Scoring operations and staff moved to Learning Technologies where they can better integrate evaluation tools with instructional goals and technologies. IS&C collaboration will continue in projects such as using the renovated Ambler Johnston computer lab for online testing.

Mike Naff was appointed the director of the Administrative Information Systems teams, and took over the chair of the General Systems Management Team. Other new leaders of units include Lee Anne Hoppe, team leader of HRIS; Mark Hoppe, team leader of Finance; Allen Campbell, technical lead for HRIS; Joan Myklebust, technical lead for Student; Judy Wills, technical lead for Finance; and Jay Smith, technical lead for Accounts Receivable.

Planning involving the breadth of the organization included a retreat in December, collaborating with other campus and IS units to guide discussion. Themes included network directions, extended campus needs, online learning, portals, and directory and authorization/authentication services.

IS&C Asset Management designed and implemented a central management resource for IS&C to assist in managing and tracking computing inventory.

In the Computing Center, the position of Andrews Information Systems Building (ISB) Facility Manager was established to handle ongoing building maintenance issues and provide point of contact for placing computer equipment in the ISB machine room.

Computer operations were merged with the Call Center, providing job shadowing experiences and conducting leadership practices inventory.

Professional Development and Training

Lee Anne Hoppe, Allen Campbell and Patricia Rodgers were among those inducted into the Academy for Leadership Excellence as members of the ALE class of 2000-01.

Terence Ordon (WARD) is now an Adobe Certified Expert (ACE). He passed the Adobe Certification Exam for proficiency in Photoshop.

The SEA team and other university areas coordinated and attended on-site joint NT/W2K training.

With the help of experience staff in several IS&C units, the Get Connected consultants were trained for their start-of-term duties.

Staff in the SEA unit attended VA-CIRT meetings, made presentations at Shadowcon NSWC, Dalhgren, VA, ISACA (Winnipeg, Canada chapter) seminar on Unix and network security, and SANS conferences. They also attended training in Solaris System Administration, Veritas Volume Management, supervisory training from New River Community College.

NOC

To create a world-class operations center, CNS and the Computing Center have created a single 24x7 Network Operations Center (NOC). The Computing Center Call Center, the CNS NOC and the VBS VNOC merged into a single operations center. For this integration process, Marshall Fisher directs the combined groups for both IS&C and CNS.

Collaboration

Virginia Tech has been an active partner with SCT through the Large School Consortium (with Mike Naff elected representative), and with Fred Medley and Ken Williams serving on the SCT Quality Council.

Internal to the university, the new General Person technical subcommittee meets alternately with the full General Systems Management Team to handle the more detailed work and manage inter-unit collaboration.

Sharing Expertise: Outreach, Presentations, News Items, Site Visits

Outreach:

The VT STARS 2000 program hosts 37 young people, mostly high school sophomores, for 3 weeks of workshops and activities. The focus is network entrepreneurship. Vernard Harrington directs the program.

Publicity:

The page titled "Virginia Tech Computing Center", <http://www.cc.vt.edu/>, was selected as a Links2Go "Key Resource" for Virginian Technology. http://www.links2go.com/topic/Virginian_Technology

Vijaya Mallikarjunan (WARD) was interviewed for an article in the Roanoke Times. The article appeared in the paper on July 11. <http://www.roanoke.com/roatimes/news/story96395.html>

Randy Marchany was quoted in INFOSEC NEWS on security issues evaluating BIND in an article entitled "BIND in a bind."

<http://www.infosecuritymag.com/digest/2001/02-01-01.shtml>

Site Visits:

Virginia Tech Administrative Information Systems hosted several universities. These requests allowed the other institutions to better see and understand the ways that Virginia Tech has implemented Banner and related systems, including portals and data marts.

- State System of Higher Education in Pennsylvania
- George Mason University
- St. Johns University
- University of Monterrey (Mexico)
- University Kentucky
- New Mexico Technical University
- University of Richmond
- Winston-Salem State University
- Howard University
- Georgia State University
- City University of Hong Kong
- University of Montana
- McGill University
- Appalachian State University
- University of Illinois
- Dalhousie University
- Sweet Briar College

Conferences On-Campus:

On April 2 and 3, WARD hosted a Web Developer Conference for campus webmasters and other interested staff members. <http://www.ward.vt.edu/webdevcon/>

The Departmental Computing Support Symposium was held on April 19 for a day of updates and information sharing.

Conference Presentations:

at SCT Summit

"TS189 Interface With Banner." Jackie McNabb and Jacqueline Nottingham

"On-line Gifts and Pledges," Janet Linkous

"Dollars & Sense from the Data Mart," John Rudd and Kim Smith

"No-Hassle Salary Encumbering," Matt Swift and Wendell Vest

“Data Warehouse From HR Data,” Mike Naff and Vicky Shaffer at CUMREC
“Enterprise Data in Jail: A Problem With a Solution,” Lore Balkan and Betsy Blythe
“What's Next After an ERP Implementation?” Janet Linkous at 12th annual meeting
of the Association of Collegiate Computing Services
"Security Programs for the Campus Community" Wayne Donald at SANS Security
2001
“Pandora's Box: Firewalls and Campus Security” Randy Marchany and Clair W.
Goldsmith, of the University of Alabama-Birmingham. Randy was also a speaker at
the University of Virginia’s Computer Security Seminar.

Security

To enhance system security, password restrictions were increased. The Systems Engineering and Administration staff helped formulate the CIS Security Rulers. Automated replies from abuse@vt.edu were created, and procedures were established to allow operations personnel help process abuse mail. Security was also enhanced by implementing IP filters, tripwire, secure shell (ssh), scanning for vulnerabilities and applying patches, and upgrading the Norton Antivirus (Symantec) software for distribution through the web site and the VT Net CD.

The areas of security awareness and education remain top priorities. The University Security Officer made over thirty presentations on campus and in extension offices during the year. Posters that encourage users to be aware of security issues were printed and distributed to departments both on and off-campus. A true/false quiz was introduced into the process for students getting their userid at orientation and orientation leaders were instructed on major security issues. A security web site [security.vt.edu] has been enhanced with more security information, links to several security tools, and references to numerous security sites.

Research and Development

Online Learning

In conjunction with Learning Technologies and extended campus directors, IS&C set about to better understand the needs of online learners. Laura Fornash was invited to an IS&C retreat in December to present view from her recent experience at the Northern Virginia Center and from her current role in starting the Richmond site for the university.

IS&C collaborated with Test Scoring to use the renovated Ambler Johnston computer lab for online testing.

Directories

IS&C staff contribute to the Information Systems Directories project, with a specific focus on directories relative to video-conferencing. The A2 Task force, headed by

Ray Cornish issued a report late summer that outlined how the current PID system could be decoupled from specific services. The Directory Clearinghouse Task force, headed by Theta Bowden, identified many of the major directories on campus and the variety of ways in which directories are used. Their findings and recommendations focused on the need to better integrate directories.

Systems

Mike Naff, Debbie Miller, and Janet Linkous are participants with SCT in a Client Focus Group to provide feedback to the vendor on the development of their forthcoming redesign of administrative systems support software.

Systems Engineering and Administration evaluated and/or tested several areas: Linux distributions; Mac OS; SAN solutions, and print spooling. After evaluating the issues and available vendor solutions, the team wrote a print spooling program for Banner output to departmental printers, saving \$20,000-\$30,000.

Development of Future Electronic Services

A major project touching most areas with IS&C is the goal of permitting self-generation of PIDs. Currently, early versions of the resulting system are being used with the alumni learning projects.

Major Initiatives for 2000-2001 and Current Status:

- Data Warehouse Implementation for Alumni Giving, and Human Resources data marts; development and implementation of data warehouse components for student-related data. **Status:** Alumni Giving data mart complete; payroll data mart nearing completion; AR data mart nearing completion; Student Admissions data mart under development.
- Creation of reporting and analysis utilities for user-friendly access to administrative data. **Status:** Executive dashboard implemented; report submission utility completed.
- Expand online services, incorporating selective customization and personalization. **Status:** Campus Pipeline replaced with VT-developed Hokie Portal.
- Implementation and enhanced integration of the Campus Pipeline portal for the entire campus: faculty, staff, and students; implementation of the portal for Virginia Tech alumni using Campus Pipeline. **Status:** Campus Pipeline was replaced with VT-developed Hokie Portal.
- Piloting several new digital signature projects. **Status:** Digital signature projects have been discussed with Sponsored Programs.
- Implementation of Banner releases, including workflow and attribute reporting enhancements. **Status:** Baseline Banner attributes were implement, and workflow has been deferred pending a more web-accessible product.

- Pilot electronic testing projects. Status: The Ambler-Johnston lab opened for scheduled online testing in March 2001.
- Quality Assurance initiatives to enhance and improve system performance and data integrity. **Status** Quality Assurance continues to monitor duplicates, resolve Banner-PID issues, and conduct data quality ongoing meetings.
- Implement Touchnet Payment Gateway. **Status:** Implemented.
- Replace cash receipts system. **Status:** The system solutions have been evaluated and selected.
- Continue to develop the call center concept. **Status:** Service Level Agreements continue, and the new Operations Center handles calls.
- Implement the Banner Sponsored Programs Billing. **Status:** Implemented
- Retire MVS and preserve the historic data residing on that system; move processes to appropriate alternate systems. **Status:** Completed.
- Research, pilot, and implement new environments for data storage. **Status:** Completed.
- Implement Pay Plan Reform. **Status:** Completed.
- Directory Services project participation. **Status:** Project moved to the newly created Middleware group.

*Advanced Network Infrastructure
and Services*

Mission

Advanced Network Infrastructure and Services (ANI&S) exists to provide leading edge, high quality voice, data, and video services at reasonable cost to all segments of the university community to meet their present and future communications needs. Operating as an auxiliary unit in support of university goals, it strives to emphasize sound fiscal management in its operations. It endeavors to advance the technological capabilities of the existing telecommunications infrastructure and to broadly disseminate information regarding new technological developments. Network management, maintenance, and support are provided with an emphasis on the highest levels of network security and reliability. The department supports the instruction, research, and outreach missions of the university and recognizes its role as a corporate citizen within the local, state, regional, and international communities. It remains sufficiently flexible to admit not only an expansion and enhancement of current advanced communications, video, print, and mail services but will also pursue aggressive development of new services.

Introduction

Advanced Network Infrastructure and Services believes a state-of-the-art communications infrastructure is mission-critical to the university. Advances in technology, corresponding reductions in the cost of providing it, and increased demand from the university community and its clients for more sophisticated communications media will continue to grow exponentially in the next five to ten years. Virginia Tech's competitive position in regional, national, and global markets will rely heavily on continued success in identifying and incorporating the finest communications capabilities available.

Advanced Networking Infrastructure and Services has an operating budget of approximately \$22 million annually and has a workforce of 235 employees distributed among Communications Network Services (CNS), Video Broadcast Services (VBS), University Printing Services, and University Mail Services. In a continuing effort to create an organizational structure and environment to support the mission of the university, two important areas addressed during the 2000-2001 Fiscal Year were the retention of an experienced information technology workforce and the construction of an adequate physical work environment for the specialized types of projects and functions undertaken by the department.

Retention of Experienced Information Technology (IT) Workforce

During the past several years, retention of a highly trained and experienced work force capable of keeping Virginia Tech positioned on the leading edge of advanced networking became increasingly challenging. As the result of the explosive growth in technology driven companies in the surrounding area during the middle to late

1990's, senior engineering and development staff were frequently courted and lured away by more lucrative compensation packages which included much higher salaries and stock-related programs. Beginning in 1999, the implementation of the Information Technology Compensation Pilot program helped to relieve the problem by offering competitive salaries in the range of 10-20 percent higher than current salaries offered at the university. Compensation reform was introduced in 2000 and extended salary incentives to all information technology classified staff. The combination of these retention measures and the onset of a contraction of the regional economy, which began in March 2000, has greatly significantly reduced employee turnover.

New Advanced Network Infrastructure & Services (ANI&S) Facility

ANI&S of Virginia Tech has been located in the Hunter Andrews Information Systems Building in the Virginia Tech Corporate Research Center since 1989. Information Systems and Computing (IS&C) also shares this 51,000 square foot facility. Advanced Network Infrastructure & Services' space requirements have grown significantly over the past twelve years.

During the 1999-2000 Fiscal Year, ANI&S conducted a study of its existing and future space requirements. The results of this study revealed ANI&S would need approximately 30,000 square feet of space to perform its mission, which led to the expansion of the facility to meet the department's needs. Groundbreaking occurred in early September 2000 and construction proceeded steadily and without significant problems or delays. The new facility is located adjacent to the Hunter Andrews Information Systems building. A bridge will link both facilities, and the new area will be ready for occupancy in early 2002. The new facility will house the Virginia Tech Operations Center and will feature the latest innovations in telecommunications technology including an integrated wireless network, advanced physical and network security. Other Information Systems departments will consolidate their personnel and backfill the space vacated by ANI&S in Andrews.

Throughout the construction of the new facility, ANI&S has maintained a close working relationship with the Construction Management Team to address issues as they arise to keep the project on time and on budget. This team includes the architects, engineers, contractors, and representatives from the Virginia Tech Corporate Research Center.

Highlights 2000-2001

Virginia Tech Operations Center (VTOC)

In November 2000, in an effort to provide coordinated and comprehensive trouble resolution and support services, Communications Network Services (CNS) and Video Broadcast Services (VBS), began a joint project to integrate their Operations' Centers. In Spring 2001, the Computing Center joined the initiative and the group

began to develop a plan for the Virginia Tech Operations Center (VTOC). This center will provide significantly better technical support for the services offered by CNS, VBS, and the Computing Center.

Blacksburg Electronic Village (BEV)

The BEV group successfully managed the Hewlett-Packard Corporation Digital Villages initiative. As part of this project, the BEV group designed and wrote Hewlett Packard's first-ever paperless grant management system and hosted it on a BEV server. More than 220 communities submitted grants using the system, and all review and selection work was done online. The BEV group also developed the "BEV in a Box" concept that enables the inexpensive duplication of key BEV services in other communities.

Network Virginia

This year, NetworkVirginia installed four Cisco Gigaswitch routers and three OC12 SprintLink connections, increasing Internet bandwidth by 600 percent. NetworkVirginia continued to upgrade its service to over 1,000 sites in the Commonwealth of Virginia.

Net@EDU Conference

Virginia Tech co-chairs the EDUCAUSE Net@EDU committee on Broadband Wireless. ANI&S planned and hosted a conference at Virginia Tech in March 2001 to bring together information technology professionals from higher education to exchange information and discuss issues of mutual concern. The conference was a tremendous success in that it firmly demonstrated the university's position as a leader in wireless technologies for educational applications. Information about the conference agenda, speakers and working groups is still available at wirelesswg.cns.vt.edu/.

RFP for Wireless Technologies and Services

ANI&S evaluated responses to the request for proposals (RFP) for Wireless Technologies and Services (RFP #638921). The goal of the RFP is to provide Virginia Tech-branded wireless voice and Internet data service to the university community that exceeds what is generally available in the commercial marketplace and creates value and productivity improvements through enhanced learning, teaching and research opportunities. The RFP was issued in March 2001 and responses were received in May 2001. While the bid was open, ANI&S hosted a number of site visits and responded to vendor inquiries generated during an online bidder's conference. Additional information about the process may be found at wrfp.cns.vt.edu. ANI&S anticipates announcing an award during the first quarter of 2002.

Wireless Campus Networks

In January 2001, ANI&S launched a pilot program for wireless local area networks using the IEEE 802.11b standard. The goal of the pilot was to increase awareness, promote demand among university users, and gain operational experience with 802.11b networks in advance of offering it as a production service. Additional information is available at wireless.cns.vt.edu/.

Advanced Networking Infrastructure

CNS Network Engineering and Operations

CNS Network Engineering and Operations is a team of twenty-seven highly skilled information technology specialists. The team has strong credentials in statistics, mathematics, computer science, network engineering, software development, and systems analysis. The team's responsibilities include:

- Network architecture and engineering;
- Network operations and maintenance;
- Network operations center and call center management;
- Services development and business case modeling;
- Network management systems development;
- Network security assessment and implementation; and
- Network performance measurement and analysis.

The CNS Network Engineering and Operations Team also engages in fundamental research of network protocols, and pilot testing of new products and technologies in association with hardware and software vendors.

Software development is a major activity of the team, with continuous work on applications supporting fault management and problem reporting, configuration change management, authentication and authorization services, and performance measurement and analysis. Most of these applications fall under the Network Engineering Management Information System (NEMISYS) project umbrella, with tight integration to the ATLAS (A Telecommunications Logistics Accounting and Scheduling) system to support the requirements of inventory/asset management, billing, cable plant provisioning, and the like.

Field Engineering

The CNS Field Engineering (FE) and Network Operations areas consist of some fifty individuals organized into the following groups:

- Field Engineering: comprising Planning and Management, Cable Plant Database, Inside Plant, Outside Plant, Network Resolutions, Video Satellite Uplink/Downlink, and Materials and Logistics units;

- Network Engineering;
- Network Operations Center; and
- Wide Area Network (Network Virginia) Operations.

During this fiscal year, significant effort was invested in improving efficiencies in FE. These investments enabled us to continue to meet operational requirements while reducing wage and overtime hours and allowing some positions, vacated by attrition, to be reallocated. Improving organizational and operational efficiencies are continuing objectives for FE.

Switch Engineering

The main objective of the Switch Engineering (SE) group is to offer the expected five nines of reliability (99.999%) for delivering telephony services to the university. As advances in technology are implemented, SE will strive for that same high level of dependable service. SE is composed of a five-member team that supports the configuration and maintenance of the university telephony systems on campus and remote Virginia Tech locations. These systems are comprised of a fourteen-node Siemens 9751 Model 70 CBX operating with release 9005.6.84 software for large CBX applications, Models 10 and 50 also operating with 9005 release, and one HiCom Model 30 operating with Siemens 9006 software release. These systems support over 15,000 extensions and 1,100 CBX data connections servicing both digital and analog devices. The university's PhoneMail system consists of eleven nodes serving all students, faculty and staff.

Due largely to SE staff efforts, there continued to be excellent performance of all equipment, and no campus CBX down time due to physical plant failures occurred during this fiscal year. Since the campus CBX became operational in August of 1988, there have been a total of 1,594,320 campus node hours. The campus CBX has been down due to physical plant failures for a total of 296 hours. Of the 296 hours of down time, 288 of these occurred at the ISB during an ice storm before the installation of emergency generators.

This year, the group began planning a preventive maintenance program to replace older physical plant equipment and continued to improve environmental monitoring system for the switchrooms based on Simple Network Management Protocol (SNMP). This system now has an improved Web interface and has the ability to send electronic mail pages in case of problems. Additional enhancements included the improvement of the storage and archive of the images generated by the web based security cameras in the Andrews Information Systems Building. These cameras allow images to be monitored and recorded over the campus Ethernet network.

The group also joined Association of Physical Plant Professionals (APPA) for Universities and Colleges. This organization is similar to the Association for Telecommunications Professionals in Higher Education (ACUTA).

The group now provides departmental Call Data Detail for ACD departmental groups throughout the university. Joe Hutson has developed a section of the SE web site to provide these statistics on a daily basis. Each department desiring "enhanced" ACD services is offered this web based feature.

Hearing Impaired Opportunities

ANI&S Switch Engineering implemented a Siemens PhoneMail TDD application for the Student Telecommunications Automated Customer Information Express (STACIE). This application allows hearing-impaired TDD customers to learn how to access account information available to hearing customers via STACIE, which offers the capability of checking account information, requesting service information, and reporting service problems.

Video Broadcast Services (VBS)

The VBS organization was transferred from Instructional Services to ANI&S in August 2000. The first order of business was to capitalize on synergies between the CNS and VBS operations. As the result, the network operations centers and business services areas of each group have been merged.

VBS provides a variety of video-related services to the university community. Some projects of note from the last year include their involvement in the implementation of multimedia classrooms in Torgersen Hall, the design and construction of the new boardroom in Torgersen Hall, designing new video conferencing classrooms in the Virginia Tech center in Richmond, providing "Video-on-Demand" for enhanced classroom instruction, designing a system for large scale video storage and retrieval and administering and upgrading a videoconferencing network for the Cooperative Extension Service. In addition to these special projects, VBS provides:

- Day-to-day services to the university community in the form of classroom video operations support;
- Support and maintenance of high-quality video conferencing networks on campus;
- Installation and maintenance of university-owned video equipment and classrooms; and
- A wide variety of production services.

ANI&S Initiatives

Wireless Campus Networks

Wireless technology is an increasingly significant component of Virginia Tech's existing campus infrastructure. In addition to the miles of copper cable and optical fiber providing communications paths for the University, Virginia Tech is also served by microwave, satellite, two-way radio, and broadband wireless networks. These

networks have been integrated to support critical campus communications and provide reliable and competitively priced voice, data, and video services. This technology enhances the university's research centers, where new technology is developed for future telecommunication services.

NET@EDU Wireless Conference

Virginia Tech chairs the EDUCAUSE Net@EDU committee on Broadband Wireless. The first annual "Conference on Wireless Campus Networks" was held at the Donaldson Brown Hotel and Conference Center in March 2001. Virginia Tech organized and hosted the conference, in collaboration with Net@EDU's wireless working group. The conference addressed developments in wireless networking such as cellular/3G wireless, antenna design, 802.11b and 802.11a wireless LANs, LMDS networking, and unlicensed broadband networking. The conference brought together case studies of existing wireless deployments, innovations by wireless vendors, industry experts from Cisco, Nortel, Harris, and Radiant Networks, and the experience of leading information technology innovators from higher education and K-12 institutions. Live demonstrations of LMDS and wireless LAN technology and applications were given. Guests from twenty-four states and Canada attended the sold-out conference. ANI&S is planning the second annual wireless conference to be held in early 2002 to bring together information technology professionals from higher education to continue exchanging information and discussion of issues in these areas.

Wireless Campus Networking (802.11b)

In January 2001, ANI&S launched a pilot service program for campus wireless local area networks based on the IEEE 802.11b standard. The goal of the pilot was to increase awareness and promote demand among university users and to gain operational experience with 802.11b networks in advance of offering it as a production service. Under the pilot, users are asked to register for wireless network access. The service was initially offered in Torgersen Hall and has been expanded to include Randolph Hall, Carol M. Newman Library, G. Burke Johnston Student Center, Collegiate Square 2 and Owens Dining Hall.

ANI&S is working with university departments and colleges to assess the demand for the service and is finalizing a comprehensive deployment plan. The latest information about the service, coverage, and technical support is available at **www.wireless.cns.vt.edu**.

ANI&S is collaborating with researchers in the Bradley Department of Electrical and Computer Engineering to advance mobile and wireless networking with projects in MobileIP, Mobile Ad Hoc Networking, and wireless system planning methodologies.

Wireless RFP

Communications Network Services evaluated responses to the request for proposals (RFP) for Wireless Technologies and Services (RFP #638921). The goal of the RFP is to provide Virginia Tech-branded wireless voice and Internet data services to the university community that exceeds what is generally available in the commercial marketplace and creates value and productivity improvements through enhanced learning, teaching and research opportunities. The RFP was issued in March 2001 and responses were received in May 2001.

The RFP solicited competitive proposals for wireless technology and associated services with the intent that a contract would be established through competitive negotiations. These negotiations are underway with qualified vendors. ANI&S seeks to offer current and next-generation wireless products, services, and content to Virginia Tech faculty, staff, students and affiliates. It is desired that this effort will enhance education, support issues of the convergence of voice and data, and result in a model that can be successfully reproduced by agencies and higher education institutions across the Commonwealth of Virginia.

Virginia Tech—as a university putting knowledge to work—must continue providing high quality, cost-effective voice, data and video services to the university community while investigating the diversity of service offerings and increased use of digital technology in the wireless marketplace. ANI&S has been conducting research and working with manufacturer and service provider representatives to understand the possibilities of wireless technology and how they may complement and supplement the existing wireline infrastructure, while enhancing the advanced networking opportunities offered by the wireless research centers on campus.

With the completion of competitive negotiations, ANI&S intends to enter into a long-term relationship with a qualified carrier and its equipment and content partners. We expect to deliver state-of-the-art wireless voice, data and Internet services and unified messaging on and off-campus, to improve teaching and learning and to enhance research. We also envision joint development projects with the successful offeror in which Virginia Tech will assist in the deployment of the latest wireless technology and applications.

Campus Backbone

In the summer of 2000, ANI&S deployed a major campus backbone upgrade. System upgrades continue to provide the University with state-of-the-art Internet Protocol (IP) switching capabilities. Advanced bandwidth management and quality-of-service controls play an important role in the new network architecture, ensuring that Virginia Tech's mission-critical applications are given premium service. The upgraded backbone provides an order-of-magnitude increase in switching capacity, in

a highly fault-tolerant configuration, which allows ANI&S to provide an unprecedented level of service availability and performance.

Remote Access Services

In addition to providing a highly reliable and affordable dial-up remote access service to the Virginia Tech community, ANI&S continues to improve methods for assessing remote access utilization. While advancing the state of the art in traditional remote access provisioning, higher capacity and higher bandwidth services are a focus of ongoing development efforts. These access technologies include wireless broadband, digital subscriber loop (DSL), and integrated services digital network (ISDN) technologies. Operationally, Virginia Tech has deployed methodologies for maintaining remote access servers at maximum total system availability, even in the presence of hardware failures of individual access servers and downtime due to network upgrades, resulting in substantially reduced total system downtime.

Blacksburg MSAP

ANI&S continues to operate a Multi-Service Access Point (MSAP) for local ISPs to connect to each other and Virginia Tech. This access point has been a key enabling technology for large-scale deployment of Ethernet service in Blacksburg apartment complexes to Virginia Tech students, faculty, and staff.

Network Capacity Planning Methodologies

As a provider of highly available service and adequate capacity, ANI&S is active in research into network scaling methodologies and capacity planning models. These efforts have resulted in methods adopted by NetworkVirginia for scaling backbone elements, more effective measurement of campus network performance, and more effective scaling models for remote access server utilization. Virginia Tech is also a member of the National Laboratory for Applied Network Research's (NLANR) Network Analysis Infrastructure Active Measurement Project and an active participant in the Internet2 community's research efforts. Virginia Tech's ongoing efforts at improved network performance measurements and network management methodologies have resulted in numerous improvements to the design of both the campus infrastructure and NetworkVirginia. These efforts continue in advancing models of flow-based capacity planning, quality of service planning and design, and stochastic models for packet traffic over circuit-switched networks. All of these efforts, in turn, are used to better deliver service to the greater Virginia Tech community.

Sponsored Research

ANI&S is a participant in the Office of Naval Research's Navy Collaborative Integrated Information Technology Initiative (NAVCIITI) project. This project establishes a collaborative environment for integrating multidisciplinary researchers

in numerous fields of engineering, computer science, *et. al*, with a goal of developing a comprehensive next-generation naval warfare and strategic planning environment. ANI&S has been actively involved in establishing methodologies for a Virtual Operations Network, whereby allied forces in a mission can ensure compatible and secure communications and information technologies. These efforts leverage ANI&S's expertise in advanced network management, security, mobile computing, and wireless deployment.

Expert Consultation

Members of ANI&S's Network Research and Development and Network Engineering staffs have achieved an unparalleled level of respect in the Virginia Tech campus environment. The advice of these individuals is continually sought by members of the community in matters of advanced network services, system security and design, database systems and applications design and development, and scientific and quantitative analysis methods. As Virginia Tech's academic researchers have achieved success in advancing their respective disciplines, they have also found eager and talented colleagues with whom to collaborate in the administrative units of the University.

IP Differentiated Services Development

IP Differentiated Services is an area of technology that provides the network-layer quality-of-service (QoS) needed to implement real-time applications such as voice or video over an IP network such as the campus backbone or the Network Virginia next generation (NwVng) network.

ANI&S has been collaborating with Cisco Systems to develop a proposal for supporting differentiated services, bandwidth guarantees, and associated service level agreements for the NwVng environment. ANI&S engineers worked with Cisco engineers at the Cisco Performance and Design Verification Center to perform testing to validate these service models and to develop implementation plans. In coming months, these efforts will lead to the availability of highly advanced NwVng services supporting ubiquitous access to IP-based voice and video throughout the Commonwealth.

Problem Reporting

As a result of the integration of the many call centers and operations centers associated with Communications Network Services (CNS), University Computing Services (UCS), and Video Broadcasting Services (VBS), there is a need for a single problem reporting (trouble ticketing) system that can serve the needs of each of the component groups of the operations center. ANI&S continues its efforts to develop application prototypes to meet these needs. The problem reporting system is still in its infancy but is rapidly becoming an important part of ANI&S operations. The system allows problems to be logged and monitored during various stages of their

resolution. By analyzing this data, day-to-day operations can become more efficient and streamlined.

Portal Security

Additional security features were activated on network portals in all residence hall rooms and many academic buildings. "Portal Security" monitors and controls the number of computers and devices accessing the university's network backbone. Additional devices can be connected, but must be registered with CNS. The aim of portal security is to ensure the integrity and reliability of the university network.

Public Portals

Ethernet portals located in public areas throughout Torgersen Hall were made available for use by Virginia Tech students, faculty and staff laptop computer users. These portals are found in the common study areas of the facility on the first floor and in the electronic reading room. This service is available to registered Virginia Tech students, faculty and staff. Additional information about this service can be found at [**publicportal.cns.vt.edu**](http://publicportal.cns.vt.edu).

Building Network Upgrades

ANI&S continued to upgrade internal building network infrastructures during this fiscal year. The immediate goal of this program is to upgrade each building network from a shared 10 Mbps Ethernet to a virtually non-blocking network providing dedicated, or switched, 10 Mbps Ethernet to each desk. Upgraded networks provide higher bandwidth to each user, but also implement enhanced security and management features. Additionally, as part of this project, ANI&S is installing a highly scalable and flexible, fiber optic based, internal building cabling infrastructure. The new infrastructure is capable of supporting very high-speed future networks, and also establishing a high degree of physical security to network assets within each building.

During the previous fiscal year, ANI&S upgraded Southgate Center, Smythe, Randolph, Squires, Cowgill, Moss, Norris, Holden, Patton, and Robeson Halls.

Due to the long lead-time required to work with departments and Physical Plant to identify and renovate spaces required to support building upgrades, ANI&S completed design and physical plant renovation process for several additional buildings during this fiscal year. Pending funding, the electronics required to complete the upgrade in these buildings will be installed during FY2001-2002. The buildings in this group include Burruss Hall, Fralin Hall, Engle Hall, Derring Hall, and the Old Security Building.

Planning and design has also taken place to begin renovations, pending funding, required to upgrade Price Hall, Sandy Hall, Saunders Hall, Seitz Hall, Agnew Hall,

Hahn Hall, Davidson Hall, Media Building, Cheatham Hall, and the Northern Virginia Center.

ANI&S took advantage of the design and construction of Torgersen Hall to experiment with next generation building network infrastructures that will be deployed on the campus at large as appropriate. New technologies utilized in Torgersen Hall include innovative equipment room cable management techniques, state of the art “Category 6” UTP station cabling, a gigabit Ethernet building backbone, network electronics capable of supporting varied quality of service (QOS) levels required to support the convergence of voice, data, and video over a single “data” network, and the infrastructure required to support wireless networking.

The department’s expertise in these advanced areas was a key consideration in the Roanoke Higher Education Authority (RHEA) retention of ANI&S to provide oversight of contractor-installed cable plant in their new facility in downtown Roanoke.

Network Operations Center (NOC)

During this fiscal year, ANI&S abandoned an experiment with the Peregrin Trouble Ticket system and implemented a Trouble Ticket system based on Remedy ARS. The experiment revealed that the Peregrin system was not meeting all of ANI&S’s needs and that Remedy ARS is flexible enough to meet ANI&S’s requirements. The Remedy-based system is used to pass tickets between the NOC and other internal groups required to investigate and correct a trouble, and to exchange tickets between the NOC and the Computing Center “4HELP” support group.

The NOC is available 24 hours per day, 7 days a week, utilizing our 24x7 operators and on-call technical staff. In January 2001, the NOC expanded the hours it is staffed from 8:00 AM to 5:00 PM, Monday through Friday (45 hours per week), to 7:00 AM to 10:00 PM, Monday through Friday. A further expansion of hours of 10:00 AM to 10:00 PM Saturday and Sunday (89 hours per week) was implemented November 2001.

During the next fiscal year, the NOC will focus on further enhancing the capabilities of the combined Virginia Tech Operations Center (VTOC) as ANI&S moves to position itself to manage a broader scope of networks such as the Mid Atlantic Crossroads (MAX) and other regional networks. In addition to increasing staff coverage above 89 hours per week, ANI&S will focus on further growing the skills of all VTOC staff, improving the technical tools they have available to them, and improving internal VTOC organizational structure and work culture.

Center for Internet Security (CIS)

Virginia Tech has been an active participant in several initiatives of the Center for Internet Security (www.cisecurity.org/). The CIS “Benchmark and Scoring/Scanning

Tools for Solaris” provides the information necessary to evaluate and secure a Solaris System. Documents like this will not only provide guidance to system administrators, but will also serve as guides for vendors to secure their operating systems. Members of the VT-CIRT team played a significant role in establishing and reviewing these standards. CIS has also proposed an "Appliance Testing Lab" to evaluate Internet appliances based on a common set of security standards. Virginia Tech has been participating in the design phase of this project.

IPv6 Campus Infrastructure

ANI&S has renewed its support of IPv6 (Internet Protocol Version 6) on the campus network. This protocol is an improvement over the current standard. A new router has been dedicated to this project and several ANI&S hosts run IPv6 services. ANI&S has started a mailing list of interested parties on Network Virginia to promote IPv6 activities among the customer sites.

System Administration, Networking, and Security (SANS) Institute

SANS is working on a "Top Twenty Threats" document and members of the VT-CIRT team will make significant contributions. The older Top Ten list is at www.sans.org/topten.htm. Randy Marchany arranged free online GIAC training and certification for Virginia Tech network security team members. See www.sans.org/giactc.htm.

Network Administration (NA)

The Network Administration group works very closely with the Operations groups and Switch Engineering. The NA group 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. They maintain ongoing and regular contact with other higher education telecommunications administrators nationwide.

This year, the group provided information to peer institutions about the services we provide, our policies and procedures, our rates, regulatory issues, vendor services and billing. Some of the schools they assisted this year include Longwood College, Duke University, Washington and Lee University, Columbia University, Georgetown University, Brigham Young University, Radford University, University of Virginia, Harvard University, Lehigh University, University of Vermont, George Mason University, Washington State University, Stanford University, Ohio State University, Northern Iowa University, Miami of Ohio, Galludet University, and Western Maryland University.

The Network Administration group also reinforced our relationship with peer institutions by representing Virginia Tech at the ACUTA Summer Conference in

Washington D.C. in July 2000. In Spring 2001, Network Administration personnel hosted a meeting of ANI&S staff and Radford University telecommunications personnel regarding the possible opportunities for cooperative efforts.

In addition to developing our relationship with peer institutions, Network Administration (NA) also assists in developing our relationship with both the university community and the community at large. They work extensively with the campus community, including the multiple vendors who provide telecommunications products and services. They work with state agencies to resolve problems, provide consulting services, and to develop productive, efficient, "partnering" relationships. They provide information to other higher education institutions and the Commonwealth of Virginia's Department of Information Technology (DIT) 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. NA conducts periodic meetings with Verizon, DIT, AT&T, Qwest and MCI to maintain open lines of communication to ensure the most rapid and efficient resolution possible of current problems. As a result of these efforts, the Network Administration group has negotiated a new campus payphone agreement with Verizon.

Network Administration is also responsible for making sure that ANI&S 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 regulations that impact current and future services.

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

Large-Scale Advanced Network Infrastructure Projects

LMDS

In the spring of 1998, the Virginia Tech Foundation ("Foundation") participated in a FCC spectrum auction and was awarded licenses for the LMDS spectrum covering an area of 16,000 square miles and 1.6 million people in southwest Virginia, portions of Tennessee, and one county in North Carolina. The LMDS spectrum represents the largest block of spectrum ever auctioned and Virginia Tech was the only university that participated as a bidder in the auction. LMDS enables wireless communications at gigabit speeds – thousands of times faster than most current communication systems use for "last-mile" voice and data services.

The LMDS spectrum offers a tremendous research tool to the university. It has been instrumental in attracting millions of dollars in research funding and support for faculty, staff, and students. Issues in LMDS deployment and business models formed the basis for an intensive summer course for students from all disciplines. The

spectrum is of great value to the university's outreach mission. Staff members from ANI&S are working with Virginia Tech's Center for Wireless Telecommunications to help localities in the license area and throughout the Commonwealth to take advantage of this wireless resource. LMDS offers a tremendous opportunity for areas to build or improve their network infrastructure to pave the way for e-commerce and the influx of high-technology jobs. This is especially important as many Virginia areas are working to transform their agricultural and textile economies.

ANI&S is currently leasing this spectrum from the Foundation. ANI&S has deployed the first rural LMDS system in the country using equipment donated by the Harris Corporation. It has become a showcase and research testbed, and has been toured and examined by visitors from all over the world. Results of the testbed are of interest to other rural and metropolitan licensees, government agencies, community leaders, and economic developers. The first-of-its-kind, Blacksburg LMDS deployment has been featured in many national journals and magazines as an example of the leading edge research performed by Virginia Tech.

ANI&S seeks to ensure that the spectrum is best utilized to support the teaching, research and outreach missions of the university and economic development, education, and quality of life for citizens of the Commonwealth.

The LMDS group operates the Blacksburg LMDS Testbed. Visitors study the system to learn about one of the world's longest running LMDS networks. This year, visitors came from as far away as Europe, South America, and Japan. The Blacksburg LMDS Testbed continues to provide production telecommunication services to Virginia Tech off campus facilities, as it has done since May of 1999. The network is also being used to design, integrate, and test LMDS technology with other evolving networking and telecommunication technologies and applications. This year, the LMDS group has implemented the design and test of a hybrid wireless network. This model combines LMDS and point-to-point 802.11b wireless LAN equipment to cost effectively solve line-of-sight issues encountered with LMDS, while still providing broadband access to remote sites. Applications successfully tested over the LMDS network include videoconferencing (broadband and narrowband), Voice over IP, analog voice circuits, and mobile wireless LAN access. The LMDS group is preparing to implement a major upgrade to Harris' next generation LMDS system, the ClearBurst 2000, released in the fourth quarter of 2001.

NetworkVirginia Next Generation (NWVng)

During FY2000-2001, Virginia Tech completed a substantial overhaul of the NetworkVirginia program and renamed it NetworkVirginia Next Generation (NWVng). ANI&S responded to a request from Sprint to perform design, engineering, and implementation of a new backbone network system for NWVng to significantly upgrade capacity and to support next generation IP services. This work was completed under paid contract ahead of schedule during August 2001 resulting in substantial benefits to all NWVng participants:

- A significant increase in reliability through improved diversity;
- A 500 percent increase in NWVng backbone capacity;
- A 600 percent increase in Internet access capacity; and
- A shift from layer 2 to layer 3 transport with support for advanced IP applications.

Additional accomplishments of the NWVng Operations Team (a component of ANI&S) included:

- Migrating the entire NWV customer base to a new network infrastructure;
- Establishing new procedures with Verizon following the Bell Atlantic-GTE merger;
- Creating a new order/design system with the new database in Oracle with the ability to interface with existing trouble ticket system;
- Installing three additional access carrier extension connections;
- Redesigning the NWV web site to include web based, hubbing, and commercial order forms;
- Adding a notification email address database to the NWV listserv and redesigned faxed order entry; and
- Adding the ability to view design forms from the online Order Design System (ODS).

Virginia Internet2 gigaPOP

Virginia Tech continues to provide leadership within Virginia for Internet2 by operating the Virginia gigaPOP. The gigaPOP provides access to the Internet2 Abilene network for all participating institutions in the state including Virginia Tech, the University of Virginia, George Mason University, Old Dominion University, the College of William and Mary, Virginia Commonwealth University, the Virginia Tech Internet2 Studio and many other schools. The ANI&S Network Research and Development group and the NWVng Operations Team manage GigaPOP configuration and operations.

During 2000/2001, Virginia Tech successfully proposed to the University Corporation for Advanced Internet Development (UCAID) an expansion of Abilene participation within Virginia to include K-20 institutions. As a result, the entire Virginia Community College System, the Virginia Science Museum, several masters' level institutions, and AEL, Inc. have all been included in the Internet2 program with access to Abilene.

Accomplishments related to the Virginia gigaPOP include:

- Active participation in the Internet2 K-20 Initiative, SURA Crossroads Initiative, National Quilt Initiative, the Net@EDU StateNets Initiative, NLANR/Joint Techs national program, the Mid-Atlantic Crossroads;

- Substantial upgrade for access from NWWng to Abilene from OC3 via New York to OC12c via Washington, D.C. at no additional cost to participants. 400 percent increase in access capacity;
- Lowest cost for Internet2 Abilene access in the country afforded to all Virginia participants;
- Growth from seven participating institutions to 48 with successful sponsorship of NWWng as an Internet2 Sponsored Educational Group Participant; and
- Support from NWWng Ops Team to other participating institutions for configuration.

Systems Development and Administration

ANI&S/CNS Systems Development and Administration is a team of ten highly skilled information technology professionals responsible for software development and systems administration, led by Morgan Allen.

The Software Development Team develops Oracle-based software applications in Oracle Forms and Reports, PL/SQL, JAVA, C, Expect and PERL to support all aspects of the organization including accounts receivable, billing, accounts payable, inventory, budgeting, phone directory, 911, work flow, purchase order, and call accounting. Most of these applications fall under the ATLAS (A Telecommunications Logistics Accounting and Scheduling) project umbrella.

The System Administration Team provides UNIX system administration for over 25 UNIX systems supporting Oracle databases, CDR polling, web servers, Veritas NetBackup software, name servers and network management systems. The team also provides system administration for several OS/2, NT and Windows file servers and approximately 150 desktop clients.

Web-Based Applications

A web development team consisting of customer support and business managers, programmers, system administrators and Web page designers was initiated to create and host Web-based applications. The group designed and implemented a web application architecture that separates the content—data extracted from ATLAS (using Java servlets) from the presentation on the customer's browser (using XSLT, CSS and HTML).

Student Applications

Among the first activities of the web development team was the launch of a residential dorm directory application and international long distance rate call costing application for the CNS public Web site at www.cns.vt.edu. Information about accounts blocked or frozen due to nonpayment was integrated with the university's Banner System. This integration superseded manual notifications of University Bursar and University Registrar who are ultimately responsible for collection. The

information systems team also enabled Hokie Passport scanning at CNS Student Telecommunications to facilitate customer account transactions.

A Service Management application was developed on cola.cns.vt.edu. This application allows students to activate and deactivate modem pool service via the web. A complementary Account Management application was also developed to allow students to view their account information and change billing address designation.

Departmental Applications

The Invoice Viewer Application was released to university departments to provide an electronic version of their monthly telecommunications bill. This application has eliminated the need and expense of printing and mailing departmental invoices. Finally, the Docuprint registration and services were enabled online for university departments to register for this distributed printing service.

Continuing ATLAS Improvements

Over 600 program modifications were completed during fiscal year 2000-2001 including improvements in the ATLAS Inventory system that enabled the integration of the work order system for an automated separation of warehouse, staging, and in-process inventories, with consumption on work orders balanced against inventory transactions. Several cable plant fiber management applications were also developed. Significant improvements made in the ATLAS work order system provide for queuing constraint enforcement, queue analysis reports and automated service charge application.

ATLAS Data Warehouse

An ATLAS data warehouse and data archive processes were developed to store large volumes of historical data. Several years of call detail information are accessible online via the data warehouse.

Other Developments

An LDAP directory system was established to support authorization to several web sites. This pilot provides LDAP experience needed to support directory applications for future advanced communications systems

The group continued to make improvements in UNIX system security including the research and use of new security tools and methodologies, as well as being very actively involved in national and global security organizations such as SANS (System Administration, Networking and Security) and CIS (Center for Internet Security).

A traffic engineering team was created to study improvements in the analysis and routing of data traffic. This work is ongoing.

Operations

The Operations area of ANI&S is led by Roy Smith and consists of several functions including public relations, accounts payable, accounts receivable, vendor billing, student telecommunications, and ordering and provisioning. These functions assure sound management of the department's day-to-day activities. Furthermore, they facilitate transactions between ANI&S and its stakeholders including vendors, students, the university community, the Commonwealth of Virginia, and partners across the world.

Public Relations

The Public Relations (PR) group develops internal and external information campaigns. This information is distributed via a variety of media such as the *Spectrum*, the CNS web page, university-wide email lists, the Virginia Tech Cable TV informational scroll, and other publications. This year, publicity campaigns included one-on-one coordination with approximately forty departments, offices, and colleges for implementation of the portal security project; information regarding special accommodations for hearing disabled students; several information campaigns regarding changes in area codes; and special support including publicity, placards, and chauffeur services for the Torgersen Hall dedication. Public Relations personnel also worked with Virginia Tech Information Systems and the News Messenger newspaper, which put together a lengthy story on "wired" and "wireless" network initiatives at Virginia Tech.

The PR group provides input at various university-level meetings. Public Relations personnel led a team of CNS staff that participated in a debriefing with the Residential and Dining Programs Vice President and his Student Advisory Committee. They provided information to RAs and Head RAs at their Annual RA Resource Fair and coordinated special summer phone services with Residential Programs for their summer conferees. The PR Manager served as faculty representative for a student organization and as a reader during Virginia Tech's Holocaust Remembrance Day activities. The PR staff also provided meeting documentation support for various meetings and projects throughout the department. They provided editorial support to the Vice President for Information Technology for the eCorridors report. The group has enhanced its staff by hiring a new Switchboard Supervisor, a second Documentation Specialist, and a full-time receptionist.

Business Services

Business Services is responsible for managing daily enterprise activities of ANI&S including accounts payable, accounts receivable, budgeting, payroll, contract management, financial reporting, purchase orders, workflow, and inventory.

Business Services applies university and state accounting principles to ensure consistency and audit ability across the \$23 million ANI&S budget. The group also develops and maintains the department's policies and procedures regarding business functions.

Accounts Payable

ANI&S had the lowest expenditure carryover for FY2001 in its history. They added a "Controller date" to the ATLAS invoice screen, which enables the user to monitor the count and dollar amount of invoices sent to the Controller's Office, but have not yet posted to Banner. They paid 3,903 vendor invoices in the amount of \$7,796,248.97.

Accounts Receivable

ANI&S began processing single page student bills in-house during November 2000. This eliminated the monthly processing charges previously paid to Best Mailing Services. The implementation of Portal Security by ANI&S resulted in the collection of additional revenues. Accounts Receivable is now sending collection letters to our customers who are 61 days past due, which reduces the number of referrals being sent to the university's Accounts Receivable department.

As of this year, all departments now retrieve their bills via the web. This reduced expenditures by eliminating the cost of printing, stuffing, and postage for off-campus customers. Accounts Receivable processed over 16,000 work orders and added a function in ATLAS that would automatically add the install charges onto a work order when a specific service code is attached to the order. They also began sending electronic mail notifications to customers prior to deactivating their service for non-payment. As a result of these efforts, the group reduced operating costs.

Student Telecommunications

Student Telecommunications is the primary contact with ANI&S's student users. In the Spring 2001, a survey issued to students at Centralized Student Services indicated that 100 percent of responses rated the quality of service as "excellent" in the Student Telecommunications area. During FY2000-2001, Student Telecommunications implemented a program to notify customers when their modem pool account was about to be deactivated. This has eliminated complaints related to service deactivations because the customer did not remember the date they had selected to deactivate the service. Student Telecommunications also began accepting applications for Electronic Funds Transfer (EFT), an automated debit withdrawal service, from authorization code customers during September 2000.

The group began auditing payment cards on a daily basis allowing Student Telecommunications to identify data entry errors from the University Bursar's Office before the customer receives them on their next bill. It saves the customer time because they do not have to bring in a receipt or a copy of the cancelled check, leading to a higher level of customer satisfaction.

During the Verizon work stoppage in August 2000, at the start of the Fall semester, Student Telecommunications assisted off-campus students by submitting orders for residential telephone service directly to Verizon.

Student Telecommunications began accepting applications from faculty and staff for modem pool service as well as distributing modem pool software to them, thus eliminating the need for them to drive across campus to pick up their software. As a result of the use of email notifications and web applications, the group reduced operating costs. During the year, the number of fraud cases referred to Judicial Affairs decreased from eight to none. EFT participation increased to 847 users. With the addition of the Student Telecommunications block, we are sending fewer accounts to Accounts Receivable for collection action. Furthermore, Student Telecommunications has authorized the Bursar's Office to print remittance slips so they no longer need to refer students to Student Telecommunications if they do not have a copy of their bill.

Ordering and Provisioning

Ordering and Provisioning (O&P) continued to provide telecommunications design consulting and support to departments, faculty, staff, and students with special telecommunications needs. Over 8,600 discrete work orders were processed during FY2000-2001. These orders were received from 180 departmental communications liaisons representing over 230 university departments. The web-based Interdepartmental Communications Request (ICR) form, an increasingly critical component of quality customer service, has been enhanced to ensure easy access and use, gathers the requisite data, speeds the process of providing telecommunications services to end users and, ultimately, results in accurate and timely billing. An electronic ICR scanning process was implemented to expedite storage of electronic copies of ICRs as they are initially received. This process also offers efficient retrieval when the ICRs are updated or after they are completed. These efforts resulted in more efficient and effective handling of several thousand ICRs.

O&P conducted regular internal meetings to identify and implement process improvements in coordination with other ANI&S units. The implementation of a listserv and periodic planning meetings has greatly improved communications and quality-of-support in the management of over fifty large telecommunications design projects, including the Advanced Communications and Information Technology Center located in Torgersen Hall.

Outreach

Blacksburg Electronic Village

The Blacksburg Electronic Village (BEV) is led by Andrew Cohill and has continued to serve as the model for other communities both in Virginia and around the world.

In the past year, the group met with more than forty-five regional, national, and international visitors and groups who wanted to learn about the BEV project. The BEV distributed more than 1,500 copies of the Community Network Briefing Book to over 1,000 individuals in more than twenty countries worldwide.

The Blacksburg Electronic Village continued to provide domain name server (DNS) services to Sprint for a fourth year as a component of the NetworkVirginia system. The group made significant progress on meeting its cost recovery goals, with a 35 percent increase in revenue.

The group continued its Outreach and Community Services mission by successfully soliciting and obtaining contracts to design, develop, and host sophisticated client tracking systems for non-profit social service agencies in Blacksburg, Virginia and Abingdon, Virginia. Both systems were delivered on budget and provided dramatically improved productivity enhancements for both organizations. The group successfully managed the Hewlett-Packard Corporation Digital Villages initiative. As a part of this project, the BEV group designed and wrote Hewlett Packard's first-ever paperless grant management system and hosted it on a BEV server. More than 220 communities submitted grants using the system, and all reviews and selection work was done online. The group developed the "BEV in a Box" concept that enables inexpensive duplication of key BEV services for other communities. The first pilot community to use BEV in a Box was Carroll County, which now has a complete community network system with services nearly identical to those offered in Blacksburg. The BEV Director was appointed co-chair of the Governor's Task Force on eCommunities, and represented the university at several high profile public meetings held by the task force. Furthermore, the BEV Director made more than a dozen conference presentations on BEV activities and programs, including nine keynote and plenary presentations at national and regional meetings. The Director was appointed as President of the Association for Community Networks (AFCN) for a second year. In 2000, Blacksburg became the permanent home of the AFCN, with a three year contract that has the BEV providing accounting and management services to the AFCN.

In addition to their Outreach and Community Service efforts, BEV also engaged in research this year. The BEV project continued to bring significant publicity to the university, with more than seventeen news articles in regional and national publications. BEV collaborated with Extension on submission of a \$700,000 U.S. Department of Commerce grant to provide electronic village services to nine counties in Virginia and the BEV Director worked closely with Big Stone Gap, Virginia, and Haysi, Virginia on proposals to the Appalachian Regional Commission (ARC) for local fiber infrastructure development grants. Both communities received \$150,000 awards.

eCorridors and eDan Support

ANI&S provided substantial support during 2000/2001 for the Virginia Tech

eCorridors and eDan initiatives through active participation by senior staff members. Contributions included strategic planning, financial analysis, technical planning, engineering, and consulting support resulting in over 700 combined staff hours.

University Printing Services

In the fourth quarter of 2000, Printing Services was charged with identifying a strategic direction to transition into the digital world. In January 2001, Printing Services began analyzing their operations, along with a study of university information distribution needs. Digital technologies are being evaluated to determine if an opportunity exists to enhance operations and better address the university's needs through their application. By implementing digital technologies and making modest changes to an existing infrastructure, Printing Services may be able to serve in the role of distributing information, regardless of the information type, form (electronic or paper), or destination. The user can make these choices. As a result of this role adjustment, a new name may need to be considered for this operating unit.

Concurrent with, and in support of this Printing Services effort, another broader initiative—the Transition to Digital Initiative—has evolved which involves representatives from across the university community.

Printing Services is composed of four revenue-generating units that meet the print and copy needs of the University's faculty, staff and students. The four units are Print Plant, Copy Center 1, Copy Center 2, and Centralized Mail. The Print Plant provides the lithographic printing needs of the University. The Copy Centers are located on campus and provide walk-in access to meet the copy and text printing needs of the University community. The Print Plant and Copy Centers combined produced 30 million impressions equivalent to 200 million standard, 8 ½ x 11-inch pages nearly 400,000 reams of paper! Centralized Mail provides the capability to do bulk mailings at significant savings to the University. Centralized Mail processed over 2 million individual pieces of mail during FY2000-2001.

In addition, Printing Services is responsible for the Satellite Copier Service. This service places copiers in departments and provides supplies and local maintenance and troubleshooting. During the past year, the number of machines serviced increased by 2 percent to over 200 units campus wide.

Printing Services is an ancillary operation; revenues and recoveries were approximately \$4.3 million. Prices have now remained unchanged for seven years.

Equipment improvements included a networked color printer that has greater flexibility on the type of files accepted, and is 600 percent faster than existing equipment. Also installed was a 42-inch 600 dpi large format printer for banners and large displays. An upgrade of hardware and software in the pre-press area was installed. A networked printer with booklet finisher will be installed in Copy Center I

before the close of December 2001. Other additions included a 42-inch programmable cutter and a rebuilt folder.

All contracts for supplies from prior years remained in effect, with one exception. A new contract for ink was negotiated that will result in a cost savings.

Transition to Digital Initiative

The Transition to Digital Advisory Group was convened to identify and evaluate digital needs, initiatives, and processes from different university constituencies. In an effort to avoid multiple, disjointed, proprietary solutions that may hinder access and distribution of information, this group includes members of different university groups, which increases its ability to take advantage of any economies of scale and scope among groups that share a common goal. The advisory group is responsible for reviewing possible solutions and compiling standards and guidelines, which may encourage consistency and facilitate information access. Additional information about this initiative can be found at www.paperless.vt.edu. The group is currently reviewing potential solutions and compiling standards, guidelines, and best practices for adoption, which may encourage consistency and facilitate information access.

University Mail Services

University Mail Services did not experience any significant changes in mail volume during FY2000-2001 as compared to the previous fiscal year. Residential Mail is now served by five consolidated mailrooms that economize space and improve efficiency. To expedite service to resident students, a new forwarding system that prints labels for all forwarded residential mail was installed.

A three-year lease for replacement equipment, including a mail management system that becomes obsolete in December 2001, is currently under negotiation and the systems should be in place by early January.

University Mail Services added a "Controller date" to their ATLAS invoice screen that enables the user to monitor the count and dollar amount of invoices sent to the Controller's Office, but have not yet posted to Banner. They also met prompt pay requirements each quarter.

Future Initiatives

VoIP – Convergence of Voice, Data and Video Networks

As packet networks evolve to complement (and potentially replace) the traditional circuit-switched voice network, ANI&S is retooling to support voice calls over existing IP networks. These VoIP solutions must offer an affordable alternative to the public switched telephone network (PSTN), by providing voice and fax calling over IP-based networks to customers virtually anywhere in the world. Switch Engineering will enter into the second stage of the ANI&S VoIP project with a larger scale

deployment of VoIP to prove and discover the functionality of the application while identifying a needed path of integration from the legacy voice network to a truly converged network.

Unified Messaging

Unified Messaging is the integration of several different communications media, such that users will be able to retrieve and send voice, fax, and e-mail messages from a single interface, whether it is a wireline phone, wireless phone, PC, or Internet-enabled PC. Switch Engineering will direct the engineering processes for the identification and selection of a system that will support all areas of communications and will lead responsibility for the replacement of the university's existing Voice Messaging systems.

Unified Numbering Plan and Unified Directory Services

One of the milestones that the ANI&S must overcome in the transition to Voice over the Network will be the installation and implementation of a Unified Numbering Plan to allow transition from the legacy telephony system and numbering plan to a network based unified system for voice, data, and video. Within this network, all devices attached to the network will have the potential to require a unique telephone number. Along with the deployment of a unified numbering plan and the upcoming convergence of voice, data and video, Switch Engineering will also share the lead in the development and deployment of a Unified Directory Services. This Directory Service must integrate with and eventually replace the existing directory service that the university now uses with integration into a WAN Directory Services. Directory listings for telephony and video devices will be imperative, not only at the university level but also over a WAN environment where any network based device must have the capability of being identified or listed within the network for directory listing purposes to the world. The development of registries, policing of the directories, and the daily maintenance (updates) of these unified directories will be a great challenge but vital to the deployment of a converged network.

H.323

The organization will aggressively pursue the integration of H.323 technology into its service offerings.

Learning Technology

Mission

The overarching mission of Instructional Services is to provide the best possible teaching and learning environment for faculty and students through the systematic application of the appropriate resources to the design, development, implementation and evaluation of instruction. This process is based on sound principles of learning and a thorough knowledge of the integration of technology to maximize faculty effectiveness and student learning.

Overview

Instructional Services has undergone additional reorganization over the past year. The unit had previously divested several service organizations that were not directly related to the support of the instructional mission of the University. This included University and Residential Mail Services, the Copy Centers, and Printing Services. The restructured Instructional Services is now in a better position to focus on mission critical instructional support activities. In addition, an intensive study of Video/Broadcast Services showed a merger could create greater synergism with the network services group on campus. This merger provides an opportunity for improved coordination with the rapidly developing statewide network infrastructure.

One of the major activities of this year has been the implementation of the instructional technology infrastructure in Torgersen Hall, which was dedicated in October 2000. This facility includes ten new classrooms, the New Media Center, the Digital Imaging Center, the Faculty Development Institute and the Institute for Distance and Distributed Learning. The staffs of all these units are now housed in this building, which facilitates better coordination and efficiency in providing support for faculty and students.

Instructional Services has had a significant impact on the instructional mission of the University by providing the coordination and leadership for several major initiatives including the Instructional Development Initiative and its Faculty Development Institute, and the Center for Innovation in Learning. We have also collaborated with the Institute for Distance and Distributed Learning including the provision of infrastructure support for delivery of courses. Consulting services are provided to faculty regarding the integration of technology in teaching. This service has a long-term impact on the climate for the acceptance of instructional technology as a critical, enabling component of the University's mission. In addition, the operational units have provided services that are vital to a modern teaching learning environment including digital imaging, test scoring, online course management systems, infrastructure support for distance and distributed learning classes, and maintenance and upgrade of technology in presentation classrooms across campus.

Instructional Development Initiative

The Instructional Development Initiative (IDI) is part of the University's ongoing plan for creating a 21st century educational environment. It is a major contributor to the current growth in distance and distributed programs. The initiative is a large-scale effort to invest in our faculty by providing them with the opportunity to investigate and adopt instructional technology to improve the effectiveness of the teaching-learning process. The goals are clustered into two areas:

Faculty Development

- Provide the opportunity for all faculty in the University to regularly participate in the Faculty Development Institute (FDI). The overarching goal is to motivate faculty to investigate, create, and utilize alternative teaching and learning strategies.
- Provide participants who complete the program with access to state-of-the-art instructional technology, the knowledge to use it, and the motivation to collaborate with their colleagues in leveraging instructional technology in their courses.

Course Development

- Provide instructional design and web-based software tools to faculty for the development and implementation of network accessible courseware modules.
- Provide access to computer labs, which run specialized software that is unique to disciplinary areas (e.g., Geographical Information Systems - GIS)
- Provide improved classroom and presentation facilities to support faculty efforts in integrating new technologies throughout the curriculum.

The Instructional Development Initiative began with three pilot faculty workshops during the summer of 1993, and has continued with additional workshops through August 2001. A total of 179 customized workshops have been conducted. More than 3100 faculty have participated in these workshops over the past eight years, with most faculty participating at least twice.

This initiative provides continuing opportunities for professional development. It helps faculty stay up to date on how emerging technologies intersect teaching and learning. The knowledge and skills taught in FDI workshops, coupled with extensive consulting and technical support from Instructional Services, enabled faculty to create Cybershool, the pioneering online course movement, and led to the current upsurge in distance learning programs. By continually teaching new and emerging applications of technology, providing access to modern technology, and highlighting exemplary lessons learned from colleagues' assessments of online courses, the FDI workshops are a critical component of course transformation at Virginia Tech.

Evaluation of the workshops by the faculty attendees continues to be positive. Faculty clearly value the opportunity to explore instructional issues with their colleagues in a supportive context, and to 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.

The results of surveys of students and faculty involved in classes that have been restructured as a result of this initiative show strong support for these new approaches to learning. Active learning has been facilitated both in the classroom and out, and constructive collaboration among students has been encouraged. Technology is promoting more communication among faculty and students outside the classroom. There is evidence that these efforts have had a positive impact on students' understanding of and interest in the course material while promoting better class attendance. In addition, students believe they are being provided more opportunities to develop skills that transcend the subject matter, including problem-solving and critical thinking.

As part of the IDI, approximately 60 classrooms have been upgraded with computers and projection systems, and ten centrally scheduled distance-learning classrooms have been put online. Over 900 computing stations have been installed for use by students in computer labs, the Math Emporium has been created, and the New Media Center has been established.

The following sections of the report describe the components that support the goals of the Instructional Development Initiative and give a summary of activities in these operations.

Center for Innovation in Learning

Established in 1996, the Center for Innovation in Learning (CIL) has the following strategic objective and mission:

Strategic Objective

In keeping with strategic direction 3.4 of the Update to the University Plan 1996-2001, the center 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.

Mission

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 designed to achieve the following outcomes:

- 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 and of the 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 form to 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 the grants awarded for 2000-2001:

| | Faculty | College | Award |
|----|----------------|------------------------------|----------------|
| 1 | Armstrong | Engineering | 30,000 |
| 2 | Carlisle | Arts & Sciences | 40,000 |
| 3 | Da Silva | Engineering | 30,000 |
| 4 | Davis | Engineering | 30,000 |
| 5 | Downey | Arts & Sciences | 25,450 |
| 6 | Dubinsky | Arts & Sciences | 35,150 |
| 7 | Hatfield, D. | Business | 30,000 |
| 8 | Heath-Camp | Human Resources & Education | 41,779 |
| 9 | Jones | Architecture & Urban Studies | 36,100 |
| 10 | Merrill | Library | 28,000 |
| 11 | Midkiff | Engineering | 30,000 |
| 12 | Newcomb | Agriculture & Life Sciences | 25,186 |
| 13 | Ragsdale | Business | 20,000 |
| 14 | Sen, T. | Business | 30,000 |
| 15 | Toth | Veterinary Medicine | 18,335 |
| | | | 450,000 |

Awards for 2001-02

The CIL Review Committee awarded grants totaling \$450,000 to be funded effective July 2001 for the 2000-01 academic year. This included funding of the online Masters of Information Technology (MIT) degree.

Educational Technologies

Mission Statement

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.

Scope of Programs and Services

Within Instructional Services, 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

- Instructional Development & Evaluation – in-depth consultation, analysis, and design of course-related digital content, plus provision of evaluation tools and consultation for application of instructional technology
- New Media Center – provides university community with access to high level computers, software, consultants and training for development of digital content
- OnLine Course Support – provision, applications support, and integration of course hosting system services and related web course software products
- Computer Assisted Teaching Stations – networked computers, podiums and projection systems used by faculty teaching in classrooms and auditoriums
- Instructional Technology Research & Development – analysis, research and development on emerging network and computing technologies for application in teaching and learning

Developments in selected program areas during 2000-2001 are described below.

Faculty Development Institute

In August 2001, the award-winning FDI program concluded the fourth year of its second four-year cycle. During summer 2001, over 425 faculty participated in the workshops and received computers. A special workshop was held at the Northern Virginia Center in the spring. A total of 33 workshops were conducted in the summer, based on nine content tracks:

- Track A – New Faculty Orientation
- Track B – Basic Computing Skills
- Track C – Basic Web Course Creation for Instruction
- Track D – Intermediate Web Course Development
- Track E – Advanced Web Course Development
- Track F – Using Geographic Information Systems: Spatial Data
- Track G – Applied Instructional Design
- Track H – Distance & Distributed Learning
- Track J – Special Topics in Course Transformation

In addition, sessions were also conducted for the federally funded McNair Scholars program.

Nearly 80 short workshops were also conducted in fall and spring semesters. A major emphasis this year was to emphasize the comprehensive year-round programming of the Faculty Development Institute rather than only the summer workshops alone. Those faculty registered for particular summer tracks were urged to attend one or more spring semester workshops so that their summer sessions could contain less basic information and more emphasis on personal application and project building. This spring term preparation activity was suggested by previous participants and seemed to be positively accepted by many. Similarly, summer participants were

urged to attend particular fall workshops as follow-ups, reviews, and expositions of more specialized topics.

To help faculty learn more efficiently, the role of the workshop track facilitators was further strengthened this year. Based on evaluation data, increased emphasis was placed by program planners on providing better transitions and explanations between the sessions to enhance understanding, transfer, and thematic continuity. Development of the workshop tracks began in late fall, after meeting with faculty in every college for a program review session. Each track had a web site developed containing all handouts, presentations, and other resources, to provide participants with ready access to these materials for review after the workshops.

Computers and software were offered in Windows 2000 and Macintosh formats. Fourteen computer choices were offered, in both desktop and laptop versions. All laptop computers offered this year were equipped with wireless network capabilities, in preparation for accessing the campus wireless network such as in Torgersen Hall. Laptop computers are offered at faculty request in order to enable more use of laptops in the classroom and to improve personal productivity. Thirty-five percent of all faculty selected a laptop.

A pilot study of the use and value of supplemental web-based tutorials began in the summer of 2001. A one-year contract with ElementK.com will provide all faculty, staff and students with unlimited access to over 200 tutorials covering widely used computer software packages such as Microsoft Office, web design tools such as Dreamweaver, Photoshop, and Director, database programs such as Access and Filemaker, and many others. These tutorials can extend learning beyond the FDI workshops to be accessed just-in-time. Moreover, students and staff will have available a variety of tutorials that may be studied at their convenience or used as an online reference tool showing how to perform specific tasks. Feedback will be gathered from users throughout the pilot study, in order to help determine the use and value of these materials.

Instructional Development and Evaluation

Instructional Resources Produced

- The Instructional Design Portal is a large compilation of information on applied instructional design principles. It contains a clickable instructional design model, quick descriptions and applications of teaching models, and several resource directories to local and web-based tools and services. The Instructional Design Portal is used extensively in the FDI and is a reference tool for Courseinfo and WebCT users. See <http://www.edtech.vt.edu/edtech/id/index.html>
- “Effective Uses of OnLine Course Tools” provides comprehensive examples of how to effectively use online course tools for student engagement. It contains a clear set of questions and rationales to reach

informed decisions about the linkage of pedagogy and instructional technology. See <http://www.edtech.vt.edu/edtech/id/ocs/index.html>

- Another website, "Accessible Web Page Guidelines" was produced with examples and resources for faculty and development staff. This site provides important guidance needed to insure compliance with university policy and Virginia law. The website is at <http://www.edtech.vt.edu/edtech/id/accessible/disabled.html>

Grant Activities

- Kevin Oliver and John Moore, along with faculty and administrators at Florida Community College at Jacksonville, submitted a \$328,000 FIPSE proposal, "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 will be involved as subject matter experts in their disciplines. We also created, tested and evaluated a demonstration module during 2000-2001, and conducted a series of interactive Symposium webcasts and conference calls for site facilitators at 30 colleges for a proof of concept test prior to the FIPSE submission.
- Kevin Oliver began work with Catherine Eckel, Sheryl Ball and Scott Midkiff on a multi-year project to develop wireless teaching simulations for undergraduate Economics courses. Funding has been received from the Mellon Foundation and the CIL. An NSF proposal is pending.
- Kevin Oliver and John Moore served as Co-PIs on "A Digital Library Network for Engineering and Technology (DLNET)", an NSF-funded project directed by Saifur Rahman, ECpE. A nationwide gap analysis of educational web tools used in engineering was conducted. Engineering faculty were recruited for a two-round web-based Delphi study. Data analysis led to development of rank-ordered categorical lists of recommended web tools.

Evaluation Activities

- An evaluation study was conducted of 28 engineering courseware projects funded through the NSF/SUCCEED project.
- Maintenance is provided for the Flashlight Online survey system for faculty. Sixty-five accounts are in use, up from 35 departments during AY1999-2000. Effective uses of the Flashlight tool is now taught during the FDI.
- Developed assessment and evaluation quick guides for faculty use; see <http://www.edtech.vt.edu/edtech/id/assess.html>
<http://www.edtech.vt.edu/edtech/id/eval.html>

- Worked with [faculty in Computer Science, Biology, Engineering, Economics, Foreign Languages, Veterinary Medicine](#), Geography, and English on evaluation projects for courses and grant proposals.
- Consulted on the evaluation component for several courses funded by CIL grants
- Conducted a faculty technology training needs assessment for the Danville Community College and Averett College in Danville, Virginia; established partnership with and trained eleven Danville faculty at FDI workshops held at Tech

OnLine Course Support and Advanced Instructional 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 our current integrated course management systems and course-hosting servers such as Blackboard Courseinfo and WebCT. 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.

The primary course management system, Blackboard Courseinfo, was successfully upgraded and integrated with the Banner administrative system during Summer 2001. Over 500 courses and 10,000 student accounts use this system, both on and off campus. Virtually all courses managed by the Institute for Distance and Distributed Learning utilize this infrastructure, as do hundreds of other courses taught by faculty throughout the university. A high level of faculty service is backed by in-depth knowledge of the software programs supported and an online knowledge base that is accessible to faculty users. Significant investments in expanded system licenses, additional file servers, improved network connectivity, file backup systems, and vendor support contracts were made in 2000-01, to better serve the university.

Significant accomplishments during 2000-01 were:

- Additional Sun and Dell file servers were added both at Torgersen and Andrews to increase capacity, response time, and reliability on the course management services. Improved maintenance agreements with vendors were also put in place. We are working with Blackboard and Sun to plan for further redundancy in our server cluster to further insure a stable and reliable online course environment for our worldwide student users.
- Expanded the online knowledge base capability, to make more information and problem solutions available, so that faculty can quickly retrieve solutions for common problems.
- Managed the beta testing and evaluation of the Prometheus course system from George Washington University.

Participation in K-12 Initiative

Members of Educational Technologies participated in the Virginia Tech STARS (Summer Training Academy for Rising Stars) 2001 program this summer. This program introduces technology to high school students in the Southside Virginia area. Ed Tech staff presented training sessions on GIS, Lego Mindstorms (robotics), and a virtual collaborative learning environment (MOO).

Instructional Technology Research & Development

Developed a Blackboard course resource to highlight common information processing features needed by Virginia Tech students to manage our increased emphasis on online information, and researched and located emerging Web-based tools with those features. Course URL (use V.T. PID/pass):
<http://www.learn.vt.edu:80/bin/common/course>.

Maintained a test-bed server to research the functionality of these web-based tools, including: collaborative concept map editors that allow student teams to research and build knowledge structures, and annotation engines that allow students to mark-up or edit Web documents. The goals of this research are to identify and test the feasibility of tools that would: 1) be attractive to a substantial number of faculty, and 2) improve students' learning experience.

Infrastructure Support for Distance and Distributed Learning

Instructional Services and Information Technology works in partnership with the Institute for Distance and Distributed Learning (IDDL) to provide technical infrastructure, staffing and coordination of distance learning activities for students enrolled in online courses. This is a collaborative relationship that provides a coordinated effort to create for faculty and students the best possible learning environment in distance learning courses. Examples of infrastructure and staff support include provisioning and support of the Blackboard Courseinfo and WebCT course management systems, and the WhizQuiz, WhizQuest, and QuestionMark online testing services. Licensing and server costs for the Blackboard, WebCT, and Centra Symposium systems are all provided by Instructional Services. In addition, the two-way video classrooms, video network operations center, H.323 desktop videoconference systems, streaming video servers, and network connectivity through NetWork Virginia and Internet2 are all provided by Instructional Services and other units of Information Technology.

The IDDL was created in 1999 to provide leadership, coordination, management and support to the growing distance and distributed learning activities at Virginia Tech. The Institute provides an organizational structure to connect learners with a system of distributed learning resources regardless of time and place and in support of teaching and learning, research and outreach.

New Media Center

Mission Statement

The mission of the Virginia Tech New Media Center 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.

Goals

The Virginia Tech New Media Center Goals are designed to provide a basic understanding of how the Center intends to achieve its mission. The following goals provide a framework for the development of the Center's usage policy. The Virginia Tech New Media Center will:

- Provide free and open access to multimedia technologies for the diverse needs of all segments of the community.
- Provide reasonable and efficient consulting in multimedia technologies for all segments of the community.
- Manage the facility and resources in a fair and equitable manner within the constraints of time, money, and resources.
- Provide up-to-date hardware and software to patrons in an easy-to-use, friendly, and well-maintained environment.
- Adhere to and abide by all policies set forth by Virginia Tech, Information Technology, and the University Libraries.

New Facilities

The New Media Center (NMC) made significant changes in the move to Torgersen Hall in the early part of AY00-01. The space in Torgersen provides the following:

- A 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
- A 20-seat open lab with 10 Mac OS and 10 Windows OS computers (most connected to specialty peripherals such as scanners). This space is intended for walk-in use in the development of multimedia objects and basic computing consulting
- An eight-seat digital video lab development lab. Using the Shared Area Networked hard drives, this area provides a unique solution to the campus digital video development needs
- A suite of small special-use rooms containing high-end workstations for digital video production, digital audio production, and QuickTime Virtual Reality production.

There is also a 3-D modeling workstation and a handful of computers for non-specific multimedia development. The NMC staff was responsible for supervising and scheduling the undergraduate workforce of 10 students.

Activities

The New Media Center Manager position was filled in July of 2000 and the Operations Assistant was hired in September of 2000. The Center also received a Graduate Student position. These positions were critical in the move to Torgersen Hall.

The New Media Center also directly supports all aspects of the Faculty Development Initiative. This year the NMC staff provided significant support of the FDI website. The table below shows traffic in the NMC during 2000-2001. The figures reflect only the transactions in the Torgersen Hall first floor NMC facility (opened in October of 2000).

| Month (00-01) | Classes | Class Attendance | Walk-In Transactions | Total Patron Transactions |
|----------------------|--------------------------------|-------------------------|-----------------------------|----------------------------------|
| July-Sept | ----- Under construction ----- | | | |
| October | | | 503 | 503 |
| November | 9 | 151 | 780 | 931 |
| December | 2 | 17 | 382 | 399 |
| January | 19 | 303 | 408 | 711 |
| February | 25 | 462 | 809 | 1,271 |
| March | 10 | 184 | 820 | 1,004 |
| April | 20 | 409 | 1399 | 1,808 |
| May | 8 | 122 | 695 | 817 |
| June | 16 | 231 | 675 | 906 |
| Total | 109 | 1,879 | 6,471 | 8,350 |

It is expected that the number of patrons will increase over the next year, as the services in Torgersen Hall become more known. It is expected that the NMC will become more in demand this fall with the increased facilities and equipment. Students comprise 62% of the users of the Center with 18% staff, 7% faculty, 7% graduate students, and 6% are from the public. The use of scanners is the Center’s biggest draw with 27% of the patron transactions using scanners. The next most popular aspect of the NMC is the use of digital still cameras. The NMC loaned out the digital cameras 982 times last year. The next three areas of interest were using the graphics programs (13%), creating web pages (13%), and working with digital video (11%). The main reasons patrons come to the NMC continues to be access to high-end hardware and software, on-site assistance, and the central location.

The Electronic Thesis and Dissertation (ETD) project has continued to require special training for our student staff. The NMC staff provided six two-hour workshops for over 400 graduate students (two each in the fall, spring and summer). Additionally,

184 students were served individually on their ETD's this year as walk-in patrons. The Virginia Tech Multimedia Users Group (VTMMUG) held several sessions over the year with visits and presentations from Adobe and Apple.

Test Scoring Services

Mission

Test Scoring Services 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.

Overview

Services include:

- Test scoring, providing student scores and statistical analysis for evaluation of results;
- Faculty/course evaluation and analysis, offering forms with standard questions along with the capacity to include custom questions for particular needs;
- Data capture, providing forms for use with surveys and other data gathering efforts.

As new technologies offer more efficient data gathering methods, Test Scoring, in collaboration with other Instructional Services units, evaluates them and encourages and supports adoption of the most promising ones.

Activities

The following table shows statistics for jobs performed in the previous year:

| | Spring 2001 | Fall 2000 | Summer 2000 |
|-----------------------------------|-------------|-----------|-------------|
| All exams | 2,455 | 2,526 | 429 |
| Final exams | 512 | 578 | 62 |
| Course evaluations | 110 | 181 | 178 |
| Other data capture | 471 | 314 | 134 |
| Total jobs processed | 3,036 | 3,021 | 741 |
| Total sheets processed | 330,000 | 409,000 | 97,000 |
| Total number of different clients | 525 | 564 | 223 |

Future Initiatives

New software is expected to be available during the fall semester, which will make online tests and surveys more feasible. Test Scoring will work with other IS units to identify potential clients and assist migration, with the long-term goal of fully digital departmental operation.

Digital Imaging Center

Mission Statement

Digital Imaging provides high-resolution technology resources along with professional design expertise to all members of the University and all related agencies of the State of Virginia in support of the educational mission of Virginia Tech.

Overview

Digital Imaging provides support for image processing through a combination of digital technologies and a staff experienced in photo imaging techniques and design methods. The primary objective for this service center focuses on the delivery of high-resolution digital output as it applies to instructional projects and course development. In addition to the primary objective, this department also provides imaging support for other university-sponsored activities.

Services are available to all members of the University faculty and staff as well as students participating in academic classes requiring high-quality image archiving or photo-imaging output. This support center emphasizes service to the University through coordinated efforts, which are aimed at providing the highest quality products in a timely fashion to the academic community at Virginia Tech.

Note: Support is available for instructional projects and course development to the students, faculty, and staff of Virginia Tech on a cost recovery basis.

Volume of Activities

Scanning

| | |
|----------------|-------|
| PhotoCD Scans | 9,200 |
| Studio Scans | 36 |
| Flat Art Scans | 6,526 |

Photography

| | |
|-------------------|-------|
| Copy Slides | 6,453 |
| Slide Duplication | 6,558 |

Digital Output

| | |
|-----------------|--------|
| Laser Prints | 26,684 |
| Computer Slides | 11,092 |
| Inkjet Prints | 210 |
| Dye-Sub Prints | 89 |

Processing

| | |
|------------|---------|
| E6 | 102,386 |
| Film Sales | 1,006 |

Media Design

| | |
|--------------|-------|
| Labor | 343 |
| Intervention | 2,686 |

Media Duplication

| | |
|---------------|-------|
| CD Duplicates | 1,629 |
|---------------|-------|

Total Work Requests 4,878

Summary

Digital Imaging was re-located to Torgersen Hall during the past year. This move back to the main campus provided the opportunity to re-focus our efforts toward support of the academic mission of the University. As a result, we were able to strengthen our ties with the New Media Center and, along with the addition of two new scanning services, develop a more complete service offering for digital image processing.

In addition, we also now serve as the primary contact for off-campus CD duplication services. Combined with the on-site services we offer our customers directly, the addition of this off-campus support provides one centralized location for efficient cost effective CD duplication service.

Future efforts involve an ongoing investigation of new technologies that both enhances the quality of the services we provide and meets the expanding needs of our customers.

Future Initiatives

Institute of Advanced Learning and Research

This project provides economic development activities for the Southside Virginia area. We will provide consultation on defining the instructional technology needs for the Center. We will also continue to provide faculty development workshops for Averett University and Danville Community College, which are key components of the economic development activities for the area.

Torgersen Hall (Advanced Communications & Information Technology Center)

Opportunities for conducting research on pedagogy and use of instructional technology abound in the highly mediated and networked instructional spaces in Torgersen Hall. Specifically, faculty have priority access to designated Torgersen classrooms and other instructional resources available in the building or through a partnership with the Center for Excellence in Undergraduate Teaching (CEUT).

Torgersen Hall has long been promoted as a place where a new educational landscape will take shape. Its physical reality suggests a bridging of new ideas and old, and a coalescence of technologies and resources that encourage imaginative new practices.

The goals are:

- To stimulate and reinforce experimentation and inquiry into teaching
- To provide a demonstration site where innovative teaching can be readily observed for faculty development and public relations purposes
- To provide ongoing data sources to inform innovative classroom re-design projects as renovation funds become available
- To further encourage the scholarship of teaching throughout the University.

It should be noted that fully one-third of the Center's capacity is devoted to direct instructional support, including some 20,000 square feet of classroom space. The ten new classrooms offer a variety of capabilities ranging from large capacity multimedia auditoriums, to specialized computer labs and integrated classrooms, to flexible spaces oriented to experiments in learning and teaching. These classrooms can also be linked to other support facilities within the building, such as the nearby New Media Center and the Digital Imaging Center.

It is important to recognize that these classroom spaces are not identified simply as added instructional capacity, but rather several of the classrooms are available as sites for experimentation in learning and teaching. In keeping with the spirit of the entire project, a prime outcome to be achieved is instructional innovation coupled with ongoing pedagogical inquiry. To this end, three classrooms in particular are

designated to support such experimental activity. These classrooms are scheduled through a special program, coordinated by CEUT, Educational Technologies, and the Registrar's Office, to provide faculty with the resources needed to advance teaching practice. For example, a group of humanities faculty is collaborating on new pedagogies in one of these flexible classrooms in Torgersen. A series of video taped interviews recorded this summer showed that faculty were very enthusiastic about the early results of teaching in this space. The space flexibility and the available technology resources provide a powerful learning environment that is not available in any other classrooms on campus. The interviews are available for viewing for interested parties. Research on these new pedagogical methods will continue throughout the 2001-02 academic year.

Access to state-of-art classrooms is only one of the potential benefits to faculty who participate in the ACITC Classroom Innovation Project. The following additional resources may also be considered in project development:

- The attached observation areas, which allow one-way viewing for data collection or demonstration purposes.
- Student support may be available, via Educational Technologies, for various technology-related applications.
- Priority access to the nearby New Media Center, which can provide project support for students and faculty in the form of specialized software and technical assistance.
- Priority access to the Digital Imaging Center for the production of teacher and student-generated instructional materials and reports.
- Access to an archiving capability, which will allow recording of class projects and research activities.
- Possible access to supplementary operational funds from CEUT for the completion of research projects.

Next Generation FDI

The cumulative success of the Faculty Development Institute over the past eight years has created a unique opportunity for an innovative approach to more effective diffusion of web-based instructional strategies into the teaching and learning practice at Virginia Tech. Key advancements that will characterize the next generation of the FDI, as described in the University's Strategic Plan, include:

- Accelerate the participant rotation to a three-year program cycle;
- Increase participation by all colleges to 95% over three years;
- Improve access to training and support by increasing online content and creating more flexible schedules, which will include year-round workshops both live and network-based;
- Develop specialized programming for graduate teaching assistants and academic support staff;

- Expand the program's scope beyond teaching to include effective applications of information technology in research, outreach and program administration, and
- Addressing the faculty support shortage through a Student Technology Assistants program.

This unique opportunity is primarily enabled by four main factors:

- The emerging ubiquity, diversity and value of information technologies across all areas of the university, including research, outreach, teaching, and administration, mandates that we provide an on-going set of flexible training opportunities to all faculty, staff and students, reflecting a wide range of abilities and motivation for both specialized and generalized technology training.
- The willingness of faculty to attend thematic 2-3 hour workshops during the academic year indicates an ongoing desire for renewal and awakening beyond the FDI summer experience.
- Continued technological improvements such as the new FDI training labs in Torgersen Hall and integrated course management systems.
- The reputation, visibility and value-added benefits of the FDI program generate enormous goodwill and are a catalyst for organizational collaboration and sustained partnerships within the University.

Modest structural changes and additional support resources beyond the Torgersen Hall facilities are needed to attain the above characterizations for a redefined approach to Faculty Development and support:

Additional Resources

We need funding to increase the FDI program to a three-year cycle, so that 130 additional faculty (total 550/year) may participate each year, starting in Summer 2002. In addition to an increase in funding to purchase 130 additional computers and software, three additional staff positions are needed to develop online training modules and support the increased number of yearly workshops required in the three-year cycle. Additional operating funds are also requested so that programming can include both academic support staff and graduate teaching assistants in the FDI workshops.

Year-Round FDI

A year-round FDI model, rather than largely concentrated on the summer, will allow a person to take a mixture of live and network-accessed asynchronous workshops during the academic year. This increased scheduling flexibility will benefit many faculty who now must interrupt research activities to participate in the FDI summer programs. It will also encourage more continuous training activities be developed, so that training may be more "just-in-time" rather than concentrated during the summer. Face-to-face summer workshops would continue and be augmented with focused

consulting and production resources for those faculty who wish to pursue course transformation projects.

Student Technology Assistants Program (New Media Center)

A new Student Technology Assistants Program is proposed to provide targeted technical support to faculty in the integration of technology in instruction. As technology is increasingly woven into the fabric of the educational process, it is clear that grants such as CIL and CEUT are vital to the development of not only classroom materials, but also the development of the faculty in their integration of the technology into their teaching. Many of the faculty that apply for the CIL and CEUT grants are still learning the technology, and avenues are needed to help bridge the gap between their skills and their needs. Those faculty that do possess reasonable technical skills, quite often don't have a good grasp of all of the resources on campus that are available to them. In summary, faculty currently spend too much time on mundane tasks in their course development activity. Faculty should be focusing on the content while leaving any production activities to staff and/or students.

Current Practice

Currently, faculty who receive CEUT/CIL funding are responsible for finding students to work on their own projects. Given the diverse skills needed to create educational materials, it is difficult to find students who have the background to provide all of the necessary skills to work effectively and efficiently. Even in the instances where the student has many of the needed skills for the tasks at-hand, there is a very extensive array of resources on and off campus that they are typically not aware of, especially in the area of instructional design.

Proposed Plan of Action

It is proposed that the New Media Center (NMC) be provided with the funding to hire and manage a student workforce that will assist the faculty, who are recipients of CIL & CEUT grants, in the creation of their materials. By allocating at least 100 student hours of time to each project, faculty will achieve greater results as well as more effectively use their development funds. This "pool" of student help could also mean that a sharing of resources can take place and it would have the built-in advantage of having technical support and instructional design assistance directly available through the New Media Center. This should provide positive results for the quality and efficiency of grant projects, and students working with multimedia development will be able to use their newly learned skills in real projects.

Benefits

This program will provide the expected benefits listed below:

- Provide direct access to expert assistance and resources on and off-campus
- Create better environment to effectively use shared resources

- Provide more solutions to project challenges
- Provide and maintain an experienced student workforce with multimedia
- Provide more opportunity for students to learn new technologies in a structured and supported environment
- Provide a more efficient use of grant funds with better accountability of project outcome
- Provide a more consistent approach to the development of funded projects
- Provide a level of project management
- Provide more attention to instructional issues within the projects

As employees of the NMC, the pool of students will have direct access to unique hardware and software as well as expert assistance in using it effectively. All aspects of instructional design will be reinforced throughout the process.

Emerging Technologies

All of the following projects will be conducted in partnership with several groups within Information Technology including WARD, CNS, and IRM, as well as IDDL and selected academic departments.

Learning Management Systems Standards

We will intensify our efforts to understand emerging distributed learning standards developed by groups like IMS and the DoD's ADL effort. These efforts will continue to impact locally important activities such as the provision of course management systems and digital libraries.

The IMS Global Learning Consortium develops open technical specifications to support distributed learning. All specifications developed by IMS are available free of charge through the IMS web site. IMS is supported by members of a worldwide coalition that currently includes more than 30 Contributing members and over 200 Developers Network members. <http://www.imsproject.org>

The Advanced Distributed Learning Co-Lab is an open, collaborative test bed for sharing learning technology research, development, and assessments. The Co-Lab is integrating work from IMS and other organizations into the Sharable Courseware Object Reference Model (SCORM). <http://www.adlnet.org>

We will research the local application of these standards to course content management, faculty and student profiles, and distributed assessment tools.

In addition, we will investigate open source instructional system initiatives, such as the Open Knowledge Initiative. The Open Knowledge Initiative (OKI) addresses what is perceived by many in higher education as a critical need: meaningful, coherent, modular, easy-to-use, web-based environments for assembling, delivering and accessing educational resources and activities. The

Massachusetts Institute of Technology and its primary partner, Stanford University, are lead planners in the OKI Project.

OKI will provide:

- Tools that are sustainable, open source, and web-based to support teaching and learning (such as discussion forums, project team notebooks, portfolios, and grade-books).
- A system for assembling sets of web tools that can work together and with other campus systems.
- A community of planners and developers who create the basic system, tool builders (both commercial and academic), service providers who make the tools available, and students and instructors who teach and learn with the tools.

[\(http://web.mit.edu/oki/\)](http://web.mit.edu/oki/)

Mobile Computing Initiatives

We will continue to investigate wireless technologies and their potential impacts in a university environment. Application of these technologies would allow faculty and students access to instructional information while away from the traditional learning sites of classrooms, labs, and offices using traditional wireless devices such as digital mobile phones, pagers, and PDA's.

Digital Signature Applications to Instruction

Virginia Tech's primary access control element, the PID, is a critical component of the authentication of faculty and students who use our course management systems. PIDs will eventually be replaced by digital signatures. We will maintain a working knowledge of PKI infrastructure components, digital signatures, smart cards, and data encryption mechanisms. One area of investigation will address means of insuring the confidentiality, integrity, and nonrepudiation of instruction-based documents (assignments, papers, tests) submitted electronically.

Web-based collaborative tools for instruction, research, and outreach

We are actively investigating new web technologies that will enhance distributed collaboration between faculty, students, and staff. One such tool has been successfully used in the current NSF DLNET project involving faculty annotation of a web-based survey. Other tools involve peer-to-peer communication and messaging, as well as shared whiteboards such as in the Blackboard and Symposium systems.

Digital Imaging

Three-Dimensional Scanning

A 3-D scanner was installed in the Digital Imaging Center. A real need exists on campus to support scanning of 3-D objects. This type of scanning is currently not suited for departmental desktop applications. By providing this service through Digital Imaging, we can maximize both the quality of the resolution and the size range for each scan in order to meet these scanning needs.

Improved Access to Output Devices

The other immediate need concerns improved access to the output devices we operate. This improved access initiative will require us to re-engineer our current accounting model for tracking work orders and recovering costs. The result would offer our customers a more efficient method for obtaining digital output. As part of this, we would also look to invest more time toward developing training materials both for our employees and for our University clientele.

Active Grants

U.S. Department of Education. Grant Coordinator/University Coordinator/Consultant. Technology Challenge Grant. (Nancy Franklin, Principal Investigator). With Jerry Niles, John Burton, Pat Kelly, Tom Head, and John Moore.

“Virginia Tech, Mathematics Department, Pew Grant Proposal in Course Redesign.” Pew Learning and Technology Program at the Center for Academic Transformation, Pew Grant Program in Course Redesign. With Robert Olin and Kenneth Hannsgen.

Center Director for Instruction/Training, Internet Technology Innovation Center. Virginia’s Center for Innovative Technology. With 12 center directors at Christopher Newport University, George Mason University, the University of Virginia, and Virginia Tech.

Grant Proposals

Educational Technologies has NSF and FIPSE grant proposals pending funding decisions.

U.S. Department of Education. University Coordinating Representative/Consultant. Information Technology Magnet School in Danville, Virginia. With Danville Magnet School Director; Virginia Tech Programs in aerospace, advanced communications, biotechnology, and teacher education; NASA-Langley.

Publications and Presentations

Publications

Moore, A.H. "Redesigning Learning Environments: Virginia Tech's Story." In R. Epper and T. Bates (eds.), Teaching Faculty How To Use Technology: Case Studies of Successful Programs. Oryx, 2001.

Moore, A.H. "Virginia Tech's Math Emporium: Three Years and Counting." National Learning Infrastructure Initiative, Annual Meeting Notes. January 2001. With Kenneth Hannsgen and John Rossi.

Moore, A.H. "The Math Emporium: An Advanced Learning Community." Special to Metropolitan Universities. Vol. 12, No. 1, Winter 2001.

Oliver, K. M., & Hannafin, M. J. (2000). Student management of web-based hypermedia resources during open-ended problem solving. *Journal of Educational Research*, 94 (2), 75-92.

Oliver, K. M. (2000). Methods for developing constructivist learning on the web. *Educational Technology*, 40(6), 5-18.

Chambers, J. A., Mullins, J. Q., Whitten, K. L., Oliver, K. M., & Milheim, W. D. (2001). Is online learning for you? A look at faculty and administrative perspectives. Jacksonville, FL: Florida Community College.

Oliver, K. M. (2001). Recommendations for student tools in online course management systems. *Journal of Computing in Higher Education*, 13(1), 47-70.

Worley, G.M., & Moore, D. M. (2001). The effects of highlight color on immediate recall on subjects of different cognitive styles. *International Journal of Instructional Media*. 28 (2).

Presentations

Head, J.T. EDUCAUSE 2000 Conference, Nashville, presented paper: "Faculty Development: Successes and Lessons Learned from Pittsburgh, Florida, Virginia Tech and Wake Forest".

Head, J.T. SCUP 36 (Society of College and University Planners), Boston, presented paper: "Virginia Tech's Advanced Communication and Information Technology Center: A 21st Center Place".

McPherson, E.J. (2001, May) Faculty Development Institute. Workshop Panelist at National Gathering of Friends (Quakers Annual Meeting). Blacksburg, Virginia.

McPherson, E.J. (2001, May) Faculty Development Institute. Best Practices Workshop Presentation at National Conference of Federally Funded TRIO Programs, (McNair Scholars). Atlanta, Georgia

McPherson, E.J. (2001, May) Faculty Development Institute. Invited Respondent Presentation at First Annual Virginia Tech Black Studies Program National Conference, (West African Leadership). Hotel Roanoke, Roanoke, Virginia.

McPherson, E.J. (2001, March) 4H Agent Training for Digital Media, (Digital Storytelling). Blacksburg, Virginia.

McPherson, E.J. (2000, September) Presenter Learning 2000: Reassessing the Virtual University; VT College of Arts & Sciences Conference. Hotel Roanoke, Roanoke, Virginia.

Moore, A.H. (April 2001) "New Technologies in Your Community." Danville Public Service Television Programming. Danville, VA.

Moore, A.H. (April 2001) "Technology In Instructional Environments: Faculty Development and Student Support." IT Everywhere Conference. Co-sponsored by George Mason University and Educause. With Dianna Benton, Tim Luke, Margaret Merrill, Ed Schwartz.

Moore, A.H. (April 2001) "The Case of Virginia Tech: Internet Trends in Higher Education." U.S. Department of State, Foreign Service Institute, Foreign Service National Employee Public Diplomacy Training Division, Thematic Program.

Moore, A.H. (January 2001) "Virginia Tech Math Emporium Assessment: Three Years and Counting." Conference of the National Learning Infrastructure Initiative. With John Rossi. New Orleans, LA.

Moore, A.H. (November 2001) "Managing On-line Educational Partnerships: Plain Talk and Practical Tools for Internet-Based Consortia." Pre-Conference Workshop Facilitator for the Council for Adult and Experiential Learning. Chicago, IL.

Moore, A.H. (November 2000) "Strategic Importance of Faculty Development." WCET Annual Conference. With Dennis Jones, George Mehaffy, Jaap Tuinman. Albuquerque, NM.

Moore, A.H. (July 2000) "Advanced Learning Communities." ACET/HERDSA Annual Conference. Toowoomba, Australia.

Moore, J.F. EDUCAUSE 2000 Conference, Nashville, TN presented paper: "Equipping Faculty for Success with Technology", with panelists from UNC-Chapel Hill, University of Mississippi, and Mt. Holyoke.

Moore, J.F. Invited presentation to Six-Pack Group for Minnis Ridenour.

Moore, J.F. Invited presentation at the North Carolina Teaching and Learning with Technology (TLT) Center Symposium annual meeting, Chapel Hill.

Moore, J.F. Invited presentation at Teaching and Learning with Technology Expo, Georgia State University, Atlanta.

Moore, J.F. Invited presentation at Dell Computing's Campus One higher education conference, Orlando.

Moore, J.F. Invited presentation at the Technology Leadership conference, Richmond.

Oliver, K.M. Learning 2000 Conference, Roanoke, presented paper "Recommendations for Student Tools in Online Course Delivery Environments"

Pacifici, J. A., Faculty Development Institute 2001, Keynote presentation: Online Training, Virginia Department of Alcoholic Beverage Control Annual Conference, JMU, Harrisonburg, VA.

Worley, G.M. and Moore, D.M. EDUCAUSE 2000 Conference, Nashville, TN. Presented poster session: "Integrating Color Effectively for Instructional Images".

Worley, G.M., et.al. Eastern Educational Research Association, Hilton Head, S.C. (2001) presented paper: "Color and instructional images: what the research says".

Executive Forum in Information Technology www.mps.vt.edu/ITForum

State-of-the-Art Learning Environments. With Center for Academic Transformation. Orlando, FL. November 13, 2000.

The Last Mile to Virtual Communities. With Virginia Institute of Government. Richmond, VA. December 11, 2000

State-of-the-Art Learning Environments. With Center for Academic Transformation. Dallas, TX. February 26, 2001.

Invited Seminar on Technology, Security, and Access. With Southern Regional Education Board. Atlanta, GA. March 27-28, 2001.

IT Summit. Emerging Transformations in Instructional Technology. Virginia Tech.
April 26, 2001.

The Last Mile to Virtual Communities. With Virginia Institute of Government.
Henrico County, VA. June 1, 2001.

Center for Innovation in Learning www.edtech.vt.edu/cil

Coordinated RFP process and awards for nearly \$450,000 in grants to faculty

Coordinated nomination process and award for 2001 XCaliber Award

eCorridors Program

The eCorridors Program

Anyone, any community, any region that does not have the capacity at reasonable cost to be a producer, a provider, of large-scale, high volume information and services to the networked world has a severe disadvantage in our global, networked economy.

The objective of the eCorridors Program is to launch a number of large-scale demonstration models focused on multiple fronts to solve the problem of affordable, available, useable access to advanced, ultra broadband communications for rural communities. The potential for advanced information technology to influence the tenets of civilization is expanding dramatically. Yet deficiency of basic access to these resources, particularly from within certain demographic areas, remains a paradoxical and highly complex problem. Much attention is paid to technological developments and there are now tools emerging that have the potential to help solve many technical and economic issues. More daunting and intriguing, however, are obstacles posed by entrenched, legacy market structures, politics, and culture.

Virginia Tech has multiple programs in numerous content and geographical areas dealing with piece-part components of these issues and significant knowledge resources capable of addressing the discrete components of this challenge; political, market, operational, and technological. Virginia Tech also has unusual expertise in advanced network technologies gained through design and engineering of both an award winning campus network and a statewide advanced network (Net.Work.Virginia Next Generation) serving more than 1 million people.

The Virginia Tech eCorridors Team has the capacity to lead and facilitate very rapid integration of advanced, fiber optic, wireless, and “next generation” Internet infrastructure to enable an extraordinary advantage in costs and communications power. This, in turn, will result in increased competitive advantage and economic development for rural communities suffering the effects of the declining tobacco, textile, and furniture industries.

It is estimated that in three years, regions involved in the demonstration projects could be the focal point, the hub, for the world’s most advanced communications infrastructure. Full development of the envisioned infrastructure has the potential to create one integrated economic engine, merging regions, currently among the nation’s poorest from Virginia’s Tidewater to the Appalachians, tying together communities in Virginia, North Carolina, Tennessee, Kentucky, and West Virginia. It will create critical mass in population, natural and capital resources. The initiative will yield large economic benefits at a fraction of the cost of traditional infrastructure (such as highways) through multiple public/private partnerships. It will create substantial competitive advantage for the up to 2.5 million citizens living in, and adjoining this region, and for its businesses.

Dan River Region Pilot Project

Approximately 2.6 million dollars is currently granted for telecommunications economic development related infrastructure projects in the City of Danville and Pittsylvania County from the Future of the Piedmont Foundation and Virginia's Tobacco Indemnification and Community Revitalization Commission. These funds will be focused on the development of advanced network infrastructure projects. We will demonstrate not only the advanced technologies, but perhaps as important, how these funds can be highly leveraged to trigger local, private sector investment related to the development of new infrastructure, services and applications consistent with the promise of the next generation internet.

The Dan River Region is an economically depressed area of Southside Virginia that because of its rural setting has substantial deficiencies in telecommunications. The Dan River Region project proposed by Virginia Tech in conjunction with the Future of the Piedmont Foundation using State of Virginia Tobacco Indemnification and Community Revitalization Commission funds is a multi-phased, proof of concept demonstration that affordable, advanced broadband telecommunications can be brought to deficient regions years ahead of when most service providers would typically schedule such deployment. Virginia Tech plans to prove that it *is* possible for communities to "leapfrog" the barriers to entry and enter directly into the next generation telecommunications at the community level. Through the Dan River Region Project, Virginia Tech will demonstrate that an advanced, next generation telecommunication infrastructure can be designed, developed and deployed utilizing our proposed innovative approaches to organizational, operational, and ownership models. Under this model, communities can take control of telecommunications deployment out of the hands of the service provider and assume the responsibility for providing next generation access to its citizenry through bottoms up, grassroots initiatives.

This approach supports the potential to significantly reduce the costs of entry into advanced telecommunications arena in such a way that every citizen can potentially become a producer, contributor and most importantly, a participant in the information economy. Virginia Tech plans to design and manage implementation of advanced network services and applications, for instance, high quality video conferencing to facilitate broadband education delivery systems, business-to-business transactions and medical imaging. As such, the Dan River Region will become a replicable model, prototype upon which other communities will be folded into the network mesh architecture in an organic fashion following the paths of least resistance - as interest, opportunity, local political buy-in and funding allow.

eCorridors Frequently Asked Questions

1. What is the eCorridors Program about?

The eCorridors Program is an economic development and outreach program of Virginia Tech that is focused on a long-term vision of facilitating the development of

next generation network infrastructure and services in collaboration with interested communities in Virginia. As the build-out of the interstate highway system increased economic development for communities along its route, "eCorridors" are electronic Internet routes that, when fully completed, will resemble a grid, or mesh, of network connectivity into and out of every community. These networks will be specifically architected to enable communities to leapfrog existing technologies and provide next generation network access for such purposes as economic development, quality of life, education and workforce training.

2. Why is Virginia Tech involved in helping communities to develop and sustain competitive advantage?

Virginia Tech is a land-grant university with a threefold mission of education, research, and outreach. University faculty and extension personnel are frequently called upon to assist Virginia communities in economic development initiatives. The eCorridors Program is one way by which Virginia Tech is helping communities to sustain competitive advantage.

3. What is Virginia Tech's role?

Virginia Tech is not in the communications business. The University is a facilitator and catalyst for the development of creative partnerships with municipalities, public utilities, non-profit entities and private sector companies to combine resources and expertise for the deployment of advanced, broadband network infrastructure and services made up of next generation technologies (see question # 5). Virginia Tech has extensive experience in research and development of state-of-the-art network infrastructure serving university communities and the Commonwealth.

4. What is "e-58" and what is its relationship to the eCorridors Program?

e-58 is an advanced network infrastructure development effort encompassing communities throughout the southern border of Virginia that roughly follows Highway 58 from Jonesville to Norfolk. The Virginia Tobacco Indemnification and Community Revitalization Commission is managing e-58 for the economic development interest of the tobacco regions. The e-58 infrastructure, once built, will complement eCorridors projects throughout Virginia as new and existing community next generation network initiatives are leveraged to maximize access and minimize costs to communities.

5. What do you mean by the term "next generation"? Are you talking about Internet 2?

The eCorridors Program has a very specific definition for what constitutes "next generation" infrastructure and services. From an end user services perspective, next generation implies a network that provides symmetrical, high bandwidth (multi-megabit up to gigabit per second) access for an array of network applications and communications services. The "next generation" vision is consistent with that of "Internet 2", a consortium established byUCAID (the University Consortium for Advanced Internet Development) of research universities, and more recently other

universities, community colleges, and K-12 schools that are connected via the Internet 2 backbone infrastructure. More information about Internet 2 can be found at www.internet2.edu.

6. What is meant by “open access”?

An open access network is one in which the transport service provider places no inequitable restrictions on the provision of services by other content and application service providers, and no inequitable restrictions on peering with and between other transport providers. End users are able to choose content and applications services from multiple providers of their choice. Any user should be enabled to be a producer of content and applications services, not just a consumer. Open access networks enable economic development, competition, innovation and lower prices.

7. Who will own the network?

Virginia Tech is a very strong proponent of the network being private-sector based, NOT a public- or government-owned network. The ownership issue is dependent upon the communities involved, the private sector companies that participate, and the resources and assets that can best be leveraged to maximize its utility and minimize costs. Virginia Tech is cooperating with sponsors who are interested in exploring a number of business models including but not limited to

- ownership by non-profit entities;
- ownership by a consortium of municipalities or non-profits representing those municipalities;
- various combinations of ownership by traditional, for-profit private companies

9. What technologies does the eCorridors Program recommend?

A major objective is to put in place and maintain an advanced network infrastructure that supports economic development and competitive advantage for communities. The core technologies needed today include fiber optic networks, broadband wireless, Ethernet, and Internet Protocols. These are the technologies being used by top research universities all across the country. Fiber optics is needed to provide a network infrastructure that can support higher level communications technologies for many years to come, without becoming obsolete too quickly. Business and residential users can be provided with high-speed Ethernet access at speeds from 10 megabits per second to a gigabit per second. The speed will depend upon the access technology used, but in some rural areas of the country, gigabit per second access is being made available for what other users pay for DSL and cable modem access, which is a substantial competitive advantage. Business and residential users can be connected over fiber optic cables to local high-speed Ethernet switching centers, which are called Multimedia Service Access Points. These centers can in turn be connected to core switching centers in other communities over fiber optic cables. All communities can be connected together via a fiber optic mesh network for reliability. Broadband wireless can be used for early access and to supplement fiber optics where

needed. The wireless spectrum used can be unlicensed, such as used for wireless LANs, or licensed, such as used for microwave and LMDS (Local Multipoint Distribution Service).

10. What is the “license” that Virginia Tech has and does it allow them to provide services?

The Virginia Tech Foundation holds LMDS (Local Multipoint Distribution Service) radio spectrum licenses that cover about 16,000 square miles in southwest Virginia. It includes four basic trading areas for Roanoke, Bristol, Danville and Martinsville. The FCC envisions that LMDS will someday be a significant competitive local access technology. Current products support radio links up to a few miles, but cost effective equipment is still under development. Virginia Tech was the only research university to bid in the FCC’s auction of LMDS spectrum and it did not bid until it was clear that there were none from private sector companies. The licenses were purchased for research and development by Virginia Tech’s two wireless research centers: the Center for Wireless Telecommunications (www.cwt.vt.edu) and the Mobile and Portable Radio Research Group (www.mprg.org). The university is also in the process of leasing licenses to the private sector for commercial development.

11. How can interested communities get involved?

The eCorridors staff will work with any community that desires to participate. A key determining factor in any community’s success with the program is the existence of a local advocate who can and will work to mobilize the people, resources, and political capital necessary to get an eCorridors project started in their community. In addition, cooperation from local municipal leaders, public utilities, citizens and legislators is essential.

12. How can interested private sector companies get involved?

Private sector companies who are interested in participating in the testing and deployment of next generation infrastructure and/or services (please see definition in question #5 above) are encouraged to contact the eCorridors Program staff. Contact information is found on the website www.ecorridors.vt.edu

13. How can citizens and businesses learn more and keep up to date about the eCorridors projects?

The Program website, www.ecorridors.vt.edu, contains up to date information on each of the ongoing projects and also contains links to presentations about the technology, program personnel bios, other community networking efforts, a glossary of technical terms, and a list of partners who are currently collaborating on eCorridors initiatives.

Research Support

General Information

An element of the University's research is supported by Information Technology and supervised by Professor Edward A. Fox, who directs the Digital Library Research Laboratory (DLRL), 2030 Torgersen Hall. DLRL has a small staff consisting of Dr. Fox, Robert France, and Debra Dudley.

The DLRL facilities include the a laboratory in Torgersen Hall, separate office space within Torgersen Hall, and additional computers including the "PetaPlex", which has a large IBM RS/6000 front-end and is a 100-processor parallel machine with 2.5 terabytes of disk storage, in the Computing Center.

The DLRL often receives international visitors, including individuals from Portugal (Nuno Freire), Spain (Pablo de la Fuente), India (Shalini Urs), Japan (Akira Maeda), and Korea (Mann-Ho Lee). Currently the DLRL is hosting an individual from Korea who will be at Virginia Tech for one year (Dr. Sunny Kim, kimbs@vt.edu). Additionally, another individual (on Fulbright - Saibaba Bathala) is expected from India late in the year 2001.

A number of students are or have been associated with DLRL from either Computer Science or the Internet Technology Innovation Center at Virginia Tech, a University Center also directed by Dr. Fox. The PhD students and their topic of interest are:

- Fernando Das Neves (fdasneve@vt.edu) - transitive documents and clustering
- Shahrooz Feizabadi (Shahrooz@vt.edu) – biodiversity and digital libraries
- Robert France (france@vt.edu) - MARIAN digital library system
- Marcos Andre Goncalves (mgoncalv@vt.edu) - federated search and harvesting
- Paul Mather (paul@csgrad.cs.vt.edu) - parallel computers, audio and video
- Ryan Richardson (wiricha2@csgrad.cs.vt.edu) – multilingual information retrieval
- Ohm Sornil (osornil@vt.edu) – parallel computers and inverted files – finished dissertation and graduated, teaching now in Thailand
- Hussein Suleman (hussain@vt.edu) - Open Archives
- Wensi Xi (xwensi@vt.edu) – parallel computers, WWW crawling and searching
- Masters students and undergraduates are involved too, working on human-computer interaction, data mining, and diverse projects of help to the university community:
- Aaron Krowne (akrowne@vt.edu) – digital libraries and computing education
- Ashwini Pande (aspande@vt.edu) – Internet Technology projects and proposals
- Jonathan Pryor (jonpryor@vt.edu) – digital libraries and learning about computing (especially history and professionalism)
- Aarthi Sundararajan (asundara@vt.edu) – XML and the “Numbers Web”

- Jesus Trespalacios (jesustres@hotmail.com) digital libraries and interfaces to learn about computing, including for Hispanics
- Jun Wang (juwang2@vt.edu) -
- Ye Zhou (yezhou@vt.edu) – Open Archives and Physics services

Current Initiatives

Many activities have been underway during the 2000-2001 CY. Since the PetaPlex was purchased in the middle of 1999, there has been a great deal of work to get it operational. It has been used as the main system for the dissertation research of Ohm Sornil on parallel inverted files, so we can quickly carry out text searches. IBM awarded a \$20,000 grant to support its use for serving video.

DLRL has played a leadership role in the Open Archives Initiative since its inception in fall 1999. Dr. Fox serves on the Steering Committee and Hussein Suleman serves on the Technical Committee. Fox was chair of workshops in June and September 2000 and will chair another in September 2001. This promises to make campus information and many other collections easily available online.

DLRL continues to coordinate worldwide activities of the Networked Digital Library of Theses and Dissertations, NDLTD, www.ndltd.org and www.theses.org, working with University Libraries, the Graduate School, and over 100 members of NDLTD that are scattered around the globe. This leads to frequent visitors to Virginia Tech, and quite a lot of travel in the US and abroad. Dr. Fox is director of NDLTD, and chairs its Steering Committee.

Another major activity has to do with digital libraries and education in computer science. Dr. Fox is helping with the Information Management curriculum work for CC2001, the new ACM/IEEE curriculum for computing that should be finalized late in 2001. We host the Computer Science Teaching Center, www.cstc.org. Dr. Fox is founder and co-editor-in-chief of the ACM Journal of Educational Resources in Computing (JERIC), with the first issue in Spring 2001; this is "fed" from CSTC and should greatly aid people to learn about computing.

A number of activities relate to computer science courses including:

- UH3004 Digital Libraries (honors class)
- CS4624 Multimedia, Hypertext and Information Access
- CS5604 Information Storage and Retrieval
- CS6604 Digital Libraries which all have term projects that relate at least in part to DLRL efforts.

Other activities relate to the following funded research projects.

- IBM: IBM Faculty Partnership Award: \$20,000, summer 2000. Project director: E. Fox.
- UNC Wilmington: A Digital Library of Reusable Science and Math Resources for Undergraduate Education: \$78,374 for 5/1/2000 - 4/30/2002. Project

- director: E. Fox. (subcontract for what originally was CCRI proposal by William Graves to NSF 98-63 for \$1,143,282, DLI-2, Undergraduate Emphasis)
- NSF SGER: Core Research for the Networked University Digital Library (NUDL): \$79,997 for 1/1/2000 - 12/31/2001. Project director: E. Fox.
 - Advance Auto Parts: Internet Technology Innovation and Visioning with Advance Auto Parts: \$193,014 for 1/7/2000 - 12/29/2000. Project director: E. Fox. Co-PIs: L. Matheson, J. Hicks, N. Ramakrishnan, A. Moore at Virginia Tech & A. Weaver, J. French at U. of Virginia.
 - NSF IIS-9905026: 1999 NSF Information and Data Management Workshop: Research Agenda for the 21st Century - IDM'99: \$105,782 for 1/1/99 - 12/31/2000. Project director: Edward A. Fox.
 - CIT: Internet Technology Innovation Center (ITIC): \$2M for 5 years starting on 10/1/98. Project director at Virginia Tech: Edward A. Fox, also serving as director of the university center to handle this (Internet Technology Innovation Center at VT). Virginia Tech is one of 4 universities in this virtual center, with rotating director, initially Alf Weaver, at UVA, which is administering the grant from the Virginia Center for Innovative Technology. See <http://fox.cs.vt.edu/itic/>
 - NLM: Advanced Information Retrieval for Toxicology and Environmental Health Databases: \$25,000 + supplements for 5/16/98 - 5/15/2000 + \$40,000 for 2001-2002. Project director: Edward A. Fox (processed through ORISE, with small support directly to Virginia Tech and tuition and stipend directly to the graduate assistant).
 - NSF DUE-9752408: Curriculum Resources in Interactive Multimedia (CRIM): \$87,000 for the DUE CCD program 97-29, 1/1/98 - 12/31/2000. Project director: Edward A. Fox.
 - NSF DUE-9752190: A Digital Library Based Computer Science Teaching Center (CSTC): \$72,820 for 1/1/98-2/29/2000. Project director: Edward A. Fox. Subaward for proposal to NSF for the DUE CCD program 97-29 granted to D. Knox of The College of New Jersey
 - OCLC: SiteSearch software license: \$50,000 for 1997-2000 for electronic thesis and dissertation research. Project director: E. Fox.
 - US-Korea joint workshop on digital libraries (NSF) \$24,472 awarded 8/21/00
 - Internet development at Public Consulting Group (PCGI) \$7,825 awarded 10/18/00
 - Internet development at Public Consulting Group (PCGI) \$15,426 awarded 12/27/00
 - International guide for the creation of electronic theses and dissertations (UNESCO) \$13,000 awarded 12/28/00
 - AOL fellowship in information retrieval (AOL) \$35,000 awarded 2/5/01
 - Open archives: distributed services (NSF – see www.nudl.org) \$315,259 awarded 3/1/01
 - High performance interoperable digital (NSF) \$99,999 awarded 4/2/01
 - CITIDEL (NSF – see www.citidel.org) \$800,000 to be awarded

- e-Numerate \$40,416 to be awarded
- Flow through from NSF's National Science, mathematics, engineering, and technology education Digital Library: from Univ. of Arizona \$104,773 and Univ. of Missouri & \$142,500

Future Initiatives

During the past AY, the PetaPlex was upgraded so each node has 64 megabytes of RAM instead of just 8M, which should allow it to be more widely used. The DLRL has become more connected to campus research due to its move to Torgersen Hall.

Work on the MARIAN system continues, aided further by several grants, including: NSF: Open Archives: Distributed services for physicists and graduate students (OAD): \$315,259 for 9/1/2000-8/31/2003. Project director: E. Fox (w. Royce Zia, Physics, VT, and E. Hilf, U. Oldenburg, PI on matching German DFG project)

Most of the grants listed above are continuing into AY 2001/2002.

Many other efforts will proceed too. One service activity, initially involving Boy Scouts, undergraduate students, and graduate students, continued a Spring 2000 class project, and is helping the Virginia Tech Museum of Natural History to build a digital library of images and metadata from interesting parts of its collection.

Dr. Fox is involved in a variety of service activities that have involved the DLRL as well. He chaired the US-Korean Joint Workshop on Digital Libraries in August 2000, at the San Diego Supercomputer Center. He chaired the National Science Foundation Information and Data Management workshop Oct. 2-4, 2000 at the Hotel Roanoke. He also served as general chair for the Joint ACM/IEEE-CS Conference on Digital Libraries, JCDL 2001, www.jcdl.org, held June 24-28, 2001, also at the Hotel Roanoke, along with the June 28 meeting of principal investigators of NSF Digital Library Initiative projects.

See details at www.dlib.vt.edu on the "DLRL" and its activities.

Security

Mission

The mission of the Information Resources & 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.

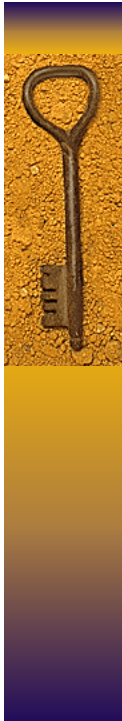
Goals and Objectives:

- Work closely with the AIS Security Officer, Communications Network Services, 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.

Ongoing Activities

- Policies
 - Promoting the university's acceptable use policy and guidelines
 - Work with Virginia's Secretary of Technology office on the Council of Technology Services Enterprise Security Architecture document
- Federal government critical infrastructure
 - Work with Federal government on cyber-threat issues
 - Participate in the Brookings Institute meetings on cyber issues
- Center for Internet Security
 - Develop and test security benchmark tools for Linux, Solaris, AIX, W2K
 - Test vendor security software for compliance with these benchmarks


- SANS
 - Coordinate Security training conference for 300 academic system administrator and information security officers
 - Teach courses at SANS conferences
- University Leadership Development
 - Construct "Securing Solaris" training course for VT staff
- Operational
 - Coordinate Risk Analysis of IS units
 - Develop Incident Response policy
 - Develop security scanning service guidelines
 - Collect data of hacker probes and feed it to Internet Storm Center Project.
- Torgersen Security Lab
 - Set up testing of Symantec security software as part of project with Center for Internet Security
 - Teach graduate level classes on Computer & Network Security



VT Cyber Security Initiative

- ◆ A leader in these cyber security areas since 1991
 - Policy
 - Acceptable Use Policy
 - VA COTS Enterprise Security Architecture document
 - US Critical Infrastructure
 - Operational
 - Risk Analysis
 - Incident response
 - DDOS
 - Data collection of probes/attacks
 - Training
 - In house security seminars
 - Outreach programs – IIA, ISACA, State Agency
 - Academic programs – Graduate level Security course

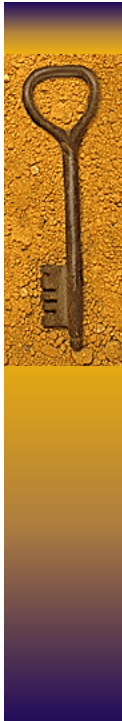
VA Preparedness & Security Panel 15



VA Tech Cyber Security Initiatives - *Policy*

- ◆ Acceptable Use Policy
 - Model for most of the EDU's in VA.
 - Active since 1991. Recognized as one of the best in the country
 - Handles most of the controversial issues elegantly ☺
 - Education and training programs for entire University community (faculty, staff, students)
 - Blacksburg Electronic Village


VA Preparedness & Security Panel 16



VT Cyber Security – *VA State Government*

- ◆ Member of the Review team for COTS Enterprise Security Architecture document
- ◆ Member of Review team for other State IT policies
- ◆ Frequent speaker at COVITS
- ◆ Consultant to DIT and State Auditor on cyber security issues
- ◆ Training programs for state IT staff


VA Preparedness & Security Panel 17



VT Cyber Security Issues – *US Critical Infrastructure*

- ◆ White House Critical Infrastructure Task Force on DDOS Attacks
 - Member of the team that analyzed the 2000 DDOS attacks
 - Discovered the toolkits on 4/99 with U of Washington
 - Part of the group that warned of its implications
- ◆ Member of Y2K task force on Cyber Security.
 - Participated in White House NSC meetings on Y2K threats
- ◆ Collecting probe data for Internet Storm Center project with SANS and FBI/NIPC.


VA Preparedness & Security Panel 18



VT Cyber Security Issues – *Risk Analysis*

- ◆ Developed STAR (Security, Targeting & Analysis of Risk) technique
 - Simplifies R/A for individual depts
 - VT ISO received 98% on-time return of departmental risk analysis
 - Federal Govt is reviewing the technique for possible adoption
 - Numerous commercial companies are adopting the technique
 - Published in Information Security Bulletin
 - Taught at IIA, ISACA international conferences

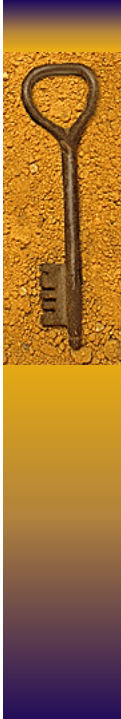
VA Preparedness & Security Panel 19



VT Cyber Security Issues – *SANS Institute*

- ◆ Incident Response/DDOS
 - Coauthored SANS Institute document describing how to defend against DDOS attacks
 - Coauthored SANS Institute’s Top 10 Internet Threats document (2000)
 - Coauthored SANS Institute’s/FBI-NIPC Top 20 Internet Threats document (2001)
 - *5 of 55 co-authors were from VT. Most from any single site*
 - Coauthored SANS Institute’s Incident Handling – Step by Step guide
 - Coauthor and instructors of SANS GIAC security certification courses now becoming an industry standard


VA Preparedness & Security Panel 20



VT Cyber Security Issues – *SANS Institute*

- ◆ Instructors at the SANS and SANS Network Security training conferences
 - Incident Response
 - Risk Analysis
 - Freeware Security Tools
 - Securing Unix Systems
- ◆ Hosting SANS-EDU Training – 11/16-18/01
 - 300 security officers, sysadmins, netadmins from VA, MD, FL, MA, NC, WV, TN schools/colleges/univ.
 - SANS donated instructor times/salaries/registration fees in recognition of VT’s contribution to the Cyber Security field
 - Free for any EDU

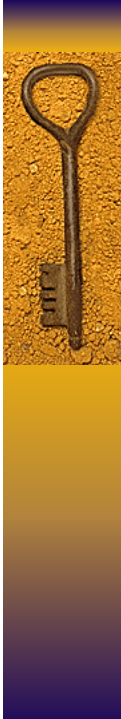
VA Preparedness & Security Panel 21



VT Cyber Security Issues – *Incident Response*

- ◆ Computer Incident Response Team (CIRT)
 - VT CIRT won SANS Security Technology Award in 2000 for their work on IRT
 - Manage and coordinate VA-CIRT – a consortium of CIRTs from VA Higher Ed schools.
 - ~40 member schools (VT, UVA, GMU, JMU, ODU, VCU, U of R, Hampton U., Longwood, Hollins, Roanoke, Radford, FBI, VA State Police, etc.)
 - In place since 1996
 - Useful in mitigating the DDOS attacks
 - Provided early warning to FBI and State Police
 - Meet annually with members
 - White House NSC Critical Infrastructure chief was a guest speaker


VA Preparedness & Security Panel 22



VT Cyber Security – *Center for Internet Security*

- ◆ VT named charter member of Center for Internet Security. Stanford was the only other EDU charter member.
 - VISA, MC, Allstate Insurance, Union Bank of CA, US Central Credit Union, First Union, National Life Assurance Co. of Canada, City Bank - LA , PWC, TRX, Deloitte Touche Tohmatsu, Harris Corp., Symantec/Axent, ISS, SWIFT (Belgium), Foundstone, AICPA, IIA, ISACA, Goldman Sachs
 - Shell Oil, Chevron, Pitney Bowes, Intel, Caterpillar, Agilent, Hillenbrand Industries, Mrs. Smith's Bakeries, Hallmark Cards, Vulcan Materials, Nu Skin Enterprises
 - RCMP, DOJ, Library of Congress, DoD CERT, NSWC, NASA/GSFC, Treasury Dept., NIST, Infocomm Authority of Singapore, Comm. Security Establishment (Canada)
 - Lucent, SASKtel(Canada), PG&E, Allegheny Energy

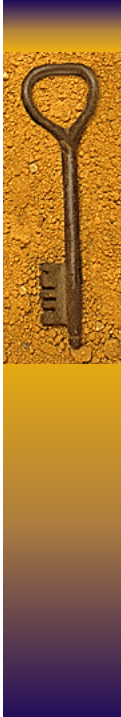
VA Preparedness & Security Panel 23



VT Cyber Security - *CIS*

- ◆ Members of Design team that developed consensus security architecture documents for Solaris, HP-UX, Linux, AIX, Windows 2000
- ◆ Goal is to provide vendors with a blueprint of minimum security standards acceptable by their customers

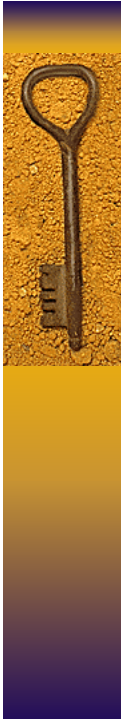
VA Preparedness & Security Panel 24



VT Cyber Security – *CIS* *Network Appliance Testing Lab*

- ◆ Network Appliance Testing Lab
 - Test the security of network capable devices
 - Parking gates, A/C control systems, door locks, printers, Data Acquisition devices, video systems, medical systems (MRI)
- ◆ Rate the security of network capable devices
- ◆ Publish report listing the ‘safe’ devices
- ◆ 1000 sq. ft lab – 3210 Torgersen
 - Unix: Linux, Solaris, AIX
 - Windows 2000
 - Macintosh 9.x, Macintosh 10.x
 - Network router/switches

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VT Cyber Security Initiative - *Summary*

- ◆ VT has been in leader in cyber security issues since 1991
 - Policy
 - Operational
 - Incident response
 - DDOS
 - Data collection of probes/attacks
 - Training
 - In house security seminars
 - Outreach programs
 - Academic programs
- ◆ VT has been recognized internationally as cyber security experts

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