Virginia Polytechnic Institute and State University

Vice President for Information Technology

Annual Report 2001 – 2002

Virginia Tech

A University Putting Knowledge to WORK

Introduction

"Virginia Polytechnic Institute and State University is a public land-grant university serving the Commonwealth of Virginia, the nation, and the world community. The discovery and dissemination of new knowledge are central to its mission. Through its focus on teaching and learning, research, and outreach, the university creates, conveys, and applies knowledge to expand personal growth and opportunity, advance social and community development, foster economic competitiveness and improve the quality of life."

Virginia Tech has announced its overall goal is to make the university ranked among the top 30 universities by 2010. The Information Technology (IT) organization is playing its part to support this goal. Its focus is on enhancing teaching and learning and supporting research activities. Additionally, essential elements of the Information Technology organization's endeavors are associated with fostering outreach with Commonwealth communities.

Organization

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

VP Information
Technology

Erv Blythe

Advanced Network Infrastructure & Services	Information Systems & Computing	Learning Technologies
Judy Lilly	Pat Jackson	Anne Moore
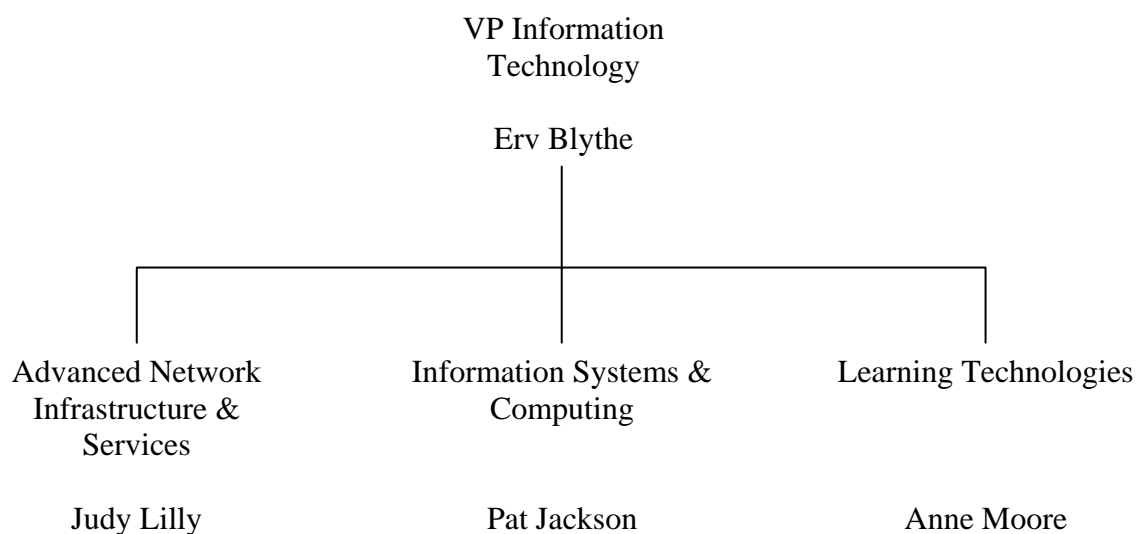
The Information Technology organization is divided into three major line elements which report to the Vice President for Information Technology. The diagram above depicts the structure, consisting of the Advanced Network Infrastructure and Services division, the Information Technology and Computing division, and the Learning Technologies division. Within the organization there are two auxiliaries, the largest being Communications Network Services (CNS).   The Information Technology organization consists of approximately 650 salaried and wage employees.

Each of the major line areas has a section of this report which will describe their activities and contributions for the past year. Additionally, there will be a section on the eCorridors program which reports directly to the Vice President for Information Technology, a section on the IT organizations efforts to support research computing and a section on information technology security.

Financial Summary

During fiscal 2002, the organizational units of Information Technology provided resources totaling $50,385,363 in support of university academic, research, administrative, and outreach goals.

Information Systems & Computing provided academic, research, and administrative support totaling $19,645,000 and Learning Technologies provided academic support totaling $4,968,000. Advanced Network Infrastructure and Services provided telecommunications, video, data, and networking services of approximately $16,806,000 plus $1,570,000 in mail services. Additional services totaling $1,400,000 were provided by IT in support of the Advanced Technology Learning Center and classroom connectivity for distance learning.

IT also operated two self supporting units to provide specialized digital imaging and volume printing to university departments (Digital Imaging and Printing Services). University support provided by these two units totaled approximately $4,203,000.

Funding to support the activities of IT was provided by:

E&G	$27,787,960
Equipment Trust Fund	2,758,390
Auxiliary Operations	15,053,899
Self Supporting Operations	4,203,567
Sponsored Grants	579,381
Overhead	2,166
Total	$50,385,363

The IT organization is an active participant in the sponsored research arena. Balances in the IT Sponsored Programs were approximately $2,500,000 at fiscal years end. Project sponsors include: The Department of Education, Future of the Piedmont, Blacksburg Electronic Village, US Department of Commerce, Tobacco Commission.

Advanced Network Infrastructure and Services

Advanced Network Infrastructure & Service (ANI&S)

Advanced Network Infrastructure and Services exists to provide leading edge, high quality data, video and voice infrastructure and services 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, operations and support are provided with an emphasis on the highest levels of network security and reliability while continually moving Virginia Tech forward as a leader in the advanced networking community. 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 address the expansion and enhancement of advanced network infrastructure to support the university communities and pursue the development of related new services.

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 Network 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 and Digital Imaging Services, and University Mail Services. In a continuing effort to create an organizational structure and environment to support the mission of the university, we aggressively restructured the organizations to effectively develop and manage key important information technology areas during the 2001-2002 Fiscal Year.

Virginia Tech Operations Center

In Spring 2002, ANI&S successfully established the Virginia Tech Operations Center or "VTOC". The center joins traditional call center and computing help desk functions with network operations, video operations, and systems support in a single integrated operations center. The center is the nexus for information technology trouble reporting and resolution services for the campus and for remote centers around the Commonwealth, on a 24 hours a day, 7 days a week (24x7) basis.

Putting It All Together: An Integrated Approach to Network Management

The operations center is supported by a state-of-the-art system known as NEMISYS that monitors and manages the network infrastructure and server environment. This system was developed and integrated by the ANI&S Research and Development team and is based on world-class software products from Systems Management Arts, Remedy Corporation, and Oracle.

ANI&S researchers evaluated candidate network management systems for nearly two years before concluding that the vast majority of enterprise network management products on the market are not cost effective, have exorbitant licensing fees, and don't address the unique needs of the university computing and network environment.

The ANI&S research and development team decided on an alternative approach, of identifying smaller, less expensive network management components that offered "open interfaces" that would allow solutions from different vendors to interoperate. This strategy proved highly effective, and led to an integrated solution that was far more than the sum of its parts. Software engineers on the ANI&S team developed the "glue" software components that would allow the component systems to be plugged together in a seamless manner. These "glueware" components provide extraordinary flexibility and extensibility, allowing NEMISYS to readily adapt to the changing needs of the university telecommunications and communications environments.

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

Call Center: Single Point of Contact for IT Support

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

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

Automated Fault Management: The Proactive Approach to Resolving Network Faults

When network faults are detected and resolved proactively, users never find themselves needing to contact the call center to report a network outage. The goal of automated fault management is to ensure that network outages are discovered *before* users are impacted. The NEMISYS fault management system uses highly advanced root cause analysis and correlation components to isolate network faults and automatically open and escalate problem reports so that diagnostics staff can resolve faults as soon as they occur, greatly reducing the impact to the business of the university.

Automated fault management ensures that those network faults having the greatest impact to the business are resolved first, leading to much greater availability of the university's most critical information technology resources.

Problem Reporting System: Tracking Problems and Building Troubleshooting Knowledge

The NEMISYS Problem Reporting System was developed during 2001-2002 to provide the basis for integrating call center, network diagnostics, and desktop support in a common operations center. The system provides the fundamental framework of communicating information between computing/network service users, call center operators, and diagnostics groups responsible for resolving problems – the problem report.

Problem reports are entered by call center staff by means of easy-to-use on-screen forms. Reports can also be entered into the system under automation by the fault management system. Based on the problem symptoms contained in the problem report, a diagnostic ticket is opened with an appropriate diagnostics groups; technical staff with competencies in a particular area such as desktop computing support, server administration, network infrastructure.

Diagnostic tickets are represented by sophisticated, yet easy-to-use on-screen forms that provide access to the details of the reported problem as well as crucial supporting resources such as directories, databases, and knowledgebases. While working on a particular problem, the diagnostician can engage peers in other diagnostics groups by opening additional diagnostic tickets for the problem with the target diagnostics groups. This unique and powerful capability allows the diagnostics process to proceed in parallel (need to know) across all IT areas that might be able to identify and resolve the problem.

The problem reporting system includes a sophisticated service impact, scheduling, and notification component, so that appropriate technical staff can be contacted and engaged in the fault resolution process at any time, day or night. This component analyzes the impact of the fault in terms of the affected services and service subscribers, thus ensuring that the scope and severity of a fault are well understood as early as possible in the resolution process. The system uses a robust combination of alphanumeric pagers and call-out dispatches (via the call center) to contact technical staff.

Advanced knowledgebases are developed by the operations center through post-resolution review of problem reports, so that future occurrences of similar problems can benefit from past experience. Development and use of knowledgebases allows the operations center to improve service and reduce costs by quickly resolving problems that have recognizable symptoms.

Engineering Support: Synergistic and Cost-Effective

High level engineering and consultation support is provided to the operations center using a model in which duty engineers from various ANI&S engineering units are temporarily assigned to and located in the operations center.   The role of each duty engineer is to provide next-level technical support to the diagnostics groups when problems need to be escalated to take advantage of strong skill sets. This highly effective and synergistic approach helps build lines of communication between front-line staff responsible for solving problems and engineering staff responsible for deploying infrastructure, network solutions, and the like. Significant cost savings are achieved by leveraging the highly-skilled workforce in existing engineering units, rather than recruiting and retaining engineers specifically for the operations center.

Advanced Telecommunications Laboratory

With the move to our new facility in Research Building XIV, ANI&S established the Advanced Telecommunications Laboratory. Staffed by expert technologist with strong credentials in engineering, statistics, mathematics, computer science, the laboratory provides a center for telecommunications product testing and evaluation, protocol analysis, and network solutions modeling.

ANI&S researchers can construct network topologies in the laboratory that model real-world networks, and thus accelerate the deployment of the most advanced telecommunications technologies in the university's campus and wide-area network infrastructures. Examples include Cisco Systems, Lucent/Avaya, Enterasys, Netcom, and World Wide Packets.

The laboratory gives a competitive advantage to Virginia Tech. ANI&S researchers can cite the availability of the laboratory facilities in grant applications. For example, a recent NSF grant in community networks awarded to Virginia Tech made extensive use of the laboratory using wireless technologies to design a network solution for Smyth County Public Schools. Technical staff from Smyth County worked side by side with ANI&S researchers to learn and understand these sophisticated technologies, ensuring the success of the network as it was deployed and brought up to production status.

The laboratory also serves as a training center, allowing technical staff in network engineering and operations to learn best practices in network configuration, operations, and management. Facilities are available that meet or exceed the specifications for

industry-standard certification testing in internetwork engineering, and network administration.

Campus Network: Continuous Refinement

During the summer of 2000, ANI&S undertook a major effort to upgrade the core of the campus network using Gigabit Ethernet switching over the campus fiber optic backbone as the foundation. While this sophisticated core network continues to serve the most demanding needs of university researchers and administrative applications, recent advances and refinements in network switching components have led to the latest round of improvements in campus network service.

Broad Availability of Low Cost 100 Mbps Ethernet Service

Leveraging the existing Gigabit Ethernet core and fiber optic backbone, ANI&S began widespread deployment of low cost, high performance access switches, permitting a drastic reduction in the monthly rate for 100 Mbps service, from $75/month, to only $10/month. From cutting-edge research to Banner administrative applications, the increase in bandwidth combined with a low monthly rate provides distinct advantages in productivity, applicability for network/application research, and so on.

Internet Access Capacity Upgrade

In summer 2002, ANI&S began preparations for a major upgrade to the Internet access facility that connects the campus backbone to the global Internet and Internet2. The upgrade will increase the capacity of the facility from 155 megabits per second (Mbps) to 622 Mbps. ANI&S, responding to the needs of university researchers and analysis of network utilization patterns, undertook the upgrade using a funding model that will not necessitate an increase in the monthly rate network users pay for access.

This four-fold increase provided by the upgrade will make available the bandwidth resources needed for advanced grid-based computation, network-based collaboration environments, and other research efforts in key areas such as biotechnology, computer science, engineering, and mathematics.

Network Virginia/Internet2

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

Supported by ANI&S within Information Systems, NWV today connects over 1.4 million people to the Internet, to Internet2 (http://www.internet2.org/), and to each other.

A Great Success Story

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

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

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

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

A University Putting Knowledge to Work

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

An important and unique aspect of NetworkVirginia is the service provided by more than twenty competing telecommunications companies. Virginia Tech provides a "Provider Coordination" function to facilitate the needed cooperation. An order for new service actually flows through a design team within ANI&S who works with the ordering party to understand application requirements, translate those requirements into configuration specifications, then communicate those specifications to all involved providers.

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

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

Benefits of the Program

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

The Service Providers

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

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

Lowest Possible Cost for Access

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

Current prices for access service are reflected below:

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

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

Network Virginia NG

During 2001–2002, ANI&S substantially completed an overhaul of the NetworkVirginia backbone under contract to Sprint. Virginia Tech has been in a leadership position for driving the technology and effective management of NWV since its inception. Sprint asked the university to undertake a development project to design, configure, implement, and initially manage a new, next generation Internet core network consistent with Internet2 capability. The resulting state of the art, statewide network system extends gigabit scale access throughout the Commonwealth with capability to support new multimedia IP-based services. The new network includes an 800% increase in capacity between backbone nodes, 1,200% increase in commodity Internet capacity, and substantial improvements in diversity and reliability. Virginia Tech's Network Operations Center will continue to manage the new network system through the remainder of the two year arrangement before transitioning management to Sprint.

ANI&S negotiated several addenda to the NetworkVirginia agreements with both Verizon and Sprint to continue to update and improve services offered. The Verizon contract was modified to extend OC12c ATM access service increasing the maximum offered access data rate from 155 Mbps to 622 Mbps. Also, a separate Verizon addendum offers an innovative, flexible new Full Service option enabling customer tailoring of specialized Customer Premises Equipment to be included within the service offering. Of particular interest, ANI&S has been working with Verizon on an additional addendum to offer a whole new class of Ethernet-based access services ranging from 10 Mbps to 1 Gbps. We expect to complete development and negotiations during the fall of

2002. Appropriate contract addenda were executed with Sprint to accommodate the backbone network overhaul and also to further reduce prices for certain NWVng services. NetworkVirginia continues to operate effectively with moderate growth now reaching an estimated 1.4 million people statewide at nearly a thousand network access points.

NWVng Internet2 gigaPOP

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

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

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

- connector for Virginia for the Internet2 Abilene network;
- the Mid-Atlantic Crossroads (MAX). Virginia Tech is a co-founder, along with the University of Maryland, Georgetown, and George Washington University, of the Mid-Atlantic Crossroads (MAX) supporting research connectivity in the Washington D.C. area among university, federal, and commercial research institutions;
- the Southeastern Universities Research Association Research Infrastructure Initiative program;
- the national Quilt organization of gigaPOPs (http://www.thequilt.net/);
- Educause (http://www.educause.edu/);
- the National Laboratory for Advanced Network Research Joint Techs;
- peering with federal research networks;
- the National Lightrail Initiative, and others

The NWVng gigaPOP is currently working to develop new regional high performance network initiatives in support of a research partnership between Oak Ridge National Labs, Georgia Tech and Virginia Tech.

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

During 2001–2002 the NWVng Internet2 gigaPOP (NWVng I2) grew substantially from connecting eight institutions to the Internet2 Abilene network to forty nine campuses statewide.   Leveraging the increased cost share among participants, NWVng I2 negotiated, acquired, and implemented a substantial upgrade to the Abilene gateway facility with a 400% capacity increase. ANI&S continues to manage the NWVng I2 gigaPOP on behalf of the Virginia research and education community on a cost recovery basis.

NWVng negotiated and executed an agreement with Metromedia Fiber Networks for construction and an Indefeasible Right of Use for dark fiber in the Washington D.C. metro area. Initially, the fiber will interconnect the NWVng core router node in D.C., the Abilene router node in D.C., a MAX router node in D.C., PAIX East in Arlington, and a new physical gigaPOP node Arlington.   These resources position NWVng I2 with extremely cost effective scalability and flexibility over the next several years. The dark fiber construction is scheduled for completion by the end of 2002.

In concert with the upgrade to the NetworkVirginia backbone network ANI&S implemented several Internet2-related technology enhancements within the core of that network to extend the capability to participate with Internet2 initiatives throughout Virginia. Examples include facilitation of an IPv6 testbed, IP multicast services, IP-based QoS preparation, and MPLS.

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

Inernet2 K20 Initiative and Sponsored Education Group Participant

NWVng I2 successfully implemented an Internet2 Sponsored Educational Group Participant (SEGP) initiative to broaden opportunity for access to Internet2 to more educational institutions.   Participants added under the SEGP (http://k20.internet2.edu/index.shtml) include the entire Virginia Community College System, the University of Richmond, Hampton University, the Virginia Institute of Marine Science, the Virginia Science Museum, Norfolk State University, and AEL, Inc.

ANI&S coordinated startup of a multi-institution "K20 Initiative" for Virginia. The K20 Initiative and SEGP made several exciting strides this year. The entire Virginia Community College System was connected to Internet2 via the NWVng I2 gigaPOP and began sharing distance learning programs with the West Virginia community college system during the Spring of 2002 over Internet2.   The K20 Initiative also initiated and executed a highly successful K-12 demonstration project in association with the Jason Project (http://www.jasonproject.org/) leveraging the power of Internet2 to expand access to Jason's science education program and to improve instruction. "CAVEapps" was another successful project focused on extending the use of Collaborative Virtual Environments for use in K-12 instruction. The K20 Initiative is preparing a new

initiative for ThinkQuest called "ThinkQuest Live: My Teacher is an Avatar" further extending use of the CAVE in K-12 instruction.

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

Enterprise Information Systems and Business Services

Over the past fourteen years, Advanced Network Infrastructure and Services has gained a strong strategic advantage by developing its enterprise management systems internally. This philosophy has allowed the organization to adapt quickly to the rapidly changing telecommunications environment. It significantly reduces implementation time, effort and cost for the delivery of new networking technologies, allowing for sophisticated networking initiatives to move quickly from the organization's Research and Development teams into production to begin serving the university. The organization's Systems Development and Administration team is responsible for the in house development and maintenance of these systems and works closely with every area of the organization.

ATLAS

The organization's primary enterprise management system is ATLAS. ATLAS provides integrated billing, accounts receivable, accounts payable, materials inventory, cable plant inventory, service management, budgeting, purchase order, call detail accounting and work order functionality for the organization. The system generated and managed over $18 million in billable charges last year. The inventory systems manage over 84,000 active services, more than 380,000 cable segments and in excess of 65,000 materials inventory items.

The ATLAS system is an Oracle based client server system developed primarily in Oracle Forms (160+ applications), Oracle Reports (110+ applications) and PL/SQL (90+ applications). Support functions are also developed in C, Java, Perl and Expect. The system serves 60+ concurrent users and provides rapid access to over 30Gb of enterprise information including over 50 million call detail records and over 24 million modem pool accounting records. Significant research and testing was done this year using Oracle 9iAS in preparation for moving the ATLAS code base to a Web based service in the coming year.

ATLAS is tightly integrated with the organization's mission critical NEMISYS network management system, as well as University administrative systems included in the Banner suite. This year the Systems Development and Administration team worked closely with the Controller's office, the Bursar's office and Information Systems and Computing to develop and enhance the ATLAS interface with the university's new cash receipts management system (Salespoint).

E-business

E-commerce systems developed internally are available at https://cola.cns.vt.edu. This suite of Java servlet applications interface with the ATLAS system and provide customers with easy to use Web access to their account information. Departments access and download pdf versions of their bills from the cola site, while students can provision many of their services via the Web site as well as review charges, download copies of bills and review recent long distance activity. The addition this year of student long distance authorization code provisioning saved the organization an estimated $10,000 annually.

Another Web focus for the year by the Systems Development and Administration team, working closely with the Public Relations team, has been the development of a secure centralized Web hosting and management system for the organization's internal use leading to the development of internal.cns.vt.edu. The site provides secure, granular access to important information, documents and a series of Java servlet applications that further extend the ATLAS reporting capabilities.

A third major accomplishment in the Web area has been the migration of all Web Java applications from Jserv to Tomcat. This upgrade was critical in order to keep pace with the emerging standards in the Web development environment.

The Development Cycle: Developers and users working together to continuously improve the organization

As stated earlier, the organization's commitment to internal development has been an important strategic advantage over the years. Systems Development members continue to serve as project leaders for numerous on going development teams that include representation from all areas of the organization. These teams manage the continuous improvement that allows the organization to continually become more efficient and react to the changing business environment. As a result of these efforts, the Systems Development team made almost 750 code modifications this year. This commitment to continuous improvement and increased automation will be very important as the organization reacts to the impact of budget reductions.

Some of the larger ATLAS improvements implemented this year include the development of a project estimate system that allows for the estimation and allocation of inventory prior to consumption and the development of a fixed asset management module that allows system administrators to better manage computer infrastructure and enforces sign off confirmation of the reformatting of storage media prior to exit from the organization.

An example of the organization's ability to move very quickly as a result of the tight integration between its operational units and its systems development team was this year's pilot project to provide dial-tone to summer conference attendees using the university's dorms. Within two weeks of the final decision to go forward with this

project, Systems Development implemented a new ATLAS/CBX interface application that automated the update of over 2,000 phone configurations.

Our Voice over IP research project is another excellent example of the strategic benefits gained by the organization from the tight integration between its Research and Development team and the Systems Development team. The organization successfully implemented an internal pilot for Voice over IP this year and seamlessly integrated the call detail management into its current ATLAS call detail management system and customer billing system.

Significant effort was put forth this year in developing improved call detail traffic engineering systems that will allow the organization to use more sophisticated decision support tools for strategic planning.

Economies of Scale Support Growth

The organization's commitment to in house development has also allowed it to quickly and effectively integrate new organizations into the ANI&S family. During the past several years the organization has integrated Mail Services, Printing Services and VBS into its ATLAS system. The majority of Mail Services billing was integrated into ATLAS, providing an automated process for the billing of more than 7,000 monthly charges that were previously entered manually by the Controller's office.

In addition to the economies gained by integrating the new organizations into the ATLAS system, the new organizations have benefited from custom ATLAS development as well. This year, Systems Development developed a video teleconferencing management system in support of distance learning that integrates the scheduling and billing functions for VBS, reducing the number of manually entered charges by more than 900 a month.

Focus on Security

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

This year the System Development and Administration team continued improvements in UNIX system security including 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, www.sans.org) and CIS (Center for Internet Security, http://www.cisecurity.org/). This team manages approximately 40 UNIX systems supporting Oracle database servers, Web servers, application servers, network management systems, domain name servers, call detail polling systems, LDAP servers and file servers. The systems development team

continues to be very responsive to patch application, applying numerous patches every day. The team also manages several Windows 2000 servers.

In an effort to improve desktop security, over 60 users were migrated to Windows 2000 and the Hokies Domain authentication and authorization system this year, providing centralized system management for much of the organization's desktops. Significant effort was put forth during the year investigating methods for implementing personal firewall software on these systems as well.

Improvements in physical security include the relocation of 10 test and development machines from various desktops to a secure, climate controlled server lab. Also, significant improvements were made relative to server security at Printing Services. Security policies and configurations were improved on the machines and many were moved to a private network.

Network Administration (NA)

Network Administration (NA) provided information to peer institutions about the services ANI&S provided, policies and procedures, rates, regulatory issues, vendor services and billing. The colleges and universities NA assisted between 2001 and 2002 included: California Polytechnic State University at San Luis Obispo, George Mason University, Georgetown University, Johns Hopkins University, Loyola College of Maryland, Penn State University, Purdue University, Radford University, Randolph-Macon College, Syracuse University, University of Akron, University of North Carolina at Charlotte, University of Pennsylvania, University of Richmond, University of Texas at Austin, University of Virginia, Virginia Commonwealth University, Washington and Lee University, and Weber State University.

Ongoing projects with the Virginia Tech Police Department should result in the more efficient handling of emergency telephone calls and improved campus security. NA provided information to other higher education institutions and the Commonwealth of Virginia's Department of Information Technology (DIT) about new services 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, and other telecommunications vendors providing services to the university to maintain open lines of communication.

NA oversaw the implementation of multiple network modifications to avoid costs in the provisioning of telecommunications services. NA functions as the university's primary resource in investigating and interpreting FCC and SCC regulations that may impact current and future services. NA also acts as the primary resource to protect the university from fraudulent use of its telecommunications network on a local, national and international level.

Operation Engineering

The ANI&S Operations Engineering group has a long history of positioning the university to take the best advantage of existing and future telecommunications environments. For almost two decades, we have worked on the leading edge of emerging telecommunications cabling systems technologies. We have continually collaborated with manufacturers, vendors, engineers, and architects to specify and otherwise influence the development of new cabling systems customized to meet the requirements of a high end, research and academic community. Our expertise in this area is corroborated by requests from the both the public and private sectors to specify, certify, and install telecommunications infrastructure. It is further corroborated by the participation of major cabling manufacturers (i.e. Berk-Tek, CommScope, Mohawk, Tyco, Belden, General Cable, and more) when we conduct rigorous evaluations of emerging communications technologies. Virginia Tech provides an exceptional test bed for next generation systems.

ANI&S has a proven record of specifying and installing advanced, structured, systems that support the dynamic and evolving telecommunications requirements of a large academic and research university. We design systems that will not only support the most advanced telecommunications services available at the time, but that will also support evolving technologies for the foreseeable future.

We consult with the university community, renovations planners, and with capital project architects and engineers to design systems that are robust, secure, efficient, long lived, and flexible. We have developed, and maintain, a Cabling Standard for Virginia Tech that has been incorporated into the cabling standard used by the Commonwealth. We emphasize efficient placement of the minimal number of secure, dedicated, telecommunications equipment facilities required to serve the space, structured systems that are flexible enough to meet changing requirements, the use of advanced technologies best suited to support emerging technologies, and taking advantage of the economies of scale available during construction projects to install telecommunications portals required for future use during the capital construction process.

These system strengths and benefits are consistently brought to the university community at much lower cost, and higher quality, than similar services available elsewhere.

Providing Quality Infrastructure

A significant advantage Operations Engineering brings to Virginia Tech is the ability to shift resources as required to dynamically support the critical requirements of the university.

On a day-to-day basis, this flexibility allows us to quickly install standard, as well as customized, telecommunications systems in real time support of research initiatives, vendor testing, special events, presentations, and non-standard instructional activities. In the event of a system failure that interferes with distance learning, or other mission

critical activities, we can shift staff as required to correct the problem in the shortest possible time.

On a larger scale, we can quickly react to support Virginia Tech's strategic initiatives. Recent examples include designing, installing, and operating the telecommunications infrastructure for the fast track Virginia Bioinformatics Institute move into the Corporate Research Center, and ongoing planning to do the same for the Edward Via Virginia College of Osteopathic Medicine.

Efficient and Effective Operations

Our long-standing operational policy is to outsource certain portions of Operations Engineering work to contract and/or wage labor as appropriate and as required. Examples include outsourcing excavation work, avoiding the overhead of operating and maintaining our own heavy equipment, and staffing up to meet deadlines during peak load periods, avoiding overstaffing during non-peak load periods. Experienced ANI&S managers always work with contracted labor in these instances to manage their efforts and otherwise insure that the quality of contract work is up to established Virginia Tech standards.

Our goal is to be an efficient and effective organization, keeping costs down while providing leading edge infrastructure and otherwise supporting the advanced telecommunications requirements of Virginia Tech. As a general practice, management external to this work unit regularly critiques its operational practices and procedures to ensure work is performed in an efficient and cost effective manner. During the normal course of internal and external audits, the efficiencies of this unit are also assessed. We will continue to employee internal Quality Assurance, and other efficiency analysis programs as we strive to meet this goal.

Category 6 Cable and Connectivity Test Bed

For almost two decades, CNS has performed independent testing of cabling systems in order to select the best station cable and connectivity products for all new VT construction projects. A new standard, Category 6, has recently been ratified for cabling systems and operations Engineering and the Research and Development group are testing samples of Category 6 station cable and RJ-45 "jacks" (cable termination) collected from major cable manufacturers. In order to do so, we have established a cabling infrastructure test bed in our facility at Corporate Research Center, Research Building 14. CNS engineers are currently testing RJ-45's from 12 manufacturers and Category 6 station cable from 14 manufacturers. CNS engineers have written software to statistically evaluate the test results so that the best performing products can be identified and ranked. Once the best performing products are identified, bids will be solicited and contracts will be established.

Our long established cable testing process is of great interest to the major cabling system manufacturers. We frequently collaborate with their development groups as they

consider new products. Over the years we have worked closely with cabling manufacturers to improve and customize their products to better meet the needs of a high-end research and education community.

Positioning Virginia Tech for the Future

This process is a critical component of our ongoing goal to deploy cabling systems and infrastructure that have a 15-year useful life. Telecommunications systems continue to evolve at a rapid pace. The useful life of telecommunications electronics is sometimes as short a two years. However, with careful research and planning, and utilizing our extensive experience in designing, specifying, and installing cabling systems, we continue to deploy structured cabling systems that can support the ongoing evolution of the telecommunications industry with little retrofit to the cable plant. The design process we have developed ensures that our cable plant will have the best performance at the best price and will maximize its service length.

Engineering Operations has developed a Cabling Standard for Virginia Tech based on our experiences in this area. The Cabling Standard is used by the University Architects, Capital Design and Construction, and Physical Plant renovations when specifying cabling requirements for construction projects. Our Cabling Standard has also been incorporated into the cabling standard utilized by the Commonwealth of Virginia.

The Virginia Tech Optical Fiber Outside Cable Plant

Since 1987, we have been installing single mode and multimode optical fiber in the inter-building outside cable plant. As with the inside cable plant, this optical fiber network is designed to be robust and flexible and creates a backbone that supports many data, video, and voice applications campus wide. As the academic and research communities demand more bandwidth and other capabilities in order to support leading edge and next generation activities, ANI&S has stayed in front of the curve in part by utilizing expansion capacity pre-installed in the fiber cable plant and by introducing new very low loss optical fiber termination and splicing methods. Today, optical fiber is fusion spliced to fiber pigtails of pre-terminated fiber cabinets. This process saves labor and delivers high performing fiber circuits with very low insertion loss.

We provide service to over 100 buildings on our main campus housing almost 700 network equipment rooms. We support approximately 25,000 user data network portals, 6.000 video portals and 12,000 user telephone connections on campus. Behind those end user portals are an additional 40,000 managed core network service ports. On average, each building utilizes some 2500 feet of single and multi-mode optical fiber.

Major Projects Completed between July 1, 2001 and June 30, 2002

- *Worshman Field Cabling* Project Manager: Garry Goad

- o This project involved the installation of cable pathway infrastructure and cabling to support audio, video and communications systems on Worsham Field.

- *Shanks Conversion* Project Manager: Randy Broome
  - o Shanks Hall, formerly a residence hall, was gutted and renovated for administrative offices and classrooms. The entire facility was re-cabled and networked.

- *Special Purpose Housing Phase III* Project Manager: Maury Sparks
  - o Four new buildings were constructed to house eight student organizations. Each room was cabled with three Cat 5E station cables, a pair of multimode fiber and RG-59 coax.

- *Shultz Conversion* Project Manager: Joe Agnew
  - o A portion of Shultz Hall was converted from a dining hall to administrative space, which now houses offices and a TV studio for the Communications Department.

- *Virginia Bioinformatics Institute, CRC* Project Manager: Dewey Williams
  - o This project was completed in five weeks from start to finish. This building has gigabit speed in the backbone and Cat 5E station cabling. This project was completed in five weeks from start to finish.

- *Collegiate Square* Project Manager: Joe Agnew
  - o This off campus leased space houses several VT departments. CNS fiber and copper cable were extended to serve this project. VT tenants in this facility have identical voice/data services as on campus employees.

- *Research Building 14* Project Manager: Joe Agnew
  - o This brand new facility houses the Communications Network Services Department. The facility has a gigabit backbone, a robust optical fiber infrastructure and Cat 6 station cabling. The building has an excellent layout and supports space for servers, research labs, classrooms, conference rooms and a state of the art network operations center.

- *Old Security Renovation* Project Manager: Randy Broome
  - o This building was entirely gutted and renovated and upgraded to meet ADA requirements. The building was re-cabled and networked.

Wireless Installations Completed

1. Torgersen Hall
2. Owens Food Court
3. Wallace Atrium

4. Moss
5. Randolph
6. Burke Johnston
7. Andrews Information Systems Building
8. Research Building 14
9. Newman Library
10. Pamplin
11. Collegiate Square II
12. Squires (partial)
13. Durham (partial)
14. War Memorial Gym (partial)

Video Broadcast Services

In 1971, under the name "Learning Resources Center," Virginia Tech began offering limited use of video technology for instructional support. In those days, much of that support consisted of broadcasting instructional material over the campus cable television system. Within just a few years, as television production became more feasible, the department developed its high standard of service to include high-quality video production. Today, as Video Broadcast Services (http://www.vbs.vt.edu/), we produce not only broadcast-quality instructional television, but we've also moved our production skills into state-of-the-art delivery systems. These days, in addition to online classes for MBA and Graduate Engineering programs through Interactive Video Conferencing, we produce instructional video for the Internet, for interactive CD-ROM delivery and, most recently DVD.

In 2001-2002, Video Broadcast Services expanded its service to the University and the Commonwealth in three categories, Multimedia Production, Interactive Video Conferencing Facilities Support and Video Support Services. What follows is a brief description of some of those activities. We recognize that Virginia Tech is unique among universities, and we take pride in our innovative support to the University and its mission.

Multimedia Production Unit

The function of the Multimedia Production Unit (http://www.vbs.vt.edu/services/media.html) is to design and produce high-end instructional media. This group maintains and operates a television studio capable of either digital or analog production and has traditionally produced broadcast-quality video for videotape and satellite delivery.

The Future of Distance Learning – Supporting Evolving Requirements

In recent years this unit has broadened its scope to include production of video and audio for delivery not only by the traditional means, but also by CD-ROM, DVD and Internet delivery. Multimedia production has expanded and enhanced CD and DVD mastering

capabilities in order to support these new delivery mechanisms. Now, rather than a linear string of video images accompanied by sound, an instructional instrument can have enhanced audio, graphics, video, links to the internet, links to streamed media and more options almost daily.

Since the operation of the multimedia production unit is heavily dependent upon the scheduling of people and assets, it became imperative that these functions be closely linked. To that end, the unit designed and produced a business software application that allows efficiencies in the integration of scheduling, operations, inventories, and accounting functions.

This year the unit completed the beta version of Engineering Cultures Online, an online class developed by Virginia Tech Professor Gary Downey and Colorado State University Associate Professor Juan Lucena. The class explores the effects that engineering has had on various societies across generations and comprises 30 hours of coursework as well as streaming media. The impetus for presenting the class online came from a consistent enrollment of 300-400 students. This approach maintains the high quality of instruction required by our faculty and students while minimizing the number of faculty and classrooms required to deliver the instruction to a large number of students. The alpha version of the program received a nomination and a Certificate of Excellence from the Virginia Tech Xcaliber Award Committee (http://www.edtech.vt.edu/cil/xcaliber.html); several national publishing companies are currently evaluating the beta version for publication. For more information, please see: www.cyber.vt.edu/hst/2054 and www.conted.vt.edu/e-cultures.

In May of 2002, multimedia production completed a unique CD-ROM based "interactive textbook" for introductory dance instruction that demonstrates seven basic dances with associated choreography and dance notation. The program presented two simultaneous video tracks accompanied by a music track and animated dance notation. The production is an innovation in dance instruction as it demonstrates the elements of craft that blend in artistic instruction.

The multimedia unit designed and constructed a system to produce Virtual Reality sequences of 75 different plants for an online class for the horticulture department. The resultant sequences allow a student to view plants and structures from almost any angle, close to distant, in 360-degree horizontal rotation and 120 degree vertical rotation.   For more information, please see:
http://www.hort.vt.edu/williamj/hort2144/plants/common_images.html.

In late fall of 2001, the multimedia unit began principal photography on a project for the Department of Family and Child Development in the College of Human Resources and Education. The project, which will result in a DVD for classroom instruction, follows an infant from the age of three weeks. At least once each month, another half hour of video was shot demonstrating the child's growth and development. Upon completion the project will allow students to see how and when human functions and behaviors develop

and how a tiny hand movement at one-month-old leads directly to a rudimentary throwing motion at three months.

We developed, produced and edited 30-minute programs of the award-winning Choices and Challenges Forum for broadcast on the Public Broadcasting System (http://www.cddc.vt.edu/choices/2000/index.html). This production has been done annually for the last eighteen years and is broadcast live to Virginia Tech Campus Cable and then edited for distribution by PBS.

We continue to support MBA/CGEP students enrolled in Interactive Video Conference (IVC) classes by providing archived copies of individual classes. Currently, this is most easily accomplished on videotape. This is a popular service that has grown with the number of distant students. The increasing number of duplications necessary for that function, as well as for other on-campus clients, required a new approach to videotape duplication. We are currently evaluating how to best meet this need.

Interactive Video Conference (IVC) Facilities Support Group

The Interactive Video Conference Facilities Support Group supports faculty, students, and classrooms involved with Distance Learning activities and technologies.   We also assist in the design and development of new Distance Learning facilities.

Interactive Video Conference Facilities Support staff assist with faculty workshops and training throughout the year and provide group and individualized faculty training for the effective use of video conference room presentation equipment. We regularly demonstrate conferencing and instructional strategies and capabilities to promote effective use of Interactive Video Conference (IVC) facilities. We also train and otherwise prepare students to use facilities for class presentations.

The Interactive Video Conference Facilities Support Group sends a qualified IVC technician to every on-campus class utilizing Distance Learning. The technician ensures that the technologies required to support Distance Learning are operating properly and that the instructor is trained in the use of the technologies. Our faculty are thus able to focus on instruction and not on mastering the evolving technologies required to deliver that instruction to distant students.

A primary duty of the Interactive Video Conference Facilities Support group is the scheduling of on and off campus video conference rooms, support staff, and video bridging services. We also coordinated use of non Virginia Tech facilities used in video conferencing.   Support staff further ensure that distant instruction will be successful by preparing network equipment and presentation equipment in advance and participating in proactive operational tests of our Distance Learning systems on a daily bases.

Video/Broadcast Services supported two key Distance Learning programs: the Commonwealth Graduate Engineering Program (CGEP) and Virginia Consortium of Engineering Sciences. Both programs are critical and important to the College of

Engineering's outreach mission to provide advanced degrees to off-campus engineers and scientists

Design for Success

Our Interactive Video Conference Facilities Support Group is also expert in the design of Distance Learning classrooms and related facilities. We have decades of experience designing instructional spaces and systems to maximize the learning experience by both utilizing the best technologies available today and by planning for the integration and use of next generation Distance Learning technologies. The considered and thoughtful design of newly constructed or renovated Distance Learning classrooms insures a positive experience for students and faculty today and minimizes the future costs required to migrate to emerging technologies.

During this year, the Interactive Video Conference Facilities Support group was pleased to provide design and engineering consultation for the configuration of teleconference rooms at the new Virginia Tech Hotel and Conference Center/Alumni Center in Blacksburg, the Institute for Advanced Learning and Research at Danville, and the Richmond Higher Education Center.

Video Support Services

The chief function of the Video Support Services group is to enable the reliable electronic distribution of Virginia Tech's distance and on-line classes and other University-related events. This group works closely with the Multimedia Production and Interactive Video Conference Facilities Support groups to integrate the various technologies involved in preparing and delivering Distance Learning instruction into a positive, and robust, learning environment. To this end, the group maintains video servers, interactive video conference bridging services, and other related systems and technologies that provide courseware for the distant learner through a variety of synchronous and asynchronous delivery mechanisms (http://www.vbs.vt.edu/services/vnoc.html).

This year, the service unit helped configure and relocate the Video Network Operations Center (VNOC) from Whittemore Hall to the new Virginia Tech Operations Center in RB XIV. This move enhances support services by co-locating this function with related technical operations groups.

Video Support Services unit improved its file storage capabilities as well with the installation of a reliable small storage network utilizing a DVD-RAM jukebox and Point Software. These allow the storage of video digital files and immediate access to them so that theses class files can be streamed to distant students.

Since holding many gigabytes of sensitive class files demands confidentiality, video network operations enhanced security by installing a secure computing environment creating a MS Windows 2000 network, installed MS Windows 2000 and Zone Alarm on all desktops and converted all hardware capable servers to MS Windows 2000.

VBS archived and served 23 College of Engineering classes for web based video on demand to meet the asynchronous learning needs of professionals in pursuit of advanced degrees. In addition, we provided compression, hosting, and creating/maintaining web based interface for a variety of video on demand applications.

Interactive Video Conference Courses Supported

Fall 2001	52 Virginia Tech courses 4 George Mason University courses	1414 enrolled students
Spring 2002	60 Virginia Tech courses 4 George Mason University courses	1320 enrolled students
Summer 2002	15 Virginia Tech courses 2 George Mason University courses	441 enrolled students

Although the largest majority of these conferences served the instructional mission of the university, VBS also provided support for over 200 other videoconference projects ranging from administrative support to remote graduate students' theses and dissertation defenses to conferences between Virginia Tech researchers and their corporate sponsors, and support of Continuing Education short courses.

In all, Video Support Services facilitated the delivery of 127 Virginia Tech courses via Interactive Video Conferencing across Network Virginia.

Staying Ahead of the Curve for Distance Learning Classes

Distance Learning classes, and the use of related technologies by traditional classes, are rapidly increasing in popularity. The increased use of network based instructional delivery creates associated technical challenges. To that end, the ANI&S group also began investigating the H.323 standard that will allow videoconferencing via the Internet. Moving to H.323 video delivery has the potential to support simultaneous access to Virginia Tech classes by greater numbers of students that we can support with today's technologies.

Currently there are several popular media players, Real Media, Windows Media and Quicktime. Often this requires that each video file be stored in all different formats plus at different data rates to accommodate variations in users connection speed. In 2001, we took a major step toward the ability to store a file in one format, MPEG 4, so that it could be received and read by any of the three media players. This effort was accompanied by an upgrade in video-on-demand and internet-delivered-video capabilities which will allow a scaling up of video quality, enhanced storage and access speeds and an overall increase in quality of service.

VBS is in the final implementation phase of this project to provide reliable, cost effective, scalable storage and retrieval for the large amounts of data required for enterprise level video on demand service. VBS proposed, specified, procured and configured a system, which uses rewritable DVD media to provide large amounts of storage. The current configuration provides nearly two terabytes storage; this can be expanded to over four terabytes simply by adding media as needed and should be able to scale to much larger capacity as the need arises.

Non-Traditional Collaborations

VBS also was able to negotiate a collaborative distance learning arrangement with the USDA Forest Service Wood Education and Resource Center, which will provide Video Broadcast Services with access to newer technologies, an necessity if we are to maintain compatibility and interoperability of existing technology and with future technologies.

Blacksburg Electronic Village

The Blacksburg Electronic Village (BEV) is celebrating ten years of service to local communities in Southwest Virginia, across the Commonwealth of Virginia, nationally and worldwide. It is one of the oldest and best-known community network projects in the country and has been a pioneer in community outreach through the incorporation of technology in community development projects. It has a proven record of significant outcomes in developing community-based technology strategies and has a national reputation for sharing information and expertise on utilizing technology for community service projects. It is also committed to providing a variety of pertinent online resources to the public through its online Web presence. Though the scope of its efforts has expanded greatly since its inception, BEV continues to partner with the Town of Blacksburg in projects that will benefit the residents of Blacksburg such as the Neighborhoods program which provides an opportunity for various neighborhoods within the town to have their own Web presence and other online tools like list serves, Web calendars and discussion forums. It also provides services to community organizations through its Community Connections package. Over a hundred community groups such as churches, artists, citizens groups and other similar organizations have benefited from these services. BEV continues to provide support for the activities of seniors who contributed to and benefited from its success.

In 2002, the leadership of the BEV transitioned from Andrew Cohill, who served as director for eight years, to Mathew Mathai. This transition took place without any disruptions in the services or operations of the BEV. With Mathew's leadership, BEV has engaged citizens and representatives of citizens groups in dialogues to determine where and how the BEV can be most effective in its efforts. The BEV Web site, http://www/bev.net, has been updated and information has been corrected. The Visitors section on the Web site was significantly enhanced at the beginning of Fall semester 2002 to help incoming students, faculty, staff and alumni who returned to Blacksburg for the football games. The vision for the BEV is to continue to do ground breaking work in the areas of community awareness and development. Since grassroots participation in its

activities is considered vital to its success, it's heartening to see volunteers and interns willing to sign up to undertake tasks that fulfill the mission of BEV. We expect to see a growth in the number of volunteers and interns in the year ahead. Another key area that we're currently investigating is the synergistic collaboration with other projects and programs within the University and with organizations within the local community.

The BEV and the Virginia Cooperative Extension (VCE) received a federal Technology Opportunities Program (TOP) grant in 2001 to create and support 29 community technology networks in nine rural counties across Virginia i.e. Accomack, Carroll, Craig, Cumberland, Dickenson, Grayson, Louisa, King & Queen and Northampton. These counties were chosen because of high illiteracy or unemployment rates. The 'BEV in a Box' set of services that will be deployed as part of this project is ready for its first prototype demonstration. It has the capabilities of providing e-mail, web services, e-mail list services, LDAP authentication and authorization, calendaring, threaded discussion lists and directories on a turn key basis to communities that want to start their own community networks. A key feature of the BEV in a Box is that all the system administration is done by the expert system administration and programming staff of BEV and ANI&S systems development and administration staff, freeing community members to focus on using the services effectively rather than worry about maintaining the server and network.

The planning phase of this TOP funded project is almost complete and the implementation phase is about to begin. This phase will be a challenging one because we expect that BEV and VCE staff will be coordinating the efforts of over a hundred people spread throughout the state. However, when it's done, we expect that these communities will permanently increase their capacity to use technology effectively to improve local social and economic conditions while including as many citizens as possible in each community's decision making process. Details of this project can be found at http://top.bev.net.

One of the key attributes of the BEV is its ability to adapt freely available, no cost, open source software for the use of community organizations. The client tracking systems developed by BEV for the non-profit New River Community Action Agency and Community Action agencies in Washington county are a testament to this methodology. Community Action agencies in Roanoke have expressed strong interest in utilizing this software. Judging from the accounts given by these agencies, this software system is proving to be of great value to these groups as they strive to help the disenfranchised members of our communities. The BEV runs Linux, a freely available, no cost, open source operating system on all new servers that are acquired. This keeps the operating costs down and saves on licensing and maintenance fees charged by vendors of proprietary operating systems and products. Applications on existing legacy servers will be migrated to Linux servers as the legacy servers are replaced with new ones.

BEV continues to provide DNS services to Network Virginia, a nationally recognized entity that utilizes public private partnership to develop advanced communications infrastructure and delivers Internet and intranet services state wide. BEV staff members

participate in the eCorridors program at Virginia Tech to work with communities as they try to solve the first mile (some times also referred to the last mile) problem. BEV is also positioned to partner with the Edward Via Virginia College of Osteopathic Medicine and the Montgomery Floyd Regional Libraries to apply for a grant that will enable health care providers, their patients and the general public to connect to online health information resources they need to make informed health care decisions. We continue to look for opportunities such as these in which to serve communities and enable them to be healthy, vibrant places to live.

Other Network and Infrastructure Services

Broadband Wireless LMDS

The LMDS Project operates the Blacksburg LMDS Testbed. This network is among the longest running LMDS networks in the United States, operating since May 1999. The network continues to provide voice and data services to university off-campus offices. The LMDS Project has continued its research relationship with the Harris Corporation, a major provider of broadband wireless equipment. The LMDS Project offered input into the development and design of Harris' second-generation LMDS equipment, which will be available in late 2002.

The LMDS Project also researches broadband wireless networking solutions. In 2001-2002 they have implemented research projects to study emerging solutions in broadband wireless access. Funded research includes a study of Radiant Network's wireless mesh topology and the associated 'Meshworks' equipment. Studies also include research of free space optical equipment, broadband wireless equipment operating in unlicensed bands, and Quality of Service issues in broadband wireless.

The LMDS Project continues to provide expertise for designing and implementing broadband community networks. The group collaborated on multidisciplinary projects that recommend broadband network solutions to encourage economic development in distressed areas of Virginia. The networks are designed to enable voice, video, and broadband data to accommodate applications including distance learning and medical imaging.

The LMDS Project continues to provide expertise to Virginia Tech's Center for Wireless Technology (CWT) 'Broadband Wireless Communications for Disaster Relief' project. The LMDS Project provides support to realize the viability of broadband wireless solutions in a rapidly deployable communication infrastructure.

Digital Imaging and University Printing Services

Printing Services has successfully met the printing needs of the university community for almost 80 years. We serve a broad internal customer base, which includes academic departments, sponsored programs, auxiliaries, Foundation, and student organizations.

Because our only customers are Virginia Tech and associated entities, not only do we have a good understanding of their needs, but we also have an additional incentive to provide professional results. "Their success" is "our success". For example, when a faculty member has a short timeline on a research project or class materials and needs documents printed quickly, we work with him to meet his deadline. This is a cost savings to the faculty member. Customers can visit our facilities to view an order while it is being printed to ensure it meets their expectations. Changes can be accommodated at this time, preventing expensive reprints.

As the University established its mission of becoming a top-30 research institution we quickly began to assess what might be required in the printing arena. We have identified a strong correlation among the top 30 research institutions and the top 15-ranked university printing and digital imaging operations; i.e., many of the top 30 universities have vibrant, growing and dependable support from their internal digital imaging and printing service functions. Printing support at Virginia Tech continues to position itself to meet anticipated demands.

Throughout the years, we have attempted to keep abreast of applicable technology that will satisfy our customers' ever-changing needs. During the last year, we implemented technology that converted one of the two copy centers from a predominately analog copying to totally digital printing. Similar changes will be made to the other center in late 2002. The names of Copy Centers I and II will soon become Digital Print Centers I and II to reflect this change. By late 2002 hardware and software will be deployed to enable web-based submission of printing jobs. This change will allow faculty, staff, and students. regardless of their physical location, to submit jobs, and choose custom specifications. n addition, hours of operation at one center will be extended in recognition of the fact that faculty, staff, and students have printing needs outside of normal business hours, Monday through Friday. This will be accomplished with no increased cost.

In addition, our strategic plan addresses migrating the print facility from older film-based technologies to newer, digital technologies. Not only will this decrease annual costs to the university, but will also allow increased efficiency and improve the quality.

Printing Services is composed of four revenue-generating units that meet the digital imaging, print and copy needs of the university's faculty, staff, and students. These four units are Print Plant, Digital Print Center I, Digital Print Center 2, and Centralized Mail.

The Print Plant meets the lithographic printing needs of the university. The Print Centers, located on campus, provide walk-in access to both black-and-white and full-color printers as well as print-on-demand (POD). The Print Plant and Digital Print Centers, combined, produced 30 million impressions, which is 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 FY2001-2002.

In addition, Printing Services is responsible for the Satellite Copier Service. This service places copiers in departments and provides supplies, local maintenance, and troubleshooting. This "one-stop shopping" provides additional convenience for the university and reduces the administrative and operating costs.. During the past year, the number of machines placed has increased by 25 percent to over 250 units campus-wide.

Printing Services successfully functions as a cost effective ancillary operation for the university where rates have remained unchanged for eight years.

Equipment improvements include three networked black-and-white printers with finishing capabilities and one networked color printer in Digital Print Center 2. A networked printer with booklet finisher was installed in Digital Print Center I.

All contracts from prior years for supplies remained in effect and an extension of the contract is sought for the satellite copiers by one year. This would result in cost avoidance to the university in excess of $150,000.

The Transition to Digital Advisory Group, convened in mid-2001, continued to meet. Represented by a cross-cutting group of university faculty, engineers, and administrators, the advisory group continued to evaluate digital needs, initiatives, and processes from across the university, as well as a variety of solutions. A predominate theme throughout the discussions was the potential cost savings that could be realized by the reduction of paperwork, as well as leveraging off of a unified, university-wide solution.

The group suggested benchmarking with our peer institutions to determine how they are approaching imaging and solutions that they have selected. Benchmarking results will be released in early late fall 2002. Six infrastructure components, such as security and data access and storage, were identified that are common to all projects, regardless of the solution(s) selected. Subgroups were formed to review each of these components and to identify and document standards, guidelines, and best practices. While all groups have made progress, the Legal Working group has been particularly successful with developing standards, guidelines, and best practices concerning copyright issues and records retention of electronic documents. The two resulting documents will be added to the initiative's website at www.paperless.vt.edu.

University Mail Services

University Mail Services is composed of two functional entities, Campus Mail, which processes mail for university departments, and Residential Mail, which processes mail for resident students. Information about Mail Services can be found at its revised website, www.mailservices.vt.edu.

University Mail uses a mail management system with three mail processors to expedite the processing of campus mail. Services for specific vendors, DHL, UPS, and USPS, are now billed through the use of an updated, on-line billing system. In addition, network connectivity is being enhanced, allowing for the more efficient use of resources.

Residential Mail Services continues to serve students by the use of five staffed mailrooms. In addition, Mail Services has recognized and taken advantage of changing trends in mailing patterns by reallocating internal resources that resulted in an increase in the hours that these mailrooms remain open to students. Residential Mail is also increasing its reliance on technology to ensure that students receive important mail despite being incorrectly addressed.

Campus Mail makes 294 stops per day to deliver and pickup mail from all university departments located in Blacksburg. The volume of mail processed is significant, with the number of items of presorted mail, alone, estimated to be approximately 100,000 pieces per month. Residential Mail is responsible for mail delivery to approximately 9300 students living in residence halls.

Learning Technologies

Learning Technologies

Mission

The mission of Learning Technologies is to provide a teaching and learning infrastructure that meets modern needs for integrating technology across content areas. We seek to create and support robust environments for teaching, learning and discovery for faculty and students that are grounded in sound principles of learning, and in a thorough knowledge of integrating technology for effectiveness and efficiency of effort. We seek these aims in several ways:

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

Overview

Learning Technologies has undergone additional reorganization over the past year. The computer lab support services group was moved from IS&C to create greater synergism with the classroom support activities, and the faculty development initiative.   Since computer-integrated classrooms provide direct support for faculty and student instructional activities, the computer lab support group is now aligned with the mission of Learning Technologies. The outcome of many phases of the faculty development effort requires close coordination of the training of faculty with the hardware and software installed in computer-integrated classrooms. As a result of this restructuring, the reorganized Learning Technologies unit is now in a better position to focus on mission critical instructional support activities.

The implementation of the instructional technology infrastructure in Torgersen Hall has provided a vastly improved setting for serving the needs of faculty and students. This 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 fulfilling the mission of the unit.

Learning Technologies 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. Consulting is also provided on planning for the integration of technology in all new facilities on campus. 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 2002. A total of 205 customized workshops have been conducted. More than

3500 faculty have participated in these workshops over the past nine 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 Learning Technologies, 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. A quote from a faculty attendee is given below:

> *"I had the opportunity to participate in the Faculty Development Institute this summer, and now that fall classes are under way I would like to take a moment to observe several ways in which this training has affected my job and my life.*
>
> *The Educational Technologies people I encountered during the summer program were incredibly knowledgeable, flexible, and helpful. In particular, Eddie Watson introduced and led the sessions with tremendous professionalism and humor -- a rare combination of skills in a classroom setting. Later in the Summer I had another occasion to contact your office. While installing a version of statistical software on the FDI computer I received, the registry was corrupted. I contacted your office and, although it was late on a Friday afternoon, within 30 minutes Greg Campbell had re-Ghosted the hard disk. My department tech support grad student and I then reinstalled an updated version of the statistical software and everything ran smoothly.*
>
> *Now that the fall term is under way, I have had the opportunity to use both the laptop computer and a several new software tools that were introduced to me in the summer sessions. I can't say enough about the wireless network capability. Due to a mobility limitation, I often do my work in a prone position and having the flexibility to work some distance from an Ethernet jack has markedly improved my working (and living) conditions. Additionally, I've brushed-up on some older and some new software applications using Element K training on my own, as well as making my syllabi available to my students as PDF files for the first time.*

> *Once again, thank you very much for all of your personal and collective efforts to make these tools available to faculty."*

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 has been involved in supporting the development of online courses and in providing 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.

Looking to the future, the center will provide support for two goals described in the updated University Strategic Plan for objectives to be achieved by 2005-06:

Goal 4: Expand the university's leadership role in the effective integration of instructional technology with pedagogy.

Goal 5: Strengthen Virginia Tech's role as a recognized leader in distance and distributed teaching and learning, research and scholarship, and outreach.

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 by CIL for 2001-2002:

	Faculty	**College**	**Award**
1	Anderson	Arts & Sciences	29,158
2	Ball	Arts & Sciences/Engineering	57,879
3	Campbell	Arts & Sciences	38,064
4	Downey	Arts & Sciences	22,325

5	Mack	Agriculture & Life Sciences	60,000
6	Merrill	Newman Library	37,730
7	Papadakis	Architecture	15,484
8	Sen, et.al	Business/Engineering (MIT)	120,000
9	Toth	Veterinary Medicine	28,000
10	Zallen	Arts & Sciences	41,360
	Total		**450,000**

Since the program's inception, a total of 101 grants totaling $2,935,875 have been awarded to faculty.

Educational Technologies

Mission

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

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

Developments in selected program areas during 2001-2002 are described below.

Faculty Development Institute

In August 2002, the award-winning FDI program concluded the first year of its third four-year cycle. During summer 2002, over 425 faculty participated in the workshops

and received computers. A special workshop will be held at the Northern Virginia Center in September 2002. A total of 26 workshops were conducted in the summer, based on nine content tracks:

    Track A-New Faculty Computing Orientation
    Track B-Basic Computing Skills
    Track C-Developing a Web Course using Dreamweaver and Blackboard
    Track D-Developing Web Course Interaction
    Track E-Creating Digital Media Content
    Track F-Using AutoCad
    Track G-Using MatLab
    Track H-Creating Learner-Centered Instruction
    Track J-Developing and Delivering Online Instruction at a Distance
    Track K-Instructional Media/Web Production
    Track L-Research Presentation Tools
    Track M-Visualization and Virtual Environments

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

Nearly 80 short workshops were also conducted in fall 2001 and spring 2002 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.

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. Three tracks (G, L, and M) were added to increase research-oriented coverage.

Computers and software were offered in Windows 2000 and Macintosh OSX 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. Forty-one percent of all faculty selected a laptop.

The university has licensed courseware from Element K, a company specializing in online training for higher education. The web-based computer skills tutorials

provided free to Virginia Tech students, staff and faculty by Educational Technologies have been expanded to 550 courses, along with new Books24x7 online reference manuals. Technical subjects, previously offered only to a limited audience, are now accessible by everyone and cover such topics as Oracle, Linux, Visual Basic, and Windows 2000 system administration. Microsoft Project is included with other office productivity tutorials such as Office, Excel and PowerPoint. Web design (Dreamweaver, Flash), graphics (Photoshop, Freehand), and multimedia development (Authorware, Director) are just a few other popular subjects.

Element K tutorials offer faculty a new tool to help students acquire skills needed for success in the classroom and their profession, without devoting valuable class time to technology training. Specific tutorials can be assigned as homework in order to assure students have the skills to create web pages, databases, presentations, etc. that might be used to enrich the classroom experience. Students can acquire the necessary skills at their own pace, beginning at their own level, at any time of day. The tutorials lend themselves to just-in-time refresher courses as well that help both faculty and students refresh their memories on specific aspects of software operation.

By March 2002, Element K had been used for 3500 hours, with 18,500 logins. In June 2002, there were 2800 people using the system, of which 55% were students, 30% staff and 15% faculty.

Instructional Development and Evaluation

Grant Activities

- Kevin Oliver and John Moore, along with faculty and administrators at Florida Community College at Jacksonville, were recipients of a $328,000 FIPSE grant, "CREOLE: Creating Online Learning Environments." The three-year project will create, evaluate and market an online system designed to acquaint higher education faculty in eight disciplines with basic research in learning and motivation and facilitate their application of pedagogical tools based on the research. Six Virginia Tech faculty will be involved as content writers.
- Kevin Oliver continued 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.

Evaluation Activities

- A second evaluation study was conducted of 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. Effective use of the Flashlight tool is taught during the FDI.

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 continued to grow in use. Over 500 courses and 10,000 student accounts use this system each term, 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 to increase reliability and capacity.

Significant accomplishments during 2001-02 were:

- Sun file servers were reconfigured to add redundancy at Torgersen and Andrews. 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. A new web-accessible database was placed in use.

Participation in K-12 Initiative

Members of Educational Technologies participated in the Virginia Tech STARS (Summer Training Academy for Rising Stars) 2002 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).

Assistive Technologies

Mission

Assistive Technologies (AT) coordinates the effective application of assistive technologies and computer-related disability accommodations for information and learning technologies, conducts multidisciplinary research and development of AT, and publicizes the benefits of AT for all individuals through outreach.

Assistive Technologies Lab

"Advancing assistive technologies that can empower people for a lifetime."

Assistive Technologies Lab – Activities, Programs, and Services

AT Research & Development

The AT Lab hosted collaborative research that encouraged corporate, government, or private funding of research, training, and development efforts. This research explored new uses of computer related assistive technologies, which incorporated universal design principles.

Efficacy of Speech Recognition – With Dr. Richard Snider, the AT Lab helped conduct research on the efficacy of using speech recognition for written expression for persons with learning disabilities (LD). The study built on existing theory and research indicating that individuals with LD in written expression have abilities of oral expression that not only precedes, but also exceeds their written expression capabilities.

Cellular Phone Sponsored Research – Along with ISE, Human Factors Engineering (ISE-HF), the AT Lab served as an advisory panel and conduit for obtaining research subjects on a study called "User requirements for Cell Phone and Laptop Systems for users with Disabilities". This fiscal year Toshiba will fund the AT Lab to conduct research with ISE-HF on a related cellular phone research project involving persons with LD and cognitive disabilities.

Other or Proposed Research Initiatives – The AT Lab evaluated signing avatars, digitally animated characters that can generate sign language for the deaf, as a web-authoring tool. Advanced research combining avatars and speech recognition is being considered. Future development could be tools for speech pathology, software to assist anyone learn a second language, and real-time sign language authoring tools for the deaf. Lastly, working with ISE-HF the AT Lab issued a proposal titled Global Roaming Access for Learning Environments or GRALE. This project is centered on helping students with learning, visual, and physical disabilities access a wide range of computing devices based on a roaming user's profile from any operational network computing environment. If

successful, GRALE could be potentially used by any teacher or student to improve teaching and learning.

AT Teaching & Outreach Activities

Maintained an advanced computing AT Lab that is a model classroom, conference/training facility, and accessible distance-learning site. The AT Lab publicizes research results and demonstrates the benefits of AT for all individuals by academic, administrative, and outreach activities. Outreach activities include one-time classes/lectures, brochures, publications, and professional participation or presentation at statewide/international conferences on disabilities and assistive technologies. Examples of annual activities by the AT Lab include:

Examples of AT Lab Teaching Activities:

CS 3604 – Computer Science "Professionalism Course" is one-time classroom instruction that promotes concepts of universal access design, assistive technologies, and disability accommodations for information technologies and computing. Students generally have follow-up assignments related to AT and evaluating accessible design practices.
EDCI 5554 – Education "Educating Exceptional Learners Across the Lifespan" is classroom instruction on assistive technologies, with lecture and hands-on AT, for graduate students who will become secondary education teachers.
ISE 4644 – Industrial Systems Engineering "Occupational Safety" one-time lecture on assistive technologies and disability accommodations as they relate to preventing or mitigating injuries in the workplace.
CS 4624 Multimedia, Hypertext, and Information Access – Supervised students in a Computer Science senior class project that developed a database to be utilized by individuals with disabilities. The database was designed to serve electronically scanned books for people with blindness or other disabilities that are entitled under Public Law 104-197
Accommodating Adults with LD – Woodrow Wilson Rehabilitation Center / Department of Rehabilitative Services classroom lecture on assistive technologies for accommodating adults with learning disabilities (LD) in adult education classes and at the workplace.

Examples of AT Lab Outreach Activities:

College Bound – Statewide program to prepare students with disabilities for college
Youth Leadership Forum – Empower youth with disabilities to develop leadership skills
Imagination – Recruit minorities into technology, science, and engineering careers
C-Tech[2]– Recruit women into engineering, math, or science careers
Building Bridges – (VT-VATS) AT workshop for consumers, educators, and professionals

AT DAY – University consortium workshop for AT consumers, educators, and students

College Bound: "Preparing students with disabilities for a collegiate experience"
The College Bound program is a two-day conference at Virginia Tech, with a consortium of sponsors: VATS (VA Assistive Technology Systems), Equal Opportunity, Radford, NRCC, and the AT Lab. The conference prepares students with disabilities (High School – Juniors and Seniors) and parents of students for the realities of attending college. Students and parents attend different workshops on various aspects of preparing for college, including a lecture and hands-on workshops involving assistive technologies and computing.

Estimated attendance: 50 students and 60 parents in 1 lecture and 6 workshops

YLF-VA: "Empowering Young Leaders for the 21st Century"
The YLF-VA program seeks to empower young people with disabilities to further develop their leadership skills. Students, serving as Delegates from communities throughout Virginia, participate in a wide range of activities and learning experiences during the four-day **Youth Leadership Forum (YLF)** set on a university campus. The Virginia Board for People with Disabilities (VBPD) funds the conference.

Estimated attendance: 80 students in 1 panel discussion and 5 workshops

C-Tech[2]: Computers and Technology at Virginia Tech
A College of Engineering program open to rising junior and senior women currently enrolled in Virginia high schools. The focus of the program is to allow young women to have access to both information and technology that would help them prepare for college and careers in engineering, math, or science.
Estimated attendance: 60 students in 4 workshops

Imagination: "Imagine yourself an engineer at Virginia Tech"

A College of Engineering program in partnership with Roanoke City Schools that is open to 8th and 9th grade students from Roanoke and Montgomery County. The focus of the program is to allow minorities to have access to information and technology that would help them prepare for college and careers in technology, science, and engineering.

Estimated attendance: 60 students in 4 workshops

Note: AT Lab provided all necessary disability accommodations for workshops.

Special Services

"Facilitating assistive technologies and cost-effective disability accommodations that help achieve equal access opportunities and independence for all people."

Special Services – Activities, Programs, and Services

AT for Equal Access

Advocated assistive technologies and disability accommodations for teaching, learning, and employment that incorporate universal design principles and promote cost effective solutions for all individuals. Universal design does not imply one optimal solution for everyone, but underscores a need for inherently flexible access tools and media that makes most information technologies accessible to individuals with differing abilities, learning styles, and backgrounds.

- AT Coordinator serves as a resource for the ADA Executive Committee which meets monthly to address university compliance with the Americans with Disability Act. ADA Executive members are comprised of ADA service support personnel from throughout the university and customers receiving AT/ADA related services or disability accommodations.
- AT Lab and Special Services participated as presenters and participants in a Universal Design Forum conference held at Virginia Tech during this academic year.
- AT Lab and Special Services (or AT Department) was restructured during the academic/fiscal year in order for the department to better serve customers receiving AT services and disability accommodations. Restructuring also enabled the department to conduct AT research more effectively by a reporting structure within Information and Learning Technologies.

Coordinating AT Resources

Facilitated accessible computing resources in classrooms, labs, research facilities, distance-learning, and administrative offices by helping coordinate assistive technologies and disability accommodations within the university community (and distance-learning throughout the Commonwealth). This includes facilitation and support of accessible computing workstations, access tools, and accessibility standards for information and learning technologies.

- AT Lab/Special Services help maintain approximately 50 AT/ADA computers throughout the university, which utilize specialized software or hardware. The AT Lab/Special Services staff also supports three servers (2 production, 1 test) for AT/ADA services. The servers provide networked AT software for ADA workstations, AT statistics for the Training and Technical Assistance Centers (T/TAC) statewide, a new roaming profile service which is under development for customers of the AT Lab/Special Services, and a new web

accessibility development and testing database to be used by an academic course in Instructional Technologies and by the AT Lab for teaching/testing web accessibility.

- Approximately 27 of the accessible workstations supported university-wide have motorized sit-to-stand height adjustable tables with tilt/height adjustable keyboard trays. These ADA accessible tables are ergonomically designed to reduce repetitive stress injuries from typing on a keyboard and include LCD flat panel monitors with adjustable arms for ergonomic positioning. Scanners are also provided for OCR scanning of printed materials and all computers have synthetic speech software as an ADA accommodation.
- AT software or 4-Access Tools supported on AT/ADA computers can assist with enhancing vision, hearing, speech, touch, and assist with a wide range of learning, teaching, and working styles for students, faculty, and staff. AT software is either locally installed on computers or maintained by AT/Special Services servers.
- AT Lab/Special Services staff serves on the Electronic Information Access Task Force (EIATF) in several positions involving accessibility standards, training, and support issues.

AT/ADA Awareness Training

Helped achieve university goals for equal access opportunity by conducting American's with Disability Act (ADA) awareness training sessions to promote diversity, help increase learning, teaching, and employment opportunities of persons with disabilities, and promote the benefits of AT for all individuals.

- AT Lab/Special Services participated in or provided oversight for a number of conferences (see AT Lab above), which promote AT/ADA awareness issues. AT Lab/Special Services staff also served as spokespersons at several ad-hoc meetings that directly or indirectly address issues involving the ADA/AT services for persons with disabilities at Virginia Tech or within the Commonwealth.

AT Consulting Services

Provided consulting services to the university community and public outreach programs (for example, phone consults and requests for information) involving assistive technologies and disability accommodations.

- Approximately 150 AT/ADA phone consultations, AT demonstrations, or Special Service facility tours were provided to the university community or to the public. AT consulting by Special Services range widely as to solutions for a disability issue or AT technical issue. For AT conferences or group workshops, please see "AT Lab Teaching or Outreach Activities" above.

<u>AT Training and Support</u>

Provided AT training to individuals with disabilities referred by Office of Equal Opportunity, Dean of Students, or Personnel Services/Extension for university supported assistive technologies and disability accommodations. Provided support accessible computing workstations and access tools in academic classrooms, administrative offices, and computing facilities for individuals with a documented need for disability accommodations.

- AT Lab and Special Services staff annually research and support a wide range of AT software and hardware for disability accommodations. AT software or 4-Access Tools can assist with enhancing vision, hearing, speech, touch, and assist with a wide range of learning, teaching, and working styles for students, faculty, and staff. Individualized training for 30 students and 5 faculty or staff was conducted last year on software and hardware. Approximately 200 persons retain access card privileges to Special Services for disability accommodations. See "AT Lab Teaching or Outreach Activities" above for class lectures or conference training.

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 Learning Technologies 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

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.

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 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 2001-2002. The figures reflect only the transactions in the Torgersen Hall first floor NMC facility.

Undergraduate students comprise 59% of the users of the Center with 6% staff, 9% faculty, 22% graduate students, and 3% are from the public. The use of scanners is the Center's biggest draw with 29% of the patron transactions using scanners. The next most popular aspect of the NMC is the use of digital cameras at 26%. The NMC loaned out the digital still and video cameras 2,436 times last year. The next three areas of interest were video digitizing/editing (17%), graphics (12%), and web development (10%). Our biggest area of growth is our video equipment usage. Last year, video ranked 5th in popularity with 11% of our transactions. This year, video ranks third with 17%. 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, 256 students were served individually on their ETD's this year as walk-in patrons. This is an increase from the 184 students served last year. 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.

Month (01-02)	Classes	Class Attendance	Walk-In Transactions	Total Patron Transactions
July	30	445	640	1,085
August	10	114	509	623
September	15	265	819	1,084
October	23	306	1,003	1,309
November	2	39	889	928
December	2	35	783	818
January	18	360	777	1,137
February	32	519	1,108	1,627
March	14	182	730	912
April	11	189	1,446	1,635
May	14	210	650	860
June	29	359	547	906
Total	**200**	**3,023**	**9,901**	**12,924**

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
- Support for survey.vt.edu, online survey software developed at Virginia Tech.

Activities

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

	Spring 2002	Fall 2001	Summer 2001
All exams	2,322	2,472	482
Final exams	535	561	81
Course evaluations	152	138	222
Other data capture	353	220	120
Total jobs processed	2,827	2,830	824
Total sheets processed	350,000	375,000	100,000
Total number of different clients	497	489	196

As new technologies offer more efficient data gathering methods, Test Scoring, in collaboration with other Learning Technology units, evaluates them and encourages and supports adoption of the most promising ones, with the long-term goal of fully digital departmental operation. This year, introduction of survey.vt.edu provided a significant tool to further this goal, allowing clients to create surveys and gather and evaluate responses much more quickly and efficiently online, compared to the opscan paper method. Test Scoring promoted and supported this product and saw a decline in demand for survey opscan processing.

Internally, efficiency was improved with the development of Visual Basic front-ends to the FORTRAN programs long used to process opscan data. This will decrease training time for new staff and help eliminate processing errors. More forms were also made available online for clients, and this effort continues, with plans to provide more sophisticated, interactive forms for appropriate applications.

Digital Imaging Center

Mission

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

CD Duplicates	5,912
Color Laser Prints	23,928
Color Inkjet Prints	187
Dye Sub Prints	23
Studio Scans	822
Flatbed Scans	5,859
Photo CD Scans	3806
Microfiche Scans	446
3D Object Scans	6
Ektachrome Processing	79,051
Computer Slides	6,248
Copy Slides	3,838
Duplicate Slides	2,771
Print Film Processing	865
Film Sales	911
Work Requests	4,550

Summary

Digital Imaging continues to provide a valuable service in support of the academic needs for the faculty and students of the University. Several departments in particular depend upon this output support for student projects and assignments requiring high-resolution imaging.

In addition, the University Library contracts our services exclusively for all their archival scanning projects. During the past year this included support for images from the Civil War and the Culinary Arts collections. We also provided scanning for images from the Women in Architecture collection consisting of numerous large format drawings on paper as well as ink drawings on transparencies.

Several events however, during the past fiscal year contributed to a decrease in the overall number of customer service requests we received. The events of September 11, 2001 resulted in a significant drop in revenues for that month which impacted revenues for the first half of the fiscal year. Similarly, the announced budget shortfall at the State level in April also resulted in a sharp decline for the months ending the fiscal year. When combined, these two events greatly reduced the total revenues we had anticipated for the year.

As a result of these events, we have taken several steps toward decreasing our overall expenditures. For example, film processing was discontinued as an on-campus activity and is now supported entirely through an off-campus vendor. This change allows us to keep prices low and provide flexibility in terms of additional options for customers who may choose processing alternatives. While these steps were necessary

in order to decrease costs, they have not impaired our efforts to preserve the high level of service our customers have come to expect.

Future efforts will continue to involve an ongoing investigation of technologies that both enhance the quality of the services we provide and address the expanding needs of our customers.

Information Retrieval, Analysis, and Management (IRAM)

Mission

The Center for Information Retrieval, Analysis, and Management (IRAM) produces strategic information to facilitate the development of new companies, promote the growth of existing companies and support the economic health of communities. Operating on a cost recovery basis, IRAM performs an essential role by providing timely information and analysis that enables our clients to keep pace with the increasingly sophisticated demands of the corporate, government and educational user communities.

Overview

Created in 1988 as the Virginia Tech Information Center (VTIC), we became known as the Virginia Tech Center for Information Retrieval, Analysis, and Management (IRAM) in 2001. IRAM is a department within Learning Technologies and partners with Virginia's Center for Innovative Technology (CIT).

In 1988, CIT approached the Virginia Tech University Libraries and asked them to provide research services for CIT's Regional program. A successful test was conducted in February - April 1988. This success led to the center's establishment through a contract set up between the center and CIT. Initially set up to provide services to the manufacturing sector, IRAM has evolved to cover all industry groups and to serve local, national, and international clients.

The Document Delivery services, still called VTIC, were added to the group in 1991, initially supplying business with documents only from the Virginia Tech University Libraries. VTIC now supplies documents not only from the Virginia Tech University Libraries but also from worldwide sources. VTIC's wealth of resources and knowledgeable staff has a fulfillment rate of at least 90%.

In 2001, the center's name was updated to IRAM and began revamping our services. IRAM's Analysis Group provides analyzed information to businesses, not just research services. The Statistics Group compiles primary data, which is sent to IRAM's clients as standalone products or used by our Analysis Group to complete

currently ongoing projects. A high level of customer service is offered with friendly staff that possesses expert searching skills to provide maximum value the client.

Activities

The listing of services provided by IRAM for 2001-2002 is given below:

- 850 requests for information from Virginia Companies
- 10 Research projects (in-depth collection and analysis of data) for Virginia Companies
- 1 research project for a Virginia university IP Office
- Developed 2 databases of Virginia companies for NASA Tech Transfer
- 6 projects for Virginia Tech President's Office, Provost's Office, or Board of Visitors
- 2 projects for Virginia Tech College of Engineering Centers
- 1 project for Virginia Tech Outreach
- 1 project for Virginia Tech faculty member for production of a book
- Taught 8 Virginia Tech FDI courses in new area developed by IRAM (Web Based Research)
- Presented a session on grants at College of Engineering Graduate Student Week
- Revenues of $345,000

Computer-Integrated Classroom Support (VT Labs)

Mission

The mission of the VT Labs unit is to provide the highest quality and most reliable computer-integrated classroom environment to enable faculty to transform teaching and learning at the university.

Activities

The VT Labs unit provides support for all computer-integrated classrooms on campus. This includes approximately 1000 computing stations throughout the campus.

VT Labs services include the following:

- Provide software/hardware installation, maintenance and troubleshooting for computer integrated classrooms (CICs) and labs

- Train faculty & staff on the use of computer teaching stations and A/V equipment in CICs
- Provide consultation and support as requested to other departments
- Provide laptops for check-out by students, faculty or staff from TechConnect Lab (Torgersen 3250)
- GIS Project Server
- TimeClock System Administration and Training
- Support the President's Conference Room – Burruss 325
- Manage and maintain the following computer-integrated classrooms

Lab	Macs	PCs	Operating System
Ambler-Johnston 4102		50	Win2000
Architecture Annex 1		25	Win2000
Art Design Learning Center	16		Mac OS 9
Davidson 123		20	WinXP
Derring 2069	25		Mac OS 9
Henderson 24A	22		Mac OS 9
Major Williams 502	24		Mac OS 9
Math Emporium	520		Mac OS X
Moss Classroom		13	Win2000
Price 301A	15		Mac OS 9
Randolph 114E		19	Win2000
RB7 Classroom		16	Win2000
Saunders 101		25	Win2000
Shanks 160	30		Mac OS 9
Shanks 180		25	Mac OS 9
Shanks 360	25		Win2000
Torgersen 1010		33	Win2000
Torgersen 1080		36	Win2000
Torgersen 3250	18	18	WinXP, Mac OS X
Ware 103		3	Win2000
Totals	695	283	996

In the past year, one facility was closed and assumed administrative duties for two new facilities. The Hillcrest computer lab was closed, one of the oldest labs, in August and returned the room to Residential and Dining Programs. Hillcrest had been primarily an open lab and with the shift toward classroom labs it was felt the resources expended could be better utilized elsewhere.

As of July 1st administrative duties were assumed for Art & Art History's computer facilities in the Art & Design Learning Center and the Henderson Digital Lab. Because of the methods of lab management it was simple absorb these new facilities without requiring additional staff.

Another initiative fulfilled this year was the installation of security cameras in several facilities. This allows students, faculty, and staff 24/7 access to these facilities without requiring a hired lab monitors. In doing so, Learning Technologies was able

to improve service to the university community while still reducing our costs in the long term.

Future Initiatives

Institute for Advanced Learning and Research

This project provides economic development activities for the Southside Virginia area. We continue to 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 2002-03 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.

Document Scanning

The need to convert documents to PDF format for electronic distribution is gaining momentum with the faculty, students, and administration. Uses include student projects, which can be submitted electronically, and administrative documents for tenure review which will replace the printed copies that are distributed in paper format. Increasing our current capacity to handle these types of projects will provide our customers an additional element of service in this area. An additional scanner is planned for purchase in November to support this initiative.

Digital Video

As part of the archiving services we provide to the University Library, we are considering the addition of support service for converting videotapes to digital DVDs. This comes in response to several local theatre companies who have expressed interest in donating their production videos to the Special Collections department in the library. This initiative is currently in the early stages of discussion, and is dependent upon available funding through the Library.

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
- 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:

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 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/**)

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.

<u>Digital Signature Applications to Instruction</u>

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 confidentially, integrity, and nonrepudiation of instruction-based documents (assignments, papers, tests) submitted electronically.

<u>Web-based collaborative tools for instruction, research, and outreach</u>

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.

Publications and Presentations

Publications

Head, J. T., Lockee, B. B. & Oliver, K. M. (In Press). Method, Media, and Mode. *Quarterly Review of Distance Education*, 3, 3. Association for Educational Communications and Technology.

Moore, A. H., & Head, J.T. (In Press). Philosophy of Faculty Development at Virginia Tech. *Faculty Development Strategies That Work.* Brown, D. G. (ed).

Moore, A. H. (In Press). Lens on the Future: Open Source Learning. *Distance Learning Administration: Managing the New Frontier.* Keating, R. (ed). Atwood Publishing.

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

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Oliver, K. M. & Hannafin, M. J. (2001). Developing and refining mental models in open-ended learning environments: A case study. *Educational Technology Research and Development, 49*(4), 5-32.

Schwartz, E. & Phillips, S. (In Press) Supporting Faculty in the Use of Technology. *Faculty Development Strategies That Work.* Brown, D. G. (ed).

Presentations

Moore, A. H. (May 2002) "Integrating Technology in Learning Activities: Reflections and Emerging Practices." Keynote Address at Regional Instructional Technology Conference. Minnesota State University. Moorhead, MN.

Moore, A. H. (April 2002) "Community Networks: Lessons from Blacksburg, Virginia" and "Moving Academic Technology to the Center of the University's Radar Screen: Reflections and Best Practices." Case Western Reserve University. Cleveland, OH.

Moore, A. H. (March 2002). "Innovations in Teaching with Technology." CrossTalk at MIT. Cambridge, MA.

Moore, A. H. (November 2001). "Open Source Learning." Lens On Learning: Invitational Seminar sponsored by the Distance Learning Policy Laboratory of the Southern Regional Education Board and Virginia Tech's Executive Forum in Information Technology. Atlanta, GA.

Moore, A. H., Hurst, F. & Freedman, G. (November 2001). "Revolutionary Open Source Technologies: The Impact on Education." WCET Annual Conference. Coeur d"Alene, ID.

Moore, A. H., Okimoto, H. & Fox, L. (November 2001). "Emerging Practices in Faculty Development." WCET Annual Conference. Coeur d'Alene, ID.

Moore, A. H. (April 2002). "The Future That Could Be Here: Policy and Practices for Community Networks." The Sorenesen Institute for Political Leadership of the University of Virginia. Roanoke, VA.

Moore, A. H., Christoph, K. & Sabean, R. (October 2001). "Targeting Transformation: Taking the Big Step in Teaching and Learning with Technology." Educause Annual Conference. Indianapolis, IN.

 Moore, A. H., Christoph, K. & Sabean, R. (August 2001). "Targeting Transformation – Taking the Big Step in Teaching and Learning with Technology."

Tutorial at the Seminars on Academic Computing: An EDUCAUSE Affiliate. Snowmass, CO.

Moore, A. H. (October 2001). "Technology, Danville and The Future of Education." The Danville Wednesday Club. Danville, VA.

Oliver, K. M. "Digital Library Network" (November, 2001) AECT Annual Conference, Atlanta, GA.

Oliver, K. M. "Wireless Interactive Teaching Simulations" (November, 2001) AECT Annual Conference, Atlanta, GA.

Oliver, K. M. "Wireless Interactive Teaching Simulations" (April, 2001) International Conference on College Teaching & Learning, Jacksonville, FL.

Worley, G., Raby, M., Guthrie, M., Turner, S. (October 2001). "Synchronous Tools for Enhancing Online Learning." Educause Annual Conference. Indianapolis, IN.

Executive Forum in Information Technology

(www.mps.vt.edu/ITForum)

Lens On Learning. Invited Seminar with Distance Learning Policy Laboratory of the Southern Regional Education Board. Atlanta, VA. November 28, 2001.

State-of-the-Art Learning Environments. With Center for Academic Transformation. Orlando, FL. December 3, 2001.

The Last Mile to Virtual Communities. With Virginia Institute of Government. Roanoke, VA. January 17-18, 2002.

State-of-the-Art Learning Environments. With Center for Academic Transformation. Dallas, TX. February 25, 2002.

Integrating Technology in Communities. For The Sorensen Institute. January 8, 2002 in Danville and April 3, 2002 in Roanoke.

Information Systems and Computing

Information Systems and Computing (IS&C)

Overview

Information Systems & Computing provides support for Virginia Tech's computing infrastructure and major application systems. The University's email systems, BANNER, data warehousing, portal development, and middleware services are included in the services provided by Information Systems and Computing.

Information Systems and Computing employs approximately 160 people to support the following operational areas:

Computing Infrastructure Services

- University Computing Support, which incorporates 4help, the Get Connected program and desktop support services.
- Systems Engineering and Administration (SEA), which is responsible for central computing resources and servers supporting email, administrative systems, research, and instruction.

Research/Cluster Computing Services

Application Services

- Data and Information Access Services, which is responsible for developing and maintaining a data warehousing system that captures, structures, and delivers University data to support timely, effective decision making, in addition to being responsible for knowledgebase and content management services.
- Database Management Services (DBMS)
- Administrative Information Systems (AIS), consisting of the Banner Teams for Alumni/Development, Finance, General, Human Resources, and Student & Financial Aid.
- Internet Application Development (IAD), consisting of Middleware Services, Microsoft Integration, Portal and eProvisioning.

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.

University Security Office

- Additional reporting responsibilities to the Vice President for Information Technology.

Computing Infrastructure Services

University Computing Support

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

Direct Support of Information Technology Services

University Computing Support (UCS) provides technical assistance to university affiliates through several programs under the 4Help brand name. These programs include Get Connected, Residential Computer Consulting, the helpdesk and Desktop Support. University Computing Support also provides assistance through a prominent presence at New Student Orientation and by developing and distributing the VTnet connection cd-rom. The Call Center (which was formerly part of UCS) merged this year with the Network Diagnosticians and Video Broadcast Support groups to form an integrated front end for the 4Help system. The new unit, called the Virginia Tech Operations Center (VTOC) reports to Communications Network Resources (CNS).

New Student Orientation

New Student Orientation (NSO) provides a forum where new students and their families get answers to many diverse questions about the students' upcoming move to campus and their beginning a college career. University Computing Support provides information during NSO regarding the details of the student computer requirement. In July 2002's NSO, we spoke with 11,252 students and parents. Also at NSO, students meet with their academic advisors to request their fall semester courses. In preparation for the academic advisor meeting, UCS works with students one-on-one to ensure that their PID is activated and authorized for course request. In 2002, we worked on PIDs with the 4,500 first year students and 680 transfer students.

Get Connected

The Get Connected program began in the fall of 1998 and is currently in its fifth year. Get Connected (GC) staff ensures that residence hall students' computers are connected to the campus network and that basic applications, including email and web browsers, are working correctly by the start of fall classes. The ninety-seven

students hired for move-in worked from approximately 10:00 A.M. to 10:30 P.M., August 21-25. Approximately twenty GC staff and twenty Resident Computer Consultants (RCCs) worked during the first two weeks of classes, completing connections and resolving problems.

Legend:
- Connected by GC Technician
- "Self" connections reported
- Total Connected
- GC Total visits
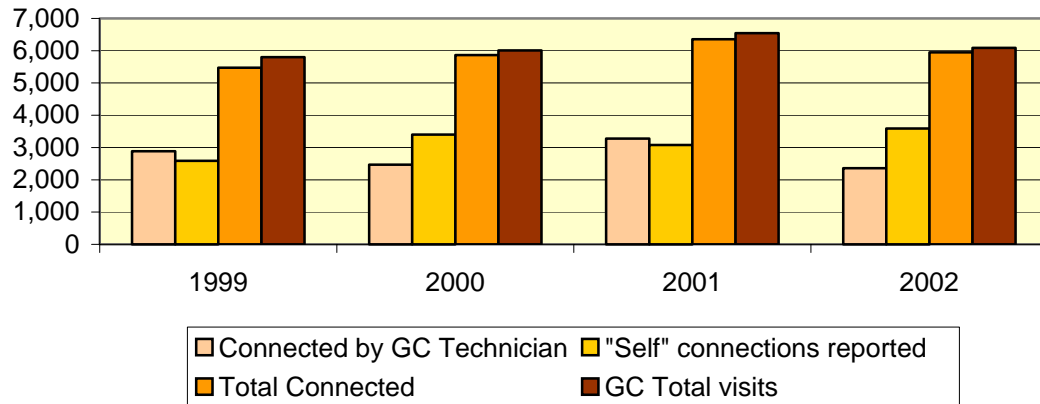
Residential Computer Consultants

The Resident Computer Consultants (RCCs) are students who live and work in the resident halls. The program began in the spring of 1999 and is currently in its fourth year. They provide on-site computer support and educational computer presentations to on-campus residents throughout the academic year. RCCs begin their official duty immediately following the completion of Get Connected.

RCC tickets - First month Fall Semester
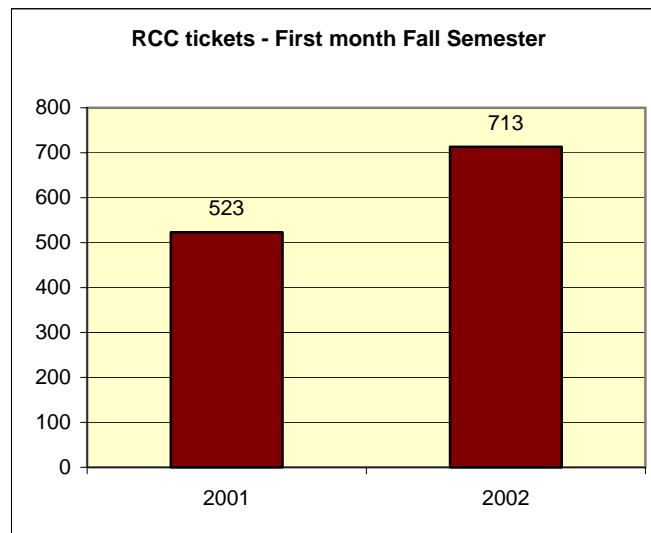
Approximately 40% increase over last year's tickets during same time period.

Helpdesk

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

Annual Helpdesk Tickets
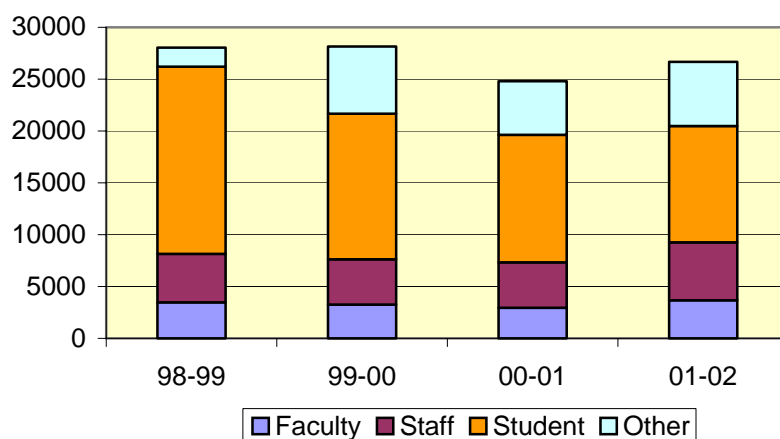
Consultants provide assistance with internet connectivity, internet applications, central computing resources (such as Blackboard and Hokie SPA), e-mail, administrative systems (Banner, etc.), operating systems and many other topics. This year brought an increase in computing security issues often caused by unwanted programs that are installed when clients download free music or file-sharing applications. Because of the increasing availability of online courses through the Blackboard system, more students contacted the helpdesk about accessing class materials.   Customers reported fewer problems with computer viruses due to the implementation of virus scanning and removal on Virginia Tech e-mail systems.
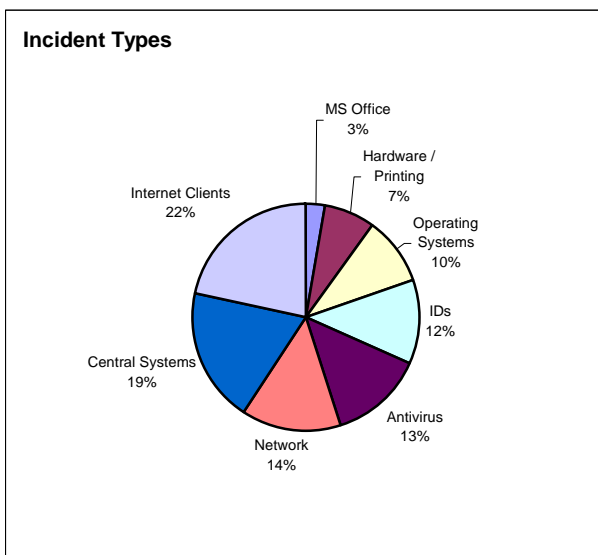
Desktop Support - From August 1, 2001 to August 1, 2002, the Desktop Support group has performed 1381 service calls. Of these 913 were faculty or staff troubleshoots and 468 were new Banner machine installations.

Security Dimension

UCS has played a major role over the past year in researching, investigating, developing, testing, configuring and implementing the latest security practices and products. Our approach over the last year has been three fold: **1) Reactive**: Getting a user's compromised system restored quickly, identifying the security exploit, and fixing the exploit. This may involve working with the Security office, Abuse, or campus police. **2) Proactive**: Programmatically implementing specific security precautions for certain users. **3) Instructive**: Developing and publishing to the university community (through the Knowledge Base and Computing.vt.edu) best practices, recommended configurations and job aids related to security.

Specific examples are listed below:

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

Help Desk/Desktop Support
http://kali.cc.vt.edu/ask4help/general/vtkb1824.htm - What to do if you are hacked.

Proactive:
Banner Machine Deployment: In the summer of 2002 (448) Dell OptiPlex G240 PC's were deployed. The objectives of this deployment were:

- Security and Standardization.
- Increased security options with W2K.
- Distribute systems with modified security policies.
- Distribute personal firewall with each system.
- Include user tutorial.
- Tested and documented system configurations.
- Standardized systems to reduce support costs.
  For a detailed description of the security changes see "2002 Banner Image Summary."
- VT Net:
    o Norton Antivirus included.
    o The Installer automatically looks for Antivirus software and if not found prompts the user to install NAV, as first step.
    o Security web page is advertised on the front cover of fall 2002 edition.
- Get Connected: Students are told about picking strong passwords during NSO and GC.

- Extended Support Service: GS staff shows students how to run Windows Updater to get latest security patches.

A standard security configuration has been defined for ESS clients. (See "Proposed Security Standard for Computers in Burruss" for details.)
Twenty-four machines of ESS clients in Burruss have been reviewed and individual work orders written to upgrade each machine (if possible) to the standard security configuration.

Instructive:
Security Product evaluation and configuration: The following KB articles have been published:
General Firewall article: http://kali.cc.vt.edu/ask4help/desktop/vtkb1837.htm
Simple security recommendations:
http://kali.cc.vt.edu/ask4help/desktop/vtkb1829.htm
Configuring Tripwire: http://kali.cc.vt.edu/ask4help/thirdparty/vtkb1807.htm

Accessibility Dimension

The relocation of the UCS department to Torgersen Hall allows wheel chair access to both Help Desk and Desktop Support office and service areas.
Our location in Torgersen Hall also puts us in close proximity to the University IT Accessibility lab to allow informal communications and collaborations on appropriate testing and support projects.

Systems Engineering and Administration

The mission of Systems Engineering and Administration is to support the University computing community by providing a robust technical computing infrastructure, with secure, reliable centralized services and "best practices" procedures for systems administration. In 2001-2002, SEA improved customer service, security and accessibility with the following accomplishments.

UNIX Administration Services:

- Created Big Brother monitoring interface for CNS SMARTS monitor
- Installed server hardware and operating system with appropriate security patches for the following customers
    - Educational Technologies department
    - DBMS Web enabled forms
    - DBMS Job Control Services
    - Banner forms (tested Linux/samba based forms servers)
    - UCS
    - ITA

- o Vice President for Information Technology

- Administered 39 production servers for other units in Information Technology to support Banner, IWA, Ed Tech, ITA, VPIT Office, WARD, IAD applications
- Developed IWA server using SAN storage
- Expanded and configured disk space for the following servers
  - o Banner Web Server – phased out old DEC hardware Raid device
  - o Banner db servers
  - o Filebox server

E-Communications and Client Tools

- Deployed enterprise-wide virus scanning for campus-wide mail server, listserv server and approximately 2300 on-campus hosts that use mail.vt.edu as their Mail Exchanger host.
- Upgraded Exchange server to Windows 2000 and Exchange 2000, thereby improving Outlook Web Access service and integrating into Active Directory structure
- Deployed load balancing hardware for virus scanners
- Upgraded mail storage capacity on Webmail server
- Deployed SSL accelerator hardware to provide password encryption and encrypted retrieval of mail from campus-wide e-mail server
- Completed software evaluations for e-mail task force. Recommended and tested iPlanet e-mail software to provide upgrade path for expiring SIMS mail server on campus-wide mail server. iPlanet allows more options for e-mail and password encryption than SIMS.
- Deployed Blackberry server, interfacing with Exchange
- Served as primary contact for e-mail abuse
- Provided response to security incidents as part of University CIRT team
- Provided system administration for TimeClock Plus system

Performance Measurement and Capacity Planning

- Diagnosed problems with IWA servers, recommended solutions
- Installed and implemented SAS IT Service Vision capacity planning software
- Produced capacity planning reports via the Web
- Installed and implemented StorWatch Expert SAN performance monitoring software
- Provided assistance in resolving Banner Forms server performance problems
- Security Team
- Generated CIS Benchmarks for AIX
- Participated in Risk Analysis, Business Impact Analysis and Business Recovery Plan
- Created Security Lab for testing appliances in conjunction with Center for Internet Security
- Maintained security.vt.edu Web site, pointing to security checklists. tools and "best practices" documentation

- Hosted and participated in listserv lists such as CIRT, va-cirt, vtsug, rs6k-l, sgi-l, techsupport
- Gave presentations on good security practices to faculty, staff, Freshman students and graduate students
- Lectured on security in classes for business, engineering and statistics
- Contributed security articles to Virginia Tech Knowledge base

Professional Development

- Participated in steering committee for IT Professional Network including planning and teaching classes on UNIX and Windows security and system administration
- Conducted activities and provided an instructor for SANS-Edu conference

Research/Cluster Computing

- Hardware Initiatives
  - The Guinevere Sun E6500 system is completely dedicated to research computing faculty and is currently being heavily used. It is a part of the campus wide Globus grid, and is expected to be a major resource for that facility. This year IS&C hosted the first guinevere user group meeting
  - Two cluster/grid initiatives are being undertaken: a 4-node Appleseed cluster will be up and operational in the fall of 2002, and a commodity PC-based Linux cluster will also be made available. These systems will also be a testing ground for system management and grid computing application software. System administration will be provided by IS&C. These initiatives are severely limited by the lack of funds during the budget crisis.
  - After hours use of some large computer labs is also being investigated for use in grid computing. Such system can become a very large cluster for some portion of the day.

- Additional Support Services

  - Placed IBM M80 into production for VTAIX, installing appropriate security patches
  - Provided system administration support for Solaris and AIX research systems, including supporting research applications such as REXX, SAS, Matlab, Mathemetica, Gauss, Gaussian and scientific subroutine libraries
  - Network Backups and Storage Support.
    - Completed evaluation of Storage Area Network requirements and vendor solutions, resulting in purchase of IBM Shark-based SAN
    - Completed evaluation of Network Attached Storage requirements and vendor solutions, resulting in purchase of Network Appliance F840 Filer

- Deployed network backup solutions and NAS storage for desktop computers to fulfill needs identified inW2K Pilot project

- Commodity Services
  - Network Attached Storage will be made available for research purposes. This service will allow researchers to have their documents, programs, and research results stored centrally, where the storage can be managed and backed up without additional effort from the researcher. This should be available the first quarter of 2003.
  - Centralized Backup service is also now available for research purposes. This service is available at a small yearly fee to recover license fees and tape costs.
  - IS&C is providing Digital Certificates (CA & PKI) through a pilot program. Such certificates are essential to the formation of grids and to authenticate access of users to the grids.
  - Other services that IS&C is providing or in the process of providing are:
    - Windows 2000 Central Services Domain
    - Authentication by EdAuth
    - hardware and software security testing
    - operating system installation standards for Linux, Solaris, and Win2K

Application Services

Data and Information Access Services

The information warehouse group was charged with doing a data warehouse for Virginia Tech in 1998. We actually began development of the first data mart in September 1998. That was Finance. Ralph Kimball provided training in August of 1998, and we have used his approach to develop an enterprise data warehouse with conformed dimensions. One of our goals is to make it easy for people to pull together data from different systems. We have already achieved some success with this with our Giving (from out fundraising organization system) data mart, and our Finance Foundation data mart.

We have developed data marts in the Finance, Human resource, and University Development areas (our source is SCT Banner), and are just beginning to tackle the Student area. We have completed Undergraduate Admissions, and are getting ready to finish up the extraction, transformation and load process for graduate admissions.

The warehouse team has acquired, and developed some tools for getting access to data and reports. All Finance month-end reports are run against the data warehouse, and it is used to prepare the University Finance summary. We have approximately 1200 users accessing the data warehouse with standard reports. We have approximately 50 active ad

hoc query users; the challenge with ad-hoc users is adequate initial training, and on-going support.

Increasing use of the warehouse has surfaced performance issues, and the warehouse team recently migrated parts of its operation to new servers and a SAN. Results to date indicate that the SAN will significantly improve performance.

As the number of data marts grows, and as the data within those data marts grow, it is extremely important to continue to work on availability to users, load efficiency, and query performance. The implementation of the SAN should help us provide a degree of redundancy. The implementation of a new system to support testing will allow thorough testing of all loads, provide sufficient user testing, and provide production back-up when there are problems. At a minimum continue to provide access to the previous day's data while addressing problems with the load.

Finance - The Finance Warehouse continues to support power users such as Ken Miller and Vernon Bogs and the budget office. It is also used for the monthly Finance reports, reports for University Development, and reports for the Student area.
- Implemented the Accounts Receivable Data Mart.
- Designed Sponsored Research Data Mart.
- Made significant changes to support additional the Financial Statement reporting requirements for Ken Miller.

Alumni Data Mart - Developed a dashboard for the University Development office that is being used on a daily basis.

Student Data Marts
- Implemented the Undergraduate Admissions data mart.
- Completed the Design and Initial data load of the Graduate Admissions Data Mart.

Warehouse Maintenance - Received 126 service requests for changes to existing data marts, completed 105 and spent 1,800 man hours.

Dashboards – These tools have been developed, and maintained for University Development, and Undergraduate admissions. The dashboard for Minnis Ridenour continues to be maintained and work is in progress for developing dashboards for the budget office, human resources, and the controller to identify additional applications that will be helpful to Minnis and his direct reports.

The dashboard is a wonderful way of presenting the diverse capabilities of the underlying data structure. It provides an easy to use interface for executives. With 1–2 hours of work or less, a report can be written, and included in the Dashboard. It is the first step towards the development of a Portal for Administrators.

IWA Data Mart and Tool Training
- Trained over 175 Brio users
- Currently have over 50 active Brio users (use Brio at least twice a week)
- Benefits: Tool training has been separated from the data training. This has been very effective, since the user may want to use a different tool to access the Warehouse (SAS, Microsoft Access or Excel, etc.)
- Training is tailored to the audience by preparing exercises that will be relevant to their jobs. One-on-one sessions are provided for users who have been trained to help them get started with queries that help them do their jobs. We have worked with the Provost's area, RDP, International Programs, the College of Engineering and many others.

Database Management Services

Application Software Upgrade

The Banner system was upgraded from release 4.x to 5.x during the year. Forty-four (44) different Banner upgrades were installed to the Banner databases during the year. The upgrades were applied to six (6) Banner databases and four (4) Banner foundation databases for a total of three hundred four (304) installs done to support the Banner environment. All FMXs were regenerated since we moved from Oracle developer 1.6.1 to Oracle developer 6i with the 5.x upgrade. In addition numerous patches were downloaded an applied at the request of the functional and technical leads.

SQR was upgraded from release 6.1.3 to release 6.2. SQR is a specialized programming language for data access, data manipulation and reporting.

The credit card payment gateway Touchnet was upgraded to release 3.2.1 to address security issues. This release provide for the encryption of credit numbers on log files. It also includes an ECI required by NOVA which identifies a transaction as a web transaction.

New Application Software

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

Software allowing users to schedule production jobs was developed and deployed for testing and feedback.

DBMS staff worked with the Student area to automate procedures for the capture of student census data.

DBMS staff researched, evaluated and defined an environment for the deployment of Banner forms in a web environment (web enabled). This involved educating current staff, consulting with ORACLE, SCT and other areas to define the environment, software installation and setup. A development environment has been tested for several months.

System Software Migrations

Oracle database were migrated to two new releases during the year. The databases were first migrated from Oracle release 8.0.5.1 to 8.1.6.3 with Banner 5.x upgrades. The databases were later migrated to 8.1.7.3 because of Oracle discontinued support of release 8.1.6.3. A total of ten (10) Oracle databases to support the administrative system were migrated in each release. All of the Banner and VT application programs were recompiled for each upgrade. Estimated total number of compiles for C, COBOL and SQR for these upgrades is approximately twenty thousand (20,000).

System software supporting the Development and Production Banner web applications was migrated from OAS 4.0.7.1 to OAS 4.0.8.2. These web servers house web applications such as Hokie Spa and the Banner web allowing access to employee data, student course request, drop/add, class schedules, grades, etc. This upgrade was necessary to move the environment to a supported release.

SQL Scripts

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

Performance Monitoring

A new release of Oracle Enterprise Manager (OEM) was installed. The CC operation staff uses OEM to terminate Oracle sessions. The DBMS staff uses OEM to monitor the system usage and to diagnose performance problems.

DBMS staff chaired a group to evaluate and resolve Banner forms performance issues. As a result of this effort the Banner FMX deployment structure was reworked. The group found that the 5 servers deploying the FMXs were a bottleneck in the system. These servers were found to be too small and outdated to handle the load on the system. This was mainly due to increased FMX size with the Banner 5.x release and the number of users had increased substantial since the acquisition of the machines. Two new servers were purchased to replace the 5 existing forms servers. The replacement servers have been in operations for several months now without encountering performance problems. The last of the old forms servers are scheduled to be decommissioned soon.

Software Evaluation - DBMS evaluated WebObjects and Oracle Jdeveloper software as a Web Development tool and made recommendations to Management.

DBMS Team Goals

- **Security**
    - The Oracle databases are scheduled to be migrated to Oracle 9i. Oracle 9i provides a more secure platform by minimizing risk through enhanced security for data and users.
    - The credit card payment software TouchNet is scheduled to be migrated to release 4.x and moved to a Solaris platform. The software will be more stable and reliable on the Solaris platform than the NT platform that it is currently running on. Security provided by the Solaris operating system will be an improvement over that provided on the NT.
    - Operating systems are scheduled to be upgraded to Solaris 2.8. The 2.8 release has a more robust security package. It also supports smart card technology.

- **Accessibility**
    - Banner forms web deployment will provide an alternative to access and update data. This environment will also allow data to be more ready accessed from anywhere using a web browser.
    - Upgrading the source code management software (Harvest) to release 5.x will be web enabled with added functionality.

- **Customer Service**
    - The Solaris upgrade to release 2.8 has improvements in memory management which means applications will run more efficient. Also the 2.8 release is more stable than the version currently running
    - Moving the Development and Production web servers off of the E10K will free up resources on the E10K. There will be replication of the web servers providing for a more stable environment with less down time.
    - The JCS (Job Control System) that has been developed and is currently being tested will allow users to schedule jobs in advance. Planned enhancements to the systems will allow for job streaming, job dependences and more.
    - Moving databases storage off of the E10K to SAN will free up resources on the E10K, improving database backup and reducing down time on such resources as the read-only database. Also it moves us a little closes to a 24x7 environment.
    - Banner forms web deployment will eventually eliminate the Banner client from the desktop. It will also make the use of Citrix unnecessary.
    - Upgrading databases to Oracle 9i will provide improved database performance. It also includes several new features that make the database server more autonomous and self-managing.

Administrative Information Systems (AIS)

<u>Student Team</u>

During the past fiscal year, the Student Project Team continued the implementation of modules associated with the Banner Student module and Banner Financial Aid module. Since the systems went live, the team has not only been dealing with what processes are left to implement for functional areas but also with the maintenance of production processes. Throughout the year corrections have been made to those which are not performing as the functional area requires. Over 160 service requests for modifications and/or enhancements were completed.

Corrections and Maintenance:
- Participated in the testing and verification of a new release of Banner – 10/2001 and preparation for 10/2002
- Enhanced and corrected the routines associated with the teaching load reports produced for the University
- Enhanced processes associated with end of term processing and graduation, including the processing of tentative grades for graduating seniors
- Enhanced the routines used to create the files associated with census processing
- Enhanced and maintained routines to process the moving of data from one pidm to another in the processing of duplicate records
- Developed tables and procedures to clear pidms no longer needed thus reducing the size of several General tables. For example, the SPRIDEN table was reduced by over 290,000 records.

Enhancements and Expansions
- Piloted the implementation of imaging technology in the Office of Scholarships and Financial Aid
- Implemented on the Web an application for degree process for graduate students
- Implemented the enrollment verification process
- In partnership with SCT, developed the housing preference and assignment sub-module
- Developed tables, forms and processes for tracking student organization information, including web capability to search student organizations
- Developed for Office of Scholarships and Financial Aid an email notification process using Banner variable selection
- Developed process for veterans educational benefits needs
- Created tables to audit selected data and corresponding forms to display the audit trails created
- Implemented satisfactory academic reporting for Financial Aid

- Continued to enhance the Web for Student and Faculty/Advisors capabilities, including student request of Degree Audit report, University transfer guide, and award change request for Financial Aid
- Continued work on the Student Data Warehouse, using Undergraduate Admissions and Graduate Admissions as the first areas of data to migrate to the warehouse
- Built and began distribution of self-service data extracts from the Student Data Warehouse.

Finance Team

- Finance completed 306 Service Requests:
    - 88 Data Repair/Fixes/Bug Correction etc. SRs
    - 35 Maintenance/Applying Patches/Problem Solving SRs
    - 137 Modification SRs (both for Banner and in house developed)
    - 46 New applications/reports/processes

- Included in the above counts are Service Requests related to the following Projects/Implementations:
    - Developed and Implemented Tuition Remission system
    - Replaced Cash Receipts system
    - Modified and Implemented Banner Fixed Assets Module and Developed and Implemented Inventory system to 'front end' Banner Fixed Assets
    - Developed and Implemented a batch general encumbrance loading system
    - Developed and Implemented an automated VT Foundation Scholarship Billing System
    - Modified the VT Student Billing system to reduce the number of bills, and therefore postage costs
    - Rewrote most departmental Web reports to improve ease of use and performance
    - Developed and Implemented an Accounts Receivable / Sponsored Program account aging reporting system
    - Installed a new release of Banner (Finance and A/R version 5.2) which required re-applying over 100 modifications/bug fixes and nearly 1400 hours effort.
    - Provided an unknown number of hours of consulting / analysis / debugging services to our various constituent offices.

General Team

- Rewrote the Budget Tuition system to change it from a focus based system to a forms based system.
- Made numerous enhancements to the new Budget Tuition system.
- Installed a new version of the Banner system.
- Applied enhancements to the Banner system processing in the way of enhancing the forms and the web processing.

- Applied enhancements to the Banner web system for usability in the way of directing users to different pages for PID and Password explanations.
- Applied Area Code changes that affected 12 states area codes.
- Created a PID to PIDM process that interfaces with the Banner system and the Blackboard system. The system is set up to run daily to keep the ids for the Blackboard system up-to-date.
- Data clean up on the General Tables.
    - Removed the PID out of the goremal tables and into the pidm tables
    - Removed all the vtvm1 email addresses from the goremal tables.
    - Created a process to activate and inactivate email addresses.
    - Successfully moved into AISB.

Alumni Development

- Development completed 589 service requests.
- Major projects included:
    - Implemented 5.2 version of Banner
    - Designed and implemented the new prospect management system
    - Implemented the new corporate and foundation ratings system
    - Implemented the upload of pledge information from Smartcall (freeing up .75 position in Gift Accounting)
    - Developed a new endowment reporting system to supply donors to endowed accounts a financial statement of their account's funds, growth and distributions
    - Worked with the student team to build a process to delete recruiting records (deleted ~ 300,000 records)
    - Worked with IWA to develop a dashboard application for pledge and gift information to provide reports to senior management

HRIS Team

The HR team started fiscal year 2001 down one highly skilled and functionally knowledgeable employee. During the year, we lost two additional valuable employees. We hired two entry level employees both of whom have quickly increased their programming skills and are learning the functional processes as they work on programs in the different areas of HR.

Completed approximately 350 service requests:
- Modified, tested and installed Banner HR 5.0
- Modified, tested and installed the year end tax and W2 release. Wrote a new program to print the 1042 forms on the Docuprint printer.
- Modified and tested the Banner HR 5.3 release – installation in October 2002

- Assisted Rec Sports and IS&C with the installation of the TimeClock Plus software for tracking wage employees' hours. Developed procedures for collecting the data and sending it to Personnel Services for batch loading into the Banner system.
- Created a batch load process to take employment applications from the Personnel Services web server and load into the Banner system. This automated process runs unattended three times a day.
- Changed the savings bond system to accommodate the new federally issued I bonds
- Wrote multiple reports to provide information to executives concerning budgets, faculty severance, layoffs, etc.
- Collaborated with Internet Application Development to develop a web page for classified employees to select a bonus option. This information was used in the programs to grant classified employees additional leave effective July 1 or bonus payment effective August 10 or both. Developed programs to grant faculty bonus payments effective August 10 and graduate students bonus payments effective September 10.
- Worked with the Health and Safety Office to increase their understanding of the Banner Worker's Compensation module and to create a view of allow them to start producing their own reports.
- Modified the leave system to include new leave types defined by the state.
- Continual changes to the system to improve data quality, system performance and customer satisfaction
- Payroll data warehouse in production (August, 2001)

Internet Application Development

Internet Application Development is concerned with the development of informational applications and interactive services that are delivered over the Internet to a wide range of users. The centerpiece of IAD's efforts is the enterprise portal for the University. Enterprise portals have the potential to replace many of today's desktop-bound functions, in an integrated, device-independent self-service environment available anytime and anywhere.

In a distributed environment, infrastructure needs are more significant than in the past, when fewer servers performed multiple tasks. In that environment, one application could access the resources of another more easily, often by simply accessing their shared storage. Another challenge we face in a distributed environment is knitting distributed services back together in a consistent and meaningful way. Middleware is a term that has been adopted to describe the standards-based infrastructure components that provide inter-application messaging, e-commerce, authentication and authorization, and other services. Distributed hierarchies of directories play a large role in information and service discovery. Portals are a framework in which an organization can recombine online

services with selected content, interactive components, and support in a personalized and customizable, yet consistent environment that can be delivered to any desktop or information retrieval device.

Internet Application Development is strongly committed to using and developing open source software, open standards, and open computing environments such as Linux and Java. IAD is committed to contributing its own products to the open source community as well.

A major project of Internet Application Development in 2001-2002 was the redesign of the university's directory infrastructure to emphasize security, extensibility, and improvement of authentication and authorization processes. The new Enterprise Directory relies on the University's ERP, Banner, as the database of record, and information from Banner is used to populate both the Enterprise Directory and the Active Directory on a daily basis.

- Enterprise Directory (all operating systems) – The new Enterprise Directory implemented new and stronger password requirements as well as services to enforce these. It also implemented mechanisms to secure the transmission of sensitive authentication and authorization data between the directory and applications. Methods requiring services to respect account states such as expired passwords and account lockouts have also been implemented. Developed a third generation single sign on framework that complied with many Internet2 recommendations.

- Active Directory (Windows) - The Microsoft Active Directory structure fits within the Enterprise Directory structure and is designed to synchronize with both Banner and the Enterprise Directory. The Active Directory structure allows approved security policies to be pushed via the network to all university Windows desktops that are members of the Hokies domain and a related computer domain. Policies and procedures for enabling this capability have been drafted. IPSec policies have been developed that may replace more costly personal firewall software. A Daisy auto-hotfix tool for Windows was developed and released as open source. A Synopsis lite distributed event logging/evaluator tool and Hokies auto-disable tool were also developed and implemented.

Middleware Services

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

Current Projects
Our current projects focus on the creation of the Enterprise Directory, a key piece of infrastructure that will serve as a repository for much of the person, group, and service

information required by applications. In addition to that we also work closely with the Internet2 Middleware organization on pure research projects such as authPortal3, a single sign on system based on WebISO requirements.

What is Middleware?
In an ad campaign for its E-commerce product line, IBM referred to Middleware as "the sweet, nougaty center of infrastructure." Internet2's Middleware site calls it the glue between the network and applications. In general, it is software that users rarely see as it usually does not have a user interface. It relies heavily on open standards (such as LDAP and XML), and facilitates the exchange of data between systems.

What are some applications that depend on Middleware?

- Messaging systems like E-mail and instant messaging services which use it for locating e-mail addresses and instant messaging IDs
- Portals that personalize content based on what they know about you like Hokie Portal
- General purpose authentication and authorization services for accessing Web applications
- Learning management systems like Blackboard Course Info
- E-commerce systems that provide online customer support and recommender functions

Enterprise Directory
The Enterprise Directory is the next generation of the current Virginia Tech Directory also known as the VTLDAP. The new Enterprise Directory will be fully eduPerson 1.0 compliant allowing it to work with a wide range of applications developed for educational institutions. Along with the schema changes for eduPerson compliancy we are also introducing new features such as the ability to offer finer grained authorization and greater user control over their data. In addition to these new features, a wealth of tools will be released making interacting with the directory, either directly or programmatically, much easier. Also, with the creation of some of these new tools, and because of some of the changes being made to the structure of the directory, some of the current tools in production will be retired.

PeopleFinder
PeopleFinder is the web based white pages application here at Virginia Tech. It is actually composed of three separate software pieces. One which performs the actual directory search and offers results in XML, the web based interface to the XML engine, and a final experimental piece which provides a cell phone accessible interface.

authPortal
authPortal is the Single Sign On framework used for some web applications here at Virginia Tech. The portal currently uses authPortal version 2 in order to transparently log users into such services as Filebox and Webmail without requiring them to re-enter their credentials. In addition to the currently deployed version of authPortal, a new version of

authPortal, version 3, is being constructed as a proof-of-concept for many WebISO requirements. This version of authPortal incorporates new features like the ability to use varying forms of authentication, other than a user id and password, and integrate with other Internet2 projects such as Shibboleth. For more information, see here.

Publications

Enterprise Directory Documents

- ED-Lite Schema
- ED-Auth Schema
- ED-Auth Account States
- ED-Auth Password Requirements
- ED-RO Schema

- Enterprise Directory Presentation: Security Focused

Miscellaneous Documents

- SSL Certificates: What are you paying for?

References

- DSML v2 Specification
- eduPerson Schema
- LDAP Recipe
- Groups Implementation Guide
- Practices in Directory Groups

Microsoft Implementation Group

The Microsoft Implementation Group maintains Active Directory and develops AD-enabled applications.

Virginia Tech's root Windows 2000 domain, Hokies, went live on July 10, 2000. Hokies is the root of Virginia Tech's Active Directory (AD) directory service and is ready to bring child domains from departments within the university into the AD.

The Microsoft Implementation Group provides resources and services to departments who wish to participate in Virginia Tech's AD.

Information Technology Acquisitions

FY2002 was a year of progress and transition for Information Technology Acquisitions. The year brought record sales in the Student Software Auxiliary, implementation of new

control systems in the Student point of sale procedures, a revamping of ITA's web site and the introduction of free security and operating system upgrades to the campus community. Details of each ITA area, computer purchasing, student software distribution, and software sales to faculty and staff, are reported below.

Computer Purchasing

The Computer Purchasing office issued 1770 purchasing orders and processed $22.8 million dollars in FY2002 accounting for 40% of the total purchase orders issued by the University.   The following graphs show the activity of the two Computer Purchasing buyers, Judy Poff and Vicky Moore, in relation to other buying staff at Virginia Tech. 117 requests for bids were issued in FY2002 to 3651 vendors giving an average bid participation of 31 vendors per bid.   83% of the bids issued in FY2002 were delivered through the ITA-developed Bids on the Web or BOW application. The remaining 17% were faxed using ITA's automated bid faxing system.   ITA's web based ReqStat utility, which provides online computer purchasing information, logged over 7,200 hits from campus users during the year.

FY2002 Purchase Orders
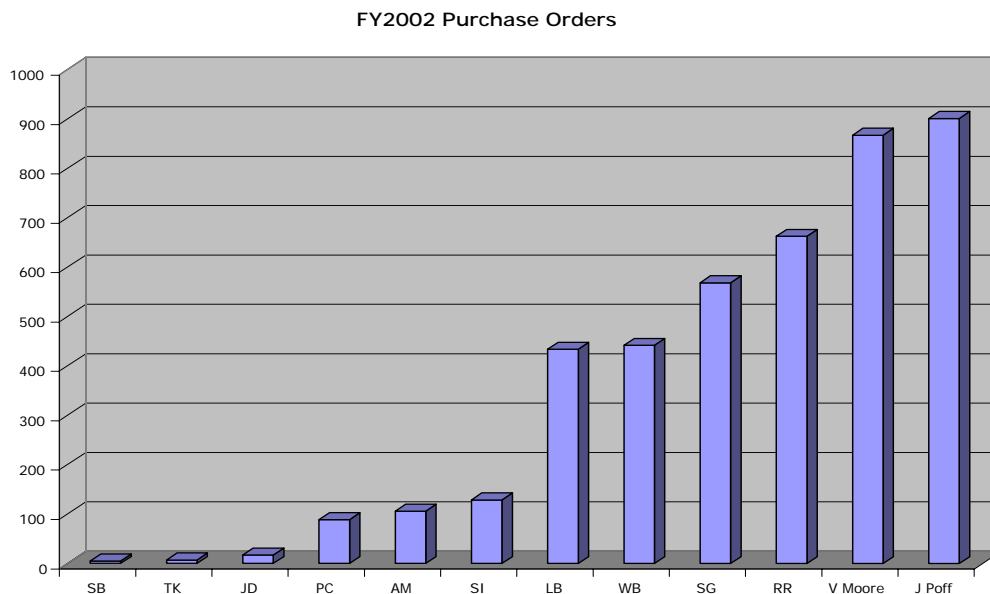
FY2002 Purchase Order Totals
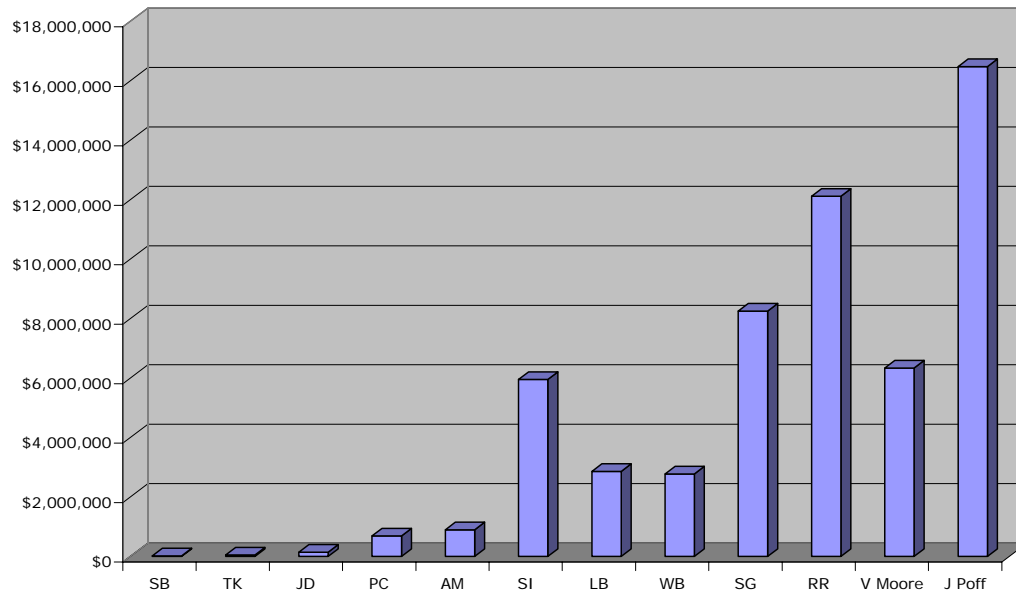
FY1999-2002 Purchase Orders
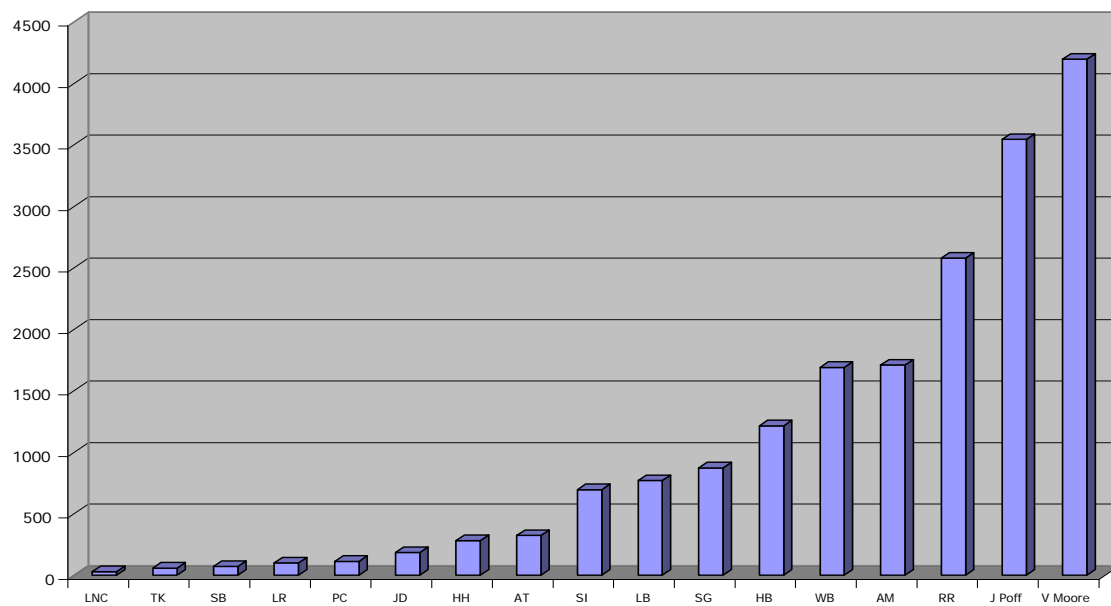
FY1999-2002 Purchase Order Totals
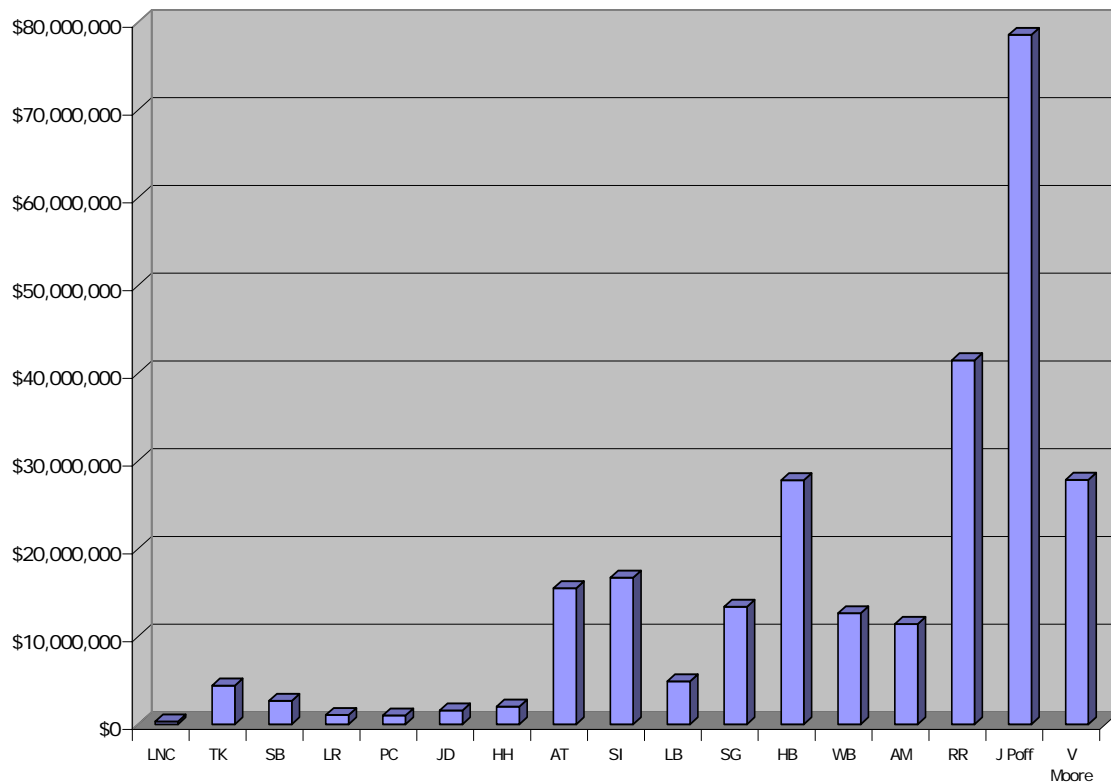
Student Software Distribution

FY2002 marked the first full year for Student Software Distribution on the Torgersen Bridge. A barcode-based inventory control system, implemented in August, 2001, and currently in use, provides airtight control of all student license inventory and sales. CSS or Student Check In August, 2001 took advantage of the new facilities on Torgersen Bridge and initiated a state-of-the art point of sale ordering and sale system developed by ITA staff. The Student Software Auxiliary saw a record year of student orders and ended the year with a 5% budget surplus.

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

Student Software Sales by Product
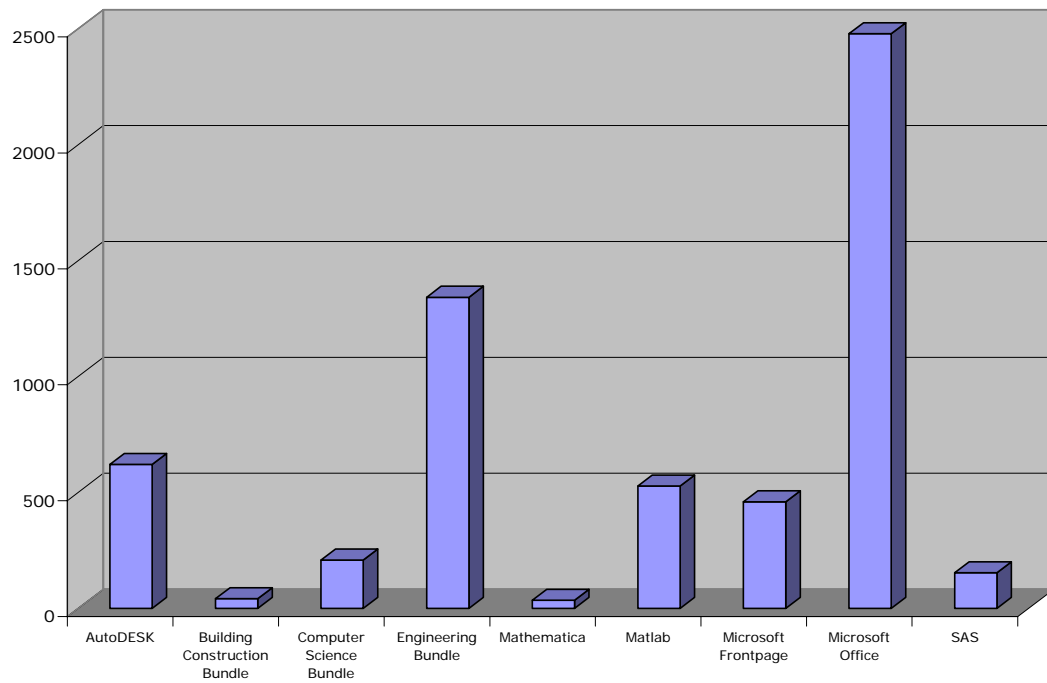
The graph below shows Auxiliary activity compared to previous years. During FY2002, Student Software distributed 5,899 software products and collected $922,022 in revenue.

Student Software Orders - FY2000 to 2002

Student Software Sales - FY2000
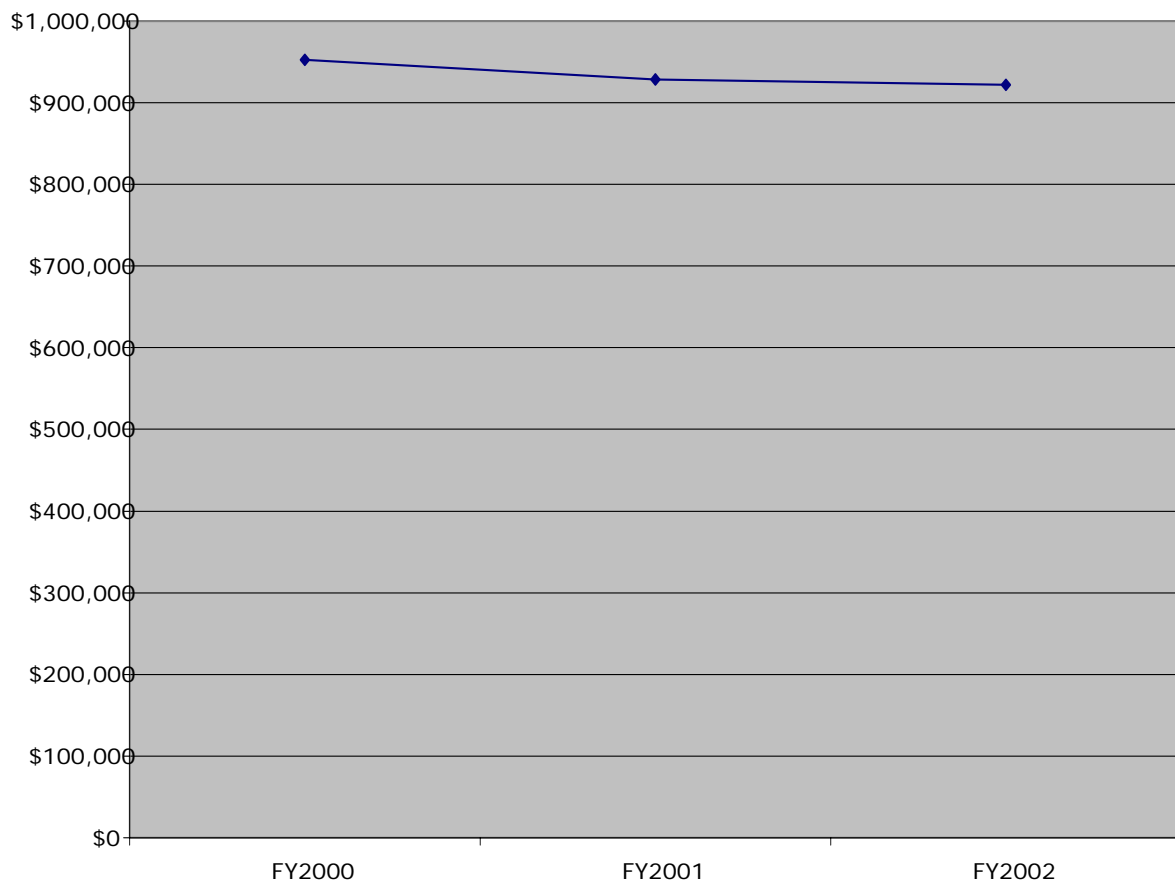
 Department Software Distribution

Department Software Distribution moved from Andrews ISB to Torgersen 3240 in August, 2001, benefiting faculty and staff on campus with walk-in service. During FY2002, the 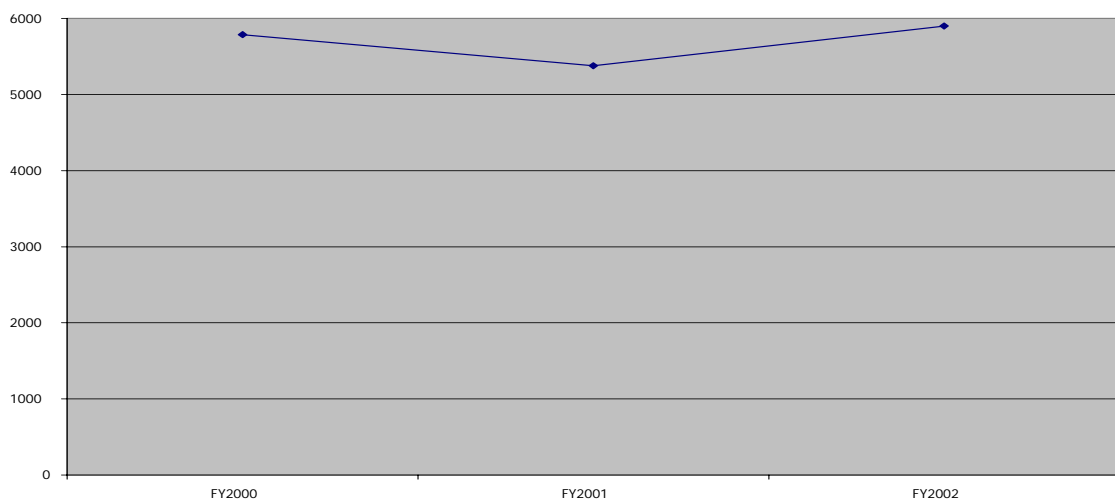Software Distribution web pages were merged into the computing.vt.edu web site to provide easier access to software information. Two new initiatives were started in FY2002 to improve the security and functionality of computers throughout the entire Virginia Tech campus community. The first initiative provided Windows 2000, Windows XP, and Mac OSX free of charge to all campus users; the second supplied personal firewall products, namely, BlackIce Defender, ZoneAlarm Pro, and IceCap Manager and Agents, to the university community. These programs which provided improved OS security and personal firewall software are part of the vision of IS&C administration to protect the campus and Virginia Tech assets from the increasing threat of computer vandalism. The chart below shows licenses distributed free of charge to the campus.

Additional statistics related to Department Software Distribution are provided below.

Security Initiative Software Distributed in FY2002

Faculty and Staff Deparment Software Sales
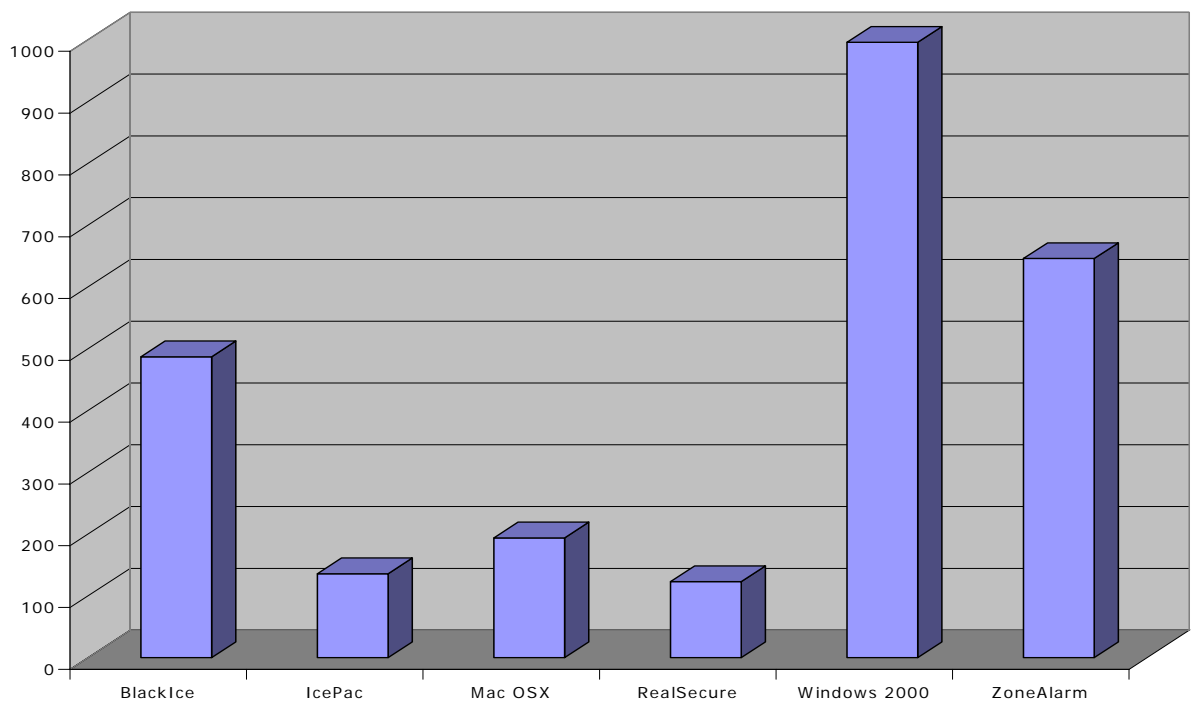
Faculty and Staff Department Software Orders
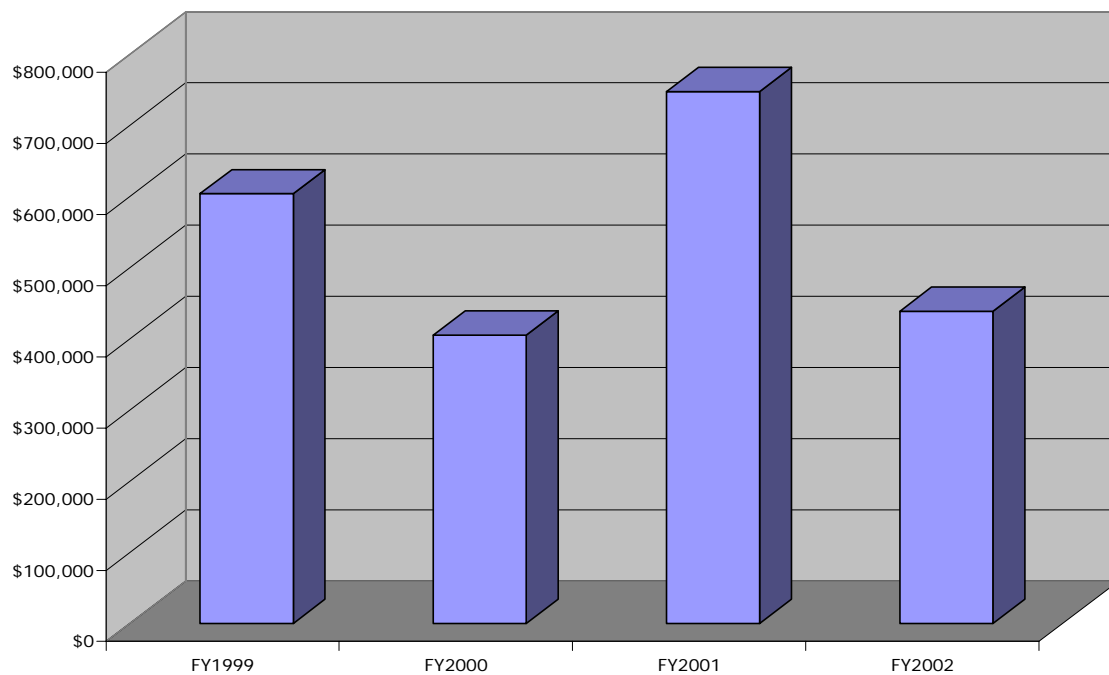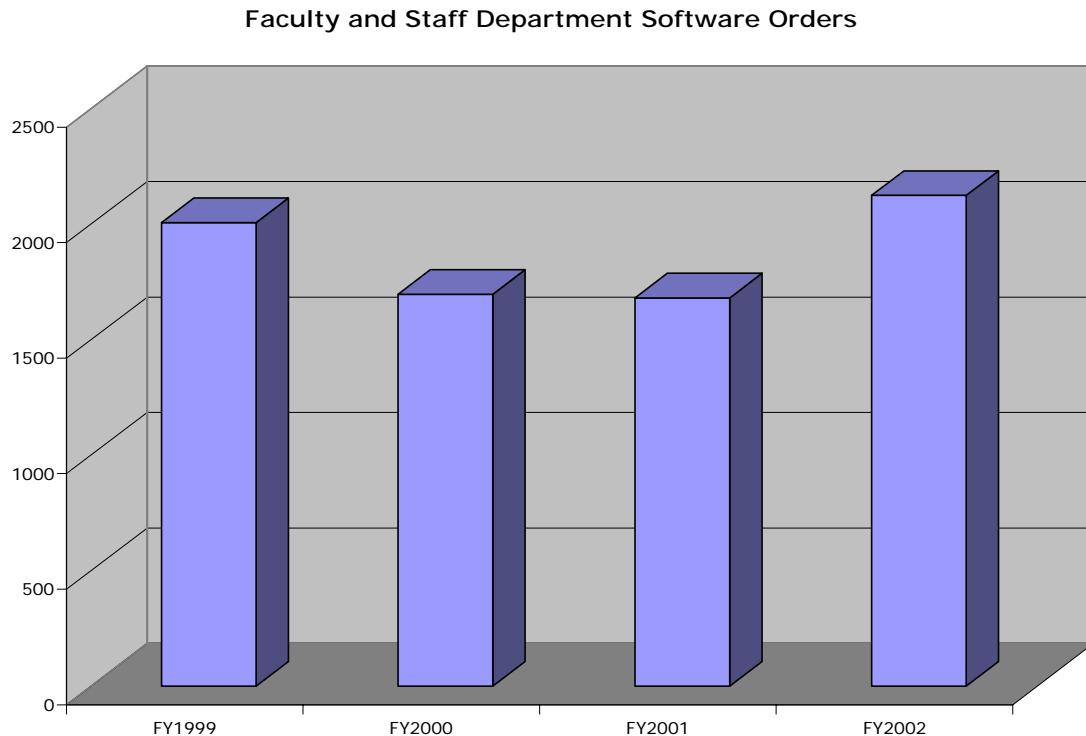
Information Resource Management

<u>Accomplishments</u>

- **Better Customer service**

    o Last March, IRM put the Banner Access Request system into
       production to automate giving banner and data warehouse access to
       new users for standard banner requests for access to HR, Finance and
       Student, Accounts Receivable, Graduate Student, and Plan of Study.
       We hope to add Financial Aid shortly. Training sessions were held for
       staff in College of Arts and Sciences, Personnel, Controller and
       Registrar's Office. Presented new process to Call Center and 4Help so
       they could begin answering questions about the tool. IRM has
       processed over 400 banner requests using this new system.

- o **Automatic generation of PIDs by new students**. *(indirect student service tool mainly maintained by NOC)*

  - Beginning Spring 2002, approximately 3200 students generated their PIDs via the web so they could register for classes online. They generate the PID before arriving at Virginia Tech or during New Student Orientation. This includes 'signing' and recording their agreement to abide by the Virginia Tech Acceptable Use (AUP) policy similar to a software license agreement. Student PIDs are no longer pre-assigned with a default password making the PID more secure and also the student can choose his PID. (At least 1500 alumni generated a PID since Spring as well; with approximately 5000 alumni having used the alumni PIDgen tool over the last 2 years.)

- o **Automatic generation of PIDs by new employees**.

  - Currently new employees can either generate the PID via the web with the new Employee PIDGEN tool or let the old batch process do it. The current employee batch process has some security concerns - default passwords, no agreement to Acceptable Use policy and unused PIDs. Over the past year, IRM and Personnel improved the process for incoming faculty. The web PIDgen tool eliminates having a pre-assigned PID with a default password. Employees 'sign' the VT Acceptable Use Policy (AUP) and the state AUP as well.

- o **New Student Orientation and Centralized Student Services** *(direct student service-1 FTE - twice a year for 3-4 days)* - provide administrative and technical support during New Student Orientation and Centralized Student Services.

- o **Answer Peregrine problem tickets** *(direct student service- 1-5%)* and direct emails to customers in a timely and professional manner.

- **Improve Security of IT Systems and Resources**

  - o **PKI Infrastructure -** In the past year, IRM was able to move from a shoe string Certificate Authority (CA) to a near production caliber configuration. An entirely new hardware and OpenCA software configuration was installed and made operational. This provided significant improvements for the usability, security and scalability of the CA service which is the **foundation for all of our PKI pilot initiatives**. Though just an open source solution, the functionality of our OpenCA service mirrors many of the features found in some of the

big name commercial CA products including the ability to issue certificates online and in batch. A high level of security was maintained by separating RA (Registration Authority) and CA (Certification Authority) services to run on different machines and keeping the CA host offline. The CA is fully capable of issuing user, server, and developer object signing certificates. Scalability was achieved by interfacing the RA and CA services to an Oracle backend database. An LDAP directory server was implemented as a method for publishing user certificates and maintaining certificate revocation lists. There was a considerable amount of effort involved in tweaking the OpenCA code in order to achieve the current level of functionality - it was certainly not a turnkey venture.

o **IDDL Digital Signature Pilot** *(direct student pilot service for one term)* –

- Two professors of graduate level Electrical and Computer Engineering courses agreed to participate in the IDDL pilot where their students would enclose homework documents within an XML form, sign the enclosure using their digital certificate on the smart card and then submit the form either through IDDL's Blackboard Drop Box utility or via email. http://www.irm.vt.edu/projects/index.html

- The test group consisted of 39 students enrolled in ECE5984 - Computer and Network Security and 35 enrolled in ECE4984 – Fundamentals of Computer Systems. To further minimize support issues, the pilot limited support to computers with Windows 98 or Windows 2000 operating systems, a USB port for the smart card reader, and Microsoft Internet Explorer 5.5 (or higher) or Netscape Navigator 4.7x, 6.1 and 6.2 (6.0 is excluded) Web browsers.

- IRM issued x.509 digital certificates from an in-house certification authority (CA) running Open Source software such as Linux, OpenCA, OpenLDAP and Apache. Certificates were batch processed and then installed on Schlumberger Cyberflex Access 16K smart cards. Participants in the pilot received a packet that contained a smart card, a smart card reader and an installation CD.

- The core application tested was an XML document enclosure form that could be digitally signed via a web browser and/or a stand-alone application. The XML form served as an enclosure for documents such as homework assignments. Users enclosed documents within the XML form, signed the enclosure using

their digital certificate on the smart card, and then submitted the form either through IDDL's Blackboard Drop Box utility or via e-mail. IRM specified that the XML form application was to be used a minimum of 5 times by each student.

- The IDDL PKI pilot was a giant step in the direction of being able to implement PKI for the university community. Users were comfortable using the technology and expressed an interest in using smart cards for applications such as e-mail, Web access and lab or building access. The technology used in the pilot performed as well as the development team had expected. However, it was not perfect, and there are still a number of obstacles that must be addressed before conducting a large-scale deployment.

- The greatest obstacle involves the process of user verification. A true PKI needs to provide a method for face-to-face verification in order to issue a digital certificate. Having some sort of issuance station in the future will be a requirement. Tying this process into the existing Hokie Passport office is the most logical solution and should be examined as a possibility.

- The second greatest obstacle is system integration for the end user. The installation package this pilot provided created the majority of complaints. The process was tedious, required a specific order of execution and only supported a limited number of operating systems. Choosing a smart card provider that offers better and more complete documentation, an easy and affordable installation package or built-in operating system support would be preferred. If this is not an option, a better installation package should be developed in-house.

- And finally, the cost of establishing a full PKI will be great. Outsourcing this service to a third party has been explored in the past and it is very costly. Deploying an in-house solution will require additional hardware and security measures as well as a dedicated staff of qualified system developers and engineers to maintain the infrastructure. Regardless of whether an in-house or outsourced PKI solution is chosen, both options will require costly and time-consuming changes to Virginia Tech's authentication services framework.

o **Strong User Authentication** - IRM has been able to successfully introduce two-factor authentication (smartcard and pin) as a way to enhance security for users who log into W2K, Solaris, and Linux

workstations.   Research and development continues in this area using Solaris SunBlade and SunRay workstations that can now be purchased with integrated card readers.

o **OSP Digital Signature Pilot** – IRM is working with David Richardson to implement the latest revisions to the OSP Approval Form. In addition, IRM plans to issue professional looking smartcards by using the HOKIE passport office card printing services. David has arranged for researchers in Mechanical Engineering to receive SmartCards for this pilot.

o **Academic/Research Pilots** *(direct student & research service)* - IRM continues to work with members of the Globus project by issuing SSL server certificates for their secure servers using our pilot OpenCA service.   IRM has also assisted the CS and Physics departments by issuing developer certificates, which they are using to publish digitally, signed java applets for their respective projects (SNAP, Sky Image Processor).

o **Managed PKI for SSL Certificates -** We have just recently completed setting up the managed PKI SSL certificate services which were purchased from Thawte and Verisign. Reduced times to process a certificate request and cost savings when compared to retail prices are immediate benefits that can be realized. It also allows us to control the certificate content so that standards can be enforced.

o **User Provisioning: -** Researched the existing security configurations for the machines in the machine room that IRM does not currently manage; identified and contacted vendors with user provisioning products; wrote an RFI which identifies what VT is looking for in a provisioning product.

o **In House eProvisioning Project - In** short time this project team has developed a working prototype based on open source for managing unix accounts across multiple unix platforms. It has been a great opportunity for us to see how open source technologies like LDAP, PAM, RDIST, and CVS can be used to provide a cost effective and secure solution for addressing our unix account management issues. Due to the recent budget deficit we are experiencing, "open source" may be the answer to some of our eProvisioning requirements.

o **Oracle security replacement** - Design, develop and implement programs to replace existing functionality associated with the SQLCQR software that is being phased out. This includes routines to track break-ins, dormant id identification and removal, last login tracking, password history maintenance, password rules enforcement,

and web tools for the administration of passwords and other id related information.

- o **PID notification process** - Developed and implemented a process to check PIDs identified for batch deletion against Banner data to remove PIDs belonging to students and/or active employees. This process also incorporated a notification process to warn PID owners and a CNS check to ensure that paid modem pool users were not cut off.

- o Designed, developed and implemented a **Banner Lookup web tool** to provide IRM and Call Center/4Help staff with employee and student information for assisting with PIDGen tool user problems.

- o **PID audit tables** - Designed, developed and implemented the user agreement capture audit tables and procedures for use with the PIDGen tools and IRM Banner Userid Password Change/Reset Tool.

- **Oracle/Banner Security** - Reviewing the security setup for the Banner OTG imaging software, aiding DBMS in the installation of the SCT Banner Security patch, redesigning Develop and developer security using new security constraints, representing security concerns in table reviews.

- **SQL-Secure Replacement –** Designed and implemented password synchronization replacement and identified the requirements for Password Management and Banner API to retain all the functionality of the existing SQL-Secure system and to attempt to make the migration as seamless as possible. *(In house solution – saved ongoing maintenance costs of approximately $10,000 per year)*

- **Middleware -** Helped design the Oracle database that will serve as the back-end repository for the Enterprise Directory; identified the data sources for the repository; reviewed the LDAP schemas including how to maintain the account states in the authentication directory.

eCorridors Program

eCorridors

Overview

The eCorridors program is completing its second year promoting the development of advanced communications. The following bullets describe the program.

- The eCorridors program is an economic development and outreach activity 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.

- **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.

- The infrastructure, once built, will complement projects throughout Virginia as new and existing community next generation network initiatives are leveraged to maximize access and minimize costs to communities.

- The program will launch a number of large-scale demonstration models focused on solving issues associated with affordability, availability, useable accessibility to advanced broadband communications for rural communities.

- Virginia Tech possesses an unusual expertise in advanced network technologies gained through design and engineering of both an award winning campus network and a statewide advanced network.

- Virginia Tech is developing a technical architecture and comprehensive plan:

o Development of advanced network infrastructure focused on the deployment of large scale communications network infrastructure based on leading edge technologies that can radically alter the economies, types and levels of communications services.

o Develop the business case identifying or synthesizing cost minimizing tactics and identifying current and potential revenue sources for advanced network services that could anchor a major deployment.

o Stimulate private sector participation and competitiveness.

- eCorridors and the **Electronic Villages Program**, directed by Mathew Mathai, have joined forces to research, identify, and evaluate network applications appropriate for an advanced network infrastructure for communities that can help drive demand, create content, and facilitate citizen utilization of the infrastructure. Application areas such as medical, educational, community/government, and cultural service sectors represent next generation network application areas that will advance quality of life and economic development throughout Southwestern and Southside Virginia.

- The eCorridors Program endorses a multidisciplinary approach to the maximization and utilization of advanced network infrastructure. As a result, the Program is working closely with a number of faculty and graduate students from **academic departments** of the university. To date, joint projects are being planned with faculty from the departments of Marketing, Education, Theatre Arts, and Urban Affairs and Planning.

Presentations

The eCorridors Program has generated significant interest throughout Virginia and bordering states. Invited presentations were given at the following meetings and conferences in 2002:

- WVA Business Summit, January , 2002, Greenbrier, WVA
- Telecom South III, Southern Growth Policies Board Conference, Jan. 23-24, 2002, Atlanta, GA
- Corridor L West Virginia Tourism Conference, March 26, 2002, Beckley, WVA
- Briefing to the VA Secretary of Commerce and Trade, April 4, 2002, Blacksburg, VA
- Presentation to Caswell County, NC representatives, April 8, 2002, Blacksburg, VA
- Presentation to Gilbert Scott, SVP; AOL Time-Warner, May 22, 2002, Blacksburg, VA

Southside Initiative Activities

During the course of the past year, much work has been done to plan, focus, and implement a strategic course for Virginia Tech's engagement with Southside Virginia. This work has involved not only the creation of plans and execution of activities, but has required tremendous effort to interface with and pull together leaders and stakeholders across many sectors of Southside as well as expertise and faculty involvement from Virginia Tech. The challenges have been compounded by a commitment to provide economic advantage through projects that are first of their kind, where there is little or no roadmap to chart a course. Much progress has been made in shaping and embracing a common vision for the future as well as obtaining buy-in and advancing planning for numerous initiatives. In sum total, we believe we are on track to create a new model for university engagement and are finding already that other communities are interesting in replicating aspects of the work to date.

Following are brief summaries of key activities in which Information Systems has been engaged during the past year in Southside Virginia:

eDan

eDan is an advanced network infrastructure project that is being implemented in Danville and Pittsylvania County by local private and public partners, with Virginia Tech in the role of catalyst. $2M of funding provided by the Virginia Tobacco Commission to the Future of the Piedmont Foundation, a local 501c3 entity, was combined with approximately $.5M of local private funds to seed the infrastructure development. These funds will finance the deployment of approximate 40 miles of optical fiber installation, from the northern part of Pittsylvania County south to downtown Danville, and the development of three Multimedia Services Access Points (MSAPs) in Danville, Chatham, and Gretna.

Over the course of the past year, project collaborators were selected, project task forces were formed, plans and budgets were developed, contracts were signed, materials were acquired, and installation was begun. In June, 2002, a fiber deployment groundbreaking ceremony was held in Gretna, the northern terminus of the fiber. To date, most of the Gretna-to-Blairs fiber route has been installed by RACO, a Pittsylvania County cable construction company. The City of Danville is installing the Blairs-to-Danville MSAP segment of fiber, and plans to have this completed by the end of November, 2002. Gamewood, Inc. a Danville-based Internet services and applications company, is starting construction of the MSAPs, and expects to have this work completed by the end of 2002. Demonstrations of high bandwidth applications have occurred throughout the year, with more planned in the upcoming months.

Southside Infrastructure

The vision for the eDan advanced technology infrastructure is that it would be part of a larger, regional network infrastructure and that Danville would be a hub point for cross-connecting major north-south and east-west fiber optic cable. Since the eDan project was launched, neighboring communities have been looking to develop network infrastructure that would connect to eDan, thus building out the network in a next phase. Conversations with communities to the south (Caswell County, NC), east (Halifax County), and west (Martinsville) have led to planning activities in those localities to implement advanced network infrastructure. A focused effort is currently underway to request funds to extend infrastructure from Martinsville to South Boston, via Danville.

DOE Grant

In 2001, a 3-year $1.4M grant was awarded from the U.S. Department of Education to the Future of the Piedmont Foundation, and is being managed by Virginia Tech. The focus of this grant is to provide the resources to initiate a sustainable faculty development program, integrating information technology into the K-12 curriculum. K-12 teachers and principals from the Dan River Region attend workshops conducted by Virginia Tech faculty, receive personal computers to implement what they've learned in the workshops, and follow-up with numerous focused activities. A portion of the grant funds also support the Summer Training Academy for Rising Stars (STARS) program, which provides opportunities for disadvantaged high school youth in Danville and Pittsylvania County to have a computer-based, residential learning experience for three summers at Virginia Tech. During the first year of the grant, an assistant project director to interface with the schools was hired, workshops were held for 124 teachers in Pittsylvania County and Danville schools, and a grant administration process was established with Virginia Tech's Sponsored Programs office.

IALR Technology Planning

The Institute for Advanced Learning & Research in Danville is intended to be a symbol of the aspirations of the region. As such it is planned to look, feel, and function as a high tech building. This year, considerable effort has gone into the definition of the information technology plan for the IALR. Audio visual equipment and network infrastructure has been evaluated and determined for each area of the building. This technology will serve classrooms (including distance education), computer labs, conference rooms, auditorium spaces, gathering spaces, and office areas. Preliminary consultation on the audio visual equipment portion was conducted by Virginia Tech, and was detailed by a technology integration company from Raleigh. Network design consultation has been provided by Virginia Tech, which is currently in the process of detailing the cabling and network infrastructure.

Academic Program Partnering

A series of meetings between the three core academic partners has resulted in the development of an academic policy framework for the IALR. The three fundamental elements in this framework are the IALR's core academic mission, the IALR as a higher education center, and partnering among Virginia Tech, Averett University, and Danville Community College. This framework will assist the academic partners in shaping their contributions so that the IALR can be a focal point in Southside for preparing citizens to participate in the network economy.

Advocacy

Significant attention has been devoted to educating local, state, and federal elected officials about the Southside initiative. Meetings and presentations during 2001-2002 have taken place with Danville City Council, Pittsylvania County Board of Supervisors, Virginia State Legislative leadership from the Senate and House as well as Senators and Representatives from Southside, U.S. Senators and Representatives and their staff, and the Governor. In addition, Provost McNamee visited twice and was provided with an overview of the Southside project and introduced to many of the key stakeholders and players.

Public Relations

Much work has been done to educate the community about the change initiatives in which Virginia Tech is engaged, in particular eDan, the Institute for Advanced Learning & Research, and the K-12 Faculty Development Program. Over the course of the last year there have been over a hundred articles referencing Virginia Tech-related activities in Southside, in the local media, Roanoke, Greensboro, Northern Virginia, and The Chronicle of Higher Education. In addition, presentations have been given to scores of groups including higher education and K-12, neighboring municipal leaders, and civic organizations. Also, numerous materials have been developed to describe initiative activities and a web site has been created which houses summary information about Southside projects: www.ialr.vt.edu

Virginia Tobacco Indemnification and Community Revitalization Commission Project

The Tobacco Commission awarded the eCorridors with a grant of $750,000 for the development of a comprehensive plan and technical architecture encompassing the e58 corridor and all communities in the tobacco growing regions.   This project, with a completion date of January 2003, will address the telecommunications interests of 34 counties in Southside and southwest Virginia. It requires the dedicated effort of the

entire eCorridors staff, along with collaborative input from academic faculty and graduate students (see academic departments, below), private sector industry leaders, and a number of technical and engineering professionals from within the University and the private sector. The final product will be a large-scale, comprehensive report outlining a benchmark network architecture and technical design for a mesh network with connect points in every county throughout the tobacco region.

Additional Aspects of IT Support for Research Activities

Additional Aspects of IT Support for Research Activities

Throughout this document support for research recurs in many of the daily activities accomplished by the IT organization. This section of the report is to highlight additional activities that play a role in supporting and improving the University's capability to conduct research.

Despite severe budget cutbacks, the Information Technology organization is actively seeking to reallocate more funding towards research computing infrastructure and support. While those reallocations are more modest than we would have desired, we will continue to look for opportunities to invest more substantially in this area.

New Programs

One such investment is the creation of a pilot program for funding graduate assistants. Initially, this pilot program is very limited by budget constraints; however, we hope to grow this pilot into a substantial program in the coming years. The initial focus of the pilot program will be to support grid computing applications, in cooperation with the Laboratory for Advanced Scientific Computing and Applications.

Another pilot program which has been created is focused on the funding of portions of full-time professional positions which will be used for system administration support. This IS&C project will provide training and some funding for shared positions, in an effort to provide a high level of systems support for academic areas.

The Research Computing Technical Roundtable has been formed, to deal with system administration and other common issues that IT professionals working in academic areas may be facing. This group is meeting quarterly and is active in providing feedback and ideas for new and better services from Information Technology.

The new Research/Cluster Computing Department has been created in IS&C. Its primary focus is to provide "super support" for research computing. This group and IS&C will provide help to beginning system administrators, deal with the more difficult technical issues that arise, stay generally aware of research computing issues, serve as a focus for collaboration among the various research entities, and market new services.

Hardware Initiatives

The Guinevere Sun E6500 system is completely dedicated to research computing faculty and is currently being heavily used. It is a part of the campus wide Globus grid, and is expected to be a major resource for that facility.

Two cluster/grid initiatives are being undertaken: a 4-node Appleseed cluster will be up and operational in the fall of 2002, and a commodity PC-based Linux cluster will also be made available. These systems will also be a testing ground for system management and grid computing application software. System administration will be provided by IS&C. These initiatives are severely limited by the lack of funds during the budget crisis.

After-hours use of some large computer labs is also being investigated for use in grid computing. Such a configuration has the potential to become a very large cluster for some portion of the day.

Commodity Services

Network Attached Storage will be made available for research purposes. This service will allow researchers to have their documents, programs, and research results stored centrally, where the storage can be managed and backed up without additional effort from the researcher. This should be available the first quarter of 2003.

Centralized Backup service is also now available for research purposes. This service is available at a small yearly fee to recover license fees and tape costs.

IS&C is providing Digital Certificates (CA & PKI) through a pilot program. Such certificates are essential to the formation of grids and to authenticate access of users to the grids.

Other services that IS&C is providing or in the process of providing are:

- Windows 2000 Central Services Domain
- Authentication by EdAuth
- Hardware and software security testing
- Operating system installation standards for Linux, Solaris, and Win2K

An easy-to-use web-based survey tool has been released to the general university community, and has been used for both instructional and research purposes. Survey.vt.edu has been used to formulate 1444 surveys in the past year, and there is still considerable usage growth for this application. Survey.vt.edu was released as open source to the public.

Web Hosting services offered by IS&C will be expanded in the coming year with a number of new services:

- Windows hosting on IIS with Frontpage support and MSSQL database functionality.
- Coldfusion application server for CF based sites.
- ASP (Active Server Pages) support.
- Database support on Unix (MySQL).

- Additional tool availability: bulletin boards, form processors, shopping carts, etc

Expanded FDI Research-Oriented Offerings

During the summer of 2002, FDI provided three new workshops for faculty: Research Presentation, Using Matlab, and Visualization and Virtual Environments. These sessions were taught by knowledgeable local faculty, and senior technical staff and were very successful. This method can be cost efficient when sufficient numbers of faculty will enroll in a particular workshop offering. We anticipate these will continue to be offered for several more seasons.

FDI will be developing additional topics focused on research computing, and will seek input from research faculty to identify both potential training needs and training resources. In the year-round training opportunities provided by FDI, we will differentiate between training topics that are broad enough to interest groups of faculty from a variety of departments and those other topics that are so narrow as to interest only particular disciplines. FDI will attempt to address both sets of needs but will likely use different strategies to provide a valued training experience.

We will also be looking at the possibility of partially underwriting a workshop that is organized, programmed and conducted by an academic department. One such workshop for spring would be code optimization for grid computing and parallel code development. Finally, we will look at the alternative of underwriting the cost of sending faculty to specialized training off-campus. For this last method to be cost-effective, we may wish to limit the offer to those faculty who agree to share what they learn by later teaching in an FDI workshop.

Security

Information Technology Security Office

Mission

The mission of the Information Technology Security Office is to provide technology tools, education, awareness, and guidance necessary for Virginia Tech to work towards a safe and secure information technology environment for teaching and learning, research, outreach, and the conduct of university business.

Goals and Objectives

- Work closely with the Information Systems & Computing, Advanced Network Infrastructure & Services, Learning Technologies, 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 Systems with plans and needs for a secure environment.
- Coordinate Business Impact Analysis/Risk Assessments and Business Recovery Plans for Information Systems, and assist as needed with areas identified as critical University systems.
- Provide assistance to University departments for the Business Impact Analysis/Risk Assessment process as needed, and maintain a copy of all for reference. Assist departments as needed for any Business Recovery Plan for their specific area(s).

Major Accomplishments and Ongoing Activities

- Education and awareness:
    - Continued to provide security presentations as invited to groups and departments.
    - Participated in almost 20 Faculty Development Institute sessions during the spring and summer of 2002.
    - Assisted orientation leaders in developing skit to be used during new student orientation.
    - Presented security session at new foreign students' orientation and a training session for new GTAs. Also participated in graduate student orientation fair, and had the opportunity to speak to a few new faculty.
    - Enhanced the security web site with new links and access to security tools for all users.
    - Assisted in hosting professional security-related programs on campus for both technical and non-technical personnel.
    - Used publications, both locally and on the national level, to promote security issues within higher education.
        - Wayne Donald profile and the risk analysis process was included in the May, 2002 issues of "Information Security" magazine.
    - Hosted Howard Schmidt, Vice Chairman, President's Critical Infrastructure Protection Board, for a visit to our campus.

- State and Federal interactions:

    - Worked with the Department of Information Technology and other State schools (JMU, UVA, and GMU) to develop and implement techniques for dealing with security issues.
    - Worked with the SANS Institute on educational opportunities for high education, and with the Center for Internet Security on tools and possible training programs.

- Business Impact Analysis/Risk Assessment (BIA/RA):

    - Oversaw the process for the Information Systems organizations – it was decided to split the process in 2002 to include four (4) separate BIA/RA efforts to reflect the organizational structure.
    - Worked with some individual University departments on updating their risk analysis. Also reviewed several risk analysis and recommended appropriate changes.
    - Made some minor modifications to the risk analysis forms and updated to the security web site.

Information Technology Security Advisory Group

A security advisory group was initially established in 1999 to meet quarterly for the purpose of discussing security concerns/issues as they relate to the information technology environment at Virginia Tech. In the early part of 2001 the membership of that group was reviewed in order to have better representation from specific areas. The list below was finalized and may be modified during the course of this plan as deemed necessary.

The group is expected to provide the Security Office suggestions as to programs/tools that may need to be implemented or taken to other areas for consideration. This group will also provide the Security Office with a resource for the discussion of ideas, and a communication link to other key University areas.

The membership for this discussion group is as follows:

- Betsy Blythe – Information Systems & Computing
- Tom Brown – Dean of Students' Office
- Jerry Cain – University Legal Counsel
- Jennifer Calhoun – Judicial Affairs
- Wayne Donald – Information Security Officer
- Carol Eggleston – Information Resource Management
- Rosie Higdon – Personnel Services
- Jeff Kidd – Communications Network Services
- Judy Lilly – Communications Network Services
- Mike Naff – Banner Systems
- William Shank – Internal Auditing
- Dixon Hanna – Provost Office
- Theta Bowden – Research Computing
- Mark Raby – Distance Learning
- Jeb Stewart – Office of Vice President for Information Systems

- Ad Hoc members:
  - o Randy Marchany
  - o Wanda Baber
  - o Phil Benchoff

Information Technology Security Office - Business Plan

Portions of the IT Security Business Plan, which was prepared in August, 2001 for a two-year period, have been included to provide reference for many activities in the IT Security Office.

The security considerations presented in the Plan are the result of needs expressed by management, groups, and individuals that have met with Security Office personnel over the past two years. Initiatives are both influenced by State requirements and by the rapidly growing technology environment at Virginia Tech. Below is the business plan for the July 2001 – June 2003 timeframe.

1) **Education and Training**

a) Improve and expand the security awareness programs for the following groups:

   i) Faculty

      (1) Utilize new faculty orientation through the Provost Office
      (2) Work with Personnel Services to include in any orientation programs
      (3) Work with FDI to ensure information is included in their sessions
      (4) Invite all faculty to information sessions to be held during year

   ii) Staff

      (1) Work with Personnel Services to include in orientation for new employees
      (2) Invite all staff to information sessions to be held during year

   iii) Students

      (1) Continue to meet with student orientation leaders during their training period
      (2) Work with orientation leaders to include more education in the new student programs
      (3) Discuss ways to educate student population with student leaders

   iv) Off-campus students/personnel

      (1) Investigate how security issues can be incorporated into the distance learning environment
      (2) Determine students and employees that are covered in this category
      (3) Determine if policies apply in the same manner
      (4) Develop plan to reach these individuals with same type of information

b) Work closely with other groups to determine needs for special security training programs in the general campus community (this would primarily involve the technical training). This might include training for areas such as specific operating systems, network issues, and such. Some individuals providing such education are listed below:

   i) Randy Marchany - UNIX and some general security areas

      ii) Ray Cornish and Marc DeBonis- Windows 2000 and NT

      iii) Bill Sanders and the DCSS annual meeting

      iv) Professional organizations on campus

c) Develop an outline and determine a schedule to publish an online "User Handbook"

      i) Provide information about the general user community

      ii) Provide linkages to important information – for example, State and Federal laws, how to be a responsible computer user, and information about exposures that are threats

      iii) Where a user can find services and tools to help provide a secure computing environment

d) *Utilize other resources at Virginia Tech to assist in the general education and training*

      i) Special speakers

      ii) Videos

      iii) Vendor opportunities

      iv) Professional organizations (such as SANS)

2) **Information Technology Business Impact Analysis/Risk Assessment Process** *(The name (and process) was changed in 2001 to become the Business Impact Analysis/ Risk Assessment.)*

a) Responsibility for annual business impact analysis/risk assessment in Information Systems.

      i) Determine if there is a need to split the organization so there will be three business impact analysis/risk assessments (IS&C, ANI&S, and the Learning Technologies areas)

      ii) Assemble business impact analysis/risk assessment team in November to begin process

      iii) Complete business impact analysis/risk assessment for Information Systems by end of calendar year

      iv) Review with IT management early in the calendar year

      v) Updates should be done mid-year and at the end of the calendar year

b) Maintain the business impact analysis/risk assessment template and monitor the departmental process

      i) Provide updated tools to complete a departmental business impact analysis/risk assessment

      ii) Provide necessary education and assistance to departments

iii) Serve as a "collection agency" for departmental business impact analysis/risk assessment – this will only be done every 2-3 years (next collection in 2003 or 2004)

iv) Work with Executive Vice President's Office to secure all business impact analysis/risk assessment

v) Provide ongoing tools and training for departments

c) Work with Internal and State Auditors to comply with State requirements

   i) Set up regular meetings with State Auditors when they are on campus

   ii) Submit reports as requested on issues monitored by this office

   iii) Work with Internal Auditing on issues that involve IS areas

3) *Maintain the IT Business Recovery Plan and work with Critical Systems areas*

a) Update the IT Business Recovery Plan beginning early in the calendar year (after the business impact analysis/risk assessment process is complete)

   i) Determine the appropriate members for the BRP team and make necessary contacts

   ii) Review the current BRP to determine where and how updates need to be done

   iii) Maintain the necessary copies of the BRP (making sure at least one is secure)

   iv) Update the BRP during the course of the year as needed and make sure updated copies are kept by key personnel

b) Work with the critical systems areas to make sure they have updated Business Recovery Plans

   i) Call on responsible individuals in each area to ensure they have reviewed and update plans

   ii) Provide assistance as needed to meet all regulations

c) Develop and implement a test plan for a specific number of Business Recovery Plans each year (the number of recovery plans tested each year will need to be determined after the test has been designed and resources are determined)

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

4) *Maintain the security web page (http://security.vt.edu)*

a) Ensure the web page is easily accessible for all users

   i) Get a link to security web page off of the VT home page so it can be easily found

       ii) Include information about web page in any educational offerings and publications

b) Keep the web page up-to-date and publicize it throughout Virginia Tech

       i) Monitor links from Security web page to ensure they are operational
       ii) Promote the use of web page (for links, templates, information, tools, etc.) to the entire University community
       iii) Regularly look for new links that will provide the users with helpful information and tools

c) Work with other State institutions to share and coordinate efforts for web sites

       i) Set up a state-wide group from higher education for security related issues in IT
       ii) Coordinate efforts and share tools used for security concerns
       iii) Look for opportunities at State-level meetings to share information

5) *Review University policies/procedures and consider necessary changes*

a) Acceptable Use Policy and related materials

       i) Ensure the Acceptable Use Policy (AUP) reaches all students, and that all faculty and staff are aware of the contents -- promote-promote-promote
       ii) Present the concept that all users be required to sign off (electronically) on the AUP before they can proceed with any processing – this may also need to be considered for other policies

b) Consider new policies and procedures that are needed with the changing technology environment. New policies should be consider for these areas:

       i) New policy on user responsibilities
       ii) New policy on Information Systems involvement with investigations
       iii) New policy on responsibility of lab machines (as well as other special machines)

c) Determine appropriate office for such policies/procedures to be maintained

6) *Develop appropriate publicity campaigns/efforts to stress security concerns*

a) Look at both expanding and moving the security office function to an on-campus location

       i) Consider using space in the new Torgersen building on campus to house a security office/function for the user community

ii) Work with Randy Marchany and the research efforts he is doing with security to house some (or all) facilities in Torgersen

iii) Work with John Krallman to have a demo area for software available from his group

iv) Develop a plan on ways to work with on campus personnel and groups to enhance the security work

b) Develop a plan and work with other offices to promote security products and practices at Virginia Tech.

  i) Establish a contact in specific user groups. This would primarily be done with technical personnel from the Computing Center.

  ii) Incorporate plans into the awareness and education efforts for this office.

c) Use various materials and techniques to promote proper use of technology

  i) Utilize the catalogue for students to highlight special issues

  ii) Consider the faculty and staff catalogues for security materials

  iii) Design, publish, and distribute posters to emphasize issues and safe computing

d) Look at what tools can be used to promote technology security issues

  i) Consider articles in Collegiate Times and other student publications

  ii) Consider articles and other promotional materials for entire university community

  iii) Discuss the use of pamphlets for distribution to a wide range of users

  iv) Utilize the security web page and consider other web pages that might reach constituents

  v) Conduct sessions on campus to bring awareness to security issues

e) Utilize resources in the various areas of the institution

  i) Instructional technologies and the remote learning

  ii) University Libraries

  iii) Department heads and administrative leaders

  iv) Student orientations and special student programs

7) **Establish a Computer Security Awareness Committee**

a) Select representatives from key campus areas to serve on an awareness committee and present to the VP for Information Technology for approval

b) The committee would meet regularly to become educated about the security issues at Virginia Tech and to discuss possible resolutions. This would be

accomplished through

i)   Seminars by security personnel both at VA Tech and from professional groups
ii) Input from a broad representation of users at VA Tech
iii) Discussions on specific security related topics

8) Develop and Improve Security Efforts with Other IS Offices

a) Work with other areas within the IS organization to develop and improve security efforts both internally and within their specific mission. Areas to be considered are:

i)   Learning Technologies
ii) Distance Learning
iii) Advanced Network Infrastructure and Services
iv) Information Systems & Computing

b) Consider instructional needs for current employees and those hired in the future.

Information Technology Security Lab

Executive Summary

The Information Technology Security Lab (sometimes referred to as the Computer, Appliance and Network Defense Initiative) was created in September of 2001. The VA Tech Computer Incident Response Team (VT-CIRT) has been recognized internationally for its work in incident response, system administration training and its work with the Center for Internet Security (CIS), SANS Institute, NSA and FBI. The CIS and the SANS Institute were the sponsors of an initiative to create a testing facility that would determine the security settings of "Network Appliances". These devices include computers, laser printers, parking gates or any device that is capable of communicating over the Internet. In general, these devices are shipped to customers with minimal security installed and consequently, these devices were used in small scale Distributed Denial of Service (DDOS) attacks at various sites around the country. Patricia Jackson, Associate Vice President for Information Systems and Computing was instrumental in the creation of the Laboratory. She agreed with the CIRT that a testing facility would be of benefit to VA Tech's Information Systems initiatives. The laboratory was created on 10/1/01 in 3210 Torgersen Hall.

Mission

The laboratory's mission:
- Design, develop and implement training materials, classes (in-person and online) to University technical and general users.
- Coordinate all technical and general user security issues under the direction of the Virginia Tech Information Technology Security Office.
- Test computer hardware and software for security vulnerabilities and provide guidance for addressing these vulnerabilities.

Scope

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

Project Goals

1) Technical Education

   a) Develop and provide computer security guidelines for VA Tech system and network administrators.
   b) Develop and provide Information Technology Acceptable Use training for general users (faculty, staff and student) with the cooperation of the University Information Technology Security Office.
   c) Develop and conduct system administration, computer and network security training classes (in-house and online) for system and network administrators within and outside of the University. This includes professional organizations, conferences, state and federal government agencies.
   d) Coordinate computer and network security training classes and material with distance learning initiatives at the academic and continuing education levels.
   e) Develop marketing strategies to "sell" computer and network security to the general user community.

2) Computer Incident Response Team and Security Initiatives

   a) Coordinate and manage all security initiatives with Information Systems & Computing in coordination with the University Information Technology Security Office. Define guidelines and procedures for the six phases of Computer Incident Response: preparation, detection, containment, eradication, recovery and follow-up.

      i) Coordinate response to system and network attacks
      ii) Coordinate with external CIRTS.
      iii) Maintain and manage VA-CIRT.

3) Academic Instruction

   a) Assist the Electrical and Computer Engineering (ECE) Department develop system administrator intern program.
   b) Assist the ECE Department in teaching graduate level Computer & Network Security Fundamentals course.
   c) Provide online materials for computer and network security distance learning classes.
   d) Provide guest speakers for undergraduate and graduate level classes offered by University colleges on computer and network security topics.

4) Security Testing and Certification Laboratory

   a) Serve in partnership with the Center for Internet Security (CIS). The laboratory is the testing site for certification of compliance of vendor security software with CIS benchmarks.
   b) Develop methodology for testing security of network capable devices such as printers, data acquisition devices, modems, environment control systems, and medical equipment.

      i) Create security guidelines for these devices

   c) Develop methodology for testing security of Unix, Linux, Windows 2000, Windows XP and Macintosh systems.
   d) Develop and implement forensic kits for Unix and Windows systems.
   e) Develop and update computer and network minimum security benchmarks for Unix, Windows, Apple and network devices.
   f) Work on security initiatives with the SANS Institute, FBI, Center for Internet Security, NSA, Federal and State agencies.

5) Professional Society, training conferences

   a) Provide speaker to local, state, regional, national and international conferences on computer security issues.
   b) Host regional and national security conferences and seminars for peer organizations.

Major Accomplishments and Ongoing Activities

- Technical Education

  o Worked with the SANS Institute to "donate" 3 days worth of instructor time for seminars on Active Directory Security, Freeware Security Tools,

and Computer Forensics. Had 100 technical personnel from Virginia Tech attend, as well as 200 from other institutions – all at no cost.

- o Assisted Wayne Donald in Faculty Development Institute security presentations, as well as other presentations during the summer (including several faculty and student orientations).
- o Provide technical security seminars with University Leadership for various University departments.
- o Completed a 3-day security seminar for CE on securing Solaris.

- Computer Incident Response Team and Security Initiatives

  - o Participated on the response team and assisted other Information Technology personnel in determining appropriate problem responses.
  - o Completed a draft that provides detail procedures for the response team.
  - o Reviewed and provided input on the State's Information Technology Security Standard.
  - o Have participated on a committee with security personnel from GMU, JMU, and UVA on a State coalition project.

- Academic Instruction

  - o Taught a graduate security class last semester for College of Engineering. Also work with undergrad and grad students doing independent studies.

- Security Testing and Certification Laboratory

  - o Established the testing lab in 3210 Torgersen Hall. It was created with 16 machines (Linux, W2k, AIX, Solaris, Mac), workbench tools, and printer support.
  - o All new versions of the Center for Internet Security (CIS) tools are being tested in the lab before release.
  - o Have tested vendor security tools at the request of the vendor.
  - o Virginia Tech received $100K of free services from Symantec for providing probe data to Symantec for the ARIN early warning network service.
  - o Secured a contract with Tripwire that includes several "perks" for Virginia Tech (heavily discounted and research opportunities).

- Professional Society, training conferences

  - o Given talks at various conferences around the country – ACUA, SANS, NMIA, and Naval Weapons Lab.
  - o Provided instruction at various SANS conferences.
  - o Gave a security presentation to Secretary of Technology during his visit to the Tech campus.

- o Spoke to the Secure Virginia Panel (twice) at the request of President Steger about technology security issues.