

**Library Services and Resources for University Communities**  
**SEBIB Library Directors' Seminar**  
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Higher education systems are being challenged as confidence in educational institutions declines, at least in the United States. This produces, among other things, demands for more accountability and productivity from governing boards and funding agencies. In partial response are ambitious technology programs such as those that support asynchronous (or networked) learning in addition to the traditional classroom teaching and learning situations.

As networked learning makes inroads throughout academia, changes are taking place in campus information systems. Academic libraries, as the entity responsible for serving the information needs of the university, have little choice but to change dramatically. Academic libraries, of course, have a history of aggressively adapting state-of-the-art technologies. For example, they have decades-long involvement with the development of online catalogs and the use of shared cataloging utilities. Libraries continue to serve teaching and learning in higher education by taking on new roles, revising traditional services, and eliminating time and space constraints.

Libraries have, perhaps, been slow to adjust organizational structures and processes that would leverage the potential of technology. While change is incremental rather than dramatic, patterns are emerging in resource reallocation and the formation of partnerships with other university units that reflect new and changing priorities.

Academic libraries are providing new and unique sources of online information such as two that I'll focus on today. VIVA (the Virtual Library of Virginia) is funded by our state legislature to encourage collaboration among the state's institutions of higher education and to support the electronic dissemination of information. The Scholarly Communications Project, is a library department that works with university faculty and staff to implement online electronic scholarship and has dealt with such issues as archiving and Web access, as well as copyright and publishers' control of academic publications. Both are emanate from library constituencies that included Virginia Tech.

Network-based access to information resources such as these is changing higher education and libraries are adjusting their policies, processes, and services.

## **The Institutional Context**

Recently many institutions of higher education have begun to reconsider policies and procedures due to of closer scrutiny by their governing boards and funding sources. One result is that traditions such as tenure, shared governance, and the focus on conventional degree programs are being challenged and modified. Rising costs and declining budgets demand increased efficiency while changing demographics demand programs that are responsive to a more diverse population of learners. Sometimes the result is that higher education is compelled to operate more like industry in considering the needs of its clients. Reductions in state support at a number of American public universities combined with additional regulation are leading to a renegotiation of institutional roles as state agencies. Both the benefits and constraints that state support imposes are being reconsidered in light of new economic realities. [1] [2]

Computing and telecommunications technologies are perceived by many to have the potential to deliver networked instruction that will enable higher education to respond to its critics, meet assessment requirements, and garner sufficient revenue to remain viable in a new century. In response to user needs and demands coupled with changing computer technologies, academic libraries have moved beyond automated access tools like online catalogs and indexed databases. Libraries now also deliver network-based journals, theses and dissertations, images, class materials, and regional and international news reports online. Libraries collaborate with others in the academy, for example teachers, editors, and researchers, as well as with commercial publishers to provide access to materials that support the entire university community, whether on campus or off--the traditional teacher and learner as well as those using networks for asynchronous education and research.

Until the early 1990s most universities operated primarily in the time-honored manner. Faculty-centered education was imparted to students who resided locally. Field faculty and staff provide extension services in the conventional way throughout a region. Library services were largely delivered in the customary, building-centric manner.

More recently, however, innovators throughout the university community, including those in the library, have developed new processes that use the network to

provide access to extended campus learners. In a statement about the university plan for the near future, Virginia Tech's president said

. . . we must not only anticipate but lead the *revolution in information technology* that gains momentum daily. The end of distance as a determining factor in the cost of communication; the advances in teaching and learning made possible by interactive digital technology; the opportunities to combine knowledge in new ways to create new visions; and the power to reach out to the community, the Commonwealth, and the world--all of these afford us enormous opportunities but also risks if we fail to take advantage of them. Finally, *changing demographics as well as shifting patterns of education and employment* require that we become more agile and responsible to the demands for our services--statewide, nationally, and internationally. [3]

Participation in the technology "revolution" requires a transformation of policies, processes, and the interactions among the constituent groups of the university community. Through the use of technology, universities have "enormous opportunities" while at the same time the members of the university community confront tremendous challenges.

It is one thing to have the technological potential to extend educational programs and improve instructional quality and faculty productivity, but quite another to re-engineer the Academy. In recent years many books have been published that point to a decline in the quality of universities, especially relative to undergraduate education. These range from constructive and thoughtful critiques, to shrill polemics, but in each the basic notion is that colleges and universities must be convinced "to rethink their relevance in today's world," [4] an important issue that you may be contemplating also.

This call for relevance and change reflects the fact that universities have delivered instruction, and their libraries have delivered resources and services, in the same way for decades. The reasons are many, including the lack of resources for rewards, which, despite efforts to the contrary, continues to emphasize research to the neglect of

undergraduate education and user-oriented services. One more factor that makes the response to current attacks so difficult is that critics are applying *corporate* values as a measure of success to higher education's restructuring efforts, not the criteria by which universities are accustomed to judging themselves.

Until recently, students have been a largely captive audience, and educators have considered the market for networked, electronic course materials to be primarily non-traditional students or "distance learners." With the prevalence of digital technology, institutions of higher education are able to extend their reach and deliver networked learning materials throughout the world. A national or international information infrastructure that permits the distribution of quality instructional materials and their purchase from a number of sources and transmits them to an individual's workstation, will eliminate time and space constraints and allow structured but asynchronous learning.

In the future, efficient cost-effective learning for traditional as well as non-traditional students will be delivered on demand by access to remote learning resources through affordable communications and information technology. Speculate what the impact on universities will be if the best calculus course originates at Stanford University, the best statistics course at Virginia Tech, the most effective language teaching at the University of Geneva, and these classes can be delivered anywhere on the globe at a reasonable cost. In such an environment, a number of questions arise about the relationship between students and universities, including these: **[summary slide, DO NOT READ]**

- Will students choose to purchase and enroll in open market, widely available networked courses regardless of institutional affiliation?
- Will students continue to be content having all or most of their courses taught at a particular institution?
- Will a calendar of semesters, summer breaks, and credit-for-contact hour continue to be the rule?
- What will a plan of study look like in a networked environment? Who will design it? And, who will award the degree?

- Will institutions assist students in choosing appropriate instructional materials from outside sources rather than providing an entire program of study?
- What about tuition payments and residency requirements?

When you consider these issues and others, it becomes clear that information technology will increase the amount of choice students have relative to instructional content and style by changing the way students, educators, and educational institutions interact.

What about the relationship between students and libraries in this new environment? In fact, learners often realize before faculty, the importance of the role libraries play for students engaged in distance education. [6] [7] Accreditation is another factor in motivating universities to provide strong library support of distance education, according to one set of university accreditation criteria [8] and the recent draft revision of the Association of College and Research Libraries' "Guidelines for Extended Academic Library Services." [9] The changes in information technology modify the mechanics of higher education's degree-granting process, and these in turn require that educational support services such as those provided by libraries to be delivered through the network.

What does this mean for academic libraries? As the entity responsible for serving the information needs of the university, academic libraries appear to have little choice but to change dramatically. Like their parent institutions, these are some factors making change inevitable: **[slide, DO NOT READ]**

- decreased resources
- increased costs
- pressure for additional productivity and accountability
- network-based information delivery
- changing patterns of scholarly communications
- asynchronous and off-campus instruction
- importance of computer and telecommunications expertise

**[VT Ulib's homepage]**

Libraries are responding to these factors by aggressively in adapting state-of-the-art technologies. They have been involved for decades with the development of online catalogs and shared cataloging. Recently many libraries, like Virginia Tech, for example we moved from Telnet access to a Web gateway for our online catalog. As these online catalogs move from in-house to Internet access systems, libraries took the initial steps to extend many traditional resources and services beyond the campus. Improvements include electronic reserve systems providing online course materials, hosting works such as online journals that the faculty edit and graduate student works such as electronic theses and dissertations, and automating document delivery and interlibrary loan systems. Libraries have assumed ... “primary responsibility for identifying, developing, coordinating, and providing library resources and services which meet both the standard and the unique information needs of the extended academic community.” [9]

Despite some aggressive technology initiatives, libraries have been slower to adjust *organizational* structures and processes to leverage their potential. As you know, “The new technology per se is not a revolution—the revolution is the difference that technology makes in how we organize, structure, and empower our lives.” [10] While surveys such as the one conducted for the Association of Research Libraries (ARL) in 1996 demonstrate that change in libraries is incremental rather than dramatic, we can see patterns emerging particularly in resource reallocation. Libraries have also formed partnerships with other university units that reflect new priorities and emphasize networked resources and services.

### **The Virginia Experience**

In the state of Virginia and at Virginia Polytechnic Institute and State University (Virginia Tech), there are initiatives currently underway that move libraries a giant step forward in the delivery of networked information. The first one I’d like to tell you about involves all of the state’s academic libraries and is called VIVA, which stands for the Virtual Library of Virginia.

#### **[VIVA homepage]**

In the early 1990s Virginia began to build support for lifelong learning that would promote the state’s economic development in the information age. During the summer

of 1993 the Subcommittee on Networking of Virginia's Library Advisory Council proposed the foundation for the Virtual Library of Virginia with a two-part mission. It recommended improving access for its faculty and students to collections, both shared access to online library resources and coordinating collection development by Virginia's academic libraries.

### **[VIVA institutions map]**

VIVA is now a consortium of the 39 state-assisted colleges and universities (on 52 campuses): nine four-year comprehensive colleges and universities, 24 community and two-year branch colleges (on 37 campuses), and six doctoral institutions. Participation by the community colleges was particularly important since there is a branch of the Virginia Community College System in every legislative district and the legislature is the ultimate funding source. With the added participation of the 28 independent and private institutions, all of Virginia's institutions of higher education benefit from cooperative purchases. The library directors of the six doctoral granting institutions, plus representatives from the four-year colleges, the community colleges, and the private institutions, lead the VIVA Steering Committee.

VIVA's leadership developed "Principles of Selection Criteria" to address some of the difficult, pragmatic issues involved in such an ambitious undertaking. Establishing a model for asynchronous learners, the "Statement of Principles" says that "VIVA seeks to provide students and faculty anywhere in the Commonwealth [with] convenient access to the information resources needed to support the missions of its parent institutions, including distance education and other evolving programmatic initiatives." [11] One goal is to position VIVA strategically to exploit rapid changes in scientific and scholarly communication, to be a catalyst for such change, and to facilitate the cost-effective acquisition and distribution of intellectual resources that are specialized or lend themselves to shared access. Within the first year of operation VIVA established the technology base necessary to deliver information in all electronic formats to all the academic libraries.

The task of supporting the electronic dissemination of VIVA's information resources is the responsibility of the libraries at the six doctoral-granting institutions. These hubs service their regions and operate as the central archive and the single source of access for purchased databases stored at the individual sites.

### **[selection criteria slide]**

Twelve "Selection Criteria" provide substance to the VIVA philosophy and near-term as well as long-range goals. For example, widespread access to general bibliographic databases was an early priority, while a later goal was to identify basic electronic titles to which all libraries should have access. VIVA purchased a number of electronic collections, including online indexes, full-text English and American literature databases, the *Britannica Online*, and the *Oxford English Dictionary*. Negotiations for additional collections are ongoing; recently *Dow Jones Academic Edition* was added. Once basic virtual library user needs had been met, VIVA acquired more specialized scientific and scholarly resources.

VIVA interlibrary loan guidelines also benefit all the participating institutions. Specific practices include not charging members for interlibrary loan services; completing these transactions within 48 hours; and being as responsive as possible. An explicit standard is to act in accordance with the US copyright law.

VIVA has improved collection access for Virginia's faculty and students, both shared access to online library resources and the coordination of collection development with enhanced support for interlibrary loan. "The virtual library project provides evidence that investment in cooperative technologically based projects can produce new ways of doing business and dramatic changes in efficiency and effectiveness." [12]

### **[VIVA budget slide]**

When Virginia's legislature provided the initial funding for VIVA, it appropriated \$5.3 million for 1994/1996. Funding continued with \$5 million allocated for next biennium. Current funding, for 1998/2000, the state includes a base budget of \$2,015,000 each year and New Initiative funds in the amounts of \$250,000 for 1998/1999 and \$520,000 for 1999/2000. In addition, \$555,700/year has been added to the public institutional budgets for VIVA priorities.

In addition to the resources allocated through the legislature, individual institutions support VIVA in a variety of ways, most notably through the time contributed by library staff. The estimated financial benefits through group purchases (that is, money saved over what would have been spent if each institution had individually purchased the resources), as of March 30, 1998, was over \$18 million.



These are often resources that many of the schools would not have been able to purchase in an electronic form without state support of this consortium. [13?]

From the first funded biennium to the second, the focus of VIVA moved beyond the initial goals of working together, eliminating unnecessary duplication, and avoiding creating a new central bureaucracy. Focus subsequently moved to improving interlibrary loan, expanding electronic collections, encouraging cooperative collection management, and providing access to special collections.

Because of VIVA, academic institutions in Virginia have also received support to develop online access to many unique historical resources. The **VIVA Special Collections** homepage links to finding aids, inventories, and guides. VIVA funding supported digitizing, purchasing equipment and software, and employing student workers who scanned images and entered identifying information. The participating institutions focussed on digitizing materials that can be used, in particular, by schools in the celebration of the state's 400th anniversary in 2007.

User authentication became an issue as increasing numbers of students used independent Internet service providers. Because of licensing agreements with information vendors, initially access to some VIVA resources was dependent on students using their campus networks so that IP (Internet Protocol) addresses could be validated. Spring 1997 saw the implementation of three different prototype 'user authentication' projects at Virginia Tech, George Mason University, and Old Dominion University. To validate students who are using network access outside of Virginia Tech, for example, they can configure the Netscape proxy, using their campus PID (Personal Identification, and also their email user ID) and password, to reach restricted VIVA resources. I'll elaborate on this when I describe electronic reserve and online class materials.

## **VIVA Conclusion**

The combined benefits to Virginia's institutions of higher education means that both purchased collections as well as unique digitized materials are available through additional VIVA-funded equipment, services, and technical assistance. Cooperative electronic collection development and management has led to financial benefits for the institutions and, therefore, for the state. Virginia's libraries play a strong role in the

state's efforts to revitalize higher education through technology. "As institutions of higher education restructure to improve faculty and staff productivity, use technology, enhance learning, and avoid duplication, VIVA enables libraries to play an important role in that transformation by providing networked information resources that can be used by teachers and learners in a 'virtual' learning environment." [14]

Now I'll continue to narrow the focus to library resources and services, drawing largely from **Virginia Polytechnic Institute and State University**.

### **[VT homepage]**

Since its founding as a land grant college in 1872, Virginia Tech has grown to become the state's largest institution of higher education. A research university located in southwest Virginia, its enrollment includes 24,812 on campus students with 83 percent undergraduate students and 17 percent graduate students. 59 percent are men and 41 percent are women. There are approximately 1,425 full-time instructional faculty, providing a student-to-faculty ration of 17:1. The university employs 4,000 other staff members.

### **[8 colleges]**

Virginia Tech offers about 200 degree programs and about 70 bachelor's degree programs through its seven academic colleges. On the postgraduate level, the university offers about 120 masters and doctoral degree programs through the Graduate School and the Virginia-Maryland Regional College of Veterinary Medicine. Virginia Tech produces 40 percent of the state's Ph.D. graduates. The academic calendar includes two semesters and two summer sessions.

The university conducts a \$143.8-million-a-year research program, which places it among America's top 50 in terms of research expenditures. Among the more than 3,500 projects is the Electronic Theses and Dissertation Project. We received funding from the US Department of Education's Fund for the Improvement for Post-Secondary Education for \$263,000 over three years.

All campus facilities, including residence halls, are connected by more than 1,000 miles of fiber optic cable providing voice, data, and video communications. Virginia Tech leads the nationally recognized Blacksburg Electronic Village project, connecting the town and campus with each other and the world. In our town, over 60% of the residents have Internet access in their homes.

For almost a decade, initiatives such as the Blacksburg Electronic Village and directives from Virginia's higher education oversight agency (SCHEV, the State Council of Higher Education in Virginia) encouraged the use of technology to increase administration and teaching productivity and to emphasize extended campus programs.

Virginia Tech has earned a reputation through the innovative use of instructional technology. Media Services, formerly called the Learning Resources Center, has existed since the early 1970s. The Center for Excellence in Undergraduate Teaching was created to foster instructional excellence and innovation. And, recently the Center for Innovation in Learning was established and endowed with substantial funds to support the development of online courses and to provide an infrastructure (i.e., technical support). This Center also serves as an umbrella for coordinating communications and developing partnerships focused on integrating technology in learning.

In 1993, the Vice President for Information Systems and the University Provost (i.e., chief academic officer) jointly proposed and funded an Instructional Development Initiative (IDI) to further encourage and provide incentives for faculty to use instructional technology. The IDI has three goals:

#### **[IDI goal 1]**

The first goal is faculty development. The IDI provides the opportunity for all instructors in the University to receive training through the FDI, Faculty Development Initiative. The FDI is designed to motivate faculty members to investigate, create, and utilize alternative teaching strategies. In addition to instruction, participants who complete the program receive state-of-the-art technology, both hardware and software.

#### **[IDI goal 2]**

The second goal of the Instructional Development Initiative concerns student access. Information Systems advises students about their investments in computer technology in order to maximize its usefulness during their college careers. Students, who do not have their own computers, may use one of 12 computer labs on the main campus.

In addition, students receive network-based training materials to ensure that they have a basic foundation in the use of computing and instructional technology resources. As of August 1998 all incoming students are required to own a computer. This requirement prompted a rethinking and expansion of student technology support.

### **[IDI goal 3]**

The third and final goal involves course development. Faculty members receive support to develop network accessible courseware. In addition, the Instructional Development Initiative encourages faculty to put into electronic formats the materials that support their courses and contribute to the building of digital libraries. A component of this goal is improved classroom and presentation facilities that support faculty efforts to introduce new technologies into core curriculum courses. [1]

With the focus on faculty and their electronically enhanced courseware, less emphasis was given to an almost more difficult challenge--devising a coherent, plan and an online presence for marketing library, bookstore, and student services. Now I'd like to describe two technology initiatives that support Virginia Tech's "Academic Agenda." These were developed outside the usual organizational mechanisms by people who recognized a need and organized themselves in response.

### **The Virginia Tech Experience**

Virginia Tech Online (VTOonline) and the Scholarly Communications Project (SCP) are two initiatives that are largely the result of self-organizing, collaborative work by information systems and library personnel with administrative and academic faculty members. Each initiative provides electronic support services and takes advantage of the network's capacity to reach the global community. The first, VTOonline, serves as a single point of contact for all computer-mediated instructional, administrative, and information services that is available at Virginia Tech.

#### **[VTO homepage]**

Created in response to a number of needs, VTOonline is a work in progress. One of its goals is to provide students with more efficient access to online and electronically enhanced courses through a single Web site that presents all of Virginia Tech's electronic learning opportunities and information services. Though most college and academic departments point to the online work of their faculty, before VTOonline, Virginia Tech did not display in a coherent way the extraordinary and creative work that is the result of the Faculty Development Initiative. Innovative programs hid several layers under the main Virginia Tech homepage. These are the goals of VTOonline:

### **[VTO goals slide: READ]**

- To support student enrollment in electronic courses by providing links to services such as online enrollment, financial aid, transcript and registration processes, University Bookstore order forms, electronic reserve, and information resources
- To encourage the development of additional online course materials by providing links to support for faculty members regarding the design, delivery, support (such as electronic reserve), and assessment of innovative, computer-mediated teaching

### **[VTO homepage in French]**

- To demonstrate that Virginia Tech wishes to recruit and retain international students by providing, VTOnline in a number of languages.

VTOnline also presents information concerning degree programs, short courses, extension activities, and public service initiatives. It links existing and new network centered teaching initiatives, ranging from course and program innovation to intellectual property policies, assessment, and evaluation practices.

From a planning and policy perspective, almost as interesting as the operationalizing of VTOnline is the process through which plans and implementation decisions were made. Many in the university feel that in the new context for higher education the traditional governance system is a hindrance rather than an asset. It takes too long to move a policy through the system or to gain the necessary approvals for a new course or acceptance for major revisions to an existing academic program. The governance system also does not operate in the summer because many students are not in residence and faculty members with academic year (or nine-month) contracts are unavailable. This is not an acceptable time frame in a climate where the accelerating pace of change combined with legislative and governing board assertiveness requires expeditious decision-making.

The network can be a metaphor for a new work style and organizational culture. Rather than working within organizational boundaries to implement VTOnline, a group of teaching and library faculty, information services and educational technologists, systems analysts, graphic designers, and admissions staff collaborated on an ad hoc

basis. Information technology fairly rapidly creates new mechanisms for collaboration, communication, and building virtual communities.

As a result of networks, universities and their information services organizations are in transition. The evolution of scholarly communications through electronic media is ongoing and becoming more intense. Technology-mediated asynchronous learning and support services hold great promise, and because of networked-based information delivery there are more options for people who want an education beyond high school. In the years ahead many students will have different constraints and aspirations from today's students. The innovation required to meet the needs of these students and to support scholars in a digital environment will change what universities, their libraries, and information services organizations do, and the way they do it. Now I'd like to narrow the focus to change in academic libraries and use University Libraries at Virginia Tech as the primary example.

#### **[VT Library Holdings]**

#### **[VT Library Expenditures]**

#### **[VIVA Resources]**

### **University Libraries**

The mission of the University Libraries is to meet the instructional, research and service needs of students, faculty, and staff at Virginia Tech. The libraries, established in 1872 with just 500 volumes, have grown to include 2 million printed volumes. Here are other facts about the library.

#### **[VT Library Activity]**

The collections are fairly centralized, with a large part housed in Carol M. Newman Library, the main library building. There are also four branch libraries: Art and Architecture, Geosciences, Veterinary Medicine, and the Northern Virginia Graduate Center. The libraries are open to the public, and all Virginia residents may borrow materials. We circulated nearly one-fourth of the collection last year, excluding interlibrary loan transactions and reserve materials.

#### **[VT Library Personnel]**

University Libraries has a professional staff of 37 faculty who are held accountable to standards comparable to the teaching faculty and are similarly evaluated

for tenure or continued appointment in their 6<sup>th</sup> year. In addition, the Libraries employ 97 staff and hundreds of students.

One of the most innovative features of our library faculty is the Collegiate Librarian/Information Officers known as CLIOs. Librarians work in the Colleges of Agriculture, Arts and Sciences, Business, Education and Human Resources to provide on-site information services. In collaboration with academic faculty the CLIOs assist with the integration of library and information literacy skills into the curriculum, furnishing specialized contacts for graduate students, and serving on college committees.

### **[SCP homepage]**

Another initiative that reaches far beyond the walls of the library is one whose goal it is to use technology to experiment in scholarly communications and to prepare resources and services to meet the needs of today's as well as tomorrow's faculty and students: The Scholarly Communications Project. It is an extension of the traditional library that enhances services and adds value to library resources through networked activities.

The professional literature for library as well as computer science is rich with jargon and a term currently in vogue is “digital library.” Unfortunately, too many authors write as if a digital library is a database of online resources, distinct and separate from a library. They ignore that libraries provide user services as well as materials in a variety of media, including digital. For nearly a decade, libraries have not only provided links between users and digital resources; some libraries, like Virginia Tech's, are the originating source of online information. The Scholarly Communications Project (SCP), a department within University Libraries at VT, has nearly ten years experience in storing and providing access to original electronic works and in designing online systems that improved library services by adapting and enhancing them for the Internet.

### **Background**

Since its establishment in 1989, SCP's goals are to work with developing Internet technology so that faculty can experiment with new forms of scholarly communications-forms beyond the scope of the academic journal in print, for example. Since then, the SCP has developed the library's electronic reserve system, built and maintained the

infrastructure for ejournals and electronic theses and dissertations (ETDs), conceptualized and developed a digital image storage and access system, and worked with regional and international agencies to put timely news reports online.

These and other digital initiatives combine the traditional library focus on collection development and user-friendly services, and farsightedness that leads to a content-rich future, even when predicting that future in clear detail is not possible. Library services such as those provided through the Scholarly Communications Project support innovative teaching and learning environments while continuing to support traditional classrooms and individual research and scholarship. This is one way an academic library incorporates digital library operations to serve the university far better than the traditional library or the digital library could independently.

To initiate and sustain new forms of scholarship and to support and improve library services for the whole university, University Libraries has allocated staff and other resources to the Scholarly Communications Project. It is not enough to accumulate digital resources and provide storage and access systems; SCP also assumes the responsibility to help users discover and use its resources. SCP staff assist editors, authors, and publishers to put their works online, and increasingly support user access to these works through one-on-one contact including via e-mail and telephone, and also through presentations to workshops and classes, and soon through the incorporation of metadata.

A compelling need to provide user-friendly services and access is where the traditional library with digital resources differs dramatically from the digital library that may be content rich but service poor. After designing and implementing computer programs, the unpredictable human element often requires human-to-human interaction. SCP combines rich digital content and automated access and storage systems, with user-friendly library services.

From its beginning in 1989, SCP staff and the faculty at the university who requested their support have provided the unit's direction. We collaborated to determine what experiments to conduct, resolve questions arising from the user community, address issues raised by the technology, and determine how to meet the needs of users and clients. SCP has grown from a behind-the-scenes and technical



support unit, into a prominent role as liaison to students, staff, and faculty developing and using online resources and services.

### **[Electronic Journals]**

One of the initial activities of the SCP was to determine how to publish an electronic journal. By the time the first issue was ready in the fall of 1990, a desktop computer was rigged to also be a Gopher server and the *Journal of the International Academy of Hospitality Research* went online as ASCII text. In the ensuing years the SCP migrated this and three more ejournals from Gopher to the Web and added another 16 titles to its roster. Seven are available in multiple electronic formats, most often HTML and PDF.

### **[EJ format chart]**

Eight of SCP's ejournals are the Web equivalents of printed academic journals, enhanced with hot links and 24-hour access. Fifteen titles are currently available with four more under development. Forty-five percent are electronic-only journals. All are associated with scholarly societies or professional associations; and four are mirrored for MIT Press. Four publish individual articles as they complete the peer-review cycles and editorial processes, while the remaining 13 replicate the delays inherent in a traditional academic journal. Only three are not full journals. *The Journal of Fluids Engineering* provides the data authors used in the research for their articles published on paper. *The Journal of Youth Services in Libraries* releases tables of contents through the Web, and *Modal Analysis* emailed abstracts as articles were accepted for publication.

SCP makes it easy for faculty editors to put their journals online by providing them with flexible guidelines. All they are required to do is submit the journal in a popular word processing file format and our staff does everything else necessary. There has, however, been a continuing increase in the level of technological expertise among our faculty editors. For example, they no longer want to know which word processor they should use, they want to know if SCP will accept PDF files in addition to HTML. While articles in HTML are each separate files, editors prefer that one PDF file contain an entire issue of the journal.

### **[EJ stats slide]**

The initial goal of most new ejournal editors is to educate their subscribers. They reason that publishing online will give their subscribers have an incentive to use the Internet; then they will navigate to other Web sites and expand to online research. Among the current full text ejournals available from SCP, the number of accesses to each title increases every year. For example, the number of accesses to the *Journal of Technology Education* increased 1641% in 1995, 67% in 1996, and 58% 1997. Editors rely on the library to provide the access and archives (including security, back up and preservation functions), as well as to support their readers and their students as they branch out to use other online resources.

### **Faculty and Students Build the Digital Library**

SCP receives almost all of the resources it stores and provides access to in digital formats and this is one reason the small staff accompanied by revolving student assistants can accomplish a so much. (There are 1.5 full time positions, a full time programmer/systems administrator, and me, director of SCP and head of the Special Collections Department). Converting from hard copy to digital formats on a production scale is not in the library's past and it is not a current or forthcoming service. An increasing number of ejournal editors submit PDF files with word-processed text. SCP students convert the files to Web-friendly displays and link citations to references.

When SCP designed the library's electronic reserve system, we gave faculty various formatting options for making class materials available online, but we did not offer, and very few asked us, to convert print materials to digital formats. There are two reasons for this: (1) digitizing equipment and software and individual assistance is available in the library, and (2) Virginia Tech faculty receive equipment, software, and formal training to improve teaching and learning including creating works for the online environment.

### **[NMC]**

The New Media Center is a sophisticated and well-staffed computer lab located near the Reference Desk in the main Virginia Tech library. Open to the public, The New Media Center has 21 G3/233 MHz Power Macintoshes with PC compatibility and 18 Apple Color One Scanners, as well as more specialized equipment in an adjacent

development lab. Four full-time staff and three FTE student assistants are well-trained and have experience with software applications in graphics, desktop publishing, word processing, Web development, 3-D animation, CD-ROM development, digital video, digital audio and other multimedia areas. Consulting services are available by phone and at faculty offices. This computing lab is heavily used, especially in the summers when the Educational Technology unit conducts intensive faculty training sessions. In 1996/97 over 5000 people used the Center and the staff from the library and Educational Technologies taught nearly 400 classes.

Because Virginia Tech faculty receive training in combination with equipment and software, they are fully prepared to create materials for electronic publication or online classes. Therefore, the library is not seen as a source for converting works to digital formats. The library can devote its resources to storing and delivering content and to mapping traditional services to enhanced, online, user-friendly services. Students more independently learn about new technologies. Virginia Tech's graduate students are another source of digital works. They have submitted masters' theses and doctoral dissertations in electronic formats since January 1997.

### **[ETD homepage]**

For decades libraries have stored and infrequently circulated the final product of each graduate student's research, masters' theses and doctoral dissertations. In 1994 the Virginia Tech Graduate School invited the library to prepare for the inevitable arrival of this research in electronic formats. SCP accepted the challenge and developed the procedures and mechanisms for storage and timely access that resulted in a working prototype. The Networked Digital Library of Theses and Dissertations (NDLTD) had over 1300 Virginia Tech ETDs as of last month (September 1998).

The ETD project is another example of how the library has improved services and increased accessibility to the information for current as well as future users by incorporating digital library resources and technology. Our first step was to bring together all the staff involved in processing theses and dissertations in paper so they could design a parallel workflow for ETDs. Then SCP programmed and enhanced processes to take fuller advantage of the digital resources and the Internet access. For example:

- Students may give their works unlimited access, university-only access, or no access.
- When their ETDs have been approved, students and their committee chairs are notified by programmatically generated email messages.
- Users browse or search for ETDs on the Web in addition to the (online) library catalog much sooner than they did when library staff had to handle paper copies.

### **[List of NDLTD members]**

Virginia Tech is not alone in predicting that initiatives like ETDs provide better library services than do their paper counterparts. In the fall of 1996 the Virginia Tech initiative began expanding to include other universities in part through a grant from the US Department of Education's Fund for the Improvement of Post-Secondary Education. Currently nearly 40 universities in the United States and abroad are also committed to participating in the Networked Digital Library of Theses and Dissertations.

[<http://www.ndltd.org/members/index.htm>] Some of their common goals include:

### **[NDLTD Goals slide]**

- Collect, catalog, archive, and provide scholars with access to ETDs beyond the host academic community.
- Improve timely access to the information within theses and dissertations.
- Provide unlimited browsing, searching, and linking to related works and resources on the Internet.
- Eliminate the need to bind, stamp, security strip, label, circulate and reshelve materials so that libraries can serve more users without additional staff.
- Reduce the need for additional shelf space in university libraries and archives.
- Allow graduate students to be more creative in documenting their final research.
- Save students money producing their final research projects.
- Enable graduate students to learn about electronic publishing and digital libraries so they gain valuable skills as they complete their degrees.

Important to libraries is increasing the size of their digital collections without having to increase the staff to process and maintain the collections (e.g., circulation and reshelving) or the space to house additional works. By storing and providing access to the digital works of both students and faculty, SCP addresses issues such as online archiving, unrestricted vs. limited access, and intellectual property considerations. Cooperation among separate institutions contributes further to maximizing access and services as we experiment with simultaneously distributed (i.e., multi-library) and centralized (i.e., single library) searching.

**[Continue discussion of ETD from SCP/theses/ homepage: Oren's homepage and N'tal Gal of Art link, Oral too]**

### **[Electronic Reserve homepage]**

When Virginia Tech's University Libraries began discussing expanding its Reserve Desk functions in the early nineties, SCP developed a system that enabled instructors to put their class materials online. The initial electronic reserve system mapped Reserve Desk practices to Web processes so that in the spring of 1995, faculty sent their digital course materials to the library to manage and make accessible to students. One draw back was a time delay while library staff determined that files had been sent, verified to which course and instructor they should be linked, and moved the files to the appropriate directory. Advantages to the system included typical library services: once the faculty had sent the files, they were relieved of having to deal with the files or the students who needed the information. Improved library services included 24-hour access and programmatic backups so those files would always be accessible throughout the semester.

The next generation of the system allowed faculty to manage their class materials on a library server or to link from EReserve to files on another server. By fall 1998 semester, EReserve evolved links to the university's timetable and course descriptions, relieving faculty of the need to complete a Web form with this information. The third generation system also made it easier to link to files on any server of class materials. Faculty use the same PID and password that they use with the university's email system to become immediately linked to the Registrar's current list of classes. From their list of classes, faculty add and remove files or enter a URL to link their classes to existing Web sites. Students also have immediate access to the links and files.

### **[EReserve findings—Caryl]**

Many improvements in EReserve are a direct result of SCP collaborating with units outside the library. SCP oversees EReserve while the computer storing the class information is under the purview of the Registrar. The programs and scripts, along with the faculty database and their files, reside on yet another computer, but the campus network links them all to EReserve. Some of EReserve's innovations directly result from SCP joining the university-wide initiative to provide current as well as potential students with improved and efficient access through VTOnline.

The library oversees compliance with copyright law and fair use guidelines in the electronic reserve system so access continues to be limited to our university community. Whenever access must be restricted, as with EReserve and some ETDs, all registered students and university employees are recognized as valid users whether on campus or off, through name proxy servers or IP addresses. (I'll elaborate on this when I discuss "Copyright" in a minute.)

### **News Online**

SCP has enhanced library resources and services also by collaborating with publishers as well as users outside the university. Working with Landmark Communications, SCP began providing access to regional news for the Blacksburg Electronic Village (BEV) in addition to the university community in 1994. In collaboration with regional news publishers, SCP developed procedures and wrote scripts that programmatically linked daily news reports to the Web. News resources evolved from tape loads to automatic pre-dawn file transfers and HTML mark-up. New challenges included quality and quantity control for files received daily that quickly grew cumbersome. One result was that programmed re-indexing enabling word searching was relegated to the weekends when less network traffic would be effected by slower system response times.

An early goal of "news online" was to provide same-day Web access to printed news, but the newspapers' in-house procedures and out-dated technology as well as the publisher's fear of losing paid subscribers, combined to curtail meeting this goal. SCP ceased news downloads early in 1997 but continues to provide historical reports about the region and the state.

### **[VA News homepage]**

Through "news online," SCP accumulated valuable experience, including managing daily updates on the Web, effective security precautions, and indexing large sets of files. SCP staff took this knowledge to a meeting with the station manager of the near-by CBS affiliate, WDBJ-7, who agreed that SCP would create a Web site from electronically transferred daily televised news files. SCP's programmer adapted the scripts and programmed procedures for newspapers to television news files. Since March 1995, within 24-hours of broadcast news reports have been available at online through the Scholarly Communications Project. Timely availability is due in large part to the television news already being available in digital format from the closed-captions prepared for hearing impaired viewers.

### **[WDBJ7 homepage NOTE: how to read news "scripts"]**

#### **[October calendar]**

#### **[Reporting sample]**

### **Networked Images**

An opportunity to expand online news resources came in March 1997 from a Washington, D. C. newspaper distributor, NewsExpress. SCP was invited to participate in an experiment to supply international newspapers online along with four other libraries.

### **[International News homepage]**

The first newspaper, *Le Monde*, is available online in PDF format before it is available in paper on the streets of Paris or New York! *The European* from Great Britain came next and then Ettella'at (in Persian from Iran) and Al Nahar (in Arabic from Lebanon). About a year after this experiment began, NewsExpress was ready to terminate the free library access and offered paid subscribers continued access to *Le Monde* online. The library easily determined that this would be less expensive and give greater access than the current subscriptions to both the daily paper and periodic microfilm versions. (All online news homepages look very similar because we use a calendar layout such as this example from WDBJ7.)

An obvious direction for SCP to turn was to digital image access but this is one area where we did not expect to receive original digital works. Digitizing, storing, identifying, and presenting non-textual files were new challenges.

### **[green tile slide of "testimages"]**

To initiate our online digital image collection, in 1994 we selected original watercolors of early cadet uniforms and fragile glass negatives from the library's Special Collections Department.

### **[selection from Col. Temple uniforms]**

This first generation digital image collection was very rudimentary with SCP staff adding brief text in Web pages with appropriate hypertext links.

### **[CTHA homepage]**

The second generation added black and white images extracted from a video laser disk originally prepared by a VT architecture faculty member. Available staff rekeyed or scanned the index and linked the images to the index in typical Web fashion. Though unadvertised, SCP fields a growing number of requests for access to these images, especially by architecture students and history teachers. However, the copyright holder of the laser disk has not released the online images for use outside the university.

### **[ImageBase homepage]**

The third generation was a major departure from previous systems. Called VT ImageBase, it is a searchable database of images and identifying information that a small interdisciplinary working group developed for the Information Systems' 1996 strategic plan. The plan showed how, in the course of normal class preparation, faculty would select slides to be digitized, photographic experts would create high quality digital images, and the library would store and provide access to the images. This process would work equally well for the entomology professor as for the art professor. This system enabled the faculty to elaborate on the information already accompanying each slide. ImageBase incorporated an early version of the Dublin Core metadata, a set of 15 standard elements.

The working group envisioned many advantages over the typical analog slide collection used by most faculty. Instructors could display images in any order during a lecture and would no longer be tied to the order the slides were placed in the carousel. Students could view the images outside of class at any time. With the success of this prototype, slide collections around the university could be systematically digitized for use in classroom lectures and faculty and students would have access to all the digital images, not just the ones used in their classes. SCP staff followed through and



constructed a prototype with 300 art history slides and metadata now part of the "VT ImageBase." These images were incorporated into an art history course taught fall semester 1996.

### **[search result: Burruss]**

With access to relatively inexpensive student labor, SCP hired students who derived small "thumbnail" images and larger full-screen images (from the "archival" TIFF images prepared by the experienced staff at PhotoGraphic Services), entered the metadata, and linked the images and identifying data in the database. As they digitized images, PGS sent the TIFF to a Computer Center machine that is accessed by SCP students to create user-friendly image displays and later by PGS staff when reproductions are contracted and paid for through Special Collections. PGS later purchased Kodak CD equipment and software to prepare, store, and ship to Special Collections all digital images; workflow was modified accordingly.

Several challenges had to be addressed for the plan to be fully implemented. The major downfall of the prototype design was that not a single classroom on the Virginia Tech campus could display with the clarity--sharpness, distinct lines, and vibrant colors--now available with 35mm slides. That students had access to the images associated with each day's lecture, in addition to improving instructors' lecture contents and classroom environments was not sufficient incentive (in the design team's opinion) to garner faculty participation in a large image conversion project. These challenges remain, but the fast campus network and construction of the Advanced Communication and Information Technology Center (ACITC), may combine to provide the necessary incentives for broader participation in the VT ImageBase.

Through financial support from VIVA, the Virtual Library of Virginia, the VT ImageBase grew steadily for two years. As of August 1998 there were over 14,000 unique and fully identified images. All descriptive elements are indexed and can be searched individually or in combination.

### **Access--Open and Restricted**

The library has a philosophy of open access that is typical of public institutions of higher education, that is, the library is open to any citizen of the state. Accordingly, the Virginia Tech Scholarly Communications Project encourages all of its collaborators and

contributors to provide unrestricted access to their works. We have met with varying degrees of success. Our ejournal editors have been willing to allow unrestricted access with the caveat that they could later change their access options. However, editors have not made any access option changes to date--all are available without restrictions (and none have lost paid subscribers, according to SCP ejournal editors informally polled). When access had to be restricted for other SCP resources, we negotiated university-wide availability as is the case with regional and international news, commercial ejournals (e.g., MIT Press and Birkhauser, Boston), and is an option available to ETD authors.

There was only one situation when SCP initiated limited access--mapping traditional Reserve Desk services to a comparable but enhanced Internet service. VT EReserve adheres to US copyright law in the same way that the library's Reserve Desk does. Just as the library provides materials from its Reserve Desk, members of the university community have access to digital materials the faculty prepare and link to EReserve. Online access is more restricted in some ways, however, than the traditional Reserve Desk because faculty and students using EReserve are verified when they access the online system. We do not generally require VT ID to access or circulate library materials.

### **[Extended User web site HANDOUT]**

Restricted access is monitored through two validation systems. The most commonly known system is usually referred to as "limiting by IP address." That is, the server with the library resources requested validates that the user's computer is registered with the university. If the Internet address of the computer is registered, access is permitted; if not, access is denied. Similarly, but through a somewhat more cumbersome process, university faculty, staff, and students who are away from campus computers can use the "proxy" functions that are components of Web browsers such as Netscape and Explorer. This function has the user enter their PID--personal identification--and their password as it is registered with the university. This system validates the user rather than the user's computer, but both require that the university maintain up-to-date registers of computer addresses and current university members' PIDs and passwords.

Today many of the library's online systems rely on these name servers to control access through user recognition systems. In addition to electronic reserve, systems using

online computer/user validation include requests for library materials entered online for interlibrary loan and document delivery. The library has also contracted with many vendors for Web access to a variety of indexes and full-text databases. These contracts usually require that the library guarantee that only its students, faculty and staff have access. Others not affiliated with the university have access when they are on campus and enter through the university's computer network, just as they might walk through the doors of the library and take a work off the shelf. These digital library components are already full services of the library.

## **Copyright**

Libraries evolving digital content and services are frequently called upon to add services extending their experiences. An evolving role of the Scholarly Communications Project has been to develop expertise relevant to online scholarship and then to coordinate and share the knowledge gained. The library has long been a guardian of copyright through thoughtful and law-abiding policies for interlibrary loans, reserve, photocopy services, and more. However, as Web sites proliferated, inconsistencies in policies developed and the library lost track of the reasoning behind some of its copyright policies.

### **[UL Copyright homepage]**

To address this discrepancy, SCP and selected User Services staff (including branch, reference, and Reserve Desk staff) met and evaluated policies, agreed upon common practices among service units, and developed this Web site to share what had been learned.

### **[US Copyright homepage]**

Linked to this Web site is another site that includes interpretations of copyright law, links to the text of the law, sample letters to request permission to use someone else's work, links to publishers email addresses, advice for authors about negotiating to retain some rights, and, most importantly, links to current library policies by area of concern.

Because faculty, especially those expanding into the realm of distance education, asked an increasing number of questions about copyright, SCP began sharing its knowledge outside the library at the summer 1998 Faculty Development Institutes. Hour-long sessions began at the VT copyright Web site; focused on the rights of

creators/authors, a thorough review of fair use, and public domain issues; then concluded with library policies especially for teaching and learning through online course materials and EReserve. I really stressed fair use and the necessity to consider all four factors because these usually are considered equally in US court cases. Copyright has been a particular concern among faculty putting course materials online and ETD authors and advisors.

### **Archiving and Security**

Other than time-sensitive class materials, a research library generally favors archiving indefinitely what it has accessioned. Therefore, when the SCP was initiating new works and aligning procedures for online resources with past practices with hard copies, we gave thoughtful consideration to the thorny issues of archiving and security. Initially many of our authors, editors, and collaborators felt uncomfortable knowing that there is not always a paper back up. However, having paper provides many with a false sense of security. Library staff are particularly aware that a book checked out, is not always returned and not always replaceable. When this happens, there usually is not a back-up copy on hand for several reasons, including the added costs of processing, re-shelving, and storage.

One of the most outstanding and beneficial attributes of digital library resources, in addition to 24-hour user access, is that the library is committed to security and archiving. We make frequent back-ups, storing them online and off-line, in the same room as the server and in other rooms and in other buildings. When equipment fails, replacements are available and there are copies of the information resources that can restore any work that was lost. This is not the case with most library resources in non-digital formats. Programmed back-ups eliminate labor intensive processes to transfer them from one location to another. Back-ups are also not bulky and do not accumulate at rates that require new buildings be constructed to house an ever growing collection as is the case with books and journals. SCP drafted archiving policies specifically for ETDs but these can be generalized to all of our online resources.

The University Archives, a unit of the library's Special Collections Department, which I also head, has traditionally archived all university publications including copies of theses and dissertations submitted. It is appropriate that we establish comparable

standards, policies, and procedures for preserving other electronic publications emanating from the university.

With digital materials we can expand access and simultaneously prolong the life of the work. This is not possible with other media. We can ensure the durability of the present by stabilizing the means of mediation. Maggie Exon from Australia described preservation of online works well when she said:

With electronically stored information, the paradigm shift from concern about durability to concern about permanence has been completed. We may worry about hackers but we do not worry about genuine use. In fact, we revel, we positively boast when we can show an exponential growth in the use of the information services we provide. It requires a large shift in perception to realise that the best chance electronic information has of being preserved is that it should go on being used, regularly and continually. As soon as it is not used, it is in trouble.

**There are 3 factors in particular effect archiving: access, security, and file formats.**

**[Archiving: Access slide]**

**ACCESS**

- The first goal is to have all electronic works that the library stores and provides access to such as ETDs online and available all the time from a single, stable server. If necessary (depending on the capabilities of the server), some works could be moved to a secondary server. Considerations for moving electronic works to a secondary server are usage (the fewest accesses) or age (oldest). Formats and file sizes probably would not be a factor in employing a secondary server, though extremely large works may be prime candidates for separate storage and access.
- If it becomes necessary to move some works to a secondary server, programs would be written to trigger migration. Currently “age” would be easier to program, but in the future “usage” (actually, lack of use) would be preferable characteristics for migrating ETDs to a secondary server for archiving.

- URNs, Uniform Resource Numbers, would link migrated works. URNs could be mapped to PURLs or "handles" at some future date.

**[Archiving: security slide]**

**Our security measures stipulate that:**

- Works that have been submitted but not yet archived are backed-up hourly if changes have occurred since last back up; otherwise, a back-up is programmatically generated every two hours.
- A back-up copy is made weekly of online works in all directories.
- Copies made are programmatically transferred to another server
- Weekly back-ups are also made to tape for short-term, off-line storage.
- Copies are retained for four-month cycles.
- Annually a copy is archived on CD-ROM, but with no real intent to use.
- Viewers or readers cannot modify and replace any works.
- Authors cannot modify their works once they are selected for archiving.
- Only in extreme circumstances will the system administrator make modifications to a work (e.g., to change the access restrictions or to activate email addresses).

**[RECOMMENDED FORMATS SLIDE]**

**FORMAT MIGRATION**

The library shares with the university the responsibility to guarantee that the online works it stores will be available to researchers, both within and outside the scholarly community. To keep online works reader-friendly and to retain full access will mean migrating the current file formats to new, standard formats not yet known. This will be done through the cooperative efforts of the library (who maintains the submission software, the live database, and the secure archive) and university computing expertise. Some people feel uncomfortable with PDF but now that so many agencies use this format, I feel more confident that its next generation will be one we will jointly figure out how to evolve into. We may at some future time say that "misery loves company," but I believe that partners such as OCLC, UMI, and the federal government (all creating and storing hordes of PDF files) as well as Adobe, with ultimately work together to solve potential format migration problems.

This slides shows our current thinking about which formats to recommend and, therefore, may need to be converted in the future to new standards/

## **Staffing**

Archiving and providing access to ejournals, news, and theses, and designing and maintaining reserve systems and the image database, is a huge accomplishment for a very small unit of 1.5 staff and less than \$100,000 in operating expenses (including student wages but not staff salaries). In 1989, the Scholarly Communications Project began one position, the director, Lon Savage, and some support from the Library Automation Department. When Savage unexpectedly retired in December 1992, I was asked to step in **[time for anecdote?]** and the Technical Director/programmer was formally assigned to SCP half time. In 1994 a half-time clerical assistant from Technical Services joined SCP to focus on HTML tagging for electronic journals and the SCP director officially devoted full-time to the Scholarly Communications Project. The technical assistant's position was subsequently upgraded to full-time, in part because there was less need for data entry.

The gradual weaning of two positions from technical services is partial evidence of the changes technology has instigated within the library organization. Further evidence is the 1996 upgraded of the then-vacant technical assistant's position to that of a programmer so that manual processing tasks could be completed programmatically through in-house scripting. The director, however, also began overseeing Special Collections in 1996. In mid-1998 the programmer reverted to Library Systems and the Technical Director (now a programmer/analyst and systems administrator) joined SCP full time. As additional staff time and positions became available to the SCP through redeployment of library resources, the quality and number of online resources and services also increased.

Though staff support has gradually increased, personnel resources are minimal considering the number of resources SCP stores, preserves, manages and provides access to, and the systems it designed and maintains. On only three occasions has SCP solicited new projects--television news reports and the EReserve and ImageBase systems design. Many VT faculty participate in scholarly journal editorial boards, but SCP is not contacting them about converting their journals to online access because we

are afraid of attracting more responsibilities than we can handle well. SCP was initially created to experiment in scholarly communications but not to put its prototypes into production or to maintain heavily used services. It struggled to maintain EReserve at a high level of service until this year when the functions could be shared more broadly with Information Systems were two previous SCP personnel are now employed. The success of ETDs tests the limits of SCP's resources, especially with our recent conversion to a database management system. The last few years have not seen an increase in the budget for this unit but they have witnessed dramatic increases in the number of faculty and students served, as well as the tremendous growth of the ETD collection.

### **Hardware and Operating Systems**

All of SCP's resources and services existed for over six years on an Apple NeXt purchased in 1990. Initially a Gopher server, in February 1993 it began operating also as a Web server and served SCP very well until 1997. From 1995 to 1997, SCP expanded to three servers, splitting the large and rapidly expanding image and newspaper files from the files of scholarly electronic journals and ETDs. In October 1994 SCP measured 479Mb; up from 78Mb of storage we were using in January 1994. In June 1995 SCP measured 4Gb of scholarly electronic works; most recent measurements show SCP at 15Gb.

#### **[Server slide]**

In October 1997, the original server migrated from the NeXt to a Sun Netra with a 200 MHz Ultrasparc processor and 128 Mb of RAM. It now runs the Netscape Enterprise Server on Solaris 2.6 and Perl 5.004\_01. To backup our system, we have a Sun 8mm Ultra Wide SCSI tape drive that takes 170m tapes with a compressed storage capacity of 40Gb. Our two older servers (a Dual-Pentium PC running Slackware Linux 3.0 and a Dec Alpha running Windows NT 4.0) now provide development space and back-ups.

The SCP's limited budget means that we do as much as possible with shareware from the Internet, in-house scripts and programs, and bargain prices. FreeWAIS served us very well until the funds became available in late 1996 to purchase the OpenText LiveLink search engine. Then we quickly learned to appreciate the faster searches



resulting in more accurate hits, and users like the variety of display options available, in particular, highlighting the search term within the retrieved document.

## **Evaluation**

The effectiveness of some of these services have been measured through student and faculty surveys. All students and faculty having class materials accessible through the Libraries' EReserve system were surveyed spring semester 1995. 75.4% of the students rated EReserve 1-3 on a scale of 1-5, with 1 being very easy to use. On the same scale, 83.3% of the faculty rated it 1-3. The same percentage of faculty had no trouble converting their files to the then required form (PDF) and 100% preferred EReserve to traditional Reserve. Increased use is another measure of satisfaction. Spring semester 1995 eight faculty made course materials available for ten classes. Spring 1996, 31 faculty were teaching 39 classes using EReserve materials. One week into fall semester 1998, 99 faculty, teaching 131 classes, were using EReserve. **[now?]**

Libraries' services have changed over time to respond to user needs. For example, EReserve originally accepted only PDF files but now all file formats are accepted, including links to Web sites outside the library and the university. Initially the library's EReserve server provided faculty with space for their course home pages, but now a powerful Information Systems server called "courseware" **[more detail?]** is used. It is available for faculty and other instructors to store online courses or supplemental class materials. In addition, the "courseware" server can also be used to mirror existing course sites, to provide searches for course materials stored on that server, to support class chats, and to restrict access to materials as needed. The limited staff resources accomplish more when faculty prepare e-course materials (including scanning articles) and determine how their materials will be presented, accessed, and archived.

**In conclusion** I'd like to point out that the Scholarly Communications Project is an example of how libraries creatively use existing resources and evolving technologies to improve services and increase the wealth and the quality of information available to their user communities and more broadly to digital library users. Experiments in electronic archiving and access systems have become standard library resources and

services in many academic libraries. On-campus and remote users have access to both open and restricted resources, improving patron services as well as broadening instructional activities. With faculty and student support and collaboration with units outside the library, a variety of new resources, access methods, and services are available for extended campus users as well as traditional library users. Especially significant is the library's ability to evolve new services as needed.

Without support from Scholarly Communications, university research and scholarship would be long delayed in reaching students and faculty through traditional publishing and library processing routines. Students, researchers, and scholars would not have constant access to the wealth of our university community's research and scholarship available especially in its electronic journals and ETDs. Their use would be limited to purchasing personal copies or to the operating hours of the library and to availability when other patrons have not removed them from the shelves. Libraries of digital resources and services already exist and are constantly evolving within academic settings like University Libraries at Virginia Tech.

With support, library units like the SCP could include outreach to faculty to better inform them about what assistance is available from the library and to promote current and new technology initiatives. Libraries could also build on current strengths, such as promoting greater innovation in electronic journals and making the digital images more broadly applicable to the university community. Further work needs to be done in a variety of areas, including intellectual property management, archiving and preservation, and multilingual appeal (not to mention metadata; automatic generation of bibliographic records; and migrating keywords to controlled vocabulary). The evaluation of resources and services beyond log file analysis should receive more emphasis, but the limitations of staff and equipment often make these difficult to accomplish.

The Scholarly Communications Project is one arm of an evolving academic library. By stretching existing resources, VT has consciously melded a digital library into the expanded collections and services of the University Libraries. The benefits extend beyond the campus to the Blacksburg Electronic Village and to members of our university community wherever they are around the world. Libraries are enhanced when they incorporate digital resources and online services and digital libraries more fully

serve the information needs of their user communities when they expand to also provide access to resources and services in non-digital forms.

As networked learning makes inroads throughout academia, campus information systems change and the role of the academic library expands. Ambitious technology programs support asynchronous learning in addition to the traditional classroom teaching and learning situations. Libraries are adapting state-of-the-art technologies and taking on new roles to improve services and resources for academic teaching and learning.

The Scholarly Communications Project at Virginia Tech's University Libraries has created a variety of partnerships with units and individuals within its university community to produce unique online resources particularly suited to [digital] library resources and services. Through activities like those I've told you about today, libraries demonstrate that they are vital and fulfilling their functions to provide current as well as historical works and expanding on-campus services to also meet the needs of extended campus learners and faculty.