

# Marshall University

*Technology and the Interactive University*



Let me introduce you to West Virginia's oldest and one of America's most progressive universities. Marshall (<http://www.marshall.edu/>) was founded in 1837 and named for United States Supreme Court Chief Justice John Marshall. With more than 60,000 alumni in all 50 states and many other countries, Marshall has a record of service of which to be proud. Marshall is experiencing a revolution in its curriculum as it drives to ensure that graduates will be competitive for the best jobs and graduate and professional opportunities available in the 21st Century. The Marshall Plan for Undergraduate Education is gaining national attention and new programs in integrated science and technology and technology management are being added to an already distinguished curriculum.

Marshall University is a member of the University System of West Virginia, (<http://www.scusco.wvnet.edu/>) with campuses located throughout southern West Virginia. The main campus is located in Huntington, with the Graduate College being located in South Charleston. The campuses serve a student population of more than 15,000, including nearly 4000 graduate students. In addition to our nationally recognized football program, Marshall University is known as the "Interactive University" due to its leadership in innovative student centered programs and rural health based medical programs. The interactive university is defined not only by its involvement in the defining of issues, but in its partnering with its community—the real stakeholders in the university—to forge real life solutions to those identified issues and problems. For example, at Marshall and in the three-state region surrounding Huntington, there is a growing consensus that a synergistic economic future may be found in emphasizing biotechnology, the environment, high-tech manufacturing and information technology. This is because both communities—the academic and the economic communities of Huntington and the Advantage Valley (<http://www.adval.org/>) region—have discovered a unified 21st Century potential in these four areas.

Perhaps the boldest has been the commitment of the university to invest some \$50 million in computers and telecommunications-related infrastructure between 1992 and 2000. Equally important to the interactive university has been the securing of \$31 million for a new university medical center \$29 million Drinko Library (<http://www.marshall.edu/library/drinko/>). Both will be completed during 1998.

## MUNET

Marshall is community focused, traditionally servicing the people of West Virginia and the nation. The University's campus-wide network, MUNet, is a collection of interdepartmental and inter-building Ethernet networks tied together by a fiber-optic backbone that was established more than ten years ago. MUNet is continually evolving and has become the lifeblood of the University. Major expansion and upgrade to main campus fiber and copper cable plant is planned. This expansion must support production video course servers. Additional plans include the implementation of an extended digital wireless voice, gigabit, ATM and low speed data network on campus.

MUNet supports a client/server environment, serving more than 10,000 campus users at 3,000 workstations, serving every campus building (including residence halls), and four remote campuses. Remote access to MUNet is supported by some 120 modems, many of which will provide 56kb service. In 1997, MU president J. Wade Gilley provided funds to finalize network access to every faculty member. Providing high-speed, ubiquitous, convenient network access to the entire university community is rapidly being realized. The MUGC South Charleston facilities are wired with 10/100 fast ethernet to all classrooms and offices. Several classrooms support networked labs and two-way video capabilities.

Thirty major central servers are tied directly to the FDDI backbone either with fiber or a CDDI interface providing database warehousing, file, print, web, CD-ROM, messaging/groupware, conferencing, and email services. Most of the campus horizontal cable plant is Category 3 twisted pair. New construction and all major renovation projects are cabled with Category 5/5+ horizontal cable. All fiber distribution cable is multimode with a minimum of 3 pair provided to all buildings. Major buildings have as much as 48 pair of fiber cable servicing them. WAN service is provided via two Frame Relay T1 circuits from Bell Atlantic as part of the WVNET Southern Cloud.



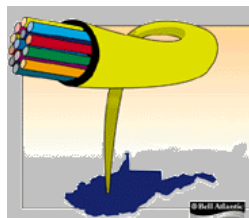
## MAJOR ADVANCES

Completion of the Faculty Desktop Initiative which placed at a minimum a Windows 95 or Power Macintosh based networked PC on every Faculty member's desk that did not

already have one. All workstations are networked and connected to MUNet, WVNET, and the global Internet. Conversion of all desktop Intel based PCs to Windows 95 or Windows NT 4.0 as part of our project Genesis initiated in July 1995. This project uses a variety of tools to help reduce our Total Cost of Ownership by implementing a streamlined installation and support methodology for desktop PCs. In addition, it began our migration from a Novell NetWare 4.1 centric PC/Mac Server environment to a Windows NT focused environment. Improved coordination and training for faculty in the use of computers in the classroom and instructional process. This activity was lead by initiatives as part of the Technology Advantage program and special project funds in FY96-97 but has expanded to streamline our efforts in multimedia course development and acquisition as well as web based course augmentation and delivery. Continuations of our lead in World Wide Web access to the university systems by providing web browser access to our library holdings via a web gateway. This access will be further extended in FY97-98 with the implementation of a much expanded library system with integration to a merged Graduate College Library. Expanded library services currently being offered include electronic document delivery and full electronic journals. These services will expand as part of our new John Deaver Drinko Library and Information Center. Implementation of over 25 online courses delivered via the World Wide Web, including development and integration of a toolset for faculty to communicate and interact with students for the delivery of courses via the Internet.

## NETWORK PLANS

Near term plans call for upgrading the campus back bone to a Switched ATM/FDDI environment and for installing edge switches behind current 10BaseT hubs to reduce the average number of clients per 10 Mbps segment from 50 to 20 as well as delivering switched 10 Mbps private service where required. ATM/OC3 based connections from our Huntington campus and ATM/DS3 connections to our new South Charleston Campus (MUGC) will integrate voice, data, and video services into the ATM cloud. Documents and network diagrams for the ATM implementation project may be found at <http://www.marshall.edu/www/atm/>. In addition, an upgrade to our current Internet and Internet2 bandwidth is critical with redundant POPs from multiple ISPs to the state ATM Backbone is critical for our continued delivery of educational content to West Virginians. Completion of our John Deaver Drinko Library/Information Technology Center will provide Bell Atlantic SONET Ring service to our main campus. Long-term networking plans call for a phased upgrade to our current horizontal



cable plant beginning in FY2000 and implementation of campus-wide wireless networking similar to that planned for use in our new John Deaver Drinko Library/Information Technology Center (to be completed summer 1998) but including voice and data integration.

## ADDITIONAL MAJOR PROJECTS

The Oracle based Banner Human Resources module is due to be implemented FY97-98. This system will integrate our human resources functions. The only major system that is not Year 2000 compliant is our financial system, CUFS. This system is being replaced with Banner Finance, thus completing our integrated administrative systems. Our VTLS Library System is migrating to a client server based system called Virtua. The first level of this plan was completed with web access to the multimedia library system and catalog (<http://www.miles.marshall.edu/gw/english/>). This project integrated the Marshall University Graduate College library in South Charleston and the Marshall University School of Medicine libraries into one system. Campus Wide Imaging/Document Management System will be initiated to eliminate paper and integrate to our groupware, messaging, and workflow software. The complete migration of our Office Automation plan from All-In-1 to Microsoft Office 97/98 and Microsoft Exchange is expected to be complete in FY98. Our campus One Card ID System project will expand its debit functions and functionality to door and building access as part of our new Drinko Library/IT Center. The Electronic Master Classroom Expansion project involves a centrally funded controlled expansion of network access, projection, and digital interaction services to are campus classrooms.

Marshall University's Intranet Distributed Educational Network is written into the report language for the 1998 NTIA grant awards. This multimillion dollar project will distribute MUNet to several of our remote facilities and provide video to the desktop capabilities.

One of the greatest barriers to technology for our students has been the lack of centralized computer purchasing, educational software pricing, installation, and maintenance of personally owned computer systems. Digital's PC Service Center will be open on Marshall's campus in the fall of 1998. The Service Center will be located in the student center beside our new CyberCafe.

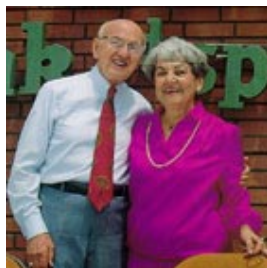
Marshall University is a member of a number of local and statewide networking outreach projects, including the West Virginia Network for Educational Telecomputing (<http://www.wvnet.edu/>), which provides statewide linkages to K12, libraries, colleges and Universities. WVNET is a recent participant in Internet2. Marshall University will be one of the first implementers of the West Virginia Bell Atlantic 2001 network project, which will provide high-speed connectivity ATM connectivity to all state agencies.

Starting this spring, a Cabell or Kanawha County wrongdoer may come face-to-face with a judge electronically through a video connection between the jail and court house, made possible by Bell Atlantic's new high-speed West Virginia 2001 Network. In a news conference Jan. 19, West Virginia Gov. Cecil H. Underwood announced that Bell Atlantic-West Virginia and the West Virginia Supreme Court will launch in April a sophisticated system that provides remote video court proceedings and other applications. West Virginia will be among the first states in the U.S. to use this type of video telecommunications technology to help speed the judicial process. In addition to Bell Atlantic and the State Supreme Court, other participants in the project include the West Virginia Jail and Correctional Facility Authority, the Governor's Office of Technology, Marshall University and the counties of Kanawha and Cabell.

## EXTENDED COMMUNITIES

The Marshall University School of Extended Education (SEE) currently delivers courses via T-1 lines to three centers: Mid-Ohio Valley Center (MOVC) in Point Pleasant; Capitol Center (CC) in South Charleston; the Southern Mountain Center (SMC) in Logan; and expects to have a new center established in Beckley within eighteen months. MOVC electronic classroom is currently in a high school but is scheduled to move into a newly constructed building in approximately eighteen months. The CC electronic classroom is located at the MUGC. The SMC is altogether a unique configuration. SMC is a collaborative effort between Marshall University and Southern West Virginia Community & Technical College where MU delivers upper division and graduate courses to the southern region of the state by interfacing with Southern's Multipoint Control Unit in Logan and has the ability to carry courses not only to Logan, but also to Williamson, Saulsville, Madison, Hamlin and Pettus. The SEE ultimately will include the integration of data, voice and video to these distant centers. Access to the ATM system at each of these locations would best meet the needs of the SEE with immediate ATM access to South Charleston and Logan and follow-on access to Point Pleasant and Beckley within eighteen months.

The continued growth of electronic classrooms improves faculty deployment of interactive educational applications. These electronic classrooms provide for real-time two-way audio and video communication between classes being held in two locations. The increased popularity of this method of teaching has left the classrooms reserved every day for classes, and a demand for more classrooms to be implemented throughout the state.



## WEB PROJECTS



The growth of networking interest on campus has been nowhere more evident than in the explosion of activity in the World Wide Web arena. MU provides e-mail and personal webpage space to all students, faculty and staff. This has resulted in many award-winning pages, including the Netscape Dynamic HTML Award for a version of the main Marshall page. The School of Medicine's Interactive

Patient (<http://medicus.marshall.edu/>) was a semifinalist in the NII awards. Marshall was one of the first universities to provide the university yearbook on the web (<http://www.marshall.edu/yearbook/>) and a complete pictorial university history site (<http://www.marshall.edu/muhistory/>). The Marshall University Official History page is a comprehensive online pictorial history of Marshall University since 1837.

Marshall was one of the first academic test sites for the SCT Banner Student Information System (SIS). All administrative applications (i.e. Alumni, Student Information, Finance and Human Resources) are integrated with the Banner 2000 system. Many of these will be completely web accessible. MILO provides a web and telephone voice response system to the Banner SIS. Marshall's community integration and support is best displayed via the Advantage Valley Regional Economic Development site (<http://www.adval.org/>), the Robert C. Byrd Center for Flexible Manufacturing Center (<http://www.rcbi.org/>) or the West Virginia Rural Health Partnerships (<http://ruralnet.marshall.edu/wvrhep/>).

The West Virginia Public Health site is provided by the Bureau of Public Health to inform the citizens of West Virginia of issues concerning public health. It is also a valuable resource for public health officials, researchers, and academicians both in and outside of West Virginia.

The creation of the Oral History website began as a class project at Marshall University, in Huntington, West Virginia. The purpose of this site to recognize and pay tribute to the experiences, knowledge and contributions, of four Appalachian African-American women. This site includes four sections of biography, which link to pages discussing, race, region, gender, as well as effects on community as related to each of the women we explore. Links to national organizations, univer-



sities, and other points of interest, can be accessed from each page. For those who would like to further investigate the lives of these women, more information is available in the [Marshall University Oral History Department](#).

The Marshall University [Women Center's](#) site contains information on the Women's Center and links to the Sociology of Sex & Gender Webpage Projects and the Contributions of African-American Women to West Virginia site. The "All About Us" page includes the story, vision and mission of the Women's Center. The site includes various programs of interest to the Marshall community throughout the semester that are put on by the Women's Center. Also included is a page that lists several resources for women to utilize on the Marshall University campus.

The [ESL](#) homepage is a front door for international students who wish to study at the Marshall University's English as a Second Language Institute. The site contains a tour of the Intensive English Program, a list of ESLI faculty and staff, and information on special ESLI programs. At the [Career Services](#) site, students and alumni can search for jobs, learn what the Marshall Career Services Center has to offer, view the schedule of on-campus recruiters, learn how to get their resume posted online, view a list of local part-time jobs now available, get help with writing a resume or employment letters, and more! Employers can post a job opening, search through student resumes, request a conference room for an on-campus recruiting session, and learn how the Marshall Career Services Center can help fill job openings with qualified Marshall University students and alumni.

## FACULTY PROJECTS

The [Marshall University Center for Instructional Technology](#) (<http://multimedia.marshall.edu/cit/>) was created to bring information technology to bear on the educational mission of the university by providing support for faculty in designing courseware, in using technology-enhanced classrooms, and in applying computer-based communication to extend classroom discussion. CIT represents a comprehensive and collaborative model for instructional innovation on the Marshall University campuses. The [Office of Information Technology](#) integrates all Instructional, Library, Computing and web resources throughout the university. An excellent collection of many of the IT projects may be found at <http://www.marshall.edu/it/demo/>.



## TECHNOLOGY ADVANTAGE GRANTS

Senate Bill 547 established the Office of the Vice Chancellor for Instructional Technology and charged his office with developing a technology plan that would significantly improve the delivery of education, improve student educational access across the state, engage faculty and administrators in technology development efforts, integrate computers into course work, and expand distance learning and information technology for teachers, businesses, and students across the state. The goal is to better position West Virginia students for the job market. Through this bill, Marshall University received 11 grants totaling just over \$620,000 with a financial match from the University. A technology showcase for the grants can be found at <http://multimedia.marshall.edu/techgrant.html>.

## ELECTRONIC COURSES

The number of electronic courses being offered by Marshall University through the Internet (<http://muonline.marshall.edu/>) is on the rise. Marshall currently offers twenty electronic courses, with plans of having additional 45-60 courses offered by the end of 1998. Marshall University was chosen to have three of their courses advertised nationally by the Southern Regional Electronic Campus, which comprises 14 states in the Southeast. This advertisement is a pilot program in which a student in the SREC region can take classes at any participating institution for credit at their home institution. The SREC plans to expand where Marshall will be able to include all of its courses by next spring. For the delivery of these electronic courses, Marshall University uses a product called WebCT.



Not only does Marshall University offer classes entirely via the Internet, but many courses are using the Internet to provide supplementary material to students. Currently 52 courses are using WebCT for such purposes with over 1600 students being able to access the web for assignments, class notes, web sites relating to their studies, etc.

## WEBCT

WebCT is a tool that facilitates the creation of sophisticated World Wide Web-based educational environments by nontechnical users. It can be used to create entire online courses, or to simply publish materials that supplement existing courses. WebCT not only produces courses for the WWW, but also uses WWW browsers as the interface for the course-building environment. Aside from facilitating the organization of course material on the web, WebCT also provides a wide variety of tools and features that can be added to a course. Examples of tools include a conferencing system, online chat, student progress tracking, group

project organization, student self-evaluation, grade maintenance and distribution, access control, navigation tools, auto-marked quizzes, electronic mail, automatic index generation, course calendar, student homepages, course content searches and much more. WebCT is an easy-to-use environment for creating sophisticated WWW-based courses that are otherwise beyond the ability of the non-computer programmer.

The development of educational technology at Marshall University is based on principles that emphasized enhancement, not replacement, of human interaction; assurance of equitable access; the importance of training; facilitation of a range of educational modalities and methodologies; production of technology-based courseware; assessment of the contribution of educational technology to a quality education; and allocation of human resources to support and accommodate change.

## SUPPORTING TEACHING AND LEARNING

Having built an outstanding network environment, the University has turned its attention to encouraging the exploration of effective uses of network technology to enhance the teaching and learning process. The "Marshall Plan" ensures that by the time a student graduates they not only have benefited from technology through a better learning experience, but they have also become technology literate and trained so that they can function in the real world.

Instructional Technologists, whose purpose is to work with faculty interested in developing and publishing high-quality, interactive multimedia instructional materials and courseware, are housed in their respective colleges, but report to the Office of Information Technology. Teams of web developers and instructional technologists develop prototypes of new products that will enable faculty to quickly and easily manage and organize a Web site as a focus for a course, without having to learn HTML.

## TRAINING AND DEVELOPMENT

The professional productivity of the University's faculty and staff was an essential ingredient of MU's migration to a client/server networked environment. Throughout the implementation of the network and associated projects, training programs were delivered to network clients via CBT software. Initially the training programs were designed to introduce networking concepts to clients that had no prior exposure to networking.

As client sophistication evolves, the training objectives are adjusted accordingly, thereby ensuring maximum utilization of the many services provided via MUNet. Several network support services have been created to assist

clients using the network. An information request line, online wizards and an open use information center is available to clients. A document that serves as a general reference for persons using MUNet and the Internet has been developed. MUNet has been instrumental in taking our graduate program to places it has never been before.

## EDUCATIONAL FACILITIES

The campus is sprinkled with public access computer laboratories for student and scheduled class. Many traditional teaching classrooms are wired to MUNet. Portable multimedia notebook computers and projection systems will allow faculty to utilize the entire network for academic support without tying up an entire computer lab. All student workstations have access to the Internet. The Medical School utilizes their local area network for online testing and student and faculty evaluation. The new Drink facility will showcase the latest in electronic education delivery systems. Presentation rooms, group collaboration rooms, electronic auditoriums, wireless patron pads, interactive kiosks, video wall, etc. will highlight the facility (<http://webpages.marshall.edu/~fox/library/>). The facility is wired with 800 nodes, many for open student owned notebook access.

## EDUCATIONAL PROGRAMS

The Marshall Community and Technical College is in the process of establishing a new strategic plan which will dramatically enhance technical work force preparation in the Huntington region. The Cisco Networking Academy, Microsoft Certification Testing are housed under the Marshall Technology Institute (MTI) The Marshall Technology Institute is a shared information environment and will provide the resources and technical expertise to assist the network members in acquiring and using the advanced technologies needed in today's competitive marketplace.

A great deal of emphasis is currently being placed on environmental issues, leading to growth in regulatory activities, business opportunities, and consequently rapid growth in job opportunities. The Center for Environmental, Geotechnical and applied Sciences is focused on technology-based efforts. In order to prepare students well for future employment in these fields, and to help current employees make greater contributions, the Center is facilitating a number of technology degree offerings in Huntington and Charleston. A new M.S. degree in Technology Management, which will help prepare working professionals to make difficult choices concerning technology, and manage insertion of technology into the workplace.

The Center is also very active in research and service that benefits our students, faculty, and the region. This includes software engineering and geographic information

system (GIS) consulting and training for the Corps of Engineers and other agencies, development of better methods for characterization and remediation of contaminated sites for the U.S. Department of Energy, development of a health, safety, and environmental protocol for the U.S. Navy, and work with small and medium sized companies in the region to help address their environmental issues and needs. We are undertaking a long-term initiative to provide an information and education/training base to serve as an "incubator without walls" to help spur economic development based on business opportunities related to the environment.

## LIBRARY RESOURCES

West Virginia's first OPAC electronic based library application package (VTLS) replaced the manual card catalog in 1973. The James Morrow Library (via MUNet) now provides an online public access catalog that can be accessed from on or off campus. Web access was implemented via the VTLS/VIRTUA web gateway. The library provides full multimedia resources and electronic subscription to our patrons. ARIEL electronic document delivery systems an in-house product developed by the MU school of Medicine called WebEDD allows for documents to be delivered over the web to a electronic distribution location. In addition to more effective processes related to Cataloging, Acquisitions, Serials, Reserves and Circulation the Library provides document delivery capability on the network. The web interface provides index searching and full document retrieval over the Internet. Several CD-ROM bibliographic databases (Medline, CINHALL, PSychLit, ERIC) are available via a WebSPIRS gateway ([www.marshall.edu/library](http://www.marshall.edu/library)).

## ADVANTAGE VALLEY

Advantage Valley Regional Economic Development Program is about collaboration. This education and facilitation effort reaches the community, institutions, and businesses to bring together their energies and resources to seize the opportunities made possible via telecommunications and technology. The program serves as a catalyst for regional action. Its educational initiatives enhance the effectiveness and adaptability of the region and its education, government, social sector and business organizations. The program identifies and advances initiatives within the region to stimulate collaboration, innovation, and the redesign and transformational change in the economic, government, educational and social sectors.



## HEALTH CARE AND BIOMEDICINE

The Marshall University School of Medicine (MUSOM) is implementing a number of online resources in support of the administration of the West Virginia Rural Health Edu-

cation Partnerships (WVRHEP). These include electronic mail discussion lists, hypermail archives, a comprehensive WWW site and Tracker, a centralized web based scheduling and tracking system for rural clinical rotations from all schools and in all disciplines. MUSOM has developed and hosts comprehensive WWW sites for both the WV Bureau for Public Health and health care consumer audiences, including the electronic publication of the WV Vital Statistics report and West Virginia's WellnessWeb, funded in part by Bell Atlantic and in use throughout West Virginia's public schools. The new Clinical Practice Center and Robert C. Byrd Rural Health Center located at Cabell Huntington Hospital will open in the May of 1998. The network infrastructure will support computer laboratories for student use and WAN connections to the main campus as a cooperative effort with Cabell Huntington Hospital. A radio microwave link supporting 7 T1 lines were established as a cost effective campus link. This facility also supports two-way video connections using the Mountain Doctor Television Network (MDTV) and is a demonstration site for the multimillion dollar National Library of Medicine Internet project electronic medical project called ARTEMIS. Electronic patient record system in the Clinical Practice Center, including the digital integration of patient health care data, wireless network connectivity and pen or voice based data entry terminals will be used by healthcare providers in this facility.

MUSOM Clinical Practice Center/Center for Rural Health Network Overview. The sophisticated networking capabilities planned for the Marshall University School of Medicine's Clinical Practice Center and Center for Rural Health will support a variety of both internal and outreach activities. Internally, the 400Mb fast ethernet trunking backbone and 100Mb switches will provide high-speed connections to an integrated, electronic patient record (EPR) system for faculty, staff and students. Bandwidth will be sufficient to support the rapid transfer of digitized components of the EPR, including radiological images such as X-Rays and audio/video physician notes. A centralized electronic warehouse of multimedia patient education resources, including a video-on-demand server, can be provided to any clinical examination room and office, the new health sciences library, the auditorium or any conference room via the more than 800 ethernet network connections throughout the facility.

Externally, the microwave link to the main campus of Marshall University will provide for wide-area network and Internet access throughout the facility. Groupware and desktop video conferencing with users throughout the Marshall community are only two of the applications supported by this connectivity. Continuing medical education (CME) opportunities



can be provided beyond the facility through resources such as the Interactive Patient, a WWW-based, natural-language processing (NLP) electronic patient simulation which was developed at Marshall's medical school and which earned a semifinalist ranking in the National Information Infrastructure (NII) awards in 1997, streaming audio/video recordings of CME presentations and statewide video conferencing through the Mountaineer Doctor Television (MDTV) telemedicine system.

Health care providers at affiliated medical facilities throughout West Virginia will have access to the wealth of electronic clinical resources available via Marshall, including access to searchable bibliographies of biomedical research journals (MEDLINE and CINAHL) and WebEDD, an electronic document delivery system developed at Marshall's medical school which provides full-text digitized copies of journal articles to a user's desktop via the Internet. In addition, tight integration with the networks of Marshall University's campuses will provide users with access to the myriad resources available via the sophisticated John Deaver Drinko Library. The Marshall University School of Medicine will continue to fulfill its mission of providing for the health care needs of underserved areas of West Virginia through support of a variety of outreach efforts. The Lincoln Primary Care Center in Hamlin, West Virginia, a nationally-recognized rural health care facility, will continue to share a network connection to Marshall's medical school and to the Center for Rural Health, providing students and physicians with both data and video-conferencing access between the facilities. Information resources, such as multimedia educational applications, can thus be provided to students on rural clerkships. In addition, RuralNet, the suite of Internet-based rural health care resources, will continue to serve the information needs of health care students and providers throughout West Virginia through its support of the West Virginia Rural Health Education Partnerships (WVRHEP), a cooperative program among all of the health sciences education institutions around the state. Among the resources available via RuralNet is a comprehensive WWW site for WVRHEP, a centralized student scheduling and tracking application, and a number of electronic mail discussion lists for campus and rural faculty, physicians and staff.

## FORENSIC SCIENCE

An excellent example biomedical technology application is the Forensic Science distance education teaching arrangement between the West Virginia Division of Public Safety and the School of Medicine. In addition, judges, lawyers and community law enforcement officers will need to stay abreast of current and rapidly evolving DNA technologies and faculty from the Forensic Science Program at MU can provide appropriate training and instruction.

## FINANCIAL CONSIDERATIONS

Careful planning has resulted in creating a network that has met and will continue to meet our client's expectations and at the same time has proved to be very cost-effective. Taking advantage of a major capital project that included the installation of a fiber optic backbone, MUNet began its existence based on a cost-effective planning. Each planned enhancement to the network was reevaluated at the appropriate time, any selections were based on component functionality and contribution to overall network efficiency. With that criteria as the driver for each decision there has been no instance where the objective was compromised. The largest issue is the maintenance of qualified technical employees under the existing State salary guidelines.

## ASSESSMENT OF EFFECTIVENESS

The fundamental transformations of effectiveness in communication, research, instruction and information retrieval over the past few years are the direct result of the network. The convenience of email and information exchange has accelerated communications and data interchange both on campus and worldwide. Information searches are accomplished globally and locally with no significant difference in response time or cost. Information is shared more readily because there is no additional burden placed on an individual to deliver or receive information. Students receive course-related instruction, submit assignments and perform research on the network. Students register for classes from home via the network or via telephone registration. Perhaps the most subtle but powerful change has been the way that the network has thrust students, faculty and administrators onto a common playing field. Communications and the movement of ideas have increased. The pace of innovation has quickened because of network access.



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