Broadband Infrastructure, Usage, and Training in the Public Baccalaureate and Graduate College System

Bluefield State College

Broadband Infrastructure

Campus LAN: Gigabit network utilizing Cisco 3750G POE switches. Fiber connects all buildings and links floors within buildings. The LAN infrastructure has Gigabit to the desktop.

WAN: Cisco 3825 Router connecting Bluefield State College (BSC) to WVNET via Carrier Ethernet. There is a current threshold of 30Mb/s for Internet traffic. A tunnel between routers is currently in place to the Erma Byrd Center in Beckley to connect that campus and allow local dialing between faculty and staff. Bandwidth is managed using a packet shaping device to maximize efficient usage of the network.

WIFI: Cisco wireless G and N is available across campus for faculty, staff and students. This ties back into the Active Directory to allow for secure access.

Broadband Usage

1. High use of Blackboard 9.1 and Moodle Course Management Systems. Systems are hosted at managed locations increasing the activity on the broadband system for the 2011 year.
2. Intensive use of broadband in delivery of lab courses in business, education, health sciences, and engineering technology utilizing streaming video, live video classroom, upload/download files, PowerPoint, and live chat.
3. Intensive use of interactive video technology to teach BSC classes in Lewisburg, Beckley, Logan, and Saulsville.
4. Intensive use of online tutorials across some disciplines.

Broadband Training

Training is made available via Blackboard 9.1. Faculty training in Blackboard and PowerPoint use also continues to grow, with Blackboard training for students given at the beginning of each semester. Training is given in Beckley and Bluefield for faculty and staff that use the IVN system, and training for faculty and staff for the electronic classrooms on the Beckley and Bluefield Campus.

Concord University

Broadband Infrastructure

Concord University has fiber optic cabling to every building on campus terminating in the Rahall Technology building. CAT5 and CAT6 copper network cable is wired to every classroom, office, and residence hall room. Cisco 3750(G) routed switches are deployed throughout the campus. 80Mb/s of bandwidth to the internet is provided via the local phone company—Frontier—for the campus. The entire network is gigabit capable.

Concord has deployed wireless access to the athletic stadium and commuter parking areas across the campus. Concord also has wireless areas in all residence hall lounges and common areas with an initiative to have the residence halls with roughly 80% wireless coverage. Complete wireless coverage is expected by the summer of 2012.

Broadband Usage

Concord University uses broadband in various ways to increase efficiency, enhance, and enrich the academic process. The Concord Center for Academic Technology continues to use the Blackboard Learning Management System and supportive technologies such as Adobe Connect, and H.323 videoconferencing to provide the faculty mediums to create and deliver rich, interactive, and easily accessible courses and communication with students.

Utilizing Blackboard, Concord's students enjoy the enhanced communication and “out of class” access they can experience with the faculty. Blackboard hosts syllabi, lecture notes, announcements, and other resources that can be accessed 24x7. Professors can bring lively classroom discussions through usage of discussion boards, wikis, live chats, and hold virtual office hours to support students in their academic endeavors. Supplemental technologies such as H.323 video, and Adobe Connect affords faculty the option of two way audio and video sessions with their students. Adobe Connect also allows faculty to create subgroups for working on projects, shared whiteboards, “shared monitors,” and other interactive features. Adobe Connect is available on computers connected to broadband or via smart phones with a 3g or better broadband connection. Administrative offices use the services to cut down on state travel, interview potential candidates for positions, and various other ways to increase efficiency and productivity. Static or prerecorded content can be exported and delivered on demand via streaming.

Concord's streaming provides a worldwide audience to campus media such as WCUR, the campus radio station, WMLT, the campus television, and access to events such as Convocations, two Commencements, and certain Athletic events.

Several deployed armed service members were able to see family members graduate from Concord due to streaming of the Commencement services to Iraq, Afghanistan and Naval assets.

Broadband Training

The Center for Academic Technologies (CAT) provides monthly training on various classroom support technologies including Blackboard course development, use of video conferencing, Mediasite software and web development services, as well as the use of supplemental technologies into the classroom that provide instructional strategy support.

One web-based resource developed by the CAT is the website "Teaching & Learning: Educational Technology Resources for Faculty, Staff, & Students." This website serves as an online resource for instructional strategies, productivity tools, and reference materials. It fosters more effective teaching practices using technology to create an effective learning experience, enhances the quality of teaching and learning in Concord University courses, and supports teaching and learning at all levels and in all contexts in which instruction occurs at the university.

Fairmont State University

Broadband Infrastructure

Fairmont State University (FSU) has in place a sophisticated layered network that is supported by multimode and single mode fiber providing a minimum of 1GB Ethernet to every building. Buildings with high network demand have multiple trunked connections providing the necessary bandwidth.

Commodity Internet service is supported by two different providers, Time Warner (30MB) and WVNET (80MB). The two connections are multihomed using Border Gateway Protocol (BGP) routing providing physical and logical redundancy –if one fails, service is automatically maintained through the other so that the campus is able to function until the failed connection is reestablished.

Four remote locations, the Center for Workforce Education, the Gaston Caperton Center, the Robert C. Byrd National Aerospace Education Center, and FSU GearUp, connect back to the FSU main campus using a 20MB Metro WAN service provided by Time Warner.

Two other remote locations—Braxton Co. High School and Weston High School—connect back to the FSU campus using "point-to-point" T1s provided by Frontier (formerly Verizon).

Bandwidth is managed using a packet shaping device to ensure no one device or network segment can utilize all available capacity. Bandwidth is continuously monitored and added, when necessary and fiscally possible, to support the growing demand for online based instruction, services and research of the campus community.

802.11 b/g wireless networking covers most areas of the campus allowing the use of laptops and other mobile devices as one crosses the campus.

The security and integrity of the network is maintained by various methods, all of which are facilitated by having a common vendor for most network equipment.

Current educational applications are clustered around server farms to provide high availability and access to the user community. These systems utilize a hardware load balancer, along with redundant gigabit network connections.

A separate Research and Development Network is deployed for Science and Technology faculty. This R&D network was created so that research faculty can install servers, conduct "destructive testing" and perform other academic research in an environment that they can fully control, but which cannot impact the security and operations of the main campus network.

Broadband Usage

FSU is one of three institutions in West Virginia that provides hosting services for Blackboard/Vista as well as handling all online course delivery. Hosted partners include WV Northern Community College, Mountwest Community & Technical College, Eastern WV Community & Technical College, and Pierpont Community & Technical College. FSU is the largest participant in the Global Grid Exchange (G2EX) project managed by the West Virginia High Tech Consortium with 923 active nodes, and an approximate value of $10 million per year provided to the West Virginia and regional research economy that is serviced by the G2EX project.

Broadband Training

FSU currently provides training via the Teaching and Learning Commons (TLC) for full-time faculty and adjuncts both at Fairmont State University and Pierpont Community & Technical College in the use of Blackboard/Vista and other learning technologies. The TLC also provides training on demand for hosted partners and other institutions in the state of WV on occasion.

Glenville State College

Broadband Infrastructure

Glenville State College (GSC) has a fiber optic delivered 100Mb Carrier Ethernet link from FiberNet connecting to WVNET for WAN connectivity. 45Mb/s of this available bandwidth is currently purchased for the use of faculty, staff and students at GSC. The core router and 95 percent of all of switches on campus are Cisco products. Other minority network equipment vendors are Cabletron/Entrasys, 3Com and Trendnet.

All major buildings on campus have fiber optic cable between them that was installed in the late 1980's. The fiber is 62.5 micron ATT multimode cable utilized in a star configuration bringing all buildings back to the Harry B. Hefflin Administration building. Recently remodeled buildings now have multiple strands of both multimode and single mode fiber available within the buildings. Wiring closets between floors are connected via fiber at 1Gb/s speeds. Most are running at 1Gb/s with two running at 100Mb/s via single mode fiber back to the core.

Most buildings have limited wireless (WiFi) connectivity in place with the Robert F. Kidd Library being the only building having total coverage. Faculty, staff, and students living in GSC Corp. units are connected to the main campus via Motorola canopy broadband wireless equipment at 100Mb/s.

Broadband Usage

GSC continues to be an innovative and driving force behind the use of broadband in North Central WV. The number of partners continues to grow, and initiatives that depend upon sustainable, stable computing resources brought online. Agreements with West Virginia Regional Jail System, Juvenile Justice System, Department of Corrections training centers, local entities (police, newspaper) are expanding GSC's environment of learning.

Grant funding from NCC, US Department of Education, US Department of Justice, NASA, PDS, and HEPC has helped to expand the network, security, support, training and utilization of broadband services. This allows GSC to build and support student success by offering additional bandwidth for tutoring, WebCT instruction, research, training, and video conferencing. The amount of hardware resources and broadband required continues to grow very quickly.

Broadband Training

Depending upon the topic area, training is provided by IT staff and/or contracted out to vendors. Training for faculty is provided in the following: Microsoft Windows XP, Microsoft Windows Vista, Microsoft Office Suite products, SunGard HE Banner SIS, Smarthinking, TeacherEase, WebCT Vista, and use of Video Conferencing equipment.

Marshall University

Broadband Infrastructure

Marshall University's Campus Network, MUnet, is a state-of-the-art 10Gb/s Switched Ethernet based backbone network linking all buildings on the Huntington Campus with WAN links to our regional campus, centers, and medical clinics. MUnet supports over 11,000 switched gigabit Ethernet ports and nearly 400 WiFi 802.11n wireless access points. The Huntington Campus is connected to the South Charleston Campus by a 100Mb/s Transparent LAN Service (TLS) circuit provided by Frontier Communications (formally Verizon) and a 100Mb/s diverse path NTelos MPLS circuit. The Mid Ohio Valley Center campus in Point Pleasant is linked to the Huntington Campus by a 100Mb/s Frontier Communications TLS circuit. The Medical Education Building and VA Hospital in Spring Valley and the Marshall University Research Corporation in downtown Huntington are connected by a 100Mb/s Frontier Communications TLS circuits. Various smaller learning centers like the Larry Joe Harless Center in Gilbert and clinical facilities are connected via 10Mb/s Frontier Communications TLS or NTelos MPLS circuits.

The Huntington Campus network is linked by a university owned metro fiber point-to-point service to the Robert C. Byrd Center for Flexible Manufacturing in downtown Huntington. The Marshall University Joan C. Edwards School of Medicine (JCESOM) Campus adjacent to Cabell Huntington Hospital and the JCESOM Fairfield Campus, including the Erma Ora Byrd Clinical Center and the Forensic Science Center, are connected by a university owned fiber optic ring operating at 10Gb/s. An additional university owned fiber ring links St. Mary's Medical Center and the St. Mary's Medical Education Center, future home of the Marshall University Physical Therapy Doctoral Program, at 10Gb/s and integrates to MUnet in Huntington.

The MUnet campus networks are connected to 1.6Gb/s of commodity Internet Service provided by three diverse path Internet Service Providers (ISP) (nTelos, OARnet, and GTT). Marshall University is also a member of Internet2 and is connected to Internet2 with 1Gb/s of service via the Ohio Academic and Research Network (OARnet). This bandwidth and redundancy will provide the reliability and services needed to support current campus initiatives.

Marshall University has established a SEGP agreement with Internet2 to offer Internet2 services to other West Virginia higher education institutions, K12, State Government Agencies, Libraries, Hospitals, and other eligible not-for-profit research and education entities in West Virginia. This is being funded in FY2012 in part by an EPSCoR grant that was begun in FY2011.

All MUnet service provides full Quality of Service (QoS) on all network ports and multicasting in support of voice, data, and video services and other real time applications. All services are switched and operate at full wire speeds. Marshall University participated in the Internet Society's World IPv6 Day 2011 on June 8, 2011. During this worldwide test Marshall University certified MUnet to be fully IPv6 enabled. Internet Protocol version 6 is the future of Internet addressing and protocols and will gradually replace IPv4, Internet Protocol version 4. IPv6 offers many enhancements to the basic protocol of the Internet in addition to adequate address space to accommodate the growing number of Internet connected devices.

MUnet supports full Voice over IP, VoIP, telephony services with unified communications and voice mail to nearly 3,500 extensions as well as a limited number of legacy FAX and other analog lines via analog gateways. MUnet central video conferencing services support full High Definition (HD) conferencing at 720p or 1080p. All HD endpoints are capable of a four way video call on their own. A 20-port Multi Point Control unit supporting full HD Video Teleconferencing over IP enables video calls requiring more than four concurrent endpoints.

The Wimba Collaboration Suite, now part of the Blackboard Collaborate Suite, provides web Conferencing for virtual classrooms. This service provides a full virtual classroom experiences with student breakout rooms, lecture recording/archiving, and poll/question/quizzing during on-demand archived sessions. Web Conferencing Virtual Rooms are also available for campus meetings and other event functions.

Broadband Usage

Marshall University makes extensive use of broadband services. The university has over 250 totally online courses that have over 14,000 enrollments each year. In addition to the totally online courses, called Ecourses at Marshall University, most traditional classroom courses at Marshall University use the learning management system, MUOnline. MUOnline is powered by Blackboard Learning Systems software and has as many as 2,000 concurrent users accessing course content, assignments, video & other multimedia, and/or interacting is discussions, chats, or videoconferences. Over 90 percent of the student population uses the learning management system for at least one course every semester.

Online Course Enrollment Summary – Academic Year '10-'11

Semester	Online Courses Offered	Enrollment
Fall '10	238	5,173
Spring '11	252	5,567
Summer '11	220	3,744
Total	**710**	**14,484**

Source: Marshall University / WV Virtual Learning Network, Course Enrollment '10-'11

* Total is not a unique student count, so likely includes head count duplication.

Marshall University also hosts learning management system services for Glenville State College and Southern West Virginia Community & Technical College. Each hosted institution has had student enrollments in the Learning Management System of between 200 and 250 students during fall and spring terms.

Marshall University has partnered with the WV Tele-health Alliance in support of advanced networking to link researchers and clinical medicine facilities together at high speeds and to the networked world via commodity Internet and Internet2 services. Marshall will support improved health care coordination in rural areas through Tele-health applications, applied research and health education.

Marshall University has made a major commitment to the research community with a recent EPSCoR Cyber Infrastructure Grant that is supporting the offering of connections to qualifying state agencies, non-profits, non-profit and for profit K12, higher education institutions, museums, libraries, art galleries, hospitals, and research groups or projects to Internet2. This Sponsored Education Group Participants (SEGP) program is intended to allow expanded access to the Internet2 network and is a major addition to the economic development toolset for the State of WV.

Broadband Training

The MUOnline Design Center, a unit within Information Technology with three professional instructional designers and six FTE student design assistants, provides technical support to faculty for the development and deployment of online courses. Many of these utilize video, audio, and other bandwidth intensive resources and collaboration technologies.

A new initiative began in 2010, supported in part by an EPSCoR CI-TRAIN Cyber Infrastructure Grant, to make faculty aware of and to train them on the resources available on Internet2. These resources include but are not limited to NSF support resources like the TeraGrid. Faculty training is on-going on topics like High Performance Computing Clusters, Science Gateways, and other resources and services available on the Internet and Internet2.

The EPSCoR CI-Train Cyber Infrastructure Grant will also support an experimental HPC Cluster at Marshall University to train faculty and other researchers in the use of high performance computing.

In May 2011 Marshall University Information Technology established a subscription agreement with the Internet Streaming Services of Lynda.com, an online training site known for excellent training content on a wide variety of computer applications, software, and general professional development. This

LyndaCampus subscription provides high quality and current training content to any Marshall University faculty, staff, or student anywhere they have a broadband connection.

The EPSCoR CI-TRAIN Cyberinfrastructure Grant also supports an experimental HPC Cluster at Marshall University to train faculty and other researchers in the use of high performance computing.

Shepherd University

Broadband Infrastructure

Shepherd University's commodity Internet connection has been increased to 100 Mb/s. This is still under the 300 Mb/s that independent assessments have said we need, but it is significantly higher than the 40 Mb/s of the previous two years. Shepherd does not subscribe to Internet2. The campus network is a gigabit fiber-optic network core with a mixture of mostly Cat-5e and Cat-6 connections to end points. Wireless networking is available in all academic and administrative buildings and in open spaces on campus and in Shepherdstown, in partnership with Frontier Communications. About half of the residence halls are also covered, with the remaining halls to be covered next summer. The access points used are a mix of 802.11g (previously covered areas) and 802.11n (newly covered residence halls). A network equipment replacement plan has been funded to ensure currency of the infrastructure on campus.

Broadband Usage

Use of the open-source Sakai Collaborative Learning Environment continues to increase. For spring 2011, 3,641 students (approximately 85% of the Shepherd headcount) took at least one course that had a published Sakai instance (464 sections total, taught by 236 separate instructors). The Internet connection is routinely at 100% utilization during business hours; this is unlikely to change until we are able to afford an increase in bandwidth to 300 Mb/s or more. Several cloud-based services are in use or planned to be used shortly; this will continue to tax our broadband connection.

Broadband Training

The Center for Teaching and Learning continues to assist instructors in the use of Sakai. IT Services participates in orientation sessions for incoming students; included in the topics are warnings about peer-to-peer file sharing, copyright infringement, and legal alternatives. No other formal training programs are in place.

West Liberty University

Broadband Infrastructure

West Liberty University has in place two physically and logically segregated networks.

Our administrative network is an internal network that is comprised of a flexible infrastructure utilizing Cisco 3750G switches and a Cisco ASA 5550. The administrative network utilizes a high capacity router connecting to Frontier Communications via Metro Ethernet Fiber Optic Circuit providing 100Mb/s of bandwidth. This circuit has the capacity to easily scale to 1Gb/s. The campus is supported by multimode fiber connected to every administrative and academic building. Wireless access has been deployed for our students in the academic buildings. Wireless coverage is 98% in academic and administrative buildings with 100% coverage in residence halls via Wireless G service. Wireless improvements in this network include moving to 802.11n, vendor used is Meraki for new deployments and planned replacements of the Cisco Aironet access points. The library and West College buildings are currently 802.11n, with full 802.11n deployment across campus expected to be completed by Spring 2012. A new Meraki managed router was deployed in August 2011 to control the entire administrative network. This provides a needed dashboard view into network performance and functionality. This Meraki router will provide packet inspection and packet-shaping capability.

The residential network consisting of seven dorms and numerous residential units are currently being serviced by a Comcast High Speed Broadband connection. Users are guaranteed 16Mb/s download and 10Mb/s upload speeds and the network as a whole can burst to 7Gb/s as needed. High Definition and on-demand TV is also provided in the residence halls and residential units.

West Liberty University also has in place a satellite location at the Highlands in Triadelphia, WV. This location consists of a high speed router utilizing 50Mb/s of bandwidth from Comcast.

Broadband Usage

The majority of West Liberty University's major applications are housed at off-campus locations, so these services are made available to the campus via existing broadband connections. Sakai, an open source course management product, continues to be hosted by rSmart. Email continues to be provided via Google Apps for Education and Banner is provided through WVNET. Increases in the use of Web 2.0 tools to support instruction have continued.

Broadband Training

To better support student learning and faculty productivity West Liberty University created a new 11-month faculty position, the Online Learning Specialist, and established a formal compensation plan to provide faculty a monetary incentive for online course development and teaching. The Online Learning Specialist's responsibilities, working with both IT and faculty, include training and support for the use of Sakai, iTunesU, Turnitin, online Web2.0 tools, Google Apps for Education, instructional technologies such as interactive whiteboards, student response systems, and streaming video such as Discovery Education. Each of these tools depends heavily upon broadband availability.

West Virginia School of Osteopathic Medicine

Broadband Infrastructure

In 2011, the West Virginia School of Osteopathic Medicine (WVSOM) completed a major network infrastructure design and enhancement project. As a result of the project, WVSOM now has redundant and diverse WAN links through multiple providers. A 45Mb/s connection is provided by Suddenlink which routes through Alta to Charleston, WV. A second 50Mb/s connection is provided by Ntelos which is routed through Ronceverte to Charleston, WV. By December 2011, Ntelos will provide a third route from the WVSOM campus through Covington to Waynesboro, VA. These connections provide failover and redundancy by utilizing BGP (Border Gateway Protocol) to advertise the divergent paths.

The campus network is serviced by a dual Cisco 6504 core with 20Gb/s fiber uplinks to all buildings via port-channeled 10Gb/s ports and 1Gb/s connections to the desktop. Distribution and access switches are a mix of Cisco 4506, Cisco 3750, and Cisco 2960 switches. Two Cisco ASA firewalls are placed in line for security, with internal and external Blue Coat Packeteer packet shaping devices and two Cisco 3925 routers. Web filtering is managed by an Ironport device while network management and monitoring is performed with the CiscoWorks and Solarwinds Orion applications. These allow WVSOM to manage network traffic thereby providing priority to academic applications. Bandwidth is monitored and can be increased based on demand. The network access is managed by multiple VLANs by location and function (i.e. server, management, voice). Layer 3 boundaries exist between the core and distribution switches creating subgroups of buildings within broadcast domains. Campus wireless is available with over 100 internal and external Cisco access points providing 802.11 a/b/g/n connectivity. Both wired and wireless environments utilize the 802.1x port-based network access protocol performing authentication via Active Directory credentials and WPA2 security.

Broadband connectivity is used to link WVSOM with statewide campuses and Mountain State Osteopathic Training Institution sites throughout WV. These include over 20 hospitals and clinics that provide clinical training for graduate students and postgraduate internship and residency training. Additional connectivity used for video conferencing is provided via MDTV.

Applications serviced throughout the campus network are reliant on a mixture of physical and virtual servers. WVSOM deployed, along with the network project, a UCS-B Cisco blade server with two NetApp storage appliances, one for primary storage and a secondary unit for backup/mirrored storage. Deployment of the virtualized server environment is accomplished by the use of VMWare and its associated application components.

Broadband Usage

WVSOM utilizes web-based resources in support of all four years of graduate student medical education. WVSOM utilizes a WAN to deliver video and other applications to statewide campuses and postgraduate training sites. There are no on-line courses as such. Graduate student pre-clinical and clinical training utilizes the Secure On-line Learning Environment (SOLE), developed at the WVU School of Medicine. All curricular material is made available via this application (which is similar to Blackboard/WebCT). Testing is conducted online using SOLE, ExamSoft and QuestionMark. The statewide campuses utilize these applications extensively. The management of rotations, evaluations, grading, et cetera, is done using web-based applications.

WVSOM is a partner in the WV Telehealth Alliance, formed to manage the FCC rural telehealth grant program, and the WV Health information network initiative, which is developing linked health-related databases. WVSOM will be providing training and will also participate in evaluation and data analysis.

Broadband Training

Instructors receive training in the use of the web-based course management system and the web site content management system. Training in the use of videoconferencing equipment is also available. Computer labs are maintained for demonstrating the use of web-based applications, and web-based seminars (webinars) are being developed to train staff at remote sites.

West Virginia State University

Broadband Infrastructure

West Virginia State University (WVSU) has in place a campus LAN utilizing Gigabit fiber connections in a combination of star and ring topologies to each of 26 buildings on the Institute campus via a multimode fiber backbone with 1Gb routers in most buildings and providing 1Gb – 10Mb connections in buildings.

Off campus facilities include Valley Fork (Clay County), WVSU Economic Development Center (Kanawha Blvd, Charleston), WVSU Capital Center (Summers Street, Charleston), Shawnee Regional Park (Dunbar), Fayette County Courthouse (Fayette County), Summers County Courthouse (Hinton), Wyoming (Pineville), Roosevelt Center (Charleston), Carroll Terrace (Charleston), and Nicholas County (Summersville) and are served via multiple methods including shared facilities, DSL, cable and dedicated T1 (Verizon, FrontierNet, WV FiberNet).

Internet service providers include WVNET (16Mb) and FiberNet (100Mb to the Governor's Office of Technology/WVNET).

Wireless LAN is supported in the Library and Student Union for visitors and students with portable computing devices. It is also supported in other locations on campus where portable computer labs may be deployed. The wireless connections are used when needed and simplify connection to internet services to facilitate quick setup of the portable computing labs.

The main campus network is composed of 3 networks sharing a common public network:

1. An administrative network protected by a Cisco PIX firewall and includes separate fiber connections to five buildings.
2. A student residential network that incorporates a registration system and is segregated from the other networks. Bandwidth to the residential network is managed using a Packeteer appliance.
3. A third network exists using VPNs on the public network for the WVSU Research and Development Corporation.

Network service is provided for the WV State Community and Technical College on the public network through 3 routers.

The separate private networks are deployed in each building or logical building segment using smoothwall routers. Public network service is provided via on-campus DSL or fiber to WV Clearing House, College Summit, Upward Bound, Kanawha County Adult Basic Education, and Kanawha County Collaborative Programs.

Campus network operation is insured by continuously monitoring segment and critical servers via TCP connect, ping, and resource availability.

Campus infrastructure is built according to published campus standards (http://standards.wvstateu.edu).

Broadband Usage

The campus continues to expand its use of WebCT, a product that supports using the web for delivering course content. While the primary use of WebCT at WVSU is for web assisted or web enriched classes, WVSU also offers online courses using WebCT.

Broadband Training

WVSU currently provides training on WebCT/ Blackboard/Vista and other learning technologies for full-time faculty and adjuncts through the Center for Instructional Technology (CIT).

West Virginia University

Broadband Infrastructure

West Virginia University (WVU) supports three 10Gb/s core network locations; one in downtown Morgantown, one in the Evansdale Campus, and one in the Health Sciences Center; each is connected by redundant single-mode (SM) fiber. Campus buildings are connected to the core locations via redundant SM fiber. The fiber is owned by WVU.

The wide-area network (WAN) consists of several different types of circuits. The main MPLS WAN consists of a 1Gb/s connection (100Mb/s access) in Morgantown with remote connections to WVUP (45Mb/s), WVUIT (45Mb/s), City Hospital (45Mb/s), Jefferson Hospital (45Mb/s), Elkins (1.5Mb/s) and WVU/Health Sciences - Charleston (20Mb/s). Additional sites—Center for Rural Emergency Medicine, Fire Training Center, Jackson's Mill, and the Center for Excellence in Disabilities—each have 1.5Mb/s Frame Relay circuits that land on the WVU ATM backbone via an ATM OC3. WVU has a total internet bandwidth of 918Mb/s with 60Mb/s of that connection dedicated to WVU Hospital. There are various other locations, both residential, and college oriented, that have DSL connections to the WVU backbone via ATM. There are additional broadband connections via Telemedicine (MDTV), and IVIN interactive academic classrooms are multiple sites across West Virginia.

WVU is connected to I2 via OC3 with an access speed of 75 Mb. We are currently looking to upgrade that connection to 10Gb/s. By February 2013, WVU will be connected to the NRAO in Greenbank, WV, at 10Gb/s speeds as part of the State of West Virginia BTOP grant. Finally there is a full T1 connection to WVU Jackson’s Mill.

West Virginia University currently has over 800 Wireless Access Points covering over 120 buildings and green space in the Morgantown Campuses
Wireless networking (WLAN) is handled by Cisco CAPWAPs controlled by five WiSM blades. Four located at the core sites and one at the Evansdale Residential Complex. Three WLC4400, one located at Potomac State College in Academy Hall and the other 2 at the core sites. Currently A/B/G/N signals are deployed with plans to eliminate B and continue the deployment of N.

Broadband Usage

West Virginia University Extended Learning — eLearn.wvu.edu —takes courses around the state and around the globe through off-campus programming and distance learning technology via broadband. WVU provides access to graduate programs as well as many undergraduate online classes. Most students tend to be adult learners, but courses are also offered to many high school students through online and hybrid classes offered in high schools. WVU offers more than 21

graduate degrees and certificates in online and/or blended formats and 3 undergraduate degree completion options. WVU Extended Learning has also expanded into the non-credit field to address the needs of all life-long learners.

The Instructional Technology Resource Center (ITRC) increases the extent to which technology enhances the quality of teaching and learning at WVU. The ITRC's mission is to support, promote, and enhance teaching effectiveness at the University through instructional strategies and faculty development. The ITRC promotes methods that enable the University to achieve its goals of providing a student-centered technology enhanced educational experience for all students. With 6 Instructional Designers and 3 Multi-Media Designers, the ITRC developed approximately 40 online courses in 2008, bringing WVU's total to over 300 totally online courses.

WVU operates an enterprise Course Management System using Blackboard Vista that hosts the WVU main campus including Health Sciences, WVUIT, Bridgemont Community and Technical College, Potomac State College and WVU-Parkersburg. Representatives from units and hosted institutions meet monthly for updates and training on eCampus Course Management System. This group, or eCampus Points of Contact, provides information and support within units on aspects related to eCampus including plug-ins and auxiliary tools (see https://ecampus.wvu.edu/faculty).

WVU eCampus Statistics

Semester	Distinct Students Enrolled	Total Enrollments	Sections	Max # of Concurrent Users
Fall '10	32,615	176,615	5,566	4,910
Spring '11	31,142	160,610	5,323	4,868
Summer '10	10,615	23,117	1,149	1,630

* Statistics are for WVU campuses only. Hosted institutions courses are not included in these numbers.

Additionally, the Health Sciences Center offers faculty assistance through the Information Technology Services. This department provides networking and telecommunication services; telemedicine, teleconferencing, and distance education; web and database support; user training, consultation, and public computing facilities; and Help Desk support to Health Sciences Center students, faculty, and staff in support of the teaching, learning, and research mission of the Robert C. Byrd Health Sciences Center. Pedagogy and effective teaching strategies are enhanced through the Teaching Scholars program for Health Sciences faculty. In Health Sciences Center, SOLE (Secure OnLine Environment) portal is used as a single point of entry for all courses and secure resources. It is a web-based open-ended system for students to access courses and for instructors to build and maintain those courses. SOLE portal (https://sole.hsc.wvu.edu) is also used as a secure gateway to access and manage other applications and databases used in Health Sciences Center. SOLE delivered about 26 million pages in spring of 2009 and the volume of usage increases approximately 10 percent each year.

Some individual Colleges host local instructional technology support units, e.g., Human Resources and Education's Teaching Learning Center, Business and Economics' Technology Support Unit, and Eberly College's Center for Computing Literacy.

Broadband Training

Training is provided by the Office of Information Technology and the ITRC to all new and current faculty on all campuses. Training includes effective online teaching and how to use the enterprise course management system and all associated eLearning tools. This provides faculty with the information needed to quickly and easily integrate into the classroom. Web-based tools are often used to provide these training opportunities.

The Computer Science/Electrical Engineering Department offers a periodic course in parallel and grid computing. Ad hoc and on-demand training is also available on-campus, conducted by the Pittsburgh Supercomputing Center in the use of High Performance Computing tools.

Discussion and recommendations regarding deployment of additional collaborative tools such as Wikis, blogs, document management, and other online tools to support teaching and learning as well as administrative efficiencies are also under consideration.

Broadband Infrastructure, Usage, and Training in the Community & Technical College System

Blue Ridge Community and Technical College

Broadband Infrastructure

Blue Ridge has two campus locations – downtown and tech center – connected with a 10Mb/s fiber connection. We also have a 10Mb/s connection to WVNET through nTelos. Within the next year the WVNET link will be increasing to 50Mb. Each individual campus network backbone is interconnected via 1Gb/s links. Phone service at the tech center is achieved through VoIP connection to the downtown building. Wireless covers both academic and administrative areas at both buildings. A local cable company internet connection is used for the student portion of the wireless network and some computer labs.

Broadband Usage

Blue Ridge CTC uses MyMathLab and SMARThinking online tutoring in the academic foundation courses. SMARThinking is available to the entire campus but is primarily used in the academic foundations writing courses. WebCT Version 4.1 hosted at WVNET is the primary learning management system. We are in the process of transitioning to Blackboard Learn 9 hosted at WVNET. Digital library resources include EBSCO Host and LLW Premium Nursing database. Access is also provided to databases at the Martinsburg-Berkeley County Public Library.

Broadband Training

Academic departments train instructors in MyMathLab and SMARThinking.

Bridgemont Community and Technical College

Broadband Infrastructure

Bridgemont has two campus locations – Montgomery and the Technology Park in South Charleston. The Montgomery campus connects four separate buildings together to form a hub-and-spoke network architecture. One building connects to the Davis Hall (hub) via a multi-pair fiber connection at 1Gb/s. All vertical connectivity between data closets are currently at 1Gb/s with plans to expand that service to 10Gb/s within six months. Two other facilities located nearly one-half mile from Davis Hall are connected with a 54Mb/s wireless bridge. Davis Hall connects to WVNET via leased services through Fibernet/nTelos with a full-duplex 10Mb/s connection. Within the next year the WVNET link will be increased to 20Mb/s in anticipation of increased bandwidth demand from the Technology Park operations. WVNET will be providing a 10Mb/s link from the Technology Park to their facility in Bldg. 6 at the Capital Complex. Phone service at Bridgemont is VoIP using a Cisco Business Edition Call Manger and Cisco 7962 handsets. All areas are serviced by 802.11n wireless access. Fibernet/nTelos provide two PRIs for external phone service.

Broadband Usage

Bridgemont CTC relies upon our broadband network for interconnectivity to the Internet and our South Charleston location. Usage beyond browsing is categorized into two concentrations: cloud-based applications and services, and providing external connectivity to selected services within Bridgemont CTC to remote users. The following is a list of those applications and services that use the broadband resources.

Cloud-Based Usage	
SMARThinking	GoogleApps for Student Email
Blackboard Vista LMS contracted service with WVU	LiveChat support for Information
Hawkes Learning	Teamviewer
SAM Testing Site	Cloud-based On-line curriculum and testing
SCT Banner Systems/FIMS – WVNET	MSDN – Downloads
WebEx – WFD Distance Delivery	MS Volume Licensing Center – Downloads
E2Campus – Emergency Notification	WEAVE

Local Server-hosted Usage
Tandberg C-20 Point-to-point distance delivery system
MS Sharepoint
MS Exchange
IP Phones – via Fibernet/nTelos PRI

Broadband Training

Bridgemont CTC has a full-time instructional designer to support faculty for development and deployment of traditional, online, video-based and hybrid forms of instruction. A centralized college Help Desk works collaboratively with all elements of Bridgemont CTC to provide technical support for all students, faculty and staff.

Eastern West Virginia Community & Technical College

Broadband Infrastructure

Eastern West Virginia Community & Technical College broadband serves four Access Centers (Pendleton County High School, Tucker County High School, Petersburg High School , Hampshire County High School), the nursing lab In Moorefield WV and added the technology Center in Petersburg, WV. These locations are networked together using a T1 frame relay circuits with a DS3 circuit at the main campus. All network traffic routes back to the headquarters using Cisco hardware. All Access Centers and the nursing lab have a 100Mb/s backbone; the main campus has a Gigabit backbone. Firewall protection, antivirus, and spam filtering are provided by WVNET in Morgantown.

Quality of Service (QOS) is installed on the Cisco routers at the Access Centers and the nursing lab to ensure priority of video packets when using Distance Learning equipment. This equipment includes a PolyCom VSX 7000 and VSX 8000. Multiple connections can be made using our PolyCom MGC-50 video bridge. Wireless network access has been deployed at all Access Centers and the nursing lab. The main campus has both secure and unsecure wireless VLANs. The secure VLAN is for use by college employees to access shared resources and printers on the LAN. The student VLAN allows access only to the internet and is restricted from access to the college LAN. Wireless at the Access Centers are secure networks using WEP with 128bit encryption.

Broadband Usage

The college currently uses the PolyCom videoconferencing systems and Blackboard WebCT as its primary delivery tools for distance education classes. The PolyCom MGC-50 makes it possible for the instructor to be located at the headquarters and to provide instruction to one or two other sites using interactive video over IP. The college has entered into an agreement with Fairmont University train, and support courses being delivered using Blackboard. Other modalities are also in use, using a combination of hardware and software.

Broadband Training

Access Center advisors and faculty receive training at the start of each semester for both existing and new employees. The training covers the use of the PolyCom VSX 7000 & 8000 systems. An Information Technology guide that contains IP addresses, location, and layout of the classrooms is also provided. Two employees of the college have been trained on the use and support of Blackboard and are readily available to assist faculty and student with their use of the application.

New River Community and Technical College

Broadband Infrastructure

The New River CTC broadband network is an integrated voice, video, and data network that connects six primary locations in Beckley, Ghent, Lewisburg, Princeton, and two sites in Summersville. Fiber connects four of these six locations to the COLO, which is currently still in Charleston. The COLO is provided by Alpha Technologies with nTelos as the Internet Service Provider, but we have plans to move the COLO to our Beckley data center over the next few weeks. The main campus in Beckley, our campus in Lewisburg, and our COLO were all recently upgraded to 50Mb/s connections. These upgrades were not planned, but instead done in response to heavier than expected network usage at these three locations. We are planning to deploy Metro Ethernet at each of these six locations starting in October 2011. At that time each location will have 50Mb/s except for Beckley, which will actually have 500Mb/s as it is the location for our main data center and our COLO after we move it from Charleston. Currently, both Ghent and our second site in Summersville (AHEC) are in transition from 10Mbps T1 connections to fiber and we anticipate these to be completed in early 2012.

The College's Internet connection is currently a 30Mb/s circuit. New River does not currently have access to Internet2. The New River wireless network is available at each of our six locations using 802.11n. All switches, routers, gateways, firewalls, and wireless access points are Cisco equipment and gigabit speeds to the desktop are supported. A Cisco VoIP phone system is deployed at all six campus locations.

New River also delivers instruction at a number of off-campus sites. Just recently we've deployed several laptop computers, some videoconferencing equipment, a wireless access point, and a VoIP phone to Marlinton, WV as part of the One Room University there. We are adding this site to our New River network and it will soon be a 10Mb/s Metro Ethernet connection provided by Frontier. We've partnered with the Kanawha Valley CTC to offer nursing classes in Valley Fork and we rely totally on their network for that location. We also have an ADSL connection at Pocahontas County High School where we deliver and originate instruction. And we've recently added a cable modem connection for Internet and voice in our welding building in Lewisburg, which is not located on the main campus there.

Broadband Usage

With six locations, New River relies very heavily upon the broadband network for all academic and administrative services. The Beckley campus is currently the primary location for most server-based solutions (email, web, active directory, etc.) but SCT Banner is hosted in Morgantown by WVNET and New River staff

members administer it. New River relies heavily on a number of cloud-based resources (nearly half of all online resources in use at the College are on the cloud). A combination of Windows Server 2008 and 2003 comprises the majority of New River hosted solutions, although some key services are hosted on Mac OS X Server.

To support a 9-county area of southern West Virginia, New River heavily utilizes video-based course delivery that we refer to as the Interactive Video Network (IVN). Currently, we have 18 IVN classrooms owned by New River with four in Lewisburg, three in Summersville, four in Beckley, two in Princeton, two in Ghent, one at the Valley Fork Education Center, one at the One Room University in Marlinton, and one at the Pocahontas County High School. Additionally, we have two IVN classrooms owned by Bluefield State College that are deployed on the New River campus in Lewisburg and one owned by West Virginia University deployed on the New River campus in Summersville. All of the New River IVN classrooms support High Definition video with multipoint connectivity and duo video (instructor plus content using two simultaneous video streams). A 24-port Cisco MCU is currently being used to bridge, schedule and manage these video connections but it provides only 16 HD ports for video. A 5-port IPVCR records and streams the IVN content following the live delivery for students to review and to assist students who might miss an IVN class.

Currently the Fall 2011 schedule has 153 course sections being offered via IVN with some of those courses also being web-enhanced, meaning that they additionally use the ANGEL learning management system. Each IVN course is comprised of at least two course sections and some comprise as many as 3-4 sections, so 153 course sections on the schedule indicates a smaller number of actual courses. The Fall 2011 schedule currently has 81 ANGEL course sections on the schedule (completely online) and one section actually does equal one course. We have 23 course sections on the Fall 2011 schedule that are web-enhanced, meaning they utilize ANGEL for some portion of the course delivery. And every course section on the schedule (over 600 total) has access to the ANGEL learning management system so that it may be used as a supplement to traditional classes.

A five-year Title III grant has been instrumental to New River's development of a broadband network infrastructure and accompanying online services by funding a large portion of these startup initiatives. We will begin year four of this initiative in October 2011.

Broadband Training

The Center for Teaching Excellence provides an instructional designer to support faculty for development and deployment of traditional, online, video-based and hybrid forms of instruction. A centralized college Help Desk works

collaboratively with Technology Services staff deployed to each campus location to provide technical support for all New River students, faculty and staff.

West Virginia Northern Community College

Broadband Infrastructure

West Virginia Northern Community College has three campus locations—Wheeling, Weirton, and New Martinsville—networked together via T1 and D3 lines. Network traffic routes through Cisco routers and switches at all locations. Fixed firewall and traffic limiter/filtering are provided through a software/hardware solution. The connection among the three campuses is via VPN. The college is currently working with a regional internet security designer/engineer to restructure the flow of traffic for both intra- and internet usage at the college and campuses. This restructuring will increase bandwidth and the availability of services to support increased use of technology for distance education, and remote connections of classes via internet/intranet applications.

Broadband Usage

The college currently uses Blackboard Vista as its primary CMS for delivery of distance education classes, hybrid courses and programs. Other modalities are also in use, using a combination of hardware and software, to deliver classes via video web conferencing. Three classrooms are fully outfitted with IP Video instruction stations.

Broadband Training

Faculty and staff professional development sessions are offered throughout the year in the use of all technology initiatives. Some of these sessions include the use of CMS systems like Blackboard, video web conferencing between campuses and with area high schools, web page design and development, and a variety of user applications available for use.

Southern West Virginia Community and Technical College

Broadband Infrastructure

Southern West Virginia Community & Technical College currently has four campus locations, and one off-site location at Lincoln County High School. All campus locations and the Lincoln County site have their Internet access routed through the Logan campus site. So, all Internet traffic comes from Charleston to the Logan campus and is then routed to the appropriate satellite campus location. For traffic that is dependant on the state wide infrastructure, such as ICR classrooms, the traffic is routed from each campus's ICR facility to the facility that is either hosting the event, or watching the conference via ICR. Southern also utilizes a 10 megabyte connection between the Williamson campus and the Logan campus that is provided by Suddenlink Communications at a monthly subscription cost. The rest of the College's connectivity is provided by Verizon. The connection to the state network and the Internet is through WVNET, the statewide ISP for higher education institutions.

Broadband Usage

Wireless network access is deployed at each campus location. There is a secure and unsecured VLAN defined for this. The secure link is for use by college employees and allows access to applications that are not available for student use. The student VLAN allows access only to the internet and is routed to a separate connection to remove the traffic from the campus network. This is accomplished by purchasing a low cost connection from the local cable company at each campus.

Broadband Training

None.

CTC Outsourced Broadband Services

The following CTCs are either hosted on four-year campuses or broadband services are managed by another institution. Broadband data related to these institutions are reported as part of the host institution.

- Mountwest CTC – Broadband services provided by Marshall University
- Pierpont CTC – Broadband services provided by Fairmont State University
- Kanawha Valley CTC – Broadband services provided by WV State University
- WVU at Parkersburg – Broadband services provided by WVU

2011 WV Higher Education Broadband Inventory - Available Bandwidth

Stated in Megabits/Second

Four-Year College & University System

	Backbone		Campus		Satellite Campus		Classroom		Research Facility	
Institution	**Max**	**Med**	**Max**	**Med**	**Max**	**Med**	**Max**	**Med**	**Max**	**Med**
Bluefield	1,000	1,000	1,000	1,000	1.5	1.5	100	100	-	-
Concord	1,000	1,000	1,000	1,000	-	-	1,000	100	-	-
Fairmont	2,000	100	2,000	100	20	10	1,000	100	-	-
Glenville	1,000	1,000	1,000	100	-	-	100	100	100	100
Marshall	10,000	1,000	10,000	1,000	100	100	1,000	1,000	10,000	1,000
Potomac	1,000	1,000	-	-	-	-	100	100	-	-
Shepherd	10,000	10,000	1,000	1,000	-	-	1,000	100	-	-
West Liberty	1,000	1,000	1,000	1,000	50	25	100	11	100	50
WVSOM	20,000	1,000	10,000	100	-	-	1,000	100	100	100
WV State	10,000	100	10,000	100	3	1.5	1,000	10	1,000	0.1
WVU	10,000	1,000	10,000	1,000	100	5	1,000	100	1,000	1,000
WVU Tech	-	-	-	-	-	-	-	-	-	-
Average	**5,583.3**	**1,516.7**	**3,916.7**	**533.3**	**22.9**	**11.9**	**616.7**	**151.8**	**1,025.0**	**187.5**
Median	2,000.0	1,000.0	1,000.0	550.0	0.8	0.8	1,000.0	100.0	50.0	0.1

	Server		PC/Node		Wireless			Internet	Internet2
Institution	**Max**	**Med**	**Max**	**Med**	**Max**	**Med**	**Coverage**		
Bluefield	1,000	100	1,000	100	54	11	0%	30	-
Concord	1,000	1,000	100	100	54	11	80%	80	-
Fairmont	1,000	100	1,000	100	54	11	90%	36	-
Glenville	1,000	100	100	100	100	11	0%	45	-
Marshall	1,000	1,000	1,000	100	160	11	80%	1,600	1,000
Potomac	100	100	100	100	-	-	0%	20	-
Shepherd	1,000	1,000	1,000	100	54	11	50%	100	-
West Liberty	1,000	100	100	100	54	11	98%	100	-
WVSOM	100	100	1,000	100	160	11	0%	50	-
WV State	1,000	100	1,000	100	-	-	0%	16	-
WVU	1,000	1,000	100	100	160	11	0%	918	155
WVU Tech	-	-	-	-	-	-	0%	25	-
Average	**766.7**	**391.7**	**541.7**	**91.7**	**70.8**	**8.3**	**33%**	**251.7**	**96.3**
Median	1,000.0	100.0	550.0	100.0	54.0	11.0	-	47.5	-

Community & Technical College System

	Backbone		Campus		Satellite Campus		Classroom		Research Facility	
Institution	**Max**	**Med**	**Max**	**Med**	**Max**	**Med**	**Max**	**Med**	**Max**	**Med**
Blue Ridge CTC	1,000	1,000	1,000	100	1.5	1.5	1,000	100	-	-
Bridgemont CTC	1,000	1,000	1,000	1,000	54	10	100	100	-	-
Eastern WV CTC	1,000	100	1,000	100	1.5	1.5	100	100	-	-
Kanawha Valley CTC *	1,000	50	1,000	10	3	1.5	100	10	1.5	0.1
Mountwest CTC *	10,000	1,000	10,000	1,000	1,000	100	1,000	1,000	-	-
New River CTC	1,000	1,000	1,000	1,000	50	-	100	100	-	-
Pierpont CTC *	1,000	100	2,000	100	20	10	1,000	100	-	-
Southern WV CTC	2,000	100	2,000	100	10	1.5	100	100	-	-
WV Northern CC	1,000	1,000	1,000	0.5	100	0.5	0.5	0.5	-	-
WVU-Parkersburg	10,000	1,000	10,000	1,000	10,000	1,000	1,000	1,000	-	-
Average	**2,900.0**	**635.0**	**3,000.0**	**441.1**	**1,124.0**	**112.7**	**450.1**	**261.1**	**0.2**	**0.0**
Median	1,000.0	1,000.0	1,000.0	100.0	35.0	1.5	100.0	100.0	-	-

	Server		PC/Node		Wireless			Internet	Internet2
Institution	**Max**	**Med**	**Max**	**Med**	**Max**	**Med**	**Coverage**		
Blue Ridge CTC	1,000	1,000	100	100	-	-	0%	10	-
Bridgemont CTC	1,000	1,000	1,000	100	300	54	100%	10	-
Eastern WV CTC	-	-	-	-	-	-	0%	4.4	-
Kanawha Valley CTC *	1,000	100	1,000	100	-	-	0%	18	-
Mountwest CTC *	1,000	1,000	1,000	100	-	-	0%	600	-
New River CTC	1,000	100	1,000	100	160	11	90%	30	-
Pierpont CTC *	1,000	100	1,000	100	54	11	90%	36	-
Southern WV CTC	2,000	100	100	100	-	-	0%	8	-
WV Northern CC	1,000	1,000	-	-	-	-	0%	3	-
WVU-Parkersburg	2,000	1,000	1,000	1,000	54	11	100%	30	-
Average	1,100	540	**620.0**	**170.0**	57	9	38%	**74.9**	**-**
Median	1,000.0	550.0	1,000.0	100.0	-	-	-	14.0	-

* Indicates shared broadband infrastructure with host institution

Data Source: HEPC Higher Education Broadband Infrastructure Survey, September 2011