other health related networks in Southern West Virginia at high bandwidths in a cost effective and sustainable manner.

Funds from the FCC grant (or alternative source) will permit integration of the facilities of various disparate hospital and healthcare networks with Marshall University and Internet2 via OARNet. Metro Ethernet connections will be established between Verizon, nTelos and FiberNet facilities and a direct fiber facility will be built to the OARNet Point of Presence in Huntington. This will provide both Internet2 and National Lambda Rail interconnectivity as well as improved integration of existing networks to any participating healthcare partner. Cost effective direct fiber links will be built to participating Huntington area healthcare facilities. Marshall University, St. Mary's Hospital and Cabell Huntington Hospital will be participating in Phase I of the project. Additional partners will added to this link as part of Phase 2 of the project.

The West Virginia Telehealth Alliance will have an opportunity to collaborate with state, academic and other public and private health policy organizations to study the impact of telehealth on social, economic and healthcare indicators throughout West Virginia, but especially in the rural communities. The collaborative efforts of the various telehealth partners will be expanded beyond the delivery of healthcare as proposed to actual assessment. Assessment is essential for the long term improvement *of* healthcare and management of costs, not only in West Virginia, but for the nation as a whole. As the initiatives outlined in this strategic plan are implemented, the Telehealth Alliance will network with West Virginia Universities and Medical Schools, health policy institutes and the various healthcare providers to measure the actual impact of these initiatives on healthcare and costs. This data should assist third party payors and health care policy makers analyze and refine proposals to improve healthcare and manage costs. The need for such evaluation and assessment has been discussed frequently during the planning of this project and the opportunity will be utilized in evaluating the effectiveness of the project in meeting the stated health improvement objectives.

Assessment and Evaluation: The overall objectives of this telehealth project are: 1) to improve patient and community access to high quality health care, including timeliness of access to medical advice, services and health information; 2) to improve the delivery of cost-effective health services in the communities; and 3) to improve linkages of remote community-based health care providers to secondary, tertiary and educational facilities in each region of the state.

Project Evaluation: Framework: The evaluation of the effectiveness of the project will focus, as comprehensively as possible, on three issues central to the project objectives:

- The impact of telehealth interventions and applications on patient and community access to needed, quality care;

- The impact of telehealth in health services delivery, including cost-effectiveness; and

- The effectiveness of linkages of telehealth with existing health resources.

The questions will be addressed thought patient and provider interviews and questionnaires and through a review of patient outcome data.

Monitoring telehealth system usage: Monitoring the use of the telehealth applications will provide information on the nature, level, quality and cost of usage. The main data collection tool will be patient encounter forms completed by health personnel and by remote health providers. Participating organizations will be asked to summarize this information and increased usage will be measured against 2006 baseline information.

Patient satisfaction: All patients using telehealth in each community will be asked to complete a brief satisfaction questionnaire or interview *to* assess their reactions to and comfort with the telehealth system. The questionnaire will be developed using similar validated tools from existing studies of telehealth. This questionnaire will be completely anonymous, and to the extent possible, completed in confidentiality from the originating providers (for example, self-administered and returned in sealed envelopes).

Qualitative interviews: Qualitative interviews will be conducted at three points during the project period, at the end of the first year, the second year and the third year. The first *two* sets of interviews will be conducted by telephone, and the third during in depth data-gathering visits *to* selected participants. The participants will be asked to respond as key informants giving their views on the evaluation questions from their perspectives within the project and the communities served. The evaluation team will develop the evaluation questions and conduct the interview process to measure impact on telehealth utilization, distance learning and training and health outcomes.

Summary of Telehealth (and related) Programs in West Virginia

1. Mountaineer Doctor Television (MDTV) at West Virginia University, based in Morgantown, West Virginia. In 1992, MDTV was created to service rural areas of West Virginia through a digital ISDN Network. Now, 15 years later, MDTV has generated 42 member sites delivering services through a digital ISDN as well as an IP network. The use of ISDN allows MDTV to expand its services throughout the world, thus improving our current administrative teleconferencing capabilities. Due to recently upgrading our technology MDTV is now able to offer IP videoconferencing at select locations. MDTV can provide point-point or multi-point configurations at varying bandwidths.

The use of telemedicine allows patients to remain in their community and receive the specialized care that otherwise may not be available to them, while maintaining the primary provider-patient relationship. These services benefit patients who are unable to travel due to transportation difficulties, cost, and health issues. With increased demands and shrinking resources for continuing education across the state, MDTV provides a valuable educational tool in decreasing professional isolation. MDTV has evolved into a state-wide Telehealth Network delivering service in clinical telemedicine consults, professional continuing education, patient/community education, distant learning and administrative teleconferencing.

Telemedicine: MDTV provides several subspecialty clinics as well as emergent consult services. The top three requested specialties include adolescent-psychiatry, pediatric-neurology, and dermatology. MDTV began providing telemedicine services in 1993 and have since provided over 10,500 telemedicine consults.

Continuing Education: Professional continuing education is an integral component of the MDTV system. Weekly grand rounds in Emergency Medicine, Medicine, Pediatrics, and Surgery are available to all distant sites.

Distant Education: WVU currently used MDTV to provide graduate and undergraduate courses, which allows the students to remain in their local community while pursuing their educational goals. Medical students and residents currently on rotations at any of the distant sites have direct access to program participation via MDTV.

Community Education: Community education continues to be a growing area of the network as well. Mini-Medical School programs are held in an effort to assist members of the rural communities in understanding their healthcare problems.

Benefits **of** program: MDTV and its Network partners have access to high quality healthcare related to education and specialty care services as well as

bridging services to allow for administrative meetings which save time and monies to those network members.

MDTV is currently able to connect to almost any site around the world that has ISDN or IP videoconferencing capabilities. Interacting over MDTV creates benefits for a variety of people; patients, physicians, residents, professors, lawyers, as well as administrative professionals. The individual needs are immediately met with the benefits of cost savings, time savings as well as quick interactive access that is efficient

Opportunities for enhancement through WVTA network: MDTV services are provided through a contract with a long distance telecommunications provider for PRI ISDN services to guarantee a reasonable rate to participating Network members. The current communications contract precludes certain service enhancements for many participating MDTV sites. Additionally, many of these sites are in need of upgrading their video conferencing equipment to allow for IP video conferencing and allow for the potential use of electronic patient records.

Enhanced broadband access would allow for improved video quality which would benefit the clinical activities of MDTV. This would also facilitate the opportunity to make electronic patient records available to improve the speed and accuracy of facilitating clinical encounters over MDTV. Increased bandwidth would also increase the flow of film reading for the tele-radiology program. This would benefit the rural hospitals utilizing this program.

Access to broadband telecommunications will open new avenues to the access of specialty care not previously available due to the lack of, or the cost of, connectivity. Quicker response will negate the need for travel and may allow for better compliance. New opportunities for collaborations should avail themselves with such an undertaking which will benefit some of the state's most vulnerable citizens.

The cost of connectivity is also a limitation on the system. Telecommunication services alone cost MDTV roughly $48,000 per year. This cost consists of 7 PRI circuits that individually cost $416 per month as well as the Frame Relay service MDTV provides to all networked IP sites which costs $13,200 annually ($1,100/month). Each member site pays for its own circuit which varies according to the type of service provided at that location. The majority of MDTV members pay $416/month for their PRI circuits, $225 for their BRI circuits. The Frame Relay site member telecommunication fees range between $360/month to $1200/month depending on their location.

Lower cost broadband would stimulate usage. Some educators shy away from utilizing interactive video for education because of the usage cost. Higher bandwidth also would improve quality with would produce higher percentages of "trouble free" events and improve satisfaction as well.

2. Telehealth programs **of** Charleston Area Medical Center (CAMC) and related entities based in Charleston, West Virginia. The Charleston Area Medical Center) Health System, with its principal operations located in Charleston, West Virginia, is one of the state's largest not-for-profit hospital-based health care systems in West Virginia, the major components of which include:

- Charleston Area Medical Center,
- The CAMC Foundation,
- CAMC Health Education and Research Institute (CAMC Institute),
- Integrated Healthcare Providers,
- Braxton Memorial Hospital, and
- CAMC Teays Valley Hospital

The CAMC Health System serves a 12-county, largely rural, poor, underserved area in the southern part of WV where nearly one third of all West Virginians reside. Charleston Area Medical Center (CAMC) is an academic medical center affiliated with the Robert C. Byrd Health Sciences Center, West Virginia University - Charleston Division (WVU-CD).

The utilizations of CAMC's services annually include:

- 530,861 outpatient visits (2005)
- 94,557 emergency room visits (2005)
- 2,616 trauma patients admitted (2005)
- 192,495 patient days (adult and newborn 2005)
- 37,454 inpatient discharges (2005)
- 26,056 general operating room procedures
- 10,028 inpatient surgeries
- 16,028 outpatient surgeries
- 22,598 ambulatory surgery procedures
- 1,741 open-heart bypass procedures
- 10,363 diagnostic and interventional cardiac caths
- 3,079 babies delivered
- 405 neonatal intensive care unit admissions (2005)
- 49 kidney transplants (2005)

CAMC Institute: The Institute provides continuing medical education, outreach education and research support to physicians and allied medical professionals in West Virginia. CAMC Institute also operates schools of cytotechnology and nurse anesthesia as well as the eight graduate medical education residency programs jointly directed by the institute and West Virginia University Charleston Division.

Partners-in-Health Network **(PIHN):** In December 1994, administrators from eleven healthcare organizations operating throughout southern and central West Virginia joined together to initiate a more coordinated approach to health services delivery in these areas and to improve the health status of the population through

assuring access to essential health services in these rural communities. Partners in Health Network, Inc. (PIHN) provides critical access hospital support, as well as serving as a liaison between tertiary hospital and PIHN hospitals and clinics, linking to administrative, clinical, educational, and operational resources.

West Virginia University, Charleston Division **of** Robert C. Byrd Health Sciences Center (WVU-CD): The Charleston Division of West Virginia University is a branch of the Morgantown-based institution and is located on the Charleston Area Medical Center Memorial Hospital campus. The WVU-CAMC partnership is the basis for an academic medical center that serves central and southern West Virginia.

Founded in 1972, this campus is the oldest regional medical education campus in the United States. Operated through an aftiliation agreement between WVU and CAMC, WVU-CD serves as a clinical campus for third and fourth year medical students as well as operating schools of dentistry, nursing, pharmacy and social work. The Charleston faculty provides education and oversight for the health sciences center as well as patient care services to the Kanawha Valley, the metropolitan area, and to specialized health referral needs of people living throughout rural southern West Virginia.

CAMC Network: The CAMC network is primarily composed of a SONET ring WAN provided by Verizon, from which are provisioned various circuits, mostly IP. There are five locations on the ring, including the three main hospital campuses. Other locations are connected via point-to-point circuits or Frame Relay [FRS]. CAMC's FRS [FRASI] and 9M Internet connection [also provided by Verizon] are carried by ATM. CAMC is planning to add another 10M Internet pipe from Charter to assist with our Internet circuit saturation. CAMC also recently added a TLS circuit to the CAMC Teays Valley Hospital (located 25 miles from Charleston, WV) **for** supporting operations there. The FRS circuits are mostly for connecting members of the Partners In Health Network to CAMC's network... There are a number of site-to-site VPN connections, using CAMC's Internet connection, with various business associates. CAMC uses ISDN connections for our MDTV (spell out) telemedicine connections. A diagram is attached that outlines how the CAMC network is structured.

Telehealth Services. CAMC utilized and operated an active telehealth program since July 1996 in the areas of clinical consultation, multipoint distance learning for health care professionals, and for professional and administrative meetings. The most extensive clinical applications are in the areas of dermatology, psychiatry and neurology however clinical consultations have provided 15 different clinical disciplines. Patients in rural areas of West Virginia have benefited from the more than 4,000 clinical consultations facilitated by this system. Educationally, CAMC has extensive experience transmitting multimedia, interactive continuing education events in medicine, nursing, pharmacy, and social

work for nearly two decades. CAMC Institute Media department transmits between 30 and 40 Continuing Education conferences per month.

3. Marshall University School of Medicine, based in Huntington, West Virginia. Marshall University, established in 1837, is a state-supported interactive university with approximately 14,000 students including 4,000 graduate and medical students. The affiliated Community and Technical College has more than 2,000 students bringing the total number of students to over 16,000. The University and its associated Community and Technical College offer 24 associate programs, 41 baccalaureate programs and 46 graduate programs including the Doctorate of Medicine and several other doctoral programs.

The Marshall University Joan C. Edwards School of Medicine (MUSOM) has been called upon to take increased responsibility for meeting the health care needs of rural West Virginia. Since its 1972 creation, the school of medicine has developed as a non-traditional, community-integrated, Veterans Affairs-affiliated school. Because the School of Medicine emphasizes placing medical students into primary care settings, it continually seeks new methods to increase the percentage of graduates who enter primary care practice, especially in rural areas. Currently, notable research progress is being made in areas of biotechnology, cancer therapy, and gene mapping in rural populations at risk for cardiovascular disease.

Marshall University's broadband network connects all associated regional campuses (Charleston, Beckley, Point Pleasant, Gilbert, and Logan) via an ATM and Frame Relay network of OC3, 2 DS3 and multiple DS1s. Plans are underway to replace this network with a much higher speed Metropolitan Ethernet Network. The primary School of Medicine location is connected via a fiber and 10Gb Ethernet to the main campus in Huntington and to the future Metropolitan Ethernet connection point to others campuses. This connectivity would facilitate an extension of this network to many of the Marshall University School of Medicine associated hospitals and clinics.

Opportunities for enhancement through **WVTA** network: The MUSOM currently uses telehealth applications for consultations with primary care providers in Lincoln and McDowell counties and for digital retinal examinations of diabetic patients at Tug River Health Clinic. The telehealth system also is used for grand rounds and coordination of rural residency programs. Possible areas of improvement and expansion are in the areas of Neonatal, Teleradiology, Telepsychiartry, Distance Learning, CME and Grand Rounds. Improved patient care and cost containment come from efficiently and effectively managing the health care knowledge base, and providing a means for quick, reliable access to information within multi-user, multi-institutional environments.

The West Virginia Biomedical Research Infrastructure Network (WV-BRIN) is being established as a unique program among higher education and medical institutions focused on the enhancement of biomedical research education and

training in the State of West Virginia. The WV-BRIN program is a consortium of 10 higher education institutions, lead by West Virginia University Health Sciences Center (WVUHSC) and Marshall University School of Medicine (MUSOM) and comprised of 8 predominantly-undergraduate institutions (PUIs). The stated objectives of the Appalachian Cardiovascular Research Network (ACoRN) are to establish a research network which identifies cardiovascular disease genes using bioinformatic approaches (gene mapping and functional genomics), train network faculty in the application of the bioinformatic approaches and foster the development of undergraduate faculty and student training in bioinformatics. These projects require collaboration within and out side our state borders. These projects would benefit from direct access to Southern Crossroads (SoX). SoX is a cooperative initiative by the members of the Southeastern Universities Research Association (SURA). SoX was designed to facilitate access to current and future highly integrated, digital communications services for education, research, and economic development within the region and across United States.

Expanding Marshall University's advanced, high bandwidth, low latency network with Internet2 will support improved health care coordination in rural areas through telehealth applications, applied research and health education (including Marshall's award-winning rural residency program). The expanded access will also provide a framework for the emergence of even higher performance networks in the future. At the same time, Marshall University, in collaboration with all partner institutions, will pursue connections to a next generation network to support increasing demands for performance, reliability and security. The convergence of these two developments, facilitated through Marshall's connection to WVNET, the State's Higher Education Network, translates into new capabilities, not only in the arena of Internet2, but within the University and among affiliated health care collaborators across the State of West Virginia and beyond.

Many of the University's academic degree programs related to health care will benefit from high bandwidth for more effective, high-quality, easily accessible educational opportunities using a combination of text, graphics, and interactive multimedia. The Performance and responsiveness of Internet2 will allow the use of more and longer audio and video clips to "humanize" the instruction, show charts and graphs changing with different populations and data sets, deliver timed tests, and give real time feedback to make the learning experience more meaningful. Those medical locations that are using DSL or cable, can continue to access expanding online course and training offerings via Blackboard Vista, Podcasts, and Macromedia Breeze.

Research labs are working on a number of projects that will provide transformative tools for learning and research in networked environments. Among the most significant emerging technologies are visualization, advanced collaboration tools, virtual reality, telemedicine, and tele-immersion. New possible research and collaboration partners, such as Emory and Virginia Tech, could

provide molecular visualization, design, and analysis of chemical agents thought to be involved in anticancer activity, facilitated through this enhanced Internet2 connection.

4. West Virginia School **of** Osteopathic Medicine (WVSOM) based in Lewisburg, **WV.** WVSOM has grouped clinical training sites (physician offices, health centers, medical centers, hospitals, etc.) into regional consortia called "Statewide Campus" sites. As these sites evolve students will be assigned to a specific consortium for the 3rd and 4th year clinical rotations. These sites, including associated satellite facilities, are and will be linked for didactic programs, Continuing Medical Education (CME) functions, clinical consultations and administrative activities using high speed broadband connections. Currently, WVSOM utilizes over 500 preceptors in WV. WVSOM operates a number of concurrent programs, including the following:

- Mountain State Osteopathic Postgraduate Training Institute (MSOPTI), which is the consortium that coordinates all osteopathic postgraduate training associated with WVSOM. These sites are distributed throughout WV, and overlap with both the statewide campus and the SEWVAHEC. Collaborative programming is conducted using the MSOPTI-Link, a video conferencing network associated with MDTV. As above, these sites are being linked for didactic programs, CME functions, clinical consultations and administrative activities using high speed broadband connections.

- West Virginia Rural Health Education Partnerships (WVRHEP) consists of 8 training consortia statewide. This training network includes over **367** community-based health, social, and education agencies. Over **640** field faculty from eleven disciplines teach 3rd and 4th year medical and health professions students, making the WVRHEP one of the largest rural training programs in the nation. The Partnership works closely with local communities and state government to provide a variety of health promotion and wellness activities. The rotations are community-based, problem-focused, and utilize an interdisciplinary team approach. WVSOM has participated in RHEP and its predecessor, the Kellogg Community Partnerships Program since the original program was started in 1989. In addition to requiring all students to complete RHEP rural rotations, WVSOM annually exceeds the requirement by placing rotating students in non-RHEP rural rotations.

- Southeastern West Virginia Area Health Education Center (SEWVAHEC), located at the West Virginia School of Osteopathic Medicine, is one of four operating in West Virginia. The SEWVAHEC provides a seamless integration of rural undergraduate health professions training programs and primary care graduate training programs within rural underserved communities. Each AHEC works

with local communities, preceptors, and faculty to develop their customized contributions and expertise in community-based health professions training in West Virginia.

Benefits of program: WVSOM records the audio portion of all classroom lectures in mp3 format and makes these files available for download from a student server. Students can download these files on campus or at home. This allows students to review any lecture at any time. Video is also being made available on a limited basis.

WVSOM and MSOPTI have been using the OPTI-link videoconferencing system (hosted by MDTV) to provide didactic teaching and hands-on demonstrations for about 10 years. Currently, 2 to 3 programs are hosted per month. These videoconferences permit Interns/Residents to participate in programs without the added travel time. Consistency of program content is possible because everyone is watching the same presentation.

Predoctoral Clinical Education manages the 3rd and 4th year rotations using a web based management system to schedule, collect logs and required reports, conduct on-line examinations, etc. The school has a 3 Mbs internet link over which this traffic travels. Rotating students currently do experience problems if broadband access is lacking at rotation sites. WVSOM is currently planning to increase internet bandwidth but this will not address issues at the rural locations.

Physicians from the Robert C. Byrd clinic use MDTV to conduct consultations with specialists in Morgantown. This permits both the local physician and patients to interact with specialists without having to drive long distances

Opportunities for enhancement through WVTA network: Under the current system, a limited number of sites have ISDN connectivity and the necessary videoconferencing equipment. Also, the lack of A/V training and support at many of the videoconferencing sites negatively impacts the quality of educational programs. The speed of downloading audio and video files is highly variable on campus and usually very slow off campus. A 2 minute presentation of particular physician skill techniques is about 12 Mb in size and a 50 minute lecture is about 300 Mb in size. Transmission speeds associated with dial-up (56 Kbs) or typical cable or DSL (< 1 Mbs) would not download this material in a timely fashion. Lack of dedicated high speed telecommunication limits the quality and quantity of interactive, real-time and "anytime/anywhere" resources available to rural sites.

Annual cost for MSOPTI-link (MDTV) presentations to seven (7) sites exceeds $10,000. Current broadband telecommunication costs average $2,000 month and are expected to increase dramatically and usage increases. The costs incurred by off-campus sites are difficult to calculate because all links are local.
The biggest challenge faced by rural communities is lack of accessible health care. One of the biggest challenges faced by rural physicians is real-time access

to resources. The multiple networks associated with WVSOM can provide the infrastructure needed to provide the needed access, and, just as important, provide the training infrastructure that can both educate aspiring and established physicians in the use of these networking tools, and, provide an incubator for developing and testing new resources and tools in the appropriate rural setting.

Upon activation of a new high speed broadband network connecting WVSOM, Statewide Campus, MSOPTI, RHEP and SEWVAHEC, WVSOM can immediately make available grand rounds, video conferencing, consultation services. Additional services will be brought on line as soon as available. For example: beginning fall of 2007 WVSOM can begin hosting videoconferencing programs for 3rd and 4th year students. Beginning fall 2007, WVSOM will increase video content available for download.

Enhanced broadband access linking Statewide campus, MSOPTI, RHEP and SEWVAHEC sites would allow the following to be implemented for current and new sites:

- Enhanced quality of instruction by providing additional training resources accessible only through high speed networks.
- Webcasting grand rounds, meetings seminars, etc.
- Web-based CME's
- Administrative networking, records, logs, patient materials
- Data collection and data sharing.
- Enhance assessment including real time training in telehealth techniques.
- Clinical and preclinical researchers could transfer data and related material within WV and the nation.
- Enhanced use of video and simulations, including classroom lectures, clinical osteopathic applications, physician skills techniques, updates and orientations for off campus students and clinicians, recorded videoconferences, and the robotics lab.
- Expanded availability of Osteopathic clinical consults and training using interactive video, audio and simulations.
- Integration of a seven plus curriculum including preclinical, clinical, postgraduate and CME charting, training, assessment, etc.
- Ability to target healthcare needs with networked support from other sites.

5. Davis Health System, based in Elkins, West Virginia: The Davis Health System consists of several health organizations working together to serve the highlands region of West Virginia. Davis Memorial Hospital is a 100 bed acute care facility providing day surgery, family birthing center, physical, occupational, and speech therapy, respiratory therapy, laboratory, radiology, dietary, many physician specialties. It serves 6250 Inpatients and 235,000 outpatients annually. Broaddus Hospital is a small emergency department, with 12 acute care beds, 60

long term care beds, a small swing bed unit and laboratory and radiology service. It serves approximately 25,000 patients annually. Clinicare is a freestanding family practice clinic with five providers. It serves approximately 15,300 patients per year.

Cancer Care Center is a dedicated cancer treatment facility, providing oncology and radiation oncology services. It provided 3171 radiation treatments and 6051 oncology treatments in 2006 with two part time providers. Two full time physicians have now been hired to provide comprehensive treatment as patient need has grown. Buckhannon Medical Care is a freestanding family practice clinic with six providers. It serves 20,000 patients per year. Davis Home Care is a home health agency associated with Davis Health System. It provides nursing, physical, and occupational therapy in the home. Approximately 7200 home visits are provided annually. Tucker Community Care is an outpatient ambulatory care center with a small emergency department. It serves 12,775 patients per year. Women's Health Care provides obstetric and gynecological care to all ages of women and it provides care with11,500 patient visits annually.

Current telehealth applications: Davis Health System currently utilizes telehealth services on a daily basis for many applications.

- PACS System - Radiological images are captured on site at Davis Memorial and Broaddus Hospitals and images are then sent to Huntington, for example, to be read and interpreted. The reports are sent back to Davis and Broaddus electronically. Davis Health System has been utilizing this technology for approximately 2 years. Telehealth technology enables Davis Health System to provide imaging, without having a dedicated radiologist on site 24 hours a day, thus resulting in cost savings for the hospital.
- HomeMed Telehealth Monitoring – Davis Home Care utilizes the HomeMed system of monitoring patients' vital signs. The HomeMed monitor captures the vital signs in the patient's home and then transmits the information back to the Home Care office for nurse and physician review. This technology results in better patient outcomes as serious situations can be caught quickly and treated as well as huge cost savings for the department as nurses do not have to make as many costly home visits. This technology also offers peace of mind and increased satisfaction for the patients as they have confidence their condition is being continually monitored.

- MDTV – Davis Memorial utilizes the MDTV system approximately once a month for Rheumatology services. This service is especially utilized in our facility as the patient population is elderly and many suffer from arthritis and associated disorders. This enables patients to be treated in a familiar facility without the pain and discomfort of long-distance travel.

Opportunities ***for*** enhancement: The primary limitation of the current system of telecommunications is cost. Davis Health System is faced with lack of dedicated

T-1 lines and other high-resolution connectivity. The System often deals with fragmented T-1, multiple carriers (contractual issues), and long distances between facilities in extremely mountainous and rugged terrain. Davis Health System currently spends approximately $30,600 per year on connectivity fees for T-1 lines between facilities. Connection via DS3 or Internet2 is cost-prohibitive at this time. Funding provided by the FCC grant would enable Davis Health System to develop a long-range budgetary plan in order to sustain enhanced Connectivity.

Expanded connectivity would facilitate even greater strides in utilizing technology for patient outcomes. For example, Davis Health System would be able to implement a new ambulatory care system for physicians in our freestanding clinics that would integrate with Davis Memorial's electronic medical record as well as practice management systems. This would result in safer, more efficient patient care and eventually, greater patient involvement in their health care. Patients would be able to connect to their patient record/billing information from their homes (community access). E-prescribing - the direct transmittal of prescriptions to the pharmacy resulting in a significant reduction of pharmacy errors due to poor physician handwriting - would also be another application made possible by enhanced connectivity.

Davis Health System is not a teaching facility, however, the System does partner with some institutions to provide limited learning opportunities. Lower cost and expanded connectivity would enable the Health System to participate in more research and learning activities in the future.

In addition, Davis Health System is committed to providing learning opportunities for the community. Expanded telehealth connectivity would enable the System to provide classes, like Smoking Cessation, to multiple sites utilizing only one instructor and serving many members of the service area. This distance learning can be delivered at a much-reduced cost to more members of the target audience. Greater telehealth capabilities would positively impact health outcomes for much of the population Davis Health System serves. Because of our extremely rural area and distance between facilities, consultations with specialists and disease management would be available to those who cannot physically travel. This access to multiple specialties would provide greater patient satisfaction as well as physician access to other specialty physicians, knowledge and resources. It would be anticipated that the incidence of chronic conditions like CHF and diabetes would be reduced as patients gain access to appropriate care.

6. St. Mary's Medical Center, located in Huntington, West Virginia has 393 beds (the second-largest single healthcare facility in West Virginia) serving south and central West Virginia, eastern Kentucky and southern Ohio. St. Mary's has nearly 16,000 admissions annually, with approximately 60,000 ER visits and 158,000 outpatient visits. Currently, St. Mary's operates a remote access system that permits most physician-related applications to be used remotely by physicians. These include 1) PACS (digital x-rays), 2) Lab results 3) access to the medical record 4) digital EKG system, and 5) Cardiology PACS. Physicians use

these applications to view data from their home or office to 1) make decisions while patients are in their office 2) assist with patient billing 3) interpret EKG's 4) remotely perform chart completion.

Opportunities **for** enhancement: St. Mary's would like to expand its use of telehealth to establish a telestroke and/or telecardiology system to provide rapid assessment of stroke or cardiac patients. This would provide outlying hospitals access to specialists at St. Mary's to assist in making decisions regarding emergent treatment and transfers to St. Mary's. St. Mary's, along with WVU and CAMC, are the state's designated stroke response centers. This would result in:

a) Faster treatment of stroke – this would decrease morbidity and mortality especially strokes due to clots

b) Faster treatment of cardiac events – to decrease morbidity and mortality.

c) More appropriate transfers. Some patients don't need to be transferred to tertiary care centers. Unnecessary transfers cause undo hardships on family members as well as till beds of tertiary care centers unnecessarily.

In addition, St. Mary's-based physicians travel to rural hospitals to provide education. The rural physicians are not always available at the time when these teaching physicians provide the educaiion. A video conferencing system that had store/playback options could allow the rural physicians flexibility in attending the educational sessions.

7. Minnie Hamilton Health System (MHHS), based in Grantsville in Calhoun County, provides the following health care services:

- MHHS, Grantsville, WV campus: Services are provided by MHHS employees and include: primary care, emergency care, 18 inpatient/intermediate care beds, 24 long-term care beds, physical therapy, radiology, high-complexity laboratory, emergency medical transportation services, social services, patient education and outreach, medication assistance program, child day care, sleep laboratory, dental and telemedicine. A primary care clinic is available seven days per week and emergency services are available 24 hours/ seven days per week (no exceptions). A physician is on service everyday to provide care to inpatients.

- MHHS/Gilmer Primary Care, Glenville, WV campus: Services are provided by MHHS employees and include: primary care, physical therapy, radiology, moderate-complexity laboratory, social services, medication assistance program, patient education and outreach

- School Based Health Services: Services are provided by MHHS employees and include: primary care, waived laboratory tests, social services,

behavioral health, mentoring program, patient education and outreach. Services are provided at the following schools: Calhoun Middle/High School, Arnoldsburg Elementary School, Pleasant Hill School, Gilmer County Jr/High School and Glenville State College. .

Current **use** of telehealth: Telehealth services were established at MHHS in 1996. Applications include: video conferencing activities, including meetings with WVU and CMAC physicians and/or staff; health education activities like the "Mini Medical School" that provides individuals in the community to receive information regarding their chronic disease; distance learning activities that provide access to "Physician Rounds", licensed medical staff can receive continuing medical education without leaving the facility; nurses can take classes toward a Master Degree in Nursing, and patients can receive specialty physician service that may not otherwise be available to them. MHHS would not support 24/7 radiologist coverage. Through digital radiology, we are able to have a diagnostic reading within minutes instead of days.

Benefits and cost savings include:

- Receiving continuing education and/or classes toward a degree without the cost of transportation and/or overnight accommodations.
- Saving of resources. A medical provider can receive education in a two hour time period, instead of being unavailable to provide care to patients because they must drive a minimum of two hours each way.
- The long-term care resident can receive pre and post orthopedic care, instead of loading them up in an ambulance, to be driven a minimum of two hours, waiting in a physician office to be seen, and then being driven back to the facility.
- With the shortage of mental health services, we have been able to provide access to these services through telemedicine to individuals that may otherwise have received no care.
- The outreach/education activities have provide access to disease management resources that people living in our rural area would never have been able to access.
- Dermatology clinics have provided the ability for patients to have early stages of skin cancer detected early.
- Digital radiology saves rural facilities thousands of dollars per year.
- Early detection of many diseases/conditions.

Opportunities for enhancement: Currently MHHS spends approximately $35,000 per year for connectivity. The speed of the system slows the process of providing access to care and the video conferencing is currently ISDN. As MHHS moves toward electronic medical records, IP based connectivity will become an even greater technology necessary for improving patient health, safety and quality of life. There is a great need to move from the current ISDN system and increasing IP bandwidth. There is also a need to replace currently used video conferencing equipment.

Improved connectivity would allow for expanded applications in all areas. Improved support for physicians practicing in rural locations. Digital radiology could be transmitted quicker and clearer. Specialty physicians would have a better interaction with the patient and local medical provider. Patient information could be transferred between facilities/organizations as the patient moved through the health care system. Patient safety would improve as knowledge of medication allergies, immunizations; care previously provided would be available for review.

Internet2 would be an advantage to the rural service area of MHHS. Providing a connection in Central West Virginia would allow multiple non-profit health care facilities in the area to have access without driving long distances. Glenville State College has agreed to house this technology and share in the benefits' along with NWVRHEC that is currently housed at Glenville State. This connection will also allow the college to utilize the technology in their nursing program.

Glenville State College and the Gilmer/Braxton Research Zone is moving forward providing wireless broadband in the area so telemedicine can be brought directly into the patients' homes. This development will improve access to care for high-risk patients with chronic conditions or fragile elderly who would otherwise need institutional care.

7. Community Health Network **of** West Virginia is comprised **of 19** member community health centers located throughout West Virginia. The Networks member sites collectively provide services in 30 of West Virginia's 55 counties each year, with 74 service delivery sites and nearly 400,000 patient encounters annually. These member health centers provided over $40 million in health care services last year, with 70% of this care to Medicare, Medicaid and uninsured patients.

As noted in several sections of this Plan, medical research has shown that living with a chronic condition can be managed and many of the complications of these diseases can be avoided through regular contact with health care providers, patient education and self-managernent, with regular physical activity and dietary modification. The Network and its members have identified a number of clinical areas for significant health improvement opportunities and have targeted:

- diabetes,
- cardiovascular risk reduction,
- depression,
- weight management and physical activity,
- asthma; and
- cessation of tobacco use

as focus areas of its health improvement program..

The Network has selected these clinical focus areas based upon medical research demonstrating the opportunity for significant health improvement by using disease

management practices with care coordination, patient self-management, telehealth applications and an integrated electronic health care system:

Current use of telehealth and health information technology: **A** central part of the Networks health improvement project involves the application of proven health information technology. The Network has adapted a version of the clinical information system used by Indian Health Service for use by Network members. The RPMS system of IHS has been used to dramatically improve health outcomes for tribal populations and the Network Clinical Committee has incorporated many of disease management tools and measures into this integrated health information system called MedLynks. The system is integrated with the Networks centralized practice management system and common reference laboratory. It will also be integrated with ***TeleLynks***, a telehealth system being implemented by the Network and its participating members to link to specialty care and for sharing of disease management services such as nutrition and exercise counseling.

Using MedLynks, participating health centers can create a continuity of care record for high risk patients that can be shared with local hospitals. TeleLynks can be used to coordinate consultations for high risk patients. The continuity of care record available through MedLynks will give other health care providers much needed information about a participating member's medications, allergies, problem-list, recent treatments and lab tests.

TeleLynks will utilize existing frame relay connectivity between the Networks central data center and each participating member site. The Network will serve as the linkage point for connectivity to other participants such as the Division of Primary Care, who will coordinate further linkage through state participants such as the Office of Health Promotions and academic health centers such as the MDTV program of West Virginia University. Participating health centers will also be able to share clinical resources such as diabetic educators, dietitians and exercise physiologists that are not readily available in many rural areas.

A recent study concluded that more than 40% of all patients with diabetes have not had an eye examination within the last 3 years. In West Virginia, transportation and access to qualified eye care professionals is a barrier to diabetic eye examinations. To overcome this barrier as part of the TeleLynks deployment, the Network has arranged for the acquisition of a portable digital camera to be utilized in the TeleLynks system by a qualified optometrist that will perform these screenings in the health centers on a rotating basis. The images will be uploaded into the MedLynks system so progression of diabetic retinopathy can be evaluated over time.

8. West Virginia **EMS** Medical Command **System:** The West Virginia Office of Emergency Medical Services was created in 1975. The Office of EMS reports organizationally to the West Virginia Office of Community Health Systems within the Bureau for Public Health of the West Virginia Department of Health and

Human Resources. The mission of the OEM is to reduce death and disability by promoting, supporting, and enhancing a comprehensive EMS system, thus improving the quality of life for everyone. One of the critical communication functions conducted by the OEM is to operate the State's Medical Command System. This system consists of five Medical Command Centers are located in West Virginia: 1) Beckley Regional Command at Raleigh General Hospital, 2) Charleston Med Base, located at Charleston Area Medical Center General Division, 3) Huntington Medical Command (a cooperative venture between Cabell-Huntington Hospital and Saint Mary's Hospital), **4)** WVU Medical Command located at Ruby Memorial Hospital in Morgantown and, 5) WestCom located at the 911 center in Parkersburg.

The main function of the Medical Command Centers is to provide physician medical direction and give treatment authorization to EMTs and paramedics in the pre-hospital environment. In addition to providing a linkage between the ambulance crew and the physician, Medical Command may also: 1) notify hospital emergency departments of in-coming patients and the extent of the injury or illness, 2) assist with field triage, 3) coordinate backup and air/medical dispatch, **4)** direct routing to an appropriate medical facility, 5) collect data, and **6)** keep communication records to facilitate quality improvement within the System. Medical Command Centers do not generally dispatch ambulances (some dispatch helicopters) and have limited involvement in transportation of patients except as it relates to incoming emergency patients to Hospital Emergency Departments.

As part of the telehealth network, projects such as Telestroke and Telecardiology, as well as advanced life support for trauma cases, will require using advanced communication and information infrastructure to link the health care facilities participating in this program with the state's Medical Command infrastructure.

9. Broadband and Internet2 for Healthcare: Information technology organizations at most of the nation's research universities have been engaged with each other in developing, supporting, and making available to their campuses a next generation Internet capability. These activities have been significantly aided by the involvement and support of the Federal government, State and regional networks, corporate organizations, and international partners. With roots in the Federal Next Generation Internet initiative and perhaps most popularly known as Internet2, these activities now also include the work of others, notably National LambdaRail (NLR). As these two network merge, their combined resources will bring a new level of resources and connectivity to healthcare, research and education.

The advanced networks that have resulted from these efforts have capacity, capability, and functionality far exceeding that of commercial Internet services. **At** the "edge" of each campus, a participating institution or medical facility would typically have at least two network connections—one for "routine" commercial Internet access and a separate, controlled-access connection to one or more

advanced networks (e.g. Internet2's Abilene infrastructure or a regional network). The new combine network will allow a single connection for both the commodity Internet combined with the more advanced Internet2 connectivity. This will allow each facility to purchase commodity Internet at Quill pricing.

A commitment to a shared infrastructure can mean a lot of different things depending on different viewpoints. From a technical viewpoint this involves a myriad of details associated with traditional "layer 1", "layer 2", and "layer 3 connections. From a network services viewpoint this starts with general issues such as performance, authentication, and security, and then extends into more specific issues related to middleware, federated authentication, and numerous other capabilities.

At each level and between levels, there must be an effective physical plant, suitable to support both quantity and quality of network flow. At each level and between levels, there must be effective communication, cooperation, and collaboration between infrastructure managers and users who would stress the infrastructure by demanding high quantity and/or quality performance. At each level and between levels, those who manage the infrastructure must commit to maintain an on-going program of quality assessment and quality control, tested by its application to high-stress applications. When teams collaborate virtually, the network is a required component of the collaboration infrastructure. This structure of networks, middleware and recognized identifiers must be in place for Phase I of the project.

Education and Research: The goal of this project is to create a premier integrated clinical network that will enhance research, education, and economic development and will expand West Virginia's role and reputation in networking technology combined with our national reputation in rural health. This network design with provide both intrastate and interstate research and education capabilities that go far beyond the capabilities of even Internet2.

All partners will expand the delivery of interactive educational programming, such **as** grand rounds and continuing medical education, clinical information systems, library services, and consultation. Beneficiaries will be students, residents, health care professionals and, above all, the patients served by the institutions and facilities connected to this Internet2 system.

Glossary: For purposes of this plan, some common terms related to telehealth applications are defined as follows:

1. Electronic Medical Record or Computer–Based Patient Record: Electronically maintained information about an individual's lifetime health status and health care. This record replaces the paper medical record as the primary source of information for health care meeting all clinical, legal and administrative requirements. It is seen as a virtual compilation of non-redundant health data about a person across a lifetime, including facts, observations, interpretations, plans, actions and outcomes. This system captures, stores, processes, communicates, secures and presents information from multiple disparate locations as required.

2. Distance Learning: Education delivered through distributed resources -- content, instructor, student, and technology -- in different, non-centralized locations allowing instruction and learning to occur independent of time and place. It can be used in combination with traditional classroom-based courses and traditional distance learning courses, or to create wholly virtual classrooms.

3. Real-time or synchronous transmission: Situation where parties on both or all ends of the connection are interacting live. Data acquisition, processing, and presentation all occurring simultaneously in a system.

4. Store and forward: The transmission of still images or audiovisual clips from clinical consultations by a practitioner to a remote data storage device, from which they can be retrieved by a health care professional, usually a physician. This enables a practitioner to give his/her opinion on the consultation without the need for simultaneous availability of both clinicians.

5. Teleconferencing: An interactive communication involving exchanges of voice, video, and data between people at two or more sites that is made possible by using telecommunications systems.

6. Telehealth: The use of electronic information and telecommunication technologies to support long-distance clinical health care, patient and professional health-related education, public health preparedness, public health and health education.

7. Telemedicine: The use of electronic communication and information technologies to provide or support clinical care at a distance.

8. Teleradiology: A system that transmits images over a distance, using leased or switched transmission lines.

For purposes of this plan, the following terms have the meaning assigned by the West Virginia Health Care Authority for institutional services:

Institutional Services in West Virainia

Adult Family Care
1. Definition: Room, board and supervision with activities of daily living (ADL) is provided in a private home from one to three adults.
2. Eligibility criteria: aged 18+, who are capable of self-preservation.
3. Services: Care management, support, and supervision.

Residential Board and Care
1. Definition: Any residence, operated by ownership or management, for payment or not, or not, to provide accommodations, personal assistance and supervision, for a period of more than twenty-four hours, to four to ten persons.
2. Eligibility criteria: 18+; ambulatory: capable of self-preservation, needs assistance with ADLS.
3. Services: Room and board, personal assistance.

Legally Unlicensed (registered) Boarding Care
1. Definition: Personal assistance for one to three consumers.
2. Eligibility Criteria: None
3. Services: Room and board, personal assistance.

Nursing Homes
1. Definition: Skilled Nursing Facilities (SNF) Medicare Nursing Facilities (NF) Medicaid.
2. Eligibility Criteria: Age 18+; Individuals with nursing care or therapy needs.
3. Services: Nursing care and therapies, (a) Hospital-based (distinct part) SNF and NF; (b) Free-standing NF; and (c) State-operated

ICF/MR
1. Definition: Intermediate Care Facilities for the Mentally Retarded (which include institutional or group home settings in which individuals are maintained within on-site.
2. Eligibility criteria: Age 18+; Individual with MR/DD or related conditions in need of active treatment.
3. Services: Active treatment.

Behavioral Health Group Homes
1. Definition: Those services intended to help individuals gain or regain the capacity to function adaptively in their environment, to care for themselves and their families, and to be accepted by society.

2. Eligibility Criteria: Age 18+; 2-17: Individuals with emotional or mental disorder, alcohol or drug abuse problems, and mental retardation or other developmental disabilities: DSM-IV diagnosis.
3. Services: Residential and day habilitation, case management, other professional services as needed.

Specialized Family Care Home
1. Definition: A Community-based, recruited and trained, family home which provides twenty-four hour services to the mentally retarded or developmentally disabled individuals.
2. Eligibility Criteria: Any age: Individuals with Developmental disabilities and/or who need intensive medical and/or behavioral supports.
3. Services: Residential and day habilitation, case management, and other professional services as needed.

State-Operated Facilities
1. Definition: Facilities originally founded as hospitals and which are owned and operated by the State. These institutions are individually approved to provided services ranging form general acute care, extended long term care, nursing home care, personal care, acute and chronic psychiatric care, and intermediate care for individuals who are mentally retarded and developmentally disabled.
2. Eligibility Criteria: 18+: Individuals with nursing care or therapy needs or Individuals with MR/DD or related conditions in need or active treatment (Colin Anderson).
3. Services: General acute care, extended long term care, nursing home care, personal care, acute and chronic psychiatric care, and intermediate care for individuals who are mentally retarded and developmentally disabled. (a) Colin Anderson Center (ICF/MR); (b) Hopemont Hospital: (c) Lakin Hospital; (d) Marion Health Care Hospital; (e) Pinecrest Hospital; and, (f) Welch Emergency Hospital.

IN-HOME SERVICES IN WEST VIRGINIA

Personal Care*
1. Definition: Community Care Program for the Elderly Admissions through Senior Centers in each county. Medical criteria for these services are less stringent than those for nursing home, home health and agedldisabled waiver services. (This program also serves behavioral health clients, but data indicated on this chart apply to the senior population only).
2. Eligibility: Individuals 60+ who are Medicaid eligible and medically stable.
3. Services:

Aged/Disabled Waiver
1. Definition: Community-based services for those aged/disabled who meet the medical criteria for nursing home admission.

2. Eligibility: Individuals 18+ needing nursing home level care who meet income criteria.
3. Services: Chore, homemaker and case management agencies.

MR/DD Waiver
1. Definition: Requires level of care provided in an Intermediate Care Facility for the MR(ICF/MR). Income of client is no more than 300% of current maximum of SSI payments per month. $2000 asset limit. Care of client must cost no more than if institutionalized.
2. Eligibility criteria Children and adults with developmental disabilities needing ICF/MR level of care.
3. Services: Residential habilitation, day habilitation, case management and respite care provided by community behavioral centers.

Home Health
1. Definition: Medical care under the direction of a physician for those individuals requiring skilled nursing and a rehabilitative service.
2. Eligibility Criteria: Individuals needing skilled level of care.
3. Services: In-home nursing and related services.

Hospice
1. Definition: Care for the dying persons provided by state licensed and Medicare certified agencies to individuals with a life-threatening illness with a prognosis of six months or less.
2. Eligibility Criteria: Life threatening illness with prognosis of six months or less.
3. Services: *Previously identified as chore services and Community Care Program (1993)

Attachment 2

Budget and Cost Estimates for West Virginia Telehealth Alliance

FCC grant eligible costs

Planning / Network Analysis Budget (per year)

Normal / Ongoing Network analysis and design		
Each Site	8	Hours
	200	Sites
Hourly Cost	$150	Dollars
Total annual cost	$180,000	Dollars
Construction / Large project Network analysis and design		
Estimated Projects	20	
Average hours per project	160	Hours
Hourly Cost	$150	Dollars
Total annual cost	$480,000	Dollars
Total Annual Network analysis and design **costs**	**$660,000**	

FCC grant eligible costs:

Operations Costs				Annual costs	Annual costs
Telecommunications costs:				Year 1	Year 2
Backbone Costs					
	Fiber Pole Rights			$5,000	$5,000
	nTelos 1 Gb MPLS Circuit for Internet2 and Hospital/Clinic Networks			$40,000	$40,000
	Verizon Transparent LAN Circuit for Internet2 and Hospital/Clinic Networks 1Gb			$40,000	$40,000
	State of WV MPLS Network Circuit for Internet2 and Hospital/Clinic Networks 1Gb			$65,000	$65,000
	Fibernet 1Gb MPLS Circuit for Internet2 and Hospital/Clinic Networks			$40,000	$40,000
Internet2 / ORAnet/TFN					
	Membership fees			$100,000	$100,000
	Connection fees			$240,000	$240,000
Community Health Centers (Eligible)	Sites		Monthly Cost per site		
		17	$800	$163,200	
		36	$800		$345,600
Hospitals (Eligible) Large Facilities					
		8	$2,000	$192,000	
		18	$2,000		$532,000
Smaller Hospitals, Health Departments and other eligible health care providers:					
"Normal" Broadband MPLS T I Sites					
		150	$600	$1,080,000	
		300	$600		$2,160,000
Total Operations costs				**$1,965,200**	**$3,467,600**