

ANNUAL REPORT FOR AWARD # 9729500

David L Shealy (PI); *U of Alabama Birmingham*

High Performance Connection for Research Universities in Alabama

From: fastlane@fastlane.nsf.gov, Sent: Friday, March 24, 2000 4:13 PM; To: flmail@nsf.gov ;
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PI Name: David L Shealy; PI E-mail: dls@uab.edu

Note: NSF personnel have been notified of your report submission. Thank you.

Participant Individuals:

CoPrincipal Investigator(s) : Stan A McClellan; Jill Gemmill; Priscilla A Hancock

Technician, programmer(s) : Landis B Manderson

Senior personnel(s) : Joyce W Iannuzzi; Sheila M Sanders; David Brown

Technician, programmer(s) : Craig White; John Watters

Senior personnel(s) : David Cordes

Technician, programmer(s) : Doug McLean; Clayton Bell

Senior personnel(s) : Stephen A Szygenda; Henry Panion; Mike Carson; Donald B

Twieg; Robert M Hyatt; Walter H Johnson; Andrew E Pollard

Technician, programmer(s) : Shane Merritt

Senior personnel(s) : Maurice Mitchell

Participants' Detail

Partner Organizations:

University of Alabama in Huntsville: Collaborative Research

University of Alabama in Huntsville is a partner in establishing a regional gigaPOP. This project was awarded supplementary funding from EPSCoR, which has been used to establish a high speed connection between UAB and UAH. (UAH is also a HPC awardee; we are working together to obtain maximum benefit from our high performance connections.)

Southeastern Universities Research Association: Facilities; Collaborative Research

SURA's Southern Crossroads Initiative (SoX) provides us with a connection to the vBNS and Abilene, as well as to other research institutions in the SouthEast. SURA is also funding other activities such as a video initiative, which will be beneficial to us in obtaining maximum benefit from our use of the HPNs.

Alabama Supercomputer Authority: Collaborative Research

Alabama Supercomputer Authority is responsible for the Alabama Research and Education Network (AREN) and is a partner with University

of Alabama in Huntsville HPC award. AREN staff have assisted UAB in reviewing equipment selections and configuration, and in discussing NOC services specifications.

University of Alabama Tuscaloosa: Collaborative Research

University of Alabama is a partner in developing the regional gigaPOP and is a subcontractor on this HPC grant.

ITC^DeltaCom: In-kind Support; Collaborative Research

Other collaborators:

1. Ron Hutchins, Director of Engineering, GCATT, Georgia Tech. Technical and administrative issues related to activating our link to vBNS, Abilene, and the SURA Southern Cross Roads (SoX).
2. Gordon D. Wishon, Associate VP for Information Technology, Georgia Tech. Management, funding, policy issues related to starting an Internet2 gigaPOP.
3. ViDe Video Development initiative, LSVNP project
4. Southeastern Universities Research Association (SURA)

Activities and findings:

Research Activities:

Summary:

Major activities during this phase of grant have been implementation of our high performance network plans to upgrade campus networks for provision of advanced telecommunications services to desktop, laboratory, and classrooms required by the meritorious research and educational applications and to establish a regional aggregation point for provision of low cost high performance connectivity to our entire institutions. Both campuses (the University of Alabama at Birmingham (UAB) and the University of Alabama (UA)) have OC3 connectivity to high performance national networks via SoX. Our regional aggregation point is known as the Gulf Central Gigapop. See <http://www.gulfcentralgigapop.net>

SPECIFIC ACTIVITIES:

1. Held SURA-sponsored workshop 'Advanced Network Applications' at UAB in September 1999. This southeast region wide meeting was attended by more than 165 people. Conference proceedings: <http://www.dpo.uab.edu/sura/>
2. Both UA and UAB have sent representatives to Internet2 member conferences, vBNS/Internet2/NLANDR technical workshops, Southern Cross Roads (SoX-our regional gigapop) and SURA meetings. These meetings generally concern advanced networking activities and applications. A list of these meetings is given in Appendix A.

3. Conducted workshop about use of vBNS and high performance network issues for the 7 supercomputer analysts assigned to research universities Alabama by the Alabama Supercomputer Authority.
4. Held 'Introduction to Video Conferencing' workshop at UAB demonstrating performance over vBNS network, in May 1999. Attended by more than 60 people.
5. After attending NLANR Network Measurements Workshop at SDSC, June, 1999, UAB began extending network performance measurements from the edge of the campus (end of NLANR measures) to researcher desktops. Data-gathering experiments have begun, and data analysis is in progress and will be reported and published during the next project year.
6. UAB has installed equipment to report actual usage of high performance network (by type of application, major user, etc). Data is being gathered and reporting tools are being refined.
7. UAB submitted a proposal to ViDe LSVNP (large scale video network backbone project) and was selected to participate.

8. UAB CAMPUS INFRASTRUCTURE UPGRADES: The campus-wide network infrastructure upgrade that we reported last year was approved by the system Board of Trustees. Work in many buildings has already been completed, and remaining buildings have been scheduled. (schedule is on-line at <http://www.dpo.uab.edu/network/COMM.PDF>).

The upgrade plan includes:

- optic fiber vertical backbone for each building
- allocation of space in each building for communications closets, and build-out of those closets
- category-5 or better wiring from the communications closet to the desktop
- upgrading connections to the campus backbone from 10MB to gigabit for each building
- The FDDI backbone has been replaced with a gigabit ethernet backbone

- improving communications inside buildings by dividing ethernet segments with large numbers of users into multiple, smaller segments
- introducing 10MB and 100MB switched ethernet connection options

The meritorious applications specified in the grant proposal were given priority in planning the upgrade. Specifically, 13 of the meritorious applications were at UAB. Of these, 2 investigators have left the university, taking their projects with them. 100MB connections to the desktop have been established for seven of the meritorious applications; a couple of investigators are in the process of obtaining more powerful computers that can take full advantage of this connectivity. It has been extremely difficult to complete upgrades for projects located in buildings managed by the hospital network staff; they have not been very cooperative, naming network standards and security as reasons for multiple delays. Finally, the research ATM network has not yet received a native ATM link to the switch at the edge of the campus.

9. UA CAMPUS INFRASTRUCTURE UPGRADES:

The University of Alabama had originally proposed an ATM network for the campus backbone upgrade. After a review of emerging technologies, The University of Alabama has decided to change its campus backbone to one that is based on Gigabit Ethernet rather than ATM. This will allow for greater speeds to the desktop, will be more compatible with the existing Ethernet topology and equipment, will be cheaper to implement, and will not require re-education of technical and support personnel. In addition, a poll of campus researchers indicated no desires for ATM connectivity.

The University of Alabama's existing network infrastructure provides both 62.5/125 micron multimode fiber and single mode fiber to all academic and administrative buildings on campus. In addition, many of the residence halls have the same fiber connectivity with the remaining residence halls scheduled to receive this connectivity soon. The layout consists of fiber stars linked to a central fiber ring with some mesh links present across the central ring.

The University has embarked on a total replacement of the existing shared/switched 10 Mbps Ethernet campus network. A layer 3 switch will be installed for each major division (e.g., Engineering, Arts & Sciences). This switch will be connected to the campus core switch/router via a Gigabit Ethernet link. Each divisional switch will also have Gigabit Ethernet links to wiring closet switches. These wiring closet switches will provide switched 10/100 Mbps Ethernet to every desktop in the division. In those instances where Gigabit Ethernet can be effectively utilized directly by a machine, a direct Gigabit Ethernet link to the nearest layer 3 switch will be provided. VLANs will also be supported as a mechanism to allow workgroup attachment where researchers are physically separated from their colleagues. The proposed network design is presented in general terms in the Figure 1 attached to this report.

It is anticipated that the Gigabit Ethernet network will carry only IP traffic. Hopefully, existing IPX and AppleTalk traffic that is carried over the current campus backbone can be dropped. AppleTalk is almost completely gone now, and the implementation of NetWare V5 will allow the University to drop support for IPX traffic. Until these protocols are dropped, they also will be carried over the Gigabit Ethernet network.

Although standard category 5, 4-pair, unshielded twisted-pair is run to most of the 'meritorious researchers' currently, some of the wire will undoubtedly need to be replaced due to faulty installation. In many cases, 66-block terminations will have to be replaced with 110-block patch panel terminations to meet the full category 5 specifications. In at least one building, category 3 wiring will have to be replaced with category 5 wiring. Although The University of Alabama currently has no fiber to the desktop installations, this technology may be utilized for some of the researchers that require a full 1,000 Mbps connection.

Overall, the campus has about 37.5% of the rooms wired with Category 3 (or below) wiring. This will all be replaced with dual Category 5E wiring. Each wire will be certified as Category 5E compliant before it is put into production. Additionally, all Category 5 wiring will be certified and moved from the existing 66-block terminations to 110-block patch panel terminations. It is expected that this rewiring effort will take a number of years to complete. All wiring and certification work is being done by the University of Alabama Department of Telecommunication.

As buildings are rewired to conform to Category 5 or 5E

specifications, the active networking equipment, typically shared 10 Mbps Ethernet hubs, will also be replaced with 10/100 Mbps switches as described above. The total cost of the wiring effort plus the cost of electronics is in excess of \$6.5 million. In addition, the annual cost of maintenance contracts on the new networking equipment will exceed \$440,000 per year.

The new central core for the campus network upgrade has been installed and is active. This involves a Cisco 8510 ATM switch and a Cisco 7507 router for ATM/OC3 connectivity to the Gulf Central GigaPoP (GCG), and then on to SoX, and Abilene. It also includes a new Cisco 7513 border router that handles the University's access to all off-campus networks: the commodity Internet, the Cisco 8510 for Internet2 access, and the Alabama Research and Education network (AREN). The new core equipment also includes the campus central switch, a Cisco 6509 with full routing capability.

Additional equipment installed at the core to support research on campus includes a RadVision H.323 video Multipoint Control Unit (MCU) and a ViewStation H.320/H.323 video gateway. The University of Alabama participates in a statewide H.320 videoconferencing system named the Intercampus Interactive Telecommunication System (IITS). The IITS began in 1991 as an effort to use emerging telecommunications technology to share Alabama's instructional resources. Starting as a University of Alabama System initiative with a site at each of the three main campuses, the IITS has grown to become Alabama's interactive video network with more than thirty sites. The IITS is a mixture of universities, community colleges, area high schools, and other agencies, such as the Beville Research Center and the Birmingham Jefferson Civic Center. Recently, the Alabama State Department of Education and Warner Brothers Studios have become full partners in this exciting venture. Use of the MCU and the H.320/H.323 video gateway will enable researchers to easily participate in conferences with their colleagues who only have access to the H.320 based videoconferencing system.

Currently personnel in the Seebek Computer Center, where the core of the campus network is housed, have switched 10/100 Mbps Ethernet connections to their desktops provided by a Cisco 6500 switch that utilizes a Gigabit Ethernet link back to the campus core switch/router. This equipment provides the network support staff with the connectivity they require to manage the campus network. In addition, personnel assigned to the Help Desk and the Faculty Resource Center, which is responsible for aiding faculty with projects dealing with computer technology, all benefit from the switched 10/100 Mbps connections. And, this connectivity allows these groups to demonstrate and assist faculty with projects requiring high speed networking.

The entire College of Community Health Sciences has recently been provided switched 10/100 Mbps Ethernet connectivity to every desktop with a Gigabit Ethernet link back to the campus core switch/router. This provides the promised connectivity to the University's 'meritorious researchers' in that area. The first applications in this area that will really take advantage of this high speed connectivity will involve H.323 video for things such as distance education, participation in medical procedures performed at remote locations, and desktop videoconferencing.

Switched 10/100 Ethernet connections are being installed in the Department of Astronomy, the Materials Information Technology Center (MINT), and the Department of Aerospace Engineering. All equipment necessary to provide this connectivity is on-site. All necessary fiber

links are ready for use. Copper wiring replacement is currently being finished. It is expected that all of areas will have full switched 10/100 Ethernet connectivity to the desktop before the middle of April, 2000. In each case a Gigabit Ethernet link is being provided from the campus core switch/router to the core of the division's network. Then, a Gigabit Ethernet link is being provided from the division's core to the individual departments where the 'meritorious researchers' are located. All connections within the affected departments are being upgraded to switched 10/100 Mbps Ethernet. Thus, not only the 'meritorious researchers,' but also all other faculty in their departments benefit from our efforts. Additionally, due to the Gigabit Ethernet links from the division core equipment back to the campus core equipment, all faculty in the affected divisions will derive the benefit of this high bandwidth link. Initial applications appear to be distance learning, remote instrumentation, and collaboration with colleagues at various Federal laboratories and other universities.

Researchers in these areas have already benefited from the University's high speed Internet2 link through the GCG, SoX, and Abilene. An astronomer recently indicated that he was able to successfully collaborate with some colleagues at Kitt Peak with excellent results. Quoting Dr. William C. Keel, Professor of Astronomy:

'I just had a chance to use our new and vastly improved Internet connection for one of the applications that went into the original proposal. Over the weekend I was working with some collaborators at the telescope on Kitt Peak, near Tucson, The detector was a CCD array of 8192x8192 16-bit pixels, 135 Mbytes every time the shutter opens. To general astonishment, I could keep up with the data for 10-minute exposures. Quite reliably (within a few percent from Friday night to this morning), it took 13 minutes per file to pull these over. As far as I can tell, this is about the raw speed of the link from the mountaintop to Tucson, at which point my guess is that it jumps on I2 from that 'other' U of A to here.'

And, this result is before he has actually been switched 10/100 connectivity to his desktop. His path to Kitt Peak currently starts at his desktop with a 10 Mbps Ethernet connection to an Ethernet hub. This hub then has a 10 Mbps link to a second 10 Mbps Ethernet hub in his building. That hub is then connected to the School of Arts and Sciences' Cisco 5500 via a 10 Mbps connection. The Cisco 5500 is then connected to a Cisco 4700 router at the Computer Center via a 100 Mbps link. The Cisco 4700 is then connected to a Cisco 2948G via a 10 Mbps link. The Cisco 2948G then has a Gigabit Ethernet link to the campus core switch. The traffic next traverses a Gigabit Ethernet link to the University's border router (a Cisco 7513). From there, a Gigabit Ethernet link is provided to the Cisco 8510 ATM switch which then connects to the ATM/OC3 link to the GCG. From the GCG, the traffic follows a 2*OC3 link to SoX then hops on an OC12 link to Abilene. As you can see, there are several 10 Mbps links that this researcher's traffic must traverse to get from his desktop to the campus core switch/router.

By mid-April, the above path will be shortened to look like the following: The connection at the desktop will be a switched 10/100 Mbps Ethernet connection to a Cisco 2948G switch. This switch will then be linked to the School of Arts and Sciences' Cisco 5500 via a

Gigabit Ethernet connection. The Cisco 5500 will then be connected to the campus core switch via a Gigabit Ethernet link. The traffic next will traverse an existing Gigabit Ethernet link to the University's border router (a Cisco 7513). From there, a Gigabit Ethernet link is provided to the Cisco 8510 ATM switch which then connects to the ATM/OC3 link to the GCG. From the GCG, the traffic follows a 2*OC3 link to SoX then hops on an OC12 link to Abilene. This shortened path will result in even better performance to the researcher's desktop. Similar changes will be made for the researchers in MINT and Aerospace Engineering by mid-April, 2000.

This will compete the high speed networking activities promised in The University of Alabama's Internet2 grant. But, the project to upgrade network connections will not stop at this point. The University of Alabama fully intends to continue this project until all faculty, staff, and student connections on campus have switched 10/100 Mbps Ethernet connections to their desktops with Gigabit Ethernet links from the switches back to the campus core switch/router.

There are several additional networking activities proceeding on The University of Alabama campus in addition to a complete re-engineering of the campus network infrastructure. All residence halls on campus are receiving 10 Mbps Ethernet connections in each room. One connection is being provided for each resident. These 10 Mbps connections are tied into shared 10 Mbps hubs (some salvaged from the campus upgrade to switched 10/100 connectivity), which are in turn connected to 10 Mbps switches in each residence hall. These switches have 100 Mbps uplinks to a central Cisco 2948G switch in the Seebeck Computer Center.

In addition to the ResNet project, H.323 videoconferencing is being implemented. Current activities in this area include an evaluation of various products available for desktop use and others suitable for small group videoconferencing. The addition of the RadVision MCU and the VideoServer H.320/H.323 gateway expands the use of this resource to include multi-point conferencing as well as interactivity with the existing state-wide H.320 IITS network mentioned above. It is anticipated that an H.323 capable video archive server, such as the Cisco IP/TV product, will be purchased soon.

Another area of active interest is with wireless networking. There are presently no implementations of this technology on campus. The University of Alabama is scheduled to receive demonstration equipment from Aironet before the first of May, 2000. This equipment will be tested for use in several areas including (1) providing Ethernet access for devices on the shop floor in a new center specializing in developing new, more efficient manufacturing techniques, (2) providing Ethernet access to students in classrooms, (3) providing Ethernet access to facilities such as the campus track stadium, baseball field, and softball field, (4) providing Ethernet access to the University Golf Course, a facility about 5 miles from campus, and (5) providing access within old, small residence halls that will be hard to wire for conventional Ethernet connectivity.

10. The University of Alabama joined the Abilene network in December, 1998. the connection was activated through SoX in July, 1999. The University of Alabama was joined by two other SoX members, the University of Georgia and the University of Alabama in Huntsville, to make this possible, Each contributed their Internet2 connectivity funding to provide an Abilene OC-3 connection to SoX at Georgia Tech in Atlanta.

11. UAB INTERNET2 APPLICATIONS WORKING GROUP: The Provost's office has approved formation of this working group; its purpose is to inform faculty and students about UAB's high performance networking capabilities and to facilitate access to these resources. The I2 Applications Working Group is chaired by Joan Lorden, Associate Provost for Research, and is staffed by Jill Gemmill, Telecommunications Services and vBNS grant co-PI. Additional working group members will include representatives from campus research advisory bodies and persons involved in meritorious applications.

12. RESEARCH PROJECT: Several research projects related to 'next generation' networks and applications are ongoing at UAB. Most of these opportunities have been primarily focussed on industrial contracts, but have also been cross-leveraged with NSF REU supplemental funding for the existing vBNS award.

These projects include:

- (a)'ATM Quality of Service Evaluation in the Presence of Extreme Oversubscription', S.McClellan (PI), Network Equipment Technologies,
- (b)'Analysis of Internet2 DiffServ Architecture', S.McClellan (PI), BellSouth Telecommunications Inc.
- (c)'Issues and Techniques in Network-Based Distributed Healthcare', D. Conner (PI), S.McClellan (co-PI), Advanced Technology Institute.
- (d)'Voice over IP Environment for Research', S.McClellan (PI), Cisco Systems.

Undergraduate students in the UAB School of Engineering have been actively involved in all of these projects, and have published/presented research results in several forums.

13. RESEARCH FUNDING SOLICITATIONS:

- (a) Pre-Proposal: 'ITR/SSI+HCI: An Oder of Magnitude Increase of Usage Efficiency for SER-CAT Synchrotron Beamlines at APS through Automation, Remote Control, and Time-Sharing,' David L. Shealy (PI), Bi-Cheng (B.C.) Wang (co-PI), University of Georgia and SouthEast Regional Collaborative Access Team (SER-CAT) Consortium, Michael C. Wright (co-PI), Oak Ridge National Laboratory, Robert M. Sweet, Brookhaven National Laboratory.
- (b)MRI Proposal: 'Alabama Software Engineering and Networks Research Laboratory,' Stan A. McClellan (PI), Murat M. Tanik (co-PI), David L. Shealy (co-PI).
- (c) NSF/ITR Proposal: 'Remote Evaluation and Management of Transportation Structures', S.Chen (PI), S. McClellan (co-PI).
- (d) UTCA Proposal: 'Bridge Safety through Remote Sensing and Distributed Networking', S.McClellan (PI), S. Chen (co-PI), M. Tanik (co-PIP).
- (e) Cisco Proposal: 'Voice over IP Environment for Research', S. McClellan (PI).
- (f) BellSouth Proposal: 'Analysis of Internet2 Diffserv Architecture', S. McClellan (PI).
- (g) NET Proposal: 'ATM Quality of Service Evaluation in the Presence of Extreme Oversubscription', S.McClellan (PI).

Activities and findings:

Research Findings:

1. 'Alabama's Internet2 and Advanced Networking Infrastructure' Dave Cordes, UA; David Shealy, UAB; Sara Graves, UAH; David McGirt, ITC^Deltacom, Alabama EPSCoR Conference, Feb, 1999.
2. 'Standards Based Delivery of IP Multicast to the Desktop : A Progress Report' Jill Gemmill, Southeastern Universities Research Association (SURA) Networked Video Workshop (March 3-4, 1999)
3. 'Applications over Differentiated Services in the Next Generation Internet', S.McClellan, M.Stricklen, B.Cummings, BellSouth Telecommunications Innovations Showcase, Oct. 1999.
4. 'Quality of Service', S.McClellan, SURA Workshop on Advanced Applications, Sept. 1999.
5. 'Demonstration of QoS Technologies: ATM, Diffserv, 802.1p/q, et.al.', S.McClellan, M.Stricklen, B.Cummings, S.Chataut, SURA Workshop on Advanced Applications, Sept. 1999.
6. 'Importance of Clinical Trials in Network-Based Medicine', S.McClellan, SURA Workshop on Advanced Applications, Sept. 1999.
7. 'Internet2: The Alabama Connection', S.McClellan, IEEE Region 3 General Meeting, Birmingham, AL, Feb. 1999.
8. Alabama's Internet2 and Advanced Networking Infrastructure Initiative. Alabama State EPSCoR Conference, Auburn, Alabama. Spring 1999.
9. Alabama's Internet2 and Advanced Networking Infrastructure Initiative. The University of Alabama Board of Trustees, Spring 1999.
10. Poster session presentation on Alabama's Internet2 Project. 1999 National EPSCoR Conference, Perdido beach, Alabama, Fall 1999.
11. Internet2: Status of the Gulf Central GigaPoP and Networking at EPSCoR Schools. Alabama State EPSCoR Conference, Montgomery, Alabama, Spring 2000.

Research Training:

1. Technical staff have continued to attend NLANR/vBNS joint engineering workshops. (both physical and virtual attendance)
2. Representatives from UAB attended the NLANR Network Performance

Measurements conference in June 1999

3. Organized the SURA Advanced Network Applications Workshop in September, 1999

4. Through the ViDe LSVNP project, we will receive technical training and support in managing videoconferencing sessions and equipment

5. The University of Alabama's chief network technician has attended several Cisco training sessions dealing with router configuration and troubleshooting. Since all of the router and switch equipment utilized in the University's new network infrastructure will be Cisco equipment, this training has been, and will continue to be, very beneficial.

Education and Outreach:

Jill Gemmill:

(a)Invited speaker at NIH General Clinical Research Centers meeting, March 2000.

(b)'Internet2: What is it? Why would you use it? How would you use it?', UAB Information Technology Day (May 6, 1999)

(c)'Report from the SURA Advanced Network Applications Workshop', U.S. National Committee for the International Union of Biochemistry and Molecular Biology (September 23, 1999)

Stan A. McClellan:

(a) Invited participant in AAAS National Workshop on Developing Guidance for NSF Advanced Networking Infrastructure Support post-vBNS Era (2000-2005), February 22-23, 1999.

(b) Reviewer for IEEE Trans. Speech/Audio Processing, Trans. Education, Trans. Info. Tech. in Biomedicine.

(c) Presented 'Internet2: The Alabama Connection', IEEE Region 3 General Meeting, Birmingham, AL, Feb. 1999.

(d) Mentor & Advisor, NASA/SHARP student, 1999.

(e) Guest Editor, Journal of System Integration: Special Issue on Telemedicine, 1999-2000.

(f) Guest Lecturer, 'Information Technology, the Next Generation Internet, and Medicine', UAB School of Health Related Professions, Oct. 1999.

(g) Invited Seminar, 'Diagnostic-Quality Network Video with MPEG2', UAB Pediatric Cardiology, Oct.1999.

David L Shealy:

(a)Invited participant in AAAS National Workshop on Developing Guidance for NSF Advanced Networking Infrastructure Support post-vBNS Era (2000-2005), February 22-23, 1999.

(b)Presentation at Virtual Laboratories Workshop, Research Triangle Park, NC, April 15, 1999.

(c)Represented UAB at SURA CIO Meeting, Atlanta, GA, April 13, 1999.

(d)Reviewer for NSF IMR proposals and professional journals (Optics & Lasers in Engineering, Optics Letters, Applied Optics,

Journal Publications:

M.Stricklen, B.Cummings, S.McClellan, "Linux and the Next Generation Internet: a Diffserv Testbed", *Linux Journal*, vol. , (2000), p. . Accepted

Y.L. Liang, S. McClellan, K. Burst, "Issues and techniques in network-based distributed healthcare: Quality of service and bandwidth", *Proc. Fourth World Conf. on Integrated Design & Process Technology*, vol. , (1999), p. ?? . Published

S. McClellan, G. Grimes, K. Burst, "Issues and techniques in network-based distributed healthcare: Advanced network technology", *Proc. Fourth World Conf. on Integrated Design & Process Technology*, vol. , (1999), p. ?? . Published

S.Chataut, S.McClellan, J.Gemmill, D.Shealy, "Tools for application performance management", *Proc. Integrated Design & Process Technology*, vol. , (2000), p. . Accepted

Book(s) of other one-time publications(s):

Y.L. Ling, "Performance Analysis of Telepathology in an ATM Network" , bibl. University of Alabama at Birmingham, (1998). *Thesis* Published

Jill Gemmill, "UAB Internet2 Web Site" , bibl. <http://www.uab.edu/internet2/>, (1998). *web site* Published

S.McClellan, "Applications over Differentiated Services in the Next Generation Internet" , bibl. Bellsouth Science & Technology Innovations Showcase, (1999). *Conference* Published

S.McClellan, "Quality of Service & Telemedicine" , bibl. SURA Workshop on Advanced Applications, (1999). *Conference* Published

S.McClellan, M.Stricklen, B.Cummings, S.Chataut, "Demonstration of QOS Technologies: ATM, Diffserv, 802.1p/q, et.al." , bibl. SURA Workshop on Advanced Applications, (1999). *Conference Demonstration* Published

Internet Dissemination:

http://www.uab.edu/internet2/nsf_vbns_award.html

http://www.uab.edu/internet2/research_applications.html

http://www.uab.edu/internet2/uab_survey.html

This site summarizes UAB's activities in implementing this award. The meritorious research applications and other applications requiring high performance network connections are described at this location.

Future publications and research findings will also be posted.

Other Specific Products:

Funded Research Grant

The University of Alabama has made presentations to NASA and Army personnel in Huntsville in hopes of developing research grants with these federal agencies. As a result of those meetings, The University of Alabama has obtained and completed a planning contract with the Army Missile Command (AMCOM) to obtain their involvement in Internet2 research. All three University of Alabama System universities were involved. The planning contract was conducted July 1 - September 30, 1998 and brought in approximately \$95,000 to the universities. Results of this research project will be distributed through AMCOM.

Contributions:

Contributions within Discipline:

Within the discipline of computer science and engineering, this project has so far focused on establishing connectivity to high performance networks for research institutions within a state that is geographically distant from such resources. The ATM components of the UAB campus network will be used to investigate QoS, traffic prioritization, and resulting impact on network traffic. Results of this research will contribute to the development of new networking paradigms and/or architectures.

This process of building, operating, and utilizing high performance networks represents development of an important information science and technology infrastructure within Alabama.

Contributions to Other Disciplines:

The availability of high performance networks is changing how courses are being taught and how research is being done in many fields on our campuses, such as, biochemistry, physics, materials science, medicine, nursing, electrical & computer engineering, computer science, biomedical engineering, astronomy, and music. Higher bandwidth networks enable real-time, remote control of medical and scientific instruments, graphic visualisation of large dataset generated at remote supercomputer, large database analysis, and collaboration using digital video. Multimedia is now becoming viable for use in web-assisted instruction, collaborations, and conference attendance.

After UA connectivity to Internet2 link through the GCG, SoX, and Abilene, an astronomer recently indicated that he was able to successfully collaborate with some colleagues at Kitt Peak with excellent results. Quoting Dr. William C. Keel, Professor of Astronomy at the University of Alabama:

'I just had a chance to use our new and vastly improved Internet

connection for one of the applications that went into the original proposal. Over the weekend I was working with some collaborators at the telescope on Kitt Peak, near Tucson, The detector was a CCD array of 8192x8192 16-bit pixels, 135 Mbytes every time the shutter opens. To general astonishment, I could keep up with the data for 10-minute exposures. Quite reliably (within a few percent from Friday night to this morning), it took 13 minutes per file to pull these over. As far as I can tell, this is about the raw speed of the link from the mountaintop to Tucson, at which point my guess is that it jumps on I2 from that 'other' U of A to here.'

Contributions to Education and Human Resources:

Widespread interest in web-assisted instruction/distance education was documented through the High Performance Network Needs Assessment Survey at UAB. As a result, a campus-wide group at UAB known as the Faculty Interest Group on Distributed/Online Learning was organized, and meets monthly to share experiences, locate resources, and meet potential collaborators. Due to their interest, the campus library is hosting a WebCT server for all UAB schools for web-assisted instruction.

Faculty and network staff from both campuses have received training in new network technologies as a result of this grant award.

UAB Professor Stan McClellan has directed network research projects of two undergraduate engineering students during the summer 1999 with NSF REU support from ANIR.

Contributions to Resources for Science and Technology:

The vBNS/Internet2 project will, in the near future, provide a fully integrated network/video delivery system for the State of Alabama by combining the Alabama Research and Education Network (AREN) with the statewide Intercampus Interactive Telecommunication System (IITS) videoconferencing service. Integration of these two highly successful existing telecommunication systems will produce a single statewide network capable of handling contemporary inter-campus educational videoconferencing requirements while allowing for desktop video delivery to be seamlessly merged with advanced research projects and state-of-the-art multimedia 'virtual classrooms'. AREN and IITS already share common clients, customers, and members and their integration will be of great benefit to researchers and educators at all levels of the educational spectrum, while at the same time eliminating the cost of redundant communications links. The proposed Asynchronous Transfer Mode (ATM) architecture provides a flexible, configurable foundation to support present video and data requirements as well as the advanced Quality of Service (QoS) requirements of future highly integrated multimedia applications.

The resulting network will be the crucial component in a statewide test-bed for the wide variety of research and distance learning applications found at participating research institutions. With the availability of a high speed QoS-aware network, multiple modes of

distributed collaboration become possible on a large scale, and the joint optimization of cost/benefit analyses, effective content delivery, and availability of network services spans into application, technical, and administrative domains.

Contributions Beyond Science and Engineering:

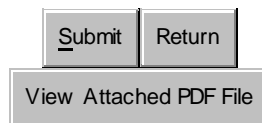
Joan Lorden, Associate Provost for Research, attended a state-wide information technology planning meeting to comment upon a plan proposed by Alabama Department of Economic and Community Affairs. Internet2 and high performance connections for research and education are included as a component of the state master plan.

Special Requirements for Annual Project Report:

Unobligated funds: less than 20 percent of current funds

Categories for which nothing is reported:

**Special Reporting Requirements
Animal, Human Subjects, Biohazards**



We welcome [comments](#) on this system

Other Project Participants

McClellan A Stan : CoPrincipal Investigator

Has worked for more than 160 hours : Yes

Contribution to project : Assistant Professor, Electrical and Computer Engineering, Center for Telecommunications Education and Research, University of Alabama at Birmingham (UAB). Work with the University of Alabama System campuses to develop regional aggregation point (gigaPOP) within Alabama.

Gemmill Jill : CoPrincipal Investigator

Has worked for more than 160 hours : Yes

Contribution to project : Internet2 Applications Lead, University of Alabama at Birmingham (UAB). Formed UAB Internet2 Applications Working Group. Work with the University of Alabama

Investigator on grant to obtain matching funds for this proposal and project manager for the resulting McCallum Building infrastructure upgrade. Southern Crossroads (SoX) advisory board member. Senior Network Applications Specialist, UAB Telecommunications Services.

Hancock A Priscilla : CoPrincipal Investigator

Has worked for more than 160 hours : Yes

Contribution to project : Associate Vice President for Information Services, University of Alabama.

Iannuzzi W Joyce : Senior personnel

Has worked for more than 160 hours : Yes

Contribution to project : Information Systems Manager II, Data Communications/Network Support, University of Alabama at Birmingham (UAB). Member of the Network Engineering Committee and has primary responsibility for upgrade of the UAB campus network to provide UAB faculty, staff, and students the advanced telecommunication services needed to achieve their teaching, research, and service objectives.

Sanders M Sheila : Senior personnel

Has worked for more than 160 hours : Yes

Contribution to project : Director, Telecommunications Services. Worked with University of Alabama System campus representatives to develop a Request for Proposal from vendors, and then, a long-term contract with ITC Deltacom for high performance networking connectivity between campuses and to vBNS, SURA SoX, and Internet2.

Brown David : Senior personnel

Has worked for more than 160 hours : Yes

Contribution to project : Professor and Director Computing and Information Division Engineering Research Laboratory, University of Alabama.

Cordes David : Senior personnel

Has worked for more than 160 hours : No

Contribution to project : Professor and Head, Department of Computer Sciences, University of Alabama.

Szygenda A Stephen : Senior personnel

Has worked for more than 160 hours : No

Contribution to project : Dean, UAB School of Engineering. Chaired the UAB Network Engineering Committee which interviewed campus wide faculty with meritorious research applications associated with the NSF vBNS grant and determined technical requirements of advanced telecommunication services necessary to satisfy applications requirement. Recommended plans for deployment of high performance network services at UAB.

Panion Henry : Senior personnel

Has worked for more than 160 hours : Yes

Contribution to project : Lead investigator from the UAB Department of Music using high performance networks in their Music Technology Program which is developing a concentration in music emphasizing concepts and techniques for MIDI (Musical Instruments Digital Interface) sequencing and scoring, analog and digital multi-track recording, synthesis, sampling, and multimedia production.

Carson Mike : Senior personnel

Has worked for more than 160 hours : Yes

Contribution to project : Research Scientist, Center for Macromolecular Crystallography UAB; use of high performance network for distributed crystallography research

Twieg B Donald : Senior personnel

Has worked for more than 160 hours : Yes

Contribution to project : Associate Professor, Departments of Biomedical Engineering and Medicine

Hyatt M Robert : Senior personnel

Has worked for more than 160 hours : Yes

Contribution to project : Associate Professor, Computer & Information Sciences; use of high performance network for distributed parallel processing

Johnson H Walter : Senior personnel

Has worked for more than 160 hours : Yes

Contribution to project : Jr. Associate Professor Pediatrics, M.D. evaluation of high throughput ethernet technology for remote pediatric echocardiogram diagnoses.

Pollard E Andrew : Senior personnel

Has worked for more than 160 hours : Yes

Contribution to project : Associate Professor Biomedical Engineering. High speed access to remote super computer for calculation of 3D model of heart electrical rhythms.

Mitchell Maurice : Senior personnel

Has worked for more than 160 hours : Yes

Contribution to project : Maurice Mitchell assisted the PI and Co-PI in their decision making by participating in regular planning and implementation activities. He also represented the project at regional and national high performance network meetings to gather and share information.

Manderson B Landis : Technician, programmer

Contribution to project : Software & Network Specialist Leader,UAB Communications Servies. Worked with technicians at Georgia Tech, Cisco, and telecommunication vendors (MCI and ITC Deltacom) to bring up the UAB link to vBNS in 3 months. Attended vBNS Techs meetings in San Diego, Jan 28-29, 98, and in Pittsburg, June 1-2, 98, and the Internet2 QoS Workshop in Santa Clara, May 21-22, 98.

White Craig : Technician, programmer

Has worked for more than 160 hours : Yes

Contribution to project : Network specialist, Seebeck Computer Center, The University of Alabama.

Watters John : Technician, programmer

Has worked for more than 160 hours : Yes

Contribution to project : Seebeck Computer Center, The University of Alabama.

McLean Doug : Technician, programmer

Has worked for more than 160 hours : Yes

Contribution to project : Network staff, Telecommunications Services, UAB.

Bell Clayton : Technician, programmer

Has worked for more than 160 hours : Yes

Contribution to project : Network Staff, Telecommunications Services, UAB.

Merritt Shane : Technician, programmer

Has worked for more than 160 hours : No

Contribution to project : Shane Merritt was integral in the implementation of the UA inteface to the high performance network, assisting John Watters in matters of design, configuration and testing.

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Appendix A: List of Meetings Attended

Internet2 Member Meetings:

First General Meeting, 22 January 1997, San Francisco, CA

Internet2 Spring Members Meeting & Applications Demonstrations, April 14-16, 1998 Washington, DC

Internet2 Project Meeting and Applications Demonstrations, September 26-29, 1998 San Francisco, CA

Spring 1999 Internet2 Member Meeting and Applications Demonstrations,
April 28, 1999, Renaissance Hotel, Washington, DC

Fall 1999 Internet2 Members Meeting, October 11-13, 1999, Seattle, WA

vBNS Technical Workshops:

First vBNS Techs Meeting, January 28-29, 1998, San Diego, CA

Second vBNS Techs Meeting, June 1-2, 1998, Pittsburgh, PA

NLANR/Internet2 Technical Workshops:

First Joint NLANR/Internet2 Techs Workshop, November 1-4, 1998,
Pittsburgh, PA

Second Joint NLANR/Internet2 Techs Workshop, March 7-10, 1999, New
Mexico State University, Las Cruces, NM

Third NLANR/Internet2 Joint Techs Workshop, June 6-9, 1999, Pittsburgh,
PA

Fourth NLANR/Internet2 Techs Workshop, December 5-8, 1999, Florida
International University, Miami, FL

SURA Meetings:

SURA/Jefferson Lab IT2 WORKSHOP, July 29, 1999, WASHINGTON,
DC

SURA Advanced Network Applications Workshop, September 7-9, 1999,
Birmingham, AL

SURA CIO Council, July 13, 1999, Atlanta, GA.

SURA CIO Council, September 20-22, 1999, Washington, DC

SURA CIO Council, January 5, 2000, Atlanta, GA

SoX Meetings:

Technical Meeting. March 18, 1999, Washington, DC

Technical Meeting. January 10, 2000, Atlanta, GA

Other Related Meetings:

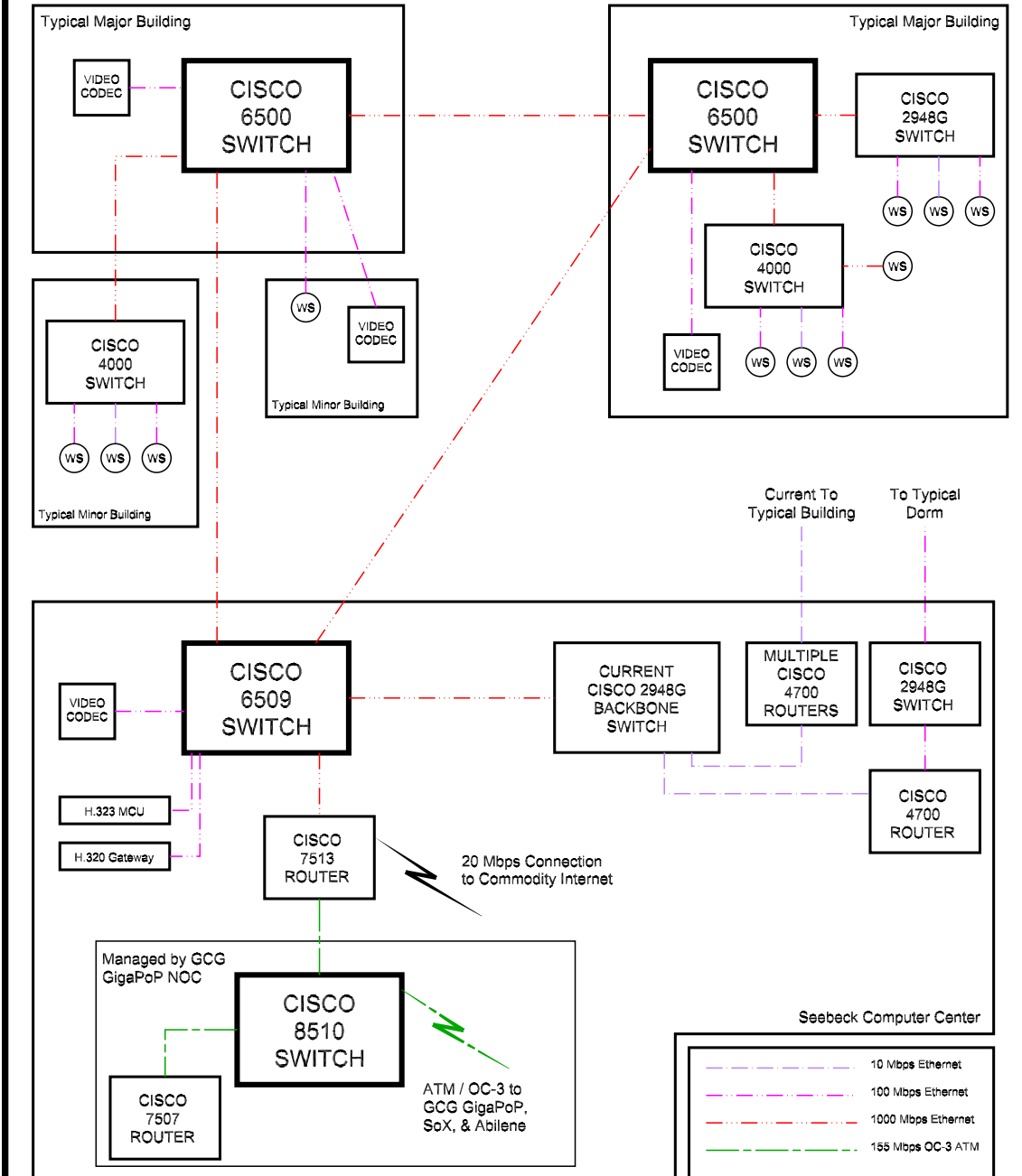
EDUCOM 98, October, 1998, Orlando, FL

EPSCoR, May 27, 1999, Birmingham, AL

NET@EDU PKI Workshop, August 11-13, 1999, Snowmass, CO

EDUCAUSE 99, October 26-29, 1999, Long Beach, CA
NET@EDU, February 6-8, 2000, Tempe, AZ

UA CAMPUS NETWORK UPGRADE



Drawing Name: UANET-52.DWG

Original Drawing Date: 23 FEB 2000

Revision Date:

The University of Alabama

Drawn By: J Watters