

ANNUAL PROJECT REPORT FOR AWARD # 9729500

David L. Shealy ; U of Alabama Birmingham ; *High Performance Connection for Research Universities in Alabama*

Participant Individuals:

CoPrincipal Investigator (s) : Stan A. McClellan : Jill Gemmill : Priscilla A. Hancock
Senior personnel (s) : Joyce W. Iannuzzi : Sheila M. Sanders : David Brown : David Cordes : Stephen A. Szygenda
Technician, programmer (s) : Doug McLean : Clayton Bell : Landis B. Manderson : Craig White : John Watters

(See Appendix for Participant's Details.)

Partner organizations:

University of Alabama in Huntsville : Collaborative Research

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

Southeastern Universities Research Association : In-kind Support; Collaborative Research
SURA's Southern Crossroads Initiative (SoX) provides us with a Connection to the vBNS, as well as to other research institutions in the South East. 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 vBNS.

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 vBNS 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 vBNS grant.

Other collaborators:

1. Ron Hutchins, Director of Engineering, GCATT, Georgia Tech. Technical and administrative issues related to activating our link to vBNS 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. Larry D. Conrad, Director, Administrative Information System, Florida State University. Technical and administrative issues related to SURA SoX regional Internet2 network.
4. Sokrates T. Pantelides, William A. and Nancy F. McMinn Professor of Physics, Vanderbilt University. High performance computing in materials physics.
5. Larry R. Quattlebaum, Communications Planning Manager, Computer Services, and Joe Gipson, Acting Director, Telecommunications and

Network Services, University of Tennessee. Shared experiences in Developing regional aggregation point for connectivity with vBNS and Internet2 within Southeastern US.

6. Mark Johnson, NC Research & Education Network, and Guy Jones, George Washington University. Technical discussions about Telecommunication equipment, connecting to vBNS and SURA SoX, high Performance networking.

7. Wendy Harris and Jim Grisham, NYSErnet, Technical discussions about high performance network engineering and telecommunication equipment.

Activities and findings:

Research Activities: Summary:

Major activities during this phase of grant have been detailed planning 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 (gigaPOP) for provision of low cost high performance connectivity to our entire institutions. Implementation of these plans has also begun at both campuses (the University of Alabama at Birmingham (UAB) and the University of Alabama (UA)).

Specific Activities:

1. UAB CONNECTION TO THE VBNS: Established an active DS-3 connection from UAB to the vBNS through the Southern Crossroads (SoX) gigaPOP at Georgia Tech in April 1998. All research and education activities at UAB have access to this connection.

2. REGIONAL GIGAPOP: UAB and UA have worked with University of Alabama in Huntsville to form the Gulf Central GigaPOP (GCG), an initiative to build a distributed gigaPOP in Alabama. GCG activities include:

(a) Development and circulation of an RFP for high performance connectivity between UAB and UA, UAH and UAB; an upgrade to at least OC-3 of the vBNS connection; and for NOC services for gigaPOP equipment. Responses have been reviewed and final vendors have been selected. The contract for telecommunications services is in the final signature stages and will be announced shortly.

Negotiations are ongoing with the selected NOC services provider.

(b) A list of equipment to be purchased for the distributed gigaPOP has been developed, and is currently under review. Expertise from NLANR and elsewhere is being actively solicited to advise us on Equipment selection.

3. UAB NETWORK EQUIPMENT ADVISORY COMMITTEE: UAB formed a Network Equipment Advisory body to select high performance networking equipment for the UAB campus. Meritorious applications were reviewed to determine their network requirements. Applications were found to have one of these sets of network requirements:

(a) Higher Bandwidth,

(b) Higher Bandwidth and special QoS considerations,

(c) Higher Bandwidth, QoS considerations, and time-constrained interactivity requirements.

It was determined that many of these applications would be well

served by a campus backbone upgrade to gigabit ethernet; the most demanding applications, however, will be connected to an ATM backbone which is inter-connected to the campus ethernet and hospital system ATM networks. Members of this committee included the UAB grant PI's; Dr. Stephen Szygenda, Dean of the School of Engineering; Todd Bowden, Director of Health Systems Information Systems; Martha Griffin, HSIF staff; Joyce Iannuzzi and Landis Manderson, Telecommunications Services. In addition, the faculty members with meritorious applications participated in the applications' requirements discussions: Michael Carson (Center for Macromolecular Crystallography), Peter Prevelige (Microbiology), Allan Dobbins (Vision Science Research Center), William Johnson (School of Medicine, Division of Pediatric Cardiology), Barton Guthrie (Computer Aided Neurosurgery Facility), Andrew Pollard (Biomedical Engineering), Cindy Kirk UAB Options, William Hardin (School of Medicine), Michael Angell (Music).

The ATM equipment for the campus has been ordered and delivered. The equipment has been installed, and its stability is being evaluated with the aim of connecting the designated meritorious applications in the near future. (See attached diagram 'UAB Newbridge ATM network'.)

4. UAB CAMPUS INFRASTRUCTURE UPGRADES: The campus connection to the VBNS served as an important impetus in developing a plan for a campus wide network infrastructure upgrades. The requirements of high performance research applications, combined with planning for future client-server administrative applications, led to a plan for upgrading the entire campus network. The UAB campus had already invested in optic fiber connections to each building on campus. However, the state of wiring and use of electronic components inside each building varied from excellent (as in newly constructed buildings) to out of date 'do it yourself' jobs put into place by network pioneers.

The university's Telecommunications Services department took the lead in developing a plan for upgrading the entire campus network, including both wiring and electronic components. The upgrade plan includes:

- optic fibers for the vertical backbone of 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 from the backbone to each building; these connections are currently 10MB connections, and will be upgraded to 100MB in most cases
- replacing the current FDDI backbone 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

This six-year plan has been reviewed and adopted by the institution, through the office of UAB's President Anne Reynolds, and will be presented to the University of Alabama System Board of Trustees for approval in early 1999. In the interim, upgrades to

several buildings are under way, using available funds.

The meritorious applications specified in the grant proposal have been given priority in this planning process, and the buildings in which these applications are located are at the top of the renovation list. The campus plan includes integration of the ATM network components funded by this proposal.

5. UA CAMPUS INFRASTRUCTURE UPGRADES: The University of Alabama had originally proposed an ATM network for the campus backbone upgrade. After a recent review of emerging technologies, The University of Alabama has decided to change its campus backbone to one that is predominately Gigabit Ethernet based rather than ATM based. ATM will still be provided to those areas where the technology is beneficial or where the technology is required for ongoing research. It is anticipated that video and voice applications will be major users of the ATM network.

UA's existing network infrastructure provides both 62.5/125 micron Multi-mode fiber and single mode fiber to all academic buildings on Campus. The layout consists of fiber stars linked to a central fiber ring with some mesh links present across the central ring. Current plans call for implementing layer 3 switches in each of the star center buildings with meshed links to other layer 3 switches. Each switch will communicate with its peers with both Gigabit Ethernet and ATM running at OC-12 speeds (where required). Connected to each switch via Gigabit Ethernet links will be 10/100 Mbps switches to provide 10/100 Mbps connectivity to each desktop. In those instances where Gigabit Ethernet can be utilized directly by a machine, a direct 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. For those devices requiring native ATM connectivity, a small ATM switch will be provided in the wiring closet with an ATM/OC-3 link back to the nearest layer 3 switch. The proposed network design is shown in the figure attached as a PDF file to this report.

It is anticipated that only native ATM traffic will run over the ATM portion of the network, and that the Gigabit Ethernet network will carry IP traffic. Hopefully, existing IPX and AppleTalk traffic that is carried over the current campus backbone can be dropped. If not, it will also be carried over the Gigabit Ethernet network. There is no intention of running MPOA or LANE over the ATM network at this time.

Although standard category 5, 4-pair, unshielded twisted-pair is run to most of the meritorious researchers currently, some will undoubtedly need to be replaced due to faulty installation. In many cases, 66-block terminations will have to be replaced with 110-block 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 UA 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.

By the end of the first year, UA is scheduled to connect at least ten dedicated vBNS researchers and to provide connectivity to three

Buildings on campus. The University of Alabama plans to have Physics, MINT, and Computer Center connected by end of the year. The Engineering and Arts & Sciences networks will be connected by end of February 1999. This will connect more than ten dedicated vBNS researchers before the end of the first year of our grant period. The University of Alabama is in the process of submitting our budget change request to NSF for approval to purchase Gigabit Ethernet equipment for the campus backbone. We will order the equipment and start installation as soon as approval is granted.

6. 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.

7. UAB HIGH PERFORMANCE NETWORK NEEDS SURVEY: A survey to assess campus high performance network requirements was conducted; about 40 such projects were submitted. Descriptions of these projects may be found at <http://www.uab.edu/internet2/>

8. RESEARCH PROJECT: Stan McClellan submitted a proposal for inclusion in Internet2 Differentiated Service Testbed (the 'QBone').

9. RESEARCH PROPOSAL: Jill Gemmill, Stan McClellan, and David Shealy submitted a NSF EPSCoR 'one-time grant' proposal for a state-wide IP video-multicast testbed, in collaboration with Alabama Research and Education Network, a state-wide research and education Network, and the Intercampus Interactive Telecommunication System (IITS), a state-wide videoconference network.

10. UA PRESENTATIONS: The University of Alabama has made several Internet2 presentations to faculty and student groups. Specifically, presentations were given to the Faculty Senate Steering Committee, Information Technology Committee, ACM, IEEE, and The University of Alabama applications faculty. Individual meetings with Education, Communication, Engineering, Continuing Studies, Library and Social Work faculty have been held to discuss their participation in Internet2. The University of Alabama has set up discussion groups for the administrative, network, and applications faculty and staff who participate in our Internet2 efforts.

Research Findings: Presentations:

1. Planning and Living the Reality, Priscilla Hancock, EDUCOM, Orlando, October 15, 1998.

2. Internet2 : Implications for and Applications in Higher Education Jill Gemmill, Faculty Interest Group on Distributed/Online Learning, October, 1998.
3. UAB Internet2 Update, Sheila Sanders and Jill Gemmill, UAB President's Executive Council, September, 15, 1998.
4. University Panel, David Shealy, Dynamics of the Networked Academy, Sponsored by Mississippi State University Information Technologies Oversight Committee, SURA, and UCAID, Starkville, MS, September 9-11, 1998.
5. UAB Internet2 Activities, David Shealy and Jill Gemmill, UAB Academic Programs Council, September 9, 1998.
6. Local Networks and Middleware (University Panel), Jill Gemmill and Cindy Kirk, Networking Resources for Collaborative Research in the Southeast; sponsored by the American Association for the Advancement of Science, Southeastern Universities Research Association, and National Computational Science Alliance, Atlanta Ga June 3-5, 1998.
7. Internet2: Build it and they will come, Priscilla Hancock, UA President's Executive Cabinet, April 21, 1998.
8. A Review of Internet2 Activities on the UA Campus and Beyond, David Brown, Association for Computing Machinery Student Chapter, Tuscaloosa, April 8, 1998.
9. Distance Education in Alabama, Jill Gemmill, SURA Advanced Networked Applications and Networked Video Workshop, RTP, NC, March 17, 1998.
10. Telepath Paradigm at UAB, Stan McClellan, SURA Advanced Networked Applications and Networked Video Workshop, RTP, NC, March 18, 1998.
11. Managing Diverse Networks - strategies, Peggy Davis (MCNC), Hunter Thompson (UNC), Tom Cox (UNC-Willington), Phil Emer (NCSU), and David Shealy (UAB), SURA Advanced Networked Applications and Networked Video Workshop, RTP, NC, March 18, 1998.
12. Internet2 : What is it and why does UAB need it? Jill Gemmill, UAB Information Technology Day, February, 1998.

Research Training: 1. Several of the faculty and staff have attended each of the vBNS Techs and vBNS gigaPOP operators workshops sponsored by NLANR.

2. Jill Gemmill attended the NLANR 'Coding for the Wide Area Network workshop.

3. Several UAB faculty members attended the June SURA/EPSCoR/AAAS meeting to find collaborators at other institutions and to learn more about funding opportunities.

4. Stan McClellan hosted a seminar on 'Routing Technology for the Next Generation Internet', Birmingham, AL, Aug. 24, 1998.
5. Participation in 3Com's Internet2 Partnership program.
6. Participation in Torrent Networking Technologies' Internet2 Partnership program.
7. Participation in Starburst Technology's Internet2 Partnership program.
8. Doug McLean and Clayton Bell attended a Newbridge ATM Network Training course.
9. UAB Telecommunications Services sponsored a seminar presented by Rich Seifert on gigabit ethernet technology. Mr. Seifert also met with researchers in the School of Engineering and Computer Science Department. Mr. Seifert is author of the book GIGABIT ETHERNET.
10. Participation in the following Internet2 conferences and workshops: SURA Advanced Networked Applications and Networked Video Workshops (March 16 - 20, 1998); Spring Meeting of the Internet2 Project (April 13- 16); First Internet2 Joint Applications / Engineering QoS Workshop (May 20 - 22, 1998); AAAS/SURA/NCSA Networking Resources for Collaborative Research in the Southeast (June 2 - 4); and the Fall Meeting of the Internet2 Project (September 26 -29).
10. UA's network technician attended CISCO training classes in preparation for the network installation.

Education and Outreach: The vBNS award to UAB-UA was announced in university publications, in the local TV, newspapers, and on several radio stations.

Book(s) or other one-time publication(s):

Y.L. Ling, "Performance analysis of telepathology in an ATM network" , bibl. University of Alabama at Birmingham, (1998). *Thesis*

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

Other specific products:

Other products:

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 visualization of large data-set 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.

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.

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 reporting requirements: None

Change in Objectives or Scope: None

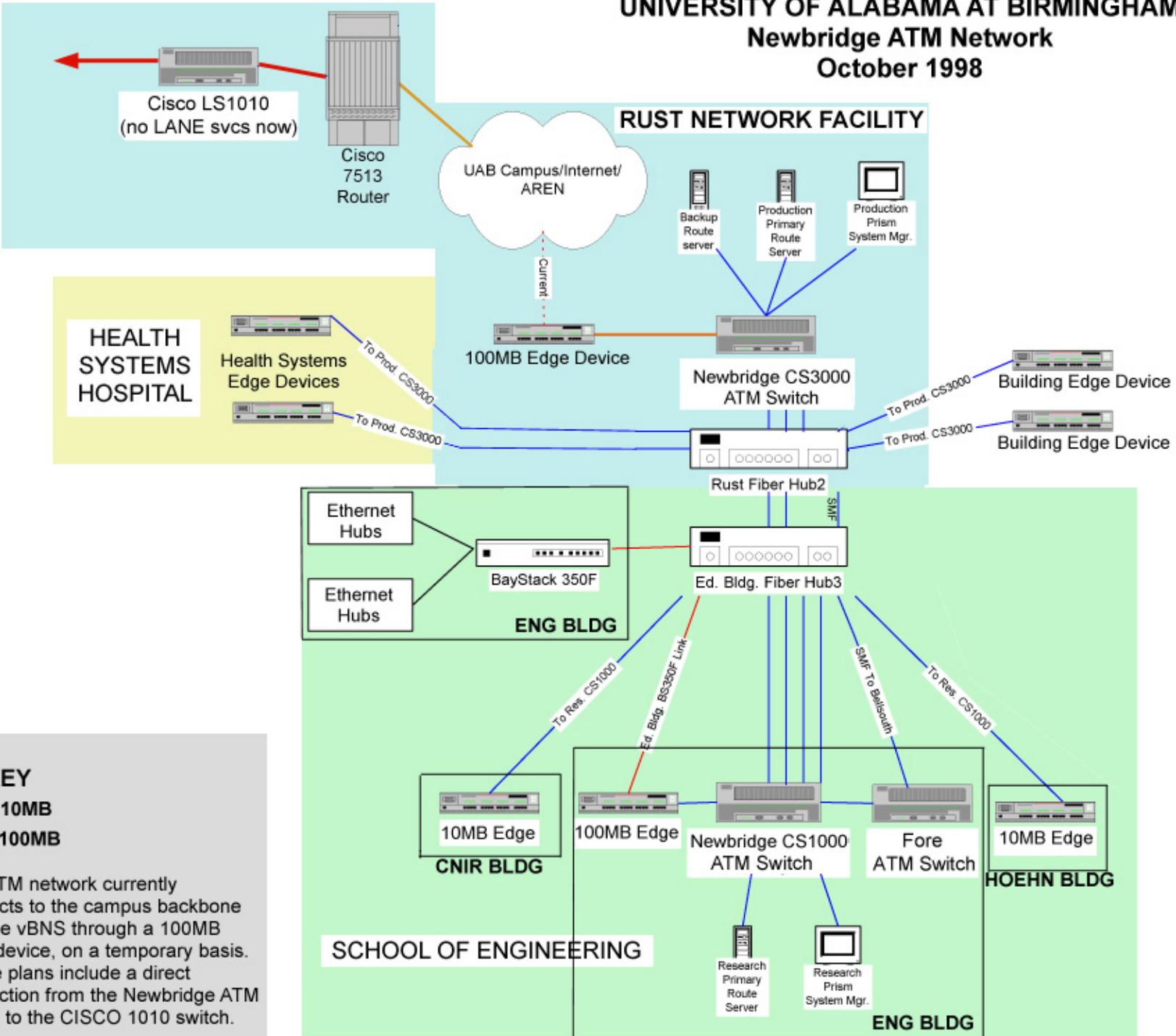
Unobligated funds: less than 20 percent of current funds

Animal, human subjects, biohazards: None

Categories for which nothing is reported:

Products : Journals

UNIVERSITY OF ALABAMA AT BIRMINGHAM Newbridge ATM Network October 1998

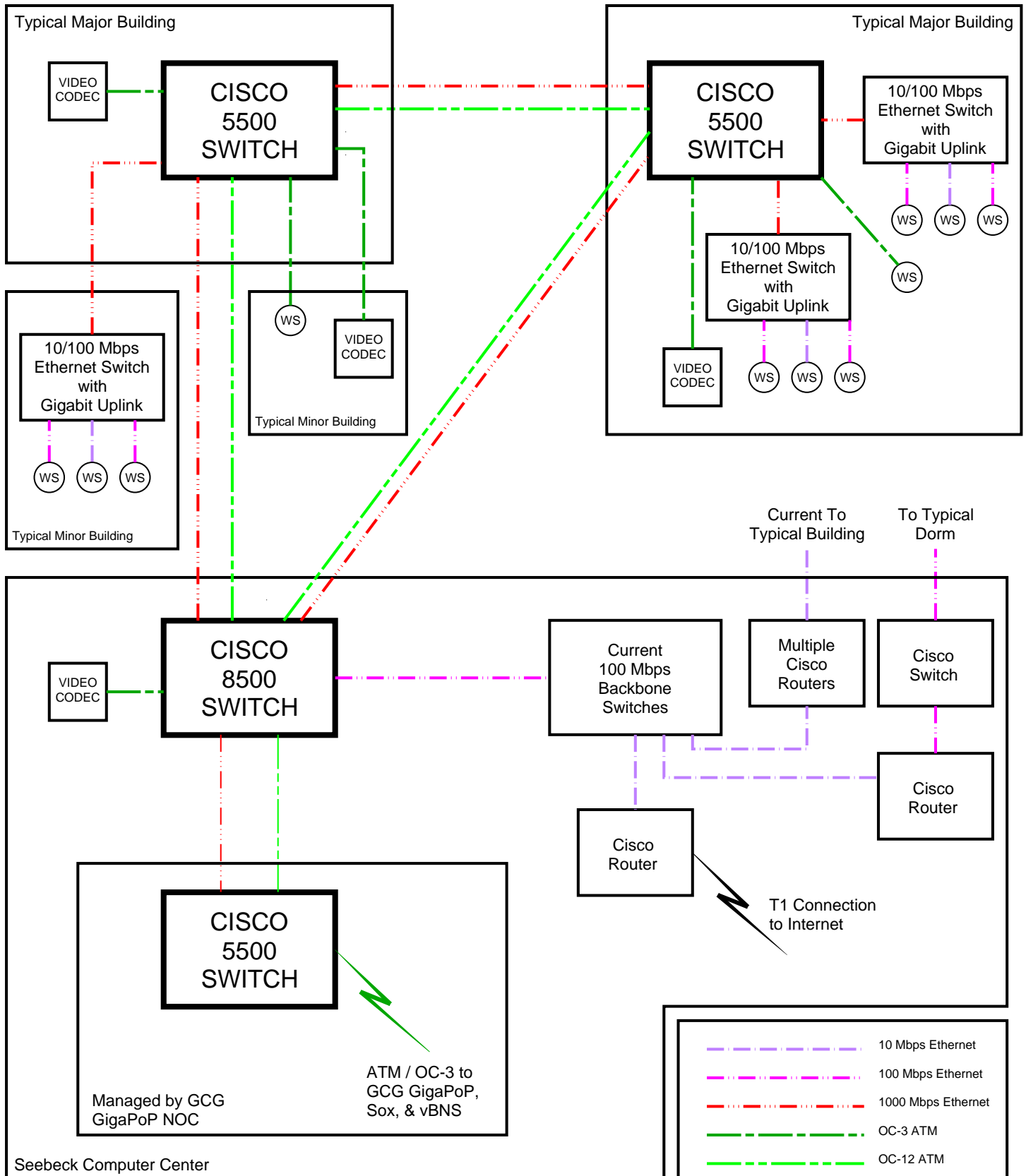


KEY

- 10MB
- 100MB

The ATM network currently connects to the campus backbone and the vBNS through a 100MB edge device, on a temporary basis. Future plans include a direct connection from the Newbridge ATM switch to the CISCO 1010 switch.

UA PROPOSED CAMPUS BACKBONE



ANNUAL PROJECT REPORT

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David L. Shealy 10/31/1998

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