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ABSTRACT

This report is part of the Southern Regional Education Board (SREB) Educational Technology Cooperative's ongoing study of state educational networks. The current report is based on a study of statewide educational networks in three SREB states during May-September 1998, including a review of published materials obtained from network and agency offices as well as visits and interviews with officials and personnel who develop, operate and use the networks. It outlines significant aspects of state wide area network (WAN) development and operation, specific success factors and challenges. This report is intended to provide information to help policy and management personnel in education agencies who are interested in planning further development of their statewide educational networks. The first three chapters describe the statewide educational networks in Florida, Georgia, and Oklahoma, and identify success factors and issues in each state. The fourth chapter, which draws from the first three and from discussions of the SREB Educational Technology's Telecommunications and Infrastructure Task Group, highlights critical factors for consideration by any state planning to develop or expand a statewide educational network. (AEF)

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# An Educational Network Study in Three States:

## Success Factors and Issues

April 1999



Southern Regional Education Board

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# Introduction

This report is a part of the SREB Educational Technology Cooperative's ongoing study of state educational networks. Surveys of the SREB member states resulted in the reports *State Education Network Survey,* 1996, and *Telecommunication's Status, Trends, and Issues in the SREB States,* 1997. A follow-on summary report, *Statewide Educational Networking: Trends and Issues Highlighted,* was published April 1998.

The current report is based on a study of statewide educational networks in three SREB states during May-September 1998, including a review of published materials obtained from network and agency offices as well as visits and interviews with officials and personnel who develop, operate and use the networks. It outlines significant aspects of state wide area network (WAN) development and operation, specific success factors and challenges. This report is intended to provide information to help policy and management personnel in education agencies who are interested in planning further development of their statewide educational networks.

The first three chapters describe the statewide educational networks in Florida, Georgia and Oklahoma, and identify success factors and issues in each state. The fourth chapter, which draws from the first three and from discussions of the SREB Educational Technology's Telecommunications and Infrastructure Task Group, highlights critical factors for consideration by any state planning to develop or expand a statewide educational network.

*Chapter 1*

# Florida WANs (FIRN and SUNCOM)

## Background

FIRN is the electronic data network dedicated to linking the Department of Education[1], school districts, community colleges and universities to computing and information resources across Florida and the Internet. FIRN's initial role was to provide data connections to all school districts, colleges and universities for reporting administrative data, as well as special connections among universities in support of research. It now provides an educational intra-net and other network-based services, such as selected administrative applications, e-mail, consulting and training.

*From The FIRN Report, December 1997:*

"Since its inception (1982-83), the Florida Information Resource Network (FIRN) has served as the primary data-communications facility for the Department of Education, school districts, community colleges and universities within the state of Florida. Over the years, FIRN's role as an information infrastructure has undergone major changes. While those changes were important, none was as important as the enhanced network upgrade that has been in progress during the last two years. This enhancement has provided faster service, more reliable connectivity and a vastly broader base of instructional resources available from sources throughout the world.

"The network upgrade improved Florida's telecommunications infrastructure and greatly enhanced the support of statewide educational and instructional initiatives. It supports cost-effective individual LAN connections to new network backbone router services.

"FIRN now can focus on supporting school districts, community colleges and universities as they migrate their infrastructures to take advantage of common network services. The upgraded network supports Florida educators in their quest to find and utilize a variety of educational resources with access to the Internet through FIRN. A vast array of materials on World Wide Web (WWW) servers, gopher clients, electronic mail and more all are a part of the services included for FIRN patrons."

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1 The Department of Education in Florida includes the Board of Regents, the Community College Board and the Board of Education (K-12).

FIRN obtains its backbone transport services from SUNCOM, a group of network services offered by the state Department of Management Services' Division of Communications. These services are available to all state agencies and schools. SUNCOM offers voice, data, Internet access, video, technical consulting, seminars and state contract services. "Advanced telecommunications services" — including distance learning, video conferencing, data communications and access to the Internet — have been emphasized recently.

SUNCOM backbone transport services are provided to FIRN for its data network, and end-user services are available to schools — overlapping FIRN's services, in some cases.

## Organization

**Responsibilities** — FIRN operates under the Department of Education, with the director of FIRN reporting to a deputy commissioner of the department. The FIRN Coordinating Council provides policy guidance for the service. This council consists of two university presidents; two community college presidents; two district superintendents; the director of information resource management in the Board of Regents and the Division of Community Colleges; four district directors of management information systems; and one representative from the Florida Council of Instructional Technology. The commissioner of education chairs the council. The Legislature appropriates the FIRN budget as a direct line item. The council advises on FIRN's budget request and on allocation of funds to various FIRN programs. The director of FIRN is also the chief information officer of the Department of Education and chairs the Florida Distance Learning Network. (This network will be discussed later in this report.) District management information systems directors meet twice per year and provide feedback to FIRN.

SUNCOM services are provided by the Division of Communications of the Department of Management Services, a cabinet-level agency of state government that also includes divisions to provide services such as purchasing, facilities management and human resources. The Division of Communications provides numerous telecommunications services to other state agencies, including the Department of Education. While agencies may provide certain services for themselves, such as LANs, procured services must be obtained through the Division of Communications. This requirement stems from 1970s legislation that unified the state's procurement of voice services, for economical reasons. Many states have similar policies.

As both FIRN and SUNCOM have moved into advanced technologies, including the Internet, and as the various telecommunications technologies begin to merge, the agencies' services appear to overlap in some cases. FIRN's purpose is to provide data network services to all of education, although educational units may elect to obtain those services from other sources, such as SUNCOM or vendors. SUNCOM's purpose is to provide telecommunications and networking services to all state agencies — including educational units, if they choose.

Educational units obtain all voice and interactive video services from SUNCOM. Other services that they may choose to obtain from SUNCOM include application development; Web site development and hosting; Internet access; intranet and LAN development; consulting; and training. FIRN provides data network connections for all public school districts and colleges and universities, although some colleges and universities have additional network connections to other sources, including SUNCOM and Internet service providers. FIRN's intranet contains all educational units, and FIRN provides consulting, training and applications development at the Department of Education. Campuses and districts are responsible for their own internal networking.

FIRN buys backbone services from SUNCOM and uses SUNCOM's contracting services for any other necessary network items.

### *Other units*

There are several other units involved in managing, supporting or providing statewide, technology-based educational delivery. Those units include the Public Broadcasting Section the Instructional Television and Distance Learning Section of the Department of Education's Office of Educational Technology; and the Florida Distance Learning Network (FDLN).

The Public Broadcasting Section contracts with the Florida Public Broadcasting Service to produce and transmit statewide public-affairs and instructional programs. The Florida Public Broadcasting Service consists of 13 public television and 12 public radio stations, locally licensed and controlled. Five educational institutions have television stations on public broadcasting.

The Office of Instructional Television is under K-12 and provides various services that support the use of television. For example, it manages the selection and licensing of top-rated telecourses for use by school districts and postsecondary institutions.

The FDLN is assigned to manage the use of the satellite transponder that replaces the lost Telstar 401, although SUNCOM manages the contract for the satellite transponder service. The Public Broadcasting Section is the coordinating point for programming for the Department of Education.

The FDLN was established in 1995 as a public corporation, initially to link the state's various existing resources to plan, design and deliver credit and noncredit programs of distance learning. The FDLN's Board of Governors comprises representatives from K-12, community colleges, state universities, public agencies and the private sector. The FDLN was established to improve coordination among the education sectors.

The FLDN in its original form was found to be too encompassing, unwieldy and dominated by providers. It is being reconstituted to focus primarily on technology policy and infrastructure development. At this point it is a policy board rather than a network or operating entity.

In an effort to better coordinate educational initiatives, programming, resource acquisition, advising, and support, the Board of Regents and the Community College System agreed to establish the Institute for Public Postsecondary Distance Learning. The institute's membership consists of four college or university presidents from each education agency; the heads of the University System, Community College System and the Department of Management Services; and one representative each from the Board of Regents and the state Board of Community Colleges. The institute's administrative offices are at Florida Gulf Coast University. The institute will coordinate all public postsecondary distance education and will advise the Board of Regents, the state Board of Community Colleges and the FDLN.

**Technical organization and management** — FIRN technical staff and management are under the Department of Education. The central staff consists of 27 positions, and a field staff of nine work in the schools to provide technical support and training. *The FIRN Report* lists the three functional areas into which the staff is divided:

*Applications development* — Staff develop and maintain applications that directly use FIRN's network services. They provide support to various areas within the Department of Education regarding the design and development of statewide applications.

*Network development* — Staff provide technical assistance and support to educational institutions that are considering or are involved in the development, acquisition and installation of local area networks. Help desk staff provide answers about program/network problems, and off-site staff (FIRNTECs) train and educate classroom teachers on the use of computers and telecommunications. Staff are responsible for the software and hardware platforms that support FIRN's statewide electronic mail system (FIRNmail and POPmail) and Internet services.

*Network operation/administrative support* — Staff design, plan and analyze FIRN's TCP/IP wide-area data-communications network. These duties include testing and implementing new network technologies and services; resolving problems with data communication hardware and software; providing technical assistance in determining the needs of FIRN clients and potential clients; and day-to-day managing of the network. Staff provide support for the administrative needs and requirements of the FIRN network.

In carrying out its role in statewide data networking for education, FIRN has shared responsibilities with the universities, regional data centers and SUNCOM.

SUNCOM technical staff and management are under the Division of Communications of the state Department of Management Services. The 51-member division staff is divided into the following units:

- Wireless Communications
- Hardware and Infrastructure
- Strategic Technologies

■ Applications Development

Many of SUNCOM's services — such as voice services, data communications services and Internet access — consist of, or are built around, procured services from vendors.

**Applications and utilization** — User agencies are responsible for end-user applications, and their methods of handling this responsibility vary. There have been several state-level initiatives, plans and policy decisions aimed at promoting and supporting the effective, efficient use of telecommunications technologies throughout education. These initiatives started in 1982, when FIRN was formed to support data communications for administrative reporting and research. In more recent years emphasis has shifted toward general-purpose networking, with a special emphasis on instruction and learning.

The State University System of Florida 1993-98 Master Plan recommended the creation of the Florida Distance Learning Network. The FDLN was intended to plan, design and deliver credit and noncredit distance-learning programs. This broad role was narrowed to technology and infrastructure policy, and the Institute for Public Postsecondary Distance Learning was directed to coordinate applications and utilization for higher education. The institute has taken up a number of issues related to network utilization and support. (These actions will be discussed later in the report.)

In December 1995 the Florida Postsecondary Educational Planning Commission (PEPC) published a report by a statewide telecommunications task force. This report contained a number of recommendations, including several related to applications and utilization management. The following is a summary of recommendations dealing with technologically delivered postsecondary instruction:

- Improving access should be a primary criterion in funding and policy decisions.
- Educational goals should be made explicit in requests for funding.
- Distance learning services should be coordinated throughout educational sectors.
- A recurring funding source for the development of technologically delivered educational courses and programs should be identified.
- Fiscal policies should describe clearly how funding and services will be processed for students enrolled in distance learning courses and programs.
- Methods such as a common system for numbering courses should be used to promote statewide recognition of distance learning courses for credit.
- There should be incentives to encourage faculty to use educational technology effectively.
- Funds for training faculty and students to use and apply a new technology program or initiative should be set aside in its total budget.
- An intellectual-property rights policy should be established to govern the development and repeated use of technologically delivered courses and course content.

- Current funding formulas, such as those for capital outlay and library support, should be amended to eliminate potential disincentives for the use of educational technology.

Most of these recommendations have been implemented, at least partially, or are under consideration.

As a result of a legislative directive, in March 1997 the Florida Postsecondary Educational Planning Commission (PEPC) published Major Issues in Technology, which addressed policy issues regarding expanded educational use of technology and distance learning. According to this report:

"To help fulfill this directive, the Commission contracted with the National Center for Higher Education Management Systems (NCHEMS) to assist in gathering background information and making recommendations centered on a) awarding credit for technologically delivered instructional programs, b) the effective application of technology to priority instructional areas, and c) funding technology-related instruction and distance learning courses and programs. ...

"In the course of the study, several structural features of Florida's higher education system appeared to present obstacles to the adaptation needed for effective use of technology and implementation of a distance learning system. These features include: the articulation system which reinforces a rigid system of roles and thus inhibits cooperation; enrollment-based enrollment funding mechanisms which encourage competition and ignore additional costs associated with technology; and a provider-driven higher education system which does not always take into account the needs of the students. ...

"... Educational technology can allow postsecondary educational institutions to become more efficient in teaching more students. ... While it is true that advances in technology will certainly bring about some positive benefits, many existing policy questions will be exacerbated and new ones will emerge. Clearly, technology will not be the panacea for all of the problems facing the State's educational sectors.

"... (P)olicy actions taken by various bodies appear, in many cases, to be designed to 'accommodate' technology within the current architecture of institutions and instructional delivery. Most appear to have been developed largely from the point of view of those providing instruction instead of those receiving it ... whose needs it is presumably intended to meet. In addition, there has been little attention in any policy discussions of the particular educational needs that must be met on a statewide or regional basis and what technology is especially good at doing. Most reports produced to date on this topic cite increases in demand as a rationale for greater investment in technology but do not present these data in ways that suggest specific strategies to meet demand — either on a regional or a programmatic basis.

"Partly as a result of these conditions, the uses currently being made of technology and distance-delivery mechanisms in Florida tend to serve institutionally defined objectives,

not those of the State as a whole. ... What is needed is a basic shift in policy discussion from a model characterized by the present organization of public provider's use of technology within the current structure, to one organized in terms of state needs and priorities, and changes in instructional strategies and approaches to provide multiple ways of meeting these priorities with consequent applications in technology."

Several recommendations in this report addressed applications and utilization, as summarized below:

- Agencies should collaborate in the statewide licensing and/or development of educational programs and courses of highest priority.
- A systemwide, computer-assisted system for student advisement should be developed and implemented.
- The Institute for Public Postsecondary Distance Learning (PPDL) should set aside funds for a team approach to training on an as-needed or as-requested basis.
- On-campus or "in-person" study should be required only when based upon clear programmatic needs for direct interaction or "hands-on" applications.
- Students should be allowed to "test out" of particular curricular components they have mastered in various ways.
- The Community College System should coordinate a statewide network of learning support centers.
- There should be a collaborative effort to identify, prioritize, procure and implement online library resources and support services.
- The secretary of state should convene a work group to review the implications and value of copyright and licensing of state-produced information.
- An policy that would meet federal financial-aid guidelines should be adopted to allow transfer and acceptance of distance-education course credit among state universities, community colleges and private colleges and universities.
- Traditional service areas for colleges and universities and any other artificial boundaries should continue to be phased out.
- The Legislature should adapt the current funding mechanisms for both the SUS institutions and the community colleges to further encourage the use of technology.
- Educational content of programs developed with state funds should be made available to other state institutions.

Some of these recommendations have been implemented; others are being investigated or are being implemented.

Much of the planning and policy activity for statewide distance-learning initiatives and programs is centered on the Institute for Public Postsecondary Distance Learning. At the same time, the education agencies and colleges and universities maintain substantial freedom in pursuing their own distance-learning programs. In an August 1998 meeting of the Institute for Public Postsecondary Distance Learning board, the following items were discussed:

- More than 1,000 courses offered by the 28 community colleges are now searchable on the Community College Distance Learning Consortium's Web site.
- The State University System is participating in the second phase of the SREB's *Southern Regional Electronic Campus*. The university system has submitted 27 courses and Florida Gulf Coast University's criminal justice program.
- An electronic course catalog, *Florida's Campus,* will provide a first point of contact and access for current or potential students and will provide direct links to the Board of Regents site, the *Electronic Campus* and the Community College Distance Learning Consortium site. There will be more than 1,500 courses listed this fall, including the community college database. Between July 1 and Aug. 3, there were about 1,400 visitors to the Community College Distance Learning Consortium site.
- Continued funding and contracts for FirstSearch library databases are being negotiated. There have been 2.4 million searches in the first eight months of operation. Several distance-learning library initiatives were implemented last year to address the following concerns: electronic resources (FirstSearch, Britannica); library user training; reference and referral services; borrowing privileges; and document delivery.
- The State University System Council of Presidents supports the Institute for Public Postsecondary Distance Learning's role in the electronic catalog but not its role in a clearinghouse operation or in faculty and staff development. The council also disapproved of changing the policy on defined service areas for institutions.
- The Institute for Public Postsecondary Distance Learning board formed a Virtual Institution Design Team to recommend academic and student services that may be facilitated centrally by a virtual community college or university.
- The institute has negotiated statewide rates for the software, support and training for the two Web course tools, Web Course In a Box and WebCT. The institute also added eight more telecourses to be leased for statewide use.
- Several developments took place this year in faculty and staff development, including:
  - A coordinated listing of resources, Web sites and opportunities for professional development;
  - A charge to provide annual or semiannual statewide conferences for sharing, demonstrations and expert presenters;

- Co-sponsorship of a statewide conference, "Advanced Levers for Change," at one-tenth the usual cost to participants; and
- A recommendation to extend policies on articulation and transfer of credit and on funding and fees. These policies generally ensure that distance learning students and courses are treated appropriately and have all the same advantages as do traditional students and courses.

Much has been done in Florida to establish the appropriate policy and support framework to manage the application and use of statewide educational networks effectively.

**Vendor relations** — The state Department of Management Services (DMS) handles all contracts and vendor relations and obtains services through competitive bids or negotiation. SUNCOM telecommunications transport services are provided by a consortium of telecommunications providers developed through negotiation.

**User groups** — There are no groups organized specifically as "user groups" for either FIRN or SUNCOM. However, because FIRN focuses only on the education sectors, there are natural and official groupings within those sectors of which FIRN staff are a part. These provide opportunities for guidance and feedback. Also, the FIRN Coordinating Council represents all FIRN constituents.

## Budget and finance

From *The FIRN Report,* Department of Education, December 1997:

"Funding for the Florida Information Resource Network is provided annually by general revenue appropriations from the State Legislature. This funding is managed by the Department of Education in accordance with budgets approved by the FIRN Coordinating Council. Each year, a large portion of the FIRN budget is apportioned to school districts, community colleges and universities in support of local data processing projects, resource sharing and instructional initiatives. The remaining portion is used in support of other FIRN activities, such as network hardware/software acquisitions and maintenance, staffing, and the design, development and implementation of instructional support projects which enhance education."

In addition, FIRN funds support central information systems and user groups.

From the portion of the budget that supports FIRN activities (about 75 percent), funding is provided for staff, hardware and software to State University System regional data centers and school districts that house a large collection of FIRN's network equipment. FIRN also funds its staff members who work in the school districts or at community colleges to provide technical assistance and training for FIRN users, primarily teachers.

A list of total annual appropriations for FIRN over the last five years follows:

| | |
|---|---|
| 1993-4 | $5,311,705 |
| 1994-5 | $5,939,258 |
| 1995-6 | $5,959,258 |
| 1996-7 | $5,966,473 |
| 1997-8 | $6,166,473 |

The amounts (included in the above totals) expended during fiscal year 1996-97 and fiscal year 1997-98 (estimated) for local data-processing projects, resource sharing and instructional initiatives are as follows:

| | 1996-97 | 1997-98 |
|---|---|---|
| Technology support for K-12 teachers | $606,420 | $474,538 |
| Regional data center support | 242,730 | 96,286 |
| Consortium support staff | 258,000 | 258,000 |
| Classroom support (i.e., Britannica, etc.) | 146,437 | 182,140 |
| ACT/SAT Test Project | 100,000 | 100,000 |
| Northwest Regional Data Center computer expense to support FASTER program | 105,260 | 252,190 |
| Total | $1,458,847 | $1,363,154 |

Because FIRN does not charge for any of its services, its funding depends wholly on state appropriations.

Approximate annual budgets last year for some other units involved in statewide educational networking are as follows:

| | |
|---|---|
| Distance Learning Institute | $350,000 |
| Community College Consortium | $250,000 |
| Distance Learning Network | $158,000 |
| Distance Learning Library Initiative | $3,000,000 |

SUNCOM operates on a cost recovery basis and therefore receives appropriations only for special projects. The expenditures for its various telecommunications services to education for fiscal year 1997-98 totaled $14,532,948. This represents about 15 percent of SUNCOM's total telecommunications expenditures.

# Charges for services

Some of SUNCOM's service rates are as follows:

| | | |
|---|---|---|
| Long distance voice | In-state calling | 8.4 cents per minute |
| | Out-of-state calling | 8 cents per minute |
| SUNCOM backbone circuits (digital or analog) per DS-0 | | 85 cents per mile per month |
| AT&T InterLATA circuits (analog only) | | $3.16 per mile per month |
| Dedicated T-1 service | | $8 per mile per month<br>$360 installation |
| SNA transport service | 9.6Kbps | $232 per port per month |
| | 19.2Kbps | $348 per port per month |

| Router transport service | Installation | Monthly rate |
|---|---|---|
| Access port charge – T-1 | $800 | $695 |
| Access port charge – 128Kbps | $800 | $375 |
| Access port charge – 56Kbps | $620 | $270 |
| Dial-up access (IP and IPX only) | None | $10 |

| Frame Relay transport | | Installation | Monthly rate |
|---|---|---|---|
| Basic service (IntraLATA) – | 56Kbps | $175 | $45 |
| | T-1 | $300 | $340 |
| Options: CSU/DSU | 56Kbps | $100 | $30 |
| | T-1 | $100 | $65 |
| Router – Token Ring | | $425 | $108 |
| Router – Ethernet | | $425 | $95 |
| 4-hour response to equipment failure | | None | $40 |
| Private Virtual Circuit, each end | | $15 | $8 |
| InterLATA Committed | | | |
| Info Rate – 56Kbps | | None | $30 |
| Additional 56Kbps, each end | | None | $8 |

Internet access

For Capital Center FDDI, RTS and Frame Relay users

| (These prices are in addition to connection prices. Access for Frame Relay users requires appropriate PVC and CIR. Firewall is available.) | Monthly Rate |
|---|---|
| Internet access for 256 address blocks | $55 |
| Internet access for unlimited addresses | $755 |
| Dial-up Internet access via RTS (single user) | $10 |

For dedicated access from user sites (These prices do not include the local circuit to the subscriber site. They include premise router and CSU/DSU. T-3 and 10Mbps available only in three cities.)

| | Installation | Monthly Rate |
|---|---|---|
| 56Kbps site with 4-hr response | $900 | $538 |
| T-1 site with 4-hr response | $1,050 | $1,321 |
| 10Mbps site with 4-hr response | $3,150 | $5,055 |
| T-3 site with 4-hr response | $3,150 | $11,250 |

Options are available for DNS, firewall and Usenet News services.

| | | |
|---|---|---|
| Video teleconferencing | | |
| Two-room point-to-point | | |
| User-provided rooms | @ One-half T-1 | $72/hour |
| | @ One-quarter T-1 | $36/hour |
| Multiple-room conference | | |
| User-provided rooms | @ One-half T-1 | $75/hour/room |
| | @ One-quarter T-1 | $50/hour/room |

# Technologies used

## *FIRN*

See Attachment 1 for the overall network configuration.

Although FIRN has provided networking services to the education sectors in Florida since the early '80s, it now is becoming a comprehensive, full-featured, high-capacity, unified intranet for education. It is moving all services to its Internet Protocol (IP) network and increasing its connections to include all school districts, colleges and universities, and libraries. Its connections are now virtually all at a level of T-1, and a process of implementing DS3 backbone elements has begun. Frame Relay is currently the telecommunications architecture, but it will move to ATM along with DS3. Wireless technology is being tested for use in more remote districts.

FIRN is now prepared to move all of its SNA connections to IP.

FIRN manages two Class B Internet addresses (64,000 addresses each). In March 1998 Internet gateway traffic through FIRN was estimated at 12 megabits. FIRN has four 10Mbps Internet gateways. Caching support is planned for the gateways and, if appropriate, other hub sites.

> "While network traffic is typically to and from the Internet, FIRN is about halfway through with a project which will keep network traffic within the state when the target host is another educational site in Florida. Since a number of universities and community colleges are using various ISPs for Internet access, traffic to and from these sites will no longer have to go out of the state onto the Internet and return via one of the gateways. Once implemented, with appropriate configuration changes on the backbone, the structure of FIRN's IP network will continue to be one of the most advanced educational infrastructures in the world." (The FIRN Report, Department of Education, 1997)

FIRN provides free dial-up access for educators across the state, using 700+ modems at 28.8Kbps.

Current application technologies are basically data, with video over IP emerging. Data services include Internet access; high-speed dedicated connections; listserv; electronic mail;

USENET News feeds; WWW hosting; dial-up access; domain name service; file transfer; informational databases. Routers provide for TCP/IP data communications as well as SNA. Value-added services include technical consultation, support, training and access to special databases.

### *SUNCOM*

Attachment 2 provides the overall network configuration for SUNCOM.

SUNCOM covers the state with 11 major nodes connected by four OC3 (155.52Mbps) routes and 11 DS3 (44.736Mbps) routes. This backbone network is available to all state entities and carries all media — voice, data and video. Frame Relay is the primary transport mode, but replacement with ATM is in progress. Other transport modes include Router Transport Service and SNA. DMS 100 switches are at each hub.

The backbone provides transport services for about 80 interactive video sites, linked by manual switching.

Provision of the backbone was negotiated with a consortium of telecommunications vendors; services and pricing were established by a "special assembly" approved by the Public Service Commission.

SUNCOM provides the backbone transport services for FIRN at special "education" prices. In SUNCOM's view, FIRN is an "aggregator" for SUNCOM.

Application technologies include a full range of voice, data, Internet and video applications, and many value-added services are offered.

## Planning methods

The state actively has developed planning studies and recommendations regarding distance learning and statewide networking for education. A number of these plans and recommendations have been implemented, as is described above. Major examples of organizational planning are the Florida Distance Learning Network and the Institute for Public Postsecondary Distance Learning. Planning continues to be very active within the education sectors and at the state level.

Each state agency in Florida, including both FIRN and SUNCOM, must submit an annual strategic plan in addition to its budget request. These plans are reviewed and aggregated at higher levels. FIRN's plan is discussed and coordinated with the education entities through the advisory structure described above. Both FIRN and SUNCOM construct their plans internally without using special planning procedures such as committees of users or other agencies. Both groups stressed the need for flexibility and the ability to change quickly to meet externally imposed conditions and requirements.

## Evaluation

FIRN and SUNCOM do not use routine, formal evaluation procedures, such as independent reviews. Both groups, however, have extensive contacts with users, which provide feedback on satisfaction with services, etc. FIRN also has ongoing involvement with advisory and other user groups, which gives it a picture of user satisfaction.

## Professional development

*The FIRN Report* describes FIRN's professional development activity as follows:

"... Most of the year, there were nine FIRNTECs housed in school districts, community colleges and universities across the state, continuing with the training effort begun last year. This program is designed to train one or two teachers in each school with the fundamentals of telecommunications and FIRN access. These teachers serve as liaisons with the FIRNTECs (technical support personnel) in an effort to minimize the number of support calls to the FIRN help desk. A little less than 50 percent of the school sites across the state have a trained FIRN contact at their school.

"With over $1,000,000 each year going to direct support of teachers, FIRN will continue to touch teachers directly with the FIRNTEC program. Plans are to include new training on POPmail use, a variety of browser software, and curriculum integration tools and techniques, as well as completion of the grass-roots training program devised for a participant in each school of every district in the state."

There is not a statewide program of training teachers to use distance learning technologies and methods for instruction.

SUNCOM's wide array of technical training does not include professional development specifically designed or selected for teachers.

## Types of educational use

While this review did not attempt to obtain specific information quantifying or valuing the various types of educational uses of FIRN and SUNCOM, these clearly are extensive and varied. The uses include the full array of educational applications and information access — electronic delivery of courses and training, transmission of administrative data, e-mail, access to learning materials and special information resources, access to special computer resources for research, and communications supporting collaborative projects among students and faculty. Both networks provide services to educational programs in public schools, vocational/technical schools, colleges and universities, and public libraries. Florida

is also developing a comprehensive Distance Learning Library Initiative which is accessible through the networks.

## Support requirements

In addition to helping clients establish a network connection, FIRN helps them use the network and solve problems. For example:

- 10 FIRN technical education consultants (FIRNTECs) strategically located around the state provide in-service training;
- Six grant positions support educational consortia;
- Special support is available to small districts; and
- Help desk support is available seven days a week to help solve technical problems, such as difficulties with the network, phone line or modem.

SUNCOM provides a full array of support services, including help desk, engineering and consulting support, workshops/training, and state contract services.

## Shared use

FIRN is used by all three education agencies for data transmission, with IP video emerging. All state agencies, including those in education, use SUNCOM. While FIRN provides most of the direct data connections to education entities, it procures backbone transmission services from SUNCOM, thus everyone shares the backbone. Also, all media and applications share the same backbone network. In summary, there is extensive shared use in Florida's educational networking.

## Internet2

The FIRN Report describes the implications of Internet2:

"One area of significant change for networking infrastructures, like those found in Florida, is the support of very-high-bandwidth services as defined by the initiatives surrounding national discussion of the Internet II. As has been done twice before, Florida's educational networking partners will once again work to develop a 'next generation' network. In the early '80s FIRN worked with the universities on Florida's first intranet, bridging IBM's SNA and Tymnet's X.25 networks together. In the early '90s, working in concert with Florida State University and the University of Florida (two adopters of

TCP/IP), FIRN was able to secure funding and expertise to provide statewide IP connectivity to the other universities. With those funds, and as that network matured, FIRN negotiated the first educational statewide contract for Internet services.

"During this third 'next generation' cycle, FIRN's production network services will follow the lead of the universities' combined research and development initiatives. Universities awarded federal Internet II funding will develop high-bandwidth networking applications. As a result, all of Florida's educational enterprise can participate as the development stabilizes (during the early phases the network will be strictly a research and development effort). Once stable enough for production services, FIRN will begin migrating end users onto this new infrastructure and be responsible for the day-to-day operation. These coordinated efforts will, for the third time, produce a statewide educational-enterprise infrastructure unmatched worldwide."

# Conclusions

## *Success Factors*

**FIRN** — High among FIRN's strengths are its long history of serving education with network services and its organizational linkages and identification with the education sectors. Because of these factors, FIRN is very familiar with education sectors' needs and priorities and is relatively free of competing priorities. Its organizational position promotes collaboration and partnership with various elements of the education establishment and responses to their needs. Planning and evaluation relationships with users thus can become a natural part of education agencies' normal processes.

The FIRN Coordinating Council, chaired by the commissioner of education, represents the education sectors. FIRN's policies and procedures, such as funding and access security, can conform to education's specific requirements, allowing FIRN to configure its services as a customized intranet for education.

FIRN views its funding from "the top" as an important strength that facilitates the establishment and implementation of executive-level priorities. This funding arrangement encourages and facilitates certain activities, such as collaboration, that would be more difficult under a system in which users are charged for services received. FIRN enjoys significant flexibility in the use of these funds. Because funding comes from appropriations, annual funding is more predictable and the "overhead" of administering a charge system is avoided.

FIRN provides direct value-added services, such as free dial access for educators statewide and especially tailored training and consulting (such as the placement of FIRNTECs in the schools to support teachers directly).

**SUNCOM** — SUNCOM's organizational strengths are its size, variety of services, and position within the state's administrative and political structure. Its size creates the potential

for lower costs. The variety of services allows agencies to select a customized mix of services that meet their specific needs. Its position in the state structure provides a strong opportunity to influence policy toward its perception of needs and priorities. These strengths have been used to make significant progress in developing and offering advanced telecommunications services to all state agencies.

SUNCOM has a large base of stable revenue, much of which comes from its voice services. This large revenue base allows SUNCOM to invest in research and development involving new technologies and applications. It also may allow the division to fund start-up services before they become self-supporting and to fund losing services during periods of low use.

SUNCOM's support of services through charges allows it to respond to its users' changing needs as soon as they are willing and able to pay for them. Also, growth in volume is funded automatically through growth in revenue. In those areas in which users have internal funds to pay for services, SUNCOM does not have to wait for the Legislature to recognize and respond to the need. Also, SUNCOM's monopoly in certain areas ensures relative stability in revenues and shields it from competition.

**Education Agencies** — Planning for networking and distance learning continues to be very active within the education sectors and at the state level. Although implementation continues to be a challenge, many strategic issues are being addressed.

Educators and students in Florida have extensive network access, including an array of technologies and educational applications.

The extent of sharing, especially for the statewide backbone, is a strong benefit. This undoubtedly has led to valuable economies of scale.

## *Challenges/Issues*

**FIRN** — One of FIRN's major challenges is obtaining adequate, timely funding increases to match education agencies' needs. Possibly because of limitations on funding, FIRN has not developed the scope of statewide telecommunications and networking services that education needs. Schools, colleges and universities must obtain additional services from SUNCOM and other sources and thus do not have a unified source or a single agent for obtaining these customized services. This problem worsens as these technologies merge and become strategic and integral to educational infrastructure. The educational intranet's potential is diminished, and confusion and conflict are likely.

FIRN's dependence on legislative appropriations, while bringing the advantages described above, also presents some challenges. Delays and competing needs in the Legislature may slow FIRN's ability to respond to its clients' changing and growing needs. Even when its clients, such as schools, have funds available for new or more services, FIRN cannot do business through charges. A solution may be to combine appropriation funding and charging for services.

One of FIRN's significant technical challenges is maintaining adequate bandwidth to match the rapidly growing use of the Internet, particularly the World Wide Web. Recent budget allocations have been level, thus possibly inhibiting FIRN's ability to respond to this need.

SUNCOM — Competitive salaries for its professional personnel is of major concern to SUNCOM. Competition with the private sector, especially in the new technology areas, is very strong. It is difficult to recruit skilled personnel and equally difficult to retain trained personnel. Outsourcing can help, but also has drawbacks such as cost and the difficulty of maintaining continuity.

Another challenge is responding to the diverse needs of agencies that are using various levels of rapidly changing technology. Services on old technologies often must be maintained while services on new technology — and investigations into services for future technological developments — are taking place. As a result, it can be difficult to sufficiently and effectively communicate with user groups regarding these services so that both FIRN and its users understand and respond to the situation. The lack of effective user-group organizations or planned interaction between users and SUNCOM could contribute to the problem.

Providing effective, clear ways for users to influence SUNCOM's plans, beyond the effect of user charges mentioned earlier, is an issue. SUNCOM does not seem to have a cohesive, coordinated method for planning to meet educational telecommunications needs.

SUNCOM also listed growth in Internet traffic as a significant challenge, but is making preparations for that growth. Network security is another issue. More services will have to be provided such as data encryption and virtual private networks. Through the technology of virtual private networks, a user group (such as an education agency) can be provided network services private to the group while sharing the backbone network and many network facilities with other groups.

SUNCOM's monopoly also may be an issue if not handled appropriately. Rules or laws to promote economy of scale in voice services 20 years ago, before the telecommunications revolution, may not be effective in all cases today, especially regarding other types of services. Careful review of this rule and explicit accountability in its implementation are prudent.

**Education Agencies** — An ongoing challenge is the rapidly evolving roles and relationships of the various players within education. For example, the Florida Distance Learning Network started with a broad scope and has been narrowed to technology planning and policy. The Institute for Public Postsecondary Distance Learning is assigned responsibilities for programming and policies, which must be distinguished over time from the responsibilities of educational institutions. While these two units focus on distance learning, the focal point for the full scope of statewide planning and policy for educational telecommunications, short of the commissioner and the Legislature, is not clear.

FIRN's changing roles in relation to merging technologies, university independence and SUNCOM also can be unclear. Education users must deal with two providers of overlapping telecommunications services with different operating philosophies. There is no single, cental agent for all educational telecommunications in Florida, although several organizational elements are in place to address separate segments. This presents a problem with developing and maintaining a comprehensive, cohesive plan, especially as viewed by users.

Without a single or a coordinated source of support for all telecommunications, users often are confused and frustrated by the complex array of services offered by SUNCOM and others, along with their cost, operational requirements, training requirements and other aspects.

Although there are significant points of sharing and collaboration between FIRN and SUNCOM, there also are overlapping services and potentially destructive competition. The role of FIRN, as opposed to SUNCOM, as an agent for the education sectors needs clarification.

- What is the scope of FIRN's relationship with education agencies, and to what extent is SUNCOM obligated to accommodate FIRN's presentation of educational needs?
- What is SUNCOM's authority as a controller (as distinguished from service provider) and independent decision-maker regarding educational telecommunications services, and how is it accountable to education for that authority?
- Are FIRN and SUNCOM basically competitors, with distinct strengths and weaknesses?

There does not appear to be a procedure for ensuring that the two agencies' plans coordinate. There was no indication that SUNCOM's plan was discussed or coordinated with the education entities or FIRN, nor was there any indication that FIRN's plan was discussed or coordinated with SUNCOM.

The lack of coordinated planning can have negative effects. An example is SUNCOM's plan to establish 40 network "mini-nodes" in remote areas of the state in hopes of reducing local-loop charges by the telephone company. In discussions about the project, there was serious concern about how it was being pursued, probable results, and effects on FIRN. Apparently SUNCOM developed and is carrying out this plan without consulting FIRN and the education sector, their biggest customer group.

FIRN, the operational agent for the educational intranet, could be developed further as an agent for all telecommunications technologies, whether or not it provides the services directly.

Two final issues are evaluation and training. As the new technology-based services mature — and especially as additional investments are required — supporters, decision-makers and funding sources probably will require more formal evaluation of previous investments' results. There also will be a requirement for more teacher training in the use of educational technology, and state-level and/or agency-level programs to promote and share training resources also may be required.

*Chapter 2*

# Georgia WAN (PeachNet)

## Background and history

PeachNet is Georgia's network for education and research. Originally developed to serve the state's 34 colleges and universities, it is being expanded to connect all K-12 school districts and county and regional libraries. Several private colleges also are connected. As of Aug. 1, 1998, there are 47 university system sites, 154 public K-12 locations, 155 public libraries, and 15 private institutions (higher education and K-12). The name PeachNet is associated with the TCP/IP (distributed) network that was initiated in 1988 to replace earlier facilities based on older technology.

Statewide networking in Georgia has developed, under university leadership, over many years. To understand PeachNet's character, one must appreciate how it has evolved. The current network succeeded the earlier University System Computer Network, which dated back to a 1969 grant from the National Science Foundation. Although the earlier network was much different in character and scope — its focus had been on the sharing of central computing resources — it established an important tradition of resource-sharing and cooperation among institutions in networking.

After PeachNet was established for the university system, other agencies began to request service. Interestingly, a group of public libraries was the first outside user. The library community has used and supported PeachNet actively since the early days — even before the highly successful GALILEO project (described below). Several public libraries were involved in an early pilot project, resulting in political support in some less-developed parts of the state and thus more interest in the network by legislators. A university library group, the Regents Academic Committee on Libraries, had been working on resource-sharing, and PeachNet attracted their early interest also.

Another pilot project extended PeachNet to a number of public schools. PeachNet's growing reputation for quality, state-of-the-art service later led the Department of Education to select it for networking the state's K-12 schools. Through such agency decisions, PeachNet became the network for all of education in Georgia, with the exception of the Department of Technical and Adult Education, whose schools are served by a network run by the state Department of Administrative Services.

One of Governor Miller's initiatives in 1998 is providing the funds to extend PeachNet to all remaining K-12 districts and public libraries. According to *Using Technology to Ensure Our Commitment to the Citizens of Georgia* by the Board of Regents of the University System of Georgia, "PeachNet's partnerships are building a technological and administrative foundation for projects involving multiple public and private agencies."

# Organization

In 1988, the Board of Regents (the governing board for the state's 34 public colleges and universities) established a vice chancellor position and the Office of Information and Instructional Technology, which includes all computing, networking, distance learning and online library projects (GALILEO). The existence of a vice chancellor position has benefited PeachNet development greatly — initially in terms of recognition, funding and general high-level support, and later in an increased number of network users. With one person overseeing initiatives such as GALILEO and distance learning, the opportunity for coordinating efforts is excellent. PeachNet comes under an executive director for information technology infrastructure support; that person reports to an associate vice chancellor for information technology. Two other people report directly to the vice chancellor: an executive director for virtual library [GALILEO], customer and information resources; and an assistant vice chancellor for distance education and academic innovation (this includes utilization of the Georgia Statewide Academic and Medical System, a separate video network discussed below).

A committee of institutional representatives, called the Administrative Committee on Information Technology, has existed since the vice chancellor position was established (slightly before PeachNet). The earlier network also had a somewhat similar, but unofficial, advisory committee. The ACIT advises the vice chancellor about academic and administrative computing issues, as well as the network. Subcommittees are formed when appropriate. The ACIT recently was expanded to represent the public library and K-12 communities. It is not a governing body for PeachNet, but now that the network serves so many users outside of universities, more attention is being given to governance issues.

Within the university system, PeachNet always has been perceived as a cooperative effort of all the institutions, and this has been a significant factor in its success. It has not been dominated by one or two large campuses, and the vice chancellor's office can ensure that that situation does not change.

The Office of Information and Instructional Technology owns, operates and maintains the network equipment, with some help from the staffs of the universities that house most of the hub equipment. Because the PeachNet staff is not large enough to handle so many new installations in addition to other required duties, an outside contractor is installing the network at libraries and public schools. This contractual relationship with a small local firm

has been an effective way to supplement the regular network staff, and that firm's personnel work closely with the Office of Information and Instructional Technology.

Data circuits are obtained through state telecommunications (under the Department of Administrative Services), which in turn deals with the telecommunications vendors. This arrangement has not always worked smoothly, sometimes resulting in errors and delays. As in other states, control and turf issues can present serious problems. However, in Georgia attitudes are changing, with the recent reorganization of the Department of Administrative Services. Managers are learning to work together more effectively, and the general relationship between the Department of Administrative Services and the Office of Information and Instructional Technology appears to be improving considerably. In particular, the Department of Administrative Services is more willing to allow the Office of Information and Instructional Technology to deal directly with the vendors. The relationship between a university-run network and the state's telecommunications authority is critical to success.

## Facilities

An overall network configuration is provided in Attachment 3 and Attachment 4.

PeachNet offers three levels of transport services: dial-in, switched and dedicated. The PeachNet Leaf provides 14.4Kbps dial-in service; the PeachNet Twig provides 14.4Kbps switched service; and the PeachNet Branch and Limb provide dedicated service at either 56Kbps or T-1 speeds.

The PeachNet Branch consists of a network router and telephone line interface (CSU/DSU), management modem, terminal server and 12-port SNMP-managed network hub. The Office of Information and Instructional Technology orders the circuit; installs the Branch equipment; and arranges for IP addresses, domain name allocation and domain name service (DNS).

The PeachNet installation team implements the required configuration, tests all connections, demonstrates PeachNet access and provides some initial training to local personnel. An outside contractor now makes the new installations. The user is responsible for providing an installed Ethernet local area network, including a 10BaseT hub unit.

All university campuses are connected by T-1 lines. The larger institutions have multiple T-1s — plus, in some cases, the much-higher-capacity fiber links associated with the "Georgia GigaPoP" described below. School systems with a minimum population of 10,000 full-time-equivalent students receive a T-1 connection, with smaller districts receiving a minimum of 56Kbps. Public libraries receive a 56Kbps connection. As of August 1998, the network includes 202 T-1 circuits and 239 56Kbps lines; an additional nine T-1s and 34 56Kbps lines are scheduled for installation. There are 427 routers. Circuit capacities will increase greatly with the planned PeachNet 2 upgrade.

Much of the network hub equipment is on the Georgia Tech campus, where staffing is available 24 hours a day, seven days a week. The network operations staff is located at Kennesaw State University (near Atlanta), separate from both the Office of Information and Instructional Technology and the hub equipment. This arrangement, although not ideal, appears to be working satisfactorily, partly because of good support from Georgia Tech personnel. PeachNet's 12-person operations staff also handles marketing, invoicing and collections.

UUNET is the primary supplier of Internet service, with BBN (formerly SURANet) in a secondary role. The Department of Administrative Services maintains a separate connection, but a "peering" arrangement offers some advantages to both PeachNet and the Department of Administrative Services network. Dial-in service is provided through a contract with MCI (a modified version of the Campus MCI service).

To enable experimentation with the latest technologies for high-speed networking, the state's research universities initiated the Georgia GigaPoP project. Created to ensure access to the very latest facilities supporting the national higher-education research community, the GigaPoP provides an aggregation point for traffic onto the emerging Internet 2 infrastructure. It will advance research and education by using the best networking technologies for the exchange of information among its users.

The Georgia GigaPoP has become a critical element in a regional networking effort sponsored by the Southeastern Universities Research Association to connect its member research institutions with others both within and outside of the region. The Georgia GigaPoP also provides support to state and regional educational and economic-development activities by facilitating access to statewide, regional and national network infrastructures.

The latest design is for a distributed facility, with three aggregation points for the GigaPoP in Atlanta, interconnected with state-owned fiber operating in a redundant OC-12 configuration. The most important of these locations is on the Georgia Tech campus, which houses the primary aggregation point for both the PeachNet and "Southern Crossroads" project of the Southeastern Universities Research Association. These co-locations serve as the primary interconnection point for research and education networks in the Southeast. The other locations, to be connected by OC-3 links, are the University of Georgia in Athens and the Medical College of Georgia in Augusta. All of the locations will have ATM switches and will connect to the Internet 2/vBNS.

The GigaPoP initiative demonstrates that PeachNet and its related organizational structures have not limited the large research campuses. The largest institutions have moved ahead with the latest and most powerful technologies; they have not been held back by a statewide network that must balance the needs of both large and small users. (Obviously, much time, effort and funding are required to convert an entire statewide network to new technology.) However, it is also significant that the large universities that launched the GigaPOP initiative, recognizing the potential for PeachNet, also wanted to have the

statewide network, the Office of Information and Instructional Technology, represented in their partnership.

PeachNet 2, the next generation of the statewide network, clearly will benefit from the GigaPoP. It will include 40 ATM switches, running over circuits with OC-3 (155Mbps) and higher capacity. There will be two core sites in each LATA, and a SONET ring between sites. Within service areas, local bidders will be encouraged to obtain the best possible prices for circuits. One alternative to the major telecommunications carriers is the Metropolitan Electric Association of Georgia, an association of power companies. The data facilities of PeachNet 2 also will have the potential to carry voice traffic, which could be cost-effective for the University System of Georgia and perhaps others. PeachNet 2 will enable GALILEO to expand to include multimedia resources.

## Applications

PeachNet provides Internet access for all of education as well as for all Georgia residents through public libraries. It supports distance learning, online library resources, and large administrative applications for the University System's student, financial and human resources.

Among the network applications that have developed since 1989, one is especially notable. GALILEO (GeorgiA LIbrary LEarning Online) has developed in close — and mutually beneficial — partnership with PeachNet. Established in 1995 by the Board of Regents, Georgia's virtual statewide library provides access to online resources for all of education and, increasingly, for state residents. The project has benefited PeachNet through both increased funding and overall political support and appreciation for the network's potential to serve state residents.

GALILEO service for the state's 34 colleges and universities has been expanded to include 161 public regional and branch libraries, 1,818 K-12 schools, 34 technical institutes, 33 private educational institutions, and other state agencies. The GALILEO system uses the widely known (and easy-to-use) World Wide Web to provide access to more than 100 databases, including an encyclopedia; more than 2,000 full-text general-interest and research journals; state documents; and reference books. According to the regents' publication *Using Technology to Ensure Our Commitment to the Citizens of Georgia:* "The search interface has proved easy enough for a middle school student and versatile enough for advanced research while providing seamless consistency among databases. ... Cooperative purchasing of online library resources equalizes opportunities for all students to learn and conduct research and allows libraries to make the best use of materials budgets. GALILEO has become a national model, both in the breadth of its resources and in the breadth of the partnership of its participating educational agencies."

The servers for GALILEO's online databases are at the University of Georgia in Athens and at Georgia State University in Atlanta, two institutions that have contributed much to the project's success. If one site is down, all services are still available from the other site.

A new library project will establish a consolidated catalog for all colleges' libraries; this will become another widely used PeachNet application. Other significant statewide applications include a popular guidance system used in the high schools and at the college-freshman level and geographical information system (GIS) resources.

Distance education requirements clearly will become increasingly important, placing varied and growing demands on the network. However, Georgia will have an excellent foundation for support of virtual-university-type activities with the PeachNet 2 facilities, interactive video, GALILEO and other existing programs, such as the Faculty Development Institute (which provides training in the use of instructional technology).

## Georgia Statewide Academic and Medical System (GSAMS)

A separate network, GSAMS, provides interactive video services statewide to 400 higher education institutions, public schools and telemedicine sites. Medical colleges use GSAMS units to consult with doctors and other universities in remote regions of the state. Remote high schools use GSAMS programming to offer classes, such as foreign languages, for which they do not have onsite teachers. GSAMS is operated by the Department of Administrative Services, but the Office of Information and Instructional Technology manages its use within colleges and universities and coordinates its use with other, PeachNet-based services relating to distance education. GSAMS services for the Board of Regents are handled by a staff that is part of the Office of Information and Instructional Technology. The staff is headed by an assistant vice chancellor for distance education and academic innovation, who reports to the vice chancellor.

Because the interactive video needed to be supplemented with data services delivered by PeachNet, all sites now have PeachNet access. This development has contributed to PeachNet's growth, and the combination of the two services has been quite effective. While the Office of Information and Instructional Technology operates PeachNet, it does not operate interactive video. It probably would be beneficial for the OIIT to have more control of its interactive video services. Future technological changes in the delivery of interactive video may necessitate this development.

GSAMS was the result of one-time funding from a refund settlement between the telephone companies and the state. Although the state was wise to devote this funding to technology for education and medicine, there was inadequate planning for the use of the network. As a result, applications are rather diverse, with no "universal" application (such as

GALILEO for PeachNet). Instructional offerings include staff development for K-12, higher education and state agencies; higher education credit and noncredit courses; K-12 school activities; and special events. The providers are state agencies, two and four-year colleges, district offices, public schools and resource sites.

GSAMS uses compressed video, at rates up to T-1. The flat-rate monthly charge for GSAMS service is $1,120 for up to 62 hours of online time. Sites receive equipment free but must pay half the line charges and equipment maintenance for the first two years and the full charge thereafter. The technology likely will change to ATM.

## Budget and finance

PeachNet receives ongoing funding through the University System Board of Regents' Office of Information and Instructional Technology. The network also has benefited from special funding, as in the case of a major upgrade of facilities associated with the GALILEO project, which included $3 million for circuits and equipment. Funding from the state lottery, which made possible the one-time allotment associated with GALILEO, also flows to PeachNet regularly through educational agency budgets. PeachNet also has received grant funds from the National Science Foundation's Connections Program. The initial seed money for PeachNet came from the Board of Regents' budget for the original network, the University System Computer Network.

The Board of Regents funds network connections for university campuses directly. Campuses are billed only if they exceed the bandwidth allotted to them by the Office of Information and Instructional Technology (at this time, a T-1 for most universities). For users other than universities, the basis is full cost recovery. Bills go to the parent agency rather than to individual sites (e.g., the Department of Education for all public school districts).

"Outside" users are charged for all network expenses (circuits, termination equipment, maintenance charges, etc.) on a distance-sensitive basis — meaning that circuit costs depend on distance to the hub site. For T-1s, there is an annual cost of $15,545 for the PeachNet Access, Monitoring and Maintenance (PAMM) fee. One-time costs include $12,255 for system installation and an estimated $2,000 for circuit installation. For 56Kbps lines, the costs are $10,139 for system installation, $1,500 (estimated) for circuit installation and $5,855 for PAMM.

The method for pricing and general cost recovery will be reviewed when an outside consultant prepares a business plan. In the future, state funds earmarked for PeachNet service may flow to campus budgets rather than directly to the Office of Information and Instructional Technology. Or a pure "business model" may be the best solution.

# Planning methods

Planning responsibility has remained primarily within the Office of Information and Instructional Technology, with the Administrative Committee on Information Technology in an advisory role. The vice chancellor position has been vital in providing leadership and support for major new initiatives such as PeachNet and GALILEO. Through the vice chancellor's office, the Board of Regents has continued to make important decisions on PeachNet upgrades and expansion (for example, the decision to begin the TCP/IP network in 1989). This effective arrangement has resulted in a first-class network that groups outside of universities have been eager to join. However, now that the number of users other than universities is increasing rapidly, more consideration is being given to their formal participation in planning and governance.

Georgia's evolutionary approach contrasts with that in some other states, where initial planning was done by committees representing multiple educational agencies and sometimes also by state government. Georgia's approach is a natural result of the state's early start in statewide TCP/IP networking under university leadership. The early start was unencumbered by committees representing divergent interests and technological biases, at a time when TCP/IP-based technologies were not widely accepted and understood. The state's educational and library communities have benefited as a result. Agencies such as the Department of Education used PeachNet in an early pilot project and then were able to select for all their networking needs a network with a proven track record and state-of-the-art technology.

However, while evolutionary planning was sufficient for the late 1980s it may have been inadequate several years later (when some other states were initiating their networks), at a time when networking requirements and technologies were better understood outside the university system. Thus it is significant that the Office of Information and Instructional Technology is working on ways to involve their "outside" users, whose dependence on the network is growing, in the governance and future planning of PeachNet.

# Professional development

Initial training in network operating procedures is provided either by OIIT staff or through the outside contractor that installs equipment at the new K-12 and library sites.

The Office of Information and Instructional Technology provides training in administrative data-processing applications (such as BANNER) used systemwide. Although this is not considered a PeachNet responsibility specifically, having all these functions under the OITT facilitates the coordination of university activities. Training and staff development are expected to receive more attention within the OIIT and the University System in the next couple

of years. Professional development for other network users, such as the Department of Education, probably will continue to be left primarily to the user institutions and agencies.

The Faculty Development Institute helps faculty learn to use instructional and distance learning technologies in their teaching. Its major goal is to increase the number of courses that incorporate technology. *Using Technology to Ensure Our Commitment to the Citizens of Georgia* reports that "each year participants are drawn from all 34 institutions and are tracked through a program of technology-based instruction which culminates in a group project. Topics include basic computer skills, use of GSAMS (interactive video), teaching over the World Wide Web, and multimedia applications. Seeding campuses with knowledgeable practitioners of new technologies builds confidence, peer relationships, enthusiasm and student interest."

In addition to formal training, annual staff and user conferences have played an important role in PeachNet development (and cooperation among institutions in general), going back to the days of the University System Computer Network. Two annual conferences have done much to develop PeachNet's "people network" and to attract users. One annual conference is for information technology managers from all universities. A second, for management and staff, has grown to include many faculty participants, some of whom make presentations on how they use the network and related computing facilities.

## Support requirements

Until recently, the PeachNet operations staff was responsible for "help desk" functions in addition to basic network operations and trouble-shooting. GALILEO also had a help desk, and a decision was made to combine the two into the GALILEO/PeachNet Service Center. This approach seems to be working well. It makes sense because users, especially inexperienced ones, often cannot distinguish between an equipment problem and one relating to services on the network, including those associated with GALILEO.

The GALILEO/PeachNet Service Center is the first point of contact for all PeachNet-related questions and problems. A toll-free number and e-mail communication are available. The center is staffed from 8 a.m. to 5 p.m. Monday through Friday, excluding holidays. An answering service takes calls during off-hours and on weekends. If a call to the answering service is an emergency, a service center staff member is notified immediately, and a customer can expect a call within an hour. If the call is not an emergency, the call is logged and the problem is addressed the next business day.

The next step will be to broaden this support group to include other applications, such as university administrative systems, so that expertise is available *from the help desk* on all such resources used systemwide. Users with questions about these applications now are directed to staff primarily responsible for software development and maintenance. A prob-

lem-tracking system, being developed in connection with the new support group, could be very beneficial. Such developments indicate an experienced, mature network operation.

It remains to be seen how effective it will be to combine personnel of varied expertise into one support group including specialists for major systems such as BANNER. However, it is important that PeachNet experiment with this integrated approach, which could lead to more efficiency for the Office of Information and Instructional Technology and very likely a more responsive support service for users.

# Conclusions

Statewide networks generally have reflected and conformed to a state's higher education organization and overall political climate. In Georgia, the educational/political environment now strongly favors the development of a shared statewide network for education.

Accordingly, some factors that have been most responsible for PeachNet's success derive from pre-existing and/or independent attributes of the "environment." These include the following:

- A University System that includes all four-year and two-year institutions (except two-year technical institutes) and thus facilitates the development of statewide initiatives;
- A highly supportive University System administration that recognized several years ago that the network was strategically important to the University System;
- The establishment of a position at the *vice chancellor* level that combined responsibilities for areas such as distance education and library networking (online resources), as well as PeachNet and all computing;
- A very supportive governor, backed by the Legislature, whose priorities for education and interagency cooperation were quite compatible with PeachNet development;
- Opportunities for special funding, such as those coming from the state lottery; and
- Large research universities, especially those with outreach missions (UGA and GSU), that supported the statewide networking and were willing to cooperate with the smaller institutions for the benefit of the entire University System (this is not always the case in higher education). Especially noteworthy are the University of Georgia's early support of PeachNet, together with the critical leadership the university provided for the GALILEO project, and Georgia Tech's many technical contributions.

Other success factors are associated more directly with good network design, planning and management:

- University System personnel have strong technical skills and can articulate a network vision. (This was especially important in 1989, when PeachNet began and the need for

statewide TCP/IP networks to connect distributed resources was not widely recognized, as it is today.)

- Good management, from the outset, has been combined with sound technical decisions.
- A "universal" application, the GALILEO library project, can be used throughout the educational and library (including public library) communities and easily can be appreciated by people without technical backgrounds. As noted earlier, this project played a key role in network funding and general political support, and it illustrated the strategic need for a strong network.
- Other existing applications, including administrative systems and distance education, make good use of the network, providing a clear payoff for the state's investment in PeachNet.
- A history and tradition of cooperation, resource sharing and networking among universities, which arose from the earlier University System Computer Network, includes regular user conferences and related activities.

With technology and the telecommunications marketplace changing constantly, and the network growing to include many more users other than universities, the network management must be open to changes in the way things are done and must be willing to look for technological improvements. PeachNet's management meets these requirements, creating an excellent outlook for PeachNet. The following ongoing developments will help ensure PeachNet's ongoing success.

- A new Board of Regents emphasis on information technology and distance learning, planned for the 1998-99 academic year, will include comprehensive plans to integrate more closely the diverse elements that report to the vice chancellor for information and instructional technology.
- As a result of growth, PeachNet governance will receive more attention, especially to encourage participation by new users outside of universities. The Administrative Committee on Information Technology will take a broader, more active role, and additional subcommittees will be formed.
- Funding and pricing models will be reconsidered in light of the expanding customer base and new offerings.
- The relationship with the Department of State Telecommunications will be improved to reflect recent changes at that agency.
- PeachNet 2 will have much higher bandwidths, utilizing SONET/ATM running over fiber (and positioning the state to benefit from Internet 2 and the Georgia GigaPoP).
- Management will recognize that PeachNet must remain competitive in the telecommunications marketplace.

- Opportunities to purchase bandwidth from alternative vendors will be explored in order to take advantage of the increasing competition.
- When feasible, voice will be included with data and video on the new, high-capacity circuits (OC-12, OC-48, etc.).

The following excerpt from a PeachNet brochure describes the rationale for the state's investment in PeachNet:

From *Using Technology to Ensure Our Commitment to the Citizens of Georgia:* "Providing the network speed, dependability and service for education today, PeachNet supports the development of a work force prepared to use the tools of technology tomorrow. The growth of the infrastructure and knowledgeable human resources promotes new industry and participation in state, national and international commerce. By investing in the vision and technology of PeachNet, the state of Georgia is planning for its economic future."

*Chapter 3*

# Oklahoma WAN (OneNet)

## Background

OneNet is the official telecommunications and information network for Oklahoma education and government. It electronically links public schools; vocational/technical schools; colleges and universities; courts; libraries; and local, state, tribal and federal government agencies.

The Oklahoma State Regents for Higher Education (OSRHE) became involved in educational networking in 1970 with the establishment of a state microwave network that carried televised courses to remote areas of the state. This successful system continued to expand through 1982 to provide statewide coverage, and in 1984 a voice and data network connecting seven locations was added. In 1991-92 a high-speed fiber-optic backbone connecting several major locations was added to the network. By this time the network was involved heavily in data communications and provided links to national computer services. In 1992 the Televised Instruction System was renamed the Educational Telecommunications Network to reflect its evolving role. Funding sources over the years included direct legislative appropriations, federal funds, regents and agency funds, institutional funds, vocational/technical system funds, grants and private donations.

In 1992 legislators, convinced of the importance of modern statewide networking, included $14 million for state networking improvement in a $350 million bond for higher education. Originally the funds were to be distributed across several agency networks. After much work and time, it was decided that the Board of Regents network, now called OneNet, would be expanded and improved to serve as the unified state network for education and government.

OneNet is now a statewide, comprehensive, up-to-date and effective network for all of education and government.

## Organization

**Responsibilities** — OneNet is operated by the Oklahoma State Regents for Higher Education in partnership with the Office of State Finance, which coordinates statewide planning for data processing and telecommunications needs. Early policy decisions for the network generally came from the State Data Processing and Telecommunications Advisory

Committee, made up of representatives of the major users of the network. (Three voting members are from the executive branch, three from the state Senate and three from the House of Representatives. Fifteen agencies are nonvoting members.) Today, the OSRHE establishes policies and rates for the network. The OSRHE's role in OneNet grew out of its history of providing a statewide system of televised instruction (microwave, ITFS and satellite), its critical needs and its preparedness.

As evidence of the OSRHE's partnership with the Office of State Finance, the director of the Information Services Division of the Office of State Finance also is serving as the director of OneNet operations. This partnership was developed to implement the major modernization and expansion funded by the 1992 initiative, resulting in today's OneNet.

**Technical management** — Technical staff and management are under the OSRHE, which installed and owns the transmission and receiving systems for the TV, radio and microwave systems, as well as major backbone segments of the new fiber system. Some backbone and all branch circuits are leased from telecommunications vendors. Also, some support services are contracted from vendors or obtained through various "partnering" arrangements with vendors (described below).

**Applications and utilization management** — User agencies are responsible for end-user applications, and they vary in their handling of this responsibility. The OSRHE and its institutions aggressively promote applications and use of the technology. Its administrators are very active in policy and planning. They are also involved directly in promoting and supporting effective use of technology, specifically OneNet. Also, several OSRHE committees, such as the President's Council on Innovation and Technology, are involved in policy and planning for OneNet.

Oklahoma's active policies on telecommunications and its use in higher education date to 1970, when legislators directed the regents to establish a statewide system of televised instruction. Further legislation and regents policy established a policy structure during the next several years. Early policies addressed academic issues such as residency, credit transfer, cost containment, expanded access, and quality assurance. Many quality efforts focused on ensuring that TV instruction was equal in quality to traditional instruction in a physical classroom. During the 1980s more and different electronic delivery operations, policies and technology were developed. Later policies tended to be more flexible for institutions. In June 1998 the OSRHE approved a major revision in the policies and procedures regarding electronic courses and programs. Geographic service areas were eliminated for distance education courses and programs, as were requirements that the OSRHE approve individual course offerings. New distance-education programs still must be approved, and "best practice" methodology is now included in that process. Discussion — much of it at the campus level — continues on topics such as faculty rewards, instructional support and operations, system coordination, planning, and quality control.

Individual colleges or universities manage their own application of OneNet. As was mentioned earlier, these institutions and the OSRHE have a long history in statewide educational networking, starting in the early 1970s with instructional television. Many of OneNet's organizational mechanisms evolved from those of the instructional television system. OneNet also incorporates recent developments in networking technology among the higher education institutions, such as the University of Oklahoma High Performance Network, Internet2 and current Internet gateways.

Other agencies have a variety of approaches to managing their use of OneNet. In K-12 education, individual school systems have the primary responsibility. An excellent example of leadership in this area is Western Heights Public Schools. This school district has emphasized Internet-based videoconferencing. Under a five-year technology plan, and in partnership with local businesses and OneNet, the district has installed 17 miles of fiber-optic cable to connect its seven schools. Each of its 230 classrooms can connect to any other classroom and to the various resources of OneNet and the Internet, including businesses, libraries, hospitals, schools outside the district, and government offices. The system enables conferences and discussions on topics such as weather, legislation, careers and cultures. It also enables students and teachers to stay involved when they must be absent because of illness or other reasons.

The state Department of Corrections is a good example of a state agency's use of the system. The department is using OneNet as a primary tool in revamping its services. OneNet provides standards, technical staff, modern telecommunications services, and a single point of contact, enabling the agency to focus on using these modern services to improve its operations. The department has used OneNet to conduct interactive video sessions, reducing inmate movement; to access information on current status and location of offenders; to find offenders' criminal histories; and to notify the community and victims when an inmate is released.

**Vendor relations/"partnerships"** — OneNet is flexible in the way it relates to vendors of telecommunications and networking services and equipment. It also has a variety of approaches to these relationships — leasing circuits under special pricing arrangements; swapping right-of-way for fiber capacity and equipment; receiving donated services; prequalifying vendors for user agencies; collaborating in joint development and testing; and procuring through normal competitive bidding. OneNet has attempted "to be as entrepreneurial as possible, eliminating the red tape that usually plagues public-private ventures." The term "partnership" is used in a general way to characterize these flexible relationships.

The OSRHE has approved guidelines under which companies meeting specified criteria may qualify as OneNet Approved Service Providers. This will help OneNet's customers as well as its marketing efforts.

OneNet is exempt from the general requirement to go through the state's purchasing agency in its purchasing and relations with vendors. This reportedly has enhanced OneNet's

ability to develop new types of arrangements and partnerships with vendors and other entities, resulting in quicker development and much lower costs.

**User groups** — Until recently, there were no organizations to represent users other than the State Data Processing and Telecommunications Advisory Committee. There also were no formal procedures for ongoing input to top-level planning, management and decision-making from all user organizations. One recommendation in *Technology 2000*, a 1997 comprehensive study on technology use in Oklahoma's colleges and universities, calls for more formal advisory structures for OneNet. The OSRHE has accepted all of the recommendations in the report and has directed staff members to begin implementing them. An advisory body and associated user groups were established in fall 1998.

# Budget and finance

The Oklahoma State Regents for Higher Education committed resources to distance education as early as 1970, when the state microwave network was established. In 1985 the W.K. Kellogg Foundation awarded the system a grant of $5.8 million for improvements in instructional telecommunications. With additional contributions from two other foundations and the state Legislature, the network was converted to digital microwave and some capabilities for voice and data communications were added.

OneNet was the result of the 1992 capital bond initiative for state networking improvement that approved $14 million in equipment and installation for a consolidated information and telecommunications network for education and government. The $14 million was made up of $8 million in general obligation bonds plus grant funds from the U.S. Department of Commerce's TIIAP fund with matching funds from the Oklahoma Department of Commerce and the State Data Processing and Telecommunications Advisory Committee. Portions of the new network use infrastructure and investments that previously were part of the regents' network, including staff.

OneNet's annual operating costs of about $8 million are expected to be recovered through network user charges. About $6 million is projected to be collected through fees ($1.4 million from higher education; $4.6 million from other state agencies, including K-12), and the regents make up the $2 million deficit. Annual equipment, maintenance and operating costs exclusive of personnel are estimated at $7 million. The regents employ about 20 engineers/technicians/support staff to operate the network, which has field offices in Oklahoma City and Tulsa.

The total state budget is about $7 billion. OneNet is capable of serving 2.1 million users statewide. A cost/benefit analysis indicated that cost recovery and revenue generation should not be a problem and that benefits easily should exceed costs.

The path for gaining additional financing seems clear, because OneNet is managed in partnership with the Office of State Finance and is under the policy direction of the State Data Processing and Telecommunications Advisory Committee. Revenue from charges to users also could be used to fund growth and improvement.

## Charges for services

OneNet is responsible for full cost recovery, except for the capital expenditures funded by grants or bonds. A telecommunications consultant was obtained to develop a demand forecast and fee structure. The consultant estimated agency usage, determined users' ability and willingness to pay, and developed a cost allocation and fee structure that would be acceptable to users and would ensure that the network could be sustained financially. OneNet fees are the same statewide for all users.

Some of the OneNet charges are as follows:

### *Data communications*

- Dial-up access (analog): OneNet services only, not including any circuit or long-distance charges (Note: OneNet modems are in several hub sites statewide.)
  - Individual user, async, PPP or ARAP access — $15 per month; $15 setup
- Dedicated connections (digital): Includes local loop costs and special OneNet tariff filed by Oklahoma's local exchange carriers; does not include customer site equipment and telephone company installation; includes communications circuit and OneNet service:
  - 56Kbps — $200 per month
  - T-1 — $400 per month
- Circuits supplied by various cable and telephone companies, not available in all areas of the state; not including installation and customer site equipment:
  - DS3 — $2,500 per month; $22,000 service establishment fee
- Connections available from each OneNet hub site; not including customer site equipment and connection to OneNet electronics:
  - Ethernet (10Mbps) — $1,000 per month; $1,600 service establishment fee
  - Fast Ethernet (100Mbps) — $1,750 per month; $7,000 service establishment fee
  - FDDI (100Mbps) — $2,000 per month; service establishment fee on a case-by-case basis
  - ATM/OC3 (155Mbps) — $5,000 per month; service establishment fee on a case-by-case basis

### *Video communications*

Rates include the circuit and OneNet fees; customer equipment (e.g., CSU/DSU, CODECS) is not included; installation on a case-by-case basis; full-motion video not available in all areas of the state. Desktop video using TCP/IP is priced under data rates above.

- Full-motion video: Over single DS3 with up to three channels of simultaneous video and up to four T-1 circuits for other use including data, Internet access, fax and compressed video.
  - Full-motion video — $2,000 per month; $2,000 service establishment fee
  - Overhead T-1 circuits — $100 per month each
- Compressed video: Over a T-1 circuit. Client may allocate the capacity in any fashion among compressed video, data communications, Internet access and other applications.
  - Compressed video — $750 per month; $2,000 service establishment fee

### *Prices from vendors and other cost abatement*

Partnering with the vendors was used in developing pricing for services to be procured by OneNet. Much effort went into bringing vendors together; obtaining cooperation; convincing them of the need and value of the state's business; and obtaining creative, effective and economical responses. These include special tariffs, new and special pricing arrangements from various suppliers, and collaborative agreements specifically for OneNet.

## Technologies used

**Background** — OneNet uses a full range of telecommunications technologies. Oklahoma has a long history of development and has incorporated evolving technologies over the years. The formation of OneNet brought all of these technologies and services under one network organization, along with the new fiber-based, Internet-styled network. Older technologies are maintained as long as they are productive, but new technology is the investment priority.

**Transmission** — Facilities include satellite, terrestrial microwave, fiber optics, copper cable, coaxial cable, radio towers and digital switches. About 50 regional hub sites for the network contain a full DS3 telecommunications circuit, video equipment, high-speed data routers, modem banks and computer systems for linking user sites to the statewide network.

**Network configuration** — See Attachment 5 for the overall network configuration. Some major elements of the established environment are voice support for more than 8,000 stations; satellite uplinks at Oklahoma State University, Oklahoma University and Oklahoma Educational Television; 560 satellite receive sites; five production studios for teleconferencing; about 500 miles of state-owned fiber optics; and 61 agencies using fiber.

**Applications** — Current applications include voice, data, video, radio, teleconferencing and distance learning. Video services include full-motion, compressed, conversion of video formats, video over Internet Protocol, video on demand, and multicasting. Data services include Internet access; high-speed, secure and dedicated connections; listserv; e-mail; USENET News feeds; WWW hosting; dial-up access; domain name service and Lotus Notes; network security, including firewall, encryption and private IP address allocation (with translation for public WWW access); file transfer; proxy services; and databases of information. Routers provide for TCP/IP data communications and other protocols, such as SNA, DECLAT, IPX and AppleTalk. Value-added services including network planning, equipment discounts, video scheduling, installation and training.

## Planning methods

**Formal planning events** — The OneNet-Business Plan (1995) provides a brief history of the planning that went into establishing OneNet as the comprehensive statewide network for all of education and state government. This history starts in 1991 with the House of Representatives Interim Study Committee on Fiber Optics in State Government. The committee was concerned with specific issues, such as duplication, costs and gaps, and generally with Oklahoma's lack of a statewide telecommunications plan.

The committee "directed the State Regents for Higher Education (operator of the state's educational telecommunications network) to work with the Office of State Finance (which has telecommunications authority over state agencies) to develop a statewide telecommunications plan." In January 1992 these two agencies submitted a report titled *Analysis of State of Oklahoma Telecommunications and Proposed Government Telecommunications Network.* The report recommended the creation of the Oklahoma Government Telecommunications Network and of the state Data Processing and Telecommunications Advisory Committee. Legislation in 1992 authorized the regents and the Department of Public Safety to continue and enhance their networks, provided that they collaborated with State Finance in developing the new Oklahoma Government Telecommunications Network.

The State Data Processing and Telecommunications Advisory Committee eventually developed a statewide network plan that included about $8 million in general obligation bonds. This planning effort was augmented by a grant from the U.S. Department of Commerce's TIIAP fund matched by the Oklahoma Department of Commerce and the advisory committee. The grant called for a strategic plan that would result in seamless networks connecting all state agencies, educational organizations, business and industry, health care and other institutions.

After three years of extensive collaborative work, the planning team concluded "expansion and upgrade of the state regents' telecommunications network — OneNet — would serve as the foundation for a comprehensive, unified statewide telecommunications net-

work." This decision — based on the previous investment in and success of OneNet — was the most efficient way to proceed.

An extensive business plan was developed and contained detailed information about:

- the specific components of the OneNet expansion and upgrade plan;
- the timetable;
- network services;
- technology to be used in the upgrade and expansion;
- the financial analysis; and
- the cost/benefit analysis.

A national telecommunications firm was hired to evaluate the plan. The validity-of-design study included hub-site, node and end-point placement; traffic loading; equality of access; network control; and maximization of potential users. The feasibility-of-design evaluation included Internet connectivity, ability to upgrade, costs and a survey of similar state networks. The plan was judged satisfactory in both its validity and feasibility.

Recently the Regents' Council of Presidents joined with the chancellor and regents' staff in obtaining outside expertise from the State Higher Education Executive Officers to assist in a strategic planning initiative involving information technology for education. This initiative was motivated largely by OneNet's capabilities, which have raised many expectations, hopes and concerns among the higher education community in Oklahoma. The SHEEO-assisted planning study resulted in a report to the regents titled *Technology 2000: Recommendations on the Utilization of Information Technology in the Oklahoma Higher Education System (August 1997).* The report listed three strategic objectives related to new capabilities of information technology in higher education and 20 specific recommendations. The recommendations were in the areas of academic policy and financing; student access to computing resources; faculty and course development; library initiatives; administrative/student support; OneNet management and government; and economic development initiatives. This report describes the actions needed to achieve maximum benefits from information technology in the Oklahoma State Regents for Higher Education.

**Planning philosophy** — The state and the regents clearly have employed most, if not all, of the formal planning elements and steps that might be recommended. These broadly based, well-documented elements of formal planning include appropriate administrative and legislative involvement, committees, outside consultants, agency collaboration and vendor partnerships.

Perhaps more important than the formal planning steps, several attitudes, behaviors and philosophies have been critical to OneNet's success. State leaders in the Oklahoma State Regents for Higher Education, Legislature, Department of Finance and other state agencies

recognized the importance of technology in general and particularly in advanced statewide networking. Technology became a general priority, and the regents took the initiative to collaborate with the Department of Finance in carrying out a successful OneNet project. The chancellor pointed out that one should avoid "slavery to plan" and, rather, work to create opportunities and "elbow room" for those who have motivation and capability.

## Evaluation

This review found no existing criteria and processes for formal evaluation of OneNet. However, visits with users and providers clearly revealed general satisfaction with OneNet services and enthusiasm and excitement over its potential. Users and providers appear to have consistent contact with each other so that problems and needs should be identified quickly. Formal evaluation, however, was not described.

## Professional development

The OneNet staff provides initial training for the client's technical staff but does not offer further training, including activity that might be called professional development. While professional development, particularly of faculty and employees other than technical staff, is considered to be the institutions' responsibility, the OSRHE has sponsored several initiatives related to faculty instructional development in distance learning. A Quality Initiative Grant of $90,000 provided training through the Teletraining Institute in Stillwater, Okla. Faculty representatives from every campus were taught distance learning strategies and techniques. The OSRHE also has been involved in the Oklahoma Telecommunications Technology Fund established by the Legislature in 1997. This fund administered by the state vocational/technical agency will provide about $1.4 million each year for training of teaching faculty at all levels (K-12, vocational/technical and higher education). The legislation that established the fund calls for its plans to be developed "in conjunction with OneNet." In spring 1998, the OSRHE sought institutions' proposals for faculty instructional-development programs in technology and distance education. In August 1998, six proposals were approved for funding (a total of $500,000); implementation was to begin in fall 1998.

## Types of educational use

While this review did not obtain specific information about the number or types of educational uses of OneNet, they clearly are extensive and varied. OneNet's uses include the full array of educational applications and information access — electronic delivery of courses and training, transmission of administrative data, e-mail, access to learning materials and

special information resources, access to special computer resources for research, and communications supporting collaborative projects among students and faculty. OneNet provides services to educational programs in public schools, vocational/technical schools, colleges and universities, public libraries and communities.

## Support requirements

OneNet's objective was to build "carrier-class" telecommunications facilities and support. For example, battery backup systems are at each hub site, and each piece of OneNet equipment is fully redundant. If a component fails at any time, the system will continue to operate and will send an alarm to OneNet personnel.

Potential customers statewide can call a toll-free number to request connections. OneNet advisers will help them to determine the types of equipment needed, identify vendors and obtain volume pricing. If requested, OneNet can install and maintain all equipment required to establish a connection to the OneNet backbone.

OneNet connects all clients to the network and provides some initial orientation and training to each client's technical staff. However, the client agency is responsible for providing staff training in the use of the video and data applications. Many training options are available, including videotapes, self-instruction materials and formal training classes.

A help desk operates year-round to assist users with common network applications and to solve any technical problems.

The OneNet Network Operations Center provides the following services for users:

- Network planning — assisting users in connecting to OneNet and, where feasible, designing local area networks;
- Statewide equipment contracts — obtaining volume prices;
- Installation — installing circuits and configuring routers;
- Technical support — providing a toll-free help desk for questions about the network, equipment and common applications such as Netscape (hours: 7 a.m. to 10 p.m. Monday through Friday; 8 a.m. to 5 p.m. Saturday; and noon to 5 p.m. Sunday);
- Network monitoring — monitoring OneNet equipment and circuits 24 hours a day;
- Scheduling of video courses and conferences;
- Domain name system services for OneNet and optional services for user organizations;
- Network security services;
- USENET News feeds (full and, where requested and appropriate, partial);

- Listserv functions (public or private, moderated or not);
- OneNet newsletter — making users aware of technical issues and helping them to understand these issues; and
- Logging system for network design, equipment, billing, maintenance and calls to the help desk.

The support organization consists of about 20 full-time-equivalent engineers, technicians and support staff.

## Shared use

In several ways, OneNet, as the name suggests, represents the ideal in shared use. It is the official telecommunications and information network for Oklahoma education and government. It electronically links the state's public schools, vocational/technical schools, colleges and universities, courts, libraries, and local, county, state, tribal and federal government agencies. It transmits video, data and some voice services through one network that consolidates various technologies, such as fiber optics and other cable, digital and analog microwave, satellites, and wireless media. OneNet's ability to carry voice services is restricted severely by the service agreement with the regional carrier.

As indicated above, OneNet is available to all state educational, government and related agencies, and all services are available to all agencies. The Department of Human Services, Department of Health and the Oklahoma State Regents for Higher Education are the largest users.

## Internet2

OneNet connects to the Internet2 national research network and provides high-level access for the University of Oklahoma and Oklahoma State University. OneNet also participates in the six-state Great Plains Network. Initial plans call for OneNet to connect to the Internet 2 backbone at the OC-12 level and the Great Plains Network at the DS3 level.

Advanced applications in genome sequencing, numerical weather modeling and 3-D molecular dynamics require more computer resources than are available in the state. With high-speed connections to each other and to the major supercomputing facilities in the nation, Oklahoma's colleges and universities will be able to conduct critical research without regard to time or distance.

# Conclusions

## *Success Factors*

The Legislature's allocation of $14 million for state networking improvement spurred serious collaborative planning. After difficult planning discussions lasting more than two years, it finally was resolved that the state should have a unified network and that the OSRHE should own and operate it in partnership with the Office of State Finance. This decision was based largely on the OSRHE's preparedness, willingness and leadership. The full cooperation and significant efforts of all parties produced a successful plan and functioning network within a relatively short time. The OSRHE's existing network, experienced and motivated staff, and top-level leadership were key factors in these accomplishments.

The broad-based planning took into account all parties effected. A feeling of ownership of the plan was encouraged throughout the process, and many efforts were made to create a general awareness of the project and the need for it. All relevant sources, including private business and external experts, were asked for input.

The plan for shared use across all agencies allowed the state to use the $14 million allocation more effectively to develop a very advanced and comprehensive network.

Another benefit of the unified approach was bringing all of the various technologies and services under one management structure. This efficient system provides users with coordinated services and a single point of contact for service and gives the network flexibility to migrate to new or different technologies as needed. OneNet provides a seamless and pervasive network connecting all of education in the state.

As a result of the consolidated organization, it was decided that, while existing technologies would be continued, new investments would go primarily into IP-type networks. This provided a unifying focus and helped ensure state-of-the-art investments.

Another factor in OneNet's success was obtaining the private sector's participation and support through "public/private partnerships." More than 20 regional and national telecommunications companies, as well as other businesses, are partners. Through its innovative and entrepreneurial approach to partnerships with business, OneNet has been able to expand and to update services substantially without significant increases in staff.

Grant and bond funds were important in establishing the network. Equally important was quickly establishing funding sources for services to support operating costs and growth.

Special pricing for OneNet from vendors was vital to economic success. Such pricing came from the special efforts to bring vendors into the planning process, as described above. Vendors were willing to make concessions for education and for an educational network, recognizing that other state business also would be served. Various other measures, such as the use of highway rights-of-way for major fiber trunks, kept costs down.

Charging a uniform rate for OneNet so that more remote areas have equal access was important to accomplishing the project's objectives. OneNet's broad scope of support services also will enable small and remote customers to use modern networking more effectively.

### *Challenges/Issues*

Several challenges and issues related to organization were identified, including the following:

- **Telephone company cooperation** — There are many small telephone companies throughout the state. Establishing common ground rules and cooperation to produce a unified network were difficult to achieve.
- **Development of public/private partnerships** — Although such partnerships occur in some other areas of state government, this is not the usual way of accomplishing state business. The OneNet project had to be "entrepreneurial" and required flexible, creative approaches.
- **Educational "turf"** — Colleges historically are dispersed throughout the state and consider higher education in their surrounding geographic area as being their domain. State agencies governing education typically have honored and "enforced" these "turf" understandings. An effective, high-capacity, statewide educational network raised many questions and issues regarding these traditional concepts of "turf."
- **Education of users** — OneNet brings new and enhanced networking capabilities and information resources and tools to residents statewide. Informing everyone of the network's availability and potential and teaching them how to use it effectively are daunting tasks. It also is challenging to ensure that users understand the pricing for services. Because many services are new, users often misunderstand how the prices apply to them and lack the perspective of knowing the market prices for such services.

The $2 million revenue deficit was identified as an issue, but it is not expected to be a problem. The expanded network is somewhat new, and services are expected to grow rapidly.

The lack of good technology-based tools for scheduling video sessions is a continuing challenge.

Although a stellar example of a public school system's involvement in OneNet was reviewed, the overall involvement of K-12 has been less than desired. This is being pursued in various ways.

Online library resources on OneNet is in an early state of development, and needs continued priority.

As a part of the recent strategic planning for information technology, a faculty advisory committee submitted a report called *Response to the Telecommunications Charge* (May 1997). A major section of this report addressed faculty development and made several recommen-

dations. Subjects included incentive funds, grants for institutional collaboration, recruitment of experienced faculty, tenure and promotion criteria, and the need for instructional design staff. Some of these recommendations were included in the report *Technology 2000* that came out of this planning initiative.

Recruiting, developing and maintaining staff with up-to-date skills are significant challenges.

The development of an organized method for users to have input into the planning, management and decision-making of OneNet could become an issue. As an agency becomes more reliant on the use of the network, that agency's management will need a clear, effective means of influencing the evolution of network services and resources.

Another significant issue will be the establishment of more explicit and systematic evaluation processes. As technology-based services mature — and especially as additional investments are needed — supporters, decision-makers and funding sources probably will demand more formal evaluation of the results of previous investments.

Finally, the restriction on the use of OneNet for voice traffic may need to be reviewed. Functional, technical and economic considerations likely will continue to move toward merging voice with the other services.

*Chapter 4*

# Summary of Success Factors and Challenges/Issues

## Introduction

Several success factors and issues emerged in all three of the states in this study. Discussions with the SREB Educational Technology's Telecommunications and Infrastructure Task Group indicated that these factors generally apply to any state, and identified other strategic factors that were not specifically covered in the three-state study. The final section of this report summarizes these success factors and issues.

## Success factors

### *Sponsorship and participation*

The level, type and scope of sponsorship and participation in the development and management of a statewide educational WAN effort contribute largely to its degree of success. All three states studied had high-level, relatively open, broad participation.

Top-level support in both the education agency and the state government is essential for several reasons. First, it is important to obtain and sustain the commitment and participation of educational entities; state telecommunications agencies and possibly other state agencies; and vendors. Also, significant funding is needed for initial development and for ongoing support. In addition, many changes are required if the network is to be successful. New organizations must be put in place, new technologies must be bought and used, and new applications must be developed and promoted. Strong, visible support at the top level makes these changes possible.

For the same reasons, success relies on broad involvement in an open and participatory planning and management process. All affected parties will need ongoing input and information about the project's status in order to ensure that their needs are met, to prepare for necessary changes in their programs, and to commit funds and other resources that may be required. Affected parties will include education entities, state telecommunications agency, and vendors. Although the overall plan and commitment should include all educa-

tion agencies, the level of active participation may vary because of factors such as funding and preparedness.

None of the three states studied felt that it was feasible to install a fully state-owned telecommunications transmission facility, although Oklahoma installed its own fiber in some of its major backbone links. Statewide networks generally depend largely on communications services provided by vendors, for example telecommunications services from telephone companies. Special provisions must be made for private-sector input and participation in planning, installing and operating the network. The manner and timing of vendor input may vary from state to state depending upon state laws and regulations. Early input is important, however, even if it must be through formal requests for information or third-party consultants.

### *Educational leadership*

The three state studies confirm that education agencies should take the lead in planning and managing the development of statewide educational networks. Such networks and related services still are not standard commodities easily obtained on the open market. Consequently, these networks and services must be tailored to meet education users' specific needs and priorities.

Vendors or other providers will supply many network facilities and services. Effective educational leadership requires that those facilities and services be responsive to the specific needs and priorities of the education users. Each education agency must develop or designate organizational responsibility for ensuring that its networking needs are met through procured or direct services. This responsibility must be designated even when networking services are obtained through another state agency, such as telecommunications.

### *Technology strategies*

The three states are concentrating new telecommunications investments on new technologies, specifically Internet-styled technologies. This investment approach is considered most beneficial to education statewide.

Oklahoma believed it was important to bring all electronic communications technologies under consolidated management. This strategy made organization and staffing more efficient and also made some decisions about technology easier. For example, the decision to invest new funds primarily in Internet technologies did not involve separate organizations that might have competed for new funding.

### *Funding*

It is not surprising that the economics of statewide educational networking are considered an important success factor. The considerations include revenue sources; methods of charging; initial vs. ongoing costs; special pricing for education; funding sources' responsiveness to changing needs and increased demand; and economies of scale. While the three

states' goals and concerns are similar, their approaches and methods vary significantly. The key to success seems to be finding the approach and method that will work at the current time in the particular state without losing sight of longer-term requirements and implications. Each state's starting point was based on its unique situation.

Typically one-time funds for acquisition and installation of the network are easier to obtain than are continuing funds for ongoing support and commitments for upgrade and replacement. One key to success is achieving a balance of types and timing of funds so that the network can be installed successfully and can continue to operate.

Funding sources need to respond to growth in business and to changes in service requirements, such as new services based on new technology. A related issue is whether to charge for services or depend on allocations from the education agency or the legislature. On one hand, allocated funding focuses attention on top-level priorities and reflects executive-level decisions regarding those priorities. It encourages and facilitates certain types of activities, such as collaboration, that would be more difficult under a charge system. Funding from allocations sometimes is a more predictable method and avoids the "overhead" of administering a charge system.

On the other hand, support of services through charges makes it possible to respond to users' changing needs as soon as they are willing and able to pay for them. Also, growth in volume is funded automatically through growth in revenue. When users have internal funds to pay for services, the network does not have to wait for funding to be approved through the competitive allocation process.

### *Special pricing and discounts for education*

Obtaining the best pricing and discounts is vital in order to keep costs affordable for all educational entities. All three states obtained some degree of special pricing for education from telecommunications vendors, although the amount and nature of the discounts varied. Special pricing is not automatic or easy to obtain from vendors. It must be included in the initial establishment of contracts for services. Typically the collaboration of the state's public service commission and sometimes the telecommunications agency is required.

Implementation of the provisions of the Universal Services Act of 1996 referred to as E-rate is a key consideration for each state. E-rate is designed to provide discounts to schools and libraries for Internet access, voice and data services and infrastructure. Which schools will be eligible, for what level of discount and for what services are not resolved and will change from year to year. How this new resource will be integrated into statewide networking is still to be determined.

### *Methods of charging users*

Some networks are funded largely through charges to users. Methods of charging users vary for several reasons, including equity of access, costs of maintaining a charge system,

and incentives for participation. Incentives for participation were discussed under the funding section.

Equity of access is often the major reason for an educational network's decision to charge all users the same, regardless of differences in cost. Actual costs are averaged to determine a single charge for all users. For example, there may be a single charge for line costs regardless of the distance involved. Thus, remote sites can participate that otherwise could not afford the actual cost and all students have equal access.

Another important consideration in determining charging methods is the cost of administering a charge system. Charging for each different service on the basis of actual costs for each user can be very costly and complex to administer. Leveling charges, as described above, reduces the administrative costs. Also, charging groups of users based upon periodic agreements for specified services reduces administrative costs. One of the networks studied employs this method by charging agencies annually for contracted services for the year, thereby eliminating detailed charges to each school or user entity.

### *Economies of scale*

Probably the most important consideration in the affordability of statewide educational networking is economy of scale. This situation comes from procuring services from the private sector at a reasonable cost and obtaining necessary staff to develop and operate a network. It is impossible for each school, library, college or university to develop its own wide area network.

It is clear that collaboration and sharing, and the resultant economies of scale, are necessary for wide area networking. However, as the study of the networks demonstrated, more discriminating decisions regarding the existence and application of economies of scale are not as easy.

Oklahoma consolidated all of its networking and communications technologies for all state agencies under one management structure. This move appears to have achieved significant economies. Because this consolidation is relatively recent, it remains to be seen whether it adversely affects other factors, such as flexible responses to each agency's specific needs and priorities, complexity of management, and long-term funding requirements.

Georgia has a consolidated data network for all of education and a second consolidated network for other state agencies; the two share a physical transport backbone as much as is practical. The apparent assumption is that sufficient economies of scale are achieved with this arrangement, which allows for more specific, different services to education and state agencies. This assumption has not been evaluated explicitly, however. Separate state agencies operate separate educational television and interactive-video networks.

Florida is similar to Georgia, except that the state agency network also offers services directly to educational institutions that overlap certain services offered by the educational network.

# Challenges/issues

## *Organization*

All three states studied face significant questions and issues regarding network governance and leadership. These questions result partly from rapid changes in technology, including the overlap and merger of various technologies; the scope required by economies of scale; and the strategic importance that education and other state agencies assign to technology. Various models of governance and leadership are being attempted. Each of the three states has a different model that offers unique challenges and issues.

A consolidated model creates the significant challenge of developing governance and management structures capable of meeting constituents' various needs and priorities. For example, education's significant needs and priorities for networking may differ from those of some state agencies in regard to security, flexibility requirements, variations in demand, emphasis on information dissemination, and funding requirements. While education agencies' needs and priorities also vary, they have more in common. Also, education agencies themselves have similar governance structures that, in some states, are related under a common structure. This factor facilitates responsive, effective network governance.

The lack of effective means of user input is a common problem. User agencies must have effective input into the planning, management and decision-making of the network. As an agency's reliance on the network grows, the management of that agency will need a clear, effective means of influencing the network's direction in order to ensure that the agency's changing needs are met.

Other aspects of network management also influence the overall governance. For example, if the network operates as a business and sells its services to users on a competitive basis, then users have the choice and control, even if they lack strong representation on a governance committee. Balancing regulation and competition is a challenge in designing the governance and management structure.

Developing an appropriate, productive relationship with the state telecommunications agency was a significant challenge in Florida and Georgia. Educational systems must exercise leadership and control in determining requirements and obtaining services. State telecommunications agencies often continue to operate under a philosophy and policy structure developed at least 20 years ago, when telecommunications was a very different business and technology (i.e., plain telephone service provided by a monopoly). The state agency consolidated the state's telephone business to negotiate better rates through economy of scale. State agencies and education typically were required by law to obtain telephone services through the telecommunications agency for reasons of economy. Little planning and user input were required.

Today's telecommunications industry is characterized by competition, many and varied services, and rapidly changing technologies. Services can and should be designed and selected to match users' specific needs and priorities. While economies of scale still are possible, they follow different "payoff" curves and must be weighed with tailoring services to match users' needs. Thus the justification for consolidation is not necessarily as dominant as in the past.

Further, as networking becomes more prevalent in education and the network increasingly is regarded as the equivalent of a classroom facility, it becomes more clear that the education system must "own" that resource, whether outright or through a contract. Because state telecommunications agencies typically don't accommodate the required educational ownership, the relationship is often difficult.

Another issue is "partnering" with private business in order to accomplish some goals of statewide educational networks. For example, making the network equally accessible to remote areas might call for commitments from vendors and the agency based on shared expectations, shared resources, and collaborative activities. Also, achieving uniform, standardized statewide service requires a consortium of vendors and state agencies. Meeting these requirements under the normal state purchasing practices can be extremely difficult. Likewise, developing a new procedure to meet these needs under existing laws and policies can be a significant challenge.

Finally, all three study states reported that recruiting, developing and maintaining staff in these new, rapidly changing technologies was a problem. The market for technical staff, especially in the new networking technologies, is very intense. State salaries typically cannot compete with the commercial market. Internal staff members often learn the new technologies, gain experience and then leave for a more attractive job elsewhere. Education agencies must pay special attention to this problem.

## *Planning*

All three study states have at least an annual planning cycle for budgets and annual reports. There also were various ad-hoc plans and studies in selected areas, such as technology upgrades, network expansion, procurement action, and policy issues. However, there generally was no comprehensive and continuing planning process involving all users. There also were no ongoing procedures for evaluation and accountability specific to WAN performance and issues. Improved, ongoing planning and evaluation procedures are expected to be a growing concern.

Another significant challenge in planning for educational WANs is maintaining adequate bandwidth to handle the fast growth in Internet use, multimedia and other applications.

*User issues*

Educational agencies have to re-evaluate existing restrictive policies on course and program offerings based on geography. In all three states colleges historically have dispersed throughout the state in order to serve students better through proximity. Each college generally considers the geographic area around it to be its domain, and agencies governing higher education typically have honored and "enforced" these "turf" understandings. The availability of effective, high-capacity, statewide educational networks has raised many questions and issues regarding these traditional concepts of "turf." New methods of delineating roles and relationships among schools and colleges must be drafted to reflect the geographic and time flexibility of electronic delivery.

Too often technology is deployed without adequate preparation of its users. Technology alone does not solve educational problems. It must be employed effectively by teachers, support staff and students in order to achieve productive results. To attain this effective use of technology there must be training programs, skill development, technical staff support, and appropriate incentives and rewards.

# Additional strategic factors

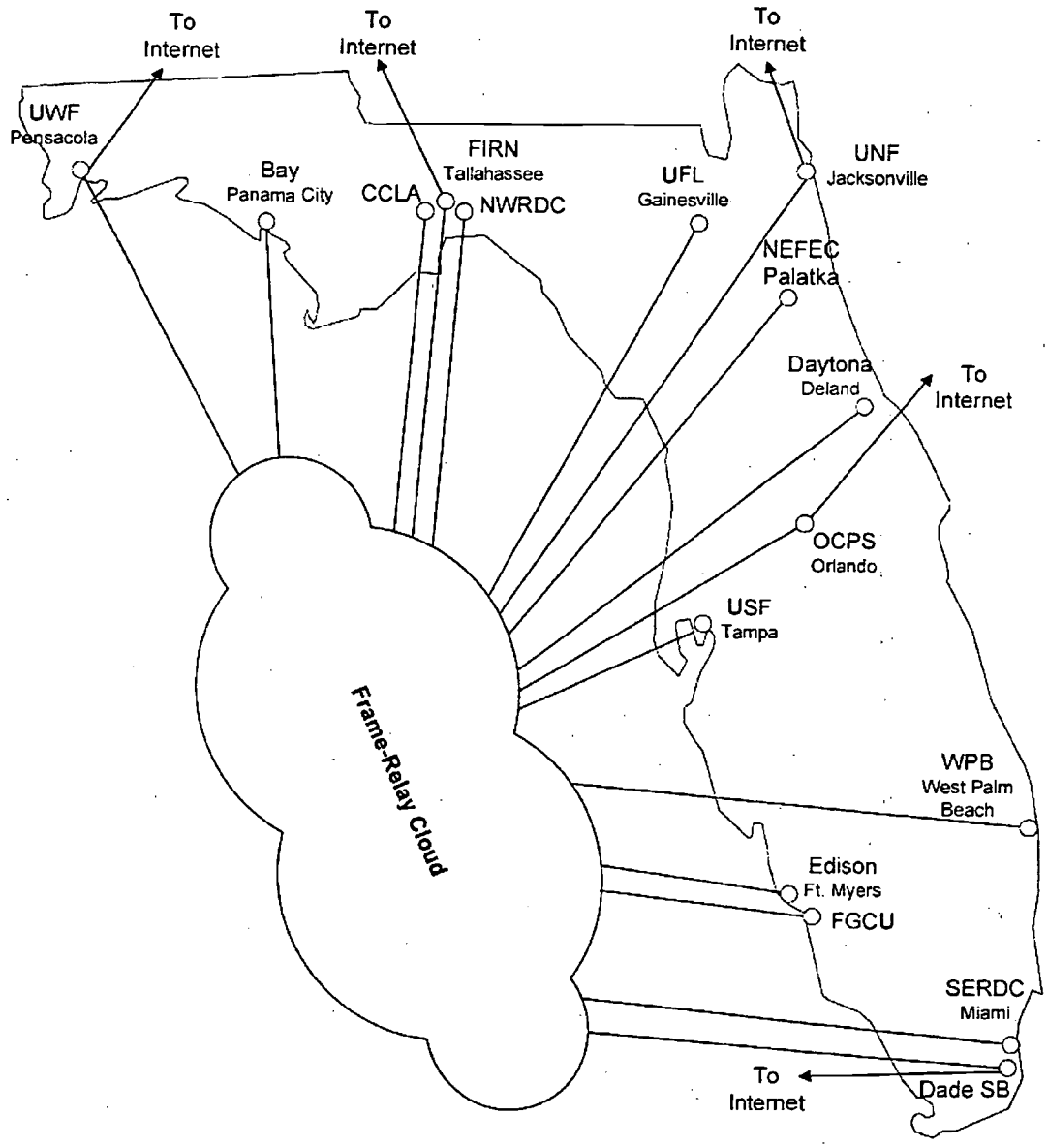
Several other strategic factors were identified during this study that were not included in the focus of this report. One such factor is the cost of procured telecommunications services. Cost is determined by several factors, including relationships with telecommunications agencies and vendors; pricing and rate structures from vendors; educational pricing; subsidies; and the E-rate.

Other factors that participants said deserve future consideration include methods of handling services to private business; effects on economic development; management of the explosive growth of Internet traffic; and funding outside of the normal budget process.

Increased technology for education often is funded through special sources and allocations and essentially results in "add-on" costs. Assuming that increasing investments in technology continue indefinitely (a justified assumption), they cannot continue to add to the cost of education. Costs must be offset and productivity must improve, thereby allowing funds from other categories of educational budgets or from other instructional methods to move into technology-based services.

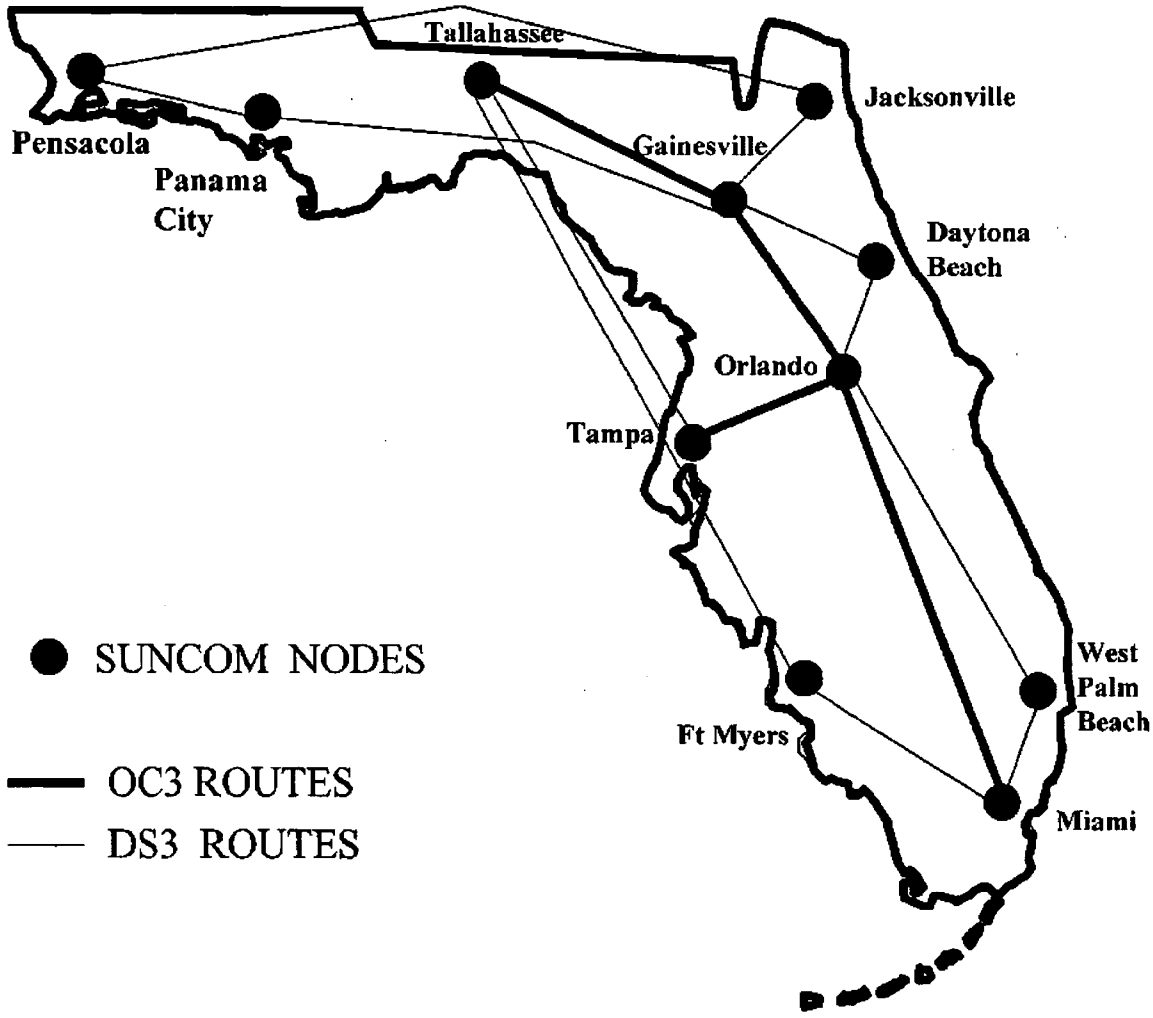
## Attachment 1

# FIRN Intranet Frame-Relay Backbone



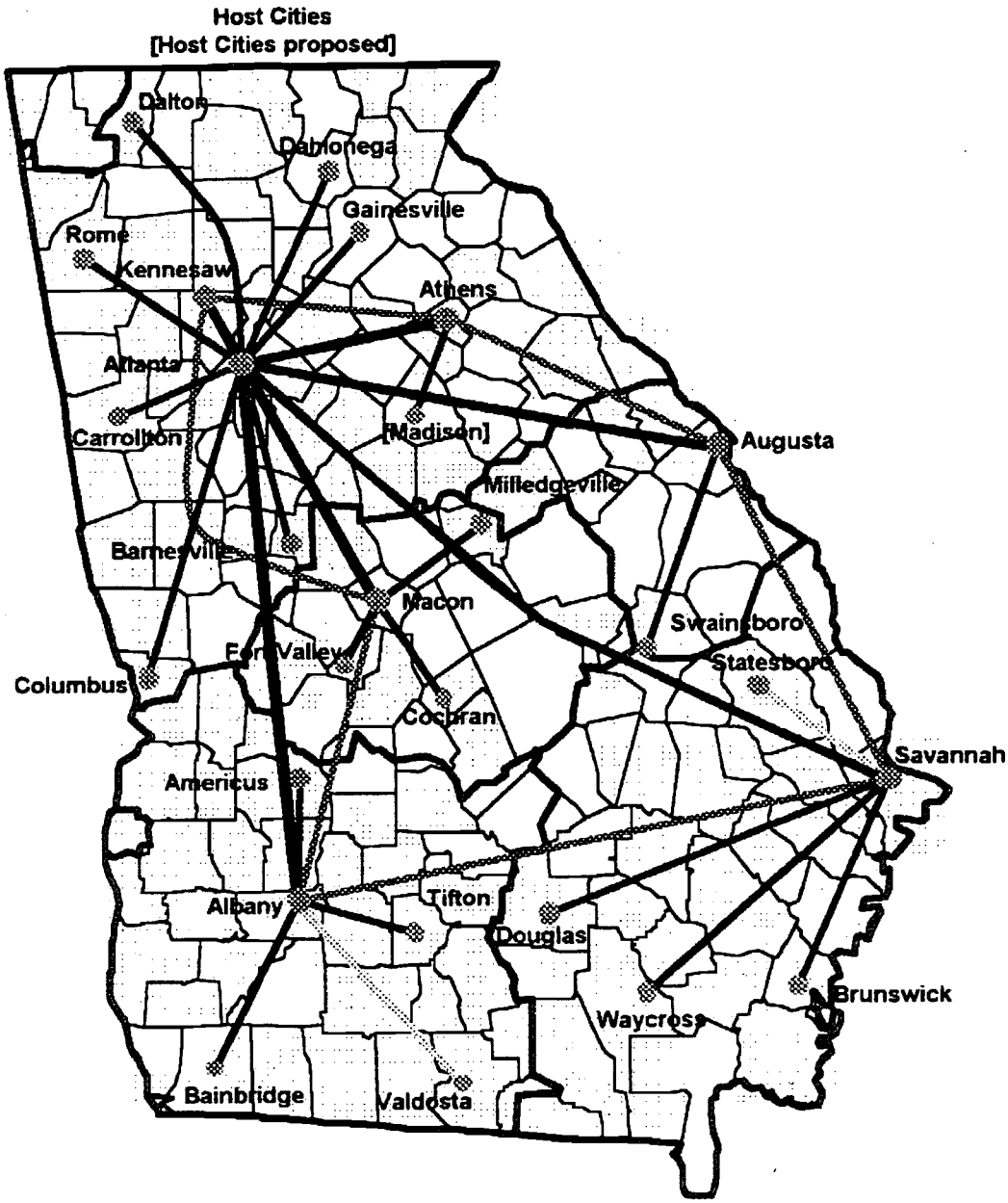
Attachment 2

# State of Florida – SUNCOM Network



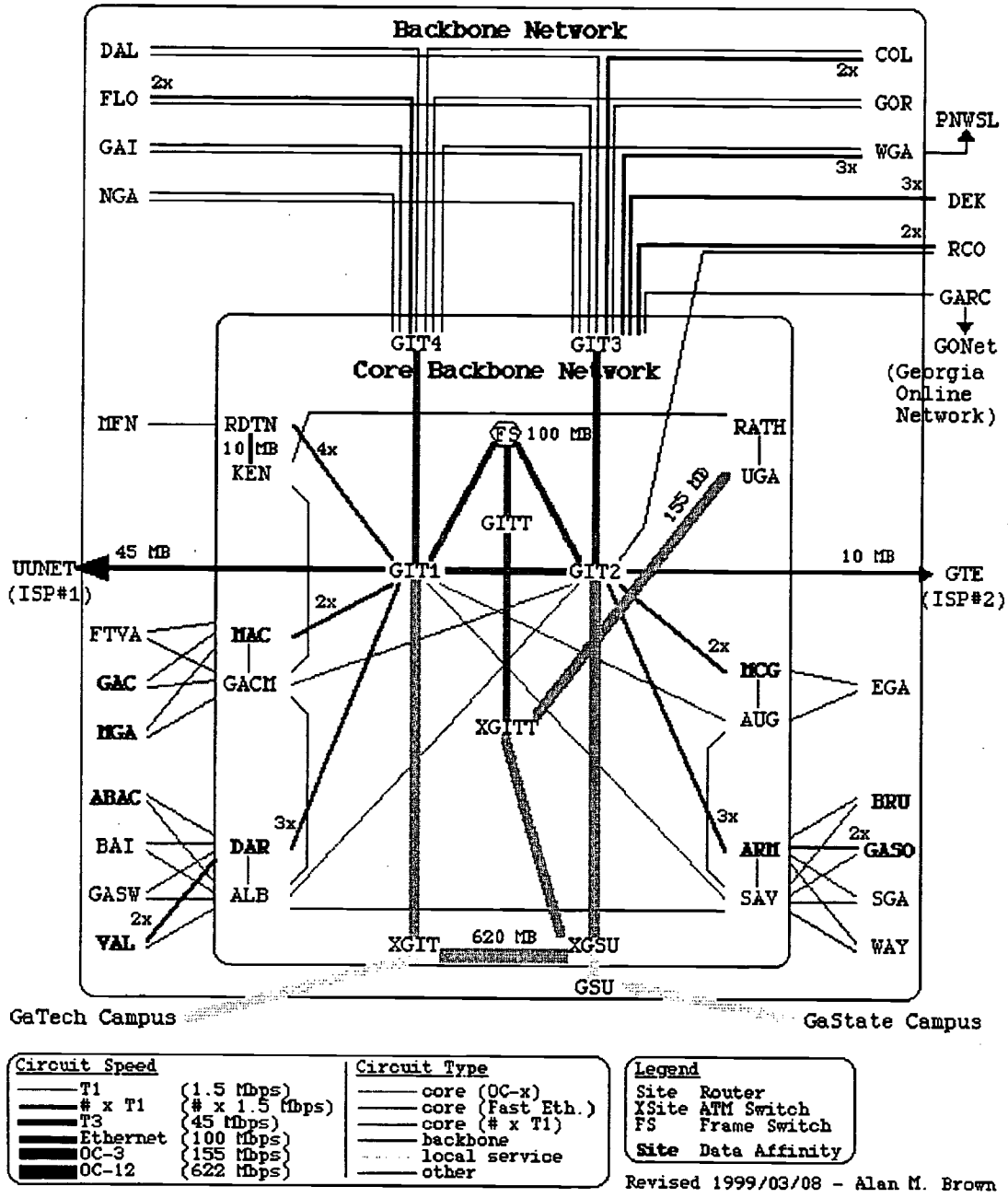
Attachment 3

# PeachNet Backbone



# Attachment 4
# PeachNet℠ Physical Backbone as of March 1999

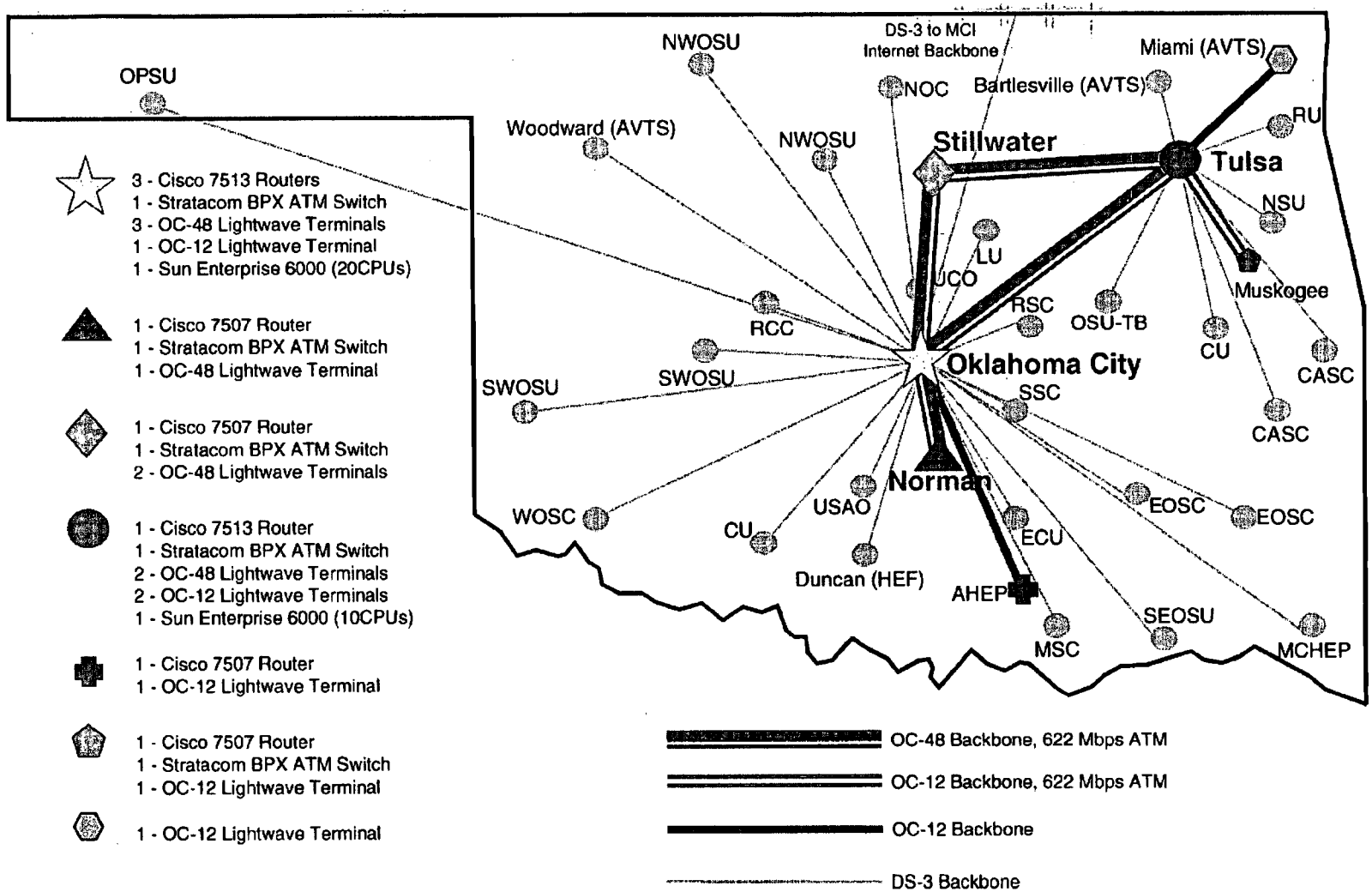
Note that the PeachNet℠ backbone is currently being upgraded from T1 to OC-3 speed circuits.




Revised 1999/03/08 - Alan M. Brown

Attachment 5

# OneNet® Oklahoma Telecommunications Network



**SouthEast and Islands Regional Technology in Education Consortium (SEIR*TEC)**

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**Office of Educational Research and Improvement (OERI)**

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