

**The Greater Austin Area Telecommunications Network
GAATN
Past, Present, and Future
Policy Analysis and Recommendations**

**Quinn Stewart
Graduate School of Library and Information Science
The University of Texas at Austin
3 December 1998**

Table of Contents

I.	Introduction	1
II.	Historical Background and Rationale	3
	A. <i>AISD Origins</i>	3
	B. <i>Original Partners</i>	4
	B. <i>Interlocal Agreement and voting arrangement</i>	5
	C. <i>Construction Phase</i>	6
III.	Current Status of GAATN	6
	A. <i>Austin Independent School District (AISD)</i>	6
	B. <i>Austin Community College (ACC)</i>	8
	C. <i>City of Austin (COA)</i>	9
	D. <i>Lower Colorado River Authority (LCRA)</i>	10
	E. <i>State of Texas General Services Commission (GSC)</i>	11
	F. <i>Travis County (TC)</i>	13
	G. <i>The University of Texas at Austin (UT)</i>	15
IV.	Networking Issues and Cooperative Use	17
	A. <i>From Construction Project to Network Utility</i>	17
	B. <i>Maintenance Issues and Governance</i>	18
	C. <i>Network Expansion</i>	19
V.	Future Use of GAATN	20
	A. <i>Innovation</i>	20
	B. <i>Community services</i>	20
	C. <i>Time-Warner connection with GAATN</i>	21
	D. <i>Content and Services sharing among GAATN participants</i>	23
VI.	Conclusion and Recommendations	24

Introduction

The increasing use of digital data by governmental and educational agencies adds bureaucracy to the list of obstacles that must be overcome in deploying data networks. Where private enterprise has the resources to purchase bandwidth from commercial suppliers and pass the costs on to customers, educational and governmental concerns have historically formed to provide services to citizens that private businesses were either unwilling or unable to supply. The ongoing experiment in privatizing government has many supporters, but the overall costs to citizens unable to represent their interests may prove incalculable.

The invention and use of fiber optics has been a fundamental factor underlying the growth of information networks, and the success of the Internet. The growth and use of packet-switched networks represents a paradigm shift in telecommunications usage in this country, and offers a vastly more affordable opportunity in areas that have not built a circuit-switched infrastructure. Fiber-optic networks cannot be viewed as simply a local phenomenon. The linking of these networks to others through cooperative arrangements can leverage the usability of these networks far beyond those of the participating entities.

The rapid growth of digital networks has created a number of problems for decision-makers in all areas of society. Making decisions on technologies has often been described as trying to hit a moving target, and in the 1990's in particular, it has proved to be exceedingly difficult to predict the future. For public policy officials in particular, the bureaucratic decision-making process is ill suited to making the rapid, evolutionary decisions necessary to utilize emerging technologies. There are few public policy officials that cannot recite some large-scale failure where technology decision-making went wrong. Public policy officials need to understand the nature of evolving

technologies, and be able to make decisions based on both the past experiences of others, as well as an educated, realistic vision of what the future may hold.

This paper will examine the creation and evolution of the Greater Austin Area Telecommunications Network (GAATN), the first governmental-educational cooperatively owned fiber-optic network in the world. The creation and maintenance of cooperatively owned telecommunications networks is an important model for public policy makers to be aware of, and the potential of networks such as GAATN to provide important governmental and educational services to citizens is unprecedented. However, matching the bureaucratic process to technological change is an inexact science, one in which the participants must become familiar with both the current technologies, as well as future potentials. It is in this situation that partnerships such as GAATN have the potential to both share the costs of building a network, as well as pooling and sharing the intellectual capital necessary to maintain parity with technological change.

An important component of the argument in favor of public-sector networking partnerships is the unwillingness of private sector companies to provide these types of services. While the momentum to “privatize” governmental services has resulted in some success stories, the story is far from over in the telecommunications arena. The Telecommunications Act of 1996 has yet to yield tangible benefits for the citizenry that its promised “competition” would produce. Instead, mergers and acquisitions continue to concentrate ownership of media into corporate hands. Governmental and educational uses of data networks simply do not provide the revenue needed to produce private-sector interest in the building of large-scale networks. Where these networks already exist, such as telephone networks, the rising costs of utilizing them has driven public-sector organizations to seek affordable alternatives. Private sector

provision of data networks in exchange for lucrative cable television franchises has produced mixed and often unacceptable results. Out of these failures of private enterprise to meet the needs of government and educational institutions was born the idea of the Greater Austin Area Telecommunications Network, GAATN.

Historical Background and Rationale

AISD Origins

GAATN began as an effort by the Austin Independent School District (AISD) to reduce its costs for telephone service. In the late 1980's, rapid growth in the Austin area created pressure on AISD to expand the number of schools, and the associated costs of telephone service for these schools caused AISD to begin to investigate building their own telephone network.

In addition to telephone service, data traffic for AISD was increasing as well. The original cable television franchise granted by the City of Austin resulted in the construction of a coaxial Institutional Network (INet) that connected the schools and was used for data and video traffic. There were problems with the INet system and its operation that caused AISD to look into including these services into its own network.

AISD initially evaluated adding telephone services to the INet, but the day the proposal was completed to move forward, the only manufacturer of coaxial cable telephone equipment in the country went out of business.¹

Estimates for providing telephone service to AISD in 1988 were approaching one million dollars per year, with the 10-year estimate approaching 3 million per year. In the summer of 1989, AISD interviewed engineering firms and awarded a contract to JanCom Engineering to study AISD's alternatives for telephone service. After a year of study, JanCom recommended the construction of a 250-mile fiber-optic network connecting all the schools in AISD. Cost analysis predicted that the network would pay

for itself over a 10-year period in savings on phone lines alone, and the network would also be able to handle analog video and data traffic as well.²

Original Partners

It was at this point that Gene Knipper, a retired administrator for AISD, suggested to Jim Ullrich, the head of AISD Media Production, that AISD might approach the City of Austin and other entities about sharing the construction cost of the network. The Superintendent of AISD, Terry Bishop, Jim Ullrich, and Gene Knipper met with the City Manager and received an enthusiastic response to the proposal.

Next, Austin Community College (ACC) and Travis County joined the project, and an agreement was reached between the four entities to put out a bid document seeking estimates on costs of construction on July 21st 1991.³ Those entities that wanted to go forward with construction would enter into an interlocal agreement to build the network.

A Request for Proposals was issued which called for a compliant bid as well as alternate bids with different equipment specifications. AISD was seeking to purchase equipment for its phone system at this time, while the other partners were only purchasing the fiber itself. A number of bids were received, and Southwestern Bell's alternate bid was accepted.

It was here that AISD began its first of many problems with the GAATN network. AISD was the majority participant in GAATN, and could not afford Southwestern Bell's (SWB) compliant bid. Out of the 18 million dollar bid, 12 million made up AISD's portion, with 6 million budgeted for construction, and 6 million budgeted for voice equipment. The City of Austin donated right-of-way and maintenance as an in-kind contribution, and AISD, ACC, and Travis County paid for the 12 fibers allocated to the City.

The telephone equipment suggested by SWB in its alternate bid utilized analog technology, and resulted in 25 of its 36 fibers being utilized for voice traffic alone. The central switch provided in the bid proved incapable of handling expansion, and the construction plans of AISD combined with the existing voice network would require more fiber than the 36 allocated to AISD. Whether this is a case of poor oversight by AISD, or built-in obsolescence courtesy of SWB remains to be seen.

During the bidding phase and construction process, the State General Services Commission (GSC), the University of Texas (UT), and the Lower Colorado River Authority (LCRA) joined the GAATN partnership through amendments to the interlocal agreement completed in 1994.⁴

Interlocal Agreement and voting arrangement

The interlocal agreement sets out the provisions by which the partners would build the network. Each partner would own a certain number of strands of fiber, and a formula was developed by Jim Ullrich that accounted for a number of factors. The GAATN network is constructed in a ring topology, with a North and South superring, and 8 subrings. Percentage of ownership is based on the number of strands a participant owns, as well as presence on the rings and number of sites on a ring. The participants commonly own the protective sheath for the fibers, as well as any other physical equipment needed to support the actual fiber network itself.

GAATN is governed by a Board of Directors made up of two representatives for each entity, a primary and an alternate. These representatives are appointed by the entities, and these participants elect a board president. Voting in GAATN is also based on the percentage ownership formula. As the majority partner, AISD served as construction manager, and also serves as the fiscal agent for GAATN.

Construction Phase

Construction on the GAATN network began in 1994. There were numerous problems and delays in the construction process. While the City of Austin owns the electric utility, there were problems with the electric department concerning placement of the GAATN fiber on the utility poles. After months of delay, GAATN was granted the lowest position on the utility poles, the position most vulnerable to teardowns and network disruptions. SWB's alternate bid called for using brackets to attach the fiber network to utility poles, which the electric utility had a problem with. Once these issues were worked out, SWB subcontracted out the construction of the fiber rings, with one ring having to be rebuilt 3 times because of poor construction. Other issues involved the acquisition of right-of-way in the Circle C area, which caused delays in the completion of the South ring, the longest of the project.

Construction on the network was completed in July of 1998, and the network was officially turned over to the GAATN partners.

Current Status of GAATN

In many ways, GAATN can be thought of as a cooperative construction arrangement. GAATN has a single employee, a Network Manager, who has played an important role throughout the construction process. Now that GAATN is entering an operational phase, its role as an individual entity is being reconsidered. In order to gather information about the current status of GAATN, it was necessary to contact the individual participants. The members of GAATN represent a diverse set of organizations, with a wide variety of planned uses for the network.

Austin Independent School District (AISD)

It is unfortunate that the majority owner of GAATN has experienced the most trouble in deploying their fiber. Leadership of the District has changed 3 times

since the project was begun, and the District is currently involved in a major construction upgrade of campuses, including network services. While the voice phone system has been operating on GAATN fiber for some time, the central switch and associated equipment originally installed by SWB is being upgraded to an Asynchronous Transfer Mode (ATM) network. The contractor for the project is IBM who is using 8 subcontractors to connect 34,000 100bT Ethernet drops to the GAATN backbone. Over 5000 new telephones will be added, with 35 schools currently cabled, and 58 schools to come online by the end of the year.⁵

Unfortunately, a number of delays have made on-time completion of the project seem unlikely. The \$369 million dollar bond package passed in 1996 has ballooned to a \$420 million dollar construction budget that is far from completion. 38 of 70 construction projects are either behind schedule, or postponed for redesigning and rebidding.⁶ Schools remain overcrowded, and a world-class fiber-optic system goes virtually unused by the District that envisioned it in the first place.

While generations of school children will not receive the potential benefits of the GAATN network, there may be a benefit to the construction delays unique to technology projects. The original GAATN design in 1991 called for six strands of dark fiber to be set aside for analog video transmission throughout AISD. Money budgeted for the video network was spent on the voice and data system, deemed to be of a higher priority. The intervening 7 years have not only seen the phenomenal growth of the Internet, but rapid changes in networking technologies. When AISD finally gets around to video, it can now utilize the latest in digital technologies, as a cost far lower than originally expected. With proper network design, AISD could theoretically convert 4 of its 36 dark fibers to an ATM network, a technology unheard of in 1991. By doing this,

AISD could operate its entire voice, video, and data network on two fibers, with two in reserve. The remaining 32 fibers would be unused.

Austin Community College (ACC)

At the opposite extreme, ACC represents one of GAATN’s success stories. ACC was one of the first GAATN partners to use the fiber, initially deploying a fiber-optic multiplexing phone system similar to AISD’s, in the process of migrating off of AISD's phone switch. ACC has 18 strands of fiber on most of the rings, connecting its campuses and administration building. It is currently deploying an ATM network over its GAATN fibers.

ACC Fiber Allocation

# of fibers	Services	Network Architecture	SONET Level	Transmission Rate
2	Voice/Phone	Fibermux		
4	Data/Internet	ATM	Dual OC3 rings	2X 155.52 Mbps
12	Reserve			

ACC is currently in the process of migrating video services off of leased microwave capacity to its GAATN fiber, for transport through Time-Warner to its PEG cable channel. Internet service for ACC is routed through the GAATN Network Operations Control Center (NOCC) at Treaty Oak, where it then goes through the University of Texas for over a 10/Mb Ethernet connection for Internet access.⁷

ACC has done an excellent job in implementing its GAATN fibers, and been able to reserve capacity for the future by utilizing scalable networking architectures. As more video and high bandwidth traffic is moved onto the fiber, ACC is well poised to make

the necessary adjustments to accommodate increased demand. ACC has historically been one of the leaders in supplying distance education materials in the Austin area, and GAATN offers the opportunity to continue expanding these services.

City of Austin (COA)

Where ACC has done an excellent job in reserving fiber capacity for the future, the City of Austin has succeeded in providing an extremely robust system with relatively few fibers. The COA currently has 137 lit sites on its network, including police, fire, and EMS stations, public libraries, and other city offices. The COA has also recently completed an extension to GAATN to service the new airport. There are over 200 Web servers and over 5000 PC's connected with GAATN fiber using a 100 MB/sec Fiber Distributed Data Interface (FDDI) network.⁸

COA Fiber Allocation

# of fibers	Services	Network Architecture	SONET Level	Transmission Rate
2 in use 2 in reserve	Voice/ High bandwidth data	SONET	OC 48 on main rings	2.5 Gigabits/sec
2 in use 2 in reserve	Data	FDDI	OC1-OC3	Up to 155.52 Mbps
2 in use 2 in reserve	Backup	SONET		

The COA is currently using GAATN for a number of mission-critical applications, including police, fire, and EMS encrypted transmissions, traffic monitoring and timing,

telephone service, and a wide variety of data needs, including Web serving and access through UT. The COA is currently doing with 2 fibers far more than AISD was able to do with 24 fibers in its initial GAATN deployment, a testimony to the rapid improvement in networking technology, as well as excellent planning by the COA staff.

Future Plans for GAATN

The COA remains focused on using its GAATN fiber to provide mission-critical city services. Toward this end, the COA is studying the use of GAATN fiber to interconnect two-way radio transmission towers used by police, fire and EMS services. The COA also plans to provide Internet service to the Austin Public Library system once proper network security measures can be implemented. The COA is clearly concerned about network vulnerabilities in the GAATN network, and has been a strong advocate of network monitoring and security precautions.⁹

Lower Colorado River Authority (LCRA)

Perhaps the most unconventional participant in the GAATN network is the LCRA. Initially charged with flood control on the Colorado River, the LCRA evolved into a major electric utility, providing electrical service to rural areas and municipalities in the Colorado River basin. LCRA has recently constructed a 70 million-dollar fiber-optic system throughout its service area, and stands poised to provide telecommunications services to many rural communities. Additional impetus for building the network came from the need to address Y2K issues throughout the organization.¹⁰

The LCRA has 12 fibers on the GAATN network, and uses them primarily to connect its Austin offices to the rest of its network. This provides the LCRA with an organization-wide fiber-optic network that it uses for flood control, river and rain gauge systems, energy load management for its power plants, and a number of other uses. GAATN

also allows the LCRA to connect to the State General Services Commission for leasing telephones on its TEX-AN network, as well as connecting to UT's Pickle Research Campus for Internet access and connections to a major microwave hub located there. In addition to its voice and data transfer needs, the LCRA is also a major user and supplier of wireless two-way radio communication in its service area. GAATN and other portions of LCRA's fiber network are used for intertower connections.

Future Plans for GAATN

The LCRA regards GAATN as an integral component of its regional fiber-optic network. The LCRA has waivers to serve public safety entities in its service area, and is planning to offer telecommunications services to rural areas. The LCRA envisions providing secure communications for rural police, park rangers, fire, and EMS organizations on its network, as well as providing fiber to rural school districts and government entities. The LCRA is allowed to serve its customers and non-profit organizations in areas where there is no competition, and envisions providing bandwidth capacity to customers, rather than network services. Toward this end, the LCRA has recently "traded fiber" with a private telecommunications company, allowing it to extend its reach into the San Antonio area to the University of Texas at San Antonio. This fiber capacity will then be leased to the University of Texas System.¹¹

State of Texas General Services Commission (GSC)

The State of Texas General Services Commission Telecommunications Services Division (GSC-TSD) joined the GAATN project as a means of bypassing Southwestern Bell for telephone services in the Austin area. GAATN is a part of the State's TEX-AN III network, which provides local, long-distance, and 1-800 services to state agencies around the state. It uses a combination of leased and owned lines, and uses GAATN to interconnect state agencies in Austin. GAATN currently provides voice, video and data

services to state agencies in the Austin area, as well as Internet access for state agencies through UT.

The GSC-TSD has 12 fibers on the GAATN network, and has recently installed the first four state sites using OC-3 and OC-12 SONET technology. An interesting note is that the Sam Houston building in downtown Austin is equipped with fiber-optic cable to the desktop, which is currently unused.¹²

Future Plans for GAATN

The GSC-TSD is required by Chapter 2171 of the Texas Government Code to plan, establish, and manage the operation of a system of telecommunications services for all state agencies, and is permitted to offer services to other political subdivisions, including independent school districts. State agencies, including universities, are required to use the services provided by GSC-TSD unless a waiver is granted by GSC-TSD.¹³

Increasing demands for Internet access statewide have exceeded the capacity of the current TEX-AN III network and its primarily leased T1 and T3 services. In addition, the University of Texas and Texas A&M have expressed a need for bandwidth capable of supporting the Very High Speed Broadband Network Services (vBNS), Internet 2, and Next Generation Internet (NGI) initiatives. GSC-TSD, The University of Texas at Austin and Texas A&M are currently working to interconnect their networks and provide multiple T3 connections to the Internet.

The GSC-TSD has recognized that the telecommunications needs of universities are generally two to three years ahead of those for government organizations, and the experience and knowledge gained from university initiatives will in turn benefit government. Toward this end, GSC-TSD is in the final stages of preparing a request for offers (RFO) to convert the existing TEX-AN network backbone to a SONET/ATM

architecture, using OC-12 rings to connect major cities in Texas, and OC-3 rings to connect other cities. GSC-TSD can lease or purchase fiber connectivity if commercial carriers are unwilling to meet the capacity needs of the state.¹⁴

GAATN represents an example of the State purchasing fiber where commercial interests were unwilling to meet these needs. GSC-TSD is currently evaluating adding 24 more state sites to its GAATN network, and intends to interconnect its GAATN network to the TEX-AN 2000 network, in order to provide cost-effective broadband services across the state.

Travis County (TC)

One of the original GAATN members, Travis County has been deploying its GAATN fiber in combination with upgrading county computer systems to achieve Y2K compliancy. Travis County has also been in the process of implementing an Integrated Justice System to modernize court proceedings and information transfer in the county. While GAATN was under construction in late 1995, the Commissioners Court of Travis County hired Fluor Daniel, Inc. to study the communications infrastructure needs of the county. This study recognized that technological advances were on the horizon, and recommended an incremental implementation of the county's GAATN fiber.¹⁵

The report recognized that the construction of networking infrastructure in the county's facilities would take time, and that the purchasing of current networking technologies would be premature. Fluor Daniel recommended purchasing the minimal SONET equipment necessary to operate a phone system for the county, and recommended continued use of Southwestern Bell for access to remote locations until widespread SONET deployment was more cost effective. They also recommended using a FDDI network to begin to connect the various LANs across the county.¹⁶ The Fluor Daniel report also contains a recommendation to move all data services off of the

INet as soon as possible, because of the unreliability of the network. This corroborates the experience of AISD with using the INet for data traffic, whose troubles with the INet were part of the original impetus to build the GAATN network.¹⁷

Travis County currently has 18 facilities connected to the GAATN network, using FDDI over an OC-12 SONET network to connect downtown facilities to outlying facilities such as the sheriffs dispatch office and Justice of the Peace facilities. In addition, the regional 911 dispatch initiative would require interconnection of area police, fire, and EMS services across the region, with GAATN providing a logical interconnect between the city and county.¹⁸

Future Plans for GAATN

Looking back in late 1998, Fluor Daniel appears to have made excellent recommendations. Travis County is still in the process of installing and interconnecting computers to meet the Y2K deadline, and the SONET FDDI and voice network are easily scalable to an ATM architecture. Costs associated with ATM equipment continue to drop, and the County looks to be well-positioned to integrate a SONET/ATM network fairly rapidly once the decision is made to do so. The County also recently participated with the City of Austin in extending the GAATN network to the new city airport and county facilities at Del Valle. This will allow information to be exchanged between the county law enforcement, judicial, and correctional components of the Integrated Justice System, as well as allow for video depositions of prisoners to occur between Del Valle and the courthouse.

By taking a “wait and see” approach on purchasing networking equipment during the process of installing new computer systems, Travis County should be able to make strategic and efficient use of its GAATN fibers.

The University of Texas at Austin (UT)

The University of Texas at Austin joined the GAATN partnership along with the State GSC in 1992, during the bid evaluation process. UT was seeking to reduce its recurring monthly costs for Internet access and access to its remote facilities in the Austin area, such as Pickle Research Campus (PRC) and the UT System complex in downtown Austin.

UT Austin uses GAATN primarily for Internet access. Every Internet access that leaves the campus, including the Telesys dialup system, travels over GAATN fiber to the Internet. UT has a T3 connection through GAATN to the Sprint point-of-presence (POP) in Austin, as well as a T3 connection through the GSC to AT&T, providing the state and UT with redundant connections to the Internet.

UT Internet access is just a portion of its usage of GAATN fiber. UT basically operates 3 network rings in the Austin area using GAATN.

UT Austin Fiber Allocation between main campus and PRC

# of fibers	Services	Network Architecture	SONET Level	Transmission Rate
2 in use 2 in reserve	Telephone services UT DataNet Link ARL and ECE VBNS service	SONET ATM ATM ATM	OC- 12	622 Mbps total twin 45 Mbps 155 Mbps 155 Mbps 155 Mbps

Ring was at full capacity in late 1997¹⁹

UT Austin Fiber Allocation between main campus, UT System, AISD, MCI, Sprint

# of fibers	Services	Network Architecture	SONET Level	Transmission Rate
2 in use 2 in reserve	Internet access to Sprint VBNS to MCI 12 T1s to UT System for voice, video data 16 T1s to AISD Treaty Oak for GAATN members	SONET	OC-3	155 Mbps total 45 Mbps 45 Mbps

Ring was at full capacity in late 1997²⁰

UT Austin Fiber Allocation between main campus and GSC.

# of fibers	Services	Network Architecture	SONET Level	Transmission Rate
2 in use 2 in reserve	Dallas link Link between UT and GSC Secondary Internet access through AT&T	SONET ATM	OC-12	622 Mbps total 45 Mbps 155 Mbps 45 Mbps

Ring was at half capacity in late 1997²¹

UT also represents the first cooperative use of the GAATN network. In supplying Internet access to all of the GAATN members, UT has demonstrated the potential that GAATN holds for cooperative use.

Future Plans for GAATN

The University of Texas at Austin, in conjunction with Texas A&M and the State General Services Commission are working to secure adequate high speed access to the

Internet using a variety of means. Meeting the growing demands for Internet bandwidth is the primary goal of the UT in using its GAATN fiber.

In addition to Internet access, the distance learning needs of the University continue to grow. Adequate service exists for providing a wide variety of distance education materials over the Internet, it remains for University departments to utilize this capacity.²²

Networking Policy Issues and Cooperative Use

There are a number of policy issues facing the GAATN Board of Directors as it moves from a construction to an operational phase. GAATN represents a unique combination of policy issues and evolving technology. While the GAATN members came to a working agreement to cooperatively build and maintain the network, the nature of each member owning their own fibers in a common bundle presents some unique problems and opportunities.

From Construction Project to Network Utility

With the transfer of ownership from the construction contractor Southwestern Bell to the GAATN members on July 22nd, 1998, the GAATN Board must now shift from a construction phase to an operational phase. The members now find themselves in a wide variety of positions as they work to utilize their portions of the network. The majority owner, AISD, is currently in the worst position as far as network utilization is concerned, and faces cost overruns and construction delays. The City of Austin and others are currently utilizing GAATN for a number of mission-critical applications. How and to what extent each of these entities continues to contribute to GAATN remains to be seen. The members of GAATN now find themselves in possession of a major telecommunications network, with many of the members interconnecting

GAATN into even larger networks. This inescapable reality will undoubtedly bring up a number of important policy issues.

Maintenance Issues and Governance

GAATN currently has one employee, a network manager, who has helped coordinate communication among the members during the construction process. This position ends on December 31st, and the current GAATN Board has indicated that they will not hire a new network manager. Instead, financial and risk management functions will continue to be undertaken by AISD, and an outside maintenance contractor will be hired to take over day-to-day and emergency maintenance.²³

Whether the Board will approve this policy remains to be seen. There are a number of drawbacks to this approach. Relying on an outside subcontractor to maintain a critical fiber-optic network without direct supervision by a Board representative does not seem wise. The Board currently has a technical subcommittee, whose members have exceptional skills and years of combined experience in telecommunications. They also have jobs in their respective organizations. Placing the responsibility of overseeing network maintenance on these members is not a good idea.

In discussions about hiring a new network manager, the members outlined a position that required both superior skills in administration and management, as well as an exceptional background in telecommunications, including voice, video, and data.²⁴ While the combination of all these skills is evident in many of the GAATN board members, they do not represent a widely available skill set, and a single individual capable of overseeing the GAATN network will be difficult to find.

In many ways, GAATN is at a crossroads. Indications are that it will divide the network manager functions among the members. A strong case could be made for dividing the position among two GAATN employees, a network administrator and a

network manager. The network administrator would be responsible for coordinating the work of the board, managing finances and legal problems, and serving as a liaison between the board members. The network manager would be responsible for overseeing the maintenance contractor, and coordinating between the members of the technical subcommittee. Each of these employees would be responsible for records management of the administrative and technical components of the network. At present, GAATN is very difficult to study because of the lack of any centralized records repository. Accurate as-built plans as well as accurate and up-to-date records of the network will become more and more crucial as GAATN is increasingly utilized.

The continuance of a paid GAATN staff has other advantages. While the relationship among the board members has overwhelmingly been reported as a good one, there has been and will no doubt continue to be changes in the boards membership.²⁵ Without a paid staff, these changes within the members' organizations have the potential to affect the other members. In addition, there is an inherent conflict-of-interest in having GAATN members handle GAATN functions. There are huge disparities between AISD's success in project management compared with the City of Austin's; one only needs to compare the school construction project with the new city airport.²⁶ A paid staff accountable only to the GAATN Board of Directors could help maintain good working relations between the members.

Network Expansion

The benefits of the GAATN network will not go unnoticed. As the Austin area continues to grow, additions to the GAATN network will be needed. GAATN staff could help with strategic planning and communication among the members to see that future expansions remain advantageous to the organization.

Future Use of GAATN

As the GAATN members continue to utilize the network, and networking technologies evolve, GAATN is well situated to finally be put to its intended uses. While the mission critical police, fire, and EMS uses make up an important component of GAATNs value, it is applications like distance learning and its use by libraries and government service agencies that will return additional value to the community. In particular in the Austin area, applications like telecommuting could help alleviate traffic and air pollution problems, as well as recover time lost in traffic jams. There are a number of obstacles to broadening the reach of GAATN, as well as a number of exciting possibilities that may yet come to fruition.

Innovation

The University of Texas at Austin and Texas A&M will continue to be involved in developing and deploying high-speed broadband networks. GAATN helps connect these two universities to the Internet, and is essential in supporting research into emerging networking technologies.

The Radio Coalition is an organization made up of public sector organizations with the need for two-way wireless communication. Law enforcement, fire, and EMS units, as well as other public safety organizations are working to establish reliable and cost-effective wireless communications. GAATN will be used by the City of Austin, Travis County, and the LCRA to provide inter-tower communications for these services.

Community Services

GAATN retains the potential to provide a wide variety of services to members of the community who could not otherwise afford them. While the City of Austin has used GAATN to enhance public safety, it has yet to provide any form of public access over

the network. GAATN fiber exists at all city police, fire, and EMS stations, all public libraries, and all city offices, but has yet to be utilized.

The City of Austin is also funding a number of TeleCommunity initiatives, but these are also not utilizing GAATN fiber.

The difficulties of AISD in completing their network have also prevented the potential benefits of GAATN from being enjoyed by schoolchildren and teachers in AISD. In addition, the location of GAATN fiber at every Austin school could potentially serve as a community access point after school and on weekends. Unfortunately, it remains to be seen whether this will happen.

Time-Warner connection with GAATN

While the use of AISD and COA facilities are one way in which citizens could access the Internet and utilize other services using GAATN, other potential interconnections between GAATN and private-sector networks exist. The City of Austin Cable Franchise agreement with Time-Warner calls for “a direct fiber connection between Grantee's headend and the Greater Austin Area Telecommunications Network (GAATN) network control center in order to provide for GAATN video feeds or data that need to be routed to the subscriber PEG access channels.”²⁷

Time-Warner has been in the process of upgrading its network to a fiber-optic backbone, and is currently deploying a cable modem service in the Austin area. A direct interconnect with the GAATN network could bring interactive educational content from UT, AISD, or ACC onto the subscriber cable-modem network without having to travel across the Internet. In addition to distance learning applications, cable modem access from the Time-Warner network direct to GAATN could provide a number of opportunities for GAATN members employee's to telecommute to work, reducing traffic and pollution.

A recent City Telecommunications Commission meeting discussed the potential of connecting the subscriber network with GAATN, but little details of the City's discussions with Time-Warner were revealed.²⁸

Time-Warner has taken the firm position that it will comply with the cable franchise agreement to the letter, and will supply a one-way single fiber connection from GAATN to the subscriber PEG access channel. A Time-Warner official repeatedly described GAATN as a private commercial network, and was unable to grasp the either the potential revenue generation or service to the community that a robust connection arrangement could provide.²⁹

The interconnection with Time-Warner remains a significant unresolved policy problem for GAATN. The GAATN Board has officially asked the City to pursue interconnection with Time-Warner. It is now up to the Office of Telecommunications and Regulatory Affairs (TARA) to resolve the issue. Where the City may choose to abide by the current franchise agreement, GAATN's educational members and students throughout the Time-Warner service area could benefit greatly from a revised agreement between Time-Warner and the City of Austin.

It is important here to repeat that one of the original incentives for AISD to begin the process that led to GAATN was the unreliability of the Institutional Network (INet). This network was built by the original cable franchisee as part of the community service component of the franchise agreement. Both AISD and Travis County found the network to be unreliable. The INet is scheduled to be upgraded to fiber optics in 1999, and considering the past problems the City has had with the INet, it would seem that city officials could negotiate an interconnect agreement with Time-Warner that could compensate for these past problems.

Content and Services sharing among GAATN participants

Absent any favorable agreement with Time-Warner, there remains the potential for GAATN to be used for distance education and other purposes. However, it is here that policy decisions and technological ones need to be made in concert. The network topology of GAATN is one of interconnecting rings and nodes, with a central Network Operations Control Center (NOCC).³⁰ Since each of the GAATN participants owns their own fiber, cross-connections would have to be made in order for content or services to be shared. UT already provides Internet access for all GAATN members through a connection at the NOCC.

In order for these connections to function seamlessly, compatible networking standards have to be used. It is in this situation where the sharing of technical experience among the GAATN members has been extremely helpful. UT was one of the first experimenters with ATM technology in 1994.³¹ ATM technology allows voice, video, and data cells to use the network simultaneously at extremely high speeds. UT and ACC have deployed ATM technology, and Travis County and AISD are also planning to use ATM technology as well. ATM can also be deployed over the SONET rings used by the City of Austin, LCRA, and GSC. With a standardization on SONET/ATM as a networking architecture, GAATN content and services could be easily shared across the network.

A common networking protocol, TCP-IP, is what made the Internet possible. Using TCP-IP over cooperatively owned fiber optic networks with shared content and services could provide affordable broadband access to schools and communities long before private corporations found it profitable to do so. The University of Texas has leased fiber capacity from the LCRA to reach its' San Antonio campus. Any content

exchanged between these two campuses could conceivably reach anywhere on the LCRA or TEX-AN III network, by cross-connecting using GAATN.

Students across the state could communicate and work collaboratively on a wide variety of subjects using this type of arrangement. Distance education courses could be provided to rural schools and communities across the state. Public service and safety can be greatly enhanced by these cooperative networks.

However, the intellectual capital and bureaucratic finesse needed to build and maintain cooperative telecommunication networks is not common, and the survival of networks such as GAATN is by no means certain. The potential for networks like GAATN to collapse in an expensive failure, either from misguided technology decisions or political infighting are all too real.

Conclusion and Recommendations

The Greater Austin Area Telecommunications Network, in spite of delays and growing pains, still has the potential to deliver reliable, affordable broadband services to the participating entities. The GAATN members have succeeded in building a network, but now they must operate and maintain it. This will require a combination of technical expertise and management capability, in combination with vision and the ability to find consensus among seven disparate bureaucracies.

Credit is due to all the men and women who worked to make GAATN a reality. The cooperation, collaboration, and expertise necessary to build the network will become even more necessary in order to maintain it. There are a number of things that the GAATN members will have to do in order to maintain the network.

- ***Maintain a strong and technically competent Board of Directors***

The planning and construction of GAATN would have been impossible without the expertise and dedication of its board members. Both design and construction

oversight have benefited from the technical background of many of the board members. It is to the benefit of all of the members that this technical expertise be shared.

- ***Build and maintain a GAATN staff***

To minimize the risk of conflicts of interest, and maintain accurate record keeping and documentation of the network, the GAATN board needs to consider hiring competent and dedicated staff capable of working with all the members to maintain and expand the network. In addition, staff could provide the necessary competence to oversee any contracted construction or maintenance on the network. The aerial nature of 85% of the network being the low wire on utility poles guarantees teardown, and staff could act quickly to respond to any emergencies, as well as follow up to see that proper repairs are made, and damages are paid.

- ***GAATN Board members must maintain an accurate accounting of network costs and savings to their particular organization.***

Few if any GAATN Board members are also high ranking officials of their own organizations. Construction for GAATN was paid for by using bond money, donated right-of-way, and other means. The operating budget for GAATN should accurately reflect the value of the network. Board members must have access to the financial data necessary to perform cost-benefit analysis of the network, in order to justify proper maintenance and equipment upgrades. Staff could also be utilized to coordinate with GAATN members to achieve economies of scale in purchasing, as well as the sharing and resale of networking equipment between the partners as demand for network services rises.

- ***GAATN Board members need to work to share the network between members and with the community.***

By standardizing networking protocols and working together to purchase equipment, GAATN could vastly improve its utility to the community. In addition to the technical subcommittee, the GAATN Board should appoint an educational subcommittee made up of representatives from UT, ACC, and AISD, and a public safety and network security subcommittee made up of representatives from COA, TC, GSC, and the LCRA. GAATN has the potential to serve a number of joint constituencies among its members, and these subcommittees could serve to coordinate planning and assess needs as the network evolves.

- ***GAATN Board members need to work to both expand and interconnect the network with both public and private sector networks to better serve the community.***

As the experience with the INet has shown AISD and Travis County, depending on a franchisee to provide reliable communications is not a good idea. The current reluctance of Time-Warner to even consider the idea of a robust connection to GAATN could be construed as a regulated monopoly failing to meet its public service obligations. Policy makers within the GAATN membership should work together and with Time-Warner officials to work out an equitable arrangement to interconnect GAATN with the subscriber network. Board members should also work together to interconnect with the TEX-AN 2000 and LCRA fiber networks as well, to further leverage GAATN's potential to serve the community.

These are but a few challenges ahead for GAATN. The popularity of the Internet has demonstrated the myriad of uses that networked communication can provide to communities. Public safety, health, and education as well as open government and free speech are cherished values of a democratic society. To connect these values at the speed of light makes sense for the 21st century.

Endnotes

- ¹ Ullrich, Jim. Personal interview. 4 November 1998.
- ² *ibid.*
- ³ <http://www.ci.austin.tx.us/gaatn/interlocal.htm>
- ⁴ <http://www.ci.austin.tx.us/gaatn/ilagree1.htm>, <http://www.ci.austin.tx.us/gaatn/ilagree2.htm>
<http://www.ci.austin.tx.us/gaatn/ilagree3.htm>
- ⁵ Ritchie, Barbara. Personal interview. 14 October 1998.
- ⁶ Copelin, Laylan. "Mistakes add time, costs for schools; Planning errors cause delays". Austin American-Statesman 8 November 1998. : A1.
- ⁷ Weseman, Gary. Personal interview. 4 November 1998.
- ⁸ Jordan, Patrick. Telephone interview. 23 October 1998.
- ⁹ *ibid.*
- ¹⁰ Zoromsky, Steve. Telephone interview. 25 November 1998.
- ¹¹ Lott, Tom. Telephone interview. 25 November 1998.
- ¹² Quartermaine, Keith. Telephone interview. 25 November 1998.
- ¹³ <http://www.tex-an.net/1998report.htm>
- ¹⁴ *ibid.*
- ¹⁵ Fluor Daniel Report submitted to Commissioners Court of Travis County. 1 February 1996.
- ¹⁶ *ibid.*
- ¹⁷ Beeman, Mike. Personal interview. 21 October 1998.
- ¹⁸ Powell, Brad. Telephone interview on 1 December 1998.
- ¹⁹ <http://www.utexas.edu/cc/newsletter/nov97/gaatn.html>
- ²⁰ *ibid.*
- ²¹ *ibid.*
- ²² Bard, William. Personal interview. 6 October 1998.
- ²³ GAATN Board of Directors working group meeting. Personal notes. 9 November 1998.
- ²⁴ *ibid.*
- ²⁵ Picazo, Linda. Personal interview. 9 November 1998.
- ²⁶ Miott, Debbie. "Flight check: six months to opening; all systems go on airport project." Austin American-Statesman 1 November 1998.: A1.
- ²⁷ <http://www.ci.austin.tx.us/telecom/acvfran3.htm>
- ²⁸ City of Austin Telecommunications Commission meeting. Personal notes. 18 November 1998.
- ²⁹ Agraz, Lydia. Telephone interview. 1 December 1998.
- ³⁰ <http://wwwhost.ots.utexas.edu/gaatn/gaatn-map-lg.gif>
- ³¹ <http://www.ots.utexas.edu/utnet/utnet-evolve/utnet-evolve-27.html#HEADING27-0>