

North Carolina Statewide Telecommunications

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for
North Carolina General Assembly
Government Performance Audit Committee
December 22, 1992

Issue Statement

The objective of this paper is to assess the degree to which the statewide telecommunications networks should be consolidated and managed on a centralized basis, and to identify opportunities for operational efficiency and technological enhancement. The paper responds specifically to the special provisions of Senate Bill 1205 which require a study of various audio and video networks of the State.

Background

There are six major physically distinct wide area networks (WANs) supported by the State. They are:

- North Carolina Integrated Network
- Administrative Office of the Courts
- MCNC CONCERT Video
- MCNC CONCERT Data
- LINCNET
- University of North Carolina Center for Public Television

A description of each of these six networks is provided below.

■ State Telecommunications Services (STS)

Under the overall direction of the State Information Processing Services (SIPS), STS operates a statewide integrated digital network, the **North Carolina Integrated Network (NCIN)**. NCIN actually consists of three distinct interconnected networks:

- A network to connect users with SIPS' IBM mainframe computer on a dedicated basis;
- A network for low-speed dial-up access; and
- A network that is associated with INTERNET.

In addition, STS provides the state with local, intra/interstate, and international voice services.

■ Administrative Office of the Courts (AOC)

AOC provides low-speed data communication service to every county and to a total of 105 courthouses. This network is for dedicated connections to AOC's IBM mainframe computer. Ten professionals are in the Communications & Network division providing network support to AOC.

■ **Microelectronics Center of North Carolina (MCNC)**

MCNC's CONCERT network is a private backbone network that interconnects nine of the State's universities and its four medical schools. The network uses both microwave and optical fiber technology. Comprising this backbone are two technically and functionally distinct networks:

- **MCNC CONCERT Video** is an interactive video network. It consists of 3 high quality video channels interconnecting 18 institutions and some 42 total facilities. It is utilized extensively for remote classroom and conferencing by collaborating researchers, faculty and students across the State.
- **MCNC CONCERT Data** is a high performance data network. It consists of multiple high capacity circuits interconnecting more than 50 university, education and research organizations, as well as over 100 North Carolina businesses. It provides direct connection to INTERNET and to the National Science Foundation network (NSFnet).

■ **University of North Carolina Educational Computing Services (UNCECS)**

UNCECS operates the LINCNET network. LINCNET provides library access to UNC host computers, 58 community colleges, 8 health centers, 9 private colleges and universities, the State library, and a growing number of public libraries. It is a low-speed data network that utilizes parts of the backbone networks of STS and MCNC. UNCECS has plans to upgrade its data processing facilities and to make a corresponding upgrade of LINCNET to provide greater capacity.

■ **University of North Carolina Center for Public Television (NCCPTV)**

NCCPTV is North Carolina's statewide public television network. More than 90 percent of the State's 6.6 million people can receive the Center's broadcasts. Operating the State's largest video production facility, the Center distributes programming via one-way microwave technology.

These six physically distinct wide area networks serve as the primary transport mechanism for most other departments of the State to move information electronically. Some of those departments, such as the Department of Transportation and Department of Human Resources, are major users of STS' NCIN. Also, the Department of Public Instruction's Uniform Education Reporting System (UERS) utilizes NCIN for transmission to 1,800 schools and 129 local education agencies.

While these network users relinquish ownership and operation of their transport to STS, the Division of Criminal Information (DCI) utilizes the NCIN circuits but manages them itself (i.e., performs network problem identification and correction) in accordance with Department of Justice regulations. DCI's share of the NCIN is known as the **Police Information Network (PIN)**.

There is an additional seventh physical network, the Highway Patrol microwave network. It was not specified in the special provisions of Senate Bill 1205, and since it also serves no other departments or functions, it was not included in this study.

From the operational reviews performed, it is estimated that the State's current network operations statewide cost at least \$35 million annually. Of this, approximately \$24 million is under the auspices of STS and \$7 million under NCCPTV.

From a governance perspective, there are at least seven separate network managers in the state (the six which govern their own physical networks, plus DCI). STS was given centralized management responsibility for the State's voice and data communications networks in 1983. On the whole, most voice services are provided through STS. However, the number of separate data networks suggests that there has been a breakdown in STS carrying out its charter to centralize control of data communications.

Findings and Recommendations

Our findings and recommendations focus on three primary areas:

- Network consolidation and integration;
- Network governance; and
- Network cost control.

Network consolidation and integration:

Finding 1 -- There is duplication of physical networks across the State.

There are at least three instances of physical duplication across the networks.

Specifically, UNCECS' LINCNET utilizes STS and MCNC circuitry, particularly for its backbone. But UNCECS owns and operates its own local circuits within the campuses and the connections from the campuses to the STS and MCNC backbone networks. It has a staff of five professionals who manage the wide area network and assist users with their local area networks (LANs). It is estimated that at least half of LINCNET's \$350,000 annual network cost is for circuits provisioned and maintained by UNCECS.

A second duplication of network ownership and operation is the AOC network. Once a part of STS' NCIN, in the mid-eighties AOC split from STS and developed its own network and technical staff because it was dissatisfied with the level of service provided by STS. AOC reports that its current \$375,000 annual network cost is less than what STS would charge, but such rationale appears not to account for out-of-pocket incremental STS costs and AOC overhead costs.

Third, while portions of the MCNC CONCERT data network are most efficiently transported over MCNC's microwave network for interconnectivity of its major university and health institutions, there are other portions of its network that support broader state coverage that duplicate coverage and services offered by STS.

All of these networks are planned and managed separately to support their respective user communities. As a result, some of the networks do not interconnect.

Recommendation 1 -- The State should evaluate consolidating two of the six physically separate networks into the others.

LINCNET into NCIN and CONCERT Data -- Specifically, the State should consider migrating those portions of UNCECS' wide area network that are currently owned by UNCECS over to the STS NCIN and MCNC CONCERT Data networks. This should be accomplished in conjunction with UNCECS' upgrade of its computing platforms and as a first step toward eventual migration to a statewide broadband (high capacity) network. UNCECS

would continue to provide support to the universities and colleges for intra-campus communications.

AOC into NCIN -- Similarly, the State should consider transferring AOC's network back to STS' ownership and management. This action should be contingent upon an independent study verifying that incremental operating costs (including incremental overhead costs) are lower under STS, and a service level agreement with STS that meets AOC's requirements for network service.

Lastly, those segments of the MCNC CONCERT Data network that can be efficiently provisioned and managed by STS should be migrated over to STS NCIN.

Finding 2 -- *There is duplication of network management on a single shared network.*

The 436,000 daily transmissions over DCI's PIN network in support of the Bureau of Motor Vehicles, state police departments and local law enforcement agencies are transmitted over NCIN. However, DCI maintains operational management of the network in compliance with the federal Department of Justice's network security requirements.

Recommendation 2 -- *The State should investigate transferring DCI's network management back to STS.*

The State should approach the Attorney General to consider initiating a request of the federal government to recognize the technical capability to maintain network security for PIN on a shared physical network. For example, encryption of PIN communications may satisfy the federal government's security requirements, in which case all of DCI's PIN network could be integrated into STS' NCIN.

Finding 3 -- *There is an overlap in broadcast production facilities between the Department of Administration's Agency for Public Telecommunications (APT) and NCCPTV.*

Each agency broadcasts a single channel of television programming. APT uses a single satellite uplink in Raleigh and NCCPTV uses a 44 site one-way microwave system to 10 public television stations and over 250 cable companies.

However, there are a number of factors that make it difficult to share basic broadcast resources:

- The agencies' broadcasts are for different purposes. APT's are in support of state government, whereas NCCPTV's are for general public consumption.
- The agencies broadcast to different receivers during concurrent time periods. APT currently utilizes satellite downlinks at public schools, community colleges and several public and private universities and hospitals, and transmits via cable TV into homes. NCCPTV is beamed as a UHF channel to all state residents.
- Both production facilities are currently being utilized at full capacity.

Recommendation 3 -- *Continue promoting the sharing of facilities and resources through additional connectivity between APT and NCCPTV.*

An example is the shared development and use of closed captioning. Additional levels of resource sharing may be possible in 1994 when the public television interconnection system is scheduled to expand its satellite transmission capacity. At that point, NCCPTV will be able to expand its broadcast capability to multiple channels; and a consolidation of the two agencies broadcast facilities would become technically feasible.

Finding 4 -- *DPI and the community colleges were both specified in Senate Bill 1205, but neither owns nor operates its own physical network.*

However, both take effective advantage of other state network facilities. For example, DPI uses APT's network for distance learning in conjunction with the 70 high schools it currently serves. DPI's Uniform Education Reporting System (UERS) utilizes the STS NCIN data network for transmission to 1,800 schools and 129 local education agencies.

Network governance:

Finding 5 -- *There is limited coordination of telecommunications planning and operations across State departments and agencies.*

The State has centralized management responsibility for its voice and data communications network in STS. However, there is no corresponding management structure within each of the agencies that use STS, nor formal management connection back to STS. This makes it more difficult for STS to work effectively with the agencies on their telecommunication needs.

For example, STS formed the Network Planning Committee to perform the advanced network planning and evaluation of a statewide broadband network. But this critical study remains driven predominantly by STS and MCNC. There is only limited participation by other State entities. Indeed, there is at least one significant network user who, until recently, was not even aware of the Network Planning Committee's pursuit of a statewide broadband network.

Recommendation 4 -- *The State should establish stronger centralized governance over its wide area networks.*

The recommended governance structure would have three components:

- **Director of Statewide Telecommunications**
- **Telecommunications Advisory Board (TAB)**
- **IRM Commission** with authority expanded to include statewide telecommunications

The recommended governance structure is explicitly intended not to infringe on the authority of any other agency regarding its programmatic responsibilities and its need for telecommunications support in the delivery of its services. This centralized governance would apply to the networks only as the transport mechanism to move information. All telecommunications applications would remain under control of their current respective governance structures.

For example, a decision on the format for a distance learning application (i.e., 2-way video versus 1-way video with 2-way voice) would remain in the province of the educational institutions involved. The governance structure would have the authority to review and approve the selection of the network to be used and the choice of other related telecommunications technology.

Local area networks would also remain under the governance of individual entities, but such entities would be responsible for meeting standard end user/WAN interfacing specifications established by the governance structure.

Director of Statewide Telecommunications -- This function is necessary because it establishes accountability for the effective coordination of the states networks. The position would have telecommunications responsibilities analogous to the current Deputy Controller for Information Resource Management (IRM). It needs to be a separate position from the Deputy Controller for IRM to avoid vesting too broad a scope of responsibility in a single position. The Director of Statewide Telecommunications would:

- Provide functional oversight and coordination to managers of all physical wide area networks.
- Provide support and direction to all entities that use the State's wide area networks.
- Be responsible for development of a statewide strategic plan for telecommunications for approval under the governance structure. This plan should document anticipated users' voice, data and video needs, and provide the direction the State should take with its network architecture and technologies.
- Assume direct line authority over STS.

For a discussion of the related organizational recommendations, please refer to the issue paper on the Organization of State Administrative Support Services

Telecommunications Advisory Board -- The State should create a Telecommunications Advisory Board whose responsibilities would be analogous to the SIPS Advisory Board, including providing user input to the Director of Statewide Telecommunications and his/her individual managers of the wide area networks. TAB would be comprised of representatives from all State network users.

IRM Commission -- Finally, the responsibility and representation of the IRM Commission should be expanded to cover statewide telecommunications. The TAB chairperson would be a designated member, and membership should allow for representation of major telecommunications users not already eligible.

Network cost control:

Finding 6 -- *A statewide broadband network and its enabled interactive video applications will require major capital investments and annual operating costs.*

As citizens' demands on the State grow, North Carolina government managers must search for better ways to deliver mandated services. The new service delivery mechanisms are likely to require greater use of LAN interconnections, telemedicine, geographic information systems (GIS), image processing, video conferencing, library access, educational TV, and the like. And each of these will require increases in network bandwidth, i.e., greater network capacity to accommodate them. A statewide broadband network will be able to support those needs.

A major planning effort for such a broadband network has been underway through the leadership of the STS-sponsored Network Planning Committee, with significant support from MCNC. In addition to providing increased "bandwidth on demand," the new broadband technology must facilitate implementation of a standard network protocol for all statewide networks, be capable of statewide geographic coverage, prove reliable, and be implementable within cost constraints. There are several technologies/standards being developed by the telephone companies that meet some or perhaps most of these requirements. One such technology is the heart of what has been offered to the State in a joint proposal by Carolina Telephone, GTE and Southern Bell.

The costs for the proposed technology have not been made public. However, order-of-magnitude estimates of annual recurring network costs are in the following ranges:

- \$4.4 million for 57 sites in 1993
- \$16.5 million for 178 sites in 1994
- In addition, one-time costs for equipment to support 2-way video, voice and data are initially projected at \$137,000 per site.

These figures are preliminary in nature. They do not reflect anticipated cost reductions typically associated with technological advancements, volume pricing or contract negotiations, nor do they reflect off-setting current costs to provide some equivalent functionality.

Recommendation 5 -- *The State should continue to pursue the feasibility of migrating to a new broadband technology.*

The Director of Statewide Telecommunications and the Telecommunications Advisory Board should assume sponsorship of the Network Planning Committee from STS and continue the evaluation of technology such as that jointly proposed for the State by the three providers (Carolina Telephone, GTE, and Southern Bell). That proposal would appear to offer significant operational advantages for the potential applications previously mentioned. Moreover, the telecommunications industry believes that the technology proposed at this time appears to be reasonably compatible with the still evolving, highly touted ATM technology that will someday support voice as well as data and video on a single network.

Primary concerns about the continued pursuit of the State's broadband network center around the following:

- Its cost feasibility and associated funding

- Its reliability; within North Carolina, it is running only in a laboratory environment
- The ability of the providers to deliver the network as proposed
- Substantiation of user demand for such increased bandwidth and realizable value from the applications

Appropriate next steps toward gaining State funding would be a comprehensive cost analysis and development of a pilot program.

Finding 7 -- *Maintenance to MCNC's microwave network will require recurring annual investments.*

MCNC's existing microwave backbone uses an analog technology that needs to be phased out over the next ten years, if for no other reason than to respond to the recent FCC ruling that reassigns MCNC's current transmission frequencies to personal computing. Bandwidth utilization is close to maximum capacity now, and as user demands increase, so will the need to expand the network. Thus the entire network will need to be replaced and/or expanded in the coming years. MCNC's current policy is to install optical fiber from the local telephone operating company when expansion or replacement of any segment of its network is required.

Recommendation 6 -- *MCNC should continue its practice of replacing/expanding its analog microwave segments with optic fiber provided by common carrier.*

As capacity constraints and demand growth require MCNC to upgrade its network a segment at a time, its current upgrade practice will eventually satisfy the FCC ruling and also position MCNC to integrate its future fiber-only network into the statewide broadband network.

Finding 8 -- *The State may have to fund the current 2-way video pilot projects to continue them through the next biennium.*

Three pilot projects are underway on two-way video conferencing for distance learning and remote medical diagnosis. They are each being funded by a non-state grant which expires in 1993. If the State chooses to continue those pilot projects, it will either have to persuade the sponsors to extend their grants or it will have to appropriate the necessary funds.

Recommendation 7 -- *The State should evaluate these projects to justify any required appropriations..*

Each project will continue as a pilot until it either becomes operational on the planned broadband network or until it is terminated. Once the State takes over the financial burden of a pilot project from its sponsors, it will own that burden for the life of the program. The State should closely evaluate the second year findings and conclusions of the distance learning pilots to validate their functional effectiveness in supporting training in the schools, homes and state agencies before it relieves the vendors of their financial sponsorship of the pilot projects.

Finding 9 -- *The proposal to broadcast gavel to gavel coverage of the General Assembly sessions requires a significant investment in technology.*

This proposal requires the purchase and installation of satellite receiving equipment in public libraries and also retrofitting the satellite uplink to accommodate "Ku Band." APT's uplink is currently limited to transmitting one "C Band" video stream at a time. A retrofit of the uplink on the Administration building to support both C and Ku Bands would enable APT to send two video streams. The cost of such a retrofit and the purchase of 100 satellite receiving dishes, net of federal matching funds, has been stated as \$314,175.

Recommendation 8 -- *The State should delay funding this investment until users' needs and benefits have been delineated and justified.*

Before the State considers the merits of the technology investment, it should validate both the need and the expected value of the program that requires that equipment. Once the program has been approved, then the technology question merits consideration. New compression technologies may make alternative (non-satellite) methods of transmission more effective and may provide a broader range of coverage.

Finding 10 -- *UNCECS' LINCNET will need to be upgraded to accommodate the UNC library system upgrade.*

LINCNET is based upon a low speed technology that does not support greater bandwidth applications, such as file/catalog transfer, desired by UNCECS. The Triangle-area library network (TRLN), which consists of Duke University, NC State University and UNC-Chapel Hill, has developed a higher speed network based on a different technology that better serves the educational community. UNCECS needs to upgrade LINCNET to this same technology.

Recommendation 9 -- *LINCNET should be upgraded to the same technology as TRLN.*

This will make LINCNET compatible with TRLN and support such applications as catalog transfers. Equally important, it will make LINCNET more compatible with STS' and MCNC's networks, serving as a stepping stone toward integration of LINCNET into the State's planned broadband network.

Finding 11 -- *There are two situations where State contracts for voice services are fragmented, thereby exposing the State to cost inefficiencies.*

- There are approximately 29,000 Centrex lines installed in state entities in North Carolina. Many of these Centrex users (at a minimum, the Department of Public Instruction and the community colleges) have independent tariffs. This means that they are being charged rates tariffed for any single user in that particular operating telephone company's servicing area. They do not have the benefit of a potentially lower rate negotiated on the basis of the State's total volume of usage of Centrex service in the area.
- STS has at least seven separate current or pending contracts for long distance InterExchange Carrier (IXC) voice service. These services are:
 - Outbound domestic traffic with Sprint;
 - Interstate 700 service under MCI's Vnet

- Voice overflow and data backup under AT&T's Megacom service
- 800 traffic with AT&T, MCI and Sprint;
- Credit card service with MCI
- Outbound international traffic in process of being bid
- T-1 circuits, primarily with AT&T

In addition, the 17 universities just went through an InterExchange Carrier bid process for all university traffic, which was won by AT&T.

Recommendation 10 -- *The State should negotiate maximum discounts on statewide contracts for Centrex and IXC voice services.*

The State should take advantage of both the size of its networks and its negotiating leverage based on its total volume of traffic to pursue maximum discounts from statewide operating telephone companies on Centrex and IXC contracts. Specifically, it should:

- Pursue a single statewide Centrex tariff with each geographic carrier (Carolina Telephone, GTE and Southern Bell). It is estimated that this could yield a minimum annual cost reduction in the \$300,000 range.
- Solicit a competitive bid for a single bulk discount agreement with the IXCs for long distance services. All three primary IXCs offer greater discounts under custom bulk discount agreements for users whose IXC revenue exceeds \$2.5 to \$3 million annually. With 800 portability coming May 1, 1993, large users are in a "buyer's market." These two factors together suggest that the State's annual cost reduction through negotiating such an agreement could exceed \$150,000.

Implementation considerations

Staffing implications. It is estimated that the consolidation of the six physical networks into four should yield a net reduction of between four and seven communications technicians and analysts. This reflects offsets in AOC and UNCECS staff reduction by necessary increases in STS staffing. A more thorough study is needed to more specifically ascertain staffing implications.

Financial implications. It is difficult to estimate the financial implications of all the projects and recommendations covered in this report. If all the recommendations for consolidation were implemented, an order of magnitude estimate of potential annual savings is in the \$500,000 range. Most of the recommendations in this report's network cost control section represent projects that require a more comprehensive cost/benefit analysis. In most cases, a value has to be placed on the additional functionality and service provided to the user.

Service implications. The major thrust of these recommendations is to enhance the service provided the State's telecommunications users. In the broadest sense this encompasses every resident and employee in the state. For example, a new broadband network would enable the transmission of medical images (X-rays, MRIs, etc.) for diagnostic review at the best hospitals without requiring patients to travel long distances. In crime control/public safety, it would enable court arraignments to be handled by 2-way video systems and the electronic transmission of finger print data bases. As a tool for education, it would put rural as well as innercity students in "virtual proximity" to highly skilled teachers. There are numerous other examples. All represent major advances in the level of services provided to the residents of North Carolina.

References

"The Future Network For All Citizens", proposal by Carolina Telephone, GTE and Southern Bell, Fall 1992

"Telecommunications in Education", Executive Order 136, report by the North Carolina Advisory Council on Telecommunications in Education

"The AOC Network" and "The Future Now"; AOC network configurations and costs

"Report of the Open Government Through Public Telecommunications Study Commission", report to the 1991 General Assembly of North Carolina 1992 session

Various handouts by the following entities at the November 9, 1992 meeting of the North Carolina General Assembly State Computer Services Study Commission: State Information Processing Service; State Bureau of Investigation; Department of Community Colleges; Department of Public Instruction; UNC General Administration; North Carolina Supercomputer Center; UNC-Center for Public Television; and Agency for Public Telecommunications.