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Mr. Larry Povich
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Dear Mr. Povich:

Enclosed per your request is a copy of *Promoting Educational Infrastructure and the Role of the Florida Public Service Commission.*

If you have any questions concerning the report, please call me at (904)413-6834.

Sincerely,

Melinda H. Butler
Public Utility Supervisor

MHB:tf\r-edinfr2
Enclosure

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PROMOTING EDUCATIONAL INFRASTRUCTURE AND THE ROLE OF THE FLORIDA PUBLIC SERVICE COMMISSION

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May 1996

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CHAPTER 1
INTRODUCTION

BACKGROUND

In mid 1995, the Florida Legislature passed the Education Facilities Infrastructure Improvement Act (Florida Act). The purpose of the Florida Act is to ensure its citizens access to advanced telecommunications services. Such access is expected to complement educational services by increasing the use of educational telecommunications infrastructure. This, in turn, is expected to give Florida a better-trained work force that can compete economically with other states as well as other countries.

There are many organizations in Florida that will play a role in increasing the use of educational infrastructure. The Florida Act created the Florida Distance Learning Network (FDLN) and gave it the responsibility of coordinating the improvement of distance learning efforts throughout the state. The FDLN board is made up of a broad range of representatives of both educational telecommunications infrastructure end users and educational telecommunications service providers.

Many organizations have also been affected by the federal Telecommunications Act of 1996. There are provisions in the federal act that are designed to increase the use of educational infrastructure on both the federal and state levels.[1]

PURPOSE

The purpose of this paper is to address the appropriate role of the Florida Public Service Commission (FPSC) in fostering the use of educational infrastructure in Florida. This paper examines three areas that can provide insight into the appropriate role of the FPSC. First, the regulatory actions taken by other states as identified by a survey of state commissions are examined. Second, the relevant laws of the State of Florida, the current status of the FDLN, and the federal Telecommunications Act of 1996 are analyzed. Third, Florida's continuing needs for further infrastructure development and use are explored via a survey of 67 school districts (K-12), and a case study of the Leon County Schools (K-12).

[1]Chapter 2 presents highlights of both the Florida Act and the Telecommunications Act of 1996.

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In order for the FPSC to make informed decisions concerning its role in educational infrastructure development, it is necessary to have an understanding of the scope and variety of telecommunications services that can be used to enhance education. Educational infrastructure development must be responsive to the needs of customers, but is constrained by the current state of technology. The following sets forth the current scope of local exchange company (LEC) telecommunications services and their capabilities.

THE GENERAL SCOPE OF LEC SERVICES

Telecourses and the use of the Internet are examples of technology-based learning applications. The connections required for a school to engage in technology-based learning involve the interface of that school's internal communications infrastructure to that of the telecommunications service provider. Such external connections may be provided over the telephone network, cable TV network, satellite transponder uplink/downlink, or other options such as leased lines and public broadcasting. While cable TV, satellite, and other technologies have great potential, the discussion in this section is focused on the scope of service provision that can be provided over the telephone network.

Range of LEC Infrastructure Capabilities

Distance learning requires transmission of information in one or more of the following forms: voice, data, and/or video. The capability of the telecommunications infrastructure to deliver the various forms of information (voice, data, and video) is generally characterized by the bandwidth. The bandwidth indicates the capacity at which information can be carried in a communications channel.

There are two basic forms of telecommunications infrastructure. One form is analog and the other is referred to as digital. In an analog system, the bandwidth is usually expressed in kilohertz and megahertz. Plain old telephone service (POTS) and human voice communications are examples of analog systems. A POTS line has a bandwidth of 4 kilohertz.

In a digital system, the bandwidth is usually expressed in kilobits-per-second (kbps) or megabits-per-second (mbps). The DS-0 designation is the base unit of the bandwidth measurement of a digital transmission system. With DS-0 service, information travels at a speed of 64 kbps.

An Integrated Service Digital Network - Basic Rate Interface (ISDN-BRI) line is in the middleband of the spectrum and has a bandwidth of 128 kbps.[2] With DS-1 service, information travels at a speed of 1.544 mbps.[3] At the higher end of the spectrum, DS-3 service has a bandwidth of 45 mbps.

LEC Service Applications

Distance learning applications that rely on LEC telecommunications services range from employing basic telecommunications infrastructure to employing advanced telecommunications infrastructure. The continuum of distance learning applications begins with audio conferencing which can be accomplished via the use of basic telecommunications infrastructure. The transport of data in the form of text/image (including Internet access) can be accomplished using either basic or advanced telecommunications infrastructure. Video conferencing usually requires the high-bandwidth associated with advanced telecommunications infrastructure.

Typical LEC services representing various bandwidth capabilities include POTS, Switched 56, ISDN Basic Rate Interface (ISDN-BRI), ISDN Primary Rate Interface (ISDN-PRI), DS-1, Frame Relay, DS-3, and Asynchronous Transfer Mode (ATM).[4] While some applications are best served by a specific service, some applications can be served by a variety of LEC services. For example, Internet access can be supported by services ranging from POTS to ATM according to the transmission speed desired.

Schools have a variety of physical constraints, functional needs, existing technology bases,

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[2]Bonding two 64 kbps ISDN "B" channels can provide a bandwidth of 128 kbps. Bonding three such ISDN lines (6 "B" channels) can provide a 384 kbps, adequate for some video conferencing applications without significant amount of motion.

[3]One megabit per second equals 1,000 kilobits per second. Therefore 1.544 megabits per second equals 1,544 kilobits per second.

[4]POTS can generally serve the individual voice needs and low-speed dial-up data communications needs (up to 28.8 kbps under current modem technology.) Switched 56 service is a generic digital data service that can be used for data communications needs up to 56 kbps. ISDN-BRI can deliver integrated digital voice and data services with a maximum data rate of 128 kbps. ISDN-PRI can offer integrated digital voice and data services with a maximum data rate of 1.544 mbps. T1 (DS-1) service offers digital transmission at 1.544 mbps. Frame Relay is a shared, packet-based data transport service using variable-size data units (frames) and relaying between nodes of the network. It supports speeds from 56 kbps to 1.5 mbps. With proper equipment such as Channel Service Units (CSUs) and Data Service Units (DSUs), data communications with DS-1 rate can be bundled in multiple of DS-0 channels for the desired voice, data, and video applications. ATM uses fixed-size cells and fixed delay communications between the network nodes, supporting interfaces for multi-service platform, enabling scalable and efficient provision of voice, data, and video applications with speeds up to 155 mbps.

and funding constraints. In choosing what services to purchase, schools may want to consider many factors. Schools may want to consider whether to acquire advanced telecommunications services with higher bandwidth capability to support multiple applications. Another important consideration is the ease and economics of migrating to future applications.[5] Schools may also want to consider whether a service may be available from numerous providers. More providers may improve the quality of service and decrease the cost to the end user (the price of the service).

End User Cost Considerations

The costs of connecting to a telephone service provider usually involve installation, recurring, and customer premise equipment (CPE) costs. These costs vary with the types of infrastructure used and many other factors. One factor is the bandwidth requirement. As bandwidth requirements go up, in general the installation and the recurring monthly service charges also rise.[6] With a rise in bandwidth, CPE costs are also expected to rise because the customer may need new or upgraded equipment in order to receive the information at a higher bandwidth.

One cause for the rise in CPE costs is that there is a difference between wiring standards and protocols for computer networks and those for telecommunications networks. To connect the two networks requires accommodations that may be costly.

Computers are usually wired together using 10BaseT cable.[7] Fiber optic cables are typically used in advanced telecommunications networks. In order to complete the connection of the internal infrastructure (the LAN) with the external infrastructure (the advanced telecommunications network), more than one approach could be used. One option is to use fiber optic cables to connect all of the computers in the LAN; however, this option is physically

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[5]For example, currently, the Internet does not generally support broadband applications such as video. However, according to George Gilder's February, 1996 article in ASAP magazine entitled, "Telecom: Goliath at Bay", the Internet backbone is expected to be upgraded to 622 mbps over the next two years. With this upgrade and other innovations, broadband applications may be achievable in the future. With Internet access being one of the most popular technology-based learning applications, whether a system can accommodate migration to a high-bandwidth application is an important consideration.

[6]Table 1-1 contains price estimates of the Bell South services that support applications with various bandwidths. These price estimates were generally based upon the current Bell South tariff.

[7]The internal connection of computers is referred to as a local area network (LAN).

impractical and cost prohibitive. A more practical and cost-effective approach is to extend the 10BaseT cables and wires with equipment such as hubs and repeaters and connect it to the fiber optic cable of the advanced telecommunications network with special transceivers such as bridges, routers, and gateways. In this example, finding a practical and cost-effective solution to connecting the LAN to the telecommunications network may still carry significant CPE costs to the end user.

In order to further explain the specific circumstances for schools in Florida, Chapter 2 contains the results of two Florida-specific studies; a survey of Florida's 67 school districts and a case study of the Leon County School District. Before delving into these specifics, however, it is important to review the laws governing the provision of telecommunications services and infrastructure for educational entities in Florida. Chapter 2 begins with a discussion of the relevant state and federal laws.

Table 1-1

Examples of BellSouth Services and Their Applications and Capabilities

SERVICES	GENERAL APPLICATION[8] (SINGLE LINE)	MAXIMUM DATA TRANSFER SPEED (SINGLE LINE)	INSTALLATION CHARGE	MONTHLY CHARGE
POTS	Voice/dial-up data	28.8 kbps	$56	$20 - $29
Switched 56	Data	56 kbps	$725	$50 + applicable local usage charges
ISDN-BRI	Voice/data	128 kbps	$206	$91
ISDN-PRI	Voice/data/video	1.544 mbps	Unknown	Unknown
DS-1 (T-1)	Voice/data/video	1.544 mbps	$945	$234
Frame relay	Voice/data/video	1.544 mbps[9]	Unknown	Unknown
DS-3 (T-3)	Voice/data/video	45 mbps	Unknown	Unknown
ATM	Voice/data/video	155 mbps	Unknown	Unknown

[8]All services support Internet access at various speeds, limited by the type of service or customer equipment.

[9]From 56 kbps up to 1.544 mbps.

CHAPTER 2
FLORIDA

STATE AND FEDERAL LAWS

In May of 1995, the Florida Legislature passed SB 1554, Laws of Florida Chapter 95-403, which included the Education Facilities Infrastructure Improvement Act (Florida Act). On February 8, 1996, the 104th Congress passed Public Law 104-104, the Telecommunications Act of 1996, (Act of 1996). Listed below are highlights of each law. While these highlights summarize the laws' literal legal contents, the implementation of the laws over time will require interpretation by those parties directly affected. As a result of this process, it is possible that the literal meaning of the laws may not directly correspond with the realities of their implementation.

State Law

Section I of Table 2-1 contains a summary of the revisions to Chapter 364, F.S., by the Florida Act. Section II of Table 2-1 contains the remaining portions of Chapter 364, F.S. that deal with recovery of costs and implementation of preferential rates associated with the Florida Act. Figure 2-1 is a flow chart of the process set forth in the law regarding the provision of advanced telecommunications service to eligible facilities via infrastructure investment. The column to the right in Table 2-1 indicates the potential involvement of the Florida Public Service Commission (FPSC).

Federal Law

Table 2-2 contains the highlights of Title I, Part II, Section 254 of the Act of 1996 which pertains to fostering the use of educational infrastructure in Florida. Table 2-2 also contains the highlights of Title VII, Section 708, National Education Technology Funding Corporation. The column to the right in Table 2-2 indicates the potential involvement of the FPSC.

Conclusion

The FPSC involvement called for by the Florida Act has been identified as:

1. The possible need for suggested interconnection arrangements/carrier of last resort identification, (Table 2-1, Section IB and Figure 2-1).

2. The possible ordering of the contractor or carrier of last resort to perform the agreed upon services and imposition of fines for nonperformance, (Table 2-1, Section IC and Figure 2-1).

3. The approval of cost recovery and the offering of preferential rates by the carrier of last resort, (Table 2-1, Section II).

The FPSC involvement called for by the federal Telecommunications Act of 1996 has been identified as:

1. The determination of the discount to be given by telecommunications providers to elementary/secondary schools and libraries for intrastate universal services.

2. Actions that are consistent with the goal of deploying advanced telecommunications capability in Florida in a timely and reasonable manner.

CURRENT STATUS OF THE FLORIDA DISTANCE LEARNING NETWORK

In formulating the appropriate role of the FPSC in fostering educational infrastructure in Florida, one factor to be considered is the Florida Distance Learning Network's (FDLN's) focus regarding the use of telecommunications technology in the schools (K-12). Those services and/or equipment targeted for FDLN grants, discounts or subsidies for eligible facilities should be known by the FPSC in order for the FPSC to make informed decisions regarding its role.

FDLN's primary focus is disclosed by its name, i.e. the Florida *Distance Learning* Network. FDLN's current definition of distance learning is contained on page 1 of the needs assessment report.[10] The needs assessment report states that FDLN is currently considering a definition of distance learning and that the most popular of the definitions currently under consideration is as follows:

> Distance learning is a term used to refer to teaching and learning situations in which the instructor and learner are separated over distance or time, and consequently, rely on electronic technology for dissemination of educational or instructional programming and print materials to obtain instruction.

Page 2 of the needs assessment report addresses the major components of distance learning. According to the report, the major components are:

- A program/course developer is the person or organization that develops the courses and materials.
- A program provider/instructor is the person or organization that originates the course and materials.
- The program distributor is the organization that distributes the program either directly to sites or to local distributors over the interconnect system. This can also be done by the program provider.
- The interconnect system connects program distributors to program providers and local distributors. A good interconnect system will allow any site to be a program provider.
- Local distributors get the signals to the intended audience. For example, many programs are transmitted by satellite (the interconnect system) to school districts, which then transmit over Instructional Television Fixed Service (ITFS) or cable to individual schools because the schools cannot directly receive the satellite signals.

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[10]Consistent with the requirements of Part II of Chapter 364, F.S. the FDLN developed a needs assessment report by 1/1/96 and a plan for using technology to improve the delivery of and access to education by 3/1/96.

- The remote sites are where the students/learners reside. These could be schools, libraries, campuses, hospitals, businesses, or homes.
- The delivery system connects program providers to remote sites, optionally through local distributors.

This approach to the components of distance learning stresses programs/courses as the distance learning "product".[11] The perspective is further demonstrated on page 44 of the needs assessment report wherein the term "distance learning" is distinguished from:

- Computer-based instruction and the use of computer work stations for independent learning activities;
- Access to electronic databases;
- Video presentations; and
- A variety of other technology-oriented resources.

Based on information contained in the needs assessment report, it is reasonable to conclude that the current FDLN perspective is that it is preferable for distance learning to be accomplished via video conferencing. FDLN's prescription for minimum functionality in the schools (K-12) is consistent with this conclusion.

FDLN's primary focus regarding the schools (K-12) is contained in the plan.[12] The section entitled, " K-12 Education System Technology Plan," contains a minimum functionality plan. This section sets forth three levels of access as conforming to a minimum functionality for K-12. All three levels call for provisioning DS-1. It appears that the minimum standard service prescribed by the FDLN for technology-based learning in the schools (K-12) is DS-1 service.[13] [14]

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[11]Programs/courses is the "product" instead of other possible "products" such as information access via the Internet.

[12]At a FDLN meeting in February of 1996, it appeared that the board's express intent was to produce a plan prior to 3/1/96 that was to be modified at a later date. Therefore, the plan that is referred to in this report is viewed as a draft document.

[13]At the February meeting, the FDLN discussed the need to produce a minimum functionality plan that took into consideration interoperability. It is possible that such a plan has subsequently been produced.

[14]This approach is significantly different than that recommended by the FPSC to the FCC in its reply comments in docket CC Docket No. 96-45 dated May 6, 1996. In these comments, the FPSC made a recommendation to the FCC regarding its implementation of the Telecommunications Act of 1996. The FPSC recommended that the FCC establish a nationwide minimum functionality of Internet access by means of a computer lab with a benchmark

In deciding what the appropriate role is for the FPSC to foster educational infrastructure in Florida, the FPSC must consider, among other things, the FDLN's focus regarding the use of telecommunications technology in the schools (K-12). To date, the FDLN appears to be focusing primarily on encouraging the provision of advanced telecommunications services in the form of video conferencing. In addition, the FDLN has designated DS-1 as the minimum functionality to receive discounted connections and under certain circumstances a discount for ongoing monthly service charges. Given the FDLN's focus, the FPSC may want to consider adopting a role that complements that of the FDLN.

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expenditure that would qualify for a discount. (The dollar amount of the benchmark expenditure would be well below that which would have been required to receive DS1 service.)

Among other things, these recommendations by the FPSC were intended to complement the approach taken by the Florida Act and the FDLN. While Florida's approach, to date, has been to encourage the use of advanced telecommunications services in the form of video conferencing with its relatively high speed and bandwidth, the FPSC proposal targeted a lower level of speed and bandwidth. It is reasonable to conclude that the adoption of the FPSC proposal by the FCC would serve to provide all of Florida's schools with an opportunity for aid either pursuant to federal law or state law.

ANALYSIS OF THE SURVEY OF FLORIDA'S 67 SCHOOL DISTRICTS[15]

Florida's 67 school districts were surveyed by the Division of Research and Regulatory Review to assess the reasons eligible facilities would or would not make needs requests and to estimate the number of requests that will be forthcoming from school districts. The results of the survey are contained in Attachment 2-2.

Of the 67 school districts that were sent surveys, 50 responded in time to be included in the results. This is a response rate of approximately 75 percent.[16]

The survey provided data regarding the reasons why eligible facilities would or would not make requests. The survey also produced information to estimate the number of requests that will be forthcoming from school districts' eligible facilities.

Reasons Why Eligible Facilities Would or Would Not Make Needs Requests

Every school district that responded to the survey reported that there were schools in their district for whom they expect to file needs requests. In survey questions 3A through 3C the school districts were asked to make judgements concerning three infrastructure issues that they might face. The school districts were directed to answer the questions in terms of the eligible facilities for whom they expect to file needs requests (See Table 2-3, I).

Regarding the first issue, 46 of the 50 respondents agreed that significant investment in internal infrastructure would be necessary prior to acquisition of advanced telecommunications infrastructure. In reference to the second issue, 46 school districts agreed that ongoing service charges would be significant compared to their overall annual budget. Finally, 41 school districts agreed that expenditures for advanced telecommunications infrastructure that are beyond the allotted $20,000 will be necessary to meet the telecommunications goals of the eligible facilities in their district.

Twenty-two school districts reported that there are schools in their district for which they do not expect to file needs requests. In survey questions 5A through 5E these school districts were asked to consider five possible issues that could cause an eligible facility not to file a needs request (See Table 2-3, II). The first issue addresses the total cost of advanced

[15]Attachment 2-1 contains the survey instrument and the results of the survey.

[16]Fifty of the school districts responded in time to be included in the results.

telecommunications infrastructure. Of the 22 school districts, 16 agreed that a possible reason an eligible facility might not submit a needs request is because the total cost of advanced telecommunications infrastructure is expected to exceed the allotted $20,000. Ongoing service charges was another issue that carried some weight. Sixteen school districts agreed that some of their eligible facilities might not file a needs request because ongoing service charges would be too costly. On the third issue, 15 school districts agreed that if the necessary internal infrastructure is not in place and is too costly, some of the eligible facilities in their district might not submit needs requests. The school districts placed less emphasis on the last 2 issues. Twelve school districts agreed that an eligible facility might not file a needs request because advanced telecommunications infrastructure is not a priority given that other educational expenditures are more important. Eleven of the school districts agreed that a possible reason an eligible facility might not file a needs request is because advanced telecommunications infrastructure is already in place and acquisition via a technology needs request is not necessary.

Estimate of Forthcoming Requests from School Districts' Eligible Facilities

Of the 67 school districts that were sent surveys, 50 school districts indicate that there are approximately 2,309 eligible facilities. This equates to an average of approximately 46 eligible facilities per school district. Therefore, if the calculation were to be expanded to 67 school districts, 46 eligible facilities per school district could be used to estimate the total number of school districts' eligible facilities in Florida. Using this methodology, it is estimated that the total number of school district eligible facilities in Florida is 3,082.

The 50 responding school districts estimate that needs requests would be filed for approximately 1,971 of the eligible facilities or approximately 85% of the 2,309. To calculate the expected number of school district eligible facilities to file needs requests, it is necessary to make an assumption regarding the rate at which eligible facilities would file. From the results of the survey, it can be concluded that 85% or 2,619 of the estimated 3,082 school districts' eligible facilities in Florida would file needs requests. In examining the school districts' eligible facilities, which is a subset of the overall total of eligible facilities in the state, it can also be concluded that if all of the schools were provided the maximum $20,000 worth of connections, that would create a responsibility of providing almost $52 million worth of value to the school

districts.[17] For LECs to bear the full responsibility of this $52 million, all of the connections would have to be provided in the absence of a bid and with the LEC having Carrier of Last Resort status.

While it is important to consider how many eligible facilities would file needs requests, it is also important to consider whether or not their requests will conform to the FDLN plan. For every eligible facility whose request does not conform to the FDLN plan, the total dollar responsibility for connections diminishes. Another important consideration is whether or not an eligible facility would be likely to require the entire $20,000 for connecting. Some argue that is questionable. Only time will tell how many dollars of value will flow to eligible facilities as a result of the Education Facilities Infrastructure Improvement Act.

[17]Eligible facilities are defined in 364.510(4) F.S.

CASE STUDY OF LEON COUNTY SCHOOL DISTRICT

A case study of the Leon County School (LCS) District was conducted to gain a specific understanding of how telecommunications technology can be used in K-12 settings. Leon County was chosen because it was anticipated that its location would make gathering information easier and, as indicated by a previous study,[18] Leon County offers a wide range of capabilities of schools. This section is based on information acquired via various sources, including an Internet search, a written and telephone query of the LCS, and a query of Sprint-Centel. The Florida Telephone Association was also contacted.

From the school administration to the local community, the LCS is strongly committed to infrastructure investment in technology-enhanced learning. The administration has established various standards and guidelines to support the deployment of technology-based infrastructure in schools. Local entities including Sprint-Centel, Tallahassee Freenet, and Supercomputer Computations Research Institute (SCRI) at FSU have also contributed greatly in providing high quality communications links and technical support.

LCS District Basic-level School Technology Standards/Guidelines

Initially, LCS began with the goal of using technology as one tool in the effort to optimize student learning. As such, in 1992, the "Basic-level School Technology Standards" for Leon District Schools were developed by various groups, including school staff, teachers, and administrators. These standards apply to technology as it relates to instructional delivery and support, information support, and network communications. These standards also provide a basis for planning and implementing appropriate school-based technology for such purposes.

Table 2-4 shows the major components of the technology standards. These standards are the minimum, basic-level requirements in terms of what is needed to optimize student and school performance. Although these standards have been developed, it appears that they are currently serving only as guidelines. It also appears that only limited analysis has been performed to quantify the use of these standards on a school-by-school basis. However, one area in which practice has been quantified is in the number of workstations relative to the number of students. On average, the Leon County elementary school workstation ratio is one workstation to every

[18] *Report on Florida's Telecommunications Infrastructure and Applications*, Florida Public Service Commission, April 1995.

10 to 12 students and the secondary ratio is one workstation to every 7 to 10 students. This compares to the FDLN prescription of one workstation to every 4 students as set forth in its plan.

LCS Telecommunications Infrastructure and Services

For telecommunications infrastructure, LCSs generally follow a model of using LANs to provide internal site connectivity, with a Wide Area Network (WAN) linking the networks together and supporting the access to the District mainframe computer and the Internet. Some smaller sites that are in close proximity are clustered together to reduce ongoing service charges by enabling the sharing of external site-to-site telecommunications infrastructure.

The specific guidelines for equipment characteristics, cabling and wiring, operating software, protocols, and network configuration are documented in the district's LAN Standards and Structured Wiring Specifications. These standards are still evolving to meet technology changes and functional needs. The LCS investment in site upgrades and WAN networking over the past three years has taken into consideration the process of upgrading and replacement of network components and the conversion to new communications protocols.

Two important functions of the LCS network are host (mainframe) access and Internet access. School access to the district mainframe computer is being accomplished by using emulation software, gateway, or other devices depending on the type of computers and LAN protocols. Direct Internet access is being accomplished by connections to Internet service providers such as BBN Planet (formerly known as Suranet) via Sprint-Centel MAN (Metropolitan Area Network). For the sites that are not directly connected to the MAN, dial-up PPP (Point-to-Point Protocol) Internet access is provided through Florida Information Resource Network (FIRN).

Telecommunications services are usually required for WAN networking. Sprint-Centel's MAN provides LAN to LAN connection through the telephone network as opposed to other options such as private or leased facilities. In Tallahassee, the MAN offers the Centel Metropolitan Data Services (CMDS) using advanced fiber distributed data interface (FDDI) architecture. The FDDI MAN can support very high data speeds, up to 100 megabits per second.

As shown in Attachment 2-3, the Sprint-Centel MAN is a ring of single-mode fiber cables that fully encircles Tallahassee. The self-healing ring architecture ensures a redundancy of

alternate fiber routes. The fiber infrastructure supports multiple LAN protocols and future service protocols such as Synchronous Optical Network (SONET) and frame relay. A school's LAN can be connected to MAN by plugging into a bridge and a fiber-optic converter. LCS currently uses dual port connections that provide separate paths for administrative and instructional traffic in order to avoid congestion.

CMDS is a group of telecommunications services designed for LAN inter-networking over the MAN within the metropolitan area of Tallahassee. It also provides TCP/IP connectivity between the Internet and subscribers via connections to FSU/SCRI/Freenet or commercial Internet service providers. Currently, 6 schools are subscribing to CMDS Class V service at 1.5 megabits per second with dual port connection. The Sprint-Centel one time installation charge and monthly recurring charge are approximately at $1,275 and $380 respectively. Another 11 schools are subscribing to a lower speed CMDS Class I service at 56 kilobits per second with dual port connection. The one time Sprint-Centel installation charge and monthly recurring charge of the CMDS Class I service are approximately at $2,000 and $127 respectively.

LCS Internet Capabilities

Internet access has become one of the major LCS technology-based learning applications since project IRIS (Internet Reaching Into Schools) was initiated in 1994 to provide multi-user access to the Internet. The development of IRIS involves the Leon County School District, SCRI at Florida State University, Sprint-Centel of Florida, and the Tallahassee Freenet. The goal of the IRIS project is to connect all Leon County Schools to the Internet, thereby tapping its vast and diverse resources. Teachers and students can therefore benefit from the rapid technological innovation on the Internet and promote educational excellence by facilitating resource sharing, accessing outside information and research, communicating electronically, and exploring various emerging new applications.

As mentioned above, 17 schools currently have direct Internet access via Sprint-Centel MAN. For schools without direct access, dial-up PPP Internet access is available through FIRN. Through Internet, students, teachers, staff and parents can have access to worldwide electronic mail communication, global information and news, as well as the opportunity to correspond with other institutions, public domain and shareware computer software of all types, discussion groups on numerous topics ranging from the environment to music to politics, and many

university libraries.

Internet provides more than merely access to information, it allows exchange of ideas and collaborative learning. Teachers can share lessons and materials so better educational practices can benefit more students. Students can post artwork and interests on their own home page on the Internet World Wide Web. Students can collaborate among themselves and with their teachers on homework and projects over the Internet. The communications link can even reach to other countries and cultures. One such example is a telecommunications curriculum for the Florida/England Connection, developed by the LCS Academic Resource Center in cooperation with the Panhandle Center of Excellence in Math, Science & Technology.

Most of the current Internet applications are text and image. With the dramatic growth in applications and innovations of Internet, particularly on the World Wide Web, potential broadband and multimedia applications may further enhance distance learning technologies over the Internet. Such systems may bring about more choice to students. However, unlimited Internet access may also raise concerns about school internal data security and student access policies such as the access of age-appropriate information.

Conclusion

Depending on the definition of distance learning, there are numerous technologies available to make distance learning possible. The technology-based educational infrastructure in LCSs presents one example of using computer and telecommunications technologies to enhance K-12 education. Through LAN/WAN internetworking and Internet access as the minimum functionalities, schools can communicate with each other, with the district mainframe computer, and with any facilities linked by the global network - Internet.

As for telecommunications services that provide external connection for their internal infrastructure, it appears that LCS has chosen local telephone services to link their LAN to Internet. The services currently used by LCS include POTS for dial-up Internet access, and 56 kbps and 1.544 mbps direct Internet connection via the Sprint-Centel MAN. The CMDS services and their prices are summarized in Table 2-5.

HIGHLIGHTS OF THE FLORIDA EDUCATION FACILITIES INFRASTRUCTURE IMPROVEMENT ACT PART II OF CHAPTER 364, F.S., AND ASSOCIATED STATUTE REFERENCES

Topic	FPSC Action/Participation Required?
I. Florida Education Facilities Infrastructure Improvement Act (364.506 - 364.516,F.S.)	
A. The Florida Distance Learning Network, 364.509 through 364.513, F.S. Objective: Establish a coordinated system for cost-efficient advanced telecommunications services and distance education, 364.509(1), F.S. The Network is governed by a 17 member board of directors from the citizenry, the public sector, and the private sector, 364.509(3), F.S. Initial chairperson: Commissioner of Education for a term of 4 years, 364.509(4)(a), F.S.	No
1. The Board shall coordinate the use of existing resources, including, but not limited to, the state's satellite transponder on Telestar 401 (the education satellite), the Sunstar Network, the SUNCOM Network, the FL Information Resource Network (FIRN), Department of Management Services(DMS), Department of Corrections and the Department of Health and Rehabilitative Services' satellite communication facility, 364.510(2), F.S.	
2. The Board shall assist in the coordination of the utilization of the production and uplink capabilities available through FL's public television stations, eligible facilities (as defined in 364.508, F.S.), independent colleges and universities, private firms, and others, as may be needed, 364.510(4), F.S.	
3. By 1/1/96, the Board shall develop a needs assessment report (to be included in the plan) that describes the overall advanced telecommunications needs of education, libraries, and teaching and rural hospitals. Such a needs assessment report shall also consider the interoperability of different technologies needed for delivery of advanced telecommunications services, 364.510(8), F.S.	
4. By 3/1/96, the Board shall develop a plan for using technology to improve the delivery of and access to education, 364.510(9), F.S. a. The plan is to be submitted to the Governor, the President of the Senate, and the Speaker of the House of Representatives. b. The plan shall include a: 1) component on how advanced telecommunications services and distance learning are currently delivered; 2) component on existing rules and statutes related to the use of technology; 3) statewide inventory of state-owned telecommunications receiving and transmitting equipment that could be used to assist with the distance learning network.	

Topic	FPSC Action/Participation Required?
5. Educational Technology Grant Program, 364.514, F.S. a. Purpose: To support the development of and to provide incentives for technologically delivered educational courses and programs. b. Florida Distance Learning Network shall annually award grants to: school districts, area technical centers, community colleges, state universities, and independent institutions eligible to participate in state student assistance programs established in part IV of chapter 240. c. Proposals shall include, among other things, provisions to use at least 20 percent of any funds awarded for training both faculty and student learners in the use and application of the products (educational programs or services) developed. d. Programs and courses developed through the grant program shall be marketed statewide and nationwide. e. Some portion of any profits from the sale or use of such programs shall be retained by the developing institutions or systems and a portion shall be reinvested in the grant program for further program development. f. The distribution of any revenues received shall be determined by formal agreement between the board of directors and the developing institution. g. The Board shall identify state educational priorities and issue a request for proposals by June 1 in every year in which funds are available for grants.	
B. Infrastructure Investment. Educational infrastructure investment for the provision of advanced telecommunications services to eligible facilities. The DMS reviews technology needs requests from eligible facilities and acquires the advanced telecommunications infrastructure needed to provide the service to the eligible facility. DMS is authorized to utilize a bid process to acquire needed infrastructure. In the absence of responses to a DMS solicitation for bids, the carrier of last resort shall provide the advanced telecommunication services, 364.515, F.S. (See attached flow chart, Figure 2-1.)	Yes, DMS, together with the FPSC, may suggest an interconnection arrangement as means of providing required services. FPSC identifies carrier of last resort upon request from DMS.
C. Penalties for non-performance. Either an eligible facility or the DMS may petition the FPSC for an order enforcing the requirements when the provision of advanced telecommunications services is not performed by the contractor or by the carrier of last resort, as specified. FPSC can order performance of contract agreements or as required of the carrier of last resort if there is no contracted bidder. Continued non-performance ultimately results in FPSC imposition of fines, 364.516, F.S. (See attached flow chart.)	Yes, determination of performance/order to perform, imposition of fine.