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Magalie Roman Salas, Esq.  
Secretary  
Federal Communications Commission  
The Portals  
445 Twelfth Street, S.W., TW-A325  
Washington, D.C. 20554

EX PARTE OR LATE FILED

Re: Notice Of Written Ex Parte Presentation  
CC Docket No. 96-45 ✓  
AAD/USB File No. 98-37

Dear Ms. Salas:

The United States Telephone Association ("USTA") hereby enters into the record in the above-referenced proceedings this letter and the attached report, entitled *Final Report on the Evaluation of Options for the Iowa Communications Network* ("ICN"), by the consulting firm of Ultrapro International, Inc. ("Ultrapro") dated January 11, 1999 (the "ICN Options Report" or the "Report"). Ultrapro prepared the ICN Options Report for the Legislative Oversight Committee of the Iowa legislature. Based on the options being evaluated in the Report, the Iowa legislature is considering whether to dispose of the ICN and the methods to do so.

*The ICN Options Report:* The ICN Options Report provides further evidence that the Commission should deny the petition of ITTC in AAD/USB File No. 98-37 and uphold the decision in the Fourth Order on Reconsideration in CC Docket No. 96-45 that the ICN is not a telecommunications carrier for purposes of universal service funding.<sup>1/</sup>

The ICN Options Report evaluates ten options for the "ownership and management" of the ICN, and presents its evaluations "in a manner that would permit ready comparison of options by the Legislative Oversight Committee."<sup>2/</sup> In addition to the ICN's current status (Option 9, discussed on pages 48 and 50 of the Report), the report describes a variety of possible sale, lease, and restructuring alternatives for ICN.

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<sup>1/</sup> See *Federal-State Joint Board on Universal Service*, 13 FCC Rcd 5318 (1997) at 5426-5428 ¶¶ 187-189.

<sup>2/</sup> ICN Options Report at 1.

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Most notably, the effect of several of the options would be to change ICN's current method of operation to one of common carriage. This of course is acknowledgment that ICN is not now a common carrier. Thus, Option 10 is the creation of a state-owned public utility, which "would open the [ICN] user base up to the general public."<sup>3/</sup> The Report notes that the staff of the Iowa Utilities Board -- the Iowa state telecommunications regulator -- prepared a definition of public utility for this option based on Iowa law. According to the Report, this definition provides that:

[A] public utility is any public or private entity, which furnishes an extensive range of two-way communications service to the general public for compensation.<sup>4/</sup>

ICN does not satisfy this definition because, among other things, it does not serve the general public.

Other options considered in the Report also acknowledge that ICN is not a common carrier. Thus, for example, options 1 and 2, which are different varieties of "Sale of the Network," each states that "School and library users would be eligible for USF/E-rate federal subsidies *if the ICN were purchased by a common carrier.*"<sup>5/</sup>

The ICN Options Report states that "it is appropriate for any user, including government, to provide service to itself; this is not competition with the private sector that provides the service unless the government provides services to the public."<sup>6/</sup> "Itself" in this case refers to "education[, ]libraries, [and] government departments."<sup>7/</sup> But a user that provides services to itself is not a telecommunications carrier because it does not provide service to the public. Thus, by the logic of the ICN Options Report, ICN cannot be considered a telecommunications carrier.

The ICN Options Report conducts its analysis assuming, as the Commission has properly ruled, that ICN is ineligible to receive direct universal service support. If the Commission were to reverse itself, as it should not, the Report's analysis presumably would change substantially based solely on regulatory considerations. There is no policy or legal basis for such a change.

*No Policy Basis For Changing ICN's Status:* The ICN Options Report shows that there are serious issues within Iowa regarding the role of state-owned networks in competing with privately-owned telephone carriers:

**ICN rates:** Industry representatives state that ICN rates are unfairly low, and that it is difficult to compete without a "level playing field." Voice and data services for all ICN users cross-subsidize the low educational video rates. Even with that subsidy element included, *government*

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<sup>3/</sup> See ICN Options Report at 48-49.

<sup>4/</sup> *Id.* at 48 n. 12.

<sup>5/</sup> See *id.* at 40, 41 (emphasis added).

<sup>6/</sup> *Id.* at 32.

<sup>7/</sup> *Id.* at 33.

*employees interviewed do not disagree* that the ratemaking principles for ICN, as mandated by statute, result in voice and data prices that are generally lower *than the rates of common carriers for similar services.*<sup>8/</sup>

The Commission should not inject further direct subsidies into ICN's operations. To do so would further skew the state of competition in Iowa, without advancing the universal service goals of the Communications Act ("the Act"). Indeed, taxes paid by privately-owned Iowa carriers already support ICN.

*No Basis In The Statute For Changing ICN's Status:* If direct universal service support was available to ICN or other state communications networks, those networks would rationally make every effort to take advantage of such support. Yet nowhere in the Act, the Telecommunications Act of 1996 (the "1996 Act"), or the accompanying legislative history is there any indication that state-owned networks are authorized or should be permitted to receive such direct support if they do not qualify as telecommunications carriers. There is no indication in Section 254(h) that the drafters of the 1996 Act contemplated any expansion of the role of state-owned networks unless they qualify as telecommunications carriers. But a reversal of the Fourth Reconsideration Order would have the unwarranted and *ultra vires* effect of providing incentives to state governments nationwide to create subsidized networks in competition with privately-owned carriers that are sources of those subsidies.

Pursuant to section 1.1206(b)(1) of the Commission's rules, four copies of this letter and the attachment are being submitted to the office of the Secretary of the Commission today (two copies for each of the proceedings listed above), and copies are being provided to the persons indicated below. Please include this filing in the public record of each of the proceedings listed above. Please do not hesitate to call if any questions arise in connection with this matter.

Very truly yours,



Porter E. Childers

Attachment

cc: Hon. William Kennard Paul Gallant  
Hon. Susan Ness Kevin J. Martin  
Hon. Michael K. Powell Irene Flannery  
Hon. Harold Furchtgott-Roth Melissa Waksman  
Hon. Gloria Tristani Amy Nathan  
Kathryn C. Brown Lawrence Strickling  
Thomas C. Power Lisa Zaina  
Linda Kinney Jane Whang  
Kyle D. Dixon Valerie Yates

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<sup>8/</sup> *Id.* at 5-6 (italics added).

**Final Report on the  
Evaluation of Options for the  
Iowa Communications Network**

Prepared by

Ultrapro International, Inc.

January 11, 1999

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## I. Executive Summary

The primary objective of this project was to review and evaluate various options for the ownership and management of the Iowa Communications Network (ICN) as previously defined in the House File (HF) 461 Report. The overall goal was to provide a current evaluation of each option in a manner that would permit ready comparison of options by the Legislative Oversight Committee. Ultrapro International, Inc. (Ultrapro) was requested to provide its evaluation in straightforward, easily understandable terms and to avoid conclusions as to the best alternative. In response to that request, this report summarizes Ultrapro's external environment analyses by presenting Technology, Market and Regulatory Principles that the Legislature could use in its deliberations and decisions regarding the ICN. After those Principles were developed, Ultrapro performed its evaluation of the options in relation to the Principles as well as operations costs, capital expenses, and security impacts.

As part of its analysis Ultrapro reviewed the HF 461 Task Force Report and more than 100 other position papers, comments and articles on the subject of ICN. The written material covers ICN from the beginning, underscoring the concern various parties have had about whether to build the network at all and, once built, how best to maintain and utilize it. In addition to reviewing the written material, Ultrapro conducted interviews with representatives of the state government (policy makers, staff, and users), and private industry, to gain a perspective on ICN that might contain insights more recent than those included in the 1995 report of the 461 Task Force.

This report includes an overview of likely technological advances in the telecommunications industry and their likely impact on the ICN. The technologies used in the development and deployment of ICN are communications and computing technologies affecting the entire US economy, and will likely be some of the most important determinants of economic success in Iowa or in the US. These technology advances are forcing major changes not only in the communications market, but also in operations of the users of communications services, including education, libraries and government.

As these new, powerful technologies continue to be deployed in the communications industry, prices have been plummeting in competitive telecom markets. Competition does not yet exist uniformly throughout the US, but the linkage is clear: competition brings new technology, lower prices and a larger array of services. That combination also brings a better economic base and growth prospects for the community in which the competitive telecommunications

market exists. The combination of competition, new technology, lower prices and new services also provides the potential for developing the human capital to drive the new economy.

For these reasons, government has an interest in furthering competition. One of the goals of the Telecommunications Act of 1996 was to foster competition in communications markets so that more rapid technology change could occur for the benefit of consumers and the economy. The Act impacts Iowa and the ICN, primarily as a result of two subjects dealt with in the new law: the potential for increased competition in the market for telecommunications services, and the expansion of the Universal Service Fund (USF). However, both of these items are proceeding more slowly than federal lawmakers and regulators envisioned, and have so far only added to the uncertainty of the analysis of costs, benefits and attractiveness of any disposition of the network. Without new competitors in the local telephone market, sale of the network to an incumbent provider could in fact lessen the amount of competition that currently exists. And, under current FCC rules the ICN does not qualify for Federal Universal Fund subsidies for schools and libraries, whereas the subsidies would be available if the network were taken over by a common carrier. The Iowa Telecommunications and Technology Commission (ITTC) has petitioned for reconsideration of this FCC rule interpretation.

The report provides an evaluation of each option in relation to Technology, Market and Regulatory Principles, as well as other factors. Of the options to be considered, those involving lease or sale of excess capacity are limited by the facilities themselves and by operations issues; those involving total network sale or lease are faced with legal, financial valuation, technical, and industry lobbying obstacles. Of the remaining three options beyond the current mode of operation, two involve state ownership of a common carrier network. The other option, State ownership/private management is an extension of the current mode of operation in which network operations are outsourced to a private company.

## II. Project Scope and Objectives

The primary objective of this project was to review and evaluate various options for the ownership and management of the Iowa Communications Network (ICN) as previously defined in the House File (HF) 461 Report. In addition, Ultrapro was asked to analyze the impact of the various options on the security of State data that traverses the ICN and to identify a process for determining an appropriate number of ICN classrooms per capita. The overall goal was to provide an evaluation of each option in a manner that would permit comparison of options by the Legislative Oversight Committee.

The RFP that described this project stated that the consultant should:

- Interview legislators, authorized users, Iowa Communications Network (ICN) staff, telecommunications experts, and representatives of private sector telecommunications providers regarding options identified.
- Review the 461 Task Force Report and other relevant studies related to management and operation of the ICN, including information provided by the Legislative Fiscal Bureau.
- Develop an overview of likely technological advances in the telecommunications industry and their likely impact on the ICN.
- Identify costs and savings to state government associated with each option identified.
- Identify positive and negative consequences impacting the State's security and future costs related to each option identified.

All of these requirements were met. The project approach included study of the HF 461 Report and other background information on the ICN; in addition, members of the Ultrapro team visited the ICN Hub and educational facilities. The team interviewed over 60 individuals: Policy Officials, Policy staff, ICN users, ICN staff and private sector (telecommunications industry) representatives to draw on their experience, expertise and perspectives on the ICN. Section III contains a summary of the interviews and a review of selected ICN documentation.

The next step in preparation for the analysis of the ICN ownership and management options was to summarize the ICN-relevant issues in the Technology, Communications/Information Technology Markets, and Regulatory/Legal areas. These three areas will significantly influence all telecommunications providers and users in the United States. There are useful principles that can be drawn from the trends, actions, successes and failures in these three

areas that can be valuable in analyzing the ICN options. Sections IV, V and VI discuss the Technology, Market and Regulatory/Legal areas. Section VII presents the Technology, Market, and Regulatory/Legal principles (TMR principles) drawn from these areas, to provide a basis for evaluating the options.

In Section VIII, Evaluation of ICN Options, all of these inputs (the ICN interviews as well as issues relating to Technology, Market, and Regulatory/Legal areas that were presented in Sections III - VII) are utilized in discussing each option in turn. The applicability of the TMR principles is discussed, implications for costs and savings are described, and the impact on maintaining security of State information is presented. Other general considerations are presented with each option. Section IX contains a one-page matrix summarizing the evaluation of each of the options.

Background information relative to the analysis is included in the Appendices in Section X. Certain issues were identified in the course of the analysis, which were relevant to the discussion, but were not developed in detail because they were beyond the scope of the RFP. These issues are included in Appendix D. A suggested process for determining an appropriate number of video classrooms per capita is described in Appendix E.

### III. Interviews and Review of Selected ICN Documentation

#### SUMMARY

As part of its analysis Ultrapro reviewed the 461 Task Force Report and more than 100 other position papers, comments and articles on the subject of ICN. In addition to reviewing the written material, Ultrapro conducted interviews to gain a perspective on ICN that might contain insights more recent than those included in the 1995 report of the 461 Task Force. An analysis of the written material and the comments of those interviewed can be summarized and categorized as follows:

- **Purpose of ICN:** The network was built initially to connect K-12 schools and provide video conferencing; use by higher education has increased substantially in recent years. No party interviewed disagrees with the educational goal of ICN.
- **Ownership:** There is general acknowledgement that, with ICN being in place as a state-run network, it would be difficult to move it to the private arena and maintain rate guarantees that state policy-makers feel are needed to protect the original purpose: education. Most industry representatives interviewed think it would be difficult to find a buyer and that, if a buyer could be found, any sale would have to include conditions that would preclude the new owner from having all the built-in advantages (and customers) that ICN has now.
- **Continuation of subsidies:** Subsidy of the network for educational purposes is seen by all as a necessary ingredient, although there are differing ideas as to whether the subsidy should go to the provider or directly to the schools to use for services as they see fit.
- **Management:** All parties recognize that there have been issues between ICN management and the legislators, but there are differences of opinion on how to resolve them. Private management is not seen universally as the answer.
- **ICN rates:** Industry representatives state that rates for ICN are unfairly low, and that it is difficult to compete without a "level playing field". Voice and data services for all ICN users cross-subsidize the low educational video rates. Even with that subsidy element included, government employees interviewed do not disagree that the

ratemaking principles for ICN, as mandated by statute, result in voice and data prices that are generally lower than the rates of common carriers for similar services.

The following paragraphs describe in more detail the input gathered during the review of ICN documentation and the interviews.

### WRITTEN MATERIAL

A great deal of material has been written about the ICN. Ultrapro reviewed in detail the 461 Task Force Report, as well as evaluations of particular ICN issues that were conducted prior to issuance of that report. In addition, comments made by interested parties in various ICN proceedings were reviewed, as well as other writings on ICN and related subjects. That written material covers ICN from the beginning, underscoring the concern various parties have had about whether to build it at all and, once built, how best to maintain and utilize the network. In all, over 100 documents were reviewed (See Appendix A for listing of documents reviewed).

### INTERVIEWS

In addition to reviewing the written material, Ultrapro conducted interviews regarding ICN:

State or Industry Group	Number of people interviewed
Policy Officials - Iowa State Legislators/IUB/ITTC	17
Policy Staff - Iowa legislative staff	5
ICN Users - Educational community	13
ICN Users - State agency personnel	12
ICN Senior Staff	6
Telecommunications industry representatives	10
<b>Total interviewed</b>	<b>63</b>

As can be seen from the above table, input was received from representatives of the state government (policy makers, staff, and users) as well as from private industry. Following are representative comments from interviewees, grouped by comment category (see Appendix B for a side-by-side summary of interview results). In this Section, quotes are shown in italicized typeface.

## **General**

Parties agree that the ICN is unique; no other state secures its communications services quite this way. The disagreement comes in interpreting what that fact means. On the government side, individuals see this uniqueness as a good thing:

*Look around and you will see others trying to imitate what Iowa has done. [ICN Policy official/staff]*

*Iowa is the envy of the world; it is still not being done elsewhere. Civil and military leaders from around the world have come to see ICN. [ICN user]*

For its part, private industry is not so sure that being different is necessarily better:

*Iowa is the only state that does it this way. If this is such a great idea, why don't more states follow the example? The State can/should prime the market pump, not dampen it by competing. For example, the state could be a major customer of an ATM provider, and help motivate them to deploy the new technology.*

Some in government view the apparent entry of the state into the communications market with concern:

*Philosophically – I'm not sure the State should be competing with private providers. [Iowa Policy official/staff]*

For its part, industry feels that ICN has already gone far enough:

*Since ICN is here, they should draw a line and not expand users or capacity.*

## **Ownership of the network**

Some government people interviewed are not sure a buyer could be found, but voice concern about what might happen if such a search were to succeed:

*I'm not sure it can be sold. There seems to be no buyer, and federal contracts present a barrier. [In addition,] selling means lack of control. We need to protect Iowa's rural way of life. How can we guarantee time for 550 [video] sites if we sell it?*

People interviewed from the private sector agree that it might be difficult to find a buyer and execute a sale:

*ICN's assets are not worth what the state has in them. The ICN facilities duplicate private facilities in many cases. [In other cases], ICN goes places a private network would not go. It is not attractive as an investment. It is important to review carefully the sale questions. Who gets to buy it, and at what price? Private industry will rally against any one buyer. [The state would] waste time on an RFP and not be able to implement it. An acceptable purchaser would be if the State paid the same as now, for education, agencies, and university use.*

In any case, if a determination were made to sell the ICN, some practical problems remain, as noted by an ICN senior staff member:

*If we sell the network, we need a process to determine the "value" of ICN: We may not be able to sell it for what we have in it, i.e., tangible and intangible assets, ability of debt to be sold, contributed capital, accounts receivable/payable, customer base, revenue stream.*

Probably as a result of these knotty issues, an industry participant said candidly:

*The State should maintain ownership and the current set of authorized users. ICN is turning the corner; continuing with the current arrangement is the most logical for the future.*

### **Management**

One of the options looked at in the 461 Report concerns privatizing the management while retaining ownership. Some government representatives interviewed voiced support for that point of view:

*ICN management has been put in to a position where they have to justify their existence. I think we should privatize management; take politics out of it. We would have a different trust level if the manager didn't have a stake in the outcome.*

Individuals in the private sector understand the concern, but question whether this is the solution:

*The bureaucracy feeds on itself, and is getting bigger. Legislators do not understand requests of ICN management. [However,] new management would still have to take direction from state legislature, based on whatever the important principles are. Not sure what difference it makes.*

Some in government think that more attention has been paid to the hardware than the support operations:

*The Legislature is willing to buy equipment, but not to pay the people and expense to support the equipment [Iowa Policy official/staff].*

### **Technology**

Parties on both sides of the issue have the opinion that a responsibility for implementing technology upgrades comes with owning and operating a communications network, but there are questions about whether the government is qualified and equipped to do this part of the job:

*If we don't sell it; we'll have to continue to upgrade technology. It's like 'pouring money down a rathole'. [We have] invested so much already; we need to continue. We should upgrade ICN to ATM technology. [The network] has to be kept state of the art, or it will not work. It's hard, in a political environment, to maintain that state of the art. [Government interviewees]*

*Should upgrade the technology as part of running the business. Replace it if needed, like other state infrastructure, e.g., roads, bridges. The big question is how [legislators] make those decisions. It's like having the hospitals ask them which MRI to buy, or which Biotech process to invest in. [Industry interviewees]*

### **Rates**

Government individuals interviewed agree that the rates provided by ICN are attractive, as compared with outside industry prices. It is acknowledged that the statute requires rates to be set to recover only operating costs.

*Every year we do a study of outside alternatives; can't beat ICN rates for video. ICN undercuts private rates for voice and data. The privates have lowered their rates now, but ICN has lower cost. [ICN user].*

*[Rates] are paying for operating costs. They are not paying for depreciation and debt service. Chapter 8D says to cover only operating costs. [ICN senior staffer].*

For their part, the industry participants agree that ICN rates are low, but view that as anticompetitive:

*For video, voice, data services, we can't compete with cheap rates of the current subsidized services. For example, a private company can hold conferences that include training as "education" and get cheap ICN rates. Taxpayers should not be subsidizing private companies like that.*

When considering the idea of selling the network, some policy officials state the "461 premise", combined with the idea of cross-subsidies:

*We need to include in any sales contract a requirement for low rates to schools; lift rate caps for services to other users.*

### ***Subsidy issues***

No individual interviewed disagrees with the idea of subsidizing the provision of services for educational purposes:

*Rates - we will have K-12 subsidy no matter what. Will continue to need appropriation from legislature, particularly for K-12. [Iowa policy official/staff]*

*The state is subsidizing the educational uses now. That should continue. [Industry participant]*

However, there are differences of opinion on how the subsidies should be handled:

*The State should put the appropriations process in the educational appropriations bill. Identify subsidies for ICN, Teachers, Books, etc. Then the legislature can compare this with other needs in education, and make choices about what to fund. [Industry participant]*

*The overall subsidy money will stay the same. Moving this expense to the Educational Department is not the answer; need to keep it in the sunshine and have everybody know what is being spent. [Iowa policy official]*

### ***Primary goal of ICN***

All agree that the initial goal of ICN was to support education in Iowa:

*ICN needs to focus on their mission: education. Government built this network to save Education. [Iowa policy official/staff]*

*We have no problem with ICN for educational purposes. We don't think it should go beyond that.* [Industry participant]

### ***Demand for Services***

Some individuals interviewed felt that ICN video distance learning use by school teachers is lower than expected and that more needs to be done to train teachers in the use of the new technology tools:

*Utilization is low on distance learning. I'd like to see more people utilize the service. Teachers with 20 years' experience find it hard to learn [to use the service]. Need to find a way to make it popular and get kids to try it. In schools, there is seldom, if ever, a technology coordinator as a stand-alone job. The function is done by a teacher, school librarian, or principal.* [Government interviews]

*Need to build on helping schools use it. Administrators don't know how.* [Industry participant]

Web-based training has not taken off yet on the ICN:

*Policy-makers do not seem to understand the importance of the Internet. Not much work is being done in Iowa on web-based training for teachers. Iowa is behind, probably because of the need for education leaders to politically defend where they stand on ICN. All ICN [video] education and training is live. No web-based training is taking place at present. National Guard would be a good candidate to lead ICN in web-based training.* [Government interviews]

## IV. Technology Advances and Impacts

The ICN was conceived and developed to support education throughout the State of Iowa and later to support the communications needs of other government departments. The technologies used in the development and deployment of ICN are communications and computing technologies affecting the entire US economy and world economies. They are the basis of the Information Age. In brief, they may be described as digital technologies. The availability and use of these technologies in any given area of the world will likely be one of the most important determinants of economic success of the area, its workers, students, and businesses.

Digital technologies represent a broad array of products and services, but may be grouped into three general categories or industry groups. These three categories are very useful as a basis for understanding the applications and impacts of digital technology. The three industry groups are Information Appliances, Communications Networks and Content. All three are necessary to create a useful end-to-end networked computing application. The information appliance is the device which interfaces between a human and an electronic network, for example, computer, telephone, cellular phone, TV or fax. The communications network provides the service of connecting information appliances to information (for example PC to World Wide Web) and to other information appliances (for example telephone to telephone). Content represents various forms of information: databases, web sites, applications software, entertainment, education courses, etc. With digital technology, all information is converted to digital form, stored in digital form, communicated across networks in digital form, manipulated/compressed/encrypted in digital form. Only when necessary, for example when a human being needs to sense the information, is the information converted back into analog form which a human can understand.

While there is a broad array of digital products and services and there are three very large industry groups that are the heart of the Information Age, the digital technology components that are the building blocks of the products and services are limited in number. The major components are:

- Lightwave (Fiber Optic) Systems
- Integrated Circuit (Chip) Technology
- General Purpose Processors
- Image Processing
- Software
- Wireless Systems
- Storage Technology
- Special Purpose Processors
- Speech Processing
- Display Technology

Of the components listed above, those of principal interest in this study of the ICN are lightwave systems, speech and image processing systems, and software (for encryption applications).

The elements of lightwave (fiber optic) systems include the fiber optic cable, the transmission (fiber speed) terminals and the transport level (sub-fiber speed) terminals. These elements are important to consider separately in the discussion of ICN.

Speech processing and image processing, specifically including compression, allow very significant improvements in network capacity utilization, particularly for voice and video applications popular with ICN end users.

Software for encryption applications allows specific communication segments, or specific applications to be encoded and protected from monitoring and decoding by unwanted parties. Certain ICN users and certain data, particularly in government departments, require such protection.

All of the major components listed above, including the ones of principal interest in this study of ICN, are improving at a rapid rate. Most end users are familiar with the impact of these changes on, for example, a personal computer. The familiar lessons that used to apply to PCs, about instant obsolescence, do not necessarily apply to all elements of a major network such as ICN. This is primarily so when the element has a fundamental capability far beyond current usage, and there is therefore no need to replace it even though there is a newer element with more powerful capabilities. To put some measure on the amount of increase likely to be seen in the near future, the list on the following page attempts to put a pragmatic layman's terminology "capability increase" multiplier to current "capabilities" of some of the components.

<b>Components</b>	<b>Relative Improvement<sup>1</sup></b>	<b>“Capability”</b>
Lightwave Systems	100X	Bits per second
Wireless Systems	1000X	Equiv. Voice channels/area
Integrated Circuit (Chip) Technology	100X	Active elements per chip
Storage Technology	100X	Bits per storage unit
General Purpose Processor	1000X+	Instructions per second
Special Purpose Processor	1000X+	Instructions per second
Software	5X	SW development productivity
Display Technology	100X+	Pixels per display (FPD)

Similar increases in capability can be expected from other components. While the capability of these components continues to rise, the cost per unit continues to drop dramatically. Again, the most common end user yardstick is the PC. The current crop of PCs is more powerful than the multi-million dollar high-end corporate mainframes of a decade ago, and the street price of the PC keeps dropping even as the capability increases throughout the year. In addition to the sheer power of the technology, much of the credit for the cost/price performance of these digital technology components goes to the competitive market for these components and systems. Such competition does not yet exist in all communications services markets or in all content markets (see Section V, Market Issues).

Considering the elements of lightwave systems, fiber is the core of the ICN system. The fiber used in the ICN is “single mode” fiber, the highest capacity fiber. All new fiber installed in long haul systems is single mode fiber and all commercial carriers have been using it in this

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<sup>1</sup> The measures for relative improvement are from an in-service 1998 capability to what can be expected to be available to be deployed in about 10 years.

role since it became available. The fundamental capabilities of single mode fiber have to date far exceeded the capabilities of fiber terminals to “push bits through the fiber.” The ICN initial installation of fiber terminals had a speed of 2.5 Gbps (Gigabits per second, or billions of bits per second), consistent with industry practice at the time. This speed was more than sufficient to meet the ICN user applications and demands at the time. Now the ICN users have begun to more fully load the fiber terminal capacity. Since the time of the initial ICN installation, industry demand has grown even faster than ICN demand, and faster fiber terminals have been deployed in commercial networks. Systems in place in commercial networks have gone from 2.5 Gbps (ICN current speed) to 10Gbps to 20 Gbps (increasing capacities by a factor of 4 to 8). Leading edge fiber terminals now being deployed are in the 80 Gbps to 200 Gbps range (increasing capacities by a factor of 32 to 80). Faster terminals are already in process. But, the fiber that is used can be the same fiber that was used to carry 2.5 Gbps speeds. Hence, significantly higher capacities can be achieved by changing the fiber terminals without having to deploy new fiber. There is in fact, much new fiber being installed across America. This is happening, however, because the demand is so high. The fiber in place continues to be used, simply with higher speed terminals.

Several trends have come together in communications services, providing the opportunity for even more flexibility in the transport of the various combinations of voice, video, data and Internet packets across a network. Previously, telecommunications networks were optimized for the transport of voice; this meant in practice that when voice was being transported across the network, a permanent path was reserved from end-to-end. The same practice was followed for video, regardless of the speed, compressed or not.

With the advent and spectacular growth of the Internet, which was optimized for data, it was possible to use a different transport mechanism, one that did not have to accommodate the characteristics of human eyes, ears, and brain used for voice and video. This transport mechanism could send small portions (packets) of the data at a time, allowing the transport network to pack the transmission facility more efficiently. Since data was being sent from computer to computer, delays and interruptions in the transfer of information from one to the other did not bother the computers (although the delays frequently do frustrate the Internet user!).

Other trends beyond the growth of Internet include:

- Growth in the volumes of voice traffic over long distance networks, fueled by lower

- competitive prices;
- Advances in fiber optic terminal speeds noted above;
- Development of standards and equipment for a very high speed packet transmission protocol – ATM;
- Development of standards and equipment for high speed Internet packet transport protocol – IP.

The overarching trend is that all of the information, voice, data, video, Internet packets is in digital form, able to be combined and transported over the common medium of fiber optic cable.

As noted above, the industry standard transport medium is single mode fiber optic cable with fiber terminals sending optical bits through the fiber at 20 Gbps up to 200+ Gbps. Feeding into the fiber terminals is an evolving mixture of lower speed transport systems, typically of 155 Mbps (Megabits per second, or millions of bits per second) up to 10 Gbps. These systems will be carrying bits representing voice-optimized (circuit oriented) voice or video, Internet or other packet-oriented data, or a combination of both. The evolution of the technology of fiber terminals and transport terminals is toward integrated systems including both functions; this trend should provide more flexibility to network providers in overall lightwave system design and in ability to upgrade, issues of concern for ICN.

One of the major applications of ICN users is video conferencing. The basic design of ICN was based on “full motion video.” This was originally defined as up to 45 Mbps, although in practice in ICN the full motion video was 39 Mbps, with the balance of a 45 Mbps connection to a user location used for voice, data and Internet. 39 Mbps for video applications is a very high quality service, far beyond the capacity taken for typical distance education video applications - 128 Kbps to 384 Kbps (Kilobits per second, or thousands of bits per second). With the use of premises-based commercially available speech/video processing, including bit compression, most universities and schools have been able to achieve great economies by trading off the relatively low cost of investing in compression technology against savings in the cost of transmission facilities.

Speech/video processing with compression does not depend on education applications alone to create the high volumes necessary for continued advances in the technology. There are numerous other popular applications which are causing continued developments to improve the power and performance of compression technology. Business video conferencing, typically at 128 Kbps, is used regularly to save time and travel expense. The consumer application, High

Definition Television, has a signal which is compressed about 50:1 from a studio rate of about 1Gbps to a through-the-air rate of about 20 Mbps. Another consumer application is voice over the Internet, which is fueled by the use of voice compression of 8:1 or more from the uncompressed 64 Kbps used in the typical telephone networks.

ICN total end-to-end video application costs, premises and ICN network, can be expected to mirror those of other users, if the pricing and incentives are similar. However, if there are no incentives to make efficient use of the network, then it is likely that bandwidth (network capacity) will exhaust before it would otherwise.

For many years, banks have used communications networks to transfer financial information in a secure manner with the application of encryption technology over private networks. In recent years, the commercial availability of much stronger, yet inexpensive encryption tools has made secure electronic commerce available to consumers and small businesses. Whenever there is a reasonable cause for concern about the security of a networked connection in transferring sensitive data, encryption technology must be considered. The encryption can be applied at a facility level, if there is a dedicated facility for an application; more commonly, the facility is switched (packet or circuit) and the encryption can be applied in the end user PC or LAN. This approach should be considered in any ICN government or other user application involving sensitive data.

## V. Market Issues

The technology advances described above are forcing major changes not only in the communications market, but also in operations of the users of communications services – including education, libraries and government. In the communications market, more powerful/less costly technologies available in ever-shorter product life cycles have caused both increased competition and consolidation of companies. The winners have been the end users (customers) in those markets where communications competition exists – primarily urban and suburban markets. The end users in competitive markets have many exciting new options with these powerful, low cost technology tools. For government as an end user, this means the ability to provide to citizens better access to information and services; e.g., Internet/web-based services available to citizens 24 hours per day, 7 days per week. For the education community as end users, this means the ability to serve students anywhere, anytime with low cost, web-based courses; e.g., university-offered professional certificate courses for both university degree students and life long learners. For libraries, this means a new information research and reference tool to add to the public services the library can offer.

There are trends underway in private industry communications networks that help to focus the effects of the changes occurring in the communications market in a way helpful to analysis of the ICN. These network trends are reflections of digital technology – driven market forces sweeping across the United States. The trends that are of major significance to the ICN are:

- Rapid transition from analog to digital services
- Very rapid growth in the use of Internet/World Wide Web/IP – based networks for virtually every market sector including government, libraries and education.
- In telecom networks: Installation of fiber optic cables (single mode fiber) to support rapidly growing traffic from all users.
- In telecom networks: Regular upgrades of fiber terminals to achieve higher speeds on existing single mode fibers.
- In telecom networks: Transition of the transport terminals feeding into the fiber terminals from circuit-oriented terminals optimized for voice to high-speed packet-oriented terminals which effectively support the voice, data, Internet and video applications of users.
- In CATV networks: Replacement of all but the “neighborhood” coaxial cable with fiber to allow added TV channels as well as Internet and telephone services.

As these new, powerful technologies continue to be deployed in the communications industry, prices have been plummeting in those telecom markets that are competitive. Unfortunately, competition does not yet exist uniformly throughout the US. The linkage, however, is clear,

wherever one looks: competition brings new technology, lower prices and a larger array of services. That combination also brings a better economic base and growth prospects for the community in which the competitive telecommunications market exists. The combination of competition, new technology, lower prices and new services also provides the potential for developing the human capital to drive the new economy.

In the absence of competition, various mechanisms have been used to try to make the benefits of competition available to education and to government end users. Examples are: Net Days, shared use of Internet services by schools and government, dedicated government networks, state-subsidized commercially-provided video education networks and E-Rate subsidies embodied in TCA96, the Telecommunications Act of 1996.

The competitive market concepts embodied within TCA96 came in the context of technology changes affecting the industry. One of the goals of the Act was to foster competition in communications markets so that more rapid technology change could occur for the benefit of consumers and the economy (see Section VI – Regulatory/Legal Issues). Yet TCA96 granted exemptions to the local communications competition mandates in certain areas – rural areas in particular (See Section VI – Regulatory/Legal Issues). While incumbent carriers in a given market may upgrade their networks to the latest technology, that action by itself does not guarantee customers new services and better prices in the absence of competition; customers must still consider all options. Another trend affecting competition in telecommunications in rural areas is the consolidation of service areas by incumbent carriers. A major example of this is underway in Iowa and other rural states; GTE announced recently that it would sell or trade all of its lines in Iowa and seven other primarily rural states.

In those areas in which telecommunications competition does not yet exist fully, governments have an interest in pursuing alternatives to obtain the best, most cost-effective communications services for their organizations and employees at taxpayer-funded sites (government offices, libraries, schools, and higher education institutions).

ICN is one such example of government pursuing alternative means to obtain access to critical technology. In situations in which the government has chosen to obtain critical technology tools such as communications infrastructure and services, via self-provision in lieu of obtaining it from the commercial marketplace, it is incumbent upon the government to regularly measure, monitor and document the operational aspects of that service. The goal of this regular auditing is to assure that the services, prices, customer training and support, quality of service,

and incentives for customers to make the correct economic choice are all consistent with and at least on a par with commercial practices and best practices of other examples of government self-provision. This “operational auditing” of the government self-provisioning choice is important to verify on a regular basis that both the government end users and the taxpayers are being well served. A similar practice occurs now in the financial area. ICN has been subjected to periodic audits from a financial perspective. As with financial auditing, operational auditing should be performed by a qualified, independent third party. This concept also is consistent with the approaches and measures that the government would use in awarding and monitoring service obtained from the commercial marketplace.

## VI. Regulatory/Legal Issues Relating to ICN

### SUMMARY

The Telecommunications Act of 1996 (TCA96) impacts Iowa and the ICN, primarily as a result of two subjects dealt with in the new law: the potential for increased competition in the market for telecommunications services, and the expansion of the Universal Service Fund (USF). During debate prior to passing the Act there was much discussion about the overall direction of federal policy moving towards competition as a replacement for regulation in the telecommunications market. In addition, Congress indicated its intention to ensure additional USF support, especially for schools and libraries. However, both of these items are proceeding more slowly than federal lawmakers and regulators envisioned.

The FCC's stated goal is to provide a climate for increased competition in the local market, and it has established national rules to enable the states and the Commission to begin implementing the local competition provisions of TCA96. Portions of the FCC's decision have been overturned by the United States Court of Appeals for the Eighth Circuit and are currently on appeal before the United States Supreme Court. Partly as a result of the uncertainty in this area, competition in the local telephone market has been slow in developing.

Even though TCA96 permits states to furnish telecommunications service to their own users, questions of government policy are raised when governmental entities expand their customer base to include non-governmental users. The main policy question is whether state or municipal governments should compete with private interests for telecommunications and Internet services. Cases from several municipalities are under active consideration in the federal arena.

As a result of the Act, schools and libraries may be eligible to receive discounts for telecommunications services, Internet access and internal connections. Discounts to schools and libraries will range from 20 percent to 90 percent, depending on ability to pay. However, a state network is not a telecommunications carrier as defined by the Federal Communications Commission (FCC) rules; thus ICN currently is not eligible for reimbursement from the Universal Service Program for discounts provided to schools and libraries. The Iowa Telecommunications and Technology Commission (ITTC) has filed a letter asking the FCC to review this and determine that ICN is eligible for reimbursement from the universal service administrator as a provider of telecommunications services to schools, libraries, and rural health care providers. An FCC decision on this item appears imminent.

The impact on ICN of these two issues – the potential for increased competition for local telephone services and the expansion of the USF –has been to add uncertainty to the analysis of costs, benefits and attractiveness of any disposition of the network. Without new competitors in the local telephone market, sale of the network to an incumbent provider could in fact lessen the amount of competition that currently exists. On the other hand, under current FCC rules the ICN does not qualify for federal USF subsidies for schools and libraries, whereas the subsidies would be available if the network were taken over by a common carrier. The effects of federal policy on ICN are discussed further in the following paragraphs and in subsequent sections of this report.

## **INTERCONNECTION/LOCAL COMPETITION**

TCA96 added provisions to telecommunications law that were designed to encourage the growth of competition in the local market. A new Part II of the Common Carrier portion of the Communications Act established new obligations for Local Exchange Carriers regarding interconnection and removal of barriers to market entry. The act included exemptions for rural telephone companies, stating that the rules "... shall not apply to a rural telephone company until (i) such company has received a bona fide request for interconnection, services, or network elements, and (ii) the State commission determines ... that such request is not unduly economically burdensome" [Section 251(f)(1)(A)]

On August 8, 1996, the FCC took action it said would remove regulatory and operational barriers to local telephone service competition by establishing a framework of national rules to enable the states and the Commission to begin implementing the local competition provisions of TCA96. The Order set out three paths of entry into the local telephone market: full facilities-based entry, purchasing of unbundled network elements from the incumbent local exchange carrier (LEC) and resale of the incumbent's retail services.

The FCC prescribed certain minimum points of interconnection necessary to permit competing carriers to choose the most efficient points at which to interconnect with the incumbent LEC's network. In addition, the FCC's order set forth a methodology for states to use in establishing rates for interconnection and the purchase of unbundled elements (actual prices were to be set by the states). The order concluded that a cost-based pricing methodology based on forward-looking economic costs would be most consistent with the goals of the 1996 Act. The FCC's order also established default proxies that a state commission could use to resolve arbitrations that must be completed prior to a required study. Acting upon petitions from several states,

portions of the FCC's decision have been overturned by the United States Court of Appeals for the Eighth Circuit and are currently on appeal to the United States Supreme Court. Oral argument before the Supreme Court took place on October 13, 1998 and a decision is pending.

Partly as a result of the controversy surrounding this, competition in local markets is developing slowly. In Iowa, for example, although at least 31 companies have been granted permission by the FCC to compete statewide for local exchange telephone business, most indicate they intend to do so by means of reselling the incumbent's facilities.<sup>2</sup> Up to this point that method has not proven to be an effective way for new entrants to gain significant market share.

The FCC's checklist for determining whether an incumbent local exchange carrier can enter the long distance market includes review of competition in the State. That review has not been made yet for Iowa because thus far US West has not filed with the FCC for permission to enter the Iowa long distance market.<sup>3</sup>

When considering the 461 Options, due consideration should be given to the impact on competition for telecommunications services in Iowa.

#### **GOVERNMENT PROVISION OF SERVICES TO NON-GOVERNMENT USERS**

There is nothing in TCA96 that precludes any customer – including a state – from providing telecommunications services, or enhanced service such as access to the Internet, to its own authorized users. By the provision of such services to itself, the State is not in competition with private industry.

However, even though TCA96 permits states (and other governmental entities) to furnish telecommunications service to their own users, questions of government policy are raised when governmental entities expand their customer base to include non-government users. For example, proceedings relating to the ICN expanding its authorized user base have been debated

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<sup>2</sup> Three competitors (AT&T, Fibercom, and US Telco) indicate they intend to provide local service by a combination of their own facilities and resale of incumbent local exchange carrier facilities.

<sup>3</sup> In its Order Initiating [an] Inquiry Proceeding in re Access to Operational Support Systems, (Docket No. NOI-98-1, July 23, 1998), the IUB indicated its belief that US West would soon file for permission to inaugurate long distance service, but to date the US West filing has not been made.

heatedly. Private industry argues that such expansion amounts to unfair competition with their lines of business, at tax-supported lower rates.

In some states (including Iowa), it is not permissible under state law for a municipality to compete with private industry for telecommunications business. Although Section 253 of TCA96 precludes states from “prohibiting the ability of any entity to provide any interstate or intrastate telecommunications service”, the Iowa Supreme Court ruled in October 1998 that state law prohibits municipalities from offering telephone service, rejecting a lower court finding that TCA96 preempts the state prohibition.

Cities in other states have attempted to provide advanced telecommunications services to their communities. To do so, the cities have asked the FCC to pre-empt state laws that bar them from offering telephone service. A case brought to the FCC by Abilene, Texas raised these issues, but the Commission ruled that cities are not entities “separate and apart” from the state.

The FCC’s decision to permit Texas to bar municipalities from the provision of telecommunications was appealed by the City of Abilene to the US Court of Appeals, District of Columbia Circuit, and on January 4, 1999 that court agreed with the FCC.<sup>4</sup> The court upheld the FCC’s 1997 decision that the Communications Act does not “warrant federal interference with a state’s regulation of its political subdivisions”<sup>5</sup>

A Missouri case brought to the FCC raises squarely the issue of whether the state can prohibit a city-owned electric utility from providing telecommunications services. That case has not been decided as of this writing. The issue will no doubt continue to be appealed, although the current FCC has been reluctant to preempt state authority.

Even while the legal questions are being debated, the policy questions could be re-evaluated. The main policy issue is whether state or municipal governments should compete with private interests for telecommunications and Internet services. If the Iowa legislature decides it is in the best interests of all of its citizens to do so, authorized use of ICN could be expanded. Based on the last proceeding that dealt with expanding the authorized user definition, however, that would no doubt be a controversial decision.

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<sup>4</sup> Telecommunications Reports Daily, January 5, 1999

<sup>5</sup> Telecommunications Reports, October 6, 1997

It may be possible to establish a policy “bright line” of demarcation. Under such a scenario, a government could provide telecommunications services to itself without violating state or federal statutes (regulatory rules do not limit who can offer other services such as Internet, so governments also can do that). On the other side of the bright line, governments could not offer telecommunications services to other than themselves without falling under the full panoply of federal and state telecommunications laws and regulations.

The state laws that underlie the cases cited above are some examples of prohibitions against such service expansion. In addition, a government entity providing service to other than its authorized users, but offering preferential rates to its own users, would have to contend with applicable state and federal statutes that prohibit discriminatory rate treatment among customers.<sup>6</sup>

This could lead to a policy decision that all authorized users (government, education, library) and sites are permissible for ICN but that the other side of the bright line, representing users and sites that are not currently authorized, would not fall under the purview of ICN.

## **E-RATE**

The Universal Service Fund, originally developed to ensure affordable consumer access to basic telephone service, was expanded under TCA96 to subsidize a special discounted rate for educational and rural health care purposes (subsequently nicknamed the “E-Rate”). A full discussion of the background and status of the E-Rate can be found in Appendix C of this report.

Service providers will be eligible for E-Rate subsidy payments when they offer discounted rates to elementary and secondary schools, public libraries and rural health care providers. The subsidies will apply as reimbursements for discounts provided on communications services, including transmission of voice and data; inside wiring (or wireless connections); and Internet services.

Discounts ranging from 20% to 90% are established as a reduction to the service provider’s price to the institution (see Appendix C for table of applicable discounts). The discount rate

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<sup>6</sup> ICN could discriminate among customers and provide preferential rates to ICN authorized users, at least for in-state services, because the Iowa statute specifically provides an exemption. Federal non-discriminatory requirements would still have to be addressed if ICN were to offer interstate services at special rates.

for schools is based on the percentage of students eligible for participation in the national school lunch program, and whether the school is classified as rural or urban. The discount for libraries is based on the percentage of students eligible for participation in the national school lunch program in the public school district in which the library is located. Institutions located in metropolitan counties, as measured by the Office of Management and Budget's Metropolitan Statistical Area (MSA) method, will be designated as urban.

Eligible schools are Elementary and secondary schools as defined in the Elementary and Secondary Education Act of 1965. They may be public or private, but must be non-profit and, if private, have no more than \$50 million in endowments. This includes individual schools, school districts and consortia of schools and/or school districts.

Eligible libraries are those qualifying for assistance under the Library Services and Technology Act. They must be non-profit and funded as independent entities (completely separate budget from any institution of learning) and not international cooperative associations. This includes individual library branches, library facilities, library systems and library consortia.

Eligible health care providers are defined under TCA96 as those furnishing health care to persons who reside in rural areas within a State. The law says that "health care providers" means: post-secondary educational institutions offering health care instruction; teaching hospitals and medical schools; community health (including mental health) centers, local health departments or agencies, not-for-profit hospitals; rural health clinics; and consortia of health care providers consisting of one or more of the entities described above.

Eligible services are all telecommunications services for voice or data that are commercially available to schools, libraries and rural health care providers. For example, eligible services include ordinary telephone lines for calls to teachers in classrooms, Integrated Services Digital Network (ISDN) lines to connect to information services, private lines between eligible acquirers and paging services for security officials. Also eligible is basic Internet access, including telecommunications (data links) and associated services such as information services needed for classroom access to the Internet. Other information content or information services, such as voice mail, are not eligible.

Some telecommunications services are not eligible for discounts, for example, content services, training and software. Certain internal connections or products/services are not eligible, such

as personal computers, fax machines, voice mail, modems, electrical wiring, fax machines, and asbestos removal.

### *E-Rate Issues Relating to State Telecommunications Networks*

Under the FCC rules, a State telecommunications network refers to a state government entity that takes telecommunications offerings from multiple service providers and makes packages of offerings available to schools, libraries and rural health care providers that are eligible for universal service support, or a state government entity that provides, using its own facilities, telecommunications offerings to such entities.

If a state network furnishes telecommunications service to eligible entities it will not qualify to receive direct reimbursement from the Schools and Libraries Universal Service Program, because a state network is not a telecommunications carrier as defined by the FCC's rules. Only common carriers can receive reimbursements for providing telecommunications services to eligible entities.

On February 4, 1998, the ITTC filed a letter asking the FCC to determine that ICN is eligible to receive direct reimbursement from the universal service administrator as a provider of telecommunications services to schools, libraries, and rural health care providers. Comments were filed March 4, 1998, and reply comments on March 16, 1998. It is believed that a decision on this item is imminent, although the relocation of the FCC and the commissioners' offices to a new facility in early 1999 may delay decisions on an array of matters, including this one.

If the FCC's current position holds, under State ownership the ICN would not qualify for reimbursement from the USF for discounts on telecommunications services provided to schools and libraries. The ICN staff has estimated that if it were eligible, ICN would receive annual reimbursements totaling \$1.2 million for discounts to schools and libraries.

Note that even though ICN is not eligible under FCC rules for reimbursement of that amount for discounts it provides, Iowa schools and libraries can still apply for discounts from access providers, who would then receive reimbursement from the USF for services they provide. Based on estimates from the ICN staff, these reimbursements would total over \$700,000 annually on a statewide basis. <sup>7</sup>

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<sup>7</sup> This amount, for access services, is in addition to the \$1.2 million described above.

Internet service is treated differently, so it should be possible for ICN to procure Internet service on behalf of eligible schools and libraries and apply for discounts. In doing so, ICN would have to make a good faith effort to ensure that each eligible institution receives a proportionate share of the shared services. It also would have to take reasonable steps to assure that the service provider applies appropriate discount amounts to the portion of the service used by each eligible school or library.

### **FCC COORDINATION WITH STATES**

TCA96 directs the FCC and the state utility commissions to take new actions to expand the competition in communications. Provisions of the Act remove old separations between interstate and intrastate assignments and require a close working relationship between the FCC and state, city and local governments. The FCC has established a web page to provide state and local governments with a central source of information on FCC proceedings of interest to them. The address of the FCC's page for this is: < [www.fcc.gov.statelocal/](http://www.fcc.gov.statelocal/) > .

The Local and State Government Advisory Committee (LSGAC) was formed to advise the FCC on issues of concern to state and local governments. In March of 1997, then-Chairman Reed Hundt appointed 15 representatives of state, local, and tribal governments to form the LSGAC. The group has submitted recommendations to the FCC on behalf of state, local, and tribal governments. LSGAC also has taken an active role in bringing representatives of state and local governments together with representatives of the communications industry to discuss issues of mutual concern and develop creative solutions to legal and regulatory issues. The LSGAC has subcommittees in the following areas:

- Public Rights-of-Way
- Wireless Telecommunications
- Universal Service

## VII. Principles from Technology, Market, Regulatory Analyses

The description of the external environment in Sections IV, V and VI (Technology, Market and Regulatory) is intended to provide facts and insights into issues that may be applied to the analysis of ICN options. These issues arise in private industry, in the commercial marketplace, in the use of technology tools by individuals and organizations, and in the implementation of regulatory/legal mandates to develop competitive markets. Applying the facts and insights from the prior sections of this report, it is possible to structure principles that can be used in the evaluation of ICN options. In the paragraphs that follow, principles are first identified, then discussed in the context of the ICN.

- A. Single mode fiber optic cables have sufficient fundamental capability to carry higher speed data that they remain state-of-the-art even though installed years ago.
- B. Lightwave transmission terminals and transport level terminals are all that need to be replaced in order to achieve higher speeds.
- C. Communications carriers installing or leasing fiber optic cable capacity are utilizing very high quantities of fiber; cables in excess of 100 fibers are common. The minimum useable quantity for a carrier to serve a customer, or to link small facilities would be one pair of fibers, with a full pair of fibers as spare (four fibers total). Exceptions would include business customers or very specific carrier situations, but the requirement for spare would still exist.
- D. Education, library and other government use of communications networks are evolving to significantly higher reliance on Internet (IP) services. Internet services are critical to education, libraries and government applications.
- E. All users benefit from competition in the provision of communications services. Government should encourage competition in all areas of communications services. Particular challenges exist in rural areas.
- F. The availability of new technology provided in the context of a monopoly market does not guarantee users the price/feature benefits of a competitive marketplace.
- G. It is appropriate for any user to provide services to itself; this is not competition with the private sector unless the end user offers services to other parties. Government appropriately pursues all mechanisms to serve government users (education, libraries

and government departments) effectively in the absence of competition in the provision of telecommunications services.

- H. It is consistent with the evolution of technology and competitive telecommunications services markets for government to directly serve taxpayer-funded operations of education, libraries and government.
- I. It is not consistent with the evolution of competitive telecommunications services markets for government to directly serve consumers, business or any users other than education, libraries and government.
- J. If government provides communications services directly to education, libraries and government, the government needs to apply certain measures and incentives to ensure effective and efficient use of the services in lieu of the measures and incentives of a competitive marketplace.
- K. The provision of support to customers is critical in a networked environment. Customer support includes Sales (description of the service and its operation, pricing, and support capabilities), Ordering, Billing, Maintenance & Troubleshooting, Training. Customer support elements can be provided directly by the service provider or outsourced to another vendor.
- L. Quality measures and audits of both the network and the customer support functions of the supplier are necessary. Audits should be performed by a qualified, independent third party.
- M. As organizations deploy new technology tools to improve efficiency and to provide more and better services, it is critical to success to educate all employees in the use of the new tools. Tools sitting on the shelf offer no value. Training, therefore, must be built into the plans to deploy new tools.

## **DISCUSSION OF PRINCIPLES IN THE CONTEXT OF ICN**

The single mode fiber used throughout ICN has sufficient fundamental capability to carry much higher speed communications than at present (2.5 Gbps). To give an order of magnitude, the current speeds in new commercial networks or newly upgraded existing networks is up to 200 Gbps, which is 80 times the speed of ICN. The speeds referenced are for each fiber pair used

in the network. These capabilities would seem to be more than sufficient to meet ICN users' needs for the foreseeable future.

The lightwave transmission terminals used in ICN at present operate at a speed of 2.5 Gbps. This speed provided sufficient capacity for the ICN users up until the present. According to statements on current network usage by both ICN staff and users, that fiber speed is now limiting. Increasing the fiber speed can be accomplished by updating the lightwave transmission terminals. Given the significant advances both in fiber terminals and in transport terminal interfaces since ICN was designed, a change in fiber terminals provides a good opportunity to re-look at the service mix driving the transport terminals and the overall design of fiber interfaces.

The ICN fiber infrastructure was designed and installed with four (4) single mode fibers connecting each of 21 sites to the ICN Hub. These 21 sites are the 16 Merged Area Part I sites, the Lucas building, IPTV, Iowa State University, the University of Iowa and the University of Northern Iowa. There are also four (4) single mode fibers connecting each Part II location to their respective Part I site, and four (4) single mode fibers connecting the IPTV transmitter locations to the nearest Part I or Part II site. In addition, four (4) single mode fibers were used to connect certain Part II sites to close up loops in the initial design for the purpose of providing a limited level of traffic diversity.

The single mode fiber of ICN is the highest capacity fiber in use. The network, however, is "thin" in that it has connectivity of four fibers, useable normally as one active pair and one standby in commercial practice. Given this architecture, ICN has little spare fiber to lease or to sell. In situations in which multiple groups of four fibers happen to go between two towns in order to complete their four fiber connectivity to multiple sites, it would be feasible to share the standby fibers to free some fibers to lease or sell; this would be an administrative issue to be worked. As noted above (Principle C), communications carriers are installing new cables with very high quantities of fiber. In general, a single fiber pair would not be of interest to a carrier as a basis of providing service to the public; exceptions would exist, but would be limited. This is a factor in considering any lease or sale options for ICN.

The usage of the Internet by all segments of business, government, education and consumers is growing rapidly. For education, the Internet is rapidly becoming one of the fundamental tools for both teachers and learners. For government, the Internet provides the very characteristics that are needed to support the broad dissemination of information to the public; it is very cost

effective, available 24 hours a day, and is capable of reaching a broader segment of the public than most media (although for some purposes, the Internet still is not sufficient). For the government, the Internet provides a very effective means to allow citizen participation, including direct input from a citizen to an individual, a committee, or an organization. In some cases, as the usage of Internet grows, the usage of other services may slow or decline. For example, the leading edge applications of distance education in higher education now include Web-based elements, or in some cases have gone to a full Web-based structure. The availability of Internet service from ICN is very important to ICN users.

The government's role of encouraging competition in the provision of communications services is both important and challenging. Communications services are at the very heart of the transition to the Information Age. Competition brings new services, lower prices and a higher rate of deployment of new technology to a community. The availability of new technology, by itself, is not a measure of competition, since it alone does not guarantee new services or lower prices. If a State or a community falls behind in the development of communications services competition, it may be behind in education and economic development for decades to come. The issues can be complex, contentious and involved in technical detail. Nevertheless, the challenge is before every State in the United States and every country in the world; given local variations on a theme, everyone is facing similar challenges. Particular challenges exist in rural areas. Yet opportunities also exist in rural areas, for once the competitive infrastructure is in place, the digital technology tools tend to blur the differences between urban and rural, between small company and big company.

Iowa has taken a decisive step to assure that education does not fall behind while the conditions for a competitive communications market are put in place, and competition develops. Iowa has included other government (taxpayer) functions in the same situation, by providing communications services directly to Education, Library and Government buildings. It is appropriate for any user, including government, to provide service to itself; this is not competition with the private sector that provides the service unless the government provides services to the public. It is of course necessary for the government to show on a regular basis that the decision to provide service to itself is still a good decision. And it is necessary for the government to assure that it does not compete with the private sector by providing communications services to the public.

If the government provides communications services to itself (education, Libraries, government departments), it needs to assure that the resources are being utilized efficiently, just as any other government expense. To help determine efficient use practices, the government can survey practices of businesses and other governments that purchase communications services from a competitive market. There is a need to give proper incentives to the government end users, including service pricing and department budgeting, to encourage end users to follow effective and efficient usage patterns.

The use of communications services in today's networked environment includes integrated use of computers, telephones, databases, web sites, LANs, video conferencing/education. End users will not be able to use these appropriate, but sophisticated, technology systems unless they are effectively trained and supported as needed. Experience from private industry shows that customer support is a critical component in the successful use of systems. The support starts at the beginning (Sales - what are the services that are available, what are the prices, how do they work), and goes through Ordering, Billing, Training and Maintenance & Troubleshooting. These functions are so important to obtaining the benefits of the use of these critical technology tools that they should all be measured as key elements of effectiveness of the delivery of service. The provision of the customer support functions listed above can be performed internally (by the government) or they can be outsourced in part or in toto to a vendor. The same customer support functions should be included in an operational audit, performed by a qualified, independent third party. Such an operational audit is as important as the financial audit in determining the effective utilization of the technology tools and systems, in this case, the ICN.

## VIII. Evaluation of ICN Options

This section discusses each option that was presented in the HF461 Report. First is presented an overall discussion of the application of TMR Principles to the ICN options. The discussion is organized into groups of options defined by the way the principles apply to the ICN options. This discussion is later referenced from each individual ICN option analysis.

Next, a discussion of security considerations identifies the issues and provides analysis of the impact of categories of options (defined by network operations factors) on security and the cost of assuring security. This discussion is the basis for security comments in the individual option analyses.

The individual ICN option analyses follow these two common background modules. To visualize the evaluation, the reader may find it helpful to refer to the option evaluation summary matrix in Section IX.

### APPLICATION OF TMR PRINCIPLES TO ICN OPTION EVALUATION

As stated in Section VII, Principles from Technology, Market, Regulatory Analyses, the descriptions of the external environment in Sections IV, V, and VI, respectively, can provide facts and insights into issues that may be applied to the evaluation of ICN options. Section VII identified the Principles, then discussed them generally in the context of ICN. In this section the Principles are discussed specifically as they apply to options involving Government ownership, options involving lease or sale, and options involving changes to the definition of Authorized Users.

In the paragraphs below, the relationship of the Principles to the options is discussed. Certain Principles apply to all 10 options and are discussed first.

#### *Principles that apply to all options*

- *Education, library and other government use of communications networks are evolving to significantly higher reliance on Internet (IP) services. Internet services are critical to education, libraries and government applications. (Principle D)*

Regardless of the ownership of the ICN, it is important to recognize the key role that the Internet plays in the future of education, libraries and government. Whether the network is under government or private ownership, ICN authorized users need to have access to the Internet and receive training and support to gain full value from the Internet.

- *The availability of new technology provided in the context of a monopoly market does not guarantee users the price/feature benefits of a competitive marketplace. (Principle F)*

Competition brings higher quality service, lower prices, new services and a higher rate of deployment of new technology. But the availability of new technology provided in a monopoly market does not guarantee users the same benefits as a competitive market; new technology, per se, is not a measure of competition. Regardless of the ownership of ICN, government needs to seek the benefits of a competitive market for education, library and government users. If the government owns ICN, it should monitor and emulate private competitive markets in the pricing, availability of new services and the deployment of new technology. If the ICN were sold, the government should assure that the sale would increase, not decrease, competition in the Iowa communications market.

- *The provision of support to customers is critical in a networked environment. Customer support includes Sales (description of the service and its operation, pricing, and support capabilities), Ordering, Billing, Maintenance & Troubleshooting, Training. Customer support elements can be provided directly by the service provider or outsourced to another vendor. (Principle K)*
- *Quality measures and audits of both the network and the customer support functions of the supplier are necessary. Audits should be performed by a qualified, independent third party. (Principle L)*
- *As organizations deploy new technology tools to improve efficiency and to provide more and better services, it is critical to success to educate all employees in the use of the new tools. Tools sitting on the shelf offer no value. Training, therefore, must be built into the plans to deploy new tools. (Principle M)*

Regardless of the ownership of ICN, it is important to provide training and support to the ICN users. Without full knowledge of the services of ICN and how to use them, users will not be fully productive. Without support in ordering, billing and maintenance for the ICN services, the users not only will not be fully productive, they will be frustrated in their daily activities. Full and effective training and customer support are key elements to the successful use of ICN, as important as the network itself; and, it needs to be provided regardless of the network owner. The best way to monitor the success of these efforts is through quality measures and operational audits by a qualified, independent third party.

***Principles that apply to government ownership options***

- *Single mode fiber optic cables have sufficient fundamental capability to carry higher speed data that they remain state-of-the-art even though installed years ago. (Principle A)*
- *Lightwave transmission terminals and transport level terminals are all that need to be replaced in order to achieve higher speeds. (Principle B)*

The single mode fiber used throughout ICN has sufficient fundamental capability to carry much higher speed communications than at present. Up to 80 times higher speeds can be accomplished by using the type of fiber terminals currently being installed by private industry. There is no need to replace the current ICN fiber, nor to install more fiber to serve ICN users. In order to achieve the increased capacity, however, the government must update the equipment that feeds information into the fiber, the lightwave transmission terminals (“fiber terminals”) and, in most cases, the transport terminals. While this is a capital expense, it is significantly less than replacing both the terminals and the fiber.

- *It is appropriate for any user to provide services to itself; this is not competition with the private sector unless the end user offers services to other parties. Government appropriately pursues all mechanisms to serve government users (education, libraries and government departments) effectively in the absence of competition in the provision of telecommunications services. (Principal G)*

It is appropriate for any organization, including government, to provide communications services for itself; this is not competition with the private sector unless the government provides services to the public (other than government taxpayer functions). It is necessary for the government to show on a regular basis that the decision to provide service to itself is still a good decision – for the taxpayers and for the authorized users.

- *If government provides communications services directly to education, libraries and government, the government needs to apply certain measures and incentives to ensure effective and efficient use of the services in lieu of the measures and incentives of a competitive marketplace. (Principle J)*

When government provides communications services to itself, it should assure that those resources are being utilized efficiently, just as with any other government expense. The government should survey best practices of business as well as other government entities that purchase communications services from a competitive market. With government self-provision of services instead of purchasing from a competitive market, there is a need to give proper incentives to users to encourage them to follow effective and efficient usage patterns. These incentives include pricing, training in the use of services, and departmental budgeting.