

What Should We Plan Given the Dilemma of the Network?

Status of this Memo

This memo provides information for the Internet community. It does not specify an Internet standard. Distribution of this memo is unlimited.

Abstract

Early last year, as the concluding effort of an 18 month appointment at the US Congress Office of Technology Assessment (OTA), I drafted a potential policy framework for Congressional action on the National Research and Education Network (NREN).

The Internet community needs to be asking what the most important policy issues facing the network are. And given agreement on any particular set of policy issues, the next thing we should be asking is, what would be some of the political choices that would follow for Congress to make?

It is unfortunate that this was never officially done for or by the Congress by OTA. What we have as a result is network policy making being carried out now by the Science Subcommittee on the House side in consultation with a relatively small group of interested parties. The debate seems to be more focused on preserving turf than on any sweeping understanding of what the legislation is doing. That is unfortunate.

In the hope that it may contain some useful ideas, I offer a shortened version of the suggested policy draft as information for the Internet community.

Table of Contents

The Dilemma of an Unregulated Public Resource in a Free Market Environment . . . . .	2
Regulation is a key NREN policy issue. . . . .	3
Technology Transfer Goals Achieved? . . . . .	4
The Context for Policy Setting . . . . .	4
Whom Shall the Network Serve? . . . . .	5
Access to the NREN is a key policy issue . . . . .	6
How Far To Extend Network Access? . . . . .	6

A Corporation for Public Networking? . . . . . 9  
 Summary . . . . . 14  
 Security Considerations . . . . . 17  
 Author's Address . . . . . 17

The Dilemma of an Unregulated Public Resource in a Free Market Environment

As currently structured, the NSFnet and american Internet provide access to several million researchers and educators, hundreds of thousands of remote computers, hundreds of databases, and hundreds of library catalogues. Money being invested in the network as a result of the High Performance Computing and Communications (HPCC) initiative should considerably increase the numbers and variety behind this unprecedented collection of resources. No other computer network on earth currently comes close to providing access to the breadth and depth of people and information. If access to information is access to power, access to the national computer network will mean access to very significant power.

Furthermore, access to the american Internet and NREN is also access to the worldwide Internet. According to the Director for International Programs at the NSF in February 1992, the development of the Internet over the past twelve years has been one of exponential growth:

Date	Connected Hosts
August 1981	213
October 1985	1,961
December 1987	28,174
January 1989	80,000
January 1991	376,000
January 1992	727,000

These hosts are computers to which anyone in the world with Internet access can instantaneously connect and use if there are publically available files. Any host may also be used for remote computing if the system administrator gives the user private access. These seven hundred thousand plus hosts are located in more than 38 nations. But they are only part of the picture. By system-to-system transfer of electronic mail they are linked to probably a million additional hosts. According to Dr. Larry Landweber of the University of Wisconsin, as of February 10, 1992, Internet electronic mail was available in 106 nations and territories.

Unfortunately, our current regulatory system does not distinguish between the unique nature of the Internet and commercial systems like Prodigy and CompuServe where perhaps a million people pay monthly fees for access to systems offering a few dozen databases run from two or three hosts and electronic mail to several hundred thousand people instead of many millions. (The picture is made somewhat fuzzy by the fact that CompuServe does provide electronic mail access to the Internet through a gateway and for an extra charge.) The Federal Communications Commission (FCC) considers all three to be Value Added Networks (VANs) run by Enhanced Service Providers. All use common carriers to provide their enhanced services and the FCC, in refusing to regulate them, reasons that all services are roughly alike. If, for example, CompuServe charges too much, the consumer can quit CompuServe and move to Prodigy. Or, if the monthly cost of access to the Internet were to become too much, access to Prodigy or CompuServe would be basically the same thing. Here unfortunately the analogy fails: the Internet now and the NREN to be, with its unparalleled resources, is not the same. Nevertheless, the FCC points out that without Congressional action it is powerless to regulate NREN service providers.

Regulation is a key NREN policy issue.

Perhaps there will be no need for regulation. Hopefully, the marketplace for the provision of network services will remain competitive and higher prices and cream skimming will not keep the national network out of the reach of the general public who wish to avail themselves of what it has to offer. However, given the scope and power of what is contemplated here, Congress should realize that there are important considerations of social and economic equity behind the question of access to the network. This is especially true since libraries and groups representing primary and secondary schools are demanding what could be considered as universal access to the network without having any knowledge of how such access might be funded.

The economic stakes are huge. Other players such as US West's Advanced Communications division are entering the market and AT&T is expected to do so by the spring. When combined with the award of the EINet backbone to Uunet, their entry should help to level the playing field. While one company is less likely to dominate such an uncontrolled, unregulated market, those concerned about widespread affordable access to the network would do well to watch unfolding events with care.

## Technology Transfer Goals Achieved?

Policy makers may ask how much priority the Federal government should continue to give technology transfer in a market where the technology that allegedly still needs aiding is showing remarkable signs of maturity? As they debate the course on which they wish to take the network over the next five years, policy makers may find that one answer to the apparent disparity between the emphasis in the legislation on the provision of the network by the government, and the growing number of commercial sources of network availability is that the market matured very rapidly while the HPCC legislation remained unchanged.

In view of all the remarkable commercial achievements (outlined in this essay) in the four years since the NREN idea arose, perhaps the policy objective of technology transfer for economic competitiveness could be considered to be achieved! A commercially viable high speed data networking industry, with the entrance of Sprint in January 1992 and the anticipated entrance of AT&T, has reached maturity.

Therefore, having successfully achieved its technology transfer goals, the Congress must decide whether to continue to underwrite the network as a tool in support of science and education goals. It seems reasonable to assume that this support could be undertaken in a way that would not seriously undermine the commercial TCP/IP data networking market place.

## The Context for Policy Setting

In order to make informed choices of goals for the network, Congress must understand the context of a rapidly commercializing network. The resulting context is likely to produce serious impacts both on the user community and the development of future network technology. It is likely to make some goals more easily attainable than others. Given its maturity, the commercialization of TCP/IP wide area networking technology is inevitable.

Some have already begun to question whether the government should be providing backbone services where commercial alternatives are currently available and are expected to grow in number.

Supporters of the NREN vision argue that the NSF is using government funds to build a leading edge network faster than the commercial alternatives. They say that use of public funds on such technology development is appropriate. Their critics state that the T-3 technology (also called DS-3) is dead end and point out that the next logical step is refining the network so that it can use ATM and SONET. For aggregate gigabit speeds along the backbone, use of ATM

and SONET will be necessary. Critics claim that the T-1 backbone could be engineered to accommodate the network for a while longer while Federal funds would be more appropriately invested now in an ATM and SONET development effort. They say that Federal policy is being used to enable IBM to have a testbed for the development of DS-3 TCP/IP routers when Network Technologies makes a comparable product that is already proven and reliable. Whether the Federal Government should be providing backbone services or merely support for access and improved network features is a key policy issue.

Finding the best answer to the questions raised by this issue is likely to center on the ability of the Federal mission agencies involved in high speed network development to articulate a long term plan for the development of new network technology over the next decade. How we shall use what is learned in the gigabit testbeds has not yet been clearly addressed by policy makers. Continuation of the testbeds is currently uncertain. There is also no plan to apply the outcome to the production NREN. These are areas deserving of federal involvement. The current players seem to be incapable of addressing them. Some possible courses of Federal action will be identified in the discussion of a Corporation for Public Networking to follow.

In the meantime, we face a period of four to five years where the NSF is scheduled to take the NSFnet backbone through one more bid. While Federal support for the current production backbone may be questionable on technology grounds, policy makers, before setting different alternatives:

- must understand very clearly the dual policy drivers behind the NREN,
- must define very clearly the objectives of the network, and
- must carefully define a both a plan and perhaps a governing mechanism for their achievement.

A sudden withdrawal of Federal support for the backbone would be likely to make a chaotic situation more so. However, the application of focused planning could define potentially productive alternatives to current policies that could be applied by the time of the backbone award announcement in April of 1993.

Whom Shall the Network Serve?

The HPCCL legislation gives the FCCSET a year to prepare a report to the Congress on goals for the network's eventual privatization. Thanks to the NSF's decision to rebid the backbone, this task may no

longer be rendered moot by premature network privatization. The FCCSET Report needs to address many questions.

One question is the extent to which, in the higher education environment, Congress through the National Science Foundation, or perhaps through another entity of its own choosing will continue to underwrite networking. A related question is whether or when Congress should act in order to preserve a competitive networking provider environment. A question subsidiary to this is whether a competitive commercial environment is adequate to ensure a fertile data networking technical R&D environment? Another related question centers on what is necessary to preserve network access that is as widely available to post-secondary education as possible? Further issues center on what type of access to promote. Should Congress support the addition to the network of many of the expensive capabilities promoted by the advocates of the NREN vision? What if funds spent here mean that other constituencies such as K-12 do not get adequate support?

Access to the NREN is a key policy issue.

If network use is as important for improving research and education as its supporters allege it to be, Congress may wish to address the issue of why, at institutions presently connected to the network, only a small minority of students and faculty are active users. If it examines the network reality carefully, Congress may sense that it is time to leverage investment in the network by improving the network's visibility and usability within the communities it is supposed to serve through improved documentation and training rather than by blindly underwriting massive increases in speed.

How Far To Extend Network Access?

With the broadening discussion of the NREN vision, expectations of many segments of the population not originally intended to be served by the network have been raised. An avid group of educators wishing to use the network in K-12 education has arisen. If commercialization brought significant price increases, it could endanger the very access these educators now have to the network.

Native Americans have begun to ask for access to the network. How will Congress respond to them? And to the general library community which with the Coalition for Networked Information has been avidly pressing its desires for NREN funds? And to state and local government networks?

Congress should recognize that choices about network access for these broader constituencies will be made at two levels. Access for large

numbers could be purchased by the government from commercial providers at considerable expense - an unlikely development in view of the Federal budget deficit. In the meantime, given the current mix of government supported and commercial providers, the environment for these user classes is quite competitive. Those who are able to pay their own way can generally gain access to the network from a choice of providers at reasonable cost. Congress can act on behalf of these constituencies by ensuring that the market for the provisioning of network services remains open and competitive. Short of either regulating the industry or establishing a new government operated network, careful use of subsidies will have the most impact on ensuring an open and competitive network. Congress can also choose to view access as a function of price. If Congress does opt for this course, it has several choices to ensure that prices will be affordable. It could seek to impose regulations on the network providers through the FCC at a national level or urge the state PUCs to do it at the local level. (Of course the viability of state PUC regulation, becomes questionable by the near certainty that there would be little uniformity in how the PUCs in each state would treat a national service.) Congress also could impose a tariff on network providers profits and use the tariff to subsidize universal access. It should, of course, understand that these courses of action would raise touchy questions of conflicts between Federal and state jurisdiction.

Congress may also have been vague in dealing with these broader network constituencies, because it wishes to sidestep making these difficult choices. The origin of most of these choices may be traced to the addition of education policy goals for the Network symbolized by the changing of its name from the National Research Network to the National Research and Education Network in the OSTP Program Plan in September 1989. While this action got the attention and support of new constituencies for the Network, it did not bring any significant shift to the science and mission agency oriented direction of network development. The legislation remained essentially unchanged: "educators and educational institutions" were as specific as the language of the bills ever got. Perhaps this was almost on purpose? Having goals that were more specific might imply the need to justify with some precision why some individual segments of the networking community deserved service while some did not.

Unless Congress were able to construct a separate rationale for the needs of each of the network constituencies - from supercomputer users to grade school students - specific goal setting by Congress might imply that Congress was arbitrarily judging some network constituencies to be more worthy than others. This would be a difficult course to follow because those who were left out would want to know what the basis for such a judgment would be? Solid answers

would be difficult to come by because networking as enabling educational technology is so new that no one is as yet quite sure how to measure its value. Without such assurances, it may be difficult for Congress to know how to justify its spread on any other grounds than equity of opportunity.

Indeed there is a constituency of grass roots-oriented, small-scale network builders allied with elements of the library community. This constituency suggests that computer networks will very quickly become such powerful means of access to information that lack of access to them will soon will carry serious implications for social and economic equity within the nation.

These groups can be expected to be very vocal in their demands that some minimal level of access to the national network be widely available and affordable. They are likely to ask that Congress turn its attention to the feasibility of establishing the goal of universal access to the national network. Although the technology and economic conditions are quite different from the conditions of the 1934 Communications Act, they are likely to demand action analogous to that.

Motivated by these concerns, Mitch Kapor has been arguing very eloquently for the building of the NREN as a National Public Network. Asked to define what he saw as being at stake, he said the following to the author in September 1991:

"Information networking is the ability to communicate by means of digitally-encoded information, whether text, voice, graphics, or video. Increasingly, it will become the major means for participation in education, commerce, entertainment, and other important social functions. It is therefore important that all citizens, not just the affluent, have the opportunity to participate in this new medium. To exclude some is to cut them off from the very means by which they can advance themselves to join the political social and economic mainstream and so consign them to second-class status forever. This argument is analogous to that which was made in favor of universal voice telephone service - full social participation in American life would require access to a telephone in the home."

Kapor through his Electronic Frontier Foundation, (EFF) is working hard to make sure that Congress is compelled to address the question of universal network access. The EFF has also begun to press for the use of ISDN as a technologically affordable means of bringing the benefits of a national network to all Americans.

If Congress wishes to promote widespread access to the network and to



design an network that is amenable to widespread use, it will do well to examine carefully the position that the EFF is articulating. It would also do well to look outside the confines of the Federal Networking Council (FNC) and the FNC Advisory Commission that is made up of members similar in orientation to the FNC and is scheduled for only four meetings and a two-year-long existence. If it wishes to increase secondary and elementary school access to the network, it could investigate enlarging the very small role granted by the legislation to the Department of Education. Unfortunately, without careful planning what would be gained by this is unclear. The Department of Education has never played a significant role in computer networking. The immediate needs of the K-12 arena are focused mainly around maintaining the existence of affordable low bandwidth access and the support of successful pioneering efforts.

When Congress states its intentions for the scope of access to the network and, as a part of doing so, sets priorities for investment in network bandwidth versus ease of use, it can then turn its attention only to one other area.

#### A Corporation for Public Networking?

Network governance and oversight are key policy issues.

If Congress has doubts about the current situation, it might want to consider the creation of an entity for NREN management, development, oversight and subsidization more neutral than the NSF.

Action should be taken to ensure that any such an entity be more representative of the full network constituency than is the NSF. If Congress decides to sanction network use by a community broader than the scientific and research elite, it must understand the importance of creating a forum that would bring together the complete range of stake holders in the national network.

While such a forum would not have to be a carbon copy of the Corporation for Public Broadcasting, given the half billion dollars to be spent on the network over the next five years and the very confused and contentious policy picture, it might make sense to spend perhaps a million dollars a year on the creation of an independent oversight and planning agency for the network. Such an entity could report its findings to the Congress and respond to goals formulated by the Congress.

Congress could declare the development and maintenance of a national public data network infrastructure a matter of national priority. It could make it clear the government will, as it does in issues of national transportation systems, the national financial system, and

national communications systems, maintain an interest in the development and control of a system that serves both the goals of improved education and new technology development.

To carry out such a mandate, a Corporation for Public Networking (CPN) could have fifteen governors nominated by the members of the network community and subject to the approval of the Congress.

Each governor would represent a network constituency.

1. The NSF
2. Department of Energy
3. National Aeronautics & Space Administration
4. Advanced Research Projects Agency
5. Corporate Users
6. K-12
7. Higher Education
8. Public Libraries & State and Local Networks
9. Commercial Network Information Service Providers
10. Interexchange Carriers such as AT&T, MCI, Sprint, etc.
11. The Regional Bell Operating Companies
12. Personal Computer Users
13. Computer Manufacturers
14. Disabled Users
15. University Computing

Since the legislation calls for backbone nodes in all 50 states, such a structure would be a reasonable way to coordinate Federal support for the network on a truly national basis - one that, by acknowledging the network as a national resource, would give representation to the full breadth of its constituencies. Governors could use the network to sample and help to articulate the national concerns of their respective constituencies.

If it adopted these goals, Congress could give a CPN a range of powers:

1. The CPN could be a forum for the expression of the interests of all NREN constituencies. In the event the network were to be administered by the NSF, it could be serve as a much more accurate sounding board of network user concerns than the FNC or the FNC Advisory Council.
2. The CPN could be authorized to make recommendations to NSF and other agencies about how funds should be distributed.

Such recommendations could include truly independent assessments of the technical needs of the network

community and the most cost effective ways of achieving them.

3. The CPN could itself be given responsibility for funding distribution. Such responsibilities would incur an increase in administrative costs and staff. Nevertheless, by creating an opportunity to start a process from scratch and one that would consequently be free of the vested interests of the National Science Foundation in high-end network solutions, Congress would likely get a clearer picture of where and how effectively public monies were being expended. With such responsibility the CPN could also keep extensive pressure on network providers to remain interconnected. When thinking about cost, Congress should also remember that effective oversight of subsidies funneled through NSF would imply the hiring of extra staff within that agency as well.
4. Congress might want to ask a CPN to examine the use of the \$200 million in NREN R&D monies. Policy direction dictating the spending of Federal funds is still suffering from the fuzzy boundaries between the network as a tool for leveraging technology competitiveness into commercial networking environments and the network as a tool to facilitate science and education. If Congress decides that the major policy direction of the network should be to develop the network for use as a tool in support of science and education, then it may want monies directed toward ARPA to be focused on improved databases, user interfaces and user tools like knowbots rather than a faster network used by fewer and fewer people. A CPN that was representative of the breadth of the network's user constituencies could provide better guidance than the FCCSET or ARPA for spending Federal subsidies aimed at adding new capabilities to the network.
5. Additional levels of involvement could have the CPN act as a national quasi-board of networking public utilities. It could be given an opportunity to promote low cost access plans developed by commercial providers. If it borrowed some of the fund raising structure of National Public Radio, it should be able to raise very significant funds from grass roots users at the individual and small business level who are made to feel that they have a stake in its operation.
6. If congress wanted to increase further the role given the CPN, it could decide that with network commercialization

and technology transfer goals completed, the majority of the NREN funds go to the CPN which could then put out a bid for a CPN backbone. In effect Congress could dictate that the backbone announced by the NSF for implementation in 1993 be implemented and run as a joint project between the NSF and a CPN.

All entities should be considered eligible to join and use the CPN in support of research and education. Commercial companies who wanted to use the CPN to interact with the academic community should pay a commercial rate to do so.

With the availability of a parallel commercial network, commercial restrictions on the CPN could be very much loosened to include anything in support of research and education. The CPN would study and report to Congress on how gateways between commercial TCP/IP networks and the CPN network could be maintained.

7. Some suggest that the Congress go even further. These people emphasize that a replacement for the R&D aspects of the Internet in the context of commercialization and privatization is uncertain. Bell Labs and Bellcore remain as the research arms of the Public Switched Telephone Network. However neither of them have ever developed major strengths in wide area data networking. Nor do they appear to be likely to do so in the near future. Despite this situation, the major private investment made in the Gigabit Testbeds indicate that the American telecommunications industry feels a need to invest in continued research. This is something that the current commercial players are too small to do. Furthermore, it is something that the larger players driven by pressure to report quarterly profits may find difficult to do.

Congress could make a decision that Federal investment in the technology should emphasize less pump-priming to increase the pace of what most see as inevitable commercialization and more the continued building of new networking technology for both technology transfer and support of the technology as an enabling tool. In this case Congress could direct the CPN to plan, deploy and manage a state of the art public information infrastructure. With goals for constituencies and levels of service defined, the CPN could produce for Congress multiple scenarios for developing and maintaining two networks.

The first would be an experimental network where the very newest technologies could be explored. It could be very similar to the current gigabit testbeds but this time with all five projects linked together. The second would be a state-of-the-art operational network that can provide wide spread field trials of technology developed on the experimental network. With the maturation of the technology on the operational network it would be available for open transfer to commercial service. It should be remembered that such a continuous widespread network R&D environment would provide wide spread training experience for graduate students that would otherwise be unavailable.

Initial seed money would come from public funds. However, the bulk of support could come from a percentage of profits (as cash or in kind contributions) that participating companies would be required to contribute to the CPN as the price of admission for developing and benefiting from new technology. Care should be taken in structuring contributions in a way that small start-up firms would not be locked out. To ensure this, Congress could mandate that the CPN commissioners (perhaps with appropriate oversight from the National Academy of Sciences, the IEEE, or the ACM) develop a plan to ensure that the cost of entry to such a testbed not exceed the capitalization of the current small commercial players.

It could also require the development of proposals to handle the issues of interconnection billing, billing for actual use versus size of connection, and interoperability among network providers.

A different financing model could be explored if the CPN were instructed to report on the feasibility of selling shares to commercial carriers in a national networking testbed and R&E network where carriers could, over a long term basis, develop and mature new networking technologies before transferring them to the commercial marketplace.

8. In its November 1, 1991 recommendations to the National Science Foundation, FARNET suggested that the NSF should consider the issuance of several separate solicitations for the development of software tools for end-user applications and network management and operations. To emphasize its point it added: "we believe that the lack of useful tools for information retrieval and display is one of the biggest impediments to the productive use of

the network and has impaired the credibility of the NREN in the eyes of the target user populations." FARNET admonished the NSF to emphasize open architectures and standards in its solicitations, adding that "where standards are not adequately understood or developed, the NSF should support programs to test, evaluate and improve them."

FARNET concluded by recommending

"that the NSF, working with the user community and the providers, define and implement clear criteria for the award of additional funding to mid-level and campus networks . . . The new criteria should be designed to further . . . goals such as the extension of network services to new or underserved communities (for ubiquity); the improvement of network operations, procedures and tools (for reliability); the enhancement of existing services through development activities, upgrading of existing connections to 'have not' institutions; leveraging of state, local, and private funds (to maximize the impact of Federal investment), and training and support for end-users (in cooperation with national and local programs)."

If a CPN is created, it should be directly involved with working toward these important goals. If implementation of the network is left to the National Science Foundation, Congress should emphasize the importance of the NSF's meeting these goals.

9. Finally, a strong and broad-based CPN might be able to make recommendations to Congress on the identification and resolution of problems of telecommunications policy engendered by the continued growth of this network technology. It could perhaps play an educational role in advising state Public Utilities Commissions on the long term implications of their decisions.

#### Summary

Policy makers must soon decide whether the National Research and Education Network is a public or a private good. Although privatization appears to be proceeding apace, since the network backbone will be rebid, there should be time for some careful planning for the development and evolution of what can, within 10 to 20 years, become an extraordinarily powerful system that is as

ubiquitous as the current telephone network and provides all Americans with access to information in much the same way as public libraries were created for a similar purpose a century ago.

Congress must understand that the NREN is not just a new technology (indeed much of it is old technology), but has the potential to become the most powerful means of access to information ever created. Within this context it must decide whom the NREN shall serve. It must decide whom shall have access to the NREN.

Once it has done this further options fall into four major areas:

- First: Congress must decide degree of oversight that is necessary to extend to the network. Such oversight could range from legislating that the FCC regulate the network, to strict reviews of the NSF's actions, to vesting oversight powers in a Corporation for Public Networking.
- Second: It must decide whether the appropriate place to subsidize technology transfer is within a privatized operational NREN or within the experimental gigabit testbeds. Without a better understanding both of how the technologies are evolving in the commercial market place, and the evolution of both the testbeds and the NREN, it will be difficult to make a wise decision. In addition, we must expect that the nature of its choice will be further influenced by its decision on whom the network is to serve.
- Third: It must decide whether to subsidize a backbone for an NREN. If it does subsidize such a backbone, it must decide whether it shall be built as a private network or as a part of the PSTN.
- Fourth: It must decide whether to subsidize additional connectivity or broader use within connected institutions or both. In other words, should more institutions be connected to the network, or should the network be made easier to use by the members of those institutions already connected?

To the extent that Congress chooses to pursue options three and four, it will want to explore the scenario for the Corporation for Public Networking discussed above.

Access to information is access to power. The creation of a National Research and Education Network based on the NSFnet and the remainder of the American Internet will mean the creation of a national information access system of unprecedented power. In its ability to affect the lives and well being of Americans, the NREN, if properly designed, will be just as significant as the national Interstate highway system and the national electric power grid. The national highway, or the national power grid, or the national telephone system could serve as models for implementation. The Federal Government provides a public but otherwise unregulated Interstate highway system with universal access available to all Americans. Private industry provides our electric power. However, it was allowed to do so only in return for submitting to Federal and state regulation designed to ensure affordable national access by all citizens. The national telephone system has been established under a similar "social contract". If the nation is not to be dangerously split into information rich and information poor classes, policy makers have about five years in which to choose a Federally provided National network, or a privately provided but nationally regulated network.

During the development and maturation of the national network, policy makers should also be very attentive to its impact on the public switched telephone network (PSTN). The technology involved and the speed with which it is changing will only increase the potentially serious impact from the freedom of unregulated components of the telecommunications industry to pursue market solutions that will keep regulated companies from becoming viable players. We must realize that we are about to enter a power struggle for the control of the information resources of the 21st century that promises to be every bit as harsh and bruising as the power struggle for natural resources was at the end of the last century.

While the intentions of most appear to be good, as this study has shown, the playing field is terribly confused. Gigabit technology (if properly understood) is desirable. Still we should take great care that its cost does not raise the price of low bandwidth or "low end" entry into the network.

Lack of a specific definition of communities to be served, lack of an agreed upon plan for how they shall be served, and lack of funds to serve everyone have combined to create the present chaotic situation in which many of the players have been motivated primarily by a desire to increase their institutional role in order to get larger Federal allocations of funds.

In the absence of both a well-thought-out plan agreed to by all parties and adequate monetary support, the grand push to accelerate both the speed and scope of the technology could have the ironic role



of weakening the entire foundation of the network. Until the Congress provides more direction, the squabbling that has developed is likely to continue. In the absence of such direction, at best large sums of public funds may be ineffectively spent, and at worst a picture of empire building could emerge that would make any Federal support for research or educational networking unlikely.

Such an outcome should be avoided because the potential of a well designed and developed network to do great good in both policy arenas is very significant. Unfortunately with the NSF under mounting criticism, ANS on the defensive and rumored to be financially weakened, and Congressional hearings scheduled for mid-March, the potential for a destructive free-for-all is very great.

#### Security Considerations

Security issues are not discussed in this memo.

#### Author's Address

Gordon Cook, Editor and Publisher  
COOK Report on Internet  
431 Greenway Ave  
Ewing, NJ 08618

Phone: (609) 882-2572  
EMail: cook@path.net