

NSFNET "Privatization" and the Public Interest: Can Misguided Policy Be Corrected?

Vol. I, Nos. 10 & 11, Jan & Feb. 1993

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An Historical Review of Network Policy Making - 1989 to the Present

Pointers for Corrective Action

Introduction

The National Research and Education Network (NREN) - potentially one of the most critical technology elements of the new Clinton Administration is in trouble. It is in disarray because the centerpiece of the future NREN, the backbone of the National Science Foundation Network was "privatized" by the Bush Administration at the end of 1990, in a mistaken belief that what seemed to be good for IBM would be good for the nation. The "privatization" placed the backbone in the hands of Advanced Network and Services (ANS), a non profit spin-off of IBM, MCI, and MERIT - the NSFnet cooperative agreement recipient.

The "privatization" was undertaken without any agreement among the players of what would constitute criteria for success, either in terms of network access and cost; in terms of technology and connectivity to other networks; or in terms of usability -- would people be able to do with the network what they want and need? Indeed one wonders whether what has happened should even be called privat-

ization. Consider the following comment: "Privatization and free markets don't result from exclusive government contracts for \$10 million a year. The free market results when the government gets out of the business, and lets individual buyers purchase whatever networking they are willing to pay for, from whoever they want to buy it from. Privatization means that the government no longer provides a service, not that they subsidize a private company to provide the service."¹ and ^a

On November 1, 1992 policy at the NSF had come to such an impasse that the agency - by administrative fiat - extended Federal payments for backbone provision to ANS for another 18 months.^b This in spite of the fact that both ANS and NSF documents released to the author by the NSF under FOIA a month ago indicate that the NSF has had some difficulty with both MERIT and ANS in enforcing the conditions imposed by NSF when it agreed to the "privatization."^c Apparently the NSF is marching onward because the only other choice would be to terminate the cooperative agreement with MERIT and watch the structure of the NSFnet collapse.

The NSF is paying ANS \$10 million a year for a backbone that is supposed to operate at 45 megabits per second (mbps) but in reality operates at closer to 8 to 10 mbps. The NSF is also subsidizing, at a rate of approximately \$7.5 million a year, a mid-level network infrastructure that connects 1200 colleges and universities to the backbone.² and ^d ANS is functioning as a

direct competitor of this mid-level infrastructure by acting (in telephone industry terms) both as an interchange carrier and a local exchange carrier. ANS has told the NSF what it intends to do to develop and expand

Special Double Issue

Based on Source Material Obtained Under Freedom of Information Act from NSF.

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Note: Comments from NSFnet Director Steve Wolff are inserted as lettered footnotes with the word footnoted in boldface. They are found at the end of the numeric footnote section on p.32

the network. But because ANS now functions as a private company with a for profit subsidiary, it is by no means certain that the NSF will be informed whether ANS game plan is succeeding in a timely enough way to allow for informed policy making by the NSF. Meanwhile there are signs that ANS will have considerable difficulty in meeting the goals it has set.

While the US government still uses taxpayer funds to build up the mid-level infrastructure, and still uses taxpayer funds to buy access from its commercialized backbone provider, it has apparently given up all control over the network **backbone**.^e In doing so, it has given up its ability to define the network in terms of the public interest. Furthermore while the NSF remains heavily involved in funding the mid-level networks, it has also acted in such a way that the outcome of events affecting the backbone could force it to significantly increase mid-level subsidies. As this report will show, ANS, into whose hands the NSF has placed the backbone, appears to be a competitor of the mid-levels having interests that may not be compatible with their long term interests. If ANS actions should harm the mid-levels, the NSF would be likely to find itself in a position where it would feel it had no other choice but to step into the monetary **breach**.^f

The NREN is seen by many as a network that will bring about major improvements in the nation's educational infrastructure. However, because the NSF does not have unlimited funds at

its disposal Vice President - Elect Gore's dream of an NREN that serves a critical information age public interest purpose of enabling that little girl in Tennessee to log into the Library of Congress and do her homework on dinosaurs is in **danger**.^g The NREN is seen by others as technology that can be transferred to business in productive ways. According to Tom Valovic, "at least in theory, with the proper oversight by those responsible for its development, the Internet [and its NREN component] could become a worldwide data networking utility that multinational corporations, and enterprises could tap into regardless of geographical location."³ Because of policy decisions made in 1990 and not yet rectified, this outcome is also **problematic**.^h

The American Internet has split into two unfriendly camps: ANS and some of the mid-levels on the one hand, and the Commercial Internet exchange on the other. The continuance of network connectivity between the two camps is not assured, and the NSF admits that there will be no single NREN **network**.ⁱ Probably through no fault of its own the NSF has lost **control**.^j But OSTP, and Congress do not even seem to recognize that there is a problem.

Senator Gore's concept of an NREN was the right technology choice. But it is one that threatens to be still-born because, for the past two years, the wrong decisions have been made about its implementation. While in

Japan industries are re configuring their cultures to form cooperative links both vertically and horizontally, we had in Republican America a counter-intuitive obedience to the free market with a concomitant belief that what is good for our biggest corporations is good for the **nation**.^k This is the policy that drove decisions in ruinous directions. Decisions were made to "privatize" the NSFnet backbone now rather than wait for the emergence of a privatized NREN that congressional legislation called for before the end of the **decade**.^l

In 1990 MERIT, IBM and MCI decided to create a jointly funded spin off called ANS that would privatize the NSFnet backbone. While the plan was carried out, the new venture quickly found itself in conflict with almost all other network players. More than two years of strife have followed where, instead of cooperation, the government endowed apparent favorite found itself in divisive conflict with national as well as regional service providers. Documents obtained from the National Science Foundation under the Freedom of Information Act provide the critical missing pieces to what is otherwise a part of the public record.

Change is needed if this critical technology is to serve the national interest. But to be able to change, those involved must realize that what they are doing is unlikely to succeed, that the model they are building is broken. This essay will show the brokenness of the model and will close with recommendations for change.

Part One: Executive Summary

With planning for an NREN going forward in Congress and competition there between the Department of Energy and the National Science Foundation for lead agency, the NSF had ambitious plans for continued growth of the NSFnet backbone. Unfortunately for it had little money with which to fund an upgrade to T-3 speed. At some point in early 1990 with IBM in the lead, MERIT came up with a plan to create ANS as a non profit operator for a new high speed privatized commercialized backbone. The NSF was asked to accept the privatization of the backbone under the guise of a mere realignment of the cooperative agreement with MERIT. Short of terminating the cooperative agreement and the politically unthinkable course of putting the backbone up for rebid, it had no other course but to accept the terms offered.

The design was immediately and grievously flawed for not only was there no plan for the privatization and no criteria by which to measure its success or failure. Furthermore it held unacknowledged economic implications for what was being privatized was the only part of the network that had no customers.

Part One

MERIT, IBM and MCI Present ANS as an Offer the NSF Cant Refuse

At least as early as June of 1990 MERIT and its joint study partners IBM and MCI began to sell their plans for a non profit spin off in and around Washington.

1990 "Privatization" as a Means of Heading Off the HPCC Legislation

In the summer of 1989 the IBM people responsible for operation and support of the NSF cooperative agreement with MERIT began planning for an upgrade of the NSFnet backbone to T-3 speeds.⁴ They presumably were also talking to the NSF at this point about an agenda that could help the NSF in Congressional jockeying for NREN leadership with the Department of Energy and about ways to meet the large cost of the T-3 upgrade. At the same time no matter what happened in Congress, the CISE directorate within the NSF was faced with shepherding a huge and complex network expansion as the direct result of current growth patterns. Indeed the NSF staff of 14 professionals were on the verge of being overwhelmed by the success of their efforts to build and expand the NSFnet. The situation was ripe for IBM to propose an outsourcing of the network.

At some point in late 1989 or early 1990 talks among IBM, MCI and MERIT began about the formation of a spin-off corporation to run the NSFnet backbone.⁵ By the spring of 1990 it is likely that Al Weis approached Steve Wolff to talk both about T-3 upgrades and perhaps about plans for a new operator for the backbone called at that time by the code name NewNet.⁶

Whether Wolff was told about "NewNet" before June 28, 1990 is unknown. What is known is that on June 28, he received the following letter from Doug van Houwelling of MERIT:

"Dear Steve:

MERIT, Inc in anticipation of continued growth of NSFNET and its evolution into a broader infrastructure for the national network, is restructuring its relationship with its partners, MCI and IBM. As you are aware that relationship has been implemented by bilateral joint study agreements between MERIT and each partner.

MERIT plans to establish, with its partners a not-for-profit corporation which will have the objective of meeting the needs of the national network community. MERIT will then enter into an agreement with this corporation where as subcontractor to MERIT, it will become the backbone service provider in lieu of MERIT.

The equipment, facilities, and services now being provided by MCI and IBM will continue on terms no less favorable than the current joint study agreements, and the parties will mutually agree on the terms and conditions applicable to levels of support required for future expansion and enhancements to the network.

MERIT believes that this new organization will be able to provide a much needed base for further investment in the network and for service to a broader group of institutions and users. We are confident that you recognize the need and share our enthusiasm for this new structure, and we request your formal approval of these plans.⁷

The tone of the letter to the overseer of its Cooperative Agreement at the NSF is **peremptory**:^m "MERIT is restructuring . . ." Merit plans to establish . . ." "MERIT will then enter into an agreement with this corporation . . . where it will become the . . . provider in lieu of MERIT." The tone does not ask permission. Rather it states a fact and invites the government to approve retroactively. It is to Steve Wolff's credit that he took 74 days (until September 10) to accede to the demands that were being placed upon **him**.ⁿ

Meanwhile, at the June 1990 meeting of FARnet⁸ "Al Weis met with the FARnet executive committee at a non-disclosure meeting to inform them that a new not-for-profit corporation, tentatively called Newnet, was being set up. . . . In a series of meetings over the summer the FARnet executive [committee] expressed apprehension at the regionals competing directly with a corporation backed by such players as IBM and MCI."⁹

In a letter to Al Weis FARnet replied that the mid-levels often used surplus revenues from large institutions to subsidize the access of small institutions. It expressed fear that if NewNet skimmed cream from the mid-levels the consequent loss of funds would endanger the access to small institutions to the network. "NewNet should be flexible in making business arrangements with the mid-level networks and should endeavor to preserve not supplant them." Later on in the same letter the author added that another way to support the mid-levels "would be to create mechanisms for sharing revenue between NewNet and the mid-levels such as . . . the direction of NewNet revenue into a fund for the develop-

ment of appropriate expertise and infrastructure at the state and regional level."¹⁰ (This is the earliest mention of what would become the infrastructure pool that will figure prominently at the end of this article.)

As Weis himself later wrote: "MERIT proposed providing T-3 service over a shared privatized backbone network which was to be owned and operated by this new company."¹¹ All these events apparently alarmed enough people that John Markoff was able to write in the *New York Times* on July 16:

"The International Business Machines Corporation, the MCI Communications Corporation and officials at a group of Michigan universities have quietly begun discussions with the Federal Government about creating a nonprofit company that would operate a high-speed computer network that could one day reach every home in the country.

Some competitors worry that I.B.M. and MCI will gain an inside track in the race to build such a network, which is expected to replace the various specialized but much slower networks in use today. The proposed network would function like the nation's interstate highway system, carrying not just computer data but television images, telephone conversations and other forms of communication.

Just as the highway system created economic activity everywhere it was built in the 1950's, the computer network is expected to create businesses that take advantage of its technology. The proposed network is thus seen as a significant business opportunity."¹²

Markoff is clearly talking about not just the NSFnet but rather about the NREN which is what people at the time felt the NSFnet was destined to become. Markoff continued: "I.B.M. and the Washington-based MCI say their motivation is to make the United States stronger. But their proposal is raising complex issues like who will operate the data networks and how they will be financed. A number of corporations, including computer manufacturers, regional telephone operating companies and providers of long-distance

telephone service are eager to participate in developing high-speed networks.

The discussions with the Government center on the network's management, whether by the Government or private corporations, as well as its structure. . . . I.B.M., MCI and the universities quietly sent a proposal to Government officials urging that they set up a nonprofit corporation to operate a national network that would carry data at more than 700 times the speed of today's fastest networks. . . .

I.B.M., based in Armonk, N.Y., insisted that it was not trying to pre-empt other efforts to develop advanced computer networks. . . . But others are puzzled about I.B.M.'s motivations for proposing a separate corporation to control the operation of data superhighways when advanced development of the systems is just beginning.

"It is still a wide-open question of how to structure a future network," said Fred J. Howlett, the division manager for high-speed data networks at the American Telephone and Telegraph Company. "The legislative momentum behind funding a high-speed computer network is strong right now. If there is any indication that corporations might go ahead without Government support, it wouldn't be helpful to the legislative effort."

I.B.M. has a significant advantage in the emerging computer network market because of its early investment in NSFnet, a number of industry executives said. And several suggested that the company might be considering computer networks as a future market for expansion.¹³

Markoff's article has stood the test of time very well for it identifies almost all the elements of the controversy that exploded in the following months. Weis is seen as the driving force behind the formation of what was announced to the world on September 17th 1990 as Advanced Network and Services. It seems very apparent that during the preceding year the IBM Vice-President had seen a window of opportunity to form ANS and in doing so to achieve two things. The first of these was that, by means of the new company, he hoped to ensure the continuation of IBM's control over the development of a testbed for experimentation in TCP/IP networking as a means of bailing out its declining market in Mainframes and SNA networks.

There were some in IBM in early 1990 who were concerned that the company was on the verge of serious market share and financial trouble. The second was that, by offering a new commercial spin-off company to inherit the NREN, he fit very well into the Republican ideology of the time which said that private industry should shepherd new technology development on behalf of the national interest.

AT&T's Fred Howlett had pointed out to Markoff his concern that, if an IBM MCI spin-off that announced it would do the NREN on its own, it would take some considerable wind out of the sails of Senator Gore's NREN legislation. It is easy to imagine how this would be looked upon with ideological and political approval at the White House since Gore was assumed to be a likely challenger of President Bush two years later. From what happened over the next year it seems very likely that White House signals of approval went out to OSTP and to the National Science Foundation in July or August of 1990.¹⁴ and o

The Birth of ANS

The "privatization" of the backbone occurred on September 10, 1990 when NSFnet Director Steve Wolff wrote the following letter to Doug van Houweling:

Dear Doug:

This letter responds to yours of the 28th June, concerning Merit's plans to establish a not-for-profit corporation with its partners.

NSF agrees to MERIT's assigning the existing joint studies with MCI and IBM to the new corporation.

NSF agrees to MERIT's subcontracting services to the new corporation. Although the new corporation may thus become the actual provider of the NSFNET Backbone, NSF will continue to deal with MERIT under the terms of the existing Cooperative Agreement.

The specific concurrence of NSF's Division of Grants and Contracts has been obtained in the above two paragraphs.

NSF agrees that the new corporation may solicit and attach to the NSFNET

Backbone new users, including commercial users, and may connect them to new or existing nodes on the Backbone, with the understandings that:

1) such users will reimburse the new corporation for at least the full average cost of the connection, the added traffic, and additional related support, and

2) the reimbursements will be used to enhance the network infrastructure and services, in order that the level of service provided by MERIT under its Cooperative Agreement with the NSF not be diminished.

NSF and MERIT will agree on the technical means of compliance with 2) above.

Sincerely,
(Original Signature)
Stephen S. Wolff
Division Director

With the issuance of this letter to MERIT the NSF gave the green light for "privatization" of the backbone. Unfortunately from available documents it seems clear that the assumptions of both parties were never spelled out in any detail. Neither any criteria for success were established nor were any milestones on the road to success charted.

The NSF had ambitious plans to expand its network infrastructure without either the money or the expertise to achieve its goals.^P Weis appeared to have both the money and the expertise as he talked of an additional \$10 million dollars pledged his new corporation by IBM and MCI over the next three years and of additional vast sums of money pledged by IBM on switch development and MCI on network upgrades over the next several years. "IBM and MCI were investing in America's research and education infrastructure to ensure greater American competitiveness over the long run" was the way he would put it public speeches during the fall of 1990 and presumably the tack he took in private discussions during the summer.¹⁵ Furthermore, according to his strategic plan, ANS would use its position to sell network attachments to the Fortune 1000, with the

revenues from this activity alone bringing in a substantial cash flow - presumably to be used in helping American Universities and colleges extend their presence on the network.

With such golden prospects outlined for the network, it is easy to assume that Steve Wolff would feel it to be his duty to facilitate the process. However given the players and the stakes one may wonder whether Wolff's letter was written without green lights having been gotten from the White House, OSTP, and the National Science Board where James Duderstat (the President of the University of Michigan where MERIT was based) had been a member since May 31 1985.¹⁶ and q Unfortunately for Wolff's ability to protect the government interest in the network, he had agreed to continue to deal with MERIT as the holder of the cooperative agreement with the NSF even though he realized that ANS would be doing the actual providing of the.^r (Of course from the government contractual point of view, if Wolff did not do this, the backbone would immediately have had to be put up for bid **again**.)^s Yet another element of the arrangement was problematic. Unlike most privatization ventures, for the immediate future, the entity in control of the network would not have a private customer base from which to generate its revenues. Its first and by far largest customer was the US government that perhaps unknowingly had just given up almost all control over the resources for which it was **paying**.¹⁷ and t

ANS incorporation papers were filed in Dover Delaware on September 13, and on Monday the 17th, a press conference was held to announce the new venture to the world. The official ANS point of view was well stated by Weis at the press conference when he said:

"The success of ANS will expand the base of financial support for the evolving national network. Fees charged to ANS subscribers, together with contributions from industrial companies such as IBM and MCI, will help reduce the financial burden on the federal government in its initiative to provide the nation with a high speed computer network. Because we are broadening the community of those using the network, the fixed costs of national networking will be more widely distributed. This will free up funds which could then be allocated to assist the neediest organizations to connect to the national network as well as to continue to support and enable the national network to

remain in the vanguard of the new technology."¹⁸

One of the questions of most interest to the network community was what entities ANS would be adding to its new network. Later at FARnet's September meeting Weis said that a main reason for founding ANS was to provide a way for commercial information providers of importance to the research and education community to deliver their goods to that community. "He maintained that ANS was not interested in attracting the business of purely commercial entities who were not interested in interacting with the research and education community."¹⁹

Part Two

Privatization Without a Plan: Contradictions of the ANS Vision Yield a Zero Sum Solution

During the autumn of 1990 ANS's plan became clearer to the NSF and to a lesser degree to the mid-levels.

Adjusting to Life Under ANS

According to a Report of FARnet-ANS Meeting of September 26 1990 (released to the author by NSF under F.O.I.A.), representatives of the mid-levels met with representatives of ANS at ANS headquarters in Elmsford New York to discuss ways of ensuring "successful relationships between the regional networks and ANS to enable both to achieve their goal of supporting research and education through high speed data networking."²⁰

The meeting's attendees included representatives from six mid-level networks. One, Joel Maloff left CICnet to become an ANS vice president shortly after the meeting. A second, Guy Almes, left SESQUInet to become an ANS vice-president in the spring of 1991. Bill Yundt represented BARRnet, Glenn Ricart SURAnet, Gary Augustson PREPnet, and Richard Mandelbaum NYSERnet. Mike

Roberts was there on behalf of Educum's National Telecommunications Task Force.²¹ Al Weis and Jordan Becker attended for ANS, Doug van Houwelling for MERIT and Ann O'Beay from MCI.

The meeting established four working groups designed to contribute to "successful ANS mid-level relationships:" Services; Qualifications Process for Regionals; Growth and Funding; Organizational Structure. All were established specifically to serve ANS purposes with the Services Group charged with developing a rating mechanism for the quality and kinds of services offered by mid-levels to their customers.

As Mandelbaum wrote: "ANS felt that for it to establish successful mutually beneficial relationships with the mid-level networks, some methods of assessing the relative capabilities of these mid-levels was thought to be required. This led to the formation of a Qualification Process work group to structure a fair qualification process for the regionals" [mid-levels]. What Mandelbaum was saying was that the regional networks did not all deliver the same quality of service in the areas identified by the Services working group and it would be necessary to develop a set of "criteria or metrics that could lead to the qualification of a regional network for the services it may provide to or receive from ANS."

The Growth and Funding Group would "focus on determining the technical, financial and process issues relating to reimbursements across Regional/ANS boundaries." The Organizational Group would "identify and make recommendations on organizational relationships between the regionals and ANS." ANS assigned a staffer to coordinate relations between the groups which would be between three and five members in size including an ANS member in each group. The groups would operate by email and face-to-face discussions and would finish their business by early December 1990 when a larger meeting of mid-levels was planned. The larger meeting did take place at the end of the first week in December of 1990. When ANS unveiled its Plan for Commercial Services for the first time at the FARnet meeting of August 1991, it would cite that plan as

Part Two: Executive Summary

Very quickly after ANS's creation it became apparent that ANS had one major aim in mind. To raise the speed of the backbone to multi hundred megabit speeds within two years. As it would explain to NSF, despite the fact that its sponsors had committed vast sums to bring their networks to SONET capability sooner than otherwise planned and produce gigabit switches as soon as possible on behalf of American competitiveness, it would need large additional sums of money.

It would obtain this income largely from the one part of the American Internet that did have customers, the mid-level networks. The money would mostly be obtained in two ways. First it would seek to detach from the mid-levels institutions that it thought it could better serve by direct attachments to its privatized backbone. Secondly, now that it was about to be granted the right to sell openly commercial use of the T-3 backbone it was building, it would develop plans to charge the mid-levels attachment fees to that backbone, and additional fees for sending commercial traffic across it.

ANS had spent much of the fall working with representatives from some mid-levels to determine the new criteria by which it expected to run the network if the NSF did not choose to rebid the backbone in 1992. From the point of view its plans for "Capital Infusion into the Backbone via Mid-level Network Fees and Settlements for Commercial Traffic," if the mid-levels had to raise costs to their end users in order to pay the fees ANS imposed, so much the better because such higher costs would narrow the difference between what it charged for its direct connections and the generally less expensive fees charged by the mid-level networks. What was not clear was the extent to which the NSF would be bound to bail mid-levels out should ANS be successful in taking away sizable numbers of their customers. A win for ANS was a loss for the mid-levels under these zero sum conditions.

In allowing ANS to sell direct access its own network (ANSnet) that used the same physical facilities as NSFnet, the NSF spoke of two virtual and presumably distinct networks. It properly insisted that commercial traffic placed by ANS on its network not diminish bandwidth needed by its own customers. However ANS's January 15 Proposal to the NSF made clear that once dumped into the network packets from its commercial customers would be indistinguishable from those of the NSF's customers. Furthermore if the network became congested it would be almost impossible to ascertain whether the congestion resulted from academic or commercial use. In ANS's own words: "there is no agreed to model for measuring congestion within an IP based network. At present, even the model of congestion determination described in the NSFnet solicitation of 1987 is not currently measurable by any tools that have been developed to date nor does there seem to be any work in the open literature suggesting that this is feasible." ANS went on to say how it would estimate congestion. One critic of the document said that it seemed to him that just as long as the counts of packets carried by the network kept going up ANS would be able to say that it had satisfied its part of the bargain.

The NSF was buying services from a new entity with an agenda more complex than just one of helping research and education. It had assigned most of the control over the network to an entity that appeared determined to sell speed in the hope that the Fortune 1000 would climb aboard, an economies of scale would be achieved, which, it was said, would benefit the research and education sector.

the result of a consultative process with the mid-levels that began at the December 1990 meeting.

The flavor of the events of the autumn of 1990 however was rather clear. ANS as the new landlord of the network was telling the mid-level tenets what it would expect of them under the regime that everyone expected to unfold beginning in November 1991. At that time it was widely anticipated that the NSF would announce that ANS would remain the backbone operator on the November 1 1992 expiration of the Cooperative Agreement with MERIT and that the NSF would continue to buy services from ANS.²¹ Since the NSF had been subsidizing mid-level backbone connectivity, it was widely assumed that when ANS became completely independent, mid-levels would have to find additional money to pay ANS for their backbone connections.²²

Thus the mid-levels publicly set out to see what would be required of them by their new backbone operator in a privatized environment. They took care in their public actions not to alienate ANS while in private conversations many expressed considerable fear that ANS was out either to put them out of business or take them over.²³ What ANS wanted became clear in a document sent by Al Weis to Jane Caviness on January 15, 1991. This document, released to the author under FOIA will be discussed below. However, in order to understand the document a look at Al Weis' infatuation with bandwidth is necessary.

A Gigabit Salesman Takes to the Road

Unlike almost everyone else who was a major player in the development and expansion of the NREN, Weis was not a network professional. His last title at IBM had been Vice President of Engineering and Scientific Computing.²⁴ In short he was responsible for IBM's efforts in supercomputing. When he and the author talked for the first time in person on November 16, 1990, it appeared to the author that he was one of those people who are infatuated with the development of leading edge technology. He explained his views on the importance of gigabit networks for American technology competitiveness and drove home his

point by saying that computer networks would be in the 1990s what supercomputing had been in the 1980s. He was moving to where the new action would be.²⁵

Wherever Weis went in the autumn of 1990 he was selling gigabits as the new bandwidth for which he was aiming. In an interview with the *Chronicle of Higher Education* published on September 26th 1990, he was quoted as saying ANS, "within two years," had "plans to offer speeds of a billion bits per second."²⁶ It later turned out that Weis felt that he had been misquoted, and said that he meant OC12 or 622 megabits within two years. He was adamant that breaking a one gigabit barrier (OC24) would take Federal help.²⁷

Some weeks later at Harvard University on December 1, Weis gave an hour long presentation on ANS's plans as part of the Kennedy School of Government Conference on the NREN. The general theme of the talk focused on how ANS would bring the necessary resources to the network to increase network speed and membership dramatically.

There Weis said: "But we [also] want to push technology and want to push it very aggressively. Right now we are upgrading to T-3 and in fact the west coast loop of the network has been running at T-3 for a couple of days. We are going to start testing OC12 next year, hopefully deploy it the year after. And we've got plans for OC24 soon. We would like to deploy it as aggressively as possible. At the same time we want to push down and expand as aggressively as possible." And a few minutes later: "and whatever you do you have to keep in mind that T-3 is only going to last a year or two and then you're going to be in gigabits shortly there after. So what you do today has to be workable with gigabits tomorrow."²⁸

From hindsight some two years later, it is obvious that Weis' vision did not materialize. (The backbone - ostensibly T-3 - has by ANS's own description seen bursts in the 16 megabit range and averages closer to **ten**.)²⁹ and ^v Weis appears to have made the same mistake that many technology enthusiasts do: assume that customers will come for the sake of the technology alone. His assumption seems to have been: we will offer the fastest most "modern" network and the Fortune 1000 will rush to populate it. A dubious assumption, for eighteen months later, his own network map would show ANS attachments repre-

senting perhaps a dozen Fortune 1000 **companies**.³⁰ and x

Who Will Mind the Public Trust? - December 1, 1990

At this talk Weis had an exchange with Mitch Kapor that would fore shadow many of the difficulties that Weis would experience over the next two years. Weis clearly had his own plan. He was also not a good listener to others input. He would appear at countless meetings during the first months of ANS' existence, give his standard speech, take questions and leave. The exchange of ideas in the opinion of most observers was one way. On November 16th he explained to the author that he did not participate in the com-priv mail list discussion because it was too open ended and would be too much of a drain on his time. His answer, when asked to participate in a US Congress Office of Technology Assessment sponsored computer conference that began on November 1, 1990, was essentially the same.³¹ While he would appear before different NREN interest groups, he studiously appeared to avoid going on record in text, by use of the network itself, where his remarks could be compared by a cross section of all interest groups.

After Weis explained how he was planning billing procedures for commercial traffic that crossed his backbone, Kapor asked to be recognized and said:

"Let me make a suggestion. In the light of what we heard yesterday from the economists about the complexities of how you might go about pricing and these issues, it strikes me that not only are the technical problems very hard but that the policy issues are equally hard and that ANS would do well to hold some sort of a public forum to pick the brains of the smart people who have thought about this as far as the policy issues and the options go.

I have to say that it makes me nervous when these deliberations take place privately because I think the public interest is involved in this. I think it is commendable that you are aggressively trying to build the infrastructure, but I would really like to see public involvement on anything that is policy related. And I'd help you organize

it. I'm sorry to slow up your process. But I think that the consequences of it have a quasi public character. It would be a tremendous mistake to pay any less attention to the policies than to the technologies."

Weis replied: "lest you think that we are paying less attention to the policy issues let me just say that at the meeting we are having in December we have got people coming from the government, from the regionals, from higher education, and from Educom. We have so much to do that we just can't afford to slow down."

Kapor: "But you also have the public trust. And you should ask yourself: does the institution [the network] have a peculiar character because of its quasi public nature? And you are breaking new ground here. It is not simply private enterprise. Private enterprise is used to moving ahead in this expeditious fashion. But I'm suggesting that if you do this in your position, it will cause problems."

Comment from the audience: "It's very much like the debate between President and the Congress on how much consultation there will be on policy making. What usually happens when the decision making is done in private by the executive, is that they get hammered by the public afterwards. Whereas, if there had been some consultation in advance, it wouldn't have happened."³²

This exchange proved to be prophetic. Mitch Kapor understood very well because it was the network that people used to network with each other. No matter what ANS would do behind closed doors, information would likely spill out and would be shared via the network. This was one technology that, because it spread power horizontally, was almost impossible to take over from above.

ANS and NSF: Diverging Directions

Weis however pressed ahead with single minded determination. While one speculates that most non profit organizations are very open with the plans for the constituency that they are dedicated to serve, ANS began to react much more as a highly pro-

prietary profit making company. Weis was dependent for most of his operating revenue on the 9,300,000 in government funds that MERIT passed through to him from the NSF between October 1 1990 and September 30, 1991.³³ Yet Weis also had achieved a status where he was well buffered from the government's guidance, since even though he was operating the network, the NSF had agreed to deal only with MERIT which essentially operated as a subcontractor to **him**.^y

The following document, released to the author under FOIA, provides some insight into the tendency of ANS (or perhaps MERIT and ANS) to go their own way in the autumn of 1990. At 9:19 am on November 29, 1990 Steve Wolff wrote to Hans Werner Braun who was a co-principal investigator for MERIT's cooperative agreement:

"No problems here at all. However the deal was and is that ANS must compensate MERIT for the connection; I quote from our letter to Doug van Houwelling of September 10th:

NSF agrees that the new corporation may solicit and attach to the NSFNET Backbone new users, including commercial users, and may connect them to new or existing nodes on the Backbone, with the understandings that:

1) such users will reimburse the new corporation for at least the full average cost of the connection, the added traffic, and additional related support, and

2) the reimbursements will be used to enhance the network infrastructure and services, in order that the level of service provided by MERIT under its Cooperative Agreement with the NSF not be diminished.

NSF and MERIT will agree on the technical means of compliance with 2) above.

I should appreciate understanding the methodology MERIT plans to use to arrive at the reimbursable "pass-through" amount under 1) (and I'm willing to help develop that methodology if MERIT wants NSF involvement). Also it seems that we'll have to "agree on the technical means of compliance with 2) above" sooner rather than later.

We're available to begin talking at MERIT's convenience. If MERIT enters into any interim agreements with ANS pending the NSF-Merit discus-

sion(s), ANS should understand that they have no force of precedent.

Cheers, -s"³⁴

Apparently, the conversation refers to the ANS decision to connect CONCERT to the network. However several things are not clear. Wolff apparently had to remind MERIT that the NSF required ANS to collect "pass through" fees from its new customer which were to be given to MERIT. (It seems that the idea of putting the fees in an infrastructure pool was not formalized until the NSF's second agreement with ANS on May 24 1991.) Clearly Wolff was reminding MERIT (and indirectly ANS) that the NSF was still in charge. From Wolff's final sentence warning MERIT not to enter into any agreements with ANS without the concurrence of the NSF, it seems reasonable to conclude that ANS (and perhaps MERIT) were already beginning to diverge from the NSF in their interpretation of what they were licensed to **do**.^z

Wolff also asked MERIT to agree on the technical means of compliance with point 2 "sooner rather than later." The fact that, according to other documents released to the author and discussed below, agreement did not take place for another two years seems to indicate that MERIT and ANS began to act increasingly in accord with their own **desires**.^{aa} One wonders whether Wolff had any recourse to bring them to heel, other than what would have been the exceedingly embarrassing public disclosure of their **disagreements**?³⁵ and **bb**

Meanwhile, on January 4, 1991 ANS Vice President Joel Maloff sent a lengthy list of ANS answers to questions that had been raised about ANS in the author's computer conference on the NREN sponsored by OTA. Maloff stated: "Regarding ANS's contribution to the backbone, ANS and the sponsors of ANS have contributed roughly 2/3 of the NSFnet backbone with only 1/3 coming from the NSF."³⁶

The author became aware of another disagreement between NSF and ANS when Steve Wolff told the author that he disagreed with Maloff's assertion and that the amount of investment on the part of the NSF was closer to **half**.^{cc} Wolff spoke of a need to have Weis screen comments from ANS before they were sent to the OTA Con-

ference. Wolff also stated that the author should not give Division Program Director Steve Goldstein an account in the OTA conference, because the NSF would speak with one voice there and it would be his.³⁷ Wolff was clearly concerned with exerting centralized control over the story that was being told about the NSF's **actions**.^{dd}

In the above-cited January 4th statement Joel Maloff also said:

"when the original NSF T-3 expansion was first proposed NSF could raise only enough funds to support a point to point spine network with no redundancy for fault tolerance, or robustness required to absorb the traffic generated at the T-3 sites. This was deemed to constitute an unacceptable level of service and the decision was made by the sponsors of ANS to add additional infrastructure to provide backbone redundancy, and facilitate restoration of services in the event of a single point of failure. NSF is not funding any of these enhancements which constitute a considerable fraction of the total backbone expenditure."³⁸

Maloff was pointing out "cost sharing" on the part of ANS, MERIT, IBM and MCI. Seven months later, Steve Wolff, in a message to the author, stated: "IBM and MCI will not say what their investment [in the backbone] is, but I have never heard an estimate below \$60 million if you include the T-3 upgrade. This does not include the MCI/IBM \$10 million initial stake for ANS."³⁹ Time and again over the next two years the "fact" that the providers of the network had spent more on it than they received would be used as justification for what by the end of 1991 many would call the uneven playing field. It was said that: ANS and its founders were justified in having an advantage because they had contributed large amounts of their own money beyond that which they got from the federal government to the network effort.

Yet the first ANS Form 990 doesn't bear these "cost sharing" contentions out. Sent to the IRS by ANS in April of 1992, it covers the period from October 1, 1990 to September 30, 1991 - roughly the first year of ANS' existence. With the most liberal interpretation it shows ANS as having spent about 4% more on the

network than the federal government paid for that purpose. A less liberal interpretation would show it making a profit.⁴⁰

On December 9, 1992 in a telephone conversation with the author, the New York City Public Affairs Office of the Internal Revenue Service stated that the intent of the Form 990 is to show all the income received for and spent on the tax exempt entity's program service activity. While the Public Affairs Officer obviously did not want to "rule" on a case where the details were not directly in front of him, he said that if ANS had spent significantly more than it received for providing the backbone service, it should be apparent from studying its Form 990 (assuming that the Form was filled out correctly and completely). (In his review of this report Steve Wolff asserted that the cost sharing had been in the form of "in kind" contributions from IBM and MCI.) The IRS Public Affairs office stated by telephone on December 30, 1992, that in kind contributions had to be tangible goods, could not therefore include services, and should be included on line 1a of page 1 of the Form 990. Consequently the author's analysis which includes the \$6,060,680 shown on line 1a appears to withstand Wolff's objection.^{41 and ee}

ANS as Decision Maker for the NSF

It is likely that Wolff was beginning to realize the extent that the NSF was only along for a ride in its new role of buying services from its privatized backbone provider when he received from Al Weis a document called A Proposal to Establish a Structure and Implementation Plan. On January 15 at 6:38 PM from Weis sent a slightly modified version of the above document to Jane Caviness, Deputy Director of NSFnet. This document was released to the author under FOIA.⁴²

In a section called "Background" Weis sets out ANS' charter:

"ANS was formed to participate in enhancing the competitiveness of the US in high performance computer networking by privatizing and expanding the current national backbone network serving the research and education community. . . . ANS expects to broaden the utilization of the network, make available vital commercial services to the research and education community, increase the speed and capability . . . [etc.]

. . . . With the formation of ANS, a transition will be required and mechanics must be created to allow for the conversion from a research effort to a viable privatized entity to carry out the mission."

Weis goes on to cite Wolff's letter of September 10, 1990 to Doug van Houweling authorizing ANS "to solicit and attach to the NSFnet Backbone new users, including commercial users . . ." He continues by saying that the "body of this paper describes how ANS expects to implement these concepts."

First and foremost Weis needs revenue to push the network to the speeds that he has desired. He proceeds to list nine activities from which he anticipates gaining revenue.

1. "ANS anticipates that many of its potential clients will be qualified institutions who are currently attached through NSF funded mid-level networks. Direct attachment to ANS will provide them with many benefits not available to them currently. Characteristics such as performance, services available, quality, and others will be the determining factor in many cases." Weis then goes on to point out that since such institutions are already attached to the network, if he prys them away from a mid-level and attaches them directly to his backbone, they will not count as part of "the ANS incremental user population" for which ANS would be responsible for investment in new backbone infrastructure. Nevertheless, he assures the NSF in the next sentences that ANS will invest in the network to broaden the overall infrastructure.⁴³

2. "Direct funding . . . will come from several sources. The initial direct funding source is the originating members contributions to establish ANS. The initial payment of \$2 million has been received by ANS and an additional \$8 million has been committed."⁴⁴

3. "In addition to the direct funding mentioned, both IBM and MCI will continue to invest significant indirect funds in the form of equipment, people resources, and circuits above and beyond the funding made available by NSF. . ." ⁴⁵ Hindsight appears to show that these were activities that both companies were involved in anyway. While IBM was developing the PARIS/Planet Switch that Weis could

use, it was not doing the work solely for Weis. (If the work had been just for the benefit of ANS, we should expect to see some indication of its value listed in the ANS Form 990.) The same thing is true for MCI which was developing SONET, but obviously not solely for Weis' benefit.

4. "Another significant source of funding will be: the attachment revenues derived from research and education users".⁴⁶ It is not clear what Weis means here. Perhaps he is talking about the universities that he is going to take away from mid-level networks and attach to his own?

5. "the attachment revenues derived from not for profit mid-level networks;"⁴⁷ All mid-level networks were attached by the NSF to the backbone for free. If this were going to change and a mid-level were to have to pay ANS \$50,000 a year for a backbone attachment at T-1 or \$300,000 for a T-3 attachment, the mid-levels would have to try to recoup these charges by increasing what they charged their university or commercial customers. To the extent that these prices grew higher, the gap between the cost of connecting to a mid-level and connecting directly to the ANS backbone would decline. This would make it easier for ANS to achieve the purpose cited in point one above: detaching current clients from the mid-levels and attaching them directly to ANS. Weis viewed the matter somewhat differently in his words to the author: the very success of the mid-levels that could sell attachments without having to account for the cost of backbone service could lead to the downfall of the network when the backbone could no longer support the traffic they shoved on to it.⁴⁸

6. "revenues from attaching commercial providers of information to the research and education communities;"⁴⁹ In addition to the direct attachment fee, it appears that Weis was thinking of this as a means of increasing the attachment fee paid by the mid-level in order to receive the commercial traffic.

7. "attachment revenues from for-profit mid-level networks;" These revenues would fall into the same category as point 5 above. They would presumably be those net-

works who over the next year in reacting to ANS pressures would form the Commercial Internet Exchange (CIX).

8. "other billable service and consulting revenues;"

9. "grants from industry and government. All of these sources will be required for ANS to meet its goals."⁵⁰

Clearly in view of the breadth of ANS' revenue requirements its goals must have been ambitious. But other than in the very general introductory paragraphs described above and in Weis' interest in extending the backbone to OC-12 speed within two years, the goals were not described. Why the emphasis on speed was there - regardless of demand - was left to the onlooker's imagination along with any kind of detailed cost budget. ANS wanted to impose a broad swath of charges to build a "faster" network. Weis showed a blind faith that if technology were put in place people would find uses for it.

But the ANS vision did not stop with the cost recoveries from pricing just described. The Proposal went on to say:

"For ANS to make the investments that will lead the network to its next plateau, SONET technology, funding above and beyond the recoveries derived from its pricing will be required. It is expected that such funding will come from investments by government, industry and the research and education communities."⁵¹

Weis appeared to be saying that the newly privatized entity would remain dependent on outside "investments" no matter what..

The very next paragraphs of the proposal shift focus back to the present:

"Qualified mid-level networks are expected to attach to ANS so that they can offer their users the advantage of a broader set of usage guidelines and the ability to access commercial providers on the national backbone. This concept was discussed at a recent meeting organized by the not-for-profit mid-level network operators and the proposal currently under consideration is attached as Appendix C. [A Mechanism for Capital Infusion into the Backbone Via Mid-level Network Fees and Settlements for Commercial Traffic.]

The proposal contemplates attaching the qualified mid-level at ANS standard pricing as a minimum fee with a premium fee assessment for commercial traffic transferred between ANS and the mid-level. The accumulated premium fees will subsequently be re-allocated by ANS to the parties which carry commercial traffic for the benefit of the national infrastructure. Portions of the available premium fees will be used to enhance ANS services, as well as a portion being redirected to the appropriate mid-levels to build their local infrastructure in support of the national network initiative."⁵²

Clearly the "reallocation" of "premium fees" was the infrastructure pool in nascent form. However when FARnet wrote to Al Weis during the summer of 1990 and said: "NewNet should be flexible in making business arrangements with the mid-level networks and should endeavor to preserve not supplant them"; it is unlikely that the imposition of a means of "capital infusion into the backbone via mid-level network fees" was what FARnet had in mind.⁵³ The above two paragraphs summarize Appendix C of the ANS "Proposal" of January 15, 1991. This plan would continue to evolve until August of 1991 when ANS presented it at a major FARnet meeting as the ANS Plan for Commercial Services.

Appendix C shows that ANS was proposing to measure traffic sent to and received from the mid-levels in the form of "COMbit counts which would be a "Combination' of network elements characterizing traffic load . . . used to calculate specific percentages" in the categories of research and education, commercial, and commercial to research and education. ANS gave an example of a fee calculation for a midlevel 85% of whose traffic was research and education only, with 10% commercial to research and education and 5% commercial only. The network's base fee for attachment to ANS would be \$5000. However there would be three fees added on top of this. First a research and education traffic fee of \$10,000, a research and education to commercial traffic fee of \$12,000 and a commercial traffic fee of \$20,000. Such a network would pay the following additional fees: 85% of 10,000 or \$8,500; 10% of 12,000 or \$1,200, and 5% of 20,000

or \$1,000. The total fee for the mid-level would be \$15,700.⁵⁴

The Appendix goes on to list a Basic Fee of \$15,000 and the difference of \$700 between basic fee and the full \$15,700 as the Premium Commercial Fee. (Note that it was presumably out of this very small percentage difference that the money for infrastructure enhancement would come after other deductions were taken.) It does not describe how the basic fee was arrived at and it also does not say what the fee would be when applied to a large versus a small mid-level. Nor does it say how the fee for a specific mid-level would be arrived at. In section H of the Appendix it does say that "funds redistributed to specific mid-levels would be based on individual negotiations between ANS and each mid-level."⁵⁵ Presumably the fee for each mid-level would be arrived at in the same manner.

After saying in the body of its Proposal what it would require of the of the mid-levels, ANS went on to say what it would give back to the network:

"In working toward meeting the spirit an letter of its agreements, ANS will fund:

1. Physical attachment to the shared infrastructure . . .
2. Services associated with an incremental ANS attachment to the shared infrastructure . . .
3. ANS traffic load placed on the shared backbone . . .
4. At NSF's request, ANS will participate at no cost to NSF, within the limitations of ANS' available resources, in technology demonstrations and conferences that serve the national interest.
5. ANS is committed to develop new tools and applications . . ."⁵⁶

Perhaps because ANS sold very few attachments to its network, one looks largely in vain on its first Form 990 for evidence of expenditures on the network that it, as opposed to the US Government paid for.⁵⁷

Some of the Difficulties of Determining Who Congests a Shared Resource

While Appendix A: "Process to Be Used by ANS . . ." is an elaboration of the points listed above, Section B called "Measuring the Network Performance" sheds some light on why it apparently took more than another two years to get a written formulation on the means of technical compliance asked for by Steve Wolff on September 10, 1990.

This section states that MERIT and ANS will monitor the performance of the network "to identify potential sources of congestion. ANS is committed to assuring that congestion sources which result from ANS attachments will be eliminated through backbone engineering or additional investments in circuits, network equipment, software or services."⁵⁸

Congestion can occur in the backbone at three points: routers, circuits, and the interface or boundary between the backbone and mid-level network. "It is recognized that congestion between the backbone network and mid-level network may be the result of capacity limitations in either the backbone or the mid-level network. It is recognized that ANS will have no control or responsibility over congestion resulting from inadequate infrastructure within the mid level network."⁵⁹

ANS was saying if its congestion at the interface, it might or might not be its fault. Consequently this leaves routers and circuits. But then we learn that: "there is no agreed to model for measuring congestion within an IP based network. At present even the model of congestion determination as described in the NSFNET solicitation of 1987 is not currently measurable by any tools that have been developed to date nor does there seem to be any current work in the open literature suggesting that this is feasible.

In the absence of any data on the actual performance of the T-3 backbone, MERIT and ANS propose to use the best measurable performance of the T-1 network for which historical records exist as a gauge for establishing a capacity ceiling below which shared infrastruc-

ture would not fall as new ANS traffic was added.

This performance measure utilizes such factors as:

- Average and peak delay - ping time
- Average and peak delay circuit utilization
- Packet switched performance

The documentation for these statistics is found in the monthly reports generated for the NSF by MERIT and in reports presented on a regular basis to the NSFnet Executive Committee."⁶⁰

What these remarkable paragraphs seem to say is that there is no way to measure what has been agreed upon as a definition of ANS commercial use of the network. Furthermore there is talk of measurement of a shared infrastructure rather than talk of measuring the traffic of either component. One wonders if separate measurements of traffic on ANSnet and NSFnet are possible. It looks as though such measurements are not possible - a strange conclusion in view of ANS assertions that which the networks share the same physical facilities, they are logically distinct.

A director of an internet services provider who reviewed this text had the following comment:

"Even worse it suggests that as long as ANS keeps traffic levels and response times better than the T-1 baseline they see the remainder of the circuits as theirs to play with. So rather than taking a bunch of federal monies and adding in private moneys and delivering a T3 net, they look to be promising to deliver something "not worse than" their old technology T-1.

Does that sound like a real good deal to you? It begs the question as to whether the T-1 was ever really evaluated. Let's examine the promises here:

1. MERIT builds a T-1.
2. It carries "a lot" of traffic.
3. MERIT/ ANS promises to build a T-3, which will carry "a lot" of traffic. It does carry "a lot" of traffic, more traffic in fact than the **T-1**.^{ff}

Never mind any other metrics of qual-

ity or performance like time to failure, time to repair, routing stability, stability under heavy load (for example the recent IETF video experiments), regional-to-regional throughput, and so on. So long as the packet counts still keep going up they seem to have satisfied the **bargain**.⁶¹ and gg

Some Concluding Thoughts on NSFnet Privatization

Privatization of an operation usually assumes there are customers who can make what the government was paying for into a financially self sustaining operation. Weis in January 1991 had one customer - the CONCERT state network which previously had been attached to SURAnet, a mid-level. Weis hoped for other customers. Yet by his own admission, his major source of customers would come from entities already attached to the network. What Wolff was greeted with here was a privatization option where the government would continue to pay for services and, in doing so, would loose control over the resources for which it was **paying**.^{hh}

For Weis offered a zero sum solution. To the extent that he was successful with his revenue raising tariffs, the mid-levels would loose by having to bear the brunt of additional charges on top of an academic user base that generally could not afford them. Especially if Weis succeeded in detaching many of the mid-levels current clients, these networks would be hard hit and would either have to increase the fees that they charged their remaining clients, go hat in hand to the NSF for more money, or go out of business. The last alternative was something that everyone knew that the NSF in the context of NREN could ill afford to allow to happen. What was by far the most likely would be for the mid-levels to go to the NSF for further subsidies.

Privatizing the one part of the network, the backbone, that had no paying customers didn't make much sense while the NSF still supported (if one can believe the accuracy of its own database figures)⁶² the more than 30 mid-level networks with

new grants for both new mid-level infrastructure and "connections program" grants in the amount of \$7,257,349 during fiscal year 1991 the first year of ANS' existence. The purpose of these grants were to extend the reach of the network and attach new colleges and universities to it. For ANS's plans to work it would have to reach into the part of the network where almost all users were attached and both take customers from the mid-levels and more money from them in the form of attachment and commercial use fees. To the extent that ANS was successful, it would create a situation where someone would have to come up with money to offset the charges that ANS imposed in order to pursue its own ends.

This however was not the picture that was given out for public consumption. When presentations were made, the emphasis was that IBM and MCI had committed vast resources to see that their non profit spin-off ANS got what it took to do the job. ANS Vice President Joel Maloff put it the following way: "IBM and MCI are each providing five million dollars to fund the startup of ANS. In addition they are spending significantly more internally to ensure that they have the technology required to achieve ANS's aggressive schedules in moving to gigabit per second services."⁶³

Part Three

Competing Designs for Commercialization ANS CO+RE versus CIX

During 1991 the network divided into two opposed camps: ANS and the CIX.

Fallout from the ANS "Proposal" of January 1991

The available evidence suggests that ANS was determined to introduce a new model into the Internet where networks that were interconnected instead of freely passing packets back and forth would keep tallies and charge each other in a form of measured use. Performance Systems International and Uunet were two other commercial TCP/IP ser-

vice providers who had been in business roughly a year by January 1991.ⁱⁱ Although they were each connected to the NSFnet backbone they were not interconnected directly with each other.

At the February 14, 1991 Internet Service Provider's Workshop held at the United States Congress Office of Technology Assessment by the author, Bill Schrader, President of PSI and Susan Estrada Director of CERFnet announced that CERFnet a California based mid-level, PSI and UUNET had agreed to interconnect their networks as the Commercial Internet Exchange (CIX) with a pledge that they would freely pass unmetered commercial traffic between each others networks. Since UUNET and PSI both ran coast to coast T-1 backbones, the CIX presented the mid-levels attached to the NSFnet with the possibility of an alternate backbone should relations with ANS become untenable.⁶⁴

As the spring and summer of 1991 passed ANS applied its strategy of attempting to pry loose clients from the mid-levels. While it met with very little success, from a succession of postings to the com-priv mail list and from numerous conversations that the author had with individuals involved among the mid-levels, it became apparent that it was creating considerable mistrust and resentment.

At the end of May it was reported that ANS was getting ready to launch a for profit subsidiary. At 12:32PM May 24 Steve Wolff gave his blessing to Eric Aupperle in the following message:

"Subject: ANS commercial traffic
To: Eric M. Aupperle, ema@merit.edu
Cc: jcavines@nsf.gov, steve@cise.cise.nsf.gov
>From: steve@cise.nsf.gov

This is to confirm our agreement on the flow of commercial traffic across the NSF sponsored gateways to the T3 network.

NSF agrees that ANS may move commercial traffic in both directions across the NSF sponsored Backbone gateways, providing that:

(1) ANS recovers at least the average cost of the commercial use that traverses the NSF sponsored gateways.

(2) Excess revenues recovered above costs for this use after tax will be placed in a pool to be distributed.

(3) An ANS resource allocation committee will be formed with representation from the participating NSF sponsored gateway management, other network organizations, the NSF and ANS to distribute those funds with the objective of further building national and regional infrastructure, and

(4) MERIT and ANS ensures that the attachment and service sponsored by the NSF under Merit's Cooperative Agreement with the NSF is not diminished.

NSF, MERIT and ANS will agree on the technical means of compliance with the points outlined above."⁶⁵

Launching ANS CO+RE

On May 30th ANS CO+RE incorporation papers were filed in Dover Delaware, and on June 4th the press conference announcing the new organization was held.⁶⁶ In the press release posted to com-priv on June 10, 1991 ANS said: "revenues from the provision of CO+RE Service, after covering associated expenses, will be used to enrich national networking infrastructure." The press release also quotes Steve Wolff as NSFnet director as saying: "the new service will not only enrich the network resources accessible to the research and education communities [that] the National Science Foundation is charged to support, but will enable all network users to benefit from the infrastructure enhancements and accompanying economies of scale."⁶⁷ Wolff's quote shows that he had bought into the official rhetoric. One wonder's whether he really believed what he was saying or whether he was hoping for the best.ⁱⁱ

In the pages of the June issue of *Tel-ecomunications*, Brian Kahin, Director of Harvard University's Information Infrastructure Project was quoted as noting that the "for-profit subsidiary offers a vehicle for substantial capital investment that would ordinarily be unavailable to a non profit corporation such as ANS, funds that would both come from

IBM and MCI. However if ANS proceeds with this approach it will raise a host of critical and unresolved regulatory

questions concerning the company's responsibilities to the public interest as a quasi-monopoly provider."

er."⁶⁸

The July issue of *Telecommunications* featured an interview with Weis who said that while ANS CO+RE would allow commercial and R&E users to interconnect, "a main objective of the company will be to develop a national data network that can offer high bandwidth connections to corporate customers. . . . Weis said that the ANS network, for example, could be used as a cost effective alternative to a nationally deployed private T-1 network. . . . For corporate customers, ANS CO+RE Services will provide 'one stop shopping' including the deployment of routers on the customer's premises, the provision of local exchange circuits, and the planning and installation of network equipment."⁶⁹ ANS, obviously aware that the outsourcing of corporate networks was turning into a multi billion-dollar-a-year business was ready to try for part of the action.

ANS supporters asserted that IBM and MCI, by "cost sharing" were themselves contributing three to four times the amount of money received from the NSF in order to provide the NSFnet backbone services. If these assertions were correct, then the NSF and US Government was just the first customer of a data network established with ten to fifteen million dollars a year in contributions from its corporate parents. On the other hand, if the ANS Form 990 for its critical first year shows all the cost inputs, we find out that contributions from its corporate parents totaled just over \$6 million while contributions from the US Government were **\$9,343,000**.¹¹ A critic could look at the latter set of figures and suggest that not only was Congress acquiescing in the use of tax payer dollars to fund a competitor of PSI and Uunet, but also a would be competitor of rather larger companies such as Sprint Net and BT Tymnet.

No matter who was subsidizing, whom with ANS CO+RE required to put profits from its success into the infrastructure pool, the NSF could perhaps feel that by assisting in the development of this commercial company, it was engaged in a venture that would benefit its constituency. However apart from the question of whether ANS was making enemies within the network

Part Three: Executive Summary

In early 1991 while ANS prepared to charge mid-level networks connection and settlements fees, two of its commercial competitors and one mid-level formed the Commercial Internet Exchange and pledged to interconnect freely, and without settlements charges, all networks who wished to join and pay an annual \$10,000 membership fee.

On May 24 1991 the NSF gave its blessing to a profit making spin off of ANS that would sell explicitly commercial use of the network backbone. While this was a privilege denied its commercial competitors, it was generally justified by assertions that ANS's sponsors, IBM and MCI, had spent far more on providing the network than they had received from the US government. (\$60 million total expenditure compared to \$18 million in Federal funds was an estimate given by Steve Wolff the NSFnet Director in July of 1991.) However a degree of doubt was cast upon this assertion in late 1992 when ANS's first Form 990 became available and showed expenditures for the backbone that roughly equaled income from Federal grants.

While ANS made it clear that it was now interested in offering turnkey outsourcing for Fortune 1000 T-1 networks, critics suggested that its marketing task would be a difficult one because of security concerns raised by offering services based on Layer 3 sharing in an environment accessible to hackers. By late 1992 it became apparent that offering services from a Layer 2 based backbone would be much more desirable from a corporate security point of view. Such a positioning would allow the commercial service provider to sell both a Virtual Private Network (VPN), and access to the Internet -- the best of both worlds. In the summer of 1992 PSI would move to a frame relay based backbone and gain VPN capability, a move that would apparently be denied to ANS as long as it remained dependent on IBM routers. ANS's strategy to expand dramatically the size of its network through corporate sales that would feed money into an infrastructure pool that would in turn benefit its research and education customers seemed to be facing some major handicaps.

Meanwhile ANS had been trying to get many mid-level customers to buy direct connections to it. Not surprisingly this alienated to a greater or lesser degree most of the mid-levels. In August of 1991, faced with the not easily understood cost impacts of the ANS Plan for Commercial Services, the mid-levels at a meeting of FARNET indicated that they wanted the NSF to stay in the backbone provisioning business in order to avoid what they feared would be tremendous fiscal uncertainty if ANS were left as the sole backbone proprietor when the cooperative agreement expired in November of 1992.

At the end of 1991 the impact of ANS's commercial backbone policy became clearer when Dialog was announced as ANS's first commercial customer and those mid-levels that had not yet signed the ANS connectivity agreement were blocked from connection. This made the impact of ANS's exclusive right to move commercial traffic across the former NSFnet backbone apparent to all. The resulting angry dispute made the *New York Times* and in January of 1992 Dialog was allowed to become an R&E customer of ANS so that it could be reached by the entire network.

world, there was the question of whether, from a technology point of view, it was positioned where it could expect to succeed. For would ANS have, from a cost point of view, to position its services against the fast packet (frame relay and SMDS) services offered by the telephone **companies**.^{mm} It would also have to deal with security as another issue. George Colony, President of Forrester Research told Telecommunications that the Internet is not thought of as a highly secure network among Fortune 1000 users. "The freedom and openness of the Internet which has been its biggest benefit, is also its biggest problem," he noted.⁷⁰ With ANS positioning itself to offer turnkey outsourcing, it was offering itself as a carrier for all a corporation's data -- not just for conversations between corporate researchers and academics. Memories of the infamous Morris "worm" would have to be in the minds of those to whom ANS would sell its services.

By virtue of the proposal that MERIT had submitted to the NSF in 1987 ANS CO+RE in 1991 could differentiate among its customers only at Layer 3 of the OSI protocol stack. Real data security however would be found only with networks controlled at **Layer 2**.ⁿⁿ Because the Department of Energy and NASA run national laboratories where classified work is done, they - like Fortune 1000 businesses - must be very security conscious in their network development and indeed their networks with classified data are never connected in any way to the Internet.

In December 1992 their plans were outlined in the draft version of the OSTP report to Congress on NREN:

"DOE and NASA will be spearheading the technology evaluation and deployment of cell relay services and protocols at the Open Systems Interconnect (OSI) Layer 2. These Layer 2 services and virtual private networks (VPN) allow for greater resource management accounting and control than typically provided in traditional Layer 3 networks. In addition DOE and NASA's choice of Layer 2 services is based upon Broadband ISDN standards advocated by the telecommunications industry as establishing the future direction for communications systems. Therefore DOE and NASA will be in full accord with the evolving worldwide telecommunications infrastructure and will be able to interoperate with the general research and education community as new telecommunications products and services

emerge and become commercially available. The DOE and NASA networks will initially interconnect at the FIXes, along with the next generation of the NSFnet backbone which itself is targeting advances in routing and peering technologies at OSI Layer 3."⁷¹

A person directly involved told the author that the NASA DOE effort had to focus on Layer 2 in part because of security concerns, adding that the Fortune 1000 would want virtual private networks which could be easily run over communications facilities at Layer 2 but not at Layer 3. Business also tends to require more protocols than just IP, and a Layer 2 based network will allow them such options. A focus on Layer 3 he added, is the best choice, if your mission is to interconnect hundreds of thousands of hosts and millions of users in a freely accessible open interoperable manner using a common protocol like IP.

Planning for November 1, 1992

During the spring and summer of 1991 speculation over what would happen with the expiration of the cooperative agreement on November 1, 1992 mounted. (The extent to which the NSF had given the backbone to ANS to operate was not yet clear to observers because Steve Wolff's messages of September 10 1990 and May 24, 1991 would not become public until December of 1991.) Wolff had made it clear that the NSF would announce its decision a year in advance or in November of 1991. He had also made no secret of the fact the NSF would like to get out of the business of providing a backbone. On May 24, 1991, in reply to questions asked by the author, he said that after November of 1992:

"the NSF may make a single award to a backbone service provider after a standards NSF competition - i.e. 'recompete the backbone'; ANS might win but so might Sprint. Or AT&T teaming with somebody, or PSI, or . . . I regard this option as very unlikely to be chosen.

Or [the NSF might] allow those who need backbone services to compete for the pot of money NSF now puts into the backbone via MERIT, and spend the money with any eligible provider ('eligible' at a minimum means participating in CIX/FIX - ie,

agreeing to carry competitor's traffic.)"⁷²

It should be noted that the second condition held an implied threat for ANS which insisted, because it provided the biggest and fastest backbone, it would measure and charge for carrying competitor's traffic. This was in contrast to the CIX where all members agreed to freely interconnect their networks without imposing settlement fees on a competitor's traffic. ANS was refusing to join the CIX. Wolff's plan to impose the CIX model of interconnection as a precondition for eligible for backbone attachment subsidies from the NSF should it not recompute the backbone was very likely the best way that Wolff could avoid a split in the network into competing CIX and ANS camps no longer connected at the FIXs (Federal Internet Exchange Points) when the MERIT Agreement expired in November 1992. ANS' forced march to gigabit speed was introducing all sorts of complicating factors into the NSFnet.

On August 2, 1991 the founding members of the CIX raised the profile of their proposed method of Commercial Internet formation by founding the CIX Association as a 501(c)(6) trade association where all commercial providers of TCP/IP services were pledged to interconnect with each other and not discriminate against each other's traffic.⁷³ Since, if its proposal of January 15, 1991 is to be believed, ANS needed hefty settlements revenues from traffic that crossed its network in order to achieve its goals, ANS refused to join the CIX.

Instead ANS, the mid-levels, and the other commercial providers prepared for a climactic FARNET meeting scheduled to convene on August 14, 1991 at Big Sky, a resort near Bozeman Montana. There the mid-levels were set to discuss in front of the NSF and commercial service providers multiple scenarios for the continued development of the network. It was at this meeting that ANS formally unveiled its Plan for Commercial Services to all the mid-levels and the network at large. The plan was a refinement of the ideas discussed in the ANS Proposal of January 15th offering the mid-levels an opportunity to sign commercial service agreements with ANS. ANS very likely believed that in less than

four months it would be blessed by the NSF as the provider of choice to operate the NSFnet backbone after the Cooperative agreement would expire in November 1992.

ANS Vice President Joel Maloff made a speech in which he showed how the market for competitive long distance providers underwent a shake out driven by the arrival of better financed companies.

As Maloff put it "The lessons that I see for all of the members of FARNET are as follows:

Determine what you do well, and what you can do better than most others, and stress the building of those activities.

Do not try to hold the status quo against bigger, better funded, more able organizations. Consider outsourcing and alliances. Bend with the wind and move to serve your constituencies rather than remaining intransigent.

Diversify your markets and sources of supply so that you are not captive to any one source and therefore vulnerable to whims and sudden changes."⁷⁴

One suspects that the middle point; "do not try to hold the status quo against bigger, better funded, more able organization [like ANS] . . . Bend with the wind . . . rather than remaining intransigent" struck home. The new backbone proprietor was there to explain the new regime to the mid-levels.

A summary of the explanation was included in a two page document called A Mid-level's Guide to the ANS Agreements and dated August 14, 1991.⁷⁵ The purpose of the agreements was to find a framework that would support "mixed research/education and commercial use of FARNET mid-levels and the ANS network. . . . The implementation of this framework has been cast into a series of agreements. In a "normative case" a FARNET member would sign the first of them, the Connectivity Agreement and either the Gateway Attachment agreement, or the Cooperative Agreement or a variant."

By signing the Connectivity Agreement, the mid-level would permit commercial traffic from the ANS backbone to enter its network. It would also agree to participate in the National Infrastructure Pool and be eligible to receive funds there from. So far so good, but what ANS perhaps inadvertently ignored was that commercial sites attached to mid-

levels were free to use the NSFnet backbone (the same physical circuits as the ANSnet backbone) if they pledged that such use was in support of research and education. Some find it hard to imagine that clearance for more obvious commercial use would prove that attractive to organizations attached under the "com" domain that were there in the first place primarily to communicate with R&E organizations in support of research and education. But others say that "even though a corporation is already attached as R&E, it doesn't mean that they are not attracted to the potential of not having to worry about the NSFnet acceptable use policy (AUP) and are willing to pay more for that privilege. Many corporations are deliberately limiting their use of the internet because of AUP concerns."⁷⁶

If a mid-level signed the Gateway Agreement it would keep control of its commercial clients for purposes of billing and support and would pay ANS fees based on estimates of the amount of commercial traffic that they would send across the ANSnet backbone. The fee structure was based on a variant of the fee structure first elaborated in the January 15 proposal discussed above. While the more detailed ANS Plan for Commercial Services showed a complicated formula by which these fees would be measured, it did not give information in enough detail so that a third party could come up with a dollar estimate figure of what it would cost a given mid-level to sign the agreement. A best guess would be about \$2000 per commercial site per mid-level would go to ANS. While the commercial sites connected to some mid-levels only number about 25, other mid-levels have 100 or more commercial sites. This could become rather expensive considering that a mid-level could join the CIX for a flat \$10,000 - giving all its commercial sites unrestricted use of the CIX backbone. Unfortunately the drawback to this solution was that about 35% of all network sites were reachable only by transit of the ANS backbone. For some mid-levels another drawback was the cost of running a T-1 link from their location to the CIX interconnect point. And, in the year following the debut of the Agreements at least two mid-levels found it cheaper to sign with ANS rather than joining the CIX and running the connect line (in the case of one) or merely running the connect line (in the case of the

second).

If a mid-level signed the Cooperative Agreement, the result would be "a closer and less hierarchical relationship" than would apply to the Gateway agreement. The mid-level would generally let ANS CO+RE market commercial connections directly to the mid-level. By in effect giving up a portion of its business to ANS, the mid-level would not have to worry about the expensive connectivity fees that came with the Gateway agreement.

Given the way that ANS had aggressively moved into the mid-level's territory over the past year, it is not difficult to guess that most mid-levels at the Montana FARNET meeting were not very comforted by what they saw of the implications of their commercial use of the ANS backbone.

As reported to the com-priv list by Robert Weber, the consultant who served as a planner facilitator at the FARNET meeting, a series of four scenarios for dealing the problem presented by the expiration of the backbone were discussed. It had become clear that if the NSF backed out of the picture, given the opposing views of network connectivity on the part of ANS and the CIX, instability and possibly a split of the network into two hostile camps lay ahead. This was not what FARNET members, especially the mid-levels wanted. Therefore according to Weber, "at the end of the second day, participants felt that predictability and stability were critical factors in any scenario going forward. The group [also] felt that the NSF should continue to play a lead role in any future interregional connectivity program. Two solutions were favored:

- (1) extending the current contract with MERIT/ANS for some period of time, and (2) creating a new solicitation for interregional connectivity after November 1992, and then awarding a contract."⁷⁷

In other words the mid-levels wanted the NSF's continued involvement as court of last resort in dealing with ANS's expectations.

On November 22, 1991 they got almost precisely what Weber said they wanted as the National Science

Board approved the request by the NSFnet Director to extend the MERIT contract by 12 to 18 months while the backbone was put through a re solicitation process.

A Flap Over ANS's First Commercial Customer

By December of 1991 less than 25% of the mid-levels had signed the ANS agreements. ANS, however, had gotten Dialog to sign as its first CO+RE customer. A commercial customer connected directly to the backbone was something new. Commercial customers were allowed to attach to mid-levels if they pledged not to send "commercial" bits across the backbone. But by definition of Dialog's relationship to ANS as its first commercial customer all of Dialog's bits were commercial and all were going across the backbone. Something had to be done to keep the commercial bits from reaching research and education institutions that had not signed up for commercial service with ANS by signing its Agreements. Consequently, according to a posting to the com-priv list on December 7 authored by Al Weis of ANS and Eric Aupperle of MERIT, the NSF "requested that ANS establish appropriate routing controls to ensure that federally sponsored networks that do not wish to carry commercial traffic are not burdened by commercial traffic."⁷⁸ The letter acknowledged that ANS would work with MERIT to see that such controls were put in place.

The next paragraphs explained what this would mean: "ANS commercial traffic will be restricted from interchange with federally sponsored networks which have not signed an ANS Connectivity Agreement or developed an alternative plan with ANS that will meet their requirements. This restriction on ANS commercial traffic also covers other Internet connected networks such as state, federal agency and international networks that do not wish to receive commercial traffic.

For the interchange to occur, federally sponsored mid-levels must have in place a signed connectivity agreement with ANS which has been designed to meet the requirements established by the NSF. Participation in the basic connectivity agreement between a mid-level and ANS is made without any charges to the mid-level. ANS connectivity agreements are currently in place for several mid-levels: BARRNet, MichNet, MidNet, OARNet, MRNet,

NYSERNet and PREPnet; several others are in the process of final approval. As the list grows, it will be posted. Customers at campuses and research organizations attached to these networks will be able to access ANS connected commercial service providers directly via the Internet." The announcement went on to add that the filtering would take place by leaving paths to non compliant networks out of the routing table of the router placed at the premises of Dialog - ANS' first commercial customer which would be subject to the policy.

The statement that, "participation in the basic connectivity agreement between a mid-level and ANS is made without any charges to the mid-level," tended to be overlooked in the ensuing controversy. It is easy to see why. This was either a shift in or clarification of ANS policy, for the Mid-level's Guide to the ANS Agreements cited above stated that in a normative case mid-levels were expected to sign the connectivity agreement and either the Gateway Agreement or the Cooperative Agreement - both of which had significant financial implications for the mid-levels.

Apparently ANS was leaving the door open for mid-levels to sign only the Connectivity Agreement. With this very important nuance left unclear it was easy for readers of the announcement to assume that the route blocking tactics were being used by ANS as a squeeze play on those mid-levels who had not signed ANS agreements that would either place them under financial obligation to ANS or would limit their ability to market to commercial clients in the future.

Those institutions which were blocked from accessing Dialog had three choices: (1) convince their network provider to sign the ANS connectivity agreement, or (2) "Interconnect to a network service provider that participates in the ANS Connectivity Agreement," or (3) Establish an ANS CO+RE connection. This is a fee-based ANS attachment service for sites that choose to interconnect directly to the ANS network." The language of the preceding paragraph stated that the three points applied to "networks that have agreed to support the exchange of commercial traffic with ANS in one of the following ways:" As such the language is very confusing for mid-level networks were known to connect with the back-

bone and not with each other (2), and mid-level networks could hardly be considered to be "sites" (3). It is safe to assume that readers interpreted points 2 and 3 as invitations for institutions which were connected to nets blocking them from access to Dialog to either switch directly to the ANS backbone, or to a mid-level that had signed an agreement with ANS.

The next day (December 8, 1991) PSI's President Bill Schrader posted the NSF privatization agreements of September 10, 1990 and May 24, 1991 for the first time asserting that the Dialog route blocking should be viewed in the context of these documents which appeared to cede control of the network from the NSF to ANS.

On December 11, 1991 Mitch Kapor and Dave Farber (both Directors of the Electronic Frontier Foundation) authored an Open Letter which they posted to com-priv:

"Merit, NSF, and ANS have recently announced tighter restrictions on commercial traffic flowing across the backbone. Steve Wolff posed a clarification yesterday citing the reasons for this move.

This has set off a flurry of responses some of which question whether it is really meaningful to distinguish between 'research' and 'commercial' traffic, other of which begin to propose technically elaborate schemes to embody finer distinctions. Steve [Wolff] agrees the model of segregating traffic by network number is seriously broken, but that he is forced to use it by virtue of the obligations [placed] upon federal employees in the disbursement of federal support.

The evolution of a strong networking infrastructure is essential to the health of R&D in this nation. Competition has shown itself to be an effective vehicle for creating the best for consumers as well as providing jobs and trade. We believe that no further progress in networking infrastructure is possible without ensuring the creation of a level playing field.

The situation which will result from the latest mandates creates a market that is fundamentally unfair in that it will tilt the playing field too strongly

toward one player -- ANS. Since the regional networks are physically connected to the backbone, they will be forced to execute an ANS agreement in order to receive any commercial traffic whatsoever. This creates an unfair marketing advantage for the ANS commercial business unit. As with any provider, ANS's commercial business unit is a welcome competitor in the market -- however, it must not receive an unfair competitive advantage owing to ANS's relationship with the NSF.

This advantage to ANS will have been accomplished solely by virtue of the exercise of intentional or unintentional NSF policy. No provider -- ALTERNET, ANS, CERFNet, PSI, etc. should be given such an advantage without public and open discussion and competition.

We are looking for ways to ameliorate the situation. We do not think that charges and counter charges however valid, are in the end, constructive. We are looking for concrete positive suggestions, either for a resolution process, or for elements of a 'level field' set of rules. We are anxious to receive such suggestions by private mail or public posting."

This was the first time that figures of the stature of Farber and Kapor had publicly stepped into the fray. Consequently on December 19, 1991 a *New York Times* article appeared under the byline of John Markoff. According to Markoff: "people involved in the planning for a national data network say it is essential to provide for fair competition which will lead rival companies to offer creative and entrepreneurial services in the hope of building market share. Without competition, they say the Government will have created a monopoly that has little incentive to innovate. . . . A number of organizations are working informally to settle the dispute."⁷⁹

The spin that ANS put on the story emphasized the infrastructure pool as what - in the long run - should make everything seem worth while. Weis was quoted as saying that while funds in the infrastructure pool were "small - less than \$25,000, and perhaps \$250,000 in a year - it could amount to millions of dollars in just three to four years."⁸⁰

In response to the Communications Week article the author made a posting to the com-priv list which included the following statement:

"We read that a regional network that wants to send commercial traffic to other regional networks over the ANS network has to pay ANS a fee. This sounds to me like the Gateway agreement. If I read that correctly, such agreements could be quite costly to the mid-levels. However I have yet to see an example of exactly how much signing such an agreement would cost a mid-level."⁸¹ The next day the author received a message from a high level official of a mid-level network stating that he too had yet to see such an example. "We at XYZNet⁸² have tried to no avail to talk numbers with ANS. We find them to be arrogant, unwilling to listen, and generally impossible to deal with." After some discussion of the desires of the network's commercial customers, he concluded: "All of this puts us into a dilemma: if we don't sign with ANS for commercial connectivity how do we provide that service for those of our commercial members who want us to transport commercial traffic?"

Later in the same day the author received a second message, this time from an employee of ABCNet⁸³ "ANS sent their salesperson over to feed us the party line. We discussed our needs and what we wanted from ANS. Seems they want to 'partner' with us but are unwilling to guarantee us a piece of our own pie. I suspect that ANS wants to use the regionals to penetrate the market and then displace the regionals in time. It is seductively easy to use ANS CO+RE instead of the CIX. ANS would keep track of the packets that travel between hosts in the COM. domain and bill the regional annually. The regional then passes the cost on to the commercial users. they also offer you a carrot: you are eligible to get back a share of the money that is collected based on your non commercial traffic. Sounds great, huh? But then I remember the meeting with the salesperson. They want to own the whole damned thing."

The author continued to ask questions about the ANS agreements. In conversations via private mail and on com-priv, it was pointed out that ANS would allow a network to a Connectivity Agreement without insisting that it also sign a Gateway or Cooperative Agreement. However the nuances that continued to be expressed by those speaking for ANS were such as to still leave the overall affect of what ANS policy would be on a given

mid-level very unclear. Finally Dr James Bruce, Vice President for Information Services at MIT and a member of the National Academy of Sciences sent the following message to the com-priv list.

"Gordon, I think you have captured quite eloquently in your questions the brokenness of the combit model and the ANS implementation of commercial and R&E traffic on the backbone. I learned long ago that you cannot build a strong lasting structure on a broken foundation. Yet that is what is being attempted.

Many of us who have responsibilities for the mid-levels are sitting on the side lines in these discussions because we understand that the present situation is broken. We see little opportunity to change this situation for the better given the proclivity of various individuals speaking now for rhetoric and their inability to listen. However we will continue to look for new solutions and I am sure that one that is "out of the box" will ultimately be found."⁸⁴

Meanwhile ANS pointed out for the first time that a network could sign only the Connectivity Agreement. However it added that while a network that signed this agreement could receive commercial traffic from the ANS backbone, it could not send commercial traffic across the backbone.⁸⁵

In mid January the issue of Dialog as ANS's first commercial customer began to boil up again when Geoff Goodfellow posted the following to com-priv:

"I called up Dialog's Chief Counsel, Bob Simmons, this morning. I found out a few things that may be of interest:

1. When Dialog signed up with ANS, ANS didn't tell Dialog that their status as a commercial customer would prevent them from having 'full' Internet access.
2. Dialog published in their customer newsletter that they were now connected to the Internet and all you had to do was 'telnet dialog.com.'
3. Dialog found out they did not have 'full' Internet access only by customer complaints when users couldn't access the service with telnet dialog.com called in.

4. Before Christmas, Dialog requested that ANS change Dialog's status from Commercial to R&E. To this day ANS has not made the change from CO to RE."⁸⁶

The Dialog episode was brought to a close only when, a few days later ANS Vice President Joel Maloff in a message to com-priv stated that "when Dialog agreed to become the first ANS CO+RE client, I was unaware that their traffic would be prevented from reaching regional networks, or other networks interested in Dialog access, even if they were R&E. . . . When I became aware of these issues, I and others in ANS began discussions with Dialog to correct both the understanding and the functional concerns.

The solution to the current dilemma has been for Dialog to adhere to the ANS research and education Acceptable Use Policy. This is an interim step in the correction of a larger acceptable use policy problem. and we have consulted with a variety of involved organizations, including Merit and NSF, prior to coming up with this answer. With the implementation of routing updates late on Thursday January 23, research and education acceptable users of the Internet will be able to access Dialog on the following day."⁸⁷

No matter how one looks at the outcome, the Dialog case strains one's credulity. Was communication within ANS so bad that Maloff was not informed that Dialog, as a first commercial client, would become the test case for implementing routing filters? Or ANS was so certain that its control could or would not be questioned, that it was blind as to how its actions would be perceived by its first commercial customer and by the network community? Moreover what is even more remarkable is that while it has signed up Orbit and BRS relatively recently, whether these clients are commercial or R&E adherent is generally unknown.⁸⁸ Because it is hard to understand how they would agree to terms less advantageous than Dialog received, one suspects that they are R&E. The author is unaware that they have been blocked from networks that have not signed the ANS agreements.

Maintaining an Integrated Internet: ANS and the CIX

Most critics of the Dialog affair suggested that the best solution to the com-

mercial routing dilemma of the Internet was for ANS to join the CIX. By January 1992 Mitch Kapor as Chairman of the CIX Association was involved in a special negotiating group aimed towards this end. At the end of April in an interview with the author, ANS Vice President, Joel Maloff stated that ANS would soon agree to a trial one year interconnection with the CIX. However ANS would not join the CIX because it believed that the CIX was out to destroy it. In interconnecting with the CIX, ANS would not for the next year insist on settlements for combits. It still believed that some sort of settlement process was necessary and would continue to negotiate towards that end.⁸⁹ (The issue of settlements is one of the most contentious in the network debate. Those who advocate settlements have never, to the author's knowledge, done any study that would be able to predict the sizable cost of imposing settlements as measured in additional network hardware and software that would be dedicated solely to the task tabulating usage and doing billing that does not now have to be done. Thus the impact of settlements on costs to the end user is generally unknown. It is certainly hard to imagine how they would lower end user costs.)

The ANS CIX interconnect agreement was announced in late May. It appeared to paper over diametrically opposed stances on the part of the two parties. Many network users seemed to think that it was a complete interconnection that would open the flow of traffic freely in both directions. In reality this was not the case. Because ANS is not a member of the CIX, its retail customers such as Chevron, Union Carbide, and Abbot Labs are not permitted to send their data through the CIX. "ANS is acting like a telephone company where it brings its wholesale customers traffic to the CIX, if and only if that wholesale customer is also a CIX member independently. Think of ANS as an alternative to renting a circuit from NEARnet to Santa Clara, and nothing more."⁹⁰ The statement about renting a circuit refers to the case of NEARnet, a CIX member situated primarily in the Boston metropolitan area that was able to negotiate, what apparently is a modified gateway agreement with ANS, to allow its commercial clients to use the ANS backbone to transit to the CIX interconnect point in California. Whether ANS would pull out in June of 1993, if it didn't get its way

with settlements in the meantime was anyone's guess.

In the meantime ANS continued work on its "Mechanism for Capital Infusion into the Backbone Via Mid level Network Fees and Settlements for Commercial Traffic" as Appendix C of its January 1991 "Proposal" to the NSF had been called. With mid-level networks appearing to be able to get something (eligibility for the Infrastructure Pool) for nothing by signing the Connectivity Agreements, ANS was able to gradually increase the number of mid-levels that were willing to take at least the first step in forming commercial relationships with it.

Part Four

Ignoring CIX and Courting Mid-Level: St Louis in April 92 and the Infrastructure Pool

In 1992 ANS sought to finesse the issue of joining the CIX by repairing its relations with the mid-levels.

ANS Attempts to Mend Fences with the Regionals

With Congressional Hearings held on March 12, 1992 into the management and privatization of the NSFnet, and a spot light placed on the question of Government action in creating an unlevel playing field, ANS decided it was time to reassess its relationship with the mid-level networks.⁹¹ Consequently it scheduled the first large scale meeting with the mid-levels in almost a year for April 15-16 in St Louis. The following information comes from a memo by Peter O'Neil, ANS Director for Mid-levels, released to the author by the NSF under FOIA.⁹²

O'Neil reports that "twenty-five individuals representing 20 different regional and state network service organizations attended this meeting." When the attendees were asked what they wanted to get out of the session the following common themes emerged:

"Some regionals receive services from ANS and would like to understand how to expand service offerings and how new services can be phased in.

ANS's 'identity crisis' confuses regionals and requires clarifying.

Some of ANS's actions are inconsistent with its words.

Unclear if ANS is pursuing a zero-sum or win-win strategy with the regionals.

Some mid-levels work with ANS while

other compete with ANS and participants want to understand why each behavior occurs.

Networking community needs to work together to help dispel 'the fog' for ourselves, existing users, and potential users of Internet services by creating and acting on a shared vision.

Need for a single network to support R&E and CO uses.

Regionals and ANS share same interest in supporting the R&E community

and want that to continue.

Desire on the part of senior ANS staff to 'listen' to regionals and determine how to mix the growth of the regionals with the growth of ANS."⁹³

This is the complete list of points from the ANS memo. In order to give readers a feeling for the balance of events as described the list of issues from the 'ask AI' session described below will also be given in complete form.

O'Neil goes on to summarize the agenda discussion: "During the course of reviewing the proposed agenda, the participants preferred to work together as a single group on all topics rather than dividing up into smaller breakout sessions. This decision resulted in scrapping the original agenda in favor of allocating blocks of time to each major topic. The initial time called for AI Weis . . . to respond to a few commonly asked questions. . . This quickly became known as the ask AI segment and it will be included in future advisory meetings. AI Weis began by addressing the question of whether ANS is a regional or backbone provider of network services. The discussion that ensued quickly began to cover other topics that had been planned for review later in the meeting. These were the extent to which ANS competes with the regionals, the perceived mixed messages that ANS gives to the regionals about who they are, what they're about, and how they plan to achieve their goals.

The exchange that developed during this segment highlighted many issues that continued to be refined over the two days. Several points are worth noting:

ANS is interested in exploring any and all ways of deriving cooperative relationships that allow regional networks to thrive and grow as providers of local services.

Regional networks want ANS to thrive and grow as a provider of reliable backbone services and to incorporate fast packet technology.

Competition for organizations with existing connections seems fruitless

-- attention should be focused on addressing issues to help promote un-

Part Four: Executive Summary

In 1992, faced with pressure from the network community to give up its insistence on settlements and join the CIX, ANS agreed to connect to the CIX so that networks which were already CIX members could use its backbone to send data to the CIX. It also decided to try to repair its relations with the mid-levels at a two day meeting in mid April attended by representatives from 20 mid-levels. There it made an honest effort to deal with mid-level mistrust head on. Glenn Ricart remarked that "ANS is unsure if it is in the wholesale or retail business -- being in both businesses simultaneously is confusing." As an unfortunate result "we are all fighting over the 2% of the customers already connected rather than the 98% that are unconnected." An unresolved issue, he concluded was "what is ANS going to be good at." By meetings end ANS had promised "to clearly state its mission and goal (and then act accordingly) to help dispel the fog."

By November 1992 ANS CO+RE had been in existence almost a year and a half. While ANS had said that about half the mid-levels had signed connectivity or gateway agreements, it had never released their identities. These mid-levels would be eligible to share in funds from ANS commercial usage fees gathered in an Infrastructure Pool. In an interview with *Communications Week*, AI Weis had almost a year earlier estimated that the pool would be worth \$250,000 by the end of 1992. Questions were asked about the status of the Pool and the Resource Allocation Committee (RAC) designated to administer it. The RAC was summoned for the first time via a telephone conference call on October 23, 1992. Maintaining that the Pool and RAC were part of the profit making side of its operations, ANS took a position that it need not answer such questions. Eventually however information about the RAC leaked out via a network discussion list and a December 4th article in *Communications Daily*. The amount of money in the pool (\$62,000) also leaked.

ANS had been asked by the attendees at the April 1992 St Louis meeting to hold a follow up meeting as soon as possible. None has apparently so far been held. (Some involved have said that they considered the RAC conference call to have served the function of the follow up meeting.) Nevertheless from communications with some of the mid-level directors who are members of the RAC, it is clear that at the end of 1992 ANS has managed to win some friends among the mid-levels. However some mid-levels seem to have a foot in both the ANS and CIX camps. And still others seemed determined to either join the CIX or try to remain independent of both camps.

attached organizations to become connected to the Internet.

Considerable confusion exists as to cost structures and the meaning of full average cost, and what ANS's prices were; ANS's price list was made available.

ANS was beginning to focus on industry market segments with national account focus and regionals could act as local distribution channels.

ANS should decide what business it is in and become good at it -- this will help the regionals figure out what they want to do with ANS based on ANS's strengths and abilities to provide services.

Commonplace today for organizations to be suppliers, competitors, partners and consumers of services all at the same time; these complex relationships must be managed well to minimize conflicts and maximize cooperation.

Regional and ANS share common organizational form, mission, and goals on behalf of the R&E community, promoting broad connectivity and encouraging technology transfer and economic growth.

Sharing a common vision is a strong argument for developing cooperative agreements."⁹⁴

These topics circumscribed the area out of which several more discussion group grew as the meeting progressed. The memo presents somewhat fragmentary ideas (best understood no doubt by the attendees) in great detail. The most significant can be summed up under four general areas. The first of these centered on problems in understanding and dealing with the ANS agreements some 15 months after they had been outlined in somewhat rudimentary detail by Al Weis in his Proposal to Steve Wolff and eight months after they had been launched publicly at the Montana FAR-net meeting of August 1991.

The Agreements Still Present Problems

While Glenn Ricart complained that even the "ANS finance person doesn't understand full average gateway costs,"⁹⁵ separate groups convened to discuss the Infrastructure Pool and Combits. Some of the questions that these looked at were:

"We need to understand the difference between fixed and variable charges.

What is the purpose of the Infrastructure Pool?

Do we need the RAC and Infrastructure Pool? (Should we fund common needs instead?)

Can the Pool funds be used to create and develop quality services that add value to end users?

What does it take to allow the regionals to have commercial attachments to the ANS backbone?

How can we make sure that everyone plays and the playing field is fair?"⁹⁶

Under the discussion of combits the questions asked showed no greater focus and as O'Neil added, couldn't be adequately answered in the time available.

"What are the responsibilities of commercial service provision (non economic) ?

Who will ensure adherence to ground rules in the Internet [once the guiding hand of the NSF is gone]?

Can or will the successor [to combits] be a flat charge algorithm (annual) based on 'capacity'? Independent of use restrictions?

What's 'capacity'? How do we define the base level of service?

Can the transfer of funds occur via the NSF rather than the combit mechanism?"

Combits is not workable for some regionals because it is not understandable or predictable in terms of costs to end user organizations.

Why do we have to worry about usage at all?"⁹⁷

A perhaps more significant group of discussion points emerged over the question of ANS's role. Glenn Ricart remarked that "ANS is unsure if it is in the wholesale or the retail business -- being in both businesses simultaneously is confusing." As an unfortunate result "we are all fighting over the 2% of the customers already connected rather than the 98% that are unconnected." An unresolved issue Ricart concluded was "what is ANS

going to be good at."⁹⁸

John Rugo had a suggestion for ANS. "He called on ANS to consider other roles that might include introducing new technologies, the tools to manage them and user services which regional networks cannot easily provide. This would be similar to the way in which Bellcore serves the RBOCs."⁹⁹

On the final day a significant conclusion emerged: "ANS is probably untenable only as a backbone provider."¹⁰⁰

Other questions raised were: "Are the regional to be 'first' line service providers for ANS? Are all value added services to be provided by ANS? What consistent set of parameters can ANS specify and the regionals fulfill to determine the boundaries on service?"¹⁰¹

At the end of the first day the regionals had decided that they wanted a "menu" of "models for CO+RE use pricing that includes:

-- retaining combits,

-- charging a flat fee based on the size and classification of pipes behind the gateway,

-- a dedicated commercial gateway price that assumes full use without regard to the pipes behind it,

-- the flexibility to change from one of these options to another."¹⁰²

Discussion on the final day of the meeting brought agreement on the following roles or relationships:

"Regionals and ANS share the same vision of supporting R&E, promoting technology transfer across all sectors of society and economic growth, and providing broad access and connectivity.

Desire to develop win-win model hat allows both to grow and be financially sound.

ANS to work national accounts.

Regionals to act as distribution channel for national accounts and ANS services.

ANS to introduce and develop management tools for new technologies

and common user services (Bellcore model).

Regionals and ANS work to supply answers and clear the fog

[Both to work to] find the proper mix between production network versus introduction of new technologies.

ANS to clearly state its mission and goals (and then act accordingly) to help dispel the fog."¹⁰³

"It was agreed that a small group be formed to work on a draft cooperative agreement between ANS and the regional networks."¹⁰⁴ At the meeting's end the "consensus was that the candid comments, suggestions and ensuing discussions were difficult but productive. . . . The feeling was that the next meeting should be triggered by the results of the small working group on the cooperative agreement and other issues mentioned in this meeting. Several participants expressed a sense of urgency for moving forward together as quickly as possible."¹⁰⁵

Translating Good Intentions into Action?

Eight months have passed since the conclusion of the St. Louis meeting. This is certainly enough time for ANS to have translated its good intentions into action, completed the cooperative agreements and had another meeting with the regionals. While the author cannot say for sure that one has not occurred, he thinks it reasonable to assume that had a follow on meeting been held, the NSF would have released information about that meeting to him. Two members of the Resource Allocation Committee (RAC) formed by ANS to administer the Infrastructure Pool have also informed the author that the October 23, 1992 telephone conference call that constituted the first meeting of the RAC was considered to be the follow up to the St. Louis meeting of April 1992.¹⁰⁶

In an article on ANS's application for 501 (c)(3) status in the September COOK Report on Internet -> NREN, the author emphasized the infrastructure pool and suggested that enough time had passed for ANS to be expected to account for its promises and to report to the network community on the status of the pool.¹⁰⁷ On October 23, 1992 the author posted a query to com-priv asking about the status of the infrastructure pool that ending with the following

words: "ANS may be a private company but it runs the infrastructure pool as a public trust. Or if it does not, then who does run the pool? And how much money has the privatization of the NSFnet backbone raised for the good of the network's research and education members?" The author asked the same question in a slightly different form on October 27. On November 2 when no answers had been posted by either the NSF or MERIT or ANS the author began to ask the question somewhat more insistently. On November 6, in view of silence from Steve Wolff that was hard to understand, a reader of the list suggested privately to the author that the time had come to use the Freedom of Information Act to extract the data from a strangely reluctant National Science Foundation. Since the reader included detailed instructions on how to execute such a request the author was able to file it the next day. To its credit, the NSF was quite prompt in its response with several hundred pages of data on which much of this report is based arriving at the author's home on November 30.¹⁰⁸

Documents received under FOIA from the National Science Foundation reveal that on October 15, 1992 Peter O'Neil, ANS Director for Regional Networks, sent by email to Resource Allocation Committee (RAC) members an invitation to schedule the first meeting of the RAC by conference call. The meeting took place from 1 to 2pm Eastern Standard Time on October 23, 1992. Those contacted were informed that their invitations as members of the RAC came because they were either a signatory of the ANS Connectivity Agreement or ANS CO+RE Gateway Agreement, or as a representative of the National Science Foundation.¹⁰⁹

The invitation stated that: "It is now time to develop a process to combine our experiences and understand the infrastructure impacts of providing commercial traffic along with research and education traffic. The purpose of this meeting is to identify the work and tasks that need to be performed prior to a face-to-face meeting. . . . [that] can be held in conjunction with other national meeting that RAC members plan to attend. . . . In addition to developing the appropriate criteria for distributing the pool funds, we propose that the committee members each undertake the task of gathering usage data, and the

relevant member attitudes and behavior so that technical, economic and organizational considerations can be taken into account."¹¹⁰

On November 3, 1992 ANS Vice president Guy Almes sent the following message to the RAC: "Brock Meeks of Communications Daily has expressed interest in the activities of the RAC. Our sense is that the RAC would work best if the details of its deliberations including the detailed minutes were kept confidential. I have just posted a draft of these detailed minutes -- please do review them for corrections or improvements. I'll be reviewing them as well. If the RAC generally agrees that such details should be kept confidential, then that raises the issue of how best to report to Meeks and others. One possibility would be to review and edit the following two documents drafted by Jim for this purpose. The first labeled 'Background Information,' discusses the RAC as an organization. The second labeled 'Report of a Meeting' summarizes the first meeting. Please comment on the basic approach to internal versus external reporting."

The Background Information Draft is very similar in content to what was released to FARnet on November 6, 1992 -- with one exception. In the text of the draft ends with the statement: "the National Science Foundation was kept apprised of the various discussions and agreements by which the Infrastructure Pool and the RAC were conceived and implemented." This sentence is missing from the document was released to FARnet.

One can only speculate as to why. The answer seems to have something to do with the position of the NSF vis-a-vis the RAC. Questions at the NSF were escalating. By November 5th, the author had become rather insistent in the questions that he posted to the com-priv list. Professor Dave Farber (one of the most senior and respected members of the Internet) had sent the author's lengthy posting of November 3 to either Steve Wolff or Chuck Brownstein -- from the material released to the author it is not clear which. Early in the morning of November 5th Brownstein replied to Professor Farber's message which contained the following statement from Farber: "I

have not distributed past versions of this from Cook waiting for the NSF or ANS to reply so I could send both at once. No reply has been forthcoming to any list I monitor." Brownstein's reply to Farber - copied to Wolff was laconic - "this seems to be in the class of questions, 'When did Gordon stop beating his dog?'"¹¹¹ That evening Farber posted the author's unanswered query on the infrastructure pool to his "Interesting Person's" mail list.

Meanwhile it is impossible to understand why Steve Wolff would have refused to answer the author's questions to com-priv unless he lacked any information with which to answer them. When Brownstein refused to become involved on the morning of November 5, Wolff may have gotten on the phone to ANS and insisted that he be told what was happening with the pool and the RAC. For at 4:20 PM on November 5, Kristen Mortensen (Al Weis' secretary) sent the following message to Wolff: "Steve, I sent quite a bit of msg from WEIS-ID to you. All are on the first discussions that have taken place on RAC mailing. [Meeting was probably meant.] I believe you have everything today. Take care, Kristin."¹¹² If this line of reasoning is correct, since the author announced on com-priv that evening that he would make a FOIA request from the NSF, Wolff may have decided simply to wait for that to arrive rather than post a reply to the com-priv list. In any case, the material about the NSF being fully informed was removed from the draft announcement perhaps at the request of the NSF.

The "Report of a Meeting" draft by Al Weis differs significantly from what was released to FARnet on November 6th. It states that 12 out of the 16¹¹³ members participated in a meeting where four actions were taken:

(1) That "distribution of funds initially would be based on an informal variation of the Grant Approval Process used by NSF. . . Distributions would be determined by use of a philosophical approach of how the Regional Networks and Backbone Network could be improved, and not on quantitative data until enough data is available to indicate where funds will be needed to solve specific problems.

(2) Infrastructure would be defined in a broad way to include both physical components and the software used in connection with the networks. This reflected the view that (a) software im-

provements can be as important as, and sometimes even more important than, improvement in the physical components of the networks, and (b) the most positive impact on the Regional Networks and Backbone Network may be achieved by using funds for improving software.

(3) A subcommittee was formed to develop a process, criteria and a draft solicitation model to be used by the RAC.

(4) Another subcommittee was formed to develop the process by which proposals submitted to the RAC were to be reviewed."¹¹⁴

On November 4 Alison Brown, the Director of OARnet responded with a suggestion that the Report on the RAC meeting was too detailed. Alison included a draft revision of the Background and Meeting Reports. Her revision eliminated point two on infrastructure definition that would include software entirely and removed the statement from point one that distributions would be determined based on a philosophical approach rather than quantitative data.¹¹⁵

Of course one could ask questions about both areas which is probably why she recommended their elimination. One wonders in particular about the elimination of point two on infrastructure and software. Perhaps the focus of point two derived from the fact that the amount of money in the Infrastructure pool is very small. Possibly it would be enough to pay for the creation of some kind of user interface program that could be given to all RAC members? Or perhaps it could be used to pay for improvements in routing software? Software after all is divisible in a way that hardware and bit pipes are not. In any case, the focus on software was a long way removed from the earlier focus on driving the network to gigabits by the end of 1992.

In response to a query from the author about who would benefit from membership in the RAC a member of the RAC replied:

"I am indeed in the group as are the others only because we signed an agreement a long time ago saying that we had no objection to having commercial traffic arrive on our networks from outside. I do not expect to benefit much if at all. Presently there is not

much money in the pool even after all this time. The amount of commercial activity has been minimal. I suppose this could change in the future, but none of us are expecting any kind of great windfalls from it." At about the same time the author was shown a recent ANS document stating that the amount of money in the pool was \$62,000. While such an amount of money wouldn't buy much hardware, it might buy some software.

Meanwhile on Friday November 6, 1992 Guy Almes sent Steve Wolff a copy of the official release on the RAC and Infrastructure Pool that he was about to send to FARnet. This version, which announced that the next formal meeting of the RAC would be in January of 1993, now had the sentence about the National Science Foundation being kept apprised of developments removed. The membership list of RAC members had also grown by one: Steve Wolff was now listed as a full fledged member.¹¹⁶ Since apparently somewhat after the fact, he had been made a member, there was apparently now no need to say that the NSF had been kept apprised of developments.

From examining the RAC deliberations, one is forced to conclude that there is evidence that ANS' plan to bring commercial traffic into the network and raise a bonanza for re-investment in infrastructure have not been a smashing success. The amount of money in the pool was only a fourth of what ANS had predicted it would be a year earlier.¹¹⁷ AL Weis, who had never enjoyed broad public scrutiny of his plans, seemed determined to operate the part of his plan that seemed most designed to serve the public interest in such a way that it would be well shielded from public scrutiny. What is somewhat harder to understand is why the mid-level directors who were members of the RAC seemed quite willing to abet his desires. Everyone, it seemed, was developing a siege mentality. And no one unfortunately seemed to remember Mitch Kapor's December 1, 1990 caution to Al Weis about the dangers of making policy outside of the public view.

Consider the following incident. Guy Almes on Friday November 13 sent the following message to the

RAC: "We've had some inquiries about the amount of money in the infrastructure pool. We'd like to know what RAC members think about this. Should we disclose it publicly, or would you prefer that it remain a private matter of the RAC? We could go either way with it."¹¹⁸

The following day Mike Staman Director of CICNet replied:

"A conundrum. I do not care. However you have a lose-lose situation here. Fail to disclose it and continued criticism will accrue . . . Disclose it and at least three items will emerge simultaneously:

1. Incredulity at the number (no matter what the size)
2. Calls for accounting (no matter what the size)
3. Re-emergence of the same criticism as if you selected option one.

You're in an unenviable and difficult position. there have been so many problems over the past couple of years that you probably can not win on this one either (from the marketing perspective, which is the issue after all), and since I continue to view the criticism as emanating from a fringe element that is best discounted and ignored, I guess I would take the first option if it were up to me."¹¹⁹

Part Five

Who's in Control? Measuring Network Usage and Contribution to Infrastructure

The issues of technical compliance on not diminishing the NSF's level of service and the question of what ANS has contributed to network infrastructure are good examples of the loss of the NSF's control over its own resources.

Oversight and Accountability

In the September 10, 1990 privatization agreement Steve Wolff had written:

"2) the reimbursements will be used

to enhance the network infrastructure and services, in order that the level of service provided by MERIT under its Cooperative Agreement with the NSF not be diminished.

NSF and MERIT will agree on the technical means of compliance with 2) above."

The point was reiterated in a slightly different form in the May 24, 1991 agreement. However, as far as the author knew, no agreement on the technical means of compliance had been announced by the NSF. Therefore, in a November 2, 1992 posting to comp-priv he asked: "Maybe they [BARR-Net] would have more standing than I to ask Steve Wolff for a report on the means of technical compliance agreed to between MERIT and the NSF regarding the 'Pool'?"

Again the author's query was greeted with silence. He suspects the NSF was silent because ANS and MERIT had never agreed on such a means and cleared it with the NSF. When the FOIA material arrived at his home on November 30, one of the very newest documents was a November 20, 1992 letter from Eric Aupperle to Steve Wolff.

"This letter describes our current understanding regarding technical compliance as referred to in your letter to D. van Houwelling dated September 10, 1990 and E. Aupperle dated May 24, 1991. MERIT and ANS agree on the methods of technical compliance and seek your concurrence. As the network technology and architecture evolves and our monitoring capabilities change, we may periodically re-evaluate the methods outlined below and suggest further modifications."

The complex and quite technical letter is four single-spaced type-written pages long. A few high lights follow.

"Several network performance measurements will be used to determine trends and select action points. While no single measurement is uniquely indicative of congestion or capacity overload, a combination of measurements taken together may be used to anticipate congestion at capacity overload. This will allow us to determine trends, anticipate problems, and select action points. These measurements include:

1. Network delay (ENSS-ENSS

- delay matrix)
2. Network throughput
3. Link utilization data
4. ENSS/CNSS peak switching rate data, and packet discard data
-

The weekly measurements and trigger points include:

1. Circuit utilization:

When a T-3 backbone link becomes routinely utilized over 70%, that logical link is considered to be saturated.

2. Packet switching load and congestion:

A T-3 CNSS/ENSS router can be operated in a mode where it will record peak packets and bytes (input and output) on every interface with a one second sampling interval. When a router routinely discards packets at a rate of more than one packet per 1000 (due to congestion) on any interface in more than two 15 minute intervals per day, the router interface is considered congested. . .

The monthly measurements and trigger points include:

1. Delay Matrix:

For each ENSS that announces NSFnet networks, an ENSS-ENSS delay matrix is generated based upon ICMP echo request packets (e.g. ping). . . . For example recent measurements of the one way ENSS-<->ENSS uncongested delay between Boston->New York->Cleveland->San Francisco->Palo Alto is 36 milliseconds. A trigger point for the identification of congestion on this path is an increase of 20 milliseconds or more.

2. Throughput Matrix:

For each ENSS that announces NSFNET networks, a full ENSS-ENSS throughput matrix will be generated using a TCP application (e.g. FTP or other). . . . An appropriate trigger level and throughput test application for this method is still under discussion."

....

"Finally, it is difficult to correlate the relationship between the T-3 network performance measurements

and end user perceptions. Performance problems with the T-3 network may affect end user perceptions. However it is not currently possible to measure accurately the performance as perceived by the end user since such traffic may traverse local and regional networks for which we have no monitoring capability or authority. The T-3 network measurements described above are only approximations of end user perceptions. ANS and MERIT will continue to work with the IETF Operations Area to develop a more complete method of measuring end-to-end system performance."¹²⁰

Although the author lacks the technical expertise to critique the Aupperle document in detail, it is evident that trying to measure the impact of ANS traffic on the NSF service is a difficult task to say the least. Nevertheless when one realizes that it was two years between this letter and Wolff's November 1990 request for action one has to ask how responsive ANS was being.

The whole episode of the RAC, the Infrastructure Pool and technical compliance is indicative of the absolute failure of the privatization undertaken in 1990 to leave anyone with enough clout to oversee the spending of public money in the public interest. Because of the

firewall of responsibility in the form of MERIT separating the government from the network operator, when things didn't happen, there was always someone who could say it was the other guy's fault. Consider the following quote from the December 4, 1992 *Communications Daily*.

"All parties involved -- NSF, Merit, ANS --denied responsibility for administration or oversight of fund. When we questioned NSF Computer Networking Dir. Stephen Wolff about status of fund he said he "didn't know" and would contact ANS for details. Those details never came, despite repeated attempts by us and Wolff to gather information about fund from ANS. When we asked Wolff specifically who was responsible for fund, he said: "Merit."

But Merit Pres. Eric Aupperle told us his organization had no responsibility because fund originally was proposed by ANS Pres. Allen Weis. "This whole [fund] thing was ANS's idea... you'll have to ask ANS about it," he said. We did ask ANS about fund and received similar denial of any responsibility. However, spokeswoman Susan Eldred did tell us so-called Resource Allocation Committee (RAC)

had ultimate responsibility for fund."¹²¹

ANS's Justification of Its Infrastructure Investment

Included in the material sent under FOIA to the author was a lengthy message to Steve Wolff from Jordan Becker, the ANS Technical Vice President. The November 6th timing of the message (the day after Kristen Mortensen sent Wolff messages from the WEIS ID) suggests that Wolff was insisting on information and ANS was complying.

In answer to the author's request to be informed as to what infrastructure ANS had added to the network Becker wrote: "ANS has steadily invested their own dollars in new infrastructure and technology since their formation. The early 1991 T-3 network consisted of 8 routers and a very sparse topology of DS3 leased lines. The current T-3 network consists of over 70 routers and a much larger DS3 mesh of leased lines."

The *COOK Report* responds: Indeed the NSF was paying for most of what Becker describes having purchased the T-3 upgrade in two installments. Each of the twelve core nodes according to the author's May 29, 1992 copy of ANS's network topology has three RS6000 routers while the Washington node actually has four. The RS6000s appear to be necessary for two reasons. First: to support the network topology and provide redundancy (given their spotty performance record). Second: at each core network node one RS6000 appears to be available to service an ANS attached network user.

At the end of May of 1992 ANS's own network map shows Cisco routers as intermediate links between the ANS attached customers and the RS6000s at almost all of the 12 core nodes. Some portion of these routers are certainly necessary to support ANS attached customers. In other words they are there because of ANS's efforts to commercialize the network. Consequently, it is difficult to understand how their presence should be seen as a part of the national infrastructure belonging to research and education. It is diffi-

Part Five: Executive Summary

From FOIA evidence released by the NSF it seems that the NSF has had difficulty in ensuring responsiveness from MERIT and ANS. In both September 1990 and May of 1991 the NSF had asserted that it would develop with MERIT a technical means of verification that "the attachment and service sponsored by the NSF under MERIT's Cooperative Agreement with the NSF is not diminished." In early November 1990 the author publicly asked the NSF to disclose the means of verification agreed upon. The NSF was silent. Finally in November 24, 1992 it received from MERIT a four page letter containing the compliance plan. As with the first plan proposed by ANS in January 1991, it made it very plain that, once in the network, NSF and ANS traffic were indistinguishable. It proposed that some benchmark measurements be used to determine when links were congested and needed upgrading. However in any given instance it would be nearly impossible to tell whether network congestion would be due to supercomputer center traffic or traffic from Perot Data Systems, a large ANS commercial customer, to use an arbitrary example.

Finally when in November 1992 the author asked what infrastructure ANS had contributed to the network that had not been paid for by the National Science Foundation, an ANS vice president sent Steve Wolff a lengthy listing of ANS contributions. However, in the opinion of the author they were almost entirely contributions that were absolutely necessary to deliver the minimally acceptable backbone service for which the NSF had been paying in the first place.

cult to understand how Becker can claim to be spending ANS money on equipment that appears either to be a part of ANS's commercialization effort or absolutely necessary to support the effort for which the NSF had increased its payment to Merit by nearly \$7 million dollars per year?

Becker continues: "Many of these routers and transmission facilities provide backup and restoration services for NSFnet service users, none of which is funded by the NSF. The entire T-1 safety network which ANS installed provides fallback routing for the T-3 network. This was initiated and never requested or suggested by NSF. ANS supported a major upgrade to the T-3 network in May '92 where all of the T-3 interfaces and DSUs and associated parts and software were completely swapped out with newer technology to improve performance and reliability. All of this was largely transparent to the user community and done at no extra cost to the NSF."

A different point of view would suggest that the back up and restoration services for NSFnet service users apparently were required to maintain minimal functionality of the T-3 network given the well documented history of poor router performance and reliability. Any funds spent here should count as funds spent to give the NSFnet minimal reliability that it should have had every right to expect. The same holds true for the T-1 safety net which MERIT admits¹²² refers to the old network that was put in place in 1988 and 1989 and could not be taken down until December of 1992 because it was needed as a back up for the failures of the T-3. The NSF would have been remiss to pay anything additional for such remedial service. The same holds true for the swap out of the T-3 router equipment which hasn't given anywhere near the 45 Mbps throughput that was called for.

Becker continues: "The T-3 wide area test network that ANS manages and supports at its own expense has been upgraded to test changes to the expanded infrastructure and to test increasingly complex routing environments. The ANSNET routing software has evolved to support over 10,000 destination networks, 40,000 routes and several hundred autonomous systems. This critical resource was never envisioned to support the scale and complexity that it has achieved. This allows the NSFNET

backbone service to disseminate inter-domain routing information for most of the US regional as well as commercial network service providers. ANS is now working on new routing software that will scale beyond the current limits and support new protocols and features (BGP4/CIDR, etc.) that are required for successful operation of the Internet, again at no cost to NSF."¹²³

The author responds: One would assume that the services enumerated by Becker would be part of what ANS would have to do in order to provide successful backbone service to the NSF, and that therefore it would be expected to do them at no extra charge. If it is using money to accomplish these tasks above and beyond what it received from the NSF, it is surprising that such expenditures are not evident on its first Form 990. While it is conceivable that these expenditures may have all been made since the beginning of October of 1991 (and therefore would not appear on the first Form 990), it would help to substantiate the point ANS wishes to make if it would supply some dollar figures for these expenditures in such a way that they could be clearly differentiated from funds received from the NSF.

In the meantime ANS appears no longer to speak of the NSFnet but rather talks of providing an "NSFnet Backbone Service" over its ANSnet physical network. To emphasize the change in early December 1992 the ANS operations staff sent out a note to regional network people explaining that the name "nsf" was being removed from network routing tables and changed to "ans".¹²⁴

As policy makers in the new administration evaluate the heritage left to them by the old, they need to ask whether there are signs that what could be a very expensive ANS strategy is working. Is ANS successfully placing the Fortune 1000 on its network so that the cash flow of the infrastructure pool could be counted on in another year or two to augment significantly Federal investment on behalf of research and education users? The information that is available suggests that this is not the case.

A May 29 1992 topological map of ANSnet recently sent to the author

shows 29 attachments that are not part of the NSFnet Backbone Service. Twenty one of these appear to be commercial as opposed to governmental or educational organizations. Of the twenty-one eight are either arms of IBM or MCI, or entities involved in business ventures with them, or entities run by ANS Directors.

With a sales staff and territory far larger than that of most regional networks, ANS appears to have been far less successful than the regionals in selling new attachments to the network. Furthermore its success in bringing commercial clients onto the network also cannot be judged because some, such as Dialog, are there as research and education users. Consequently, even if one were to have a complete and up-to-date list of ANS customers, it would not be possible to ascertain projected cash flows for the Infrastructure Pool without also seeing which customers were commercial users. So far ANS refuses to release this information.¹²⁵

(Two days before Christmas the author did receive from a reviewer a list of ANS commercial customers. It lists 12 of the 21 companies on the May 1992 map and an additional 15 corporations not shown on the May 1992 map. Appendix A below identifies these ANS CO+RE customers.)¹²⁶

ANS, however, does now acknowledge the difficulty of selling to the commercial market. Joel Maloff, ANS Client Services VP has recently expressed his views on selling commercial Internet services: "Selling Internet services can be a challenging and complicated process. The salesperson must be able to understand the prospect's internal local area network environment, external wide area network environment, and the capabilities presented by the salesperson's own product or service. Combined with a knowledge of the clients objectives and needs, the salesperson must use the technical support expertise of his company, address the functional and financial needs of the client. He must also be able to satisfy the client that his choice will serve the client's organization well for the foreseeable future. No client likes to make a deci-

sion more than once.

The use of the Internet involves entry into a shared networking environment with the specter of hidden hackers, viruses and worms. Demonstrating the value of Internet services is difficult and complex. Furthermore, use of the Internet is not yet a generally accepted business tool. This causes the sales cycle to be lengthy, extending for months or years before decisions are made."¹²⁷ It should be added that ANS does not have years to wait to see if its commercial strategy is a correct one. And that if wise decisions aren't made on the backbone rebid that tax payers could be stuck with the bill should the ANS strategy fail.

Part Six

Where Do We Go From Here?

Some steps toward recognizing and then correcting misguided policy decisions.

The Government Can Ill Afford to Expend Public Money on Backing an Inadequately Examined Strategy

ANS should not be surprised at experiencing difficulty in what it has set out to do. But in a free market economy it has a right to attempt to do what ever it chooses. However one may question whether it has a right to do it from a base provided by taxpayer money. It also does not seem wise to have a situation where those policy makers who are deciding how to spend federal funds are called upon to judge the soundness of ANS' strategy.

People at the National Science Foundation should not be expected to play the role of investment bankers in judging whether ANS has a winning strategy.

If an investment banker were giving advice, it would surely look at network architectural approaches. There are some experts who would say that,

in trying to sell services at Layer 3 of the ISO protocol stack, ANS made a strategic mis-cue because it cannot offer the Fortune 1000 the security necessary for its data transfer. Certainly the major corporate network outsourcing vendors have adopted a Layer 2 strategy that allows them to offer virtual private networks to customers something that by Maloff's own admission about selling in a shared networking environment ANS cannot do. Also during the summer of 1992 PSI announced a change of its backbone to Layer 2 Cascade Inc STDX frame relay equipment - a move that allows it to sell virtual private network as well as internetwork services.

A reviewer of this study added: "[A Layer 2 based network] also allows easier deployment of new protocols. Did you know the T3 NSFnet routers don't route OSI packets? They are converting the old T1 IBM RT's that are surplus from the T1 network now into encapsulation hosts that encapsulate OSI in IP, because their core routers don't have OSI support yet. A Layer 2 switching fabric would have a much easier job with OSI, or Appletalk, or SNA, or DEC-Net, etc. Why do you think the telco's are so hot on Layer 2 stuff, and are building IP networks on top of Layer 2 services?"

Furthermore even if Layer 3 is a workable strategy, ANS now faces national competition from US Sprint's Sprint Link Service as well as from Uninet, PSI and the regionals. Nevertheless, it's most serious competition may come from Metropolitan Fiber Systems October 6, 1992 announcement of the immediate construction of a national high speed wide area data network.

MFS is a major alternative access provider that can now take additional advantage of the recent FCC decision mandating interconnection between local exchange carriers and competitive access provider networks. This means that MFS high speed MAN networks in 14 major metropolitan areas across the US will not only be interconnected but also that businesses not tied into these MANs directly but wanting access to the MFS national backbone will be able to demand interconnection from their LECs quite possibly at lower rates than ANS can provide for what they would likely regard as a less than ideally secure service. Fi-

Part Six: Executive Summary

It has been too easy to confuse the network goal of technology development and transfer with that of access for all Americans to what should become the most powerful infrastructure of the information age. The current arrangement places the network in the hands of ANS, an entity that has shown itself to be far more interested in technology development and transfer than in the cost of access for the ordinary user.

With its recently announced intention of support a scaled down backbone that connects on the four NSF supercomputer centers, the NSF appears to be heading in the right direction. However given the contradictions that ANS faces between its profit making, commercial, proprietary side and its non profit research and education side, it seems unlikely that ANS would be able to use further stewardship of the backbone in such a way that it would unambiguously benefit the research and education community that the NSF is intended to serve. Therefore the NSF would be well advised to evaluate with great caution any ANS responses to its backbone solicitation. The NSF should also take a very wary approach to cost sharing suggestions and should not under any circumstances permit the successful bidder to resell commercially AUP free backbone bandwidth.

It is questionable whether the US government should be involved in the building of a production backbone. What the new administration must make clear that it will do whatever is necessary to ensure affordable access to the network. It must also help to educate Congress concerning the policy implications behind the network by supporting Senator Breaux's call for a Presidential Commission on Telecommunications Policy.

nally MFS is staking its reputation on being able to provide greater than ethernet speeds for single users on its national backbone immediately and FDDI speeds in the very near future -- something that after two years of trying ANS seems to have been unable to achieve.

Conclusion

"This is the first major communications business to be born under the deregulation era," said David Farber, a computer scientist at the University of Pennsylvania and a pioneer in data networking. "This hasn't happened since the growth of the telephone industry. You want it to be a business that doesn't repeat the errors of the past."¹²⁸ Farber is correct in his assessment.

As this extended essay has shown, one of the reasons that the network is embroiled in controversy is that the view of privatization in the Bush administration was apparently incapable of going beyond a narrow definition of corporate self interest in defining the public interest. The public interest was never defined. Measurable goals on the path towards meeting that interest were never established. Consequently policy makers were left without any yardsticks by which to compare the progress of ANS in meeting such goals.

What is the Public Interest?

If access to information is access to power (economic or political), access the current Internet and future NREN could very likely be a critical determinant of the economic well being of many Americans. The new administration must look squarely at the question of whom the network is to serve -- all the people or just a corporate elite? It should find the answer to be easy. The most basic definition of public interest in the question of the NREN will be universal access based on affordable costs for all Americans.

The outcome is by no means certain because Advanced Network and Services, Inc. has been placed, by the administrative action of the National Science Foundation, in the "driver's seat" of one of the most critical Federally sponsored technology programs of the last 20 years. If access to information is access to power (economic or political), access the current Internet and future NREN could very likely be a critical determinant of the economic well being of mil-

lions of Americans.

NREN was nurtured during the heyday of the privatization of public resources, including taxpayer-paid-for databases, several of which have become so expensive that they have been priced out of the reach of those whom they were intended to serve. In what has been the rush to privatize the NREN, someone should mind the public interest, lest control of the NREN fall to an entity that sees it only as a source of commercial gain and shows inadequate sensitivity to the public interest issues of access and affordability.

On Monday December 14, 1992 an important exchange between Robert Allen the Chairman of AT&T and Vice-President Elect Gore occurred at the Clinton Administration Economic Summit in Little Rock. Allen stated:

"A focus on infrastructure, including information networks, commercial networks which are interconnected, interoperable, national and global, needs to be encouraged. I have some points to make about who should do what in that respect. I think the government should not build and/or operate such networks. . . ."

Al Gore replied: "I fully agree when it comes to conventional networks and the new networks that your industry is now in the process of building. But with an advanced network like the National Research and Education Network, it does seem to me that government ought to play a role in putting in place that backbone. Just as no private investor was willing to build the interstate highway system, but once it was built, then a lot of other roads connected to it, this new very broad band high capacity network most people think ought to be built by the federal government and then transitioned into private industry. You didn't mean to disagree with that view when you said government should play a role did you?"

Allen: "Yes I may disagree." 129

Gore must come to understand that while the government does not need to build the backbone of a production (and by definition not precompetitive) NREN, where its involvement is needed is in the definition, protection and preservation of the public interest in the network. One place to start would be to examine closely the deci-

sions made - perhaps with the best of intentions - in outsourcing the backbone to ANS. The latest information to leak to the press says that the NSF is about to make some major changes in its final solicitation for the backbone rebid -- changes that may down grade the importance of the backbone in the context of an emerging commercial network infrastructure. ANS will nevertheless be a likely bidder. In evaluating the ANS bid the NSF must be ready to look very closely at the role in the context of the public interest that ANS might be expected to play if it won the solicitation.

However, determining ANS's role in the context of the public interest will be a very difficult task until:

1. It is able to decide whether it can exist only as a backbone provider and not as an entity, driven - by the demands of other parts of its program - to compete with and replace the mid-levels.
2. It makes clear whether it exists only to provide speed before there is a market demand for it.
3. It makes clear whether its monetary relationship with IBM gives it a priority to serve as a testbed for IBM equipment.
4. It decides whether it is a charitable public interest based foundation with an open agenda to advance the R&E network or whether it is a private profit making corporation with a proprietary agenda.

Non profit corporations often have profit making subsidiaries. Usually however such subsidiaries are clearly separated from the parent company. There is valid reason for such separation. The officers of ANS CO+RE when they make decisions should clearly be in a position to make them from the point of view of the profit making commercial service goals of the company. The officers of ANS should be in a position to make decisions that will clearly support its research and education oriented goals.

Since what benefits the commercial sector may not necessarily benefit the research and education community, to avoid conflicts of interest the decision makers for ANS actions in each area should be separate. ANS and ANS CO+RE should have dif-

ferent officers. Unless there has been a change since June of 1992, this is not presently the case. (The officers and directors for ANS CO+RE are a subset of the ANS officers.)¹³⁰ A minimal step toward necessary reform would seem to be putting ANS CO+RE under a set off officers who were not also employees of ANS and establishing some clear guide lines on the part of ANS itself for serving the interests of the R&E community should commercial operations conflict in anyway with such interests. ANS should position itself so that it no longer had to function in part as a test bed for IBM equipment and could avoid situations where it would have to make commercially driven decisions with no direct benefit to the network community. If it did this it should find itself more able to engage in open, documented and verifiable dialogues with the entire cross section of the network community. If it undertook such open dialogues in the manner suggested by Mitch Kapor, it likely would get some help from the community in defining indeed what it is good at. Then, fortified with an openly known, widely understood and broadly agreed upon sense of mission, it might go forward in a less schizoid manner to build positive achievements.

ANS, if the network community is to be able to work constructively with it, must chart a predictable, agreed on and understood course. It must overcome the sense that exists in the network community that its strategy is one of divide and conquer.¹³¹ If this were to happen and ANS were to chart and follow a consistent role towards policies that would clearly benefit rather than divide the R&E community, the new administration would be justified in considering further support. Based on what has transpired to date, it seems unlikely that ANS will suddenly articulate a clearly defined public interest mission.

As Mitch Kapor had cautioned Weis at Harvard in December of 1990, there was a strong element of public interest in what he would lead ANS to do -- especially if ANS should desire to control the major link in a privatized NREN. At the beginning of 1993 there is a much more widespread agreement than ever before that access to the network may become the chief public interest policy criteria. The *Boston Globe* summarized the opinion of those whom it had interviewed for a story on the growth and importance of the Internet. It found that: "All concerned agree that the rapid expansion of the Internet's reach, and

the parallel growth in its uses and information resources, make the cost of access for poor nations and [poor] individuals a primary consideration. Noting that the Internet has expanded far beyond its original focus on interactive computer communications and is now able to transmit audio and video, and that use of the network for electronic mail communications has grown well beyond expectations, [Vint] Cerf, [one of the network's original designers], said "it will become critical for everyone to be connected. Anyone who doesn't will essentially be isolated from the world community."¹³²

The US government need not build the NREN. However it must re-exert control over the public resources that it commits to the network and, in doing so, it must in conjunction with Congress and regulatory bodies more sharply define the public interest in access to the network. Having defined the public interest, it must then let the marketplace know that it will be free from interference only as long as it permits the public interest to prosper.

To implement such a policy it will be necessary that the NSF make the backbone award to an entity that is not incumbered with the divisive history of ANS. The NSF should also take care to see that its new backbone does not become a testbed for PTM over SONET switching. Technology employed should be conformant with international standards. Above all the NSF should not permit the awardee to resell commercial access to the backbone. The NASA/DOE award suggests that it should be possible to issue a performance based award without granting the winner the special privileges given to ANS.

Congress must come up to speed on these very complex issues. Warning of a continued "patchwork telecommunications network" and "Balkanized" policy battlegrounds, Louisiana Senator John Breaux has called upon the Clinton Administration to create a Presidential Commission, Chaired by Vice-President-elect Gore to review telecommunications policy and submit a blueprint to Congress to bring it up to date.¹³³ Breaux's proposal should be accepted. In choosing Dr Jack Gibbons, the Director of the Congressional Office of Technology Assessment to become the President's Science Advisor, the new administra-

tion sends a strong signal to Congress that it recognizes the importance of close cooperation in technology policy. Creation of the Presidential Telecommunications Commission would mean recognition of the educational process that must accompany if not precede sound policy making.

Appendix:

According to the ANS file "anscore nets" found in ANS's public FTP directory ANS CO+RE commercial customers include: IBM (Austin), IBM Information Network, Legislate data base service, Chevron Corp, Lexmark International, MCGraw Hill, MCI Mail, Mead Data Central, and Sears. CO+RE users apparently added since late may of 1992 include: Prodigy; University Microfilms, Ann Arbor; America on Line, Vienna VA; Communications Technical Center, Redmond, Washington; Teledyne Brown Engineering, Huntsville, Alabama; AR Inc Research, Annapolis; Lord Day & Lord, Barrett, Smith of New York City; Radiological Society of North America, Oakbrook, Illinois; Volvo GM Heavy Truck Corporation, Greensboro, NC; General Motors - Electronic Data Systems; IBM Electronic Vendor Support, Roanoke Texas; Share Inc, Chicago; AMOCO, Houston; and Accura Innovative Services Group, Orlando Florida.

FOOTNOTES

1 Electronic mail from reveiwer to author 9:36 PM, December 16, 1992.

2 Figures are for almost \$30,000,000 worth of connections and mid-level infrastructure grants in FY 1989-1992 Individual grant sheets obtained under FOIA from NSF.

3 Tom Valovic, *Corporate Networks - The Strategic Use of Telecommunications*, Artech House: Boston, 1992, p. 22.

4 Bilal Chinoy and Hans Werner Braun, "The National Science Foundation Network," 1992, p. 9 and statement by Jordan Becker, ANS vice President, to Com-priv mail list on December 4, 1992. ANS has

talked about the NSF "exercising its option to upgrade to T-3." This is a misleading way of stating reality. The NSF Backbone solicitation in 1987 never asked for an option to upgrade to T-3. MERIT in its proposal to NSF said it would be happy to provide an upgrade to T-3 in the early 90s if conditions warranted.

5 Paulette and Richard Mandelbaum, "The Strategic Future of the Mid-Level Networks," p.18. This paper was given at a December 1990 Conference on the NREN sponsored by the Kennedy School of Government at Harvard University.

6 Weis, an IBM Vice President, at this time was responsible for IBM's involvement in the MERIT cooperative agreement. By his own description Weis has at this time "world wide responsibility for the strategy, development and technical support of IBM's large systems for numerically intensive computing." Supercomputers in other words. See author box on page 7 of *Electronic Networking*, Volume 2, number 3, Fall 1992.

7 Letter obtained by the author.

8 FARnet stands for the Federation of American Research Networks, an association made up mostly of mid-level networks.

9 Mandelbaum, op cit, page 18.

10 Mandelbaum, op cit, pp 18-19.

11 Allan H. Weis, "Commercialization of the Internet," *Electronic Networking*, Vol. 2, No. 3 (Fall 1992), p. 9.

12 John Markoff, "Discussions Are Held on Fast Data Network," *New York Times*, July 17, 1990.

13 Ibid.

14 Dave Hughes of Old Colorado City Communications told the author soon afterwards of a September 14, 1990 meeting with a network coordinator who served on several national committees related to the NSFnet. The meeting was also attended by Sandy Hume, Republican State Senator from Colorado. On December 5, 1992 Hughes again recounted for the author what this coordinator said: "the coordinator had been present earlier that year at a meeting when Weis seemed to recognize for the first time the window of opportunity. When next he saw Weis he appeared as

president to be of the new ANS venture and the coordinator heard him say that he had been with IBM to the White House. The implication was that IBM's backing of Weis' new venture had White House approval, which as Hughes pointed out to the author could account for the NSF's special handling of ANS during the months to come."

15 Conversation with author on November 16, 1990 and tape recording of Weis address to Harvard symposium on December 1, 1990.

16 Date of Duderstadt's Science Board membership ascertained in a December 7, 1992 phone conversation with Telissa Thompson, National Science Board, NSF. Duderstadt became Chairman of the Science Board in November of 1991.

17 The issue of control of ANS by the NSF (still unresolved) will arise throughout this article. It would take very dramatic and public form when on December 4, 1992 Communications Daily would publish an article stating in effect that everyone involved with the Infrastructure Pool, the NSF, Merit, and ANS all denied responsibility for it.

18 Mandelbaum, op cit., p. 19.

19 Ibid., p. 20. Yet by June of 1991 he was saying in an interview with Telecommunications that he wanted to provide turnkey solutions to corporate commercial T-1 networking needs.

20 Minutes of September 26, 1990 meeting sent by Richard Mandelbaum to members@farnet.org on Wed. October 10, 1990 at 1:54 PM.

21 IBM is probably Educom's largest monetary supporter.

22 In multiple meetings and conversations between January 1991 and July of 1991 the author asked Steve Wolff and Jane Caviness, the NSFnet Director and Deputy Director to quantify these backbone subsidies by mid-level network. The author was told that it wasn't possible because the subsidies were buried in other grants. On the com-priv mail list during the summer of 1991, Wolff would discuss network "yellow stamps" as a means of the NSF giving backbone connectivity subsidies to mid-levels after the expiration of the Cooperative Agree-

ment in November 1992.

23 Various officials of several mid-level networks expressed these concerns to the author between October of 1990 and the summer of 1991.

24 Markoff, op cit., *New York Times*, July 17.

25 Author's notes November 16, 1990.

26 Judith Axler Turner, "Features of NSF's Computer Network to Be Offered to More Colleges and to Commercial Companies," *Chronicle of Higher Education* September 26, 1990.

27 Telephone conversation with Weis October 19, 1990 as recorded in author's email on October 20, 1990.

28 Passages quoted are from the transcript of the author's December 1 tape recording of the meeting. the transcript was made by the author on December 2, 1990 and sent to Al Weis for review on December 5, 1990.

29 Jordan Beker, ANS Vice President to the Com-priv mail list on December 4, 1992.

30 ANSnet/NSFnet T-3 Topology map dated May 29, 1992. A count of the Fortune 1000 attached to the CIX member networks would show well over 100. Weis seems to have thought that many would move to attach to ANS. Apparently very few have.

31 Eventually when some of his own supporters criticized his non participation in the OTA computer conference, he agreed to participate through his Client Service VP Joel Maloff. Maloff's participation in January 1991 was quite limited.

32 Preceding six paragraphs from the author's tape recording cited above.

33 Data from ANS Form 990, page 1.

34 Email from Steve Wolff to Hans Werner Braun and copied to Eric Aupperle on November 29, 1990. Received by the author under FOIA on November 30, 1992.

35 The author has asked Hans Werner Braun (now at the San Diego Super Computer Center), Eric Aupperle, and Jim Williams at MERIT to provide context for the November 29, 1990 email from Wolff. To date all have replied that given the passage of time it is difficult for them to remember.

36 Email from Joel Maloff to OTA Computer Conference 9:23AM Friday January 4, 1991.

37 Personal conversation between the author and Steve Wolff at EDUCOM reception on the evening of January 9, 1991.

38 Maloff email 9:23am Friday January 4, 1991.

39 Steve Wolff, NSFnet Director email to author, July 26, 1991.

40 The author sent the first draft of this study and a copy of ANS's Form 990 for review to Don Veach, Massachusetts Ave, Cambridge Mass 02138. Mr Veach is an accountant with expertise in public interest accounting. He found the author's questions to be reasonable and well founded. He also stated that had ANS used the cash basis of accounting rather than accrual its net worth would have been substantially greater. He pointed out that the actual provisioning of the program services activity (providing and maintaining the network) was apparently carried by MCI and MERIT with equipment from IBM. In view of this he said that ANS seemed to be nothing more than an entity established to enable the payment of salaries and expenses to officers who seemed to be engaged primarily in the establishment of a profit making commercial subsidiary.

41 Conversation with Robert Kobel, IRS Public Affairs Office on December 8, 1992, confirmed in conversation with Mr. Kobel on December 29, 1992.

42 The document, received from the NSF under the Freedom of Information Act, will be cited as Weis, "A Proposal". It is 12 pages long (five pages of text and 7 pages of Appendices. ANS was now four months old and Weis was no longer an IBM employee, yet Weis' network address was still WEIS@IBM.COM.

43 Weis, "A Proposal," p. 2. Weis' original document does not use numbers. The author has inserted them for clarity.

44 Ibid., p. 3.

45 Ibid.

46 Ibid.

47 Ibid.

48 Conversation between Weis and the author at the Educom Reception January 9, 1991.

49 Weis, "A Proposal," p. 3.

50 Points 7-9: Ibid.

51 Ibid., pp. 3-4.

52 Ibid., p. 5.

53 For FARNET statement see footnote 6 above.

54 Weis, "A Proposal," pp. 10-11.

55 Ibid., pp. 11-12.

56 Ibid., p. 3.

57 If one counts the full \$2,660,000 listed as accounts payable to IBM as money expended on the network's RS/6000 routers and adds it to the \$7,279,504 listed as spent on the network, one gets roughly \$9,940,000 -- an amount spent of less than \$600,000 more than it received from the US government.

58 Ibid., p. 7.

59 Ibid.

60 Ibid.

61 Email to author 5:54 PM December 21, 1992.

62 The \$7,257,349 comes from adding the individual grant amounts released to the author under FOIA in November 1992. The NSF data base appears to be both inaccurate and incomplete. The author was sent a printout of 200 grants covering the fiscal years 1988-1992. In FY 1988 five grants for the connection of universities to the network had no monetary figures attached. Three FY 1990 grants were listed without monetary figures. One was a cost sharing grant to the JVNC Supercomputer Center for the connection of Nordunet. A second was much more substantial - a 36 month long grant to MIT (Award Number 9000255) for a Boston node for the NSF backbone. As was the third - a 36 month long grant to Argonne National Laboratory (Award Number 9000429) for a new NSFnet backbone. (These are likely to be in the several hundred thousand dollar range each.) Then there was Award number 8720904 to MERIT for the backbone

in the amount of \$28,850,102 with a duration of 157 months! The announced dollar amount had been 14.9 million and duration of 60 months.

On the morning of December 21, 1992 the author placed several phone calls to the NSF in order to ascertain what the data on these grant sheets meant.. It turned out that Altie Metcalf in the Grants and Contracts Office was the only person who could help. She was "in" but not available. That afternoon when she had still not returned the authors call, he telephoned again. When she still could not be located, the author asked for the Inspector General's office and left a strongly worded complaint there. Late in the day a Jim Noeth, Deputy Assistant Inspector General for External Affairs called the author who explained that he would like data on the Argonne Grant and MERIT Grant and faxed to Noeth his copy of the MERIT Grant sheet. Noeth told the author that the database showed a dollar for the Argonne Grant but also now showed 60 months for the MERIT grant and a figure of \$39,000,000. He said that he would try to get answers for the author's questions by Christmas eve. He did indeed call on the morning of the 24th to say that he thought the MERIT grant sheet read 57 months and that the "one" looked to him like a scratch. [The one is an unmistakable one.] He was unable to say whether the 28 million was the original amount or whether it was an interim figure. The only feedback he had from Ms. Metcalf was regarding the Argonne which probably lacked a monetary figure because it might really exist in several other grants that fell outside the scope of the author's request. When the author asked if Noeth was saying that Argonne National Laboratory had not asked for a sum total amount to make the backbone connect, he suggested that the author write Metcalf a letter with any further questions. When the author expressed exasperation that in three days of looking no one at the NSF could determine what had been spent on the backbone node at Argonne and asked how such a state of affairs was possible, Noeth said that Metcalf could presumably pull the original contract out of the files. He also refused to see that she did this, saying that the author would have to follow the matter up himself.

63 Joel Maloff to OTA Computer Conference on NREN Policy Issues, January 3, 1991. Of course two years later the aggressiveness of ANS schedule in moving to gigabit services appears to have vanished.

64 Rick Adams, President of UUNET the third founding member of the CIX was scheduled to be present at the OTA Workshop but was prevented by illness from attending.

65 This message was first released by Bill Schrader to the com-priv mail list in early December 1991. It is copied from the author's June 1992 *COOK Report on Internet -> NREN*.

66 May 30, 1991 date from ANS CO+RE incorporation papers filed in Dover Delaware.

67 ANS CO+RE press release as quoted in com-priv on June 10, 1991.

68 *Telecommunications*, June 1991, p. 7.

69 "ANS to Market Internet to Corporate Users," *Telecommunications*, July 1991, p. 9.

70 *Ibid.*, p. 12.

71 "Draft: National Research and Education Network A Report to Congress, December 1992, Submitted by the Director of the Office of Science and Technology Policy in response to a requirement of the High Performance Computing ACT of 1991 (P. L. 102-194)", p. 19.

72 Electronic mail from Steve Wolff to the author 2:09 PM May 24, 1991.

73 As announced on the com-priv mail list on August 2, 1991. By December 1992 the CIX had expanded to include two European based commercial service providers, US Sprint's Sprint Link, and three additional mid-levels (BARRnet, NEARnet, and JVNCnet).

74 FARnet speech by Maloff posted to com-priv on January 3, 1992 by Geoff Goodfellow.

75 The Guide was publicly released by ANS shortly after the meeting.

76 Comment on draft of this report by Director of a Mid-level Network, and member of the ANS Resource Allocation Committee.

77 Posting to com-priv list by Robert Weber on August 18, 1991.

78 This quote and all quotes in the next five paragraphs from the message signed by Weis and Aupperle and posted from MERIT at noon on December 7, 1991.

79 John Markoff, "Data Network Raises Monopoly Fear," *New York Times*, December 19, 1991.

80 Sharon Fisher, "Access Providers: ANS Has Unfair Edge," *Communications Week*, December 23, 1991, p.5. In a January 2, 1992 Open Letter to the Internet Community Weis stated: "Unlike the T-1, the T-3 network was built to accommodate the needs of NSF sponsored institutions plus other potential users including commercial users. This additional capacity was built using ANS funds. Any competitive advantage gained by ANS is appropriate, considering the risks involved." One would hope that one could find some evidence of the ANS investment in building the network in the company's Form 990. Such evidence is difficult to find there. If the author has analyzed the Form correctly, ANS may have spent less than \$600,000 more on the network than it received from the government. It seems that an investment in a project of roughly 6% of what was spent overall that results in significant marketplace advantage is also a significant leveraging of ANS's funds.

81 Posted to com-priv by the author on December 26, 1991.

82 Name of network changed to protect identity of the author of the message.

83 Again the name of network is changed to protect the identity of the author of the message.

84 James Bruce to com-priv on January 3, 1992.

85 John Rugo, NEARNet Business Manager to com-priv on January 9, 1992.

86 Geoff Goodfellow to com-priv on January 17, 1992.

87 Joel Maloff to com-priv on January 23, 1992.

88 The author was told by an operations person at a mid-level network who did look ups on Orbit and BRS that they were ANS clients. He confirmed the case of BRS in a telephone conversation with their customer service desk on December 8, 1992.

89 Interview with Joel Maloff at Telestrategies sponsored conference on commercialization of the Internet April 22, 1992 as reported in May 1992 *COOK Report on Internet -> NREN*. In the *COOK Report* the author, trying to tone down the tension,

paraphrased Maloff as having said that he believed the CIX did not wish ANS well. His actual words were "out to destroy ANS".

90 Email from the CEO/Director of a CIX member network to the author at 9:06 AM December 18, 1992.

91 For some of Mitch Kapor's eloquent testimony at the Hearing see pages 4 and 5 of the *COOK Report on Internet -> NREN*, April 1992.

92 Peter O'Neil, "Summary Report of the ANS/Regional Advisory Meeting Held in St. Louis April 15-16, 1992. Released to the author by the NSF under FOIA. Referred to hereafter as: O'Neil.

93 O'Neil, pp. 1-2.

94 *Ibid.* pp. 2-3.

95 *Ibid.*, p. 5.

96 *Ibid.*, p. 8.

97 *Ibid.*, pp. 9-10.

98 *Ibid.*, pp. 5-6.

99 *Ibid.*, p. 4.

100 *Ibid.* p.11.

101 *Ibid.*, pp. 8-9.

102 *Ibid.*, p.10.

103 *Ibid.*, p.11.

104 *Ibid.*, p.12.

105 *Ibid.*, pp. 13-14.

106 Electronic mail received by the author on December 14, 1992.

107 *COOK Report on Internet -> NREN*, September 1992, p. 19.

108 A summary of the November entries on com-priv regarding the infrastructure pool appears on pages 12-15 of the December 1992 *COOK Report on Internet -> NREN*.

109 Unless otherwise noted all citations for this section are from NSF FOIA released email between mid October and mid November 1992.

Email from ANS Vice President Guy Almes on November 3, 1992 copied an October 30 memo from Al

Weis giving the identity of RAC members as: Eric Aupperle, MERIT, Thomas Bajzek, PREPnet, Alison Brown, OARnet, Patrick Burns Westnet, Dennis Fazio, MRnet, Doug Gale, MIDnet, Eric Hood, NorthWestNet, James Luckett, NYSERNet, Jeffrey Ogdan, Michnet, Joe Ragland, Concert, Glenn Ricart SURAnet, John Rugo, NEARnet, Mike Staman, CICnet, Allan Weis, ANS, William Yundt, BARRNet, Donald Zitter, NevadaNet.

This is the first time that those mid-levels that have signed agreements with ANS have been publicly identified.

110 O'Neil, email to RAC, October 15, 1992.

111 Message released to author under FOIA. Reply sent at 8:05 am November 5, 1992.

112 Message released author under FOIA. Received by Wolff's id at 4:23 PM, November 5, 1992.

113 The report states that three members were absent and 12 present but lists 16 members. Steve Wolff of the National Science Foundation was not listed among the RAC members.

114 FOIA release to author from NSF.

115 Alison Brown email to Guy Almes and the RAC mail list at ANS 6:09 PM November 4, 1992.

116 Message released to the author under FOIA. Guy Almes to Steve Wolff at 5:53 PM November 6, 1992. A mid-level Director who is also a member of the RAC stated that "ANS does not run the Infrastructure pool as a public trust. It is controlled jointly by ANS and the mid-level networks with which it has agreements. No government funds are involved and thus no government oversight is justified. No other public funds are involved and thus no public disclosure is necessary if the parties choose not to do so. The NSF is not a member of the Resource Allocation Committee. Steve Wolff was included from the start, not as a later addition, as a courtesy to keep him informed. This entire section of your paper is based on wrong assumptions and is thus in grave error." Email to author December 21 1:14 PM CST.

117 See the estimate of \$250,000 cited above in the December 23, 1991 *Communications Week* story by Sharon Fisher.

118 Almes to the RAC mail list at 2:16 PM on Friday November 13, 1992. Released under FOIA.

119 Mike Staman at 7:43 PM November 14, 1992. Released under FOIA.

120 Compliance letter from Eric Aupperle to Steve Wolff, sent to Dr. Wolff by Jim Williams of MERIT on Tuesday November 24 at 3:30 PM and released to the author under FOIA. A director of a small Internet services provider commented in email to the author at 5:43 PM, December 21 1992: "what is particularly strange is that they don't guarantee it will work as delivered, but in the same breath claim that whatever additional load they put on the network will not impact network performance. If you can't tell whether it works or not how can you measure whether adding ANS traffic to it will have congested it?"

121 Brock N. Meeks, "NSF Network Fund Has No Accountability Or Govt. Oversight," *Communications Daily*, Friday December 4, 1992.

122 Email from Jim Williams, MERIT, at 10:58 AM on December 14 and 12:04 PM December 15, 1992.

123 Email from Jordan Becker, VP of ANS to Steve Wolff at 9:57pm November 6, 1992. Released to the author under FOIA.

124 Email to author at 3:31 PM on December 8, 1992.

125 See "ANS Network Map Shows 29 Attachments from September 1990 to June 1992," *COOK Report on Internet* -> *NREN*, p.15.

126 Email sent to author at 11:09 PM EST December 22, 1992.

127 Joel Maloff, "Selling Internet Service: An Ancient Art Form on a New Canvas," *Electronic Networking*, Vol 2, No. 3 Fall 1992, p.19.

128 John Markoff, "Data Network Raises Monopoly Fear," *New York Times*, December 19, 1991.

129 "Excerpts from Clinton's Conference on State of the Economy," *New York Times*, December 15, 1992. A reviewer sent the author the following comment: The carriers can build high bandwidth transmission and switching, but even the best are in-

credibly dense about how to build a high performance network system, where performance goes from end to end. The Government still has the bulk of expertise in this area, and by the government being a savvy customer, we can insure the system works. If we were simply captives to the telecom people, and not smart buyers, we'd have to settle for what they wanted to give us. That would be bad for everyone, because I doubt the carriers on their own could figure out the whole puzzle. They just have the wrong type of people working for them. They don't understand how high performance computing systems work. With some luck, we can change this by the experiences we all go through pulling the project together. But right now, no carrier has the expertise to build a super-computer networking system on its own.

130 According to a June 25, 1992 posting to com-priv by Susan Eldred the Officers of ANS CO+RE are Al Weis, Bob Harris, Al Hoover, and Jim Parker. The ANS CO+RE Board of Directors is Weis, Harris and Hoover.

131 The network community is no longer as hostile towards ANS as it once was. Consider the following point of view of the mid-level Director cited above: "The Internet is somewhat a victim of its success. There is a lot of credit to go around for that success. Presently, it is working very well, especially for a project that is on the leading edge of technology, is as complex a system as it is, involving as many people as it does. This does not mean that there aren't problems ahead, and indeed, there will be some significant changes as more players get involved and all of the issues of privatization, commercialization and multiple backbone providers evolve. These are issues that are difficult and with which everyone (NSF, backbone providers, mid-level networks, even universities and businesses) is grappling. Nobody has the answers yet as we explore uncharted territory. A lot of the confusions and policy decisions are because of this. Though blunders may have been made, I do not see any evil conspiracy on anyone's part, however, as you apparently do. More mistakes and errors will undoubtedly be made. It is the unavoidable consequence of a new industry. I think

everyone is trying to figure it out. There is a lot of money involved, so there is a lot of self-interest. Hopefully, concern for the common good and what is best for the industry as a whole will win out. It is often argued that competition on the proverbial "level playing field" provides the best opportunity for advancement. Well, I don't think that there is any such thing as a "level playing field" and the metaphor is getting tiring. Someone always has some kind of advantage due to an environment beyond their own creation and efforts. I disagree with the competition argument, preferring to stand by the position of the anthropologist Ashley Montegu who contends that cooperation, not competition is much more effective. That's what I believe should happen with our industry. It grew out of cooperative research efforts and from significant pooled investments from universities, businesses and government agencies, and it can be a natural evolution for this cooperative effort to continue. There is money to be made and wealth to be created at a level that can support many players if nobody gets greedy and loses sight of the cooperation of the past that produces our current common good." Email to author 1:14 PM, December 21, 1992.

132 Charles A. Radin, "US Data Highway Gathers Speed," *Boston Globe*, Saturday, December 26, 1992

133 "Breux Awaiting Reaction to Suggestion of Presidential Commission on Communications," *Telecommunications Reports* (December 14, 1992), p. 35.

Note that the first draft of this report was sent for review to twenty network professionals with first hand knowledge of the events described. Substantive comments were received from twelve. MERIT was a reviewer but declined comment. ANS declined an opportunity to review.

NOTE: This section contains comments by NSFnet Director Steve Wolff received via email on December 29 1992 shortly before press time. Comments are referred to by page number and footnote numbers a-nn. They are direct quotations.

Dr. Wolff's introductory note:

Gordon,

I have put a lot of vacation time into this commentary and gotten just under half-way through.

I think you have a number of factual errors, and I've tried to point them out. But

I expect you've got them mostly right. However as both mathematicians and historians know, through any (even infinite!) subset of the (unknowable) set of *all* facts, infinitely many distinct histories can be threaded. You have selected your facts and woven about them an historical mesh that supports your point of view and there's nothing I can do about that.

No doubt there'll be more public debate after release.

Thanks for the chance to comment.

-s

Page 1 (a) But the history of the Internet in this country has been one of exclusive gov't awards for network infrastructure that the private sector was unwilling to provide any other way. The gov't (or at least NSF) is *not* in the business of providing exclusive contracts for network services that can in fact be purchased by individual campuses from whomever they want to buy them from. The reason for the exclusive awards, such as the one to Merit, is to push the technology in ways that are deemed in the national interest. And in all cases, the awards are made competitively.

Page 1 (b) The reason for the 18-month extension was *not* a policy impasse, but a result of the rapidly-changing Internet environment (including the additional complexity resulting from overlaying the HPCC/NREN on existing programs). The extension was fully justified in these terms in our request to the National Science Board in November 1991, and it was approved by them. It was a deliberate policy *decision*, not an *impasse*.

Page 1 (c) Conditions were imposed to prevent ANS' commercial traffic from degrading service to the R&E community. There has not been any such degradation, since ANS has on its own initiative installed adequate additional network infrastructure to prevent it. Therefore the conditions have not required "enforcing"; I'm not aware of any "difficulty".

Page 1 (d)...as well as a thousand or more secondary schools, hundreds of public and private libraries, and an unknown number of hundreds of commercial organisations (recall that when ANS connected to the CIX, it had to announce only seventy new networks; i.e., all but seventy of the commercial organisations now on the Internet were already accessible via the *existing* structure.)

Editor's comment: Dr. Wolff speaks from the point of view of his structure. From the point of view of the CIX backbone all customers were accessi-

ble. And in fact, as a knowledgeable source reported to the author on 12/29/92, anyone connected to the network can send anywhere because ANS has for some time not been blocking any CIX commercial traffic.

Page 2 (e) We don't want to control anybody's backbone. We *do* control the NSFNET Backbone *Service*.

Page 2 (f) The primary goal of the program is service to the R&E community; the division of expense between backbone services and mid-level support is of at most secondary consideration.

Page 2 (g) If the fulfillment of that dream is in danger, it is *not* because "the NSF does not have unlimited funds at its disposal". Few people I know dispute the notion that extending access to all the nation's primary and secondary schools will require a cooperative program with the states and the Dep't of Education being major players, and other government agencies such as NSF playing secondary roles.

Page 2 (h) The Internet is already well on its way to being worldwide, and already has some multinationals connected. I dispute that this outcome is problematic; I think it's assured.

Page 2 (i) Connectivity is certain because of user demand, but absent jackboot state control it cannot be "assured" (and remember what I pointed out above: connecting the CIX only brought 70 new nets aboard - out of the (now) greater than 8500 announced - less than one percent!). There will be no single NREN network because NREN was *always* intended to be an internet - i.e., a network of networks - and I believe NSF has never said anything different. We *have* said there will be no single federal agency "in charge", and that's simply a recognition of political reality. I think the argument could be made that if a *single* network were mandated, it would never happen because no federal agency would give up jurisdiction over its own piece of the whole.

Page 2 (j) We controlled it when it started, but few want the network controlled from Washington now.

Page 2 (k) Clearly not counter to everyone's intuition!

Page 2 (l) There was no relevant public law in September, 1990.

Page 3 (m) I think you mean "peremptory". I certainly didn't read it

that way. Van Houweling was as familiar as I with the standard provisions of NSF Cooperative Agreements that state that all subawards require Foundation approval; his letter was an expression of intent and we both knew that the details had to be approved by NSF's Grants and Contracts Division.

Page 3 (n) It wasn't a demand. Some of the 74 days were taken in the subaward approval process.

Page 4 (o) In the preceding eleven paragraphs, it is clearly not supportive of your overall position to remark that (a) MCI and IBM won the right to lose money on the NSFNET project in a free and open competition (it was for example never a secret that they were partners in the Merit proposal), and (b) AT&T has not exactly been a leader in the data networking business so that quotes from Fred Howlett need to be understood in context.

Editor's comment: what the eleven paragraph's remark on is the belief of the individuals interviewed by Markoff that IBM and MCI were succeeding in having the conditions of the Cooperative agreement changed in such a way that they could inherent control of the NREN.

Page 4 (p) "Expertise"?? That's a red herring. NSF is a funding agency. We have ample expertise on tap from various levels of advisory structure, to special-purpose workshops, to hiring experts for short or long terms. All in all, I believe the goals of the networking program at NSF are being very well met indeed.

Page 5 (q) Why do you mention Duderstadt? I think you should be very careful about any implication of conflict of interest.

Editor's comment: Conflict of interest implies personal gain and is not alleged. What is alleged that if Duderstadt did not absent himself from all NSB deliberations on the issue, because of the close relationship between MERIT and the University of Michigan, it raises the appearance of self-interest.

Page 5 (r) We continue to deal with NY-SERNET as an awardee even though PSI actually provides, manages, and operates the network. What's wrong with that?

Page 5 (s) That's not true. Why do you think that?

Editor's comment: I think this because I was told this by a reviewer with Federal Network contracting expertise.

Page 5 (t) Absolutely. We had no desire (or right) to control the resources - we only retained control of the *service* we were paying for (via the numbered paragraphs 1 and 2 in my letter to Van Houweling).

Page 6 (u) Oh? By whom? You have a reference for this assertion? Within the academic and the government communities it was and is well known that NSF makes such awards competitively. The 18-month extension was a move of sufficient import to require NSB approval. A renewal of the original agreement for an additional five years would have been out of the question.

Editor's comment: At 9:09 AM, November 9, 1990 Educom's Mike Roberts stated that he viewed ANS's existence "as a backstop against failure of NSF to renew backbone in 92." OTA Computer Conference on NREN Policy Issues. Item 4 Response 12. The NSF had often said it wished to get out of the business of providing the network backbone. The whole Yellow stamp discussion on com-priv in the summer of 1991 was based on the premise of the NSF not rebidding the backbone.

Page 7 (v) That's demand. Capacity remains at 22.5.

Page 7 (x) The trouble with the above is that a Gb/s network is a matter of public policy - both by Administration priority in the HPCC program and by legislative intent in PL 102-194. You characterize Weis' behaviour as "infatuation" whereas I would describe it as forward-thinking and aligned with the national goals subsequently expressed by both the Executive and Legislative branches of our government.

Page 8 (y) This simply isn't true. When ANS was spun off, the NSFNET Backbone Executive Committee (with representatives from Merit, IBM, MCI, Michigan, and NSF) was expanded to include Weis, and lower-level (e.g., program, engineering) committees were similarly augmented. The operation of the Cooperative Agreement has always internally been referred to as a "partnership" and all parties have participated vigorously and jointly in the activity.

Editor's comment: This seems to be a matter of changing perspective. Note that Dr Wolff told *Communication's Daily* that the infrastructure pool was not the NSF's responsibility but rather MERIT's, and that MERIT in turn passed the buck to ANS.

Page 8 (z) You characterize the situation as a tendency for "ANS (or perhaps MERIT and ANS) to go their own way" whereas it was a normal and commendable initiative - we *wanted* ANS and Merit to expand the network. My reminding them of their obligations was *not* out of a fear they would disregard them, nor that they were running out of control, but simply so that the record would show that they had obligations, and nobody could in future say that "NSF had let ANS run without controls."

Page 8 (aa) It may indicate that to you, but it didn't to me or anybody else I know of. Instead, as I have written above, ANS was so aggressive in augmenting the infrastructure on their own hook and there was no evidence of any ANS-customer-caused congestion that establishing the "technical means of compliance" assumed a low priority. The teething problems of the T3 network were not related to this issue in any way.

Page 8 (bb) In fact, if there had been ANY complaints of bad service attributable to ANS commercial traffic (and there weren't), it would have been trivial to exert the necessary control.

Page 8 (cc) Do you have documentation for this? All my public statements have been that the IBM/MCI contribution to the NSFNET project is five or more times the taxpayer investment.

Page 8 (dd) I run with a very free style of management. While within the Division we have a shared set of goals and aspirations, we differ as thinking people will on many details. Recognizing the visibility as well as the critical importance of the NSFNET project, and recognizing that there are those who will seize on isolated documents, sections, and even phrases and use them out of context, I felt it was important to render conflicting statements from the NSFNET program impossible in the context of your "conference" as well as on com-priv.

Page 9 (ee) A major part of the cost-sharing was in effect an "inheritance" from IBM and MCI which would not appear on the 990. Note that Maloff *did not* assert the cost-sharing was all ANS. The evidence you cite (the 990) is not related to the assertion (Maloff's) you're trying to refute.

Editor's Comment: See fresh information from IRS inserted into body of the text on page 9. Also on December 29, 1992 the IRS Public Affairs Office stated by telephone that to the best of its knowledge calling something an "inheritance" would not exempt the turning over of computers or telephone circuits to ANS from the need to be shown on line 1a of the Form 990.

Page 11 (ff) In fact, we've used the T3 performance as baseline, not the T1.

Page 11 (gg) Perhaps that's from one of ANS' competitors? Remember that during the mbone experiments it was *not* the "crippled" (your word, I think?) IBM routers that died, but

the off-the-shelf commercial ones that some folks have said NSF should have bought..

Page 11 (hh) We were (and are) paying for service not resources.

Page 12 (ii) Both PSI and UUNET have been in operation a lot longer than that.

Page 12 (jj) It was not a hope. The conditions on ANS *ensured* that CO+RE profits would go into enhancing the common infrastructure.

Page 13 (ll) Once again you've left out the contributins "in kind" of IBM and MCI.

Page 13 (mm) ANS offers service at levels above FR and SMDS. Indeed, I expect ANS to invest rather heavily as PSI has done in fast packet and cell-switching technology. While many large corporations do LAN interconnect with "raw" fast packet, there is an increasing tendency to use routers for interconnection and run IP over the level 2 base. Thus ANS' services are not positioned against the telcos' FR and SMDS, but against such services as SprintLink and those offered by its "traditional" competitors PSI, Alter-Net, CERFNet and a growing horde of others.

Page 14 (nn) Until you define what you mean by "Real data security", nobody can tell whether what you say is true or not. I can, as DoD does, run a *very* secure network at level 3. What you haven't twigged to is that what level 2 services do for you is to allow you total control of your connected communities, and ensure that, for example (if you wish), the NASA-funded ocean physics community network cannot possibly talk to anybody NASA doesn't want them to talk to and the DoE-funded alternative energy researchers can be kept isolated. I am *not* asserting that those specific actions will be taken, but DoE and NASA will tell you that the ability to form VPNs (i.e., closed and disconnected communities) is a driving force behind their adoption of level 2 services. Yes, PSI has characterized level 3 Internets as the "Edsels of the '90s", but I think that's just Marty's corporate posturing.

COOK Report Schedule

Please note that the next issue of the *COOK Report* will be Volume 1, Number 12. It will appear during the second half of February. Most subscriptions will expire with the February issue. This issue will be sent with invoices for those subscriptions that have expired.

Volume 2 Number 1 will appear on or about April 1, 1993. Future issues will examine telecommunications policy under the new administration and will focus on the development of world wide network infrastructure.

Chronology of Events

- Summer 1989** Discussions begin about T-3 upgrade for NSFnet Backbone
- March 1990** NSF signs of on upgrade plans
- June 28, 1990** NSF informed by MERIT of ANS's formation
- July 17, 1990** New York Times article on IBM, MCI and MERIT's plans
- September 10, 1990** NSF Privatizes T-1 Backbone
- September 13, 1990** ANS Incorporation papers filed in Delaware
- September 26, 1990** Some mid-levels meet with ANS
- December 1, 1990** Mitch Kapor publicly warns ANS to get public input
- Early December 1990** Second and Larger ANS mid-levels meeting
- January 15, 1991** Delivery of ANS Proposal to NSF
- February 14, 1991** CIX announced at OTA Workshop
- May 24, 1991** T-3 Backbone privatized by NSF
- June 4, 1991** ANS CO+RE announced
- August 2, 1991** CIX Association announced
- August 14-16, 1991** ANS Commercial Agreements unveiled at FARnet mtg
- October 1991** FARnet asks NSF not to abandon the backbone in 1992
- November 22, 1991** National Science Board approves backbone rebid
- December 9, 1991** HPCC legislation signed into law
- December 11, 1991** Kapor and Farber protest ANS commer. bbone monopoly
- December 19, 1991** Dispute over tilted playing field makes New York Times
- January 23, 1992** Dialog changes from commercial to R&E ANS customer
- March 12, 1992** Congressional Hearing into NSF handling of privatization
- April 15-16, 1992** ANS meets the mid-levels in St Louis
- June 1992** NSF releases bbone solicitation draft, breaks 2 provider pledge
- June 25, 1992** ANS announces Officers & Directors of CO+RE
- July 7, 1992** *Communications Daily* reports poor performance of IBM routers
- August 3, 1992** Comments due on much derided bbone solicitation draft
- October 23, 1992** ANS CO+RE Resource Allocation Committe first meeting
- November 6, 1992** RAC meeting memo released to FARnet
- November 24, 1992** NSF receives MERIT's backbone usage verification document first requested in September 1990
- December 1, 1992** Sen Breaux proposes Presidential Telecom Commision
- December 4, 1992** *Communications Daily* publishes article on infra. pool

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