1. Perception of value	10
2. Focussed attention of someone	6
3. Use of networks	
4. Execution - "doing things"	17
5. Establishing stable funding base	2
6. Reducing divisiveness	
7. Seeking commitment among ops providers	
8. Making FARNET's opinion re operational issues known	11
9. Providing leadership	5
10. Responsiveness to member needs	3
11. Identify issues, achieve consensus, communicate externally	
12. Developing models for inter-organizational relationships	
13. Promoting sharing of information resources	14
14. Sponsoring specific projects	1
15. Expanding membership to RBOCs, carriers, etc.	1
16. Building visibility	5
17. Merging and/or affiliating with other organizations	2
18. Avoiding diffuseness	
19. Avoiding disenfranchisement of have-nots	1
20. Matching organizational structure to its goals	
21. Commissioning specific projects	
22. Following through	
23. Permanent staff	4
24. Involving decision makers from regionals	
25. Discussing issues of interest to decision makers; becoming decision-making organization	
26. Expanding membership to state networks	
27. Foster competitiveness - no monopoly	
28. Perform clearing house function	
29. Find/discover/seek sources of funding	1

2. What is the particular mission and set of functions that you or your organization view as appropriate for FARNet to assume?

3. What are the forces currently driving change in networking for research and education and the appropriate roles for regionals and FARNet?

4. How do you envision your organization or network evolving in the next few years?

5. Who are the other important players that will influence that evolution?

6. Can you identify specific any key events or milestones that would affect the future evolution of the research and education network, the regional networks, or FARNet?

7. Is there anyone besides the representatives to FARNet that you would recommend we interview via E-mail? If so, who? Can you give us their E-mail addresses?

If we wish to discuss your answers further with you, may we call you? If so, please include your phone number.

If your organization has written materials on your future plans or suggestions for the future of FARNet would you please send them to us? Our mailing address is above.

If you have any questions concerning this questionnaire or project, please let us know by E-mail.

Thank you for your time and attention. We look forward to discussing these issues with you in January at the FARNet meeting.

9.3 Critical Success Factors

Using standard brainstorming techniques, we developed at the Las Vegas meeting a list of critical success factors. We then gave each participant 3 votes and asked them to vote for their three most important items on the list. The results are discussed in Chapter 3; this appendix documents the list and the voting. An absence of a number indicates that no one voted for the item.

Table 9.1: Critical Success Factors: Brainstorming and Voting Results

Item	Votes

that remain proprietary.

9.1.5.5. Role of FARNET:

Since different regionals and groups of regionals have different financial and technical interests, consensus is infrequent. Consequently, FARNET is unable to function and disbands. Other organizations continue their advocacy roles on behalf of national networking issues, research, and higher education, but they are less effective since there is less consensus in these communities. NSF and other government agencies are funding institutions and researchers directly; appropriate use requirements are eliminated. The phone companies do not complain about these networks carrying commercial traffic since their fiber and switches are being used. NSF funds R&D efforts for multi-gigabit networks with grants to Principal Investigators. The large demand for service by a wide constituency has led to financially healthy mid-level and regional networks without need for direct government subsidies.

9.2. Questionnaire

This memo has been sent to planning@farnet.org and to members@farnet.org.

We have been hired by FARNet to assist the organization to develop a vision for the future of FARNet and a strategic plan for attaining that vision. We seek your help. FARNet members will hold a meeting in January in Las Vegas to consider the future of FARNet. At that meeting we will present several alternative visions of the future of FARNet. To develop these alternative visions, or endstates, we would like to know your views on several issues.

The responses to this questionnaire will help us construct several alternative visions of the future climate for networking, the role(s) of the regional networks, and FARNet's function in these circumstances, among other issues. Please note that we are not putting together a forecast or predicting the future. Instead, to understand the potential role, mission, and strategies for FARNet, we have structured these survey questions to elicit opinions concerning the dynamics of the research and education networking community and the regional networksЏplace in it. Also, we are not seeking confidential information and no one will be quoted with attribution.

Please answer the following questions as fully or as succinctly as you desire.

1. Is there a particular view of the role and function of regional networks that you can characterize as your organization's (or your personal) "prevailing wisdom"? Please explain being as specific as possible about functions of the regional networks.

management to ANS and others, with local problem resolution handled by campus or regional staff, but under the direction of the relevant NOC. Service level standards vary among the network providers, and hence among the regionals. There is some difficulty in resolving problems that involve several network providers and NOCs. Management of end-to-end reliability and higher layer applications exists only on campuses and within some of the stronger regionals. NTTF, CAUSE, and other organizations are lobbying the network providers to implement a common approach to network and system management based on OSFUs DME or similar technology.

9.1.5.3. NIC/Customer Services/Marketing:

NIC and customer services are handled on a regional basis. No one is implementing white and yellow page directory services nationally. Some of the stronger regionals and several coalitions of regionals build directory services that cover only their members. These same alliances or individual regionals fund and operate separate NICs and provide substantial documentation, education, and training. Each of these NICs also provides marketing support for their regionals, including brochures and documentation. The ever-popular RResources on the Internet GuideS remains a project of BBN; the RInternet-Accessible LibrariesS list is distributed by LISTSERV and some of the NICs. Special Interest Groups (affinity groups) have sprung up, but they usually reflect the heroic efforts of a few individuals and receive little or no support from connected institutions or the regionals. There are no special funding programs to support the smaller and less advantaged educational institutions. The disparity between the RhavesS and Rhave notsS increases.

9.1.5.4. Technology:

T3 has become inexpensive; the RBOCs and IXCs have moved to much higher bandwidths using SONET. SMDS is just being phased in by some public carriers. The concept of backbone disappears, as multiple providers market ubiquitous connectivity at T3 and higher speeds. Visualization and full-motion video applications are driving up bandwidth requirements, but funding these applications remains problematic. The East and West coasts, and the supercomputer sites are connected via multi-gigabit test networks with funds provided by NSF. This network carries some of the advanced video and visualization applications. To keep pace with demand, ANS and others provides significant investment funds for upgrading the regional networks to T3 and beyond. ANS wants to assume some of the traditional roles of the IAB and IETF; the lack of consensus prevents progress on the IP address space problem. Privacy Enhanced Mail is implemented where needed. Digital signatures, optional encryption of FTP and TELNET sessions, and the authentication of users and devices are being implemented; Not without controversy, ANS acts as the central registry. Multiprotocol routers are implemented in the national and regional networks. ANS develops network management applications based on SNMP and CMIP

9.1.4.5. Role of FARNET:

FARNET remains an incorporated, but largely informal user group that meets quarterly to share information and discuss networking issues. Its members consist of the regionals plus interested carriers. FARNET leaves the political and lobbying efforts to other organizations that have more experience and well established, homogeneous constituencies. Representatives from EDUCOM, CAUSE, ARL, ALA, and the K-12 constituency are invited to serve on the FARNET Board in order to establish formal linkages with these organizations. An informal advisory panel of computer vendors and phone companies is also established. FARNETUs operating budget is very modest. A very small executive staff is maintained in Washington DC for liaison with other organizations and to provide minimal services that are largely related to the organizing the quarterly meetings. The meetings provide a significant amount of information to member organizations and an opportunity for identifying issues and discussing concerns, but with representatives from most of the fifty states it is difficult to reach consensus and all activity depends on the volunteer efforts of an increasingly disparate membership.

9.1.5. **E: FARNET is Caput**

9.1.5.1. Inter-regional Connectivity:

Congress fails to pass the NREN bill. Nevertheless, IP-based networks grow much faster than had been expected in the early 1990s. FARNET members are unable to agree on a common strategy. ANS reaches agreement on pricing models with some of the regionals and state networks. AT&T, Sprint, and the RBOCs attract the remaining regionals. These organizations also provide connectivity to of commercial and non-commercial information service providers. Sprint has the lionUs share of IP connections between American and European research and education IP networks, while AT&T connects the Asian rim. All but a few of the regionals outsource operations. In 1994, ANS and others began to provide connectivity among the regionals at speeds above T3 using SONET. Throughput and response times for interactive work remain adequate. The regionals have all upgraded to T3 and higher speeds. Most member institutions have migrated to FDDI II as their campus backbone protocol. A few leading institutions have moved to much higher bandwidths using SONET. A few of the smaller institutions are still running 10 megabit Ethernet internally.

9.1.5.2. Network Management:

Each of the IP network operators establishes a NOC that provides 7x24 coverage and minimum service levels for network availability and throughput. Some network operators extend service level maintenance efforts from the multiple inter-regional connectivity networks down to the campus level. A few campuses have also contracted out network

tivity network down to the campus level. A few campuses have also contracted out network management, with local problem resolution handled by campus or regional staff, but under the direction of AT&T and the NOC. Service level standards are relatively uniform among the state networks; consequently, most network problems are local rather than regional or national. The NOC is managing transport only; no one is managing end-to-end connectivity and distributed applications.

9.1.4.3. NIC/Customer Services/Marketing:

Following competitive bids BBN wins the contract for NIC services, customer services, and marketing in support of the state and regional networks. Using NREN funds and income from the state networks, the NIC provides substantial documentation, education, and training; it also provides a national user services hotline for information regarding network services. The NIC also provides marketing support , including brochures and documentation. The RResources on the Internet GuideS is put in the public domain and the RInternetAccessible LibrariesS list is taken over by the BBN-run NIC. As part of the NREN funding agreement, BBN is leading the effort, now well underway, to implement national white and yellow page directory services using X.500 managed from the NIC. Funded with small grants from the NIC, Special Interest Groups (affinity groups) have sprung up and assist people and organizations with shared interests to make better use of the network and its resources. The Department of Education provides direct grants for funding the smaller and less advantaged educational institutions.

9.1.4.4. Technology:

Bandwidth is inexpensive; the RBOCs and IXCs have implemented higher bandwidths using SONET and SMDS protocols. Visualization and full-motion video applications are driving up bandwidth requirements on campus, regional, and national networks. The concept of backbone disappears, as AT&T and the RBOCs provide ubiquitous connectivity at T3 to half-gigabit and higher speeds. The East and West coasts, and the supercomputer sites are connected via multi-gigabit speed test networks with funds provided by the NREN bill. The NREN bill provides significant investment funds for upgrading the state networks to T3 and beyond. The role of the IAB and IETF in the evolution of Internet technology is under attack by the RBOCs and IXCs, who argue that this process should be lead by more formal standards organizations, such as NIST. In part because the IP address space is rapidly being exhausted, OSI is becoming increasingly prevalent. Privacy Enhanced Mail is implemented where needed. Standards are published as RFCs for digital signatures, optional encryption of FTP and TELNET sessions, and the authentication of users and devices, but implementation is slow since vendors are waiting to see the outcome of the dispute on who should set the standards. AT&T offers to act as the central registry.

9.1.3.5. Role of FARNET:

FARNET voting members are the state networks and the few remaining regionals; the IXCs, RBOCs, ANS, PSI, and AlterNet are non-voting associates. FARNET leaves the political and lobbying efforts to other organizations that have more experience and well established constituencies. Representatives from EDUCOM, CAUSE, ARL, ALA, and the K-12 constituency are invited to serve as outside directors on FARNETÙs Board in order to establish formal linkages with these organizations. FARNETÙs operating budget has increased exponentially but is now leveling off as the growth required to establish and operate the NIC and the NOC has been accomplished. More than half of FARNET's funding comes from the Department of Education and NSF under the NREN bill and other programs; the rest comes from its member (mostly state) networks. The NIC and NOC are co-located to realize economies of scale.

9.1.4. **D: FARNET as User Group**

9.1.4.1. Inter-regional Connectivity:

Significant lobbying efforts by EDUCOM's NTTF, the K-12 constituency, the library community, and others results in passage of a robust NREN bill. To prevent the Department of Energy from being the lead agency, the revised compromise bill funded a network in each state to serve research, education, and government. Except in California, the regionals largely disappeared and were replaced by the state-based networks. FARNET became an organization of state-based networks. The NREN bill mandates competitive bids for inter-regional and inter-state connectivity and for national NIC and NOC services. The Department of Education, designated lead department by the legislation, awards the contract to a AT&T-led consortium that includes several RBOCs. Sprint has the lionÙs share of IP connections between American and European research and education IP networks, while AT&T connects the Asian rim. Unable to increase market share, ANS, PSI and AlterNet fail. The Department of Education and NSF agrees to connecting commercial services (including commercial-to-commerical). Most of the state networks have upgraded to SONET speeds beyond T3. Most member institutions have implemented FDDI II as their campus backbone protocol; some of the smaller institutions are still running 10 megabit Ethernet internally, although FDDI is being implemented with Dept. of Education funds (earmarked by the NREN bill).

9.1.4.2. Network Management:

AT&T assumed responsibility for running the inter-regional and inter-state connectivity network and the NOC. With NREN funding, AT&T and the state networks establish 7x24 coverage and minimum service levels for network availability and performance including response time. Consequently, service levels are managed from the inter-state connec-

inter-regional connectivity network down to the campus level. A few campuses have also contracted out network management to the NOC, with local problem resolution handled by campus or regional staff, but under the direction of the NOC. Service level standards are relatively uniform among the state networks; consequently, most network problems are local rather than regional or national. Based on OSFUs DME, FARNET and the state and campus network operators are implementing management of end-to-end reliability and higher layer applications.

9.1.3.3. NIC/Customer Services/Marketing:

FARNET also undertakes NIC services, customer services, and marketing in support of the state and regional networks. Using NREN funds and income from members, the NIC provides substantial documentation, education, and training; it also provides a national user services hotline for information regarding network services. The NIC also provides marketing support , including brochures and documentation. As part of the NREN funding agreement, FARNET is leading the effort, now well underway, to implement national white and yellow page directory services managed from the NIC. The RResources on the Internet GuideS and RInternetAccessible LibrariesS lists are taken over as NIC publications and integrated with the yellow pages directory service. Funded with small grants from the NIC, Special Interest Groups (affinity groups) have sprung up and assist people and organizations with shared interests to make better use of the network and its resources. The Department of Education provides direct grants for funding the smaller and less advantaged educational institutions which increases both the political clout and the economic viability of the state based network organizations.

9.1.3.4. Technology:

Open systems continue to spread in most Universities. The Open Software Foundation's Distributed Computing Environment and Distributed Management Environment (DME) are popular with vendors, including DEC, HP, and IBM, and users in the research and higher education communities. SunUs ONC is also popular. Independent Software Vendors (ISVs) provide a variety of network and system management applications that work in the DME. T3 has become inexpensive; the RBOCs and IXCs are moving to higher bandwidths using SONET. Multiprotocol routers are implemented in the national and regional networks. Visualization and full-motion video applications are driving up bandwidth requirements. The multi-gigabit testbed remains a research and development rather than a production environment. Privacy Enhanced Mail is being implemented. Digital signatures, optional encryption of FTP and TELNET sessions, and the authentication of users and devices are being implemented; FARNET acts as the central registry.

for services based on IP networks. NSF and other government agencies are funding teachers and researchers directly so that appropriate use requirements can be eliminated; the phone companies do not complain since their fiber and switches are being used. FARNET then negotiates a comprehensive agreement with ANS for inter-regional connectivity out-sourcing regional and mid-level network operations. R&D efforts for multi-gigabit networks are funded by NSF with NREN funds granted directly to Principal Investigators and by surpluses generated by ANS from commercial traffic. The large demand for service by a wide constituency has led to financially healthy mid-level networks without need for direct government subsidies. FARNETUs operating budget has increased modestly as it has taken on new responsibilities at the request of the regionals and mid-level networks. A small executive staff is maintained in Washington DC. The NIC does some development work on a cooperative, shared resource basis with those regionals who have taken a lead in documentation, education, or

9.1.3. **C: Operations and Customer Services**

9.1.3.1. Inter-regional Connectivity:

The NREN bill is passed by Congress as EDUCOMUs NTTF, the K-12 lobby, the library community, and others work hard for its passage. To keep the Department of Energy from being the lead agency, the revised compromise bill funded a network in each state to serve research, education, and government. Except in California, the regionals largely disappeared and were replaced by the state-based networks. FARNET became the organization of state-based networks. CREN fades away as its functions are taken over by the state networks. ANS failed after it was unable to reach agreement on pricing models with the state and regional networks which became more financially viable due to NREN funding and state support. With state money, FARNET then constructed an inter-regional and inter-state connectivity network using commercially available circuits and technology. Initially a T3 network, speeds now approach the half-gigabit range using SONET. Encouraged by many of the large industrial states, the Department of Education and NSF agree to connecting commercial services (including commercial-to-commerical) provided they pay significantly, but justifiably higher rates than non-profit, research, and education users. Many of the state networks have upgraded to T3 and higher speeds. The larger member institutions have implemented FDDI II as their campus backbone protocol; most of the smaller institutions are still running 10 megabit Ethernet internally.

9.1.3.2. Network Management:

FARNET assumed responsibility for running the inter-regional and inter-state connectivity network and the NOC. With NREN funding, the NOC and the state networks establish 7x24 coverage and minimum service levels for network availability and performance including response time. Consequently, quality assurance efforts are focused from the

on OSFÙs DME, ANS, the regionals, and campus network operators are implementing management of end-to-end reliability and higher layer applications.

9.1.2.3. NIC/Customer Services/Marketing:

In addition to lobbying and coalition building, FARNET concentrates on NIC services, customer services, and marketing. A FARNET funded and operated NIC provides substantial documentation, education, and training; it also provides a national user services hotline for information regarding network services. The NIC also provides marketing support for the regionals, including brochures and documentation. The ever-popular RResources on the Internet GuideS and RInternet-Accessible LibrariesS lists are incorporated in the national yellow pages. Funded with small grants from the NIC, Special Interest Groups (affinity groups) have sprung up and assist people and organizations with shared interests to make better use of the network and its resources. The Department of Education provides funding for supporting the smaller and less advantaged educational institutions.

9.1.2.4. Technology:

T3 has become inexpensive; the RBOCs and IXCs have moved to much higher bandwidths using SONET. SMDS is just being phased in by some public carriers. Visualization and full-motion video applications are driving up bandwidth requirements on campus, regional, and national networks. The concept of backbone disappears, as ANS (through MCI) provides ubiquitous connectivity at T3 and higher speeds. The East and West coasts, and the supercomputer sites are connected via multi-gigabit test networks with funds provided by the NREN bill. The FARNET agreement with ANS provides significant investment funds for upgrading the regional networks to T3 and beyond. ANS assumes some of the traditional roles of the IAB and IETF; Class D IP network licenses are given out. Privacy Enhanced Mail is implemented where needed. Digital signatures, optional encryption of FTP and TELNET sessions, and the authentication of users and devices are being implemented; ANS acts as the central registry. Multiprotocol routers are implemented in the national and regional networks. ANS develops network management applications based on SNMP and CMIP that are put in the public domain.

9.1.2.5. Role of FARNET:

FARNET voting membership consists of the regional and state networks and connectivity providers, such as the IXCs, RBOCs, ANS, PSI, and AlterNet. FARNET takes on a lobbying and advocacy role with respect to national networking issues and focuses on customer services. Together with CNI, EDUCOM, ARL, ALA, CAUSE, and organizations representing bookstores, university presses, and scholarly publishers (scholarly societies with a publishing program), FARNET is successful in coalescing an ever growing market

takes on an active coalition building and lobbying effort on behalf of national networking for the education and research community. Coalition partners include the Coalition for Network Information, ARL, ALA, EDUCOM, CAUSE, NTTF, and organizations representing bookstores, university presses, and scholarly publishers. FARNETÙs operating budget has increased modestly as it has taken on new responsibilities at the request of the regionals and mid-level networks. However, given limited funds, operations are contracted out to minimize head count directly on the payroll and to maximize flexibility. A small executive staff is maintained in Washington DC.

9.1.2. **B: Customer Services and Advocacy**

9.1.2.1. Inter-regional Connectivity:

Congress passes the NREN bill. IP-based networks grow much faster than had been expected in the early 1990s as NREN legislation appropriates funds for the connection of K-12 and smaller educational institutions (this after extensive lobbying by the K-12 constituency and the public library constituency). ANS reaches agreement on pricing models with FARNET and the mid-levels and becomes the predominant provider of connectivity among the domestic regional IP networks. ANS also provides connectivity to a majority of commercial and non-commercial information service providers. Sprint has the lionÙs share of IP connections between American and European research and education IP networks, while AT&T connects the Asian rim. PSI and AlterNet grow slowly. All but a few of the regionals outsource operations. In 1994, ANS began to provide connectivity among the regionals at speeds above T3 using SONET. Throughput and response times for interactive work remain adequate. The regionals have all upgraded to T3 speeds. Most member institutions have migrated to FDDI II as their campus backbone protocol. A few leading institutions have moved to much higher bandwidths using SONET. A few of the smaller institutions are still running 10 megabit Ethernet internally.

9.1.2.2. Network Management:

Acting as a cooperative purchasing organization, FARNET negotiated an agreement under which ANS runs a national NOC to manage most regional, mid-level, and some state networks in addition to connectivity among these networks. The agreement established 7x24 coverage and minimum service levels for network availability and throughput. Service level maintenance efforts extend from the inter-regional connectivity network down to the campus level. A few campuses have also contracted out network management to ANS, with local problem resolution handled by campus or regional staff, but under the direction of ANS and the NOC. Service level standards are relatively uniform among the regionals; consequently, most network problems are local rather than regional or national. As part of the FARNET agreement, ANS is leading the effort, now well underway, to implement national white and yellow page directory services. Based

9.1.1.3. NIC/Customer Services/Marketing:

Emphasizing advocacy and operations, FARNET provides little in the way of support for NIC, customer services, and marketing. The regionals are left on their own to provide documentation for using and navigating the net and resources available on the net. Computerized white and yellow pages directory services do not exist nationally, although specific lists of services are available in some regionals. The RResources on the Internet GuideS is now widely distributed, and has been incorporated in several library catalog applications, as has the Internet Accessible Libraries list. Special Interest Groups (affinity groups) has sprung up, but they usually reflect the heroic efforts of a few individuals and receive little or no support from connected institutions or the regionals. Neither FARNET nor the regionals are able to provide significant education, training, and support to smaller, less advantaged connected educational institutions.

9.1.1.4. Technology:

Open systems continue to spread in most Universities. The Open Software Foundation's Distributed Computing Environment and Distributed Management Environment (DME) are popular with vendors, including DEC, HP, and IBM, and users in the research and higher education communities. SunUs ONC is also popular. Independent Software Vendors (ISVs) provide a variety of network and system management applications that work in the DME. T3 has become inexpensive; the RBOCs and IXCs have moved to higher bandwidths using SONET; SMDS is being implemented slowly. Inter-regional and regional network routers support TCP and OSI protocols. Some of the regionals route DECnet IV. Visualization and full-motion video applications are driving up bandwidth requirements. The multi-gigabit testbed remains a research and development rather than a production environment. Neither FARNET nor the regionals are able to undertake significant development efforts for higher layer services. Privacy Enhanced Mail is being implemented. Digital signatures, authentication of users and devices, and encryption remain largely unimplemented because there is no central registry. The IAB and IETF continue their customary roles in guiding the evolution of Internet and its underlying technology; their main problem is extending the current IP addressing scheme. Migration to OSI and Class D licenses are considered possible solutions.

9.1.1.5. Role of FARNET:

FARNET voting membership consists of the regional and state networks; IXCs, RBOCs, PSI, and AlterNet hold non-voting associate memberships. Unable to reach agreement with ANS (or other existing IP connectivity providers), FARNET is concentrating on operations and network management and coalition building. Little attention is directed toward member and user services. The regional networksU membership has grown slowly and the market for internet-delivered information services has not yet coalesced. FARNET

9. APPENDICES

9.1. FARNET Endstates, 1995

9.1.1. **A: Operations and Advocacy**

9.1.1.1. Inter-regional Connectivity:

The NREN bill failed to pass Congress amidst deep divisions over who should be the lead agency, the role of the public carriers, and methods to protect intellectual property rights. IP-based networks did not grow as expected in the early 1990s. ANS failed after it was unable to reach agreement on pricing models with the mid-levels and after FARNET, CNI (Coalition for Network Information), and others prevailed on NSF to provide direct funding after November, 1992, in the form of block grants (unrestricted use) to the regionals and mid-level networks. FARNET members then constructed their own inter-regional connectivity network using commercially available T3 circuits and technology. NSF agreed that commercial services (including commercial-to-commerical) could be connected via the inter-regional network provided they paid significantly, but justifiably higher rates than non-profit, research, and education users. Through put and response times are degrading during periods of peak demand for bandwidth. The larger member organizations have implemented FDDI II as their campus backbone protocol; some of the smaller institutions are just now upgrading to FDDI from 10 megabit Ethernet campus backbones. All the regionals have upgraded to T3 speeds, but the multi-gigabit testbed network has not progressed to production mode. Two regionals are experimenting with 250 Mbs speeds using SONET. Talks are near completion with the RBOCs and IXCs (Inter Exchange Carriers) for upgrades to higher speeds on the inter-regional connectivity network using SONET.

9.1.1.2. Network Management:

FARNET assumed responsibility for running the inter-regional connectivity network, and following competitive bids, contracted out NOC functions. Setting and maintaining service levels, problem identification, and problem resolution are focused on the inter-regional connectivity network. The NOC is staffed for 7x24 operation of the inter-regional connectivity network. The NOC does not manage any of the regionals. Service standards vary widely among the regionals. Telephone hot-line support exists only for traffic on inter-regional net. Problem resolution is slow on campuses. No one is managing end-to-end reliability, and distributed applications on a national scale. Electronic white and yellow pages do not exist on a national scale.

8. TIMING CONSIDERATIONS

The recommendations contained in this report cover a wide range of issues. Organizations are often tempted to do many things at once. We believe that the most important critical success factor will be for the FARNET Board to limit itself to a few key issues at a time. Therefore, we provide some broad guidelines for implementing the plan discussed above.

8.1. 1991

During the remainder of 1991, FARNET should focus on improving its ability to function as an organization in pursuit of its mission, strategies, and near-term goals. Chief among the tasks for this year are the development by the Board of an operating plan, increasing revenue, and hiring a full time Executive Director. Another important goal for 1991 should be communicating the strategic and operating plans to members and to others in the research and academic networking community. Early discussions between FARNET and other organizations for coordinated activities are also appropriate early on. A critical issue will be making FARNETUs voice heard during deliberations on the end of NSF subsidies for the backbone.

8.2. 1992

The focus of 1992 should be on implementing the various strategies and short term goals identified in operating plans through the activities of the Board, the Executive Director, and the various committees. Income, staffing, and services are likely to be continuing focal points. Greater efforts regarding coordinated advocacy on behalf of member networks, FARNET itself, and the research and education networking community are also called for. Continued attention to the state of the inter-regional connectivity in lieu of NSF funding for backbone services will also be required.

8.3. 1993 and Beyond

t is our hope that by 1993, FARNET will have put in place staff and committees that deliver value-added services to member networks and end users. However, research and education networking is changing rapidly. Therefore, we recommended that FARNET revisit the strategic plan every year. In the 1993 time frame, the central questions may will entail FARNETUs identity in a changing and changed world. The organization and its members should make 1993 a year of evaluating accomplishments to date and reevaluating mission and strategies. Through constant reassessment, FARNET will be in the best position to provide services that make important contributions to the research and education community.

Establish a formal liaison with the IAB and IETF.

Hire a full time professional executive director as soon as possible.

Develop a formal governance structure for FARNET and publicize it widely.

Establish a membership/board liaison committee whose primary responsibility will be to provide frequent, full, open communication between the Board, the staff, the working committees and the member organizations.

The Board review the bylaws in light of the strategic plan.

Restrict voting membership to organizations.

Retain the provision of the bylaws that extends membership to any organization that subscribes to FARNET's purpose or mission.

The Board should reconsider the inclusiveness of the voting member category one year from now.

The Board should consider creating a non-voting associate membership category to allow individuals not associated with a member organization to affiliate with FARNET by paying modest dues that would bring with it entitlement to publications, conferences, forums, etc. not otherwise distributed outside of member organizations.

Non-voting members and non-members should be encouraged to participate in FARNET's committees.

Increase the number of members and the amount of member dues as the major source of new revenue in the short term.

The Board should review member fee amounts and scales annually.

Pursue aggressively and immediately a grant for providing end user services .

The first charge to new staff should be to actively solicit grant money or award money for any of the major activities FARNET wishes to pursue.

Serious attention should be given to finding the appropriate combinations and mechanisms for developing new inter-organizational relationships.

We recommend involving heads of the other organizations concerned with networking in discussion directly.

FARNET should develop a proposal for a joint planning meeting involving the leadership of CNI, CREN, NTTF, and FARNET.

Questions of actual merging rather than coordinating with other organizations should be deferred until 1993 to permit FARNET to develop its own identity and organizational capabilities.

7. SUMMARY OF RECOMMENDATIONS

The FARNET Board should develop an operational plan that specifies more concrete short-term objectives and projects and activities designed to achieve these objectives.

De-emphasize user group activities for the remainder of this year and 1992; as a new organization, FARNET should put most of its limited resources into building new capabilities to support its new status as an incorporated organization and the additional strategies adopted in Las Vegas.

Establish a User Group Committee, to prioritize and coordinate user group activities at this reduced level of effort. This committee should focus on activities other than customer and NIC services.

Establish an Advocacy Committee to address issues such as inter-regional connectivity after November, 1992, passage and the details of the NREN bill, and coordination and relations with other organizations concerned with research, education, and networking.

Establish a Customer and NIC Services Committee to prioritize, coordinate, and manage NIC and customer services activities.

The FARNET Board should consider collective purchasing/discounts in light of recent meetings with ANS and the expressed desire of some members at the FARNET meeting that the kind of negotiations held with ANS be held with other current and potential providers of inter-regional connectivity.

Establish a Collective Purchasing Committee to assess member views on these and related matters and then to discuss and negotiate with the various connectivity providers as appropriate. This committee should also investigate opportunities for savings through site licenses, volume purchasing discounts, and similar vendor programs.

Revisit the plan annually. We recommend a major reconsideration every other year, with some formal attention to the plan in alternative years.

The Board should consider creating a short monthly electronic newsletter to inform members and others in the community of FARNET activities.

FARNET should establish a technology committee whose goal would be to assess changes in computing and communications technologies relevant to FARNET members and consider whether the regional and mid-level networks have a stake in the direction of technological change. On those occasions when the answer is in the affirmative, FARNET should consider taking appropriate action to affect the course of change.

Figure 6.1 Strategic Alternatives for Network Management

Even if FARNET is not entering the network management arena -- a proper decision at this time -- its members manage directly or outsource network management. Therefore, changes in network and network management technology is vital to the FARNET community.

We recommend that FARNET establish a technology committee whose goal would be to assess changes in computing and communications technologies relevant to FARNET members and consider whether the regional and mid-level networks have a stake in the direction of technological change. On those occasions when the answer is in the affirmative, FARNET should consider taking appropriate action to affect the course of change. For example, FARNET members may well care about the implementation of the OSF Distributed Management Environment, the transition from TCP/IP to OSI, implementations of X.500 directory services vs. using the Domain Name System (MX records, for example) for white and yellow pages to mention just a few areas.

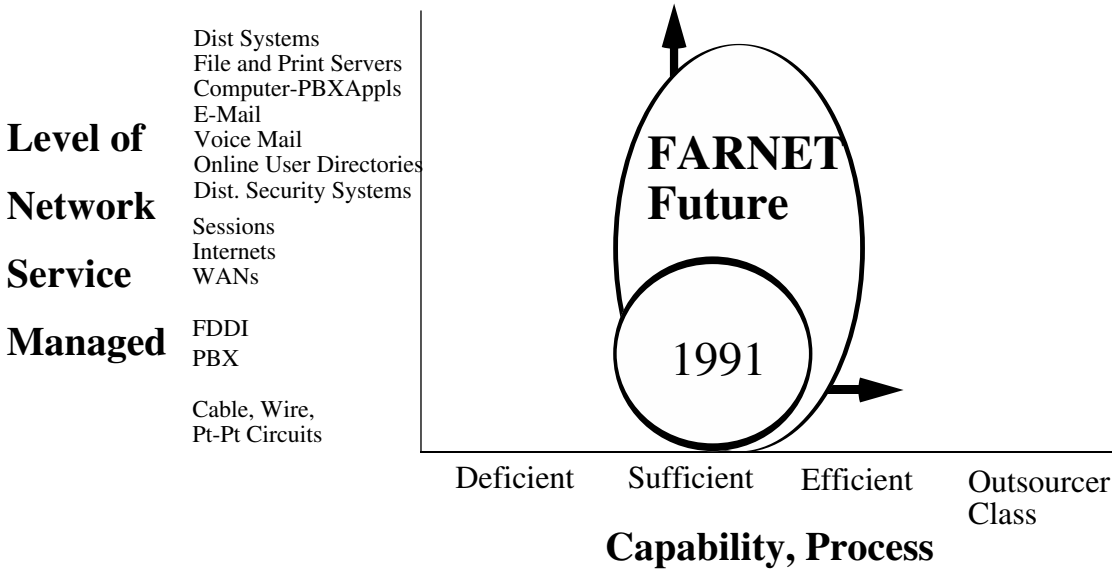
The activities of a technology committee would differ from related FARNET projects, such as

- Higher level services are more complex and require more technical expertise to manage. Distributed systems management, for example, includes management of print servers, distributed file systems using SunOS NSF or the Andrew File System adopted by OSF, software distribution and license servers, text and image servers. As customers require and as new enabling technologies come to market, networking organizations will be able to manage the systems attached to their networks.

In the future network operators will have to manage higher level processes such as on-line email directories, on-line network service directories, software distributing and licensing servers, file and print servers, fax servers, authentication of users and devices, and applications distributed across the network (using, for example, Remote Procedure Calls or similar protocols). These higher level services will be increasingly important to accomplishing the basic tasks of research and education.

The transition from mainframe to desk-top, to client/server, and then to distributed computing methods will create a more comprehensive and complex technical and service environment to be managed. In this environment, to manage the network will be to manage the more extensive system that includes the network, the hosts connected to it, and distributed processes running in those hosts and across the network. The tools are not yet available to do so, but architectures and tools under development will provide a basic framework for managing networks and systems.

A set of strategy alternatives is defined by considering simultaneously the efficiency and quality of service delivery and levels managed, as shown in Figure 6.1.



- lose control of outsourcing decisions and have its basic services outsourced to a higher quality, more efficient service provider.

By eliminating basic deficiencies in service delivery and thereby improving customer satisfaction, network managers can retain control of outsourcing decisions by becoming more efficient providers of high-quality services.

The next higher level in service delivery is what we call *sufficient*:. Customers are basically satisfied, but inefficiencies still exist in service delivery. Consequently, operating costs are higher than necessary. Sufficient service providers are less likely to be outsourced than deficient providers, but decisions made at higher levels in the company may result in some or all services being outsourced to more efficient quality service providers. Here the question is whether the difference between current costs and the costs if outsourced is sufficiently large to warrant the outsourcing effort and its possible transition difficulties. Also, organizations that are just sufficient are often under constant pressure from customers to reduce the costs of basic services.

As service organizations continue to rationalize and automate basic processes and workflows, they become *efficient* providers. Here the costs to the end users are often competitive with the costs for similar services elsewhere and customers are generally satisfied.

The pinnacle of success in providing efficient, quality services is when an organization becomes so good at management and service delivery that it is a company to whom others turn when they want to outsource services. For example, IBM, DEC, AT&T, and EDS have recently won contracts to manage large, complex corporate-wide networks for other companies. To be outsourcer quality requires being Rbest in class.S Attaining this level of proficiency requires significant investments in technology and expertise.

6.6.2. Level of Network Service

Independent of the quality and efficiency of providing services, organizations differ on what kind of network management services they provide. Services differ in complexity and advanced capabilities. In general,

- lower layer services provide basic transport, for example, wire and cable plant, basic voice services, point to point circuits, and local area networks.

- Based on lower level services, mid level services provide network-based information services, such as name service and online user and service directories, user and device authentication services, E-mail gateways and post offices, fax services, and voice mail.

issues at hand engender controversy. Nevertheless, FARNET leadership must be patient and must be prepared to invest more effort than in the past in maintaining communications and obtaining consent. The fabric of trust is easily torn, and on-going vigilance, self-consciousness, and effort is called for.

We recommend that the Board consider creation of a short monthly electronic newsletter to inform members and others in the community of FARNET activities.

6.6. Concern with Technology

For an organization comprised largely of people who manage technology, we were struck by how little technology figured in the endstate presentations and discussions in the Las Vegas meeting. This is especially so with respect to network management. FARNET and its member networks will be greatly affected by technologies for instrumentation, alarms, and responses to problems in complex internetworks. This will be especially true as the management of end-to-end connectivity and higher layer applications becomes required in the next few years.

For example, FARNET and its member networks will have to make difficult strategic choices regarding network management. A range of options for network management strategies can be defined in terms of two fundamental dimensions:

1. the quality and efficiency of providing services; and

2. the level of network service and process managed.

We address each in turn.

6.6.1. Efficiency and Quality

Organizations differ in their capability to provide cost-effective, high quality network management services. Indeed, in today's competitive environment, market forces create situations in which it may make sense for companies to save money and/or improve service quality by outsourcing selected functions.

When capability is unacceptable or *deficient* from a customer standpoint, a service organization faces several problems because it might:

- lose customers for existing services,

- be unable to sell new services,

- be bypassed when operating divisions seek services directly from more cost-effective external providers, or

6. CONCLUDING OBSERVATIONS

6.1. A Broad Consensus

The results of the Las Vegas meeting are consistent with the interviews that we conducted by E-mail, telephone, and in person. Some of those interviewed were unable to attend the Las Vegas meeting. We believe that FARNETUs strategic choices reflect a broad consensus among its members.

6.2. Feelings About FARNET

As an organization, FARNET needs to feel good about itself.

6.3. Execution is Key

The strategies adopted at the Las Vegas meeting are, in our opinion, realistic and well within the organizationUs grasp. Network management -- a road not taken -- requires a great deal of technical sophistication and some capital investment in equipment. Even outsourcing network management, as suggested in Endstate A requires sufficient understanding to reach agreement on a proper contract. The adopted strategies require different capabilities, ones that build on recent FARNET activities.

6.4. Revisit the Plan Annually

The notion of a Rliving documentS is well on its way to being a management cliche. Nevertheless, FARNET's strategic plan should be so considered. As an organization whose fundamental concerns are in part technology driven, and given the high rate of change in the technical, political, and business environments, **we recommend that FARNET revisit the plan annually. We recommend a major reconsideration every other year, with some formal attention to the plan in alternative years.**

6.5. Trust is the Glue

In highly decentralized organizations where members or major operating divisions have budgetary autonomy, trust is often a key factor for success. The member organizations or departments are often suspicious of central services and jealously guard their prerogatives. Consequently, action and progress depend in large measure on the consent of the governed, so to speak, and this consent is based on trust.

As an organization that is not only experiencing great change but change toward greater central coordination and implementation, creating and maintaining trust is a challenging, but not impossible task. Member organizations will want to be informed and consulted on an ongoing basis. Establishing consensus is often a long process, especially where the

making centralized in the Board.

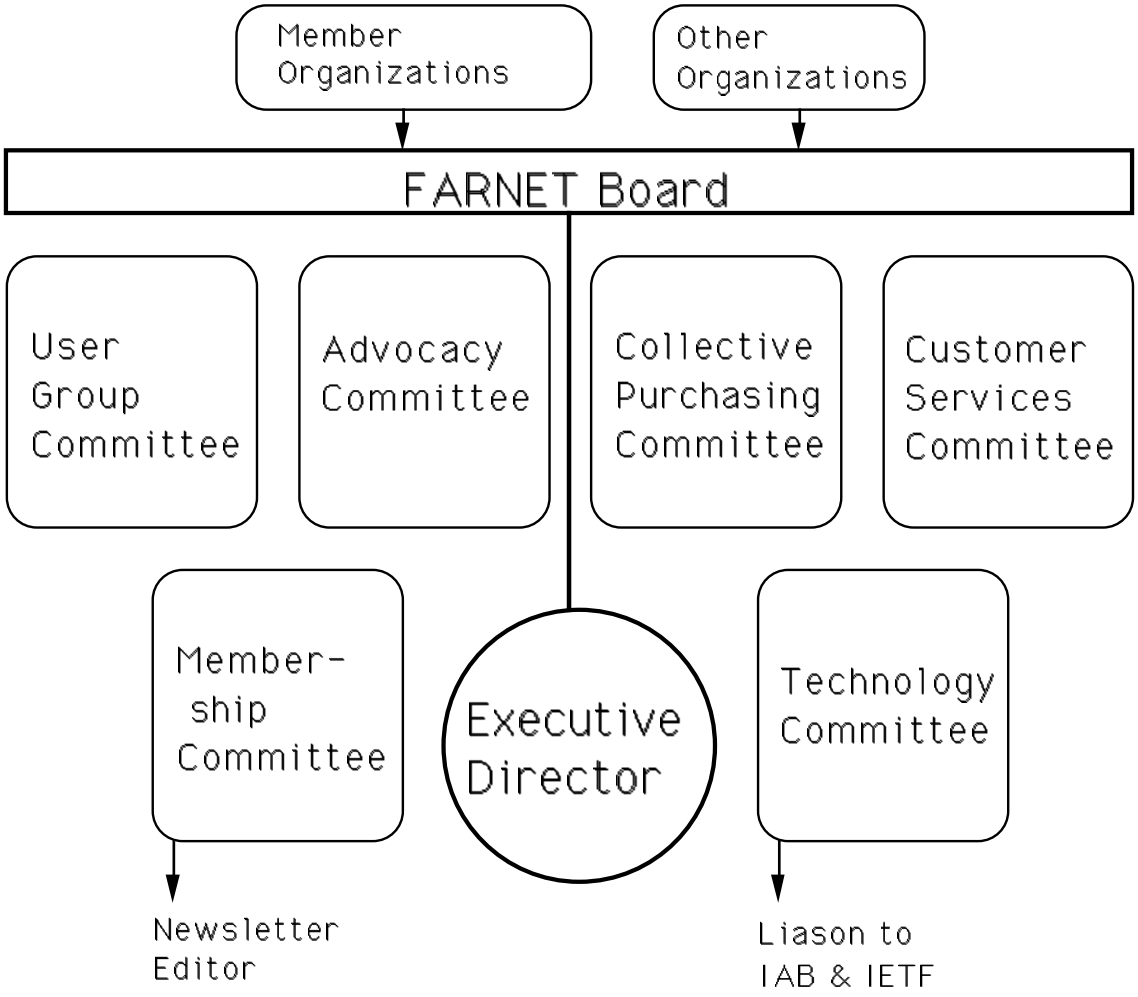


Figure 5.1: The Internal Structure of FARNET

informal communication mechanisms are essential to developing and maintaining consensus and organizational culture. Communications also give members a sense of participation and involvement.

Communicating timely information often forestalls and/or diffuses rampant dissatisfaction even when disagreements exist. Wide participation in a committee structure even if the committees only recommend policy or action diffuses the perception of a "small handful of men in power" making all the decisions. At the same time we strongly emphasize that Board members must begin immediately to recognize their responsibility to move ahead decisively. The Board cannot wait for member input, nor can it expect that every decision will satisfy all members. It is important to "take the bull by the horns." We recognize that this demands a cultural change and will require organizational learning, but it must happen for the organization to be effective in the fast moving environment in which it operates. The Board needs to learn to view itself as a collective CEO for the period of time it is in office. The Board must learn to work together as representatives of FARNET rather than as separate individuals representing member networks; and the Board must exercise leadership.

To fulfill the first goal, FARNET must move away from a purely volunteer staff. FARNET cannot accomplish its goals in a timely manner as long as it depends on a purely volunteer Board and committee structure to fuel all of its activities The organization and the executive committee in the past and the Board today is made up of extremely busy people with primary responsibilities in their institutions and often in their regional networks as well. It is not realistic to expect that they will be able to field the demands inherent in moving ahead quickly or in implementing the program that the members expect. **We recommend hiring a full time professional executive director as soon as possible.**

We recommend developing a formal governance structure for FARNET and publicizing it widely. The bylaws' delineate the Board, officers, directors, and member structure and responsibilities, thus providing a good starting point. To that should be added a formal, but revisable, committee structure. The committees recommended elsewhere in this report will provide the basis for the governance framework. **To them should be added a membership/board liaison committee whose primary responsibility will be to provide frequent, full, open communication between the Board, the staff, the working committees and the member organizations.** Its charter should be to work at consensus building throughout the organization and to provide the officers with systematic feedback about members reactions to FARNET activities and to transplant new ideas from member to member and member to Board.

Each elected board member should be assigned primary responsibility for a set of committees. Participation should be widely shared, but administration and decision

of the research and education community represented by several of the currently existing groups. **We recommend serious attention be given to finding the appropriate combinations and mechanisms for developing new inter-organizational relationships.** This effort will require the focussed attention of permanent executive staff and the Board itself. New relationships will also be facilitated by the appointment of staff or officers of the other groups to the open Board positions of FARNET. **We recommend involving heads of the other organizations in discussion directly**. Many member representatives of FARNET as well as many member organizations are members of one or more of the other groups so that these same issues are being discussed throughout the community.

It may be possible to realize economies of scale in staffing as well as stronger and more effective advocacy and lobbying efforts as groups first collaborate and eventually merge. However, merging cannot be accomplished without a significant amount of give and take over a several month period so it makes sense to begin by coordinating activities. Meetings among the leaders of these groups should begin as soon as possible. **We recommend that FARNET develop a proposal for a joint planning meeting involving the leadership of CNI, CREN, NTTF, and FARNET.**

We cannot recommend too strongly that questions of actual merger rather than coordination be deferred until 1993 to permit FARNET to develop its own identity and organizational capabilities.

The IAB and IETF are special cases. These organizations, focused as they are on development of the technology for the national infrastructure and on the development of standards play a crucial role. Close communication between them and FARNET benefits the whole community. **We recommend establishing a formal liaison with the IAB and IETF.**

5.5. Internal Structure of FARNET

The internal structure of FARNET must serve two basic purposes:

- To facilitate FARNET's ability to take action, to accomplish its work, to move ahead on its program; and
- To provide avenues of communication between the Board and the member organizations.

The latter goal is particularly important at this stage of FARNET's development as it makes the transition from a federated organization operating rather informally, often making decisions with full membership participation, to an incorporated entity with a decision-making Board representing the membership. The Board must begin to act decisively, while keeping in very close touch with the membership. Using formal and

As FARNET considers and then implements new service offerings, the potential of each of them to generate self-supporting revenue should be considered. For example, some forms of documentation and training materials might be sold; user training seminars, institutes, or conferences might well be offered for a fee. Each of these possibilities will need to be considered on a case by case basis. Obviously, some services provide more value if treated as marketing or advocacy opportunities and ought not to be expected to support themselves while others provide excellent sources of revenue generation.

Perhaps the best underutilized source of income is grants for specific projects or for performing specific functions. NSF is the most obvious source, and **we recommend pursuing aggressively and immediately a grant for providing end user services.** However, the Board ought not to stop there. **We recommend that the first charge to new staff be to actively solicit grant money or award money for any of the major activities FARNET wishes to pursue**. Private foundations as well as government programs should be targeted for development discussions. Fund raising should become a major long term goal. The Board should also consider joint fund raising with other groups in the networking community.

5.4. Relations with Other Groups

The current organizational climate in the research and education networking community is rapidly changing. New organizations have formed recently, e.g., CNI; old organizations have merged, e.g., CSnet and Bitnet into CREN; some organizations are expanding or are reconsidering their mission, e.g., FARNET and NTTF; other organizations are wondering how to get involved, e.g., ALA, K-12 advocacy groups; some wonder how to deal with all the new players, e.g., Internet Activities Board (IAB) and the Internet Engineering Task Force (IETF). Now is an excellent time for FARNET to consider how to leverage its activities by working with, merging with, or aligning with other players in the field.

FARNET, of all the national groups working in research and education networking, is closest to and represents most directly the interests of the end user community. Continuing to position the organization as the advocacy and service group for end users establishes a set of interests and a programmatic focus that will continue to be important no matter how the national networking infrastructure develops. FARNET will be in the best position to evolve with the community if it focuses on helping its members, whether they are regionals, states, or other associations, to ensure the best possible network services for consumers. The Board should adopt that stance as its underlying principle against which decisions about organizational development are measured now and in the future.

Major benefits can be realized through coordination and collaboration between the sectors

That said, **we further recommend that the Board reconsider the inclusiveness of the voting member category one year from now**. If FARNET develops the capacity to become a buying/negotiating collective, it may become unwieldy and unproductive to include among the voting membership the very organizations with whom it intends to develop agreements or contracts. In that case, a non-voting associate member category might be introduced for carriers, vendors, for-profit operators, and the like. We do not recommend that avenue currently because we believe it would be divisive at the present time. Also, it is not yet clear enough how FARNET will focus its operating plans. Trade-offs need to be considered as the Board develops organizational objectives during the next several months.

The Board should consider creating a non-voting associate membership category to allow individuals not associated with a member organization to affiliate with FARNET by paying modest dues that would bring with it entitlement to publications, conferences, forums, etc. not otherwise distributed outside of member organizations. This category of membership might well grow as FARNET becomes more thoroughly immersed in providing end user documentation, training, marketing materials, lobbying information, etc.

Non-voting members and non-members should be encouraged to participate in FARNET's committees. See below.

5.3. Funding Options

If FARNET is to become a stronger, more active, and more viable organization, it must identify and exploit additional funding sources. Hiring permanent staff and establishing an office will require a major budgetary increase. (See recommendation below under Internal Structure.) Potential funding sources include the following: member dues, fees for services, grants, and awards.

We recommend increasing the number of members and the amount of member dues as the major source of new revenue in the short term. Many current member organizations indicated willingness to support FARNET with increased funds to enable the organization to build its value-laden activities. We believe FARNET could double its current annual membership fee without any significant drop in membership. At the same time the Membership Committee should intensify its efforts to increase membership. Marketing should be aimed at existing and emerging state-based networks as well as at professional associations whose own members could benefit from FARNET's wider charter. As the number and type of organizations proliferates, the Board may want to consider a sliding scale for member fees based on the size and/or budget of the member organization . **We recommend that the Board review member fee amounts and scales annually.**

5. ORGANIZATIONAL DEVELOPMENT

5.1. By-Laws

Many of the elements in this section of the report affect and/or are affected by the bylaws of the newly incorporated FARNET organization. Therefore, **we recommend that the Board review the bylaws in light of the strategic plan.** Naturally, the bylaws, the mission, and the principles of the organization should work in concert flowing one from the other. The Board will probably not need to make many changes, but a review followed by a report to the membership will provide a more cohesive view of the organization's overall structure and its relationship to strategy. This is also another opportunity to build consensus through communications.

5.2. Participants

The recently adopted bylaws of the organization state the following qualification for membership, "Membership shall be limited to organizations and individuals subscribing to the purpose of the FARNET." The bylaws further state that there "shall be one class of voting members." Minutes of the first meeting of the corporation indicate that the Board expects the bylaws may well be amended after the strategic planning process.

We recommend restricting voting membership to organizations. Individual membership ought to be provided for in some other way. It is conceivable that an individual might join, pay the fee and, thus, under the current bylaws have the same voting privileges as an organization. This is not only cumbersome, it is inequitable, and may lead to dissatisfaction and divisiveness.

Since FARNET has expressed a preference for a strategy which involves broad advocacy for research and education networking, **we recommend retaining the provision of the bylaws that extends membership to any organization that subscribes to FARNET's purpose or mission.** There was broad agreement at the Las Vegas meeting that membership in FARNET should be promoted as widely as possible throughout the networking community and new membership, particularly of state networks, should be encouraged. We concur. Lobbying efforts on both the federal and state levels and advocacy within the private sector and among potential users and in all sectors on behalf of users will be enhanced by including an ever broader spectrum of participants. Broadening the membership, e.g., including commercial networks, for-profit networks, more state networks, common carriers, government agencies, etc., may dilute FARNET's consensus on some parochial issues. However, the benefits to be gained from speaking with one voice on broader issues seems to most participants and to us to outweigh the advantages inherent in a smaller, more narrow (and possibly eroding) membership base.

4.2.4. Collective Purchasing/Discounts

We believe that FARNET members underestimate the potential for savings and the importance of collective action regarding group purchasing agreements, volume discounts and the like. **We recommend that the FARNET Board consider collective purchasing/ discounts in light of recent meetings with ANS and the expressed desire of some members at the FARNET meeting that the kind of negotiations held with ANS be held with other current and potential providers of inter-regional connectivity.**

Our interviews left us with the strong impression that FARNET members care a great deal about such matters as whether fees to connectivity providers will be based on usage or capacity, whether commercial traffic should be handled at a premium price, whether traffic between research and educational institutions and providers of commercial information services should be considered RcommercialS traffic or usage in support of research and education, and similar questions. These issues affect all member networks.

Consequently, **we recommend that the Board constitute a Collective Purchasing committee to assess member views on these and related matters** -- judging from the last meeting with ANS, we believe that there is great consensus on several issues, including capacity rather than usage-based charging -- **and then to discuss and negotiate with the various connectivity providers as appropriate.**

At the Las Vegas meeting, several individuals pointed to the benefits of BITNET and EDUCOM discounts for hardware (and perhaps other items). Members may reap substantial benefits from site licenses, volume purchasing discounts, and similar programs. There is strength in numbers. FARNET represents most research and education networks. Thus **we recommend that the Collective Purchasing committee investigate such opportunities.** Such negotiations are likely to be time-consuming; nevertheless, we believe that many such programs will bring economic benefits that far outweigh the effort spent to reach agreement.

several months, NSF will be considering what to do after termination of the current program. FARNET and its members have a great stake in the outcome of NSFUs deliberations. We believe that FARNETUs voice should and must be heard.

The passage of the NREN bill is not certain. Here, too, FARNET and its members have a stake in the passage of such a bill and should continue working with other organizations for passage.

FARNET has a vital interest in which NREN bill is passed and funded. FARNET should consider whether it prefers state-based funding for networking, or some other strategy. Other issues include which federal agency should be the RleadS agencythe funding of K-12, programs for connecting small or economically disadvantaged institutions, groups, and individuals, funding for academic and public libraries, and funding for directory services, to mention just a few.

Besides these major issues, FARNET needs to coordinate and cooperate with other organizations concerned with research, education, and networking, including, but not limited to, EDUCOM, NTTF, CNI, CREN, ARL, and CAUSE.

We recommend that the Board establish an Advocacy Committee to address these issues and take action as deemed appropriate.

4.2.3. Customer and NIC Services

Those assembled in Las Vegas felt strongly that FARNET should offer customer and NIC services. One reasonable goal, in our opinion, is the development over the next two years of a FARNET funded NIC that provides substantial documentation, education, and training. The FARNET NIC might also provide a national user services hotline for information regarding network services. Economies of scale might be realized by providing marketing support for the regionals, including brochures and documentation.

Some of the people we interviewed were concerned that the Internet Resources Guide was not in the public domain, but rather was copyrighted by BBN. These people recommended that a FARNET NIC could incorporate this and other documentation, such as the RInternet Accessible LibrariesS list, in a national yellow pages database and make them widely available for local printing and distribution. A FARNET NIC might also promote Special Interest Groups (affinity groups) to assist people and organizations who share common interests to make better use of the network and its resources.

The development of such NIC capabilities and services will take time, effort, and financial resources. **We recommend that the Board establish a Customer and NIC Services Committee to prioritize, coordinate, and manage NIC and customer services activities.**

members are closer to the end-user. Therefore, FARNET is better suited to represent the interests of the regionals, their member institutions, and the individual users of the research and education internetwork.

In our opinion, all these criteria are well met by the strategies adopted by FARNET during the Las Vegas meeting, to which we now turn.

4.2. Strategy Adopted

4.2.1. User Group Activities

FARNET has from its inception been functioning as a user group to provide a forum for representatives from its member networks to exchange ideas and information and to discuss issues, problems, and actions of mutual concern. In addition to information exchange, FARNET has undertaken specific projects using volunteers.

Although user group activities can provide important benefits to FARNET members and to the networking community generally, **we recommend that the Board de-emphasize user group activities for the remainder of this year and 1992**. **As a new organization, FARNET should put most of its limited resources into building new capabilities to support its new status as an incorporated organization and the additional strategies adopted in Las Vegas.**

This recommendation is consistent with the results of the voting in Las Vegas in which FARNET as user group (Endstate D) was rated second in desirability after FARNET as an advocacy and customer support and services organization (Endstate B), the overwhelming favorite.

Nevertheless, **we recommend that the Board establish a User Group Committee, to prioritize and coordinate user group activities at this reduced level of effort. This committee should focus on activities other than customer and NIC services.**

4.2.2. Advocacy

In addition to on-going technical advances, the networking landscape will be affected in the next few years by two key factors:

(1) changes in support of the backbone by NSF in November, 1992, and

(2) the fate of NREN legislation.

The current NSF program for supporting the backbone ends in November, 1992. Although a brief extension might be possible, it is our understanding that NSF fully intends to terminate this program as soon after November, 1992 as possible. In the next

4.1.3. Strategy Motivates Operations

Strategies are basic approaches to achieving organizational goals. Consequently, strategies inform, but do not state specific operational projects or activities. Consequently, we recommend that **the FARNET Board should develop an operational plan that specifies more concrete short-term objectives and projects and activities designed to achieve these objectives.**

For example, if advocacy is a strategy for supporting and promoting research and education through networking, then organizing a write-in campaign to assist FARNET member networks and individuals in explaining the benefits of the NREN bill to their congressional delegations is a specific operational activity that implements the strategy.

4.1.4. Feasibility

Adopted strategies should also be feasible. Although this seems self-evident, organizations sometimes adopt strategies for which they are not well-suited. For example, strategies that depend upon FARNET owning rather than leasing nation-wide transmission facilities are unlikely to be successful, even though such a strategy is nominally consistent with FARNET's mission.

4.1.5. Consistent with Resources

Although constraints on financial resources are an obvious limitation on strategic choices, there are others. Strategies must also be consistent with staffing levels, the levels of effort that can reasonably be expected from volunteer board and committee members, and contributions of staff effort and technical resources from member networks.

4.1.6. High Perceived Value

As a membership organization, FARNETUs strategies and operational projects should be seen by member networks as providing significant value to them and/or to research and education networking generally.

4.1.7. Unique Opportunities or Advantages

There are many organizations concerned with research and education generally, with networking for higher education and research, or just with networking. The strategies adopted by FARNET should reflect its unique position as the only organization representing regional, mid-level, and state networks.

In the current 3-tiered architecture, FARNET and its member organizations have a unique advantage compared with providers of inter-regional connectivity: FARNET and its

4. STRATEGIC PLAN

The mission statement of an organization describes its top-most goals, its basic purposes, and other fundamental organizational assumptions. FARNET's mission is to support and promote research and education through networking. A strategy identifies how the organization will accomplish its goals. Strategy motivates operational plans, which, in turn, lead to specific activities and results. Figure 4.1 summarizes these points.

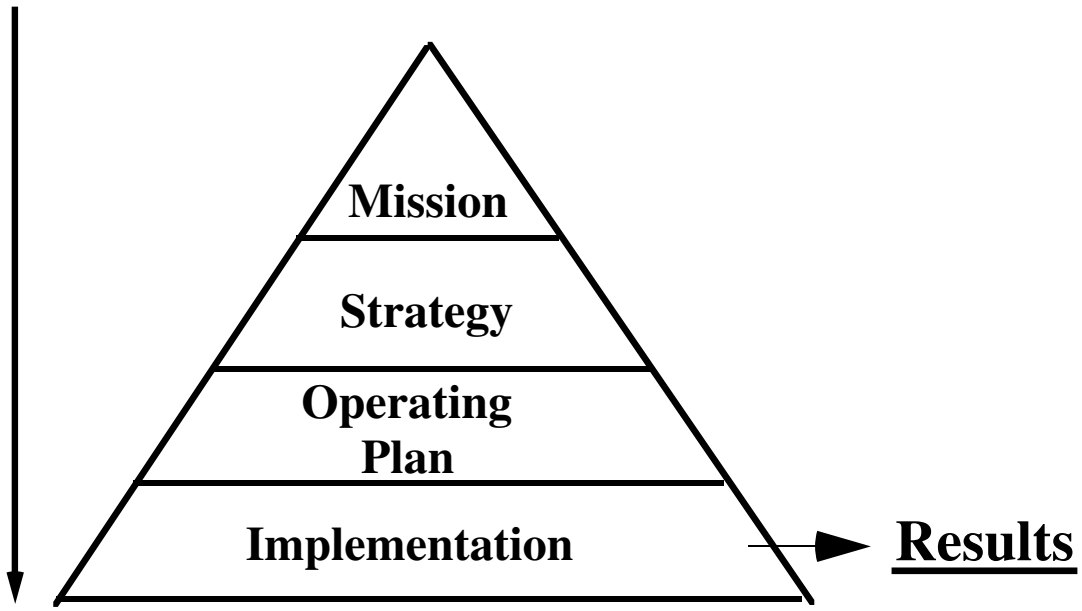


Figure 4.1: Strategy and Implementation

4.1. Criteria for Choosing Among Strategies

4.1.1. Strategy Follows Mission

There are usually many possible strategies to choose from and it is perhaps obvious that strategies should be focused on achieving the organizational mission.

4.1.2. A Strategy Imposes Constraints

A strategic plan reflects and imposes constraints on organizational activities by identifying the principal means used to achieve organizational goals; the plan sets priorities for the organization. Leaders and members can ask, "are the actions we are about to take consistent with the adopted strategy?" Of course, good reasons sometimes exist for engaging in activities that are not strategic or were not considered so when the plan was written; nevertheless, the plan creates a framework for organizational choice.

organization: there are differences in emphasis, differences about strategy, and members with different economic and substantive interests. However, nearly everyone believes that FARNET should not only exist, it should become stronger and more influential in the community. Given this healthy divergence of interests and differences of opinion, there is a notable consensus about the organization's mission and the strategies it should adopt for the future.

The challenge for FARNET is to evolve to an organization made up of all the constituent parts of the NREN. Many of the differences among the member networks are brought about by their position on an evolutionary track from network builders and providers to network usage facilitators. FARNET must assist its current, primarily regional, network members to make the transition from technically oriented, operations-fueled, federally subsidized, regionals to market-driven, service-oriented, financially self-sufficient networks. The network service business is increasingly competitive and will begin to mature later in this decade. FARNET's goal as an organization is to help its member networks to ensure that consumers of network services have access to services that are fairly priced, well managed, and responsive to their needs.

%Merging/affiliating with other organizations

We concur FARNET must pay attention to these issues. Where pertinent and feasible, we have taken them into account in framing our recommendations below.

3.6. Summary of Results

The research and education networking arena is changing and FARNET must change or be left behind. The forces affecting FARNET and its member networks, represented in Figure 3.1 below, have indeed created a new environment for the nineties. The planning process and decision meeting at Las Vegas created a set of priorities and goals that is responsive to possible legislative and agency change, member priorities, market forces, and the needs of end users.

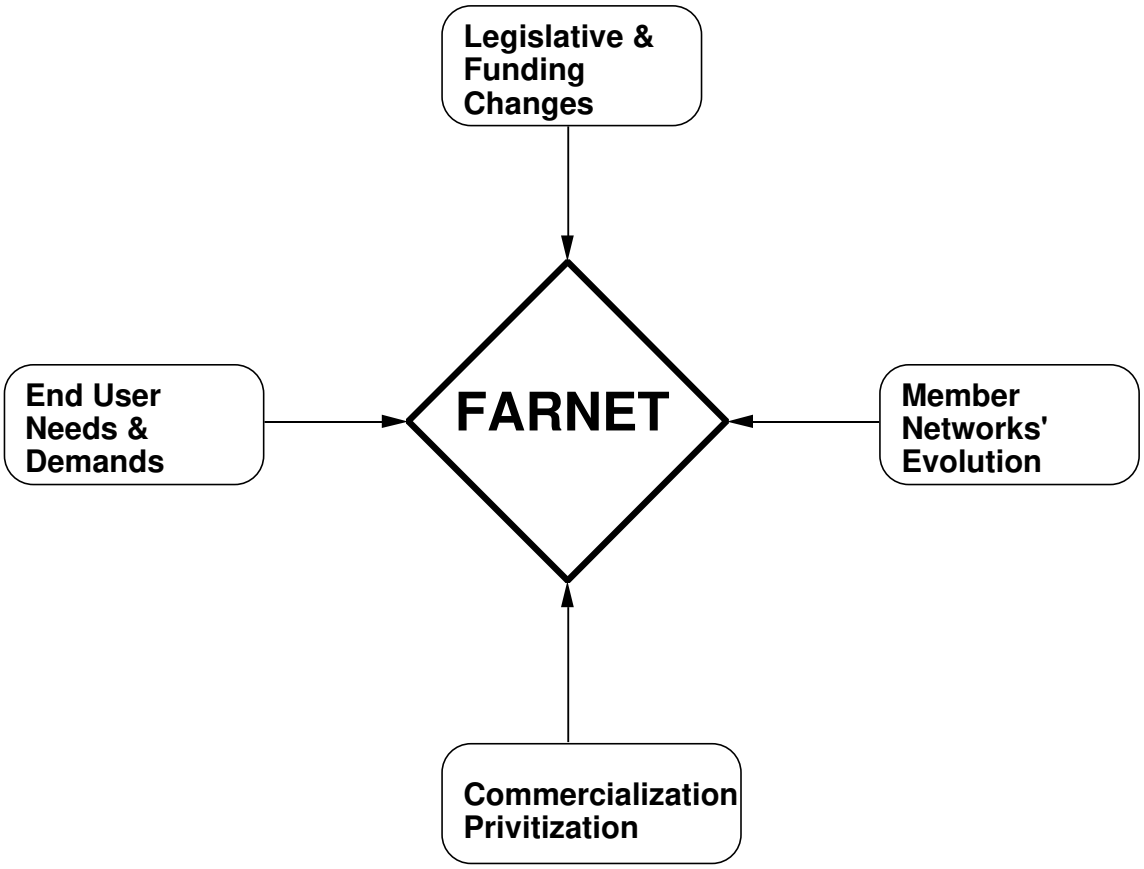


Figure 3.1 Forces For Change

The results at the meeting were consistent with what we heard at each point in the process. There were no major surprises. There are some very real differences of opinion within the

Through the rating, balloting system and through discussion member/participants chose the following roles in the order listed as the most important for FARNET to pursue:

1) Advocacy

2) Customer services and NIC

3) User group (FARNET member support)

4) Collective purchasing/buying agreements

We return to these tasks later in the report.

3.4. Mission Development

Through brainstorming and discussion the group developed the following mission statement:

The mission of FARNET is to support research and education by promoting the implementation, operation, and effective use of inter-institutional data networking for the research and education community.

3.5. Critical Success Factors

Through a brainstorming discussion and a delphic voting process the group identified the following critical success factors as most important (the complete brainstormed list and rankings appears in the Appendix.):

%Execution: taking action, "doing things"

%Promoting sharing of information resources

%Making FARNET's opinion re operational issues known to decision makers

%Hiring permanent staff (or at least providing for the focussed attention of someone)

%Creating a perception of value

%Providing leadership and building visibility

Others factors considered important were:

%Establishing a stable funding base

%Responsiveness to member needs

services
14. Costs to the Universities of networks and network-based services
15. Will RinformationS be viewed as a national resource by the Federal government?
16. The evolution of computing and networking paradigms, e.g., distributed computing
17. The role of the RBOCs and the long distance carriers
18. Economic growth;
19. The level of funding for research and education
20. Managing the network(s)
21. Managing the system (networks and attached systems)

After the five team presentations, members voted again. The endstates were ranked for probability and desirability. Table 3.3 presents the results.

Table 3.3: Final Endstate Voting Results

Directions Given: Now that you have considered each of the five endstates, please rank order the endstates again. In column A, please rank the endstates according to probability (1=highest, 5=lowest) of actually coming true. In Column B, rank the endstates according to desirability (1=highest, 5=lowest) for FARNET.

	A Probability	**B Desirability**
Endstate A	3.1	3.7
Endstate B	2.3	1.5
Endstate C	4.0	2.9
Endstate D	2.1	2.6
Endstate E	2.5	4.6

Since a rating of 1 means that **everyone** believes a particular category the most desirable outcome, a rating of 1.5 indicates a high degree of consensus (Table 3.3). A large degree of agreement also exists around the least desirable outcome, i.e., a rating of 4.6 for FARNET's demise. The desirability of endstates D (FARNET as a user group) and endstate E (FARNET as a network operator) are much closer in degree of desirability: 2.6 and 2.9, respectively. However, coupling that with the probability rating (2.1 and 4.0, respectively) suggests that the member representatives expect to continue to perform user group functions . The open discussion following the balloting bore that out. Comparison of the two ranking exercises also shows remarkable consistency in member opinions and corroborates the interviews and discussions we had both before and after the meeting.

ability (1=highest, 5=lowest) to defend this endstate as best for FARNET in a role playing exercise that we will facilitate during the Las Vegas meeting.

	A	B	C
	Probability	**Desirability**	**Defendability**
Endstate A	3.8	3.3	3.6
Endstate B	2	1.8	2
Endstate C	3.4	2.9	3.2
Endstate D	2.3	2.6	2.4
Endstate E	3.4	4.5	3.9

Table 3.1 shows that at the outset of the meeting members had a strong preference for Endstate B, that FARNET does advocacy and user and NIC services. User group activity was a clear, close second.

Using the preferences indicated on the initial ballots, we assigned each person to one of five teams. As in a debate, each team role-played a defence of one of the endstates. To help the teams analyze the endstate, each team was assigned a facilitator (we drafted 3 FARNET members to assist us) and given a list of issues that might be helpful to consider in relation to the endstate and the endstate's impact on FARNET:

Table 3.2 Issues for Analysis of Endstates

1. Funding sources for FARNET, e.g., the regionals funding FARNET, fee-for-service, grants, subsidies, etc.
2. Programmatic options; e.g., advocacy, clearinghouse functions, conferences, user group, NIC, NOC, etc.
3. Perceived needs of the regionals and their member organizations
4. Potential for revenue generation and self-support
5. What kind of subsidies to the regionals and/or FARNET are required, if any?
6. Relations with other organizations
7. The role of other non-profit associations concerned with networking issues
8. The pace of technology implementation in the various constituencies of higher education, e.g., community colleges, 4-year colleges, and universities
9. Standards for operating systems, applications, network transport, and network management
10. The expansion of the Internet to a more global RworldnetS
11. The diversity of information resources on the network
12. Cooperation or Competition among the players
13. High margin, low volume niche information services vs. lower margin, high volume mass information

3.2. Endstates

We drafted five alternative visions of research and education networking and FARNET's role in 1995. These endstates were based on a combination of, first, FARNET's membersU opinions and suggestions about the current situation, secondly, other community members' assessments, and finally, NCRI's knowledge of the evolving technological and political climate. Each endstate specified options for inter-regional connectivity, network management, NIC/customer services/marketing, computing and communications technology, and the role of FARNET and other organizations in the networking community. The endstates were purposefully extreme and divergent and intended to capture bias and different points of view.

The endstates, reproduced in the Appendix, describe situations in which FARNET's role might become:

A: Operations and Advocacy

B: Customer Service and Advocacy

C: Operations and Customer Service

D: Users Group For Regionals, and,

E: FARNET Goes Away

Drafts were distributed to members of the FARNET strategic planning committee and a few others from the general networking community and then rewritten taking into account the various comments and suggestions received. We then circulated the final versions to the membership via e-mail.

3.3. Group Exercise

The Las Vegas membership meeting began with an overview of strategic planning models and issues related to network and technology management. The presentation included an explanation of the Future Mapping process. Participants then rated the endstates as to probability, desirability, and defendability (Table 3.1).

Table 3.1: Initial Endstate Ranking

Directions Given: Please rank order the endstates. In column A, please rank the endstates according to probability (1=highest, 5=lowest) of actually coming true. In Column B, rank the endstates according to desirability (1=highest, 5=lowest) for FARNET. In Column C, rank the endstates according to your

3. PROCESS AND RESULTS

Our approach, based on a procedure for contingency-based strategic planning called Future MappingP was intended to be a learning process for the organization as well as to provide input to the strategic plan. To develop a strategic plan reflecting FARNET's goals and priorities, we suggested that the organization develop an understanding of several alternative visions of its future, to consider the advantages and disadvantages of each, and to choose from among them. We also proposed and agreed to lead FARNET through a decision making exercise that would allow for the expression of the widest possible range of opinions; and, to assist the group in acknowledging, developing, and synthesizing the diversity of opinions that exist in an organization such as FARNET.

We surveyed and elicited opinions from members of the community and then conducted a group exercise at the FARNET member meeting. Initial information gathering confirmed our judgement that the Future Mapping process was particularly well suited to FARNET's current situation. The perception of divisiveness within the organization was often expressed as was a sense of loss of mission or confidence in the organization's ability to act or to move forward. There seemed to be a very real danger that differences of opinion, perceptions, and interests that exist among the member networks might obscure the very basic underlying consensus on major issues of importance to the research and education networking community.

However, the meeting at Las Vegas revealed a significant consensus among those present. We discuss the nature of this consensus later in the report.

3.1. Interviews and Survey

As a first step in identifying central issues facing the organization, we interviewed members of the planning committee by phone, by e-mail, or in person . In addition, we spoke with other influential NREN community members in person or by telephone; we also attended meetings of other organizations interested in network development. We developed a brief questionnaire to elicit FARNET membersUopinions concerning the general climate for networking, the role of the regional and mid-level networks, the role of FARNET, and the issues currently facing the research and education networking community. A list of the questions is presented in the Appendix.

The questionnaire, sent to all members via the members@farnet.org e-mail list eventually elicited written responses from about a dozen members. Prompts and reminders were sent to members both by the consultants and by members of the FARNET planning committee. Although we would have preferred a higher response rate, the responses we did receive were extremely thoughtful and, therefore, quite helpful in developing alternative visions of the future or Endstates.

	meeting.
January 14-15	FARNET decision meeting in Las Vegas.
February 2	Complete draft report and circulate to Strategic Planning Committee for comments.
February 9	Get responses from Strategic Planning Committee.
February 19	Deliver final report to FARNET.

2.4. Overview of the Report

The following chapter describes in more detail the project plan, methods, and principal results of the strategic planning meeting held January 14-15 in Las Vegas. Chapter 4 considers criteria for choosing among strategy options and the strategies chosen at the Las Vegas meeting. Chapter 5 considers organizational choices and recommendations. Chapter 6 contains some final observations and recommendations. For the convenience of the reader, we have identified with bold type specific recommendations found throughout the report and we have gathered all specific recommendations in Chapter 7. FARNET will have to decide how to implement the plan. Therefore, Chapter 8 briefly considers the sequencing of priorities and steps in the next few years. The appendices (Chapter 9) document the endstates for FARNETUs future that we developed as part of this project and the questionnaire sent to members of FARNET and a few other leaders in the research and education networking community. The appendix also contains the results of the brainstorm in Las Vegas on Rcritical success factors.S

2.2. Goals of the Project

FARNET has chosen its basic strategies as part of this project whose chief goals at the outset were to:

- identify several alternative strategic visions for the future of FARNET,
- help FARNET understand the advantages and disadvantages of each alternative,
- help FARNET decide which alternative vision is best for FARNET, and
- develop a written strategic plan that reflects FARNETUs priorities.

2.3. Project Plan

Briefly, our approach consists of four main steps:

- Identify (three to) five alternative futures for FARNET and research and education networking that we call *endstates;*
- Facilitate a meeting in January at which FARNET evaluates each of these alternative visions of its future
- Assist FARNET in deciding at the January meeting which future is best
- Develop a written strategic plan that reflects FARNETUs goals and aspirations.

Table 2.1 briefly summarizes the project plan and timetable.

Table 2.1: Schedule, Tasks, and Key Dates for the Week Ending:

December 5	Project Kickoff, test email connections with members of strategic planning committee
December 8	Circulate by email questionnaire on the future of FARNET to members of the Strategic Planning Committee and other interested people within FARNET.
December 15	Final date for response to questionnaire.
December 19	Finish draft endstates for FARNET and circulate to Strategic Planning Committee members for comment.
January 6	Revise endstates and circulate final version to FARNET members.
January 12	Complete presentation on strategic alternatives and endstates for January 14-15

traffic on the backbone continues to increase at an annual rate in excess of 250%. Presumably, traffic in the mid-level and regional networks has increased at a similar rate. During this period of increased speed, functionality, and usage, the backbone has operated exceedingly well under a joint agreement with MERIT, IBM, and MCI. In the past few years the number of mid-level (usually regional) networks has grown rapidly to provide connectivity between the backbone and member organizations many of which are campuses. Some mid-levels have assumed a support role providing training and information as well as basic connectivity; many have had at least some financial support from the National Science Foundation. Recently, some small for profit companies without federal government funding have formed to offer similar services.

% Organizationally, the landscape has changed with the announcement of Advanced Networks and Services, Inc. (ANS), a joint venture of IBM, MCI, and Merit. A not-for-profit company, ANS will manage NSFNET under contract from Merit and NSF as well as provide a broad spectrum of network services in support of research and education in universities, federal laboratories, and the private sector. Many questions have arisen in the community about the intended role and scope of a national corporation and the potential relationship between mid-levels and ANS and the NSF backbone. Benefits and risks are being sorted out and weighed while at the same time future funding models are debated. All of the potential options carry benefits and problems that demand a thoughtful, unified response from FARNET as the major spokesman for mid-level networks.

% An additional major development over the past few years, the convergence of the concerns of the data networking community and information resources providers and users has culminated this year in the formation of the Coalition for Networked Information (CNI), a coalition of EDUCOM, CAUSE, and ARL. The emergence of the multitude of issues associated with providing both common good shared resources, fee for service resources, and mixed resources to users in both the public and private sectors is another indication that the research and education community must recast and rethink funding and management issues. Debates are raging about the meaning, the sequencing, and appropriate approaches to commercialization and privatization. Policy debates and planning strategies need to keep pace, and in some instances to catch up with the growth of the physical network.

This report identifies specific strategies that FARNET has chosen to navigate the rapidly changing research and education networking.environment.

2. A STRATEGIC PLAN FOR FARNET

This is the draft final report of a project to define a mission and strategic plan for the Federation of American Research Networks. As the organization representing primarily regional, mid-level, and state research and education networks, FARNET is uniquely positioned to advance research and education networking by coordinating the activities of its member networks, sharing information, representing its members in policy discussions with vendors, government, and other organizations concerned with research and education, and in some instances, providing services to its members.

FARNET has recently incorporated as a not for profit organization. To aid in the transition from informal user group to a more formal organization, this strategic plan will:

- Identify key strategies to accomplish FARNETUs mission,
- Shape FARNETUs programs and activities for the next few years,
- Suggest appropriate funding strategies,
- Address relationships with other organizations concerned with research, education, or networking,
- Inform organizational culture and processes, and,
- Motivate the organizational structure of FARNET.

2.1. Changes in the Environment

FARNET is making difficult choices and undergoing transition at a time when the entire research and education networking community is experiencing rapid change. Telecommunication technology, information resources, connectivity and resource providers, funding sources and models, user constituencies, level of demand for services, and types of services all change frequently, thus make planning difficult. Understanding the complex relationship of these elements and of the evolving modes of participation of government, industry, and education is a necessary first step in responding to change. Developing an appropriate organizational response is a challenge for all of the players and particularly so for a federation such as FARNET whose constituent members are themselves changing their missions and operational strategies.

Specifically, the research and education networking community has reached important milestones in the past year:

- The major technical milestone is the expansion of the NSFNET backbone and its upgrade to 45 megabits (T3). This increase in bandwidth comes at a time when

The report is organized as follows: after a brief introduction (in Chapter 2), Chapter 3 presents the project plan, methods, and principal results of the strategic planning meeting held January 14-15 in Las Vegas. Chapter 4 considers criteria for choosing among strategy options and the strategies chosen at the Las Vegas meeting. Chapter 5 considers organizational choices and recommendations. Chapter 6 contains some final observations and recommendations. For the convenience of the reader, we have identified with bold type specific recommendations found throughout the report and we have gathered all specific recommendations in Chapter 7. FARNET will have to decide how to implement the plan. Therefore, Chapter 8 briefly considers the sequencing of priorities and steps in the next few years. The appendices (Chapter 9) document the endstates for FARNETUs future that we developed as part of this project and the questionnaire sent to members of FARNET and a few other leaders in the research and education networking community. The appendix also contains the results of the brainstorm in Las Vegas on Rcritical success factors.S

1. EXECUTIVE SUMMARY

This is the draft final report of a project to define a mission and strategic plan for the Federation of American Research Networks. This report identifies specific strategies that FARNET has chosen to navigate the rapidly changing research and education networking.environment. FARNET has chosen its basic strategies as part of this project whose chief goals at the outset were to: identify several alternative strategic visions for the future of FARNET, help FARNET understand the advantages and disadvantages of each alternative, help FARNET decide which alternative vision is best for FARNET, and develop a written strategic plan that reflects FARNETUs priorities.

The mission of FARNET is to support research and education by promoting the implementation, operation, and effective use of inter-institutional data networking for the research and education community.

At its membership meeting in Las Vegas, FARNET decided that its priority strategies for attaining its mission would be: providing customer and NIC services, advocacy on behalf of research and education networking generally and on behalf of its member networks and itself; user group activities, and collective purchasing/buying agreements.

To implement these strategies, we recommend that the FARNET Board organize several committees: User Group Activities, Advocacy, Collective Purchasing, Customer Services, Technology, and Membership. We also recommend a hiring full time Executive Director.

During the remainder of 1991, FARNET should focus on improving its ability to function as an organization in pursuit of its mission, strategies, and near-term goals. Chief among the tasks for this year are the development by the Board of an operating plan, increasing revenue, and hiring a full time Executive Director. Another important goal for 1991 should be communicating the strategic and operating plans to members and to others in the research and academic networking community. Early discussions between FARNET and other organizations for coordinated activities are also appropriate early on. A critical issue will be making FARNETUs voice heard during deliberations on the end of NSF subsidies for the backbone.

The focus of 1992 should be on implementing the various strategies and short term goals identified in operating plans through the activities of the Board, the Executive Director, and the various committees. Income, staffing, and services are likely to be continuing focal points. Greater efforts regarding coordinated advocacy on behalf of member networks, FARNET itself, and the research and education networking community are also called for. Continued attention to the state of the inter-regional connectivity in lieu of NSF funding for backbone services will also be required.

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A Strategic Plan For FARNET

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