EARN Document

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Author(s): Various
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Unfortunately it has not been found possible to provide a proposal to adopt a document defining EARN's future for presentation to the Board and as requested by the Board.

Attached are a number of contributions which will be discussed with a view to guiding the author of the proposed document. Members should bring with them EXEC137 89 "Mission and Strategy" by K Neggers.

Questions raised are:

Should EARN operate over its own X.25 network?
Should EARN operate over IXI?
Should EARN operate over TCP/IP?
Should EARN support SNA connections and which services?
Should EARN support DECNET connections and which services?
Should EARN support TCP/IP high level protocols and which services?
Should EARN support OSI high level protocols and which services?
Depending on the answers which organisations should EARN have close and not so close relationships?
Depending on the answers what management structures does EARN need?

M Hebgen

The question raised during our last BOD/EXEC meeting was, how do we see
EARN in a future environment. I would like to start the discussion by assuming 2 partially extreme scenarios and looking for consequences for
EARN.

1. IXI

   Let's assume IXI takes place and will be a success. Then EARN will

at the lower layers consist of

1.1 a european part covered by IXI,
1.2 a (non-european) part made out of leased lines and
1.3 a transatlantic link to US BITNET

A possible 1st step for the IXI region could be replacing all leased lines by X.25 PVCs and running NJE on top of a variety of protocols which can be used to drive X.25 (NJE/SNA, NJE/DECNET, NJE/TCPIP, NJE/OSI).

By bilateral agreements IXI can be used immediately - EARN does not "own" the IXI PVCs and can therefore not prohibit this multiprotocol environment.

Because EARN has power and experience in cooperation, coordination and management (NOT control) EARN should prepare itself for a scenario which might look like

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NJE and other applications    Management
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OSI | SNA | DECNET | TCPIP    Management
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    X.25 or leased line       Management
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where all 3 "layers" need their own and unique management. Because this is also a scenario typical for some of the EARN hosts and some networks (NORDUNET, EASINET e.g.) it is in the interest of our community we serve.

2. OSI applications

Let's assume that all the OSI applications, people have in mind, are available, working and interworking including a satisfactory level of network management (X.400, X.500, FTAM, JTM, VTP etc.).

Then some questions EARN has to answer are:

2.1 What application is missing?

2.1.1 Interacctive messages (TELL) - what systems are based on this (RELAY e.g.) and how can we provide this service in a new environment?

2.1.2 Unsolicited File Transfer - can we use X.400 for this

purpose? Do we need old fashioned file servers or do we plan new types of file servers in a FTAM environment?

2.1.3 LISTSERV, NETSERV, ASTRA, TRICKLE etc. - to be developed on top of the basic OSI services above.

2.2 What new services are possible then, based on X.500 or other basic OSI services? Is conferencing a requirement?

2.3 What are the user interfaces of the new services? Is there a "continuity of user interfaces" possible and do we wish it?

With this draft I hope to have provoked your comments.

H Nussbacher and A Cohen

Some questions that come to mind:

- if the underlying physical network is to be IXI within Europe what will be the status of the leased lines to EARN from none European countries that are part of IXI? It appears that EARN and EUNET and Europe HEPNET and Europe SPAN would cease to exist and would rather be part of the middle layer (as Michael drew it) with IXI underneath. The differentiation will then be based on protocol and not by the name of the network.

- how will accounting work? How will EARN generate any sort of revenues or membership fees if it is merely one of a number of NJE/SNA networks running in the middle layer of Michael's model?

- for a long time, many gateways will need to be run between the various protocol suites, i.e. a gateway between SNA and DECNET and a gateway between TCPIP and OSI and all the permutations of 4 separate protocols (4!). It is nice that all of it can run over IXI but we will end up with the same situation we have today with gateways like between EARN (SNA/NJE) and EUNET (Tcp/Ip) in order to talk (and only for e-mail and not for file transfer or remote login or file sharing). Of course OSI will eliminate this problem but that is far in the future for all the systems we have today running on all the research networks in Europe. But until then, we will need many gateways. Perhaps that is what EARN should do in the future - act as a gateway switching organisation that can tie together various networks of different protocols in the interim until OSI exists.

P Bryant

Herewith my unexpurgated thoughts on the EARN mission. Paul

Quo Vadis EARN/IXI

(note - being modern and up to date I have used the term "TO" instead of PTO or PTT)

1 The EARN mission

The long term mission and strategy for EARN is bound up with:

* The technical success of various technologies.

* The political situation.

Regretfully both of these topics have a number of uncertainties.

2 The primary mission

In all these discussions EARN must remember that its single reason for existence is service to its community of users. The political and technical aspirations of various fractions must be recognised. Unfortunately a certain amount of compromise is needed to achieve the best for the community.

3 Technology

The strength of EARN has been to provide a service based on IBM methods. Without the the pressures of CEPT, RARE, COSINE, national groups, and others it is a reasonable assumptions that the network would have gradually adopted SNA or possibly have followed BITNET II. It is also likely that in various areas these protocols would have been carried over X.25 or TCP/IP to take advantage of national facilities.

What has happened is that EARN has been forced first by CEPT to migrate to OSI protocols, secondly by sponsors who have forced EARN down a particular route, and now thirdly by COSINE with particular political aims.

4 User requirements

What does the user want? Undoubtedly the world separates into IBM, DEC, and UNIX which relate broadly to SNA, DECNET, and TCP/IP. It is abundantly clear that between homogeneous machines the relevant

protocol set gives the best service - in the case of SNA and DECNET it is completely and well supported by IBM and DEC plus suppliers of emulators for non native systems - in the case of TCP/IP it is well supported by many manufacturers.

5 OSI aspirations

Many, including myself, believed that OSI protocols could replace all the above and solve interconnection between heterogeneous systems. Experience now suggests that this is highly unlikely except in the case of X.25, X.400, 802.3/4 which are really retro-standardisation of TO Xerox and IBM protocols. Their popularity is because of TO/CCITT and manufacturer activities. It is difficult to see FTAM becoming popular in the near future and even less JTP and VTP except where they are imposed in spite of the community requirements.

My view now is that OSI protocols had a window of opportunity which was only partly successful. It is interesting to note that the successful OSI protocols have been those which have been standardised pragmatic ones which have paid scant attention to the seven layer model and have been of little academic merit. The well designed ones such as FTAM have ended up being highly baroque and being "all things to all men" and have succeeded in being nothing to anyone.

It is also apparent that OSI protocols have taken a long time to produce and in the mean time SNA, DECNET, and TCP/IP protocols have advanced. It is also significant that OSI protocols are useless without functional standards. These are complex and not yet universally accepted.

It should be noted that DEC is migrating part of DECNET to use ISO protocols in DECNET phase 5 although it appears that this is mainly at the lower levels. There is no guarantee that the functional standards used by DEC will match those of others. In fact in the UK the DEC functional standard does not match the JANET one (DEC uses TP4, JANET uses TP0 and X.25 over ethernet). Thus some OSI protocols have a long way to go.

It is significant that IXI will allow any higher level protocols. Not to do this would probably result in it being only used for X.400 and X.29.

6 The future of OSI protocols

The wide imposition of OSI protocols is, in my opinion, now regarded as in-feasible. Manufacturers have been reluctant to implement protocols, the results of their efforts are poor but the development of DECNET, SNA, and TCP/IP had been good.

It is obvious that COSINE has drawn back from a rapid move to OSI high level protocols and has instead concentrated on the provision of X.25 which does have a reasonable degree of acceptance by all manufacturers. This is a good decision since SNA, DECNET, TCP/IP, and X.400 can all operate more or less effectively across such a network.

7 COSINE aspirations

COSINE has dual loyalties. On the one hand there is a desire to bring together the academic and research community in a single network, on the other a desire to support European TOs and industry. They have a belief that they know what is best for the community. COSINE appears to be led from a practical point of view by the Commission and the user input seems to be absent.

8 The TO monopoly

EARN, more than any other organisation, has suffered under the monopoly of the TOs. It has been apparent that they have been loathed to give up their monopolistic powers. We have seen the unwillingness to allow EARN to compete in any way with TO services. We have seen the unreasonable attempts to impose a volume tariff. To quote the proverb - power corrupts, absolute power corrupts absolutely. Absolute corruption has only been avoided by the welcome liberalisation.

The monopolistic service provided, and being provided, by the TOs is atrocious. Why do international leased lines take so long to obtain? Why are international services so expensive? Why is the international X.25 unbelievably bad and expensive?

I would maintain that monopoly is bad and reduces services to the lowest denominator. Competition is good and forces suppliers to provide a good service or face extinction.

Unfortunately the track record of directed development is poor, the track record of monopoly is poor, and the track record of OSI development is poor. I cannot see that any of these factors will change.

9 The COSINE monopoly

Unfortunately the strategy of COSINE is not only to provide a monopoly but also a monopoly in conjunction with the TOs. The TO monopolies have been a disgrace within Europe with restrictive practices and punitive tariffs. It is clear from the emerging COSINE network that it is seen as a corner of the TOs network. It will be easy for it connect effectively with other TO run networks such as SURFNET and DFN. It

will be difficult for non TO networks such as JANET and EARN to connect. This appears to be the TOs re-asserting their traditional monopoly with the help of the Commission. This is surprising when you remember that the Commission is expected to foster competition and de-regulation. It would appear that the COSINE network has been little influenced by the COSINE report and more by the TOs perception of what is required. Why should the community exchange the inappropriate monopoly of the TOs for a seemingly inappropriate monopoly of the TOs.

10 EARN's future

So where does this leave EARN? It is no secret that many want to see EARN disappear as it poses competition or a threat to COSINE. EARN has been popular and left to its own devised would become even more popular as it provides services now to the end user rather than some promise of services of some rather unspecified form in the future.

It has become clear that the opponents of EARN want to see EARN concentrate on high level services. It is also becoming clear that this is restricted to IBM protocols and that EARN should not take initiatives in X.400 or X.500. Thus the future of EARN in this scenario would be to migrate its mail services to X.400 under the control of the appropriate authorities and this would no doubt include migrating LISTSERV type activities in the same way. Thus EARN ends up looking after NJE.

EARN has no guarantee that COSINE/IXI will succeed any more than MDNS, there is no guarantee it will provide the quality of service EARN requires, the long term finances of IXI are unknown.

11 What are other networks doing?

EUNET appear to intend to maintain their independence and operate their own network.

HEPNET are thinking in terms of a 2Mbit infrastructure which is well outside the IXI project.

SPAN are putting in 64K lines across Europe and seen disinclined to co-operate with other international networks.

NORDUNET appear to only want connections into anything that is going but will operate their own into country Nordic links.

12 Conclusion

EARN's primary mission is to provide international communications services to the community.

EARN will provide services at the highest quality and at the lowest cost.

EARN will co-operate with other international and national organisations in order to provide an enhanced service.

EARN will use any appropriate communication technologies.

EARN will not use any particular bearer services but will use those which provide the service required by the users.

EARN will continue to encourage the attachment by direct or indirect means to its services from appropriate institutes and countries.

EARN expects to be one of several organisations providing communications services to the community.

1989 STRATEGIC PLAN
June 26, 1989
NetNorth Consortium
final version

EXECUTIVE SUMMARY

This document presents recommendations to restructure the NetNorth Consortium and its NetNorth Network to accommodate a national TCP/IP backbone network connecting provincial TCP/IP networks connecting the Member institutions.

PREFACE

In May of 1988, the Executive Committee of the NetNorth Consortium appointed a planning group to develop a Strategic Plan to address the current and foreseeable needs of the Consortium's Members over the period 1989-1992. Drafts of the Plan were distributed to all NetNorth Directors and Representatives and discussed at the NetNorth Director's meeting at Concordia University in June of 1989. This final version incorporates requests for clarification made at that meeting, indicated by left-margin revision bars ("|").

MISSION

The NetNorth Consortium exists to:

1. enable electronic communication and foster co-operation between Canadian academic institutions and associated research institutions in both the private and public sectors,
2. provide connectivity to other networks and organizations of interest to the Consortium's members, and
3. effectively represent the Consortium's membership to other networking organizations, agencies and initiatives.

In the process, the Consortium carries out specific operational activities:

4. provide effective operation and management of the network,
5. evaluate new networking technologies that could be used to improve service to the Members,
6. provide value-added services where cost effective, and
7. encourage use by peer groups in all sectors of the Member institutions (eg, Registrars, Librarians, research-interest groups, etc).

HISTORICAL PERSPECTIVE

In 1983, the computing-services departments at eight universities in Ontario decided to connect their institutions' central computing systems into a network using IBM's Network Job Entry (NJE) protocols. The initial connections were installed in April 1984 and the result began operation as OUNET, the Ontario Universities Network. In June 1984, the network was renamed to NetNorth in response to connection requests from institutions that were not in Ontario. Through the use of commercial and home-grown software that emulates the NJE protocols, additional vendors' computing systems were quickly connected to the network.

The key factors facilitating the birth of the NetNorth network were the decision to average all line costs between the participating institutions and the offer by the University of Guelph to provide administrative support for the network in the form of ordering the lines and handling the finances. In 1984 and 1985, IBM Canada signed three-year Cooperative Agreements to fund the growth of the NetNorth network:

1. with the University of Guelph for computing and

communications equipment to establish and operate the NetNorth Administration Centre (node CANADA01) and for a link to Cornell University in the United States to connect the NetNorth network to the BITNET network,

2. with the University of Alberta to extend the NetNorth network to western Canada, and
3. with the University of New Brunswick to extend the NetNorth network to eastern Canada.

In 1986, the academic institutions participating in the NetNorth network ratified the formation of the NetNorth Consortium.

The initial IBM Cooperative Agreements expanded the network from Victoria to St. John's and established links to the international academic networking community. With the expiration of those Agreements, the Members of the Consortium began funding the national backbone and international links. IBM Canada currently continues to cover the cost of maintenance for CANADA01 and the University of Guelph has generously agreed to continue providing administrative services until October 1989 at no cost to the Membership.

As of June 1989, the Consortium has 65 Member institutions and the network has 178 nodes. Anyone with access to a Member's computing system attached to the network is, from the Consortium's point of view, an authorized user of the network. Some institutions have decided to place local restrictions on network access; for example, a few do not allow undergraduate students to use external network facilities.

TECHNICAL BACKGROUND

The NetNorth network was started using mostly 2400bps DataRoute between Members, and 4800bps or 9600bps for the national and international links. To keep costs low, analogue telephone lines were often used within cities and network traffic was piggy- backed onto existing inter-institution regional communications facilities. In a few cases, adjacent Members subsequently funded the upgrade of service from 2400bps to 9600bps to meet local needs. However, for the most part, the 2400bps links have sufficed for the type and volume of traffic carried.

Without doubt, the most important service provided by the network is

the
transmission of files containing "electronic mail". This NJE
file-transfer capability has been augmented by application-layer "mail
agent" software derived from the Simple Mail Transfer Protocol (SMTP)
first developed for use in the US DARPA Internet network. Mail
gateways
have been developed between most academic networks based upon SMTP,
and
most NetNorth Members now support this mail-exchange protocol. There
has
also been some use of the international standard X.400 electronic mail
protocols but, at this time, use of X.400 is largely limited to
gateway
procedures between NetNorth and CDNnet, the Canadian X.400 network.

File transfer is an important application on the NJE network for more
than mail. For general-purpose file transfer, the IBM- defined NETDATA
format has become predominant. File transfers between similar systems
work well. File transfers between dissimilar systems can be
problematic,
since no standard presentation services (primarily ASCII/EBCDIC
translation) have been defined. Still, within limits, such transfers
are
proving productive for many users.

A number of distributed application servers have been implemented,
both
on CANADA01 and on Member systems. NETSERV, developed for use in the
European Academic Research Network (EARN) through the support of IBM,
has
proven valuable in reducing the administrative workload necessary for
the
management of the information that defines the nodes in the network.
LISTSERV, also developed within EARN, provides list redistribution
services in a very effective manner, and communicates with
redistribution
servers on other networks. List- server traffic represents a
significant
load on the network and a significant benefit for its users. Real-time
messages (NJE Nodal Message Record traffic) are used on the network to
communicate with various application servers and for interactive
exchanges between pairs of users. They also occur between groups of
users
through the use of RELAY servers operating in off-hour periods. (RELAY
simulates a CB radio environment complete with channels and
"handles".)
RELAY is popular with computer operators and undergraduate students;
there is considerable difference in opinion as to the value of such a

service, but RELAY has proven to be a valuable message-traffic "containment" measure.

SUCCESSES AND SHORTCOMINGS

By any measure, the NetNorth network has been a success. For example, the following statement was made by Dr. Richard Barham, Dean of the College of Family and Consumer Studies at the University of Guelph, in May 1988 on the occasion of the completion of the Guelph/IBM Cooperative Agreement. The statement is typical of the perception of the network by most of its users.

> NetNorth is one of the most important developments in relation to universities in many years, particularly in the way it permits almost immediate contact with colleagues both locally and around the world.

The ability to transmit a file containing mail, a program, a document, or data across the country and across the globe, often in a few minutes or less, has fostered the establishment of research alliances that were not possible or practical in the past. Joint authorship of papers and books with the authors working in different provinces, countries, and continents has become commonplace. Researchers on sabbatical leave have continued to supervise graduate students at their home institution through the use of the network. Through the use of distribution-list servers, peer groups are able to participate in ongoing discussions on a daily basis. Computing and data resources have been conveniently shared through the use of remote-job-entry procedures. Use of the network has not been limited to research and academic purposes. Institutional administrators have also used the network for various formal and informal communications. In all, the use of the NetNorth network is both diverse and intensive.

Not all initiatives related to NetNorth have been total successes, however. Examples include attempts to encourage network use for Inter-Library Loan, for communication between AUCC participants, and for

the exchange of university business data such as student transcripts.

Some of these and other peer groups are using NetNorth for some of their communications, but such use is not ubiquitous. In general, the reasons can probably be traced, in whole or in part, to one of the following.

1. Many potential peer groups in our Member institutions include individuals at institutions that do not yet have access to NetNorth or any other network, or that have institutional policies that prevent access by those individuals.
2. Some potential users are reluctant to invest the time required to learn to use a traditional multi-user computing system. In many institutions, this is still the only way in which it is possible to communicate over the network.
3. The growing use of personal computers is giving an ever-increasing number of people access to computing resources and breaking down reluctance to use computing technology in daily activities. If it were easier in most institutions for people to use personal computers to reach their colleagues at other institutions without knowledge of a multi-user computing environment, many more peer groups could benefit from NetNorth.
4. In some areas, computing technology is in regular use by almost all staff, but Telecom Canada's Envoy 100 service predominates despite the presence of NetNorth on almost all campuses. The problem appears to be one of universality. Many people using electronic mail wish to reach all correspondents from a single environment. Use of NetNorth would only be acceptable if it were possible to send mail to and receive mail from Envoy 100 via NetNorth.
5. Some people are reluctant to communicate with the informality normal in electronic communications. Others are reluctant to use computing equipment of any kind. In such cases there is little one can do about this except to wait for the next generation of people.

FACTORS INFLUENCING CHANGE

Advances in technology coupled with increases in use, user sophistication, and user expectations have created pressures that demonstrate the need for changes in the Consortium and the network that it manages.

1. There is widespread desire for the formation of a national government-funded backbone network connecting provincial networks. In the United States, recent advances in communications technologies and decreases in the pricing of

bandwidth have enabled the interconnection of that nation's academic institutions and their industrial and government research partners via a backbone network encompassing national supercomputer centres and regional networks. This has created increased expectations on the part of the Canadian academic and research communities. It has also created the realization that comparable facilities and services must be provided to enable Canadian institutions to meet increasing pressures for shared research and to attract and retain high-quality students and research and instructional staff.

2. Some provinces now have (and others are progressing toward) a provincial TCP/IP "backbone" network connecting their academic institutions and research organizations and industry partners. (The DECnet protocols are also used in some of them.) However, in Canada, significant disparities exist in the cost of bandwidth within and between each of the provinces. The economics of north-south links are often much more attractive than those of east-west links. For example, each of the recently-emerged provincial networks also has a connection to the US Internet (which also uses the TCP/IP protocols), and there are as yet no east-west links connecting these provincial networks.
3. Some universities have and many others are progressing toward a campus "backbone" network interconnecting central-services computing and communications facilities with departmental networks of personal-workstation and multi-user computing systems. The TCP/IP protocols are used in most such campus backbone networks.
4. Computer users within many of the institutions of the Members of the NetNorth Consortium have been migrating to personal workstations from the central-services multi-user computing systems that are the core of the Consortium's current network. Those users wish to be able to exchange workstation-based files (databases, spreadsheets, documents, graphic images, etc) with colleagues across the country with the same ease that they once exchanged files between NJE-speaking systems. In some cases, this includes network-wide access to remote file systems (eg, using SUN's Network File System protocols) and remote logon using screen-management windowing protocols (eg, X-Windows) over a TCP/IP network.
5. One of the greatest impediments to extending the community of users of the network is the lack at each Member institution of an online network-queriable "corporate directory" listing the electronic address of each person in the institution.
6. We do not know the extent to which the Members will be

willing to pay the cost of additional technical and administrative services.

The NetNorth Consortium must re-orient itself to address the current environment of national/provincial/institution networking. To cite the Historical Background section of the Consortium's Policies and Procedures
document ...

> There is no long-term commitment to remain bound to and bounded by the transport-layer NJE protocols currently used for communication between Members of the NetNorth Consortium. There is, however, a long-term commitment to a stable evolution by continued adherence to the principles guiding that original choice: to maximize the opportunity for interconnection of Member institutions through the use of production-quality computer-to-computer networking software supported by the vendors of the Members' computing systems.

We believe that the principles are sound, and we believe that it is time
to evolve. If we had the opportunity to start afresh tomorrow, the clear
choice would be TCP/IP.

FUTURE CONSIDERATIONS

Developments in telecommunications technology, especially those related
to the ready availability of vastly increased bandwidth at increasingly
"reasonable" costs, combine to foster both growing expectations on the part of existing users and the creation of new user communities. Examples
of some of these new users and applications include those requiring remote access to supercomputers and those using workstations with high-function graphic interfaces, X-Windows, Display PostScript, multiple
file formats, and idiosyncratic formats such as Macintosh graphics. A number of basic, staple services will be expected by the current user base and any new groups who begin systematic use of the network. These include abilities that are already provided by the NetNorth network via
the NJE protocols:

1. sender-initiated file transfer, including electronic mail, and
2. real-time message transfer (sender's keyboard to recipient's screen),

abilities that are provided by the TCP/IP protocols:

3. receiver-initiated file transfer,
4. remote logon,

abilities that are augmented by additional protocols:
5. read/write access to remote file systems (eg, SUN's Network File System protocols),

and some new services that are going to be seen as basic requirements by
many users:
6. capability of handling tele-FAX streams -- at least at Group III level, but as Group IV (digital) FAX equipment becomes more common there will be pressure in that area,
7. interconnection with other forms of electronic-mail systems such as Envoy/iNet, CNCP EOS, and a number of major public and private systems in North America and abroad,
8. telex access -- this "old" technology is still the only "electronic messaging" available in many parts of the world -- and access to the international telex networks will continue to be a major requirement for at least the next decade, and
9. voice-augmented mail -- the ability to provide store-and-forward capability linked to the increasing number of digital PBX and "voice and data" systems being installed in Canadian universities.

From the user's point of view, "one-stop shopping" electronic communication would be particularly attractive and would result in use of
the network by individuals and groups who have to date rejected it as being "too complicated". The user should not have to worry about how an
object gets to its destination, and some sort of "feature" that would present the user with a single addressing convention across all underlying networks would be a great asset.

Expanding the service offerings will broaden the user base and appeal to
many groups within Member institutions who are not currently active users
of NetNorth. However, interconnection (or access in some form) to messaging charging services (such as Envoy/iNet Messaging or telex) poses
some fundamental problems for a fixed-cost network such as NetNorth's. Implementing mechanisms for charging is certainly possible, but might introduce a level of complexity that would outweigh the benefits of the
service.

ASSUMPTIONS

The following assumptions were made to develop possible scenarios for the future of the NetNorth Consortium and its network.

1. There will continue to be a need for a national network serving the Canadian academic and research communities. The demise of a national network would result in development of north/south links rather than east/west links as Canadian academic institutions go south to join the US Internet. Since peer groups in research tend to grow along networking links, this could be to the detriment of Canadian research. The best historical analogy is the building of the Canadian Pacific Railway to link together an emerging nation and connect eastern and western Canada. As well, the federal Centres of Excellence will require east/west networking.
2. Any future network will enable TCP/IP communication between the provincial and regional networks.
3. NJE is no longer an appropriate protocol for any future network and it is anticipated that it will be phased out by IBM.
4. Three essential services exist in NetNorth which must be retained in any future network: mail services, sender-initiated file transfer, and interactive messaging (although perhaps to a lesser extent than the first two).
5. NetNorth can only survive and evolve if it continues to be self-funding.
6. Current NetNorth functions to provide widespread communication, basic services, and reasonable costs must be maintained:
   a. funding the national backbone,
   b. managing the NJE routing tables,
   c. co-ordinating gateways to other networks, and
   d. external liaison with other network-administration groups.

SCENARIOS

(A) THE NATIONAL NETWORK PROPOSED BY NRC SOON BECOMES AN ALTERNATIVE FOR CANADIAN UNIVERSITY NETWORKING

Management considerations:

1. The NetNorth Consortium will thus be able to phase its national NJE network out of existence over some finite period of time.
2. The structure of the Consortium will change so that the Regional Administrations match the concept envisioned in the NRC proposal.
3. There will no longer be a need for national network administration by the Consortium. However, the Regional

Administrations will continue to be responsible for administration of their regional networks, which will all be larger than they are today because they will include industry and government research partners.

4. Gateway co-ordination will be done by the Regional Administrations.
5. The NetNorth Consortium will evolve to a nation-wide "universities user group" participating in the management of the NRC-proposed network.
6. The NetNorth Policies and Procedures document will require changes to reflect these changes in the NetNorth Consortium and the NetNorth network.

Technical considerations:

7. NJE routing-table mangement will not be necessary. However, it will be necessary to maintain the ability to communicate via a TCP-NJE gateway with the NJE networks (BITNET, EARN, etc). For example, we will need to provide a method of NJE-like sender-initiated file transfer and message transfer via a TCP/IP network, to both TCP and NJE recipients.
8. Training and education in an IP network will be required.
9. Capacity management will become more important.

(B) THE NRC PROPOSAL FAILS

We assume that the need for a national TCP/IP network will remain.

Management considerations:

1. NetNorth will continue funding a national backbone network.
2. NJE will be phased out in favour of a TCP/IP network.
3. IP router and domain name management will be done by the Consortium.
4. It is still desirable to re-structure the regions.

Technical considerations: same as for Scenario A.

Financial considerations:

5. Consortium costs will go up as new functions are added.
6. The network will increase in size and complexity.

RECOMMENDATIONS

1. The creation of the NetNorth Consortium has resulted in a unique national peer group in the Canadian academic community. Interaction within this peer group must be encouraged to continue and evolve. The Consortium must continue to exist in either scenario and must continue to represent its constituency as a national voice in Canadian academic networking.
2. The Executive Committee must continue to be made up of representatives from the Regional Administrations.

3. The Members must be encouraged to form TCP/IP-based regional networks to interconnect to a national TCP/IP backbone network.

|4. The Executive Committee and the Regional Administrations must continue to review the makeup of the Regions and recommend changes where appropriate to facilitate the emergence of provincial/regional TCP/IP networks.

5. If the NRC proposal shows no immediate sign of becoming reality, then the NetNorth backbone must be converted to a TCP/IP backbone with one or more IP routers in each region. Minimum speed must be 9.6KB with an intent to move to 56KB as soon as possible. However, a TCP/IP network makes network management more critical than in a store-and-forward network. The NetNorth network is an essential service and availability is critical. The network-management functions must be put to tender for bid by the Members of the Consortium.

6. The Administrative Committee must develop specifications for maintaining NJE functionality in a TCP/IP network. Tenders must be put to bid by Members for any necessary software development. The Members must be solicited for names of people in their institutions with TCP/IP expertise to participate in a transition-guiding technical subcommittee under the Administrative Committee.

7. Each Member must be encouraged to develop a directory server for its institution to enable network-access query of the electronic address of each person within the institution. The Administrative Committee must develop a specification for a standard user interface to which each Member's server should adhere (command syntax, response format, etc).

|8. The Consortium must encourage TCP/IP-connected Members to continue to provide NJE connectivity to those Members that are not yet able to convert to a TCP/IP connection and to provide encouragement and guidance to Members that wish assistance in establishing TCP/IP connectivity.

final version