
Silva, Marcos, and Glenn F. Cartwright. "The Canadian Network for the Advancement of Research, Industry, and Education (CANARIE)." *The Public-Access Computer Systems Review* 3, no. 6 (1992): 4-14. To retrieve this article, send the following e-mail message to LISTSERV@UHUPVM1 or LISTSERV@UHUPVM1.UH.EDU: GET SILVA PRV3N6 F=MAIL.

1.0 Introduction

This paper examines the Canadian Network for the Advancement of Research, Industry, and Education (CANARIE). It explores the influence of the U.S. National Research and Education Network (NREN) initiative, and then it discusses the genesis of CANARIE, its potential impact on the Canadian library and education communities, and its administration and financing.

2.0 Influence of the U.S. NREN

The convergence of computer and telecommunications technologies as well as the development of high-speed networks are considered by many to be the most important factors affecting the ability of a nation to remain in the technological marketplace. [1] Indeed, the opportunities offered by advances in computing and telecommunications technologies are understood to be so vital to economic development that the U.S Congress has been considering several bills that ensure that all sectors of the American research community share in the benefits of these technologies. The High-Performance Computing Act of 1991, sponsored by Albert Gore, Jr. (Democratic Senator from Tennessee and current Vice Presidential candidate), asserts that the nation's economic growth, industrial production, scientific advancement, and security are dependent upon advances in computer science and telecommunications. [2] It explicitly states that collaboration among the academic, government (including Federal laboratories), and industrial sectors is the way to ensure continued American leadership in high-performance computing. [3] A key feature of the act is the establishment of a National Research and Education Network (NREN).

The High-Performance Computing Act of 1991 was signed by President Bush in December 1991. Subsequently, the Information Infrastructure and Technology Act of 1992, likewise sponsored by Gore, was introduced in the U.S. Senate on July 1, 1992. Although the bill died with the adjournment of Congress in October 1992, Gore has stated that he will either reintroduce the bill if he remains in the Senate or, if he is elected Vice President, work with Congress to introduce a similar bill. This bill would build upon and expand the High-Performance Computing Act of 1991. [4] The legislation is intended to ensure that the new information technologies created by the NREN are utilized by factories, libraries, K-12 schools, medical institutions, and other key sectors of society. Funds would be authorized to create digital libraries, connect primary and secondary schools to the network, and provide educational and training software. The development of NREN has received close attention from the Canadian press and the research community. Articles in both popular and academic journals have debated the project's

impact and possible evolution. This discussion has helped strengthen the perception that a similar network is needed in Canada.

2.0 CANARIE

Background The Canadian CANARIE network advances essentially the same paradigm as the NREN. CANARIE will: (1) promote communications technology in support of Canada's research and development community; (2) create a test bed for the development of Canadian electronic products; (3) introduce Canadians to new technologies and act as a catalyst for exploiting the new services that high-speed networks permit; (4) offer research centers, government, and private companies network-based services; and (5) promote the development of information databases and virtual libraries. [5] Presently, Canadian universities and research centers are connected to CA*net, which is part of the worldwide Internet. Within five years, CANARIE will upgrade the national backbone from 56 kilobits per second to T-1 speeds (1.544 megabits per second) and then to T-3 speeds (44.736 megabits per second). CANARIE will make full use of existing Canadian technology and the present CA*net infrastructure. Hopefully, this strategy will minimize duplication of funding, efforts, and resources. Interconnection of regional networks will be a national priority.

+ Page 6 +

The catalyst for CANARIE was the Network Organization Conference (April 1991), sponsored by Industry, Science, and Technology Canada. At the Conference, an executive committee and four working groups (Business, Governance, Marketing, and Network Architecture) were given the mandate to establish plans for the creation of a high-speed network. The objective of the working groups was to detail the infrastructure needed to implement the network by January 1, 1993. The composition of CANARIE's working groups reflects its mandate to foster greater cooperation between the research and industrial sectors. Among its members are representatives from major Canadian universities, industries, and government agencies. Canadian libraries are represented by Alan MacDonald, Director of Information Services, University of Calgary and by Alan Greenberg, Director of Computing and Telecommunications, McGill University.

3.0 Why CANARIE?

Canadians are motivated to establish CANARIE for the same reasons that Americans want to establish the NREN. [6] The CANARIE Business Plan Working Group argues that computing and telecommunications are perhaps the most important technological forces shaping the new world economic order. [7] Even more explicit is the Working Group's warning that ignoring the potentials of high-speed networks will place Canada at a great disadvantage in its ability to maintain a high standard of living and necessary social welfare programs. [8] CANARIE stipulates that a partnership among all research sectors of Canadian society is crucial to the successful development and implementation of the project. [9] This collaborative initiative is understood as a way to preserve and promote Canada's technological development in an increasingly competitive global marketplace. The CANARIE Marketing Plan Working Group views information technology as the central resource in advanced communities. [10] The Marketing Plan Working Group asserts that failure to grasp the implications of high-speed networks will harm Canada's ability to supply the world market with its brand of computer-based networking products and services. In fact, without such a network, Canada will be unable to compete internationally and will have to meet domestic needs with foreign products and expertise. [11]

+ Page 7 +

It is not surprising, therefore, to find a chapter in the Marketing Plan Working Group's report entitled "The Threat," which outlines the investments that Japan and the United States are making to upgrade their telecommunications networks. And even more telling is the inclusion of an electronic mail message detailing the possibility of a Canadian brain drain to the United States as a result of the NREN. [12] The same warning is found in the summary of European investments in Cooperation for Open System Interconnection Networking in Europe (COSINE), the American NREN, and other foreign networks and initiatives that is presented in the Business Working Group report. One chapter of the report, "Other Economic and Strategic Benefits," details how the CANARIE program may motivate highly-skilled workers to remain in Canada and so contribute to the development of information technologies. [13] Clearly, competitiveness and a changing world economy are the key forces pressing Canada to invest in CANARIE. If Canada is to remain a key player on the industrial and research world stage, it must embrace these new computer and telecommunications technologies and integrate them into its research and manufacturing sectors. The mission of CANARIE is to: "Support Canada's growth and enhance its international competitiveness through the promotion, development and use of high-speed communications network products and services." [14]

4.0 Potential Applications

The convergence of computer and telecommunications technologies is reshaping the needs of the Canadian industrial and research infrastructure. Since libraries are an important part of this infrastructure, it is safe to assume that the impact of these developments upon traditional library services will be profound. CANARIE will radically alter the ways that libraries meet their clients' information needs. These changes will be irreversible and will require an innovative and proactive response from libraries.

+ Page 8 +

It is interesting to note that the report of the Marketing Plan Working Group views libraries as an important market segment for CANARIE. Only schools offer a larger potential pool of users. The Working Group includes libraries as a separate category of possible users; implicit in this categorization is the realization that the success of CANARIE requires the full participation of libraries. This, in turn, provides libraries with the unique opportunity to be a key player in deciding future national objectives and policies. Because of its mandate to define the necessary management infrastructure and network architecture to support CANARIE, the Network Architecture Working Group has most clearly described the possible uses of CANARIE. CANARIE services are categorized into "embedded" services, which are further subdivided into primary and supplementary embedded services, and "enabled" services. Primary embedded services, such as routing services for the Internet Protocol (IP), are important and strategic for network operations, and they are generally expensive. [15] Supplementary embedded services, such as naming and addressing directory services and gateway services to other networks are generally needed by the CANARIE user community. Enabled services permit the user community to have access to services that are not necessarily an integral part of CANARIE, but are made possible by its establishment. It is the enabled services category that is potentially of greatest interest to network users and libraries. Some possible enabled services include: access to citation and full-text databases, multimedia information, virtual libraries, and other resources; distance education; electronic mail for organizations that wish to use their own systems; file transfers; remote "login" (Telnet) to network computers; and

video conferencing. [16] Of all the enabled services offered by CANARIE, Telnet is arguably the utility that will be used most by Canadian libraries. Using existing Internet connections, librarians and researchers are able to access hundreds of OPACs and other databases. Some sites have created special indexes to sections of their collections that are unavailable elsewhere. Dartmouth's New Hampshire Newspaper Index and Carnegie Mellon's index to architectural illustrations are two cases in point.

+ Page 9 +

With the advent of CANARIE, a greater number of users will have access to larger and more diverse databases. Once sites adhere to the Z39.50 protocol, users will be able to search and retrieve data from remote computers using their own familiar system interface. This is likely to spur greater use of the network. But perhaps the greatest impact of CANARIE will be in its ability to encourage greater resource sharing among libraries. Once access to data is made seamless and transparent, centralized access to databases that are now duplicated at many sites becomes feasible. For example, the Canadian Census tapes from Statistics Canada could be shared easily. The creation of regional online catalogs offers another resource sharing possibility. In Canada, NOVANET is a good example of a regional catalog that succeeds in bringing together the online resources of many libraries in Nova Scotia. By contrast, in Quebec, it is necessary to use a commercial database, at considerable cost, to find the holdings of most university libraries in the province. Employing the network to create regional or national catalogs would allow for greater coordination of collection and acquisition policies, while simultaneously fulfilling the CANARIE objective of increasing public access to information whenever possible. It is interesting to note that at a recent seminar on the Internet, held at Laval University in Quebec, discussion on the possibility of creating a Quebec-wide online catalog grew into a fascinating debate on how electronic networks might be used to promote and safeguard regional cultures. By exploiting the power and flexibility of future high-speed networks, libraries could play a central role in creating unique regional or national databases. In this manner, libraries would be able to fully exercise their mandates to disseminate and preserve information. CANARIE plans to offer access to anyone having legitimate use for the services found in the network. [17] If CANARIE administrators and policy makers adhere to this strategy, it is plausible that use of CANARIE will filter down to the general public through the use of Free-Nets.

+ Page 10 +

Free-Nets are public community networks that do not charge user fees. They are an outgrowth of the National Public Telecomputing Network (NPTN), a research project conducted at Case Western University. The NPTN is a nonprofit organization that works to ensure the provision of free computerized information and communication services to the general public. All members of the community are able to access and exploit the resources available on the network. And, most importantly, the system is under the administration and care of the community. Perhaps the best known Free-Net is the Cleveland Free-Net. By exploiting the Internet, the Cleveland Free-Net makes publicly available a myriad of resources and services, such as newspaper headlines, medical and health information, recent U.S. Supreme Court rulings, and instructions on how to contact government representatives. Logging in and navigating through the Free-Net is simple. School librarians and K-12 educators find the Free-Net particularly valuable because of its flexibility in introducing students to electronic resources and databases. Overall, the Free-Net now boasts of over 22,000 registered users and averages over 5,000 logins a day. Free-Nets are a good example of how CANARIE could serve the Canadian population. Support for educational initiatives is another major CANARIE objective. Indeed, the benefits of CANARIE

to all levels of education are stressed throughout CANARIE reports. Plans include integrating intelligent computer-assisted instruction software, multimedia databases, teleconferencing, and virtual libraries into classroom instruction, from the kindergarten to the university levels. Because of Canada's geography, investment in distance education programs has always found strong governmental support. Consequently, it is not surprising to find that one of the primary initial uses of CANARIE will be distance education. Libraries, in their support of distance education, have the unique opportunity to expand the provision of services by making accessible regional or national collections, full-text databases, and multimedia information. This type of networking and resource sharing is considered urgent for remote Canadian communities in the Northwest Territories and the Yukon.

+ Page 11 +

CANARIE will also support the research and development efforts of the information technology industry. The CANARIE Business Plan Working Group states that one of the major benefits from ultra high-speed networks is the development of new products and applications. [18] In addition, the Working Group stresses that CANARIE will profit Canadian information technology researchers by creating a test bed for new products and services. [19] Indeed, the development of a test bed for Canadian network products, applications and services is understood to be an integral part of CANARIE's goals and objectives.

5.0 Administration

CANARIE is to be a nonprofit company; all revenues are to be used to cover operating costs. Different shareholders will be represented on its Board of Directors, who will have responsibility for budget planning, management, and policy. The government will continue to participate in the evolution of CANARIE by collaborating in the formulation of future plans and policies. CANARIE's budget has been set at \$60 million (Canadian) for the first five years. It is believed the company can become self-supporting after that initial period. It is imperative that Canadian libraries have representation in CANARIE policy formulation and that they invest in the development of CANARIE.

6.0 Conclusion

Canadian policy makers view CANARIE as a way to support and augment the education, research, and industrial sectors. Indeed, CANARIE is understood to be an essential component of the emerging national information-based economy. Like the North American interstate highways that were created decades ago, CANARIE and NREN will provide high-speed "data highways" that will permit new technological resources to be exploited. CANARIE will help lead Canada into the twenty-first century.

+ Page 12 +

CANARIE also presents unique opportunities for libraries: the creation of virtual libraries, faster document delivery services, increased access to larger and more diverse databases and OPACs, interconnections among research centers, and the preservation of regional and national cultures. Most important, however, is that CANARIE may be the way for libraries to respond to the many profound changes in society stemming from the convergence of computer and telecommunications technologies. CANARIE gives libraries the means to meet the new challenges associated with the changing nature of scholarly communication and the growing importance of electronic publishing. It is inconceivable that a first-world economy would not invest in new telecommunications technologies. American, European,

and Japanese investments in networking leave Canada little choice. NREN has shown the possibilities and promise of high-speed networks, and CANARIE will allow Canada to share in this vision. The CANARIE working groups realize that now is the time for action--to postpone implementation would seriously harm Canada's ability to remain strong among the privileged nations of the world.

References

1. Charles R. McClure et al., *The National Research and Education Network (NREN): Research and Policy Perspectives* (Syracuse, NY: Ablex Publishing Corp., 1991); and Glenn F. Cartwright, "Computers, Mind, and Cosmos" (Paper presented at the First Annual McGill Computers in Education Conference, Montreal, Quebec, December 1983).
 2. U.S. Congress, Senate, High-Performance Computing Act of 1991, 102nd Cong., 1st sess., S. 272, Sec. 2, (1). (Computer file: /nren/hpca.1991/nrenbill.txt, available via anonymous FTP from NIC.MERIT.EDU.)
 3. *Ibid.*, Sec. 3, (1).
 4. Albert Gore, Jr., "The Information Infrastructure and Technology Act," *EDUCOM Review* 27, no. 5 (1992): 26-29; and News From U.S. Senator Al Gore, 1 July 1992. (Computer file: /nren/iita.1992/gorebill.1992.txt, available via anonymous FTP from NIC.MERIT.EDU.)
- + Page 13 +
5. C. Patrick Sampson, "Forging a National Network: The Canadian Experience" (Paper presented at IASSIST '92, Madison, Wisconsin, May 1992).
 6. Hickling and Comgate Engineering Associates, Ltd., "Feasibility Study of a National High Speed Communications Network for Research, Development and Education" (n.p., 1990), 5.
 7. Canadian Network for the Advancement of Research, Industry and Education, Business Plan Working Group, "Report of the Business Plan Working Group" (n.p., 1992), 1.
 8. *Ibid.*, 2.
 9. *Ibid.*, 22.
 10. Canadian Network for the Advancement of Research, Industry and Education, Marketing Plan Working Group, "Report of the Marketing Plan Working Group, Draft 2.0" (n.p., 1992), 1, 3.
 11. *Ibid.*, 6.
 12. *Ibid.*, 5.
 13. Canadian Network for the Advancement of Research, Industry and Education, Business Plan Working Group, "Report of the Business Plan Working Group" (n.p., 1992), 8.
 14. *Ibid.*, i-ii.
 15. Canadian Network for the Advancement of Research, Industry and Education, Network Architecture Working Group, "Network Architecture, Draft 3.1" (n.p., 1992), 18.
 16. *Ibid.*, 34-35.

+ Page 14 +

17. Canadian Network for the Advancement of Research, Industry and Education, Business Plan Working Group, "Report of the Business Plan Working Group" (n.p., 1992), 10.

18. Ibid., 6.

19. Ibid.

About the Authors Marcos Silva, Computer Services Librarian, McLennan-Redpath Library, McGill University. Internet: CZD2@MUSICA.MCGILL.CA. Glenn F. Cartwright, Associate Professor, Department of Educational Psychology and Counseling, McGill University. Internet: IN00@MUSICB.MCGILL.CA.

The Public-Access Computer Systems Review is an electronic journal that is distributed on BITNET, Internet, and other computer networks. There is no subscription fee. To subscribe, send an e-mail message to LISTSERV@UHUPVM1 (BITNET) or LISTSERV@UHUPVM1.UH.EDU (Internet) that says: SUBSCRIBE PACS-P First Name Last Name. PACS-P subscribers also receive two electronic newsletters: Current Cites and Public- Access Computer Systems News. This article is Copyright (C) 1992 by Marcos Silva and Glenn F. Cartwright. All Rights Reserved. The Public-Access Computer Systems Review is Copyright (C) 1992 by the University Libraries, University of Houston. All Rights Reserved. Copying is permitted for noncommercial use by academic computer centers, computer conferences, individual scholars, and libraries. Libraries are authorized to add the journal to their collection, in electronic or printed form, at no charge. This message must appear on all copied material. All commercial use requires permission. -----