The Canadian Information Highway

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Canada's Information

and Communications

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Minister's Message:

A new knowledge-based economy that is emerging in Canada requires a new advanced infrastructure – the "electronic highway."

This discussion paper raises some of the public policy concerns with which we must collectively come to grips as we engage in adapting to very rapidly changing technology. The issues outlined here are by no means an exhaustive list, but they do affect all of us to some extent. I encourage you to comment on the matters that we have raised and to let us know about the areas that we may not have considered.

It is essential that we consider all aspects of this issue as we develop Canada's strategy for the information highway.

We want to hear from you. To let your concerns be known, you may contact the Information Highway Advisory Council by phone (613) 990-4268, facsimile (613) 941-1164, electronic mail (Internet) at I.H..Council@Banyan .dgim.doc.ca, or conventional post, Industry Canada, 300 Slater Street, Room 640, Journal Tower North, Ottawa, Ontario, K1A 0C8.

Sincerely,

The Honourable John Manley
Minister of Industry

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Introduction

The terms *information highway* or *electronic highway* denote the advanced information and communications infrastructure that is essential for Canada's emerging information economy. Building on existing and planned communications networks, this infrastructure will become a "network of networks," linking Canadian homes, businesses, governments and institutions to a wide range of interactive services from entertainment, education, cultural products and social services to data banks, computers, electronic commerce, banking and business services.

In the Speech from the Throne and in the budget, the government announced its intention to implement a Canadian strategy for an information highway. The information highway will have broad and transformative effects throughout the Canadian economy and therefore must be consistent with our overall social and economic goals — including long-term growth and job creation.

The enabling effects of the information highway will be felt in all industry sectors and regions of Canada. It will stimulate research and development (R&D) in leading-edge technologies; it will facilitate the diffusion of innovative technologies and information-based services; it will strengthen the competitiveness of large and small Canadian businesses; and it will provide cost-effective access to high-quality health care, educational and social services. The information highway initiative is essential for Canada's success in a new global economy in which value, jobs and wealth are based on the creation, movement and application of information.

Our objective is to build on Canada's strengths in communications technologies, and to give Canada and Canadians the competitive edge needed to attract business investment and create long-term, high-paying jobs. Canada has an advantage in having one of the most advanced, extensive and universally accessible communications infrastructures in the world. Indeed, the Canadian information highway is now a work in progress. The private sector is deploying and interconnecting advanced networks as well as developing innovative products and services. Businesses, institutions and consumers are demanding greater choice and lower prices. The federal government is a key player through legislation, policy and regulation governing communications systems and R&D, and is a major user of information products and services.

This paper sketches the background to these developments and identifies a number of public policy issues raised by an information highway system. Many of these issues are readily apparent, but many others have yet to be articulated. Over time, the issues will evolve and change as advanced networks, products and services are introduced. A Canadian strategy must be flexible to help us address and adapt to a complex and rapidly changing environment. Informed participation of all stakeholders and coordinated investment of the collective resources of Canada will be essential if the benefits of the information highway are to be realized. Government leadership is required to develop and implement a national strategy.

The strategy will be made in Canada, by Canadians, for Canadians. It will be consistent with our regulatory history, our economic realities, our market size, our industry structures, the international context and our unique cultural and sovereignty requirements. Recognizing the economic, cultural and social implications of the information highway, the government proposes three objectives to be pursued by the strategy:

- create jobs through innovation and investment
- reinforce Canadian sovereignty and cultural identity
- ensure universal access at reasonable cost.

Four principles are advanced to guide the development and implementation of the strategy:

- an interconnected and inter-operable network of networks
- collaborative public and private sector development
- competition in facilities, products and services
- privacy protection and network security.

The federal government intends to provide the national leadership needed to mobilize the necessary commitment, resources and participation of all stakeholders. Only by working collaboratively will the many economic, social and cultural benefits of the information highway be realized by all Canadians.

1

The Challenge of the Global Information Economy

1.1 *Market and Technology Trends*

Developments in communications and information technologies are transforming the way that Canadians interact and do business in almost every field of endeavour, opening up new opportunities and challenges in both domestic and international markets. These technologies influence where and how we work, play and study; how we do research, design and manufacture products; how we get our banking done and pay our bills and taxes; how we learn about what's going on in the world, educate our children and retrain ourselves for changing jobs; and how we interact with friends and family and spend our leisure hours. The global integration of markets makes the timely exchange of information a critical competitive advantage. New businesses are rapidly developing to feed new markets. In an information-based economy, most of the new jobs created require the ability to generate, access, analyze and use information. These capabilities have become essential for economic growth and social well-being.

The key technological innovation driving this transformation has been the conversion of information, whether as sound, pictures, text or numbers, into streams of digitized "bits." Digitization means that information can be manipulated at high speed by computers. The exponential increase in computing power over the past 20 years, coupled with dramatic reductions in cost, have made computer applications essential to business and government, and much more affordable for use in homes and schools. At the same time, the development of inexpensive fibre optic cable, new wireless technologies, digital compression and switching techniques allows these digital bit-streams to be communicated at high speed over a wide variety of wireless and wireline networks. It is now possible to exchange information anywhere in any format and to conduct transactions electronically over any distance. These trends have accelerated both the demand for and the pace of introduction of new products and services. They have also stimulated the demand for broadband networks capable of transmitting high-quality voice, video and data.

These new technologies are causing the "convergence" of industries — historical distinctions among telecommunications, broadcasting, computing and data information services are starting to blur. By upgrading their networks, cable companies could offer competitive local telephone services, and telephone companies could compete in the delivery of broadcasting or video services. Both these industries, along with the computing, publishing and entertainment industries, are beginning to explore the markets for new information and interactive services. Information providers and carriers are aggressively seeking to expand their activities beyond their traditional borders. Some analysts have estimated that the size of the worldwide market for information technology products and services currently exceeds US$1 trillion, and will double by the year 2000. Governments are moving to update their regulatory and policy regimes so as to open up these markets to competition.

1.2 Responses by Our Competitors

Canada's major trading partners — the United States, the European Community (EC) and Japan — are responding to the challenge through ambitious infrastructure investment programs and regulatory and legislative reforms. National communications and information networks are being modernized in these countries, attracting a continuous stream of innovative value-added products and services.

The Clinton Administration in the United States announced the National Information Infrastructure (NII) initiative in September 1993, calling for joint industry and government action to create a seamless and interoperable national broadband information infrastructure. The NII will be built by the private sector within the enabling policy and regulatory framework provided by the government. Through the High Performance Computing and Communications Program and other initiatives, the government plans to allocate up to US$2 billion per year for advanced R&D, the development of education, health care and government services applications that will run on the network, and network access and training programs. In a speech on 11 January 1994, U.S. Vice-President Al Gore challenged U.S. industry to connect all of the country's schools, libraries, hospitals and clinics to the information highway by the year 2000. In addition, U.S. cable and telecommunication companies have begun to form strategic partnerships and alliances to take advantage of the convergence of technologies and the expected relaxation of regulations prohibiting cross-ownership and competition.

The EC has recently approved the budget for the Fourth Framework Programme for Research and Development for 1994-98, which includes a US$3.8-billion component in support of the development of a new information infrastructure. This investment will support advanced communications R&D and the evolution of the underpinning technologies as well as the development of distance learning, health care and other services of public interest. The Europeans believe that this new information infrastructure will consolidate internal markets, provide a platform for more efficient government administration, and promote a more balanced economic, social and cultural development.

In Japan, the Nippon Telegraph & Telephone Corporation has announced its intention to wire every school, home and office with fibre optic cable by 2015. Japan's Ministry of Posts and Telecommunications (MPT) estimates the total cost of building this domestic fibre network to be between US$150 billion and US$230 billion. In parallel, the Japanese are investing heavily to ensure that users will have access to a wide variety of services. In spring 1994, the MPT will launch a US$50-million three-year pilot project to assess the feasibility of integrated telecommunications and broadcast service applications through fibre-to-the-home networks. The project will include 300 homes and offices, and will test video-on-demand, high-definition television, videoconferencing, teleshopping and telemedicine.

1.3 Implications for Canada

If Canada is to succeed in a global economy based on the creation, movement, storage, retrieval and application of information, our communications networks must be knitted into a seamless and powerful information infrastructure serving all Canadians. If Canada does not match the efforts of its competitors in accelerating infrastructure development, opportunities for network, product and service development — and the resulting economic growth and new jobs — will be seized by firms in other countries. The critical services and connections that Canadian businesses need for international competitiveness will be provided by our competitors, and Canadians could find their communications systems almost devoid of Canadian content, products and services.

2 Canada's Information and Communications Infrastructure – National Vision and Strategy

S ince the invention of the telephone by Alexander Graham Bell in 1876, Canada has always considered it essential to have strong communications networks — owned and controlled by Canadians — for trade, competitiveness, cultural vitality and national sovereignty. The government has actively supported the development of such networks: the Trans-Canada Telephone System was set up in 1932, the Canadian Broadcasting Corporation (CBC) was established in 1936; transcontinental microwave networks were built in the late 1950s; the first in a series of domestic communications satellites was launched in 1972; cellular telephone services were rolled out in the late 1980s; and fibre optic networks have been laid coast to coast over the last two years.

In the January 1994 Speech from the Throne and in the February federal budget, the government reinforced its commitment to a strong communications capability by announcing its intention to implement a Canadian strategy for an information highway. The success of this effort will be measured, in large part, by the extent to which it creates opportunities for Canadians to succeed in the fast developing global information economy.

2.1 A Canadian Vision for the Information Highway

The goal for Canada is to build the highest-quality, lowest-cost information network in the world, in order to give all Canadians access to the employment, educational, investment, entertainment, health care and wealth-creating opportunities of the Information Age. In short, the vision is to make Canada number one in the world in the provision and utilization of the information highway, creating substantial economic, social and cultural advantage for all Canadians.

Canada's information and communications infrastructure will be a "network of networks," creating vital communications links among Canadian businesses and their clients; among industry, government and universities; among artists, cultural organizations and their audiences; among hospitals, clinics and patients; among schools; and among communities, large and small, from one end of the country to the other. It will accelerate the pace at which we exchange ideas, and will revolutionize our way of doing business. It will act as the catalyst for Canada as a vital and competitive knowledge-based society.

2.2 The Information Highway — A Transformative Role

The Canadian information and communications infrastructure will be a key factor in Canada's successful transition to an economy in which value, jobs and wealth are based on the creation, movement and application of information. Like the railroads, waterways and roads that formed the transportation infra-

structure of the industrial economy, the information highway will carry peoples' ideas and the information services that drive the new global information economy. Creation of this network of networks will stimulate the development and introduction of new products and services in a wide variety of fields with significant economic potential — in strategic business information, electronic commerce, arts and entertainment, education and training, and health care.

For the Private Sector

The widespread use of communications and information technologies has already transformed banking and financial services as well as the travel and retail sectors through applications such as on-line banking, electronic data interchange, electronic funds transfer and computerized reservation systems. Automated teller machines, point-of-sale systems, and credit and debit cards have changed the way consumers bank, shop and make payments.

The information highway will play a similar but even greater enabling and transforming role across the Canadian economy as a whole. It will allow previously disparate industries, sectors, groups and individuals to link and interact with each other in new ways, to create new products and services, to search out markets and trade globally, and to organize solutions that will meet an endless variety of needs — individual as well as organizational.

The information highway will set in motion a number of other positive outcomes. Competing in global markets is encouraging Canadian industry to work better and smarter, to improve product and service quality, and to differentiate

themselves from their competitors. The key to competitiveness will be the ability of firms to develop, acquire and adapt new and state-of-the-art information and communications technologies, products and services — the tools that will be available on and through the information highway system. In addition, the timely distribution of strategic information held by the government (for example, patent data and international marketing opportunities) could increase the competitiveness of Canadian businesses. It will improve the competitiveness of small and medium-sized enterprises (SMEs) by giving them access to a new range of information, tools, services and electronic commerce capabilities that normally is available only to large institutions.

The information highway will act as a powerful enabling tool for the development and growth of the Canadian information, cultural and multimedia industries. The broadband capacity of the highway will be needed if images and video are to be exchanged over networks. Canadian cultural holdings found in such places as the National Film Board, the CBC, museums and archives are more likely to be successfully marketed if they are packaged in Canada for electronic distribution and sale both at home and around the world. The information highway is an ideal vehicle for these industries to display and distribute their wares domestically and to the world. Recently, the CBC became the first major broadcaster in the world to use the Internet, a worldwide cooperative research and education computer network, to explore these possibilities.

For the Public Sector

Soaring costs in health care, education and training coupled with large federal and provincial deficits are stimulating interest in the electronic delivery of public services. In his February 1994 budget speech, the Minister of Finance stated that the federal government will ensure that its services to Canadians are more affordable, accessible and responsive. Delivery will be easier and more efficient via an advanced information and communications infrastructure.

The existence of such an infrastructure will act as a driver for experimentation and testing of new ways for service delivery. For example, the Telemedicine and Educational Technology Resources Agency (TETRA) system connects 207 sites in approximately 112 communities in Newfoundland and Labrador to provide better educational services and health care through the electronic exchange of medical data, community health education programs and other services.

Distance education services and the electronic networking of schools and universities are also being used to improve the availability and quality of education. The River Oaks Public School in Oakville, Ontario, has networked all of its 240 computers and reoriented its curriculum to emphasize use of information technologies. Observers have noted increased interest and participation by students and reduced disciplinary problems. The Yellowhead school district in Alberta is considering linking all 17 district schools with 250 kilometres of fibre optic cable to provide high-speed voice, data and video communications for remote learning and to reduce school board administration costs.

The federal government has launched the SchoolNet project, a cooperative venture with provinces, universities, colleges and industry. The objective of the project is to foster improved learning performance at the elementary and secondary school level by providing subsidized links to the Internet, and to produce a school graduate population with a strong command of information and telecommunications technology.

In addition to applying information technology to streamline its internal operations, the federal government is using it to improve the delivery of services to businesses and the public. For business, initiatives include an electronic open-bidding system, which gives firms across Canada equal opportunities to bid on government contracts; the implementation of a single business registration number; greater use of electronic commerce for procurement, payment and revenue collection; and electronic document distribution pilot projects using electronic bulletin boards and the Internet. As of April 1994, five Canada Business Service Centres were opened by Industry Canada, in cooperation with provincial governments and the private sector, and five more are planned. These will provide single-window access for information, assistance and referrals on all government programs and services for business. SMEs in particular can benefit directly from all these initiatives.

For individual Canadians, improved service delivery initiatives include the nearly 300 Government of Canada InfoCentres opened by Human Resources Development Canada as of April 1994, which provide client-centred, one-stop shopping for a range of government information and services; the use of toll-free numbers combined with touch-

tone telephones to provide inquiry services such as Revenue Canada's tax information phone service (T.I.P.S.); and the EFILE system for the electronic filing of income tax, used by two million people out of some 16 million who filed returns in 1992.

In 1992–93, the federal government spent $41.9 billion in transfer payments to individuals, including income support payments to some three million elderly Canadians, child benefits to some 3.7 million families with children under 18 years, and Unemployment Insurance benefits to an average of 1.4 million people each month. Projects such as the Income Security Programs Redesign will be used to test the electronic delivery of social safety net payments and services (for example, Canada Pension Plan, Old Age Security and Guaranteed Income Supplement, Family Allowances, the refundable Child Tax Credit and Unemployment Insurance benefits). Cooperative arrangements are also being worked out with provincial governments for the single-window delivery of services such as training, employment and counselling; the program is intended to save millions of dollars by reducing federal and provincial duplication.

2.3 Outline of a Canadian Strategy

Given the broad transformative effects that the information highway will have across the Canadian economy, there is a need to ensure that its development contributes to Canada's goals and objectives. The government, in consultation with all stakeholders, will develop a national strategy that will ensure an appropriate balance between commercial and public interests, and among the needs of big business, SMEs, public

institutions and individual Canadians. This strategy will be uniquely Canadian, respecting our regulatory history, our economic realities, our market size, our industry structures, the international context and our unique cultural and sovereignty requirements.

Clearly the strategy must go beyond developing a plan to put more wire in the ground or more computers into offices and homes. It involves preparing Canadians to use new technologies and services so that they can benefit from the enhanced capabilities. It means reviewing and updating statutes that may unintentionally constrain our ability to use new technologies to conduct business. It involves government using new technologies to deliver services more effectively and efficiently, and creating a fiscal climate that encourages investment and innovation.

2.4 Objectives

The government has identified the following three objectives as central to its vision for the information highway.

(a) Create jobs through innovation and investment

Job creation and economic growth are the top priorities. The government will work with the private sector to create a world-class information highway and opportunities for businesses in Canada to invest in innovative products, services and new ways of doing business as a way of creating new and desirable jobs for Canadians.

The widespread availability of the information highway will enhance Canada's attractiveness when large Canadian and foreign firms make location decisions for their head offices, research labs, and

production and marketing facilities. The existence of an advanced communications infrastructure and competitively priced services has become a necessary condition for the location of many types of business activities, and will become increasingly critical in the North American Free Trade Agreement environment embracing Canada, the United States and Mexico.

In fact, all sectors of the economy will benefit from the ready availability of such services. To improve the competitiveness of Canadian businesses in both domestic and international markets, the government will examine ways of accelerating the exploitation of new information technologies and services.

The government's policy framework will encourage the creation of new products, new services and new firms within the information technology sector — one of our most dynamic. The government will review its R&D programs and spending to ensure that existing resources are appropriately directed toward the timely development and diffusion of information-based products and services. The government will examine ways to improve access to government information as well as its use and resale by the private sector. In addition, methods of using government investment in information technologies to stimulate innovation and product development in Canada will also be considered.

(b) Reinforce Canadian sovereignty and cultural identity

Canadians have always accorded cultural and communications industries a special status in recognition of their strategic role in defining and maintaining Canadian sovereignty and cultural identity.

The strategy for the information highway will respect long-standing policies that serve these ends. These policies include Canadian ownership and control of the telecommunications infrastructure and of the broadcasting system as well as continued support for the production, exhibition, distribution and export of Canadian cultural products and services.

The information highway can make our cultural institutions more accessible to both Canadian and export markets. Canadian artists and cultural industries will find that the highway offers new promotion and distribution channels to help them reach their audiences in Canada and around the world. The government will propose policies and other mechanisms to ensure that competitive Canadian cultural products and services will have a prominent place within the diversity of information to be delivered by the electronic highway.

(c) Ensure universal access at reasonable cost

Access to the services carried on the information highway will be an important factor in Canadian employment, economic growth and social well-being. The federal government will work with its regulatory agency, the Canadian Radio-television and Telecommunications Commission (CRTC), and with network operators to ensure universal access to essential services on the information highway for all Canadians at reasonable cost — including those living in rural areas and those in the lower-income groups — as well as schools, universities, hospitals and research institutions.

Virtually all Canadians now have access to basic telephone service and most have cable television. As new products

and services are introduced, the range of services considered essential will change. The government will review and modernize the concept of essential services to ensure that Canadians have access to an adequate range of services at reasonable cost.

Equity and ease of access will be important government priorities. The information highway could change the economic geography of Canada by creating new opportunities for regional economic development and by making it easier for businesses to compete anywhere in Canada. Similarly, Canadians from coast to coast should have improved access to social services such as education, training and health care.

The widespread availability of enhanced services and products, through easy-to-use interfaces on the information highway, should broaden public acceptance of electronic ways of doing business. Video-on-demand, interactive games, access to multimedia libraries as well as access to government information and services could be a profound stimulus to those who currently lack the knowledge or skills to make use of electronic services.

The government will explore the need for public awareness and education measures to ensure that would-be users have both the knowledge and skills to benefit from use of the information highway. The technical standards for the infrastructure must provide easy-to-use interfaces for business and the public, including Canadians with disabilities and other special needs. A demanding and sophisticated domestic consumer base will contribute to a healthy information economy.

2.5 Implementation Principles

Implementation of the national strategy will be guided by four principles.

(a) An interconnected and interoperable network of networks

Public and private networks, including existing and planned telecommunications, cable, satellite and wireless networks, will be linked together to create a seamless Canadian information and communications infrastructure. Entering through any one network will provide a gateway to all others and to a rich variety of Canadian information, entertainment and cultural products and services as well as to those produced by other nations. The infrastructure must be available coast to coast, and must be interactive and able to provide whatever bandwidth capability is required. Only with these characteristics will it be possible for voice, video, images, text and data to go easily and efficiently from one place in Canada to any other place in Canada or around the world.

(b) Collaborative public and private-sector development

The Canadian information highway will be built and operated by the private sector within a strategy that meets Canada's goals and objectives. With few exceptions, Canadian communications networks are owned and operated by industry. The development, interconnection and upgrading of facilities and networks will remain their responsibility.

The federal government will continue to play a key role in the development of a coherent and flexible policy environment that will not only stimulate private sector investment and innovation, but will also oversee the interests of all Canadians — especially in areas such as universal access, privacy and Canadian sovereignty. The federal government will also coordinate the national strategy for the information highway with other levels of government in Canada and with other countries.

As a major user of information products and services, the government will also examine ways to improve government operations and public services to Canadians, thereby accelerating the deployment of new networks, products and services. The government will consider the need for public funding to assist specific projects that might not otherwise be provided by the private sector (for example, ensuring access by Canadians with special needs).

(c) Competition in facilities, products and services

Traditionally, firms in the telecommunications, broadcasting and information industries have operated in separate markets, with little synergy occurring by way of either competition or collaboration. For example, the lack of competition in Canada's telecommunications market has been blamed for our falling behind the United States in the provision, pricing and use of advanced telecommunications services.

The government will apply pro-competitive policies, to the greatest extent possible, in all aspects of the information highway. This will mean competition between traditional and new network operators. The transition will be handled carefully to ensure that the benefits of competition are realized. The regulatory

framework will be flexible enough to keep pace with rapid changes in technology and the demands of the marketplace, and changes will be debated and effected in an open manner.

An open network architecture, open access policies and common technical standards will permit the entry of all firms (or individuals) who wish to supply equipment, products or services. This will encourage new ideas, new technologies and new partners.

The government will also review copyright and intellectual property legislation to ensure that it remains appropriate in a digital age.

If market forces are allowed to work as they should, Canadians will benefit from greater choice and lower prices. Encouraging and safeguarding competition, working to eliminate bottlenecks, and protecting consumers against market failures will be public policy priorities. Besides a wide range of competitive products and services delivered on the highway, there should be non-commercial, public services.

(d) Privacy protection and network security

Public concern about privacy protection is growing in Canada, as are business and government concerns over the security of sensitive information. The information highway will multiply the flow of information and the related privacy and security challenges that must be addressed. The basis of a solution already exists in the *Radiocommunication Act*, the *Telecommunications Act* and the Telecommunications Privacy Principles. Clearly, it is in the best interest of industry to take appropriate action. However, the government is prepared to take the

required measures to ensure that privacy concerns are addressed, should this be necessary. Services on the highway must be secure from piracy and unauthorized access. The highway itself must be reliable, and able to provide uninterrupted service in emergency situations.

3 Canada's Existing Infrastructure — Building on Excellence

*S*ome of the basic building blocks for the Canadian information and communications infrastructure are already in place. This section provides an overview of Canada's existing public and private networks, research capabilities and the information technology and content industries that will supply its products and services. Implementation of the information highway will have a major impact on the structure and performance of the information sector. It will lead to more competition, open markets and more synergy between firms in the expanding information sector — the backbone of the new economy.

3.1 Communications Networks

Canada's communications networks can be grouped into two broad categories: public and private networks. Public networks are operated by regulated entities like telecommunications carriers, broadcasters and cable TV firms. Private networks are implemented and operated by end users or by third-party suppliers. They are unregulated, with access and use generally limited to closed user groups.

Public Networks

The public telecommunications system is by far the largest part of Canada's existing communications infrastructure. It consists of over 250 million kilometres of public switched telephone and data networks as well as satellite, cellular telephone and mobile radio networks, all of which are interconnected. Although telephone networks are constructed and managed on a regional or national basis, interconnection and revenue-sharing arrangements have in effect created a global network, which permits any telephone in Canada to call any other telephone in the world.

Today, almost 16 million access lines connect more than 98 percent of Canadian households, as well as virtually all business and institutional users, to basic telephone service. This is a monumental accomplishment, given Canada's size and population distribution, and one that represents a substantial investment by the private sector. In 1991, the

value of past investment in telephone network was estimated at $32 billion, after depreciation, with an additional $4.6 billion in that year in new capital expenditures (33 percent of their $14-billion revenue).

The major telecommunications carriers are regulated by the CRTC under the *Telecommunications Act*. Exceptions are some smaller companies, which are under provincial jurisdiction, and Saskatchewan Telecommunications (SaskTel), which is exempted from federal regulation until 1998. Where the use of the radio frequency spectrum is involved, carriers are regulated under the federal *Radiocommunication Act*. Regulated common carriers are obliged to provide access and tariffed services to all users on a non-discriminatory basis.

Over-the-air broadcasting and cable television networks are another important piece of the public network infrastructure. In 1992, over-the-air broadcast facilities included 617 AM stations, 1 009 FM stations and 2 025 TV stations, which served 99 percent of the Canadian population. Of these, 355 AM stations, 301 FM stations and 140 TV stations originated programming. In addition, 2 124 cable systems passed by 95 percent of Canadian homes (72 percent of Canadian households subscribe to basic cable service). In 1992, the cable industry spent $400 million, some 20 percent of revenues, on capital investments. There are about 250 000 satellite dishes in Canada, and television programming broadcast directly from satellites may provide serious competition to cable TV systems in the future.

Broadcasters and cable TV firms are regulated by the CRTC under the *Broadcasting Act*, and are subject to Canadian content rules for broadcast programming. They are not required to provide third-party service suppliers with access to spare capacity on their networks.

Private Networks

Canada also has a large number of private networks serving business, government, research, education and community interests. Most of these lease private lines from telecommunications carriers to establish dedicated networks that provide services customized to the specific requirements of their users or at a lower cost than their public network equivalents.

Local Area Networks (LANs), which are high bandwidth networks used to link personal computers with shared servers and other networks, now are the most common type of private network — they are found not only in large businesses and institutions, but also in many SMEs. A LAN may link a few computers in an office building or extend over a university campus, a hospital complex or a factory. LANs may be further linked in regional, national or international networks.

Large organizations such as banks, insurance companies, utilities, airlines and governments have long used private networks for direct support of their operations, marketing or related activities. Examples include the Society for Worldwide Interbank Financial Telecommunication (SWIFT), the international network for interbank transfers (used by some 2 600 banks in 90 countries), and the Sabre and Gemini computerized airline reservation systems. The federal Government Telecommunications and Informatics Services is the largest private network in Canada. The best-known example of an international computer communications network is

the Internet, which interconnects some 10 000 networks and over 20 million users in the United States, Canada and 150 other countries. Internet growth is explosive — the number of users doubled over the last year and is growing at 10 percent per month.

Canada also boasts a hierarchy of research, education and community networks. These are organized by particular interest groups or communities for the exchange of information and communications geared to specific tasks such as research, education and access to public information. Canada's national backbone research network is CA*net (see the section on CANARIE for a description of plans to upgrade CA*net), which interconnects 10 provincial research networks — BCnet, Alberta Research Network (ARnet), SASK#net, MBnet, ONet, Réseau interordinateurs scientifique québécois (RISQ), NB*net, Prince Edward Island Network (PEINet), Nova Scotia Technology Network (NSTN), and Newfoundland and Labrador Network (NLnet) — and also provides access to the Internet. SchoolNet is planned as a national network that will link Canada's 16 000 schools to the Internet. The Ottawa Carleton Research Institute network (OCRInet), which was introduced on 23 January 1994, is an example of a high bandwidth, metropolitan area network. There are 10 such metropolitan area networks planned for Canada. FreeNets are community-based networks that are open to all users; three are in operation (in the National Capital Region, Victoria and Trail, British Columbia) and another 18 are in the planning stage.

CANARIE

In June 1993, the federal government, in partnership with the private sector,

announced the creation of the Canadian Network for the Advancement of Research, Industry and Education (CANARIE). CANARIE is an important building block in the information highway, and can be seen as a prototype of the large-scale public and private sector collaboration that will be required.

CANARIE will connect researchers and educational communities across Canada by 1999 with a high-speed broadband highway and will upgrade the gateway to the Internet and other international networks. Phase I of CANARIE, to be completed by March 1995, will upgrade the transmission speed of CA*net to T-1 (1.54 megabits per second). Another objective is to accelerate the development of new network products, applications and services through joint funding of innovative projects. A third objective is to establish a high-speed experimental test network. Total planned investment for Phase I is $115 million, with the government contributing $26 million and the private sector $89 million. A non-profit corporation, CANARIE Inc., has been established to manage this investment. Plans for future phases of CANARIE will likely include expanding its user community beyond research and education.

3.2 Research Facilities

Comprehensive R&D will be required for the information highway to evolve from today's diverse networks to a fully interconnected information and communication infrastructure. These technical challenges include work on network architecture, standards, harmonization of numbering schemes to identify users, communications systems, network security, service applications and user privacy. All of these technologies will

influence the optimal design of the information highway and the timing of its full implementation.

Building the information highway from the existing networks will depend on having appropriate bridges and links. It will be critical to maintain the functional use of current networks while upgrading and implementing new features.

A major challenge in the development of the information highway will be the provision of image- and video-based information and communications services over both narrowband and broadband networks. Significant parts of the present infrastructure are limited in their bandwidth at the local loop or lack interactivity, which will impede the introduction of new services. The telecommunications infrastructure provides for interactivity with narrow bandwidth while on the other hand the cable industry with its broadband delivery lacks full interactivity. Mobile users who depend on narrowband communications links as well as remote locations that are connected via wireless channels will present a particular challenge.

Technologies being developed in Canada and elsewhere will have an important influence on the privacy and security of networks, on the user interface and on the design of service applications. Canada's challenge will be to implement the best of these technologies and to contribute some of the best from our own laboratories.

Canada's information highway R&D activities are best focused on areas where we have already established expertise and world leadership. Dominant players in the Canadian telecommunications manufacturing industry are Northern Telecom and its research arm, Bell Northern Research — both universally recognized as world-class in their field. Canada also has a number of excellent medium to large-sized organizations, such as MPR Teltech, Mitel, Newbridge, NovAtel, Canadian Marconi, Spar and COM DEV, with substantial research capabilities in terrestrial and satellite communications. On the computing side, IBM Canada has a major R&D program in software development, and SHL Systemhouse is a major player in systems integration. Canadian universities also have strong R&D programs in wireless communications and in network technology.

A number of government laboratories, both federal and provincial, have also established expertise in areas that will be important in a national information highway R&D program. The National Research Council Canada (NRC), the Communications Research Centre (CRC) and the Centre for Information Technologies Innovation (CITI) are examples of federal government laboratories. The focus of the R&D activities of CRC and CITI is on those elements that expand on the main backbone network infrastructure, for example, integration of wireless networks (terrestrial and satellite), integration of cable TV and telephone networks, enabling technologies that maximize the use of networks, user-friendly delivery of applications in a multimedia/multimodal environment and development of government service applications.

3.3 Information Technologies Industry

The information technologies (IT) industry is an integral component of Canada's information and communications infrastructure. One of the

fastest-growing sectors in Canada, it encompasses telecommunications equipment and services, computers and office equipment, software and computer services, instrumentation, microelectronics and consumer electronics. The industry consists of some 13 500 establishments, which employ 278 000 people. Revenues have expanded at an average annual rate of 7.4 percent over the past six years. In 1992, revenues exceeded $43 billion — $19.1 billion on the manufacturing side and $24.3 billion from services. The sector contributes 5.8 percent to Canada's gross domestic product (GDP), exceeding the combined contributions of the aircraft and parts, motor vehicle and transportation services sectors.

While concentrated in Ontario and Quebec (close to 80 percent of manufacturing shipments are from central Canada), the IT industry features clusters of expertise across the country. It contains one of Canada's most successful global firms, Northern Telecom, as well as other large Canadian firms (such as Bell Canada, Mitel, Newbridge and SHL Systemhouse) and the subsidiaries of foreign multinationals (such as IBM, Xerox, Digital Equipment and Hewlett-Packard). However, the industry is primarily composed of SMEs, with the vast majority of these in the software and services sector, for example, Cognos, Corel, Alias, Softimage and DMR.

The value of Canadian exports in the IT industry has climbed steadily over the past five years, reaching $9.9 billion in 1992. However, Canada is heavily reliant on the import of finished products such as computers, fax machines, cellular and cordless telephones and consumer electronics. As a result, the industry had a trade deficit of

$9.3 billion for 1992. Among the IT subsectors, only telecommunications equipment held a trade surplus in 1992.

Nonetheless, the sector is well positioned to be a source of products and services for Canada's information and communications infrastructure. The need to be flexible, fast to market and innovative fits the Canadian mix of small, adept, niche players. International attention is increasingly turning to content, software and services. These are areas in which Canada has several competitive advantages — a demanding domestic marketplace and an educated labour pool as well as internationally recognized expertise in systems integration, data communications and switching, network computing, geographic information systems, full-text search tools, graphics software and computer-aided systems engineering.

While Canadian firms can compete on the basis of technical excellence, many have difficulty in international marketing, in selling to government markets in Canada and abroad, in securing adequate financing, and in managing high growth in a rapidly changing market. As IT R&D continues to grow in cost and risk, there will be increased pressure for Canadian firms to form strategic alliances to maintain technological excellence.

The information and communications infrastructure can be an important agent in helping IT firms improve their core business competencies, reduce costs and provide rapid access to researchers, suppliers and customers around the world. It can also serve as a test bed for new networking products and services.

3.4 Content Providers

The ability to transmit, combine and reproduce digitized voice, text, graphics, images, sound and full-motion video will open up new markets and opportunities for creators and producers of cultural and other content-based products and services. Production and distribution in broadcasting, film and video, sound recording and publishing will all be affected. Moreover, new technologies are being combined with existing media and content to produce new multimedia products, applications and services. This increased activity in both cultural and content-based industries will create opportunities for economic growth, job creation and exports. While statistics on newer media are scarce, Frost & Sullivan, a U.S.-based market intelligence company, estimated the worldwide multimedia market to be $7.2 billion in 1993, and forecast a jump to $24.3 billion by 1998.

Canada has already produced stable and growing industries in the cultural sector, in addition to the electronic publishing and database industries. Statistics Canada estimates that, for 1990-91, the arts and culture sector directly contributed 2.4 percent of GDP ($14.7 billion), and generated direct employment exceeding 332 000 jobs. Revenues for the cultural industries alone totalled $13.4 billion, divided as follows: broadcasting and cable ($4.1 billion), newspapers ($3.5 billion), film production, distribution and exhibition ($2.6 billion), book publishing ($1.6 billion), periodical publishing ($0.9 billion) and sound recording ($0.7 billion).

There is a potential to develop a dynamic multimedia industry in Canada that is capable of providing a wide variety of content services. One challenge will be to encourage cultural industries,

including agencies such as the CBC and the National Film Board, to seek wider markets, to work with technology suppliers where advantageous, and to support Canada's creators in developing new information commodities in such areas as entertainment, personalized learning and business training. Distribution channels must be strengthened, and Canadian firms must act quickly to exploit markets for new services. Otherwise, they risk being pushed aside in both foreign and domestic markets for new information services and products.

Canada's electronic publishing and database industry also has grown steadily, branching out from the electronic publishing subsidiaries of the Southam and Thomson communications companies to establish specialized strengths in financial and legal information. A 1992 survey[1] found some 90 Canadian firms selling information for profit and generating annual revenues of $250 million.

The content holdings developed by federal, provincial and municipal governments is enormous. The federal government alone has over 7 500 electronic holdings involving annual expenditures of $1.5 billion for their collection and management (for example, statistics, georeference and polling data). Statistics Canada is the largest publishing house in the country, collecting, compiling, analyzing and publishing statistical information on the commercial, industrial, financial, social and economic activities of Canadians.

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[1] "The Information Industry in Canada: The First National Survey of An Emerging Industry," a survey performed by Optima Consultants in Applied Social Research for the Information Technology Association of Canada, Willowdale, April 1992.

4 Public Policy Issues

Canada already has in place many of the building blocks for a national
information highway system as well as many of the industrial
strengths and technological skills for the successful completion of this
initiative. However, a number of public policy issues must be addressed before
further progress can be made.

4.1 Building a Competitive, Advanced Network Infrastructure

Issue 1 — How fast should the advanced network infrastructure be built? How will network improvements be financed?

The cost of upgrading and ensuring full interconnection of existing networks in Canada will be high. Some analysts have estimated the cost of a universal broadband fibre optic network to be in the order of $30 billion. The private sector has stated its commitment to building advanced network infrastructures, but timing will be crucial and financing a key consideration. Many of our competitors have set specific targets for interconnection. The Japanese have called for a fibre link to every home by 2015; the Americans have called for every library, classroom, hospital and clinic to be linked by the year 2000. How fast a pace should Canada set for the development of the infrastructure? How can public policy or regulatory measures accelerate the process? Should public funding be used to accelerate network expansion? If so, how should it be funded and targeted?

Traditionally, regulation has ensured that carriers eventually recover their capital expenditures in full from the general body of subscribers. Demand for enhanced network services will be heaviest from business and institutional users, yet these same users need and continue to press for lower, more competitive rates. At the same time, an increasingly competitive environment will encourage innovation and risk-taking among network service providers. The question is, Who should bear the risk of building the enhanced networks? How can the advanced infrastructure be built without reversing the drive toward lower rates? In an increasingly competitive environment, is it appropriate that regulation guarantee any carrier recovery of capital expenditures? Should all carriers, including telephone and cable companies, be expected to assume a much larger share of the risk associated with capital investment? Should the price charged for services better reflect the cost of providing them?

Public policy has been "technology neutral," letting service providers choose the most appropriate technology (for example, fibre optics, coaxial cable, copper wire or radiocommunication). Should this continue to be the case or should public policy favour certain technologies for certain uses? For example, over-the-air television broadcasting still places heavy demand on the radio spectrum, even though most Canadians receive television programs via cable. Should broadcasters be encouraged to exploit the advantages of non-spectrum distribution in order to free the airwaves for other uses?

Issue 2 — What is the proper balance between competition and regulation?

The Canadian telecommunications and cable TV industries developed as natural monopolies due to the high cost of the networks and the need to ensure universal service. This context has changed: new technologies have stimulated the growth of competitive service providers; the goal of universal access has been achieved; and global forces of deregulation and free trade have increased market demand for a wider range of competitive services and prices. Government policy and regulation have moved away from supporting monopolies toward greater reliance on market forces. This transition must be handled carefully, however, to ensure that the benefits of competition are in fact realized and that new monopolies do not result.

How quickly can pro-competitive policies be applied to all aspects of the infrastructure and services? Given the high cost of the advanced network infrastructure, can market forces alone ensure effective competition? How should the issue of market dominance

be dealt with in the transition to greater competition? Can different levels of competition be anticipated in urban and rural areas? Will regulation continue to be a long-term requirement in some services or geographic areas? Wireless technologies have great potential to contribute to network competition — how can this potential be realized?

The telecommunications, broadcasting, cable and satellite industries were established with different technologies to serve separate markets. They were subject to different degrees and types of government regulation and intervention. Cable firms, for example, cross-subsidize Canadian broadcasting and program production. In a more competitive environment characterized by a network of networks and converging technologies and services, line of business and cross ownership restrictions may no longer be appropriate.

What legislative, policy and regulatory changes are required to provide a forward-looking, integrated and market-oriented environment? How can we build enough flexibility into these frameworks so that they stay abreast of rapidly changing technologies? Can restrictions on cross-ownership and lines of business between telephone and cable companies be relaxed without undermining competition or cultural policies? Would full interconnection between cable TV and telephone networks produce overly complex and litigious rate structures designed to address various cross subsidies? To the extent that cable companies offer telecommunications services, should they be subject to the same non-discriminatory access obligations as common carriers? In a competitive environment, should these obligations be altered for common carriers? Video-

on-demand services may be an important economic driver for the deployment of advanced networks, yet it is unclear whether they would be subject to regulation under the *Broadcasting Act*. This ambiguity could stymie investment. Should government take the initiative in clarifying the status of video-on-demand?

Issue 3 — Should requirements for Canadian ownership and control of communications networks be reviewed?

The *Telecommunications Act* requires 80 percent Canadian ownership and control of facilities-based carriers. Draft regulations published in the *Canada Gazette* in July 1993 provide for investor corporations with at least two thirds Canadian ownership to be considered "Canadian," allowing carriers access to broader pools of capital. Broadcasting law and regulations impose a strict 80-percent Canadian ownership requirement on broadcasters and cable TV networks, with no flexibility for holding corporations.

It has been common practice in many countries to limit the foreign ownership of domestic telecommunications carriers and broadcasters. For example, the U.S. *Communications Act* requires companies using radio systems that provide telecommunications services to the public to have a minimum of 80-percent ownership by Americans. Japan has similar rules applicable to its major domestic and international carriers. Even developing countries anxious to obtain foreign financing for upgrading their telecommunications infrastructure usually insist on control, i.e., 51-percent ownership by domestic interests. In most countries, the major broadcasters are owned by the government, while those countries with private broadcasters usually prohibit or severely limit foreign ownership.

Full implementation of the Canadian information highway will require large investments. Should we continue to require that the majority of that investment be provided by Canadians? Foreign investors often provide advanced technology and services in addition to capital. Can the capital and organizational needs of developing advanced information networks be met within existing ownership rules, or should these restrictions be relaxed? Would the relaxation of domestic ownership rules open up new foreign markets for Canadians? Independent of the actual level of foreign investment permitted is the issue of standardizing the foreign ownership rules; i.e., would it be beneficial to have common Canadian ownership rules for telecommunications, broadcasting and cable TV companies?

Issue 4 — How quickly can Canadian industries move toward universal standards, and how should these standards be determined?

The adoption of universal technical standards will be a key element in ensuring the interconnection of existing and planned networks and the interoperability of information systems and services. By design, different networks have their own unique interfaces and standards. Interconnecting them in an equitable manner will require open standards (as opposed to proprietary standards) to ensure full interoperability. Technologies are being developed to connect the pieces of the information highway, to allow users the means to create information in text, graphics, video and sound,

to compress this information so that it will fit into smaller bandwidth transmission lines, to code, encrypt and store information, and to organize information for access and delivery. Open standards for these various networks and services will ensure interoperability.

Canadian businesses are creating hardware, software and services for both domestic and international networks, and must be involved in the standards-setting process. Canadian standards must be internationally compatible, but not simply through the passive acceptance of standards formulated elsewhere. In a free trade environment, standards are an important tool to foster domestic economic growth and to gain a share of world markets. Both the Canadian government and Canadian businesses need to take a more active stance in the development and exploitation of international standards.

The current processes for establishing technical standards are complex and involve several organizations at the national and international level. Given the limited resources available, should opportunities in the standards process be identified and targeted? How should priorities be established and how should Canadian participation be funded? How can Canadian involvement and influence in domestic and international standards fora be improved?

The present process for disseminating information on standards is inadequate since information is only readily available to firms which participate in the standards process. SMEs traditionally do not participate in these processes due to resource constraints and lack of knowledge that the process even exists.

Industry Canada, in collaboration with the Standards Council of Canada, is in the process of developing a database of standards information to address the needs of SMEs. Should more be done to improve the processes for disseminating information on standards and assisting in the exploitation of standards information in product design and development? Are we taking appropriate actions to ensure that SMEs in all regions of Canada are able to participate in and benefit from the standards process?

Technical standards can also advance public policy objectives, e.g., requiring television sets to include capability for closed captioning for the hearing impaired. Issues such as access for persons with disabilities and protection of personal privacy and security could be partially resolved by the setting of captioning standards for the hearing impaired and encryption standards for secured communications. How should the standards process be used to address these issues in a timely fashion? Should more effort be made to involve consumer and special interest groups in these and other standards processes?

Issue 5 — How can the federal government coordinate its activities with other governments?

Other levels of government in Canada are funding the development of a broad mix of research, education and community networks. In addition, several provinces have identified telecommunications as a key sector for economic growth, and some provincial initiatives are already under way. The federal and provincial governments need to work together to stimulate

industry investment and innovation, facilitate development and deployment of advanced applications, explore joint service delivery to businesses and the public as well as increase public awareness and the capacity to exploit these new tools. How can the two levels of government coordinate their strategies to reinforce initiatives and maximize the economic, social and cultural benefits for all regions of Canada?

Canada's information highway must be linked and integrated with the networks of our trading partners as part of a seamless, global information infrastructure. This global reach will allow businesses and individuals to access information, markets, clients and partners around the world. The strategy for the information highway must clearly address Canada's role within key international fora, such as the development of international standards, and determine how Canada should proceed in areas such as joint projects between countries, access to offshore technology by Canadian firms, and R&D collaboration with trading partners. A key concern will be to ensure that international strategies complement and support domestic policy developments in areas such as SMEs, R&D initiatives, and science and technology objectives.

4.2 Content on the Information Highway

Issue 6 — How should copyright and intellectual property issues be addressed?

Professionals in multimedia research, marketing and policy who attended the Multimedia Communications

Conference, hosted by the federal government and private industry in Banff in 1993, identified copyright as a critical issue affecting the development of new products and services for Canada's information highway. Content-based products and services such as books, computer programs, audiovisuals, sound recordings and databases will increasingly rely on electronic distribution channels to reach their markets.

Existing copyright law in Canada and internationally does not provide adequate protection in an electronic world in which intellectual property can be reduced to digital form to be used and reproduced, in whole or in part, in new and unintended ways. The new media environment is posing intellectual property questions that require review of the present copyright framework. This review would determine whether the present framework can be marginally amended or whether it needs to be fundamentally transformed.

Solving copyright policy issues is a time-consuming process for government and key stakeholders. It is very difficult to strike a balance between what often appears to be uncompromising interests. This balance is crucial, however, in an economy increasingly based on knowledge and information. Creators' rights for authorizing the use of their works and obtaining fair compensation must be ensured as well as providing businesses and the public with reasonable access to these works.

Furthermore, international obligations are such that an entirely new policy framework would need to be supported at the World Intellectual Property Organization (WIPO) and at the General

Agreement on Tariffs and Trade (GATT), which administer international instruments regulating copyright and neighbouring rights. Outstanding questions relate to the varying regimes in copyright and neighbouring rights legislation, which are defined according to traditionally distinct types of works, for example, books, musical scores, films and videos, live and recorded performances. All these works and the information they contain potentially will be easily accessed and amended as a result of digitization of information and increased interactivity. What should be Canada's position with respect to various international conventions?

Should a multimedia work be defined as a distinct category of work for the purposes of copyright legislation? Who would then be the "creator" of the work: the producer or the "multimedia maker"? Are new additional rights such as display rights required to cover such features as the "look and feel" of software-based products? More fundamentally, are commercial contractual arrangements, as opposed to arrangements imposed by legislation, sufficient to protect rights holders and avoid unnecessary litigation?

Are present mechanisms for rights clearance and their remuneration adaptable to growing multimedia markets as creators of new multimedia works wish to use previously existing works? For example, should there be, for these instances, mandatory clearing systems, collectives and rights registries, to facilitate business activity for electronic suppliers and distributors? What mechanisms should be in place for payment by end users? How should moral rights, which allow creators to protect their works' integrity, be managed once a work is distributed throughout the system?

Also, is there a need to review exceptions to copyright related to the use of electronic data in schools, libraries, and on-line and CD–ROM-based media? How should we address concerns about Canada's deficit in royalty payments to foreigners?

Issue 7 — What measures are needed to support Canadian cultural and other content-based products and services?

Traditionally, the creation and exhibition of Canadian cultural products has been supported through a wide range of measures, including restrictions on foreign ownership, public funding to support production, tax measures and regulations such as content quotas in broadcasting. Governments and regulators in Mexico and some European countries have adopted similar measures; the United States opposes them vigorously. As digitization and global networks erode the boundaries between formerly distinct types of media (audio, video, data and publishing) and distribution systems (broadcast, telecommunications, cinemas and book stores), traditional cultural policy measures may no longer be workable. The government, however, is committed to reinforcing Canadian sovereignty and cultural identity.

What are the implications of the information highway for Canada's cultural industries and artists? How can long-standing policies aimed at fostering the creation, exhibition, distribution and export of Canadian cultural content in broadcasting, publishing, sound recording, and film and video production be adapted to the new environment? Will new measures be required, for example, to support digitization of current content holdings? Should support for

domestic production be extended to other categories of content-based services, such as databases and software used by schools, hospitals and other public institutions?

To what extent can market forces provide news, information, entertainment and other content-based services with a Canadian focus and perspective? Is the Canadian market large enough and willing to support domestic production in all categories of content services? To what extent is increasing reliance on foreign cultural and information-based products and services acceptable to Canadian consumers, businesses and educators? Can we take advantage of electronic networks to expand domestic and export markets for Canadian cultural and information products? What joint alliances with international partners should be undertaken to produce content that would be more economical and more widely marketable?

Issue 8 — What controls, if any, should be placed on the information that is put on the network?

Canada is a democratic society that tolerates diversity of expression. Nonetheless, some forms of expression are considered illegal or obscene under the *Criminal Code*. Distributors of such materials can be prosecuted, and customs measures prohibit their entry into Canada. Similarly, provincial legislation protects children from violent and sexually explicit material through labelling or display requirements, and broadcasting regulation has begun to deal with public concerns about excessive violence in programming. Pornographic, obscene and hate-mongering materials have already begun to appear in various computerized and electronic forms,

such as on electronic bulletin boards. In this form, they are much easier to obtain but are more difficult to monitor and take action against.

Should there be a gatekeeping function to control what is available on the information highway? Is this possible in a world where anyone with a video camera, a personal computer and a modem can become a movie producer and distributor? Is censorship compatible with freedom of speech and freedom of association? Who should carry out the gatekeeping role, if required, — the networks, a regulatory agency, user-controlled technologies, or all three? What is the appropriate role of government in this area? How can Canadian solutions to these problems be harmonized with actions taken by other countries? Are there effective technical screening solutions for users that will allow them to control reception of undesirable content? Should we pursue the development of technologies that could trace the authors of illegal content?

Beyond the issue of censorship, there is the question of whether or not the carriers or network providers should be able to control or influence the information or services carried over the infrastructure. Should single companies be allowed to control both infrastructure and content, or will this restrict freedom of choice by users as well as access to the networks by competing content providers?

Judging from the extensive use made of the Internet and similar systems for personal communication and discussion groups, the rising use of electronic bulletin boards, as well as the rapid deployment of electronic mail and messaging systems, it is obvious that users value the ability to converse freely with each other.

Are measures required to ensure that the information highway meets these needs, rather than simply providing newer and more powerful channels for electronic consumption of commercial goods and services? Should the network of networks be deliberately designed to provide a public space for information sharing, public debate and electronic democracy? How can the government ensure that citizens have access to the tools and knowledge they need to use the networks as producers as well as consumers?

Issue 9 — How can the information highway be used to improve government services to the public?

The federal government is the largest collector and distributor of information in Canada. How can the information highway best be used to improve public access to information collected by government? The recent budget, for example, noted the difficulties of small businesses in easily accessing the programs, services and other forms of assistance available to them, and announced the opening of new Canada Business Service Centres. How can the information highway improve access to the immense store of information and programs useful to the small-business community?

In 1991, Canada spent some $67 billion on health care and $53 billion on education. Many observers claim that significant savings (and improved quality of service) are possible in both areas through the use of information and communication technologies. For instance, Stentor, a partnership of Canada's major telecommunications companies, estimates that health care

applications could reduce costs by some $6 billion. Should governments take a more active role in financing the development and deployment of applications or services in areas of their responsibility such as health, education and training?

Issue 10 — How can the personal privacy and security of information be protected?

Governments, public institutions and businesses already gather, store and transmit vast amounts of personal and business-related information electronically. Interconnection of networks will increase the amount of information — such as electronic transactions, credit ratings, financial accounts, educational records, and medical and driving records — that can be assembled and collated into comprehensive profiles of individuals or companies. These records can be sent across national borders, resold or reused, or integrated with other databases without consent or remuneration, for purposes unrelated to those for which the data were originally collected. The ability to access, update, alter, repackage and resell information can benefit individuals as well as firms, and create new employment opportunities. On the other hand, public concern about privacy protection is growing, as are business and government concerns over the security of sensitive information.

Does government need to take stronger measures to protect the privacy and security of information? Are stronger measures needed to protect personal data in the private sector, or can we continue to rely on voluntary compliance to protection guidelines? Is a uniform national level of privacy protection needed to cover all types of personal information flowing on the network? Do

we understand exactly what information privacy means to various users of the network, and agree on what level of privacy is required for different tasks? How can the government ensure that Canadian privacy protection standards meet international norms? Failure to meet these norms can restrict Canada's trade with these countries and can result in transborder data blockages.

Should one of the factors influencing the choice of technologies and standards for the information highway be the implications for privacy protection or erosion? Are there affordable technical solutions that would protect the privacy of individuals? Who should pay for improved privacy protection — network or service suppliers, or individual citizens? Will governments need to intervene to regulate the use of electronic surveillance and the subsequent or third-party use of transactional data generated by use of credit cards and government services? What measures should be adopted to ensure the security, reliability and integrity of the information highway network? What kind of encryption protection should be provided and who should pay for it?

4.3 Benefits of the Information Highway

Issue 11 — How can we ensure that Canadian information industries take full advantage of the R&D and technological development opportunities presented by the information highway?

The process of innovation is a long and expensive one, stretching from basic and applied R&D, through the assembly and demonstration of prototypes and market testing, to final production. In Canada, this process is primarily funded by the private sector, although the government plays an important role by providing a positive environment, some funding of strategic R&D and the transfer of technology from government research labs. Many of our competitor nations have launched large-scale programs to support advanced research and stimulate the development of new products and services. How can Canadian industry be encouraged to develop information-based products and services on a timely basis?

The scale and scope of the purchasing power of all levels of government can also be a powerful stimulus in both the deployment of advanced networks and the development of new products and services. For example, the New Brunswick government is stimulating private sector development by acting as a catalyst and model user/customer of information highway applications. The federal government alone spends $2 billion each year to procure information technology goods and services. Can and should government purchasing and investment in the development of public sector applications be targeted to stimulate and accelerate private sector innovation and product development in Canada? If yes, how should this be done? A transparent, open and nation-wide electronic procurement information system, for all levels of government, could open up market opportunities to Canadian industries, big and small, and help eliminate interprovincial trade barriers. Should the government make the establishment of such a procurement system a priority?

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Issue 12 — How can the information highway best be used to improve the growth and competitiveness of all Canadian businesses, especially SMEs, throughout Canada?

The Canadian information and communications infrastructure will have a profound impact on how Canadian businesses organize and operate. A recent Statistics Canada study, for example, demonstrated that the implementation of technologies such as electronic data interchange, just-in-time inventory systems and statistical process control was the leading management strategy for successful SMEs in Canada. Many legislative provisions state that commercial arrangements are invalid, unenforceable or not admissible as evidence unless documented in writing bearing the signature of the parties. How can the concept of personal signature be updated for the digital world? Are legislative and regulatory amendments required to remove impediments to electronic commerce by businesses and governments? What other measures are needed to encourage electronic commerce? How can Canada harmonize its efforts with those of other countries?

A recent issue of *The World Competitiveness Report*, published annually by IMD in Lausanne, Switzerland, points to poor Canadian performance in applying new technologies to streamline work and develop new products and services. The budget noted that Canadian companies, particularly small businesses, have not integrated leading technologies as rapidly as their competitors abroad. Are Canadian businesses sufficiently aware of opportunities to improve competitiveness through new technologies? Should more be done to improve industry and institutional awareness and use

of, as well as benefit from, these technologies? Are technology-transfer mechanisms sufficient? Are incentives of some kind required to encourage and assist Canadian industries to make more use of these technologies? Should the tax treatment of capital depreciation be enhanced to speed the deployment of new technologies?

Are special measures needed to assist SMEs? What else must be done to encourage Canadian business and industry to exploit enabling information and communications technologies? How can the information highway be used to put businesses in smaller cities and in rural Canada on a more equal footing with their counterparts in major centres?

Issue 13 — How can Canadians be assured of universal access to essential services at reasonable cost?

Public policy has long sought to ensure that all Canadians, regardless of their income or place of residence, along with schools, universities, hospitals and research institutions, have access to basic telephone services. Universal access has been supported through cross-subsidies from long-distance to local services. In a competitive environment, prices move toward the cost of providing services, and there will be increased pressure to reduce or eliminate cross-subsidies. As new and enhanced services are introduced, the widest possible customer base will be increasingly necessary for the viability of electronic delivery of commercial and essential public services. The information highway system will play a critical role in employment, economic and social well-being, and the exercise of democratic

values and citizenship. Without appropriate public policies, we run the risk of creating classes of information "haves" and "have-nots," with potentially serious downstream implications.

How far should the concept of basic telephone service be broadened to include new types of services? Who should determine the range of essential services to which all Canadians should have access? How can we ensure that all Canadians continue to have access to their government and its services as we move toward electronic delivery? What measures will be needed to ensure that all Canadians, including those in remote communities, Canadians with disabilities, those who are functionally illiterate, new Canadians and other groups with special needs, have access to an adequate range of services? Should the government play a role in establishing and/or promoting pilot networks — for example, community or specialized networks? Should pricing structures be designed to ensure access by individuals and public institutions? Will there be a continuing need for subsidies — as income supports, rate subsidies or some combination of measures — to ensure that basic services are affordable?

Issue 14 — What consumer awareness and learning opportunities should be provided to enable Canadians to be effective users of the information highway?

In the information society, success in school, the workplace, and everyday life will depend on learning new and more efficient ways to rapidly access a variety of information- and knowledge-based resources. The information highway will stimulate the development of an enor-

mous range of education, training and lifelong learning applications that will provide access to courses, libraries, museums, specialized databases and other people, regardless of location. Users will need to understand how to access and use the information highway effectively if they are to derive the full benefit of these services.

How will Canadian consumers and small businesses be encouraged to explore the opportunities that the information highway will present? How will they be guided in making choices and navigating among the many possibilities offered? Are public awareness and training programs needed? In effect, do we need the equivalent of drivers' education courses to learn how to navigate the information highway? If so, who should pay for these? Who should be responsible for designing and delivering these programs? What vehicles should be used to provide this training — schools, libraries, community centres or community television channels? Are other vehicles needed to meet the needs of small businesses, new Canadians, the elderly, Canadians with disabilities, those in remote communities, or other groups? In view of emerging personal and mobile communications services, users will likely need assistance in directory services to easily find correspondents' addresses. How can we best develop familiarity and confidence so that all Canadians take advantage of the opportunities for learning, working, creating new jobs and interacting on new economic, social and cultural levels?

Issue 15 — What opportunities does the information highway present to improve government operations?

In an environment of continuing financial restraint, the re-engineering of government operations through the application of communications and information technologies has become a priority. The Treasury Board of Canada Secretariat has published a discussion paper titled "Blueprint for Renewing Government Services Using Information Technology," which describes an integrated approach to the delivery of government services while significantly reducing associated costs. The approach proposed builds on the experience gained from program renewal projects under way at agencies such as Revenue Canada, Health Canada, Human Resources Development Canada, Public Works and Government Services Canada, as well as from the work of the Council for Administrative Renewal. How can this federal government infrastructure be made an important component of the Canadian information highway?

The federal government will explore cost-effective, innovative means to meet its infrastructure needs, such as making use of available systems and forming partnerships with the private sector and other levels of government, rather than relying on unique and custom-tailored in-house solutions. What steps should be taken to make government a more sophisticated and effective user of these technologies, products, services and networks? How can the private sector take advantage of this situation to develop products, services and solutions that, while meeting the needs of the federal government, can also be sold to other customers?

5 The Road Ahead

The Canadian information highway is now a work in progress. Actions being taken on a day-to-day basis are influencing its development. The private sector continues to invest in new technologies, deploying advanced networks and developing innovative products and services. Businesses and consumers continue to seek and demand new choices, lower prices and greater performance.

The federal government is also a key player. It is responsible for a number of important legislative, policy and regulatory instruments that will influence the development of communications systems in Canada. Government R&D activities are contributing to the emergence of new technologies, applications and services, and will continue to do so. The federal government is a major user of telecommunications and information products and services, whose needs can, and do, generate substantial business.

Many of the questions raised in this paper are being confronted now, but they will evolve as advanced networks and new products and services are introduced. Our answers must therefore be flexible enough to remain relevant over the longer term. These public policy issues are too important to be left to any single organization or narrow set of interests. They are also too important to go unanswered for long.

The Canadian information highway can only be achieved collaboratively through the informed participation of all stakeholders and the coordinated investment of our collective resources. It is time to start the process of study and consultation with other levels of government; with the industries that will build the information highway system; with those who provide the content it will carry; and with the businesses, hospitals, schools, libraries and individuals who will benefit from its availability.

With this purpose in mind, the Minister of Industry has established an Advisory Council representing industry, labour, consumer and public interest groups. The Advisory Council will make recommendations to the Minister of Industry on a national strategy to govern the evolution of Canada's advanced information and communications infrastructure respecting the overall social and economic goals of the federal government.