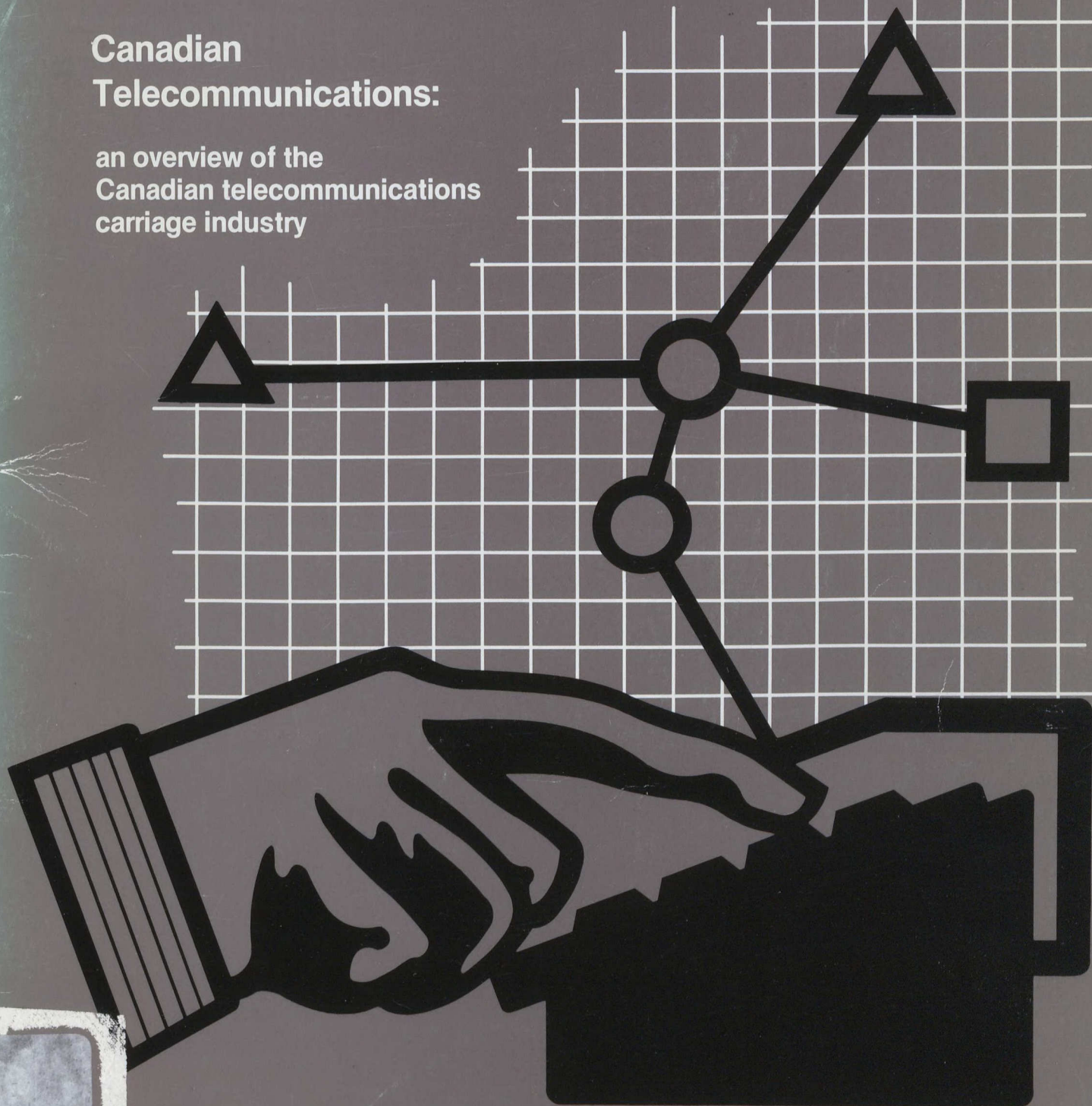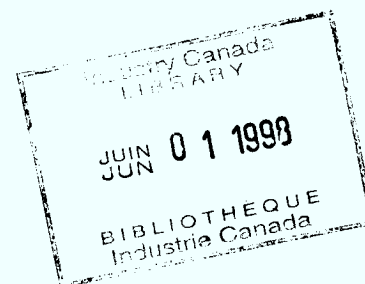Communications
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Telecommunications:

an overview of the
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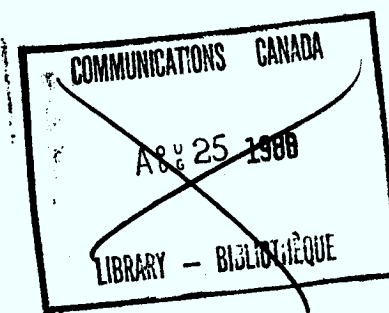
Canada

CANADIAN TELECOMMUNICATIONS:

AN OVERVIEW OF THE CANADIAN TELECOMMUNICATIONS CARRIAGE INDUSTRY

Prepared by

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Communications Canada

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TABLE OF CONTENTS

INTRODUCTION

The industrial and regulatory structures for telecommunications in Canada differ significantly from those situations found in many other countries. Canada presents a complex mixture of federal and provincial legislation, policies and regulation. Unlike the practice in the many countries where there is a state-controlled Post, Telephone and Telegraph (PTT) organization, the Canadian telecommunications carriage industry consists of a mixture of private, governmental and joint private-governmental corporations and organizations. These are generally each regulated by a single federal or provincial regulatory agency.

This paper describes Canada's complex industry and regulatory structure. Chapter 1 outlines the industry structure and is followed, in Chapter 2, by a description of the principal categories and characteristics of telecommunications services. Chapter 3 describes the telecommunications regulatory structure, and Chapter 4 outlines current initiatives.

1. INDUSTRY STRUCTURE

Historical development

Telegraph companies

In 1846 the first telegram in Canada was sent from Toronto City
Hall by the mayor to his counterpart in Hamilton. The formation and
incorporation of telegraph companies took place rapidly in Canada after
this event, following the pattern of many fledgling industries;
companies were started to serve small areas and, as districts began to
overlap, amalgamations occurred. The first large scale commercial
telegraph company was the Montréal Telegraph Company. Incorporated in
1847, it had before the end of the year completed a line from Toronto
to Montréal and east to Québec. In 1868, the Dominion Telegraph
Company was formed and soon had lines to all important points between
Detroit and Québec. It became the chief competitor of the Montréal
company and by 1880 had approximately 14 000 km of wire. In 1881, the
two companies merged to form the Great North Western Telegraph Company
of Canada, a subsidiary of the U.S.-based Western Union, connecting
important points between Toronto, Detroit, Buffalo, Québec and the
Maritimes.

Another major telegraph company was Canadian Pacific Railway
Telegraphs. It was officially formed in 1886, though it had been
partially operational for the previous five years. Upon completion of
the company's transcontinental railway system in 1885, the first all-
Canadian telegraph service was established from the Atlantic to the
Pacific oceans. Until that time, all telegrams between eastern Canada
and British Columbia had been transmitted through the United States.

By 1915, there were three main telegraph companies operating in Canada: Canadian Northern (which had acquired control of the Great North Western), Grand Trunk Pacific Telegraph Company and Canadian Pacific. At the end of the World War I, the various railway companies that controlled the main telegraph services in Canada found themselves in serious financial difficulties. In 1920, the federal government took over the Canadian Northern and the Grand Trunk Pacific railways. Thus, on January 1, 1921, Canadian National Telegraphs was born and charged with providing all necessary railway communication required by the newly formed Canadian National Railway system as well as a public telegraph service. In 1928, the Grand Trunk Pacific Telegraph Company (previously operated independently) merged with Canadian National and, the following year, the federal government acquired control over the complete land mileage of the Western Union in the Maritime Provinces. Thus, as Canada entered the 1930s, it was principally served by two telegraph systems, operated by Canadian National and Canadian Pacific.

Gradually, Canada's telegraph companies began to provide specialized telecommunications services in addition to telegram service. The first coast-to-coast transmission of a commercial radio broadcast was made over Canadian National lines in 1925. On July 1, 1927, Canadian Pacific provided more than 2900 km of transmission circuits for the Jubilee of Confederation broadcast. In 1932, Canadian National and Canadian Pacific jointly secured the National Network Contract for the Canadian Radio Commission. This network was the beginning of what is now the national broadcasting system operated by the Canadian Broadcasting Corporation.

By 1937, Canadian Pacific was providing network facilities and equipment for the dissemination of weather information in western Canada. This network was later joined to facilities provided by Canadian National in the east, so that by 1939, the first nation-wide

weather gathering and dissemination service was being provided for the federal government over the facilities of Canadian National and Canadian Pacific. Three years later the railway companies were asked by the government to provide Canada-wide voice communications systems for air traffic control.

At the end of the World War II, the Department of Transport acquired the 2700 km Northwest Communications System, a major trunk line that connected the Alberta Government Telephones network with Alaska; it had been constructed by the U.S. government in 1943 as part of a defence system for North America. In 1946, the Department of Transport, on behalf of the Canadian Government, entrusted this system to Canadian National to maintain, operate and, if necessary, expand. From this beginning of its activities in the north, Canadian National expanded its operations to the point where, through its subsidiary NorthwesTel, it now provides a full range of modern telephone and other telecommunications services in Canada's northwest, including northern British Columbia, the Yukon and the western portion of the Northwest Territories.

When Newfoundland became Canada's tenth province in 1949, the federal government entrusted Canadian National with the operation of communications services previously provided by the Newfoundland Post and Telegraphs. This included not only telegram service but also public telephone service in much of rural Newfoundland. Telecommunications services are still provided today in much of Newfoundland by Canadian National's subsidiary, Terra Nova Telecommunications.

In 1947, Canadian National Telegraphs and Canadian Pacific Telegraphs began joint operations in the provision of private wire services. This was a first step towards formation of today's CNCP Telecommunications, a partnership of the Telecommunications Divisions

of Canadian National Railways and Canadian Pacific Ltd. After 1947, the associated Canadian National/Canadian Pacific Telegraphs increasingly pooled their resources in developing business communications services: in 1956 CNCP introduced Telex to North America; in 1964, it completed its microwave network across Canada. Today CNCP is becoming an industry leader in the development and application of fibre-optic technology and digital switching and transmission capability for inter-city telecommunications. As a national facilities-based telecommunications carrier, CNCP provides a wide range of business services in the competitive segment of the market, offering services directly to customers and leasing channels to other service providers and high-volume users.

Telephone companies

The development of Canada's telephone networks can be traced back directly to the work of both Alexander Graham Bell, inventor of the telephone, and Guglielmo Marconi, the inventor of radio. Bell invented the telephone near Brantford, Ontario, in 1874. Two years later, the world's first "long-distance call" was made from Brantford to Paris, Ontario, over 16 km of telegraph company lines. In 1901, Marconi received the first transatlantic radio signal, which was transmitted from England and received at Signal Hill in St. John's, Newfoundland.

The Bell Telephone Company of Canada was founded in 1880. Although the company was chartered to provide telephone service to the whole of Canada, the geographic and economic problems associated with establishing a Canada-wide telephone system proved to be too difficult for the newly formed company. From the beginning, therefore, other companies served British Columbia. Furthermore, during the 1880s, local interests purchased the Bell facilities in Prince Edward Island, Nova Scotia and New Brunswick. In the Prairies, populist movements in

the early 1900s fostered the establishment of provincial government
telephone systems in Manitoba, Saskatchewan and Alberta, which acquired
Bell's existing facilities in these provinces.

Because of the harsh climate, small and scattered population, vast
distances and difficult terrain, interconnection between the various
independent telephone systems in Canada posed many problems. In 1921
the Telephone Association of Canada was organized, and its technical
committees began to explore the problems of developing a national
telephone system. At that time many long-distance calls between
Canadian cities were routed through the more advanced American
telephone systems at various border crossing points because of the
lack of trans-Canadian long-distance circuits.

During the late 1920s, the Telephone Association of Canada decided
to construct an all-Canadian network from coast to coast. An all-
Canadian line linking Montréal and Winnipeg was completed in 1928, and
in 1931, the TransCanada Telephone System (TCTS) was formed to develop
and maintain a Canadian transcontinental long-distance telephone
network. The network was completed before the end of 1931 and
inaugurated in January 1932. In September 1983, TCTS changed its name
to Telecom Canada.

The original members of Telecom Canada were: Maritime Telegraph
and Telephone Company Limited (Maritime Tel & Tel), The New Brunswick
Telephone Company Limited (NB Tel), The Bell Telephone Company of
Canada (later Bell Canada); Manitoba Government Telephones (later
Manitoba Telephone System, MTS); Saskatchewan Government Telephones
(later Saskatchewan Telecommunications, SaskTel); Alberta Government
Telephones (AGT); and British Columbia Telephone Company (B.C. Tel).
Since 1931, three other companies have become members of Telecom
Canada: Avalon Telephone Company (later Newfoundland Telephone Company

Limited) in 1957; The Island Telephone Company Limited of Prince Edward Island (Island Tel) in 1975; and Telesat Canada in 1977.

After World War II, the Canadian economy prospered and telecommunications technology progressed at an unprecedented rate. Until the 1950s, microwave radio had been used experimentally for short distances but had not been tested over long distances. Then, in 1958, Telecom Canada inaugurated a 139-station trans-Canada microwave system. At the time, it was the world's longest system, extending from Sydney, Nova Scotia to Victoria, British Columbia -- a distance of approximately 5400 km. Today this system is the backbone of Telecom Canada's network.

During the 1950s, Bell Canada also completed the first tropospheric scatter system in the world, to serve parts of the eastern Arctic. Such systems bounce radio signals off the troposphere over distances of up to 300 km and still form part of the NorthwesTel network. However, the Bell Canada eastern Arctic system was taken out of service in 1972, when it was replaced by satellite communications.

The next important step was the introduction of communications satellite technology. Operating like microwave towers in the sky, satellites transmit telephone, teletype, data, radio and television signals across the country and are especially suitable for providing telecommunications services to remote settlements. In order to introduce satellite technology into the domestic telecommunications system, Telesat Canada, the national satellite carrier, was incorporated in 1969. Jointly owned by the federal government and the major telecommunications carriers, Telesat became a member of Telecom Canada in 1977. The company's satellites and earth stations now form a significant part of the national telecommunications system.

International telecommunications

International telecommunications services to and from Canada can be divided into (a) continental and (b) overseas services. Since the early days of telephony, connections to U.S. points have been provided by means of technical and operating agreements between Canadian telephone companies and their U.S. counterparts. Through these industry arrangements, the North American telephone network is jointly planned and maintained, allowing for the regular interchange of traffic between the two countries.

The development of Canada-overseas telecommunications services has also involved a high degree of planning. Telephone service between Canada and the United Kingdom was inaugurated in 1927 by a conversation between Prime Minister Stanley Baldwin in London and Prime Minister Mackenzie King in Ottawa. This service was routed through New York, but by 1933, a direct channel between Montréal and London provided service to Europe, Asia, Africa and Australia. Service to and from ships at sea had been inaugurated in 1929. A regular radiotelephone service was established between the Canadian mainland and Newfoundland in 1938, and in 1945 the Canada-Barbados service was inaugurated. In 1953, negotiations were completed for installation of the first transatlantic cable under the sponsorship of the Canadian Overseas Telecommunications Corporation (now Teleglobe Canada), the American Telephone and Telegraph Company and the British Post Office (now British Telecom). Several other undersea cables were laid later. Spanning the Atlantic and Pacific oceans, they provided an international network of channels, so that by the late 1960s, it was possible for Canadians to telephone virtually any other country in the world.

Teleglobe Canada, known until 1975 as the Canadian Overseas Telecommunications Corporation, was formed in 1949 to comply with the 1948 Commonwealth Telegraphs Agreement, whereby each signatory government agreed that external telecommunications operations would be acquired by a government department or a public corporation representing its government as the "National Body" at meetings of the Commonwealth Telecommunications Board. Formerly owned by the federal government, Teleglobe Canada was sold to Memotec Data Inc. of Montréal in March 1987. New legislation authorizing the reorganization and divestiture of Teleglobe and placing the company under the regulatory authority of the CRTC received Royal Assent on March 31, 1987.

Telecommunications carriers

The historic separation between telegraph and telephone networks has continued to the present, with the result that, in Canada, there are now two national telecommunications systems, Telecom Canada and CNCP Telecommunications (CNCP). Telesat Canada, while a member of Telecom Canada, is also emerging as a third network for certain services. Together, these groups account for approximately 90 percent of the $12 billion telecommunications carriage market. Selected statistics on the telecommunications carriage market are shown in Appendix A.

Telecom Canada is an unincorporated association of the largest telephone company operating in each province plus Telesat Canada, the domestic satellite carrier. Thus, the member companies of Telecom Canada are:

British Columbia Telephone Company (B.C. Tel)
AGT (Alberta Government Telephones)
SaskTel (Saskatchewan Telecommunications)

Manitoba Telephone System (MTS)

Bell Canada

The New Brunswick Telephone Company Limited (NB Tel)

Maritime Telegraph and Telephone Company Limited
  (Maritime Tel & Tel)

The Island Telephone Company Limited (Island Tel)

Newfoundland Telephone Company Limited (Newfoundland Telephone)

Telesat Canada.

In addition, Québec-Téléphone is an associate member of Telecom Canada.

Almost all Canadian telecommunications carriers are majority owned by Canadian interests, either investors or governments. Each of the principal telephone companies in the Prairie provinces (AGT, SaskTel and the Manitoba Telephone System) is owned by the respective provincial governments. All other members of Telecom Canada, except Telesat, are privately owned. Bell Canada, which operates in Ontario and Quebec, is the largest member of Telecom Canada, with 60.8 percent of lines served by Telecom Canada member companies. As a result of a major reorganization in April 1983, it is now a wholly-owned subsidiary of BCE Inc. which, in turn, is owned by a large number of mainly Canadian shareholders. BCE has significant direct and indirect equity interests in the principal telephone companies in each of the Atlantic provinces -- New Brunswick, Nova Scotia, Prince Edward Island and Newfoundland. Newfoundland Telephone and NB Tel followed suit with corporate reorganizations in 1985. Provincially-owned telephone companies have also established subsidiaries to pursue international consulting and other opportunities. B.C. Tel, the second largest telephone company in the country, with approximately 13.2 percent of Telecom Canada lines, is controlled by Anglo Canadian Telephone Company of Montréal, a subsidiary of U.S.-based GTE Corporation.

Telesat Canada is jointly owned by the federal government and the major common carriers.

In addition to the Telecom Canada member companies, there are over 95 other, generally smaller, telephone systems. The largest of the non-Telecom Canada companies are: 'edmonton telephones' and the Thunder Bay Telephone System, both municipally owned; Québec-Téléphone, controlled by Anglo Canadian Telephone Company of Montréal, a subsidiary of U.S.-based GTE Corporation; Télébec Ltée and Northern Telephone, both subsidiaries of BCE; and NorthwesTel and Terra Nova Telecommunications, both owned by Canadian National Railways, a federal Crown corporation.

CNCP Telecommunications is a partnership of the telecommunications divisions of the major Canadian railways, Canadian National Railways and privately owned Canadian Pacific Ltd.

Teleglobe Canada provides Canada's overseas telecommunications services. In accordance with its legislative mandate, Teleglobe provides facilities or otherwise arranges for the carriage of telecommunications services between Canada and overseas points, including the provision of private switched networks and leased circuits. In addition, Teleglobe is Canada's representative in the Commonwealth Telecommunications Organization, the International Telecommunications Satellite Organization (INTELSAT) and the International Maritime Satellite Organization (INMARSAT).

Cellular mobile telephone service is provided on a competitive basis by the telephone companies and Cantel Inc., whose system is interconnected with the telephone networks in many areas of Canada. (For further information on cellular mobile radio, see page 46.)

In addition to the foregoing telecommunications common carriers, there are more than 200 radio common carriers in Canada, which provide various mobile radio and radio-paging services across the country, primarily in urban areas, in competition with telephone companies. Their combined annual revenue is estimated to be about $200 million. Although their rates are not regulated, the interconnection of radio common carrier systems with telephone networks falls under the jurisdiction of the respective telephone company regulatory agencies. Generally, up to the present time, interconnection has been permitted for one-way paging systems. Interconnection of conventional two-way mobile radio systems is permitted in federally-regulated areas.

There are also approximately 900 cable television systems operating in Canada, which had operating revenues of $763 million in 1986. These systems served more than 6 million subscribers in 1986, or nearly 64 percent of the total television households in the country. Although the main business of cable companies is the distribution of television and radio programming, they are also competing with telecommunications carriers in the provision of special services, such as monitoring of fire and burglar alarms.

The Canadian telecommunications carriage industry has close links with a strong domestic telecommunications manufacturing and research capability. The BCE group of companies includes Northern Telecom Ltd., a major telecommunications equipment manufacturer, and Bell-Northern Research, the largest private industrial R&D organization in Canada. Similarly, B.C. Tel is affiliated with Microtel Ltd. and Microtel Pacific Research. Although most telecommunications research in Canada is undertaken by the private sector, Communications Canada operates the internationally renowned Communications Research Centre (CRC) based at Shirleys Bay near Ottawa, as well as the Canadian Workplace Automation

Research Centre (CWARC), situated at Laval, Quebec, which has the mission of helping people adjust to new office technologies.
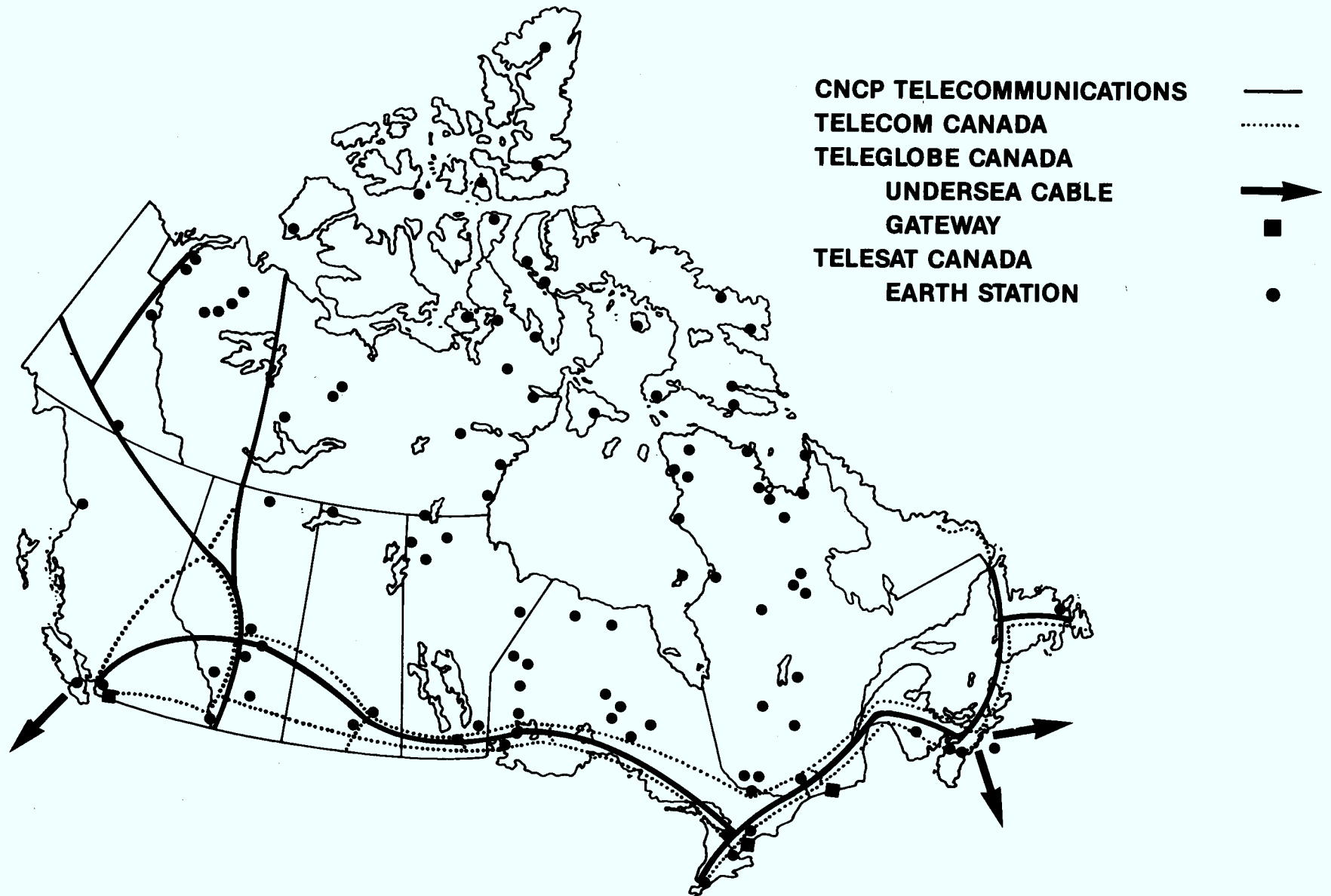
Carrier facilities and networks

The member companies of Telecom Canada provide telecommunications services to Canadians through a variety of transmission facilities. Long-distance traffic is carried both interprovincially and across the country on two coast-to-coast microwave routes, through Telesat Canada's satellite and earth station network and through traditional coaxial cable. Both Telecom Canada and CNCP are converting existing analogue networks to digital ones and are increasing their use of inter-city fibre-optic systems. The member companies of Telecom Canada are building a 7000 km fibre-optic network that will reach from Halifax to Vancouver and which will be fully operational by the end of this decade. Fibre-optic systems are also being developed at the provincial level. For example, in early 1984, SaskTel inaugurated its own fibre-optic network which connects all Saskatchewan cities and 40 of the province's largest towns.

CNCP operates its own national microwave relay system and switching centres but generally leases local loops from local telephone companies. Furthermore, CNCP has been granted interconnection to the local exchange facilities of Bell Canada and B.C. Tel, permitting CNCP customers dial access through the public telephone network to certain CNCP competitive data and voice services. CNCP was the first national carrier in Canada to use fibre optics for a long-distance, high capacity network, linking Montréal, Ottawa, and Kitchener, and extending to Windsor by the end of 1987. The fibre-optic network section between Edmonton and Vancouver is also under construction.

Canada-overseas traffic is delivered by Canadian domestic carriers to international gateway switches operated by Teleglobe Canada in Montréal, Toronto and Vancouver, where it is routed internationally by means of transoceanic cable or INTELSAT satellites. Major Canadian network facilities are shown on Chart 1.

MAJOR NETWORK FACILITIES

CNCP TELECOMMUNICATIONS
TELECOM CANADA
TELEGLOBE CANADA
    UNDERSEA CABLE
    GATEWAY
TELESAT CANADA
    EARTH STATION

2. SERVICES

Overview

An overview of the types of services provided by the different Canadian carrier groups is shown in Table 1.

TABLE 1

OVERVIEW OF TELECOMMUNICATIONS SERVICES

Service category	Carriers
A. Voice telephony — Public switched telephone services	Telecom Canada and other telephone companies.
A. Voice telephony — Leased circuits (private lines)	Telecom Canada, other telephone companies and CNCP.
B. Non-voice services — Data — Public switched data services	Telecom Canada, CNCP and certain other telephone companies.
B. Non-voice services — Data — Leased circuits (private lines)	Telecom Canada, CNCP and certain other telephone companies.
B. Non-voice services — Switched teleprinter and other text	CNCP, Telecom Canada and certain other telephone companies.
B. Non-voice services — Public message (telegram)	CNCP.
B. Non-voice services — Program transmission (audio and video)	Telecom Canada, CNCP and certain other telephone companies.

Services in these various categories are classified as "enhanced" if they provide more than a basic transmission capacity for the movement of information.

The telephone companies have a monopoly on switched public voice telephone in their respective operating territories. CNCP has a monopoly in the provision of public message (telegram) services. In all other service categories, there are varying degrees of competition between Telecom Canada and CNCP. The provision of Canada-overseas telecommunications facilities and services is the responsibility of Teleglobe Canada. Table 2 summarizes the principal data networks and services in Canada.

TABLE 2

DATA NETWORKS AND SERVICES

Service	Switched or non-switched	Speed range	Major carrier
Direct Distance Dialing Network*	Cct** switched	up to 1200 bps async up to 2400 bps sync	Telecom Canada members
Telex	Cct switched	50 baud	CNCP
TWX	Cct switched	up to 110 baud	Telecom Canada members
Data Telex	Cct switched	up to 180 baud	CNCP
International Telex (including TWX)	Cct switched	50 baud	Teleglobe Canada

*   Although intended as a public switched voice network, the direct Distance Dialing Network is also used extensively for transmission of data.

** "Cct" represents "Circuit."

TABLE 2 CONTINUED: DATA NETWORKS AND SERVICES

Service	Switched or non-switched	Speed range	Major carrier
Multicom I	Cct switched	full range	Telecom Canada members
Broadband Exchange	Cct switched	up to 56 kbps	CNCP
International Datel 600	Cct switched	600 bps	Teleglobe Canada
Globedat	Packet or cct switched	2400 to 9600 bps sync	Teleglobe Canada
Telenet	Message switched	full range	CNCP
Autocom II	Message switched	up to 300 baud	Teleglobe Canada
Infodat	Non-switched digital	up to 56 kbps	CNCP
Securnet	Packet switched	up to 64 kbps	CNCP
Dataroute, Dataroute Multistream & Dataroute International	Non-switched digital	full range	Telecom Canada members
Datalink	Cct-switched digital	full range	Telecom Canada members
Teletex & Teletex International	Cct switched	2400 bps	CNCP and Teleglobe Canada
GLOBETEX	Message switched	110 to 1200 bps async	Teleglobe Canada
Datapac & Datapac International	Packet switched	full range	Telecom Canada members
Anikom 100, 500, 1000	Non-switched digital	full range	Telesat Canada

TABLE 2 CONTINUED: DATA NETWORKS AND SERVICES

Service	Switched or non-switched	Speed range	Major carrier
Infoswitch I - Infocall - Infogram - Infoexchange - Infoexchange International	Cct-switched digital or packet switched	full range	CNCP
Infoswitch II - Infoswitch X.25 - Infoswitch X.28 - Infoswitch SDLC	Packet switched	full range	CNCP
Envoy 100	Packet switched	110 to 1200 bps async	Telecom Canada members
iNet 2000	Packet switched	***	Telecom Canada members
Dialcom	Packet switched	300 and 1200 bps async to 9600 bps	CNCP
Megaroute Intercity	Non-switched digital network	1.5 mbs	Telecom Canada members
Megastream	Cct-switched digital network	1.5 mbs in increments of 64 kbps	Telecom Canada members
MACH III	Non-switched digital network	1.5 mbs and 64 kbps	CNCP

*** An information retrieval system, supporting a wide range of terminals and providing access to Canadian, European and U.S. data bases.

Public network services

Telephone

Canada ranks among the world leaders in the development of its public telephone service, which reaches more than 98 percent of domestic households. The service is provided by approximately 100 telephone companies and co-operatives, of which the 16 telephone companies shown in Table A.2 (page 60) account for more than 91 percent of the telecommunications carriage industry revenues.

Domestic local and long-distance public voice telephone services are provided by Telecom Canada member companies and by other telephone companies and co-operatives. There are border crossing points between most of Telecom Canada member companies and U.S. carriers for the carriage of transborder (Canada-U.S.) traffic. Telecom Canada has agreements with a number of U.S. carriers for terrestrial and satellite telephone services -- the latter provided under umbrella agreements between Telesat and U.S. satellite carriers in accordance with inter-governmental arrangements for transborder satellite traffic. Traffic to other countries is handled by the international public telephone facilities of Teleglobe Canada.

Most telephone companies in Canada follow similar pricing principles and have adopted comparable rate structures. Thus, local residential and local business telephone services are offered on a flat-rate basis, whereas rates for long-distance service vary with usage, that is, distance, duration, time of day, day of the week and whether direct dialed or operator assisted.

Key principles and factors that are taken into account in rate-setting are company-wide rate averaging, value of service, costs and usage. Rate averaging means that all customers pay the same price

for the same class of service. The value-of-service principle reflects the economic fact that a prospective buyer will pay a price that is reasonably related to the value derived from the service: thus, basic local flat-rate charges are higher at locations where there is a larger number of subscribers in the local calling area, and business telephone rates are higher than those for residential subscribers. Costs are taken into account by charging more for higher-cost services. Thus, operator-assisted long-distance telephone calls are priced higher than direct-dialed calls. Usage is a rating factor that can be associated with both value and cost considerations. With respect to value, subscribers attach value to "use" and are willing to pay more for more use. With respect to costs, increased use of a service may cause increased costs. Reduced charges for Sunday, weekend or night service reflect the principle of cost-recognition in that these discounts can assist increased network utilization at a low incremental cost to the system and help reduce peak traffic demands.

Switched teleprinter and other text

CNCP and Telecom Canada compete in the provision of switched teleprinter services. Telex, provided by CNCP has more than 50,000 Canadian subscribers. The comparable Telecom Canada services, Teletypewriter Exchange (TWX) service, has fewer Canadian subscribers. Both services allow access to over one million telex or telex-type installations around the world. Both Telecom Canada and CNCP provide facsimile communications services which allow for the transmission of text or graphics over their respective networks. Teleglobe provides connections to overseas destinations on its Globefax facsimile service. Electronic message, mail and text services are described under Other services, page 32.

Data services

CNCP and Telecom Canada each provide domestic public switched data network services. Two of the major competitive service offerings are Infoswitch and Datapac. Teleglobe Canada, in conjunction with CNCP or Telecom Canada, provides the same service to overseas locations.

Infoswitch, provided by CNCP, is a nation-wide digital switched data communications network that offers both circuit and packet switching services to users. Charges for use of the Infoswitch network consist of access and transmission components. Access charges are fixed monthly amounts that are directly related to terminal transmission speed. Transmission charges vary with volume more than distance. Infoswitch I features three service options: Infoexchange, Infocall and Infogram. Infoexchange provides a digital circuit-switched point-to-point channel using the Infoswitch network. Infocall utilizes packet switching technology with the Infoswitch network to provide channels between terminals of like code and protocol. It is available to 79 cities in Canada. Infogram uses the X.25 protocol and allows users to form their own packets. In 1984, CNCP introduced a new Infoswitch network, Infoswitch II, which supports CCITT standards and IBM SDLC. This network offers three types of services: Infoswitch X.25, Infoswitch X.28 and Infoswitch SDLC.

Datapac, introduced by Telecom Canada in 1977, was the world's first commercially available nation-wide public packet-switched data network. This pay-as-you-use network supports a wide variety of host computers, front-ends and cluster controllers as well as intelligent and non-intelligent terminals. This is now available in over 100 centres across Canada. Both Infoswitch and Datapac can be connected to numerous other countries through Teleglobe Canada's Globedat international data gateway, which routes both packet- and circuit-switched traffic and provides low- to medium-speed data transmission.

Telecom Canada also offers two other digital data networks: Dataroute and Datalink. Dataroute, the world's first public digital data network, serves customers with large dedicated data-handling needs. Dataroute operates over a wide range of speeds and can be used in point-to-point, multi-point and multi-drop networks. Service is available in more than 100 Canadian cities with access to over 115 areas in the United States through Dataroute International. Datalink joins Datapac and Dataroute to complete Telecom Canada's portfolio of data networks. It is a pay-as-you-use, end-to-end, circuit-switched digital data transmission service designed for the low- to medium-volume user. It is best suited to users requiring a transparent service to transmit data in batch or remote job entry form.

CNCP's Infodat is a data communications network offering dedicated facilities and digital transmission to 76 major locations in Canada. In addition to the data services provided by Telecom Canada and CNCP, Telesat Canada offers Anikom 100 which is a data distribution service to multiple receive locations anywhere in Canada. It is based upon customer ownership of small earth stations.

There are few restrictions on the use of the public data networks as long as technical criteria are met. Thus, terminal attachment policies for public data networks have been considerably more liberal than those for voice; the primary concern has been to prevent damage to the networks. The use of coupling devices leased from or approved by the carrier is required by some carriers.

Integrated network services

Telecom Canada has introduced the Megaplan family of services which brings together voice, data and image applications for transmission via its national digital network facilities. These services include Megaroute Local Service, Megaroute Inter-City, Megaplex and Megastream.

Megaroute Inter-City allows business users of telecommunications services across Canada to transmit combined voice, data and image traffic on a single network service. It is available between major Canadian cities and interconnects to AT&T's Accunet T1.5 in the United States. Megastream is a digital network service providing voice, data and image transmission through smaller 64 kbps channels. Megaplex is a high-speed multiplexing option available as a complement of Megaroute.

CNCP is offering the MACH III service which merges traditionally separate voice, data and image services into a single telecommunications network. Network additions, deletions and reconfigurations can be executed to meet changing traffic demands. The MACH III network is evolving towards ISDN standards. It also interfaces with CNCP's non-switched services such as Infodat and Econovoice.

Telesat Canada's offering, Anikom 500 and Anikom 1000, are satellite-based, digital transmission services that integrate voice, data and video communications into a business network. These services are available to any location in Canada within Telesat's Ku-band coverage area.

Teleglobe Canada provides Globesat, a new generation of private business services for digital transmission of voice, data and images by satellite. Triangular service applications allow multinational organizations to link their overseas offices in Europe, Canada and the United States.

Leased circuits

In most regions in Canada, leased circuits (sometimes referred to as "private lines" which include audio and video transmission services) are readily available on a competitive basis from telephone companies and CNCP. The terms and conditions governing the provision and use of

leased circuits are normally incorporated in a carrier's tariffs or in a contract between a carrier and a user, either of which usually requires the approval of the appropriate regulatory agency, subject to any governing legislation. As a result of competitive and regulatory influences, telephone company and CNCP charges for leased circuits are comparable. Customers are able to choose between public network offerings and leased facilities according to their needs. A CRTC decision issued in August 1985 permits the resale and sharing of facilities leased from the federally-regulated carriers for any purpose except the provision of public telephone service. In the case of international leased circuits, relevant recommendations of the International Telecommunication Union/International Telegraph and Telephone Consultative Committee are applied by Teleglobe Canada.

Interconnection of leased circuits to the public switched voice or data networks is permitted. This interconnection may take place at the customer's switching equipment and also, in certain cases, within the telephone network. The attachment of customer-supplied terminal equipment to leased circuits is generally permitted, subject to compliance with technical criteria.

New services

Both the carriers and the federal government are involved in the development and introduction of new telecommunications technology. For example, Communications Canada acts as a leader in introducing office automation in the federal Public Service, and a catalyst in organizing and co-ordinating the assessment of various trials.

From 1980 to 1985, the Department carried out pilot projects to introduce office automation in four federal departments: National Defence, Revenue Canada, Environment Canada and Communications Canada.

These trials in several Canadian cities -- Ottawa, Hull, Toronto, Winnipeg, Calgary and Jasper -- tested the most common applications of office automation, such as word processing, electronic mail, electronic datebooks and teleconferencing. Between 80 and 150 employees partici- pated simultaneously in these trials, which cost about $12 million.

The primary goal was to help Canadian industry by allowing it to develop telecommunications and office automation equipment likely to improve routine clerical tasks in the federal Public Service and the business sector. In November 1985, the Department opened the Canadian Workplace Automation Research Centre in Laval, Quebec. This centre focusses its research on the needs of users, a large proportion of whom belong to the federal Public Service. The centre's mission is to help people adjust to new office technologies. Its research makes it possible to define user attitudes and behavior, promotes the development of software designed to meet user needs, and examines how systems are interrelated -- one of the most difficult problems to solve in automating clerical functions.

In addition to government initiatives in the introduction of new services, the carriers have introduced various new services in the past few years.

iNet 2000:   a service providing a message store-and-forward
                    compatibility and access to on-line data bases
                    via the Datapac packet-switched network
                    (Telecom Canada).

900 Service: a service permitting telephone subscribers
                    to access recorded announcement and voting
                    facilities in the United States and Canada
                    (Telecom Canada).

Conference 600:	a satellite-based, point-to-point, color video conference service, now being extended to overseas locations, initially the United Kingdom and France, through an interconnection agreement with Teleglobe Canada regarding its Confratel service. Conference 650 is a one-way video, two-way audio service that permits participants in one location to address groups of any size in many locations (Telecom Canada).
Centrex III:	A business service based on central office digital switching and digital transmission to multiple subscriber's premises, which may be located anywhere in a local calling area. Centrex III Data is an integrated voice/data system complementing the existing voice service (Telecom Canada).
TradeRoute	A service featuring Electronic Data Interchange (EDI), an automated communications process by which organizations using different computer systems can electronically exchange business documents. Through TradeRoute, the computers of all "trading partners" are electronically linked via Envoy 100 (Telecom Canada).
CBANET	An information management service offered by the Canadian Bar Association to its members in co-operation with Telecom Canada.
ANIKAST RadioNet I	An innovative point-to-multipoint audio program distribution service. RadioNet 2 is a high fidelity satellite-based radio service (Telesat Canada).

Other services

Many electronic message and mail services have been introduced by
the carriers in recent years. Among them are Envoy 100, EnvoyPost,
Telepost, Globefax, Intelpost, Teletex, and Globetex.

Telepost, provided jointly by CNCP and the Canada Post Corporation,
is a service in which messages submitted by Telex, telephone or
computer tape are transmitted electronically to a specially equipped
post office close to their destination, where they are printed and sent
out by the next mail delivery. Telepost messages can be sent anywhere
in Canada or the continental United States.

Since 1979, Teleglobe's Globefax has provided two-way public
high-speed digital facsimile service between Montréal and several
countries. In June 1980, Teleglobe Canada and Canada Post inaugurated
Intelpost as an experimental facsimile/electronic mail service between
Halifax, Montréal, Ottawa, Winnipeg, Calgary, Edmonton and Vancouver
through interconnection with the CNCP/Canada Post domestic facsimile
network. Today, over 25 Intelpost centres and 350 post offices provide
access points within reasonable proximity to nearly 96 percent of the
Canadian population. Internationally, Intelpost links Canada with over
50 countries.

Envoy 100 is a national store-and-forward messaging service offered
by Telecom Canada. It is accessed by standard terminals through the
telephone network, Datapac or TWX, or, in the United States, through
the Telenet or Tymnet packet-switched networks. EnvoyPost, an
Envoy 100 option, is an electronic mail service offered co-operatively
by Telecom Canada and Canada Post. The service, using Canada Post's
electronic mail-printing and delivery service, allows Envoy 100

subscribers to access the national mail stream to send Envoy 100 messages to non-subscribers. EnvoyCourier is another service available to users to send Envoy 100 messages to non-subscribers.

Dialcom, which is offered by CNCP, is part of a worldwide electronic messaging network. The service was designed by Dialcom, a U.S. firm, which has exclusive licensee agreements with companies operating compatible systems in 15 countries serving over 100,000 users. Dialcom offers a comprehensive range of computer-based communications, information and support services that could be accessed through existing office equipment. Dialcom offers users the capability of reaching the subscribers of many different messaging services and of accessing information data bases via "Gateway." LASERCOURIER is a service by which documents are transmitted via CNCP Dialcom, Telex, Teletex or telegraph offices and delivered by Purolator Courier.

Teletex, which is provided by CNCP, allows word processors made by different manufacturers to communicate with each other, thereby effectively providing a new generation of Telex/switched-teleprinter services. It conforms to international standards developed by the International Telegraph and Telephone Consultative Committee (CCITT). This service enables users to communicate nationally and internationally and forms the basis of a wide variety of communications applications, including electronic mail for users who have text-preparation equipment. It is fully compatible with Telex and can be connected with personal computers using PC Teletex. The connection to some overseas destinations is provided by Teleglobe Canada.

Teleglobe's Globetex is a computer-based messaging service designed to streamline the flow of international business communications through the provision of certain store-and-forward features which allow economical and efficient handling of record message traffic to almost

anywhere in the world. Subscribers to Globetex can transmit messages destined for international telex stations using telex terminals or higher-speed terminals and workstations.

In addition to these text messaging services, at least one major telephone company is offering Integrated Voice Messaging Systems (IVMS) which is the voice equivalent of an internal electronic mail service. The service provides companies with 24-hour telephone answering and messaging capabilities and can be fully integrated with an organization's telephone system. The service is designed to ensure that all calls are answered automatically. B.C. Tel provides Exten, an electronic voice messaging service accessible on toll-free telephone lines from anywhere in Canada and the continental United States. One of its main features is the usage sensitive billing.

One of the first applications of resale and sharing approved by the CRTC was the provision of enhanced telecommunications services, defined as any service beyond the basic offering of transmission capacity for the movement of information. In fact, many of the carrier services already mentioned are classified as enhanced. Non-carrier service providers have also entered the market, offering enhanced services such as electronic mail and electronic bill payments.

3. REGULATORY STRUCTURE

The exercise of regulatory powers over telecommunications in Canada is currently divided between federal and provincial governments. As a result, carriers are regulated either by the federal agency, the Canadian Radio-television and Telecommunications Commission (CRTC), a provincial public utility board/commission or, in some cases, a provincial or municipal government. The allocation and use of the radio spectrum is regulated by Communications Canada. The complex division of regulatory responsibilities between federal and provincial jurisdictions is being examined in the context of a legal proceeding now before the Supreme Court. This case is the result of a CNCP application to the CRTC for interconnection with AGT, a provincially regulated company.

Table 3 lists major Canadian telecommunications carriers and their respective regulatory agencies.

TABLE 3

MAJOR CANADIAN TELECOMMUNICATIONS CARRIERS
AND THEIR REGULATORY AGENCIES

Carrier	Regulatory agency
Bell Canada British Columbia Telephone Company CNCP Telecommunications Teleglobe Canada Telesat Canada NorthwesTel Terra Nova Telecommunications	Canadian Radio-television and Telecommunications Commission (CRTC)
AGT	Alberta Public Utilities Board
SaskTel	Responsible to the Government of Saskatchewan
Manitoba Telephone System	Manitoba Public Utilities Board
The New Brunswick Telephone Company Limited	New Brunswick Public Utilities Board
Maritime Telephone and Telegraph Company Limited	Nova Scotia Public Utilities Board
The Island Telephone Company Limited	Prince Edward Island Public Utilities Commission
Newfoundland Telephone Company Limited	Newfoundland Public Utilities Board
'edmonton telephones'	City of Edmonton
Northern Telephone Limited	Ontario Telephone Service Commission
Québec-Téléphone	Régie des services publics du Québec*
Télébec Ltée	Régie des services publics du Québec*
Thunder Bay Telephone System	Ontario Telephone Service Commission

* In December 1987, the Quebec government introduced a Bill aiming at the creation of a new agency to be called the Régie des télécommunications du Québec.

Originally, the primary purpose of telecommunications regulation was to protect subscribers against any unreasonable treatment by monopoly providers of telecommunications services. This regulatory role has evolved into a broad oversight of telecommunications carriers activities "in the public interest." Thus, the primary responsibility of regulatory agencies is the approval or disapproval of carriers' tariffs. In addition, regulatory agencies hold broad powers to make regulations, approve construction programs, inquire into company operations and establish service standards. Regulatory decisions on certain issues, such as system interconnection or terminal attachment, may have significant policy implications for governments. While the federal Cabinet does not have the power to give policy directives to its regulator, legislation in several provinces gives this authority to the provincial Cabinet. However, the federal Cabinet has the power to vary or rescind any CRTC telecommunications decision, a power exercised sparingly and only when significant or broad public policy issues are involved. By contrast, in most provinces, the only appeal of regulatory decisions is through the Courts.

In addition to all the mechanisms for public participation in the development of public policy normally found in democratic governments, there are in Canada various avenues for direct public participation in telecommunications regulation. The most important one is the public proceeding process, which is an integral part of regulatory practice in Canada. Federal and provincial regulators hold public proceedings on important matters that come before them, encourage public input and receive submissions from interested parties. However, for most regulatory agencies, telecommunications regulation is only one of several areas of responsibility. For example, the CRTC also regulates and supervises all aspects of the Canadian broadcasting system, while provincial regulators also regulate other utilities such as oil, gas and electricity.

Federal and provincial regulatory agencies have adopted similar approaches in areas such as rate setting, depreciation practices, establishing regulations, the rate base, public hearings, etc. In other areas, important differences exist. Some agencies regulate all services provided by companies under their jurisdiction, while others exempt certain competitive services. Some agencies also have the power to tax regulatory costs or to make regulations for the purposes of recovering these costs. The CRTC has that power and it can also make rulings whereby costs of intervenors may be reimbursed.

4. CURRENT INITIATIVES

Telecommunications policy review

In the past 10 to 15 years, the pace of development in telecommunications and related information technologies has been rapid. For example, we have seen the convergence of computer and communications technologies and economic efficiencies that allow large users of telecommunications to by-pass public or other Canadian telecommunications facilities. These developments, together with the massive restructuring of the telecommunications industry in the United States, create both profound challenges and new opportunities for the Canadian telecommunications system. There is a clear need for a national telecommunications policy that will allow the Canadian telecommunications system to adapt as effectively as possible to this new environment.

It was in this context that Communications Canada began a review of telecommunications policy in mid-1983. In May 1984, the Department received 35 submissions in response to a Notice published in the Canada Gazette inviting comments on telecommunications policy.

In June 1985, the Honourable Marcel Masse, then Minister of Communications, announced in an address to the Electrical and Electronic Manufacturers Association of Canada, in Montebello, Quebec, a broadening of the consultation process relative to the telecommunications policy review and indicated that he would be inviting provincial and territorial Ministers responsible for Communications to meet with him to review policy matters. Federal, provincial and territorial Ministers met in February 1986 and agreed to establish a Committee of Ministers to maintain progress in developing a new telecommunications policy. This Committee has focussed on the development of policies for nation-wide application, including policies

on interconnection, and roles and responsibilities of the federal, provincial and territorial governments in telecommunications.

In April 1987, the Ministers adopted six policy principles to guide the development of a national telecommunications policy: a uniquely Canadian approach to telecommunications problems and policies; universal access to basic telephone service at affordable prices; the international competitiveness of Canadian industry; technological progress to benefit all Canadians; the goal of fair and balanced regional development; and the need for government to assume responsibility for policy development. The Ministers also signed a Memorandum of Understanding supporting the general consensus reached on interconnection policy and on sharing governmental responsibilities in telecommunications. The Ministers have agreed to seek ratification from their respective Cabinets and requested their officials to continue work in these areas and on the elaboration of implementation mechanisms.

In July 1987, the Honourable Flora MacDonald, Minister of Communications, announced a policy for telecommunications in Canada, which was the first comprehensive statement of such a policy by a federal government since the early 1970s. The policy has three central objectives: universal access to basic telephone service at affordable prices, an efficient telecommunications network infrastructure and a viable competitive marketplace in the supply of telecommunications services and equipment in all regions.

The new policy establishes two classes of telecommunications carriers, Type I and Type II, to simplify the regulatory environment and promote effective competition. Type I carriers own and operate interprovincial and international network facilities and offer basic services to the public. Included in this category would be major telephone companies that are members of Telecom Canada, as well as

CNCP, Telesat and Teleglobe. The federally-regulated carriers will be required to lease their facilities to Type II carriers, who may resell them to provide some basic services, and a variety of enhanced services.

The Government will also introduce legislation to guarantee Canadian ownership and control of Type I carriers. This will safeguard national sovereignty, and promote social and economic security. A ceiling of 20 percent foreign ownership in Type I carriers has been established, while there are no ownership restrictions in the operation of Type II carriers.

Competition

In the federal regulatory jurisdiction, most telecommunications services are competitively supplied to some degree. This includes customer-provided terminal equipment, private-line services, and public data services connected to the public switched telephone network. Regulated monopoly continues to exist only in local and long-distance telephone services. In provincial regulatory jurisdictions, however, the degree of competition is generally not this extensive.

Network facilities

Interconnection between adjacent telephone company networks has existed for many years. A milestone in the development of a national telecommunications network in Canada was the 1931 agreement between major regional telephone companies to set up the TransCanada Telephone System. One of its major achievements was the establishment of an all-Canadian route for long-distance telephone calls. Moreover, Canadian telecommunications facilities are interconnected with the United States continental network and, through Teleglobe Canada's

facilities, with overseas networks. This permits the connection of virtually all Canadian telecommunications services with those of other countries.

A significant development was the CRTC's decision in 1979 to permit CNCP to interconnect its facilities with Bell Canada's local telephone network. This allows CNCP's customers to access its competitive data and voice services via the local Bell Canada telephone network. A similar decision by the CRTC in 1981 permitted CNCP to interconnect its facilities with those of B.C. Tel. CNCP is continuing to press for similar interconnection arrangements throughout Canada. In addition, interconnection is permitted between Telesat Canada's facilities and the public telephone network in most provinces.

In April 1987, as part of the telecommunications policy review, federal, provincial and territorial Ministers responsible for Communications signed a Memorandum of Understanding supporting a general consensus on interconnection policy. This policy would create a coherent basis for competition in telecommunications that is sensitive to regional differences. This approach to interconnection policy would provide Canadians with consistent ground rules for the provision of telecommunications business services and a broad range of customer-owned equipment in all regions of Canada.

Long-distance telephone service (Message Toll Service: MTS)

In October 1983, CNCP applied to the CRTC for authority to connect its facilities with the telephone networks of Bell and B.C. Tel. CNCP proposed to compete in providing long-distance public telephone service within and between the areas served respectively by the two telephone companies, that is, Quebec and Ontario, and British Columbia. CNCP also proposed to provide long-distance public telephone service to the United States and overseas. In August 1985, the Commission issued a

decision in which it found that a number of benefits could potentially result from competition in the long-distance market. However, the Commission expressed the view that competition raises a number of concerns that could impact on the principle of universality, the profitability of CNCP and the telephone companies, the quality as well as the provision of the service, and regulation. The Commission therefore concluded that it would not be in the public interest to approve CNCP's application. However, the CRTC decided to permit more competition in the provision of various other telecommunications services. The Commission also denied the proposals by Bell and B.C. Tel to rebalance their telephone rates and placed a freeze on increases of long-distance rates of Bell and B.C. Tel. In December 1985, CNCP requested the CRTC to review and reverse the part of the decision in which it denies its application. In October 1986, after a thorough public process and consideration of submissions by interested parties, the Commission denied CNCP's request to review the decision.

In April 1987, in their efforts to develop a national telecommunications policy, federal, provincial and territorial Ministers responsible for Communications agreed that prior to any regulatory determination with respect to public long-distance competition, a joint fact-finding study would be carried out by federal, provincial and territorial representatives. This group would examine the effects of competition in public long-distance service and report back to the Ministers within one year. At that time, the Ministers would review the desirability of public long-distance competition.

Non-MTS services

The members of Telecom Canada compete with CNCP in the provision of a wide range of business-related services, such as private systems and networks, specialized business-interexchange service, enhanced

services, etc. However, price competition between Bell Canada and
B.C. Tel (federally-regulated companies) on the one hand and CNCP on
the other continues to be regulated by the CRTC.

Private-line service, which refers to the provision of a circuit
that is dedicated to the private use of a specific customer, has
traditionally been offered by both Telecom Canada and CNCP. A CRTC
decision issued in May 1979, allowed a broadening of competition in
private-line services by authorizing CNCP to interconnect their system
with the local exchange facilities of Bell Canada for the purpose of
providing private-line voice and data services to CNCP customers. The
CRTC subsequently granted CNCP authority to interconnect with B.C. Tel.
Telesat Canada and B.C. Rail have also obtained CRTC approval to
compete in the provision of interconnected private-line services.

Following an extensive consultation process relating to the
provision of enhanced services, the CRTC issued a decision in July 1984
allowing competition in these services between the federally-regulated
common carriers and the service providers who lease underlying
transmission capacity from them. To facilitate this competition, the
decision also allowed the resale and sharing of all carrier services
for the provision of enhanced services. In order to ensure that the
carriers do not have an undue competitive advantage in this respect,
the Commission developed specific regulatory requirements to govern
their participation in the market.

Terminal attachment and procurement

Subject to compliance with certain basic technical criteria
intended to protect networks and personnel, most regulatory
bodies in Canada allow some form of customer-owned and maintained
terminal attachment, although the scope and rules for attachment are
not consistent across the country. Generally, a full range of terminal

equipment may be attached to carrier networks in all provinces except Saskatchewan, Manitoba and Newfoundland. Competition resulting from liberalized terminal attachment has benefitted the public through lower prices, increased product choice, and accelerated technological innovation.

The attachment of network non-addressing equipment, such as data modems and telephone answering machines, has been permitted for some time in several jurisdictions. A more liberal regime governing the attachment of network-addressing terminal equipment, such as telephones and PBXs, was established by the CRTC on an interim basis for Bell Canada in August 1980 and for B.C. Tel a year later. (Bell Canada and B.C. Tel represent approximately 70 percent of the Canadian telecommunications carriage market.) A decision issued in November 1982 extended the policy to apply to CNCP Telecommunications, NorthwesTel Inc. and Terra Nova Telecommunications Inc.

The decision provides that all equipment manufactured after September 1, 1983 must be certified as meeting the technical requirements established by Communications Canada's Terminal Attachment Program if it is to be attached to the public switched telephone, Telex or TWX networks. Furthermore, it permits single-line residential subscribers to own all their telephone sets, including the main set, which had not previously been permitted. Although single-line residence and business subscribers are given the choice of owning or leasing their telephones, the associated inside wiring should remain the property and responsibility of the telephone companies. Multi-line business customers are also given the choice of owning or leasing their terminal equipment. However, where such subscribers choose to own their terminal equipment, the associated inside wiring must also be subscriber-owned.

In addition, the CRTC concluded that carriers should be permitted both to lease and sell terminal equipment. Although the carriers are not required to conduct their terminal equipment business through separate subsidiary companies, the Commission established regulatory requirements concerning lease and sale rates to help ensure that such offerings are not subsidized by revenues from the carriers' monopoly activities. The associated tariff came into effect in 1984 and included unbundled rates for the primary telephone instrument and local telephone service.

Technical standards for terminal equipment have been developed by the Terminal Attachment Program Advisory Committee (TAPAC) which was chaired by Communications Canada and included the voluntary participation of carriers, manufacturers, suppliers, users and provincial governments. The object of the Program was to develop terminal attachment standards suitable for nation-wide adoption. These standards are intended to guard against network harm, which has been defined as hazardous voltages for carrier personnel and the user, electrical damage to the network, interference with network functions such as billing, and the degradation of service to others. Communications Canada's certification of equipment for compliance to these standards is a requirement of the federal and certain provincial regulatory agencies for the attachment of this equipment to carrier networks.

Cellular mobile radio

In September 1981, Communications Canada issued a discussion paper which invited public comment on several cellular mobile radio policy issues, including the appropriate number of competing systems in a market, spectrum allocation matters and compatibility with other systems including those in the United States. In October 1982, after a review of the comments, the Department announced its cellular mobile radio policy and requested applications to provide a public mobile telephone service with some form of interconnection with the public

switched telephone network. In establishing a policy for cellular radio, the Department's purpose was to serve the public interest by providing for the implementation of nation-wide high-capacity mobile radio communications services capable of serving both local and "roaming" mobile telephone users.

The policy provides for a maximum of two systems in each service area, one to be operated by the local telephone company and the other by another service provider. The systems are to be technically and operationally compatible with each other and with systems operating in the United States to allow for wide-area roaming. The frequency bands allocated to the cellular service are 825-845 MHz (mobile transmit) and 870-890 MHz (base transmit).

As a result of the call for licence applications, submissions were received from seven industry groups and nine telephone companies in February 1983. Following an in-depth analysis of the submissions presented by the non-telephone company applicants, the Minister of Communications announced in December 1983 that radio licences would be issued to Cantel Inc. to develop cellular mobile radiotelephone service across Canada, and to the various telephone companies within their service areas.

July 1, 1985 was the official start-up date for the cellular mobile radiotelephone services for the first metropolitan areas (MAs) in Canada. Service is currently available in 14 MAs in Ontario, Quebec, British Columbia and Alberta. In some of the above locations, the service has been extended to include adjacent communities and the corridors between the cities. Under an expanded policy introduced in July 1986, the Department now accepts applications from cellular service providers in Ontario, Quebec, British Columbia, and Alberta to offer service in areas not originally designated as MAs.

Microwave licensing policy

The microwave radio licensing policy established in 1970 by
Communications Canada provided for a system approach in dealing with
applications in order to give proper attention to the social and
economical importance of radiocommunications. Specific criteria of
public interest were formulated to assist in the decision-making
process.

Over the years, through the administration of the microwave policy,
the Department has acknowledged the particular needs of certain
institutions to establish microwave facilities to carry out their
public responsibilities -- such is the case with recognized common
carriers, electric power utilities, licensed broadcasters and cellular
mobile telephone operators.

Some policy initiatives have followed an extensive public
consultation process. This was the case with the establishment of
a microwave licensing policy for broadcasting undertakings in 1983
respecting the carriage of program signals. In dealing with
applications to establish private microwave systems, the system
approach continues to ensure that these applications are assessed
against the broad principles of public interest. The Department
is continuously studying the effectiveness of the existing policies,
or carrying out public consultation to make the policies more respon-
sive to current needs. At this time, there is significant activity in
the area of local microwave radiocommunications development.

Canada/U.S. satellite telecommunications policy

The 1972, Canada and the United States exchanged letters that
comprise an agreement on the use of the satellites of one country to
provide service in the other country. Under this agreement, service

may be provided in the case of a catastrophic failure of one country's facilities, where there is a temporary shortage of capacity, or where the service being provided in the second country is clearly incidental or peripheral to a domestic service being provided in the first country.

In 1982, as an addition to the 1972 agreement, the two governments exchanged further letters to institute the terms and conditions whereby domestic satellites could be used to provide transborder services. In general, this agreement seeks to respect the parties INTELSAT obligations, and provides for equitable utilization of the facilities of both countries.

Satellite earth station licensing policy

Rapid growth in the use of telecommunications satellites and in the variety of applications of satellite technology have led to the evolution of the federal government's earth station licensing policy from one that restricted the ownership of earth stations to Telesat Canada and Teleglobe Canada to one that permits many users to own and operate earth stations in certain circumstances. Since 1983, individuals as well as commercial establishments such as bars and taverns are exempted from the requirement for a radio licence for a television or radio receive-only earth station for the reception of programming signals from satellites as long as the signals are not distributed to others. Similarly, broadcasters can choose to operate under an exemption from radio licensing requirements where the CRTC has approved the distribution of the signals received from the earth station. Furthermore, apartment buildings, condominiums, hotels and motels equipped with master antenna television systems are also exempted from licensing requirements for television or radio receive-only earth stations where the CRTC has approved the distribution of the satellite signals on the system. Despite these

exemptions, operators of earth stations may still require permission to receive and use satellite programming signals from the signal originators. Since April 1985, carriers may apply for radio licences to operate domestic transmit earth stations in any of the fixed satellite service bands. Also broadcasters, business users and others may now apply for radio licences to operate domestic transmit earth stations in conjunction with Canadian satellites.

Other elements of the policy for services with Canadian satellites are:

° Persons or organizations wishing to receive signals other than radio or television programming (such as newswire services, weather information, stock market information or other business services) may apply for a receive-only earth station licence.

° Resource camps may operate television or radio receive-only earth stations under an exemption from the requirement to obtain a radio licence, if they are eligible for the corresponding CRTC exemption.

° Provincial educational authorities or agencies may apply for earth station licences for the reception of Canadian educational signals.

For service with international satellites, Teleglobe Canada may apply for earth station licences to carry international services. Private applicants may apply for the licensing of maritime mobile earth stations involved in a maritime mobile satellite service upon endorsement by the international carrier -- Teleglobe.

Applications for radio licences to operate earth stations with foreign satellites are dealt with on a case-by-case basis.

Furthermore, operations with U.S. satellites are subject to a Canada/U.S. inter-governmental arrangement signed in 1982 regarding transborder fixed satellite services and any transborder service application must conform to that agreement. (For more information, see previous section.)

Mobile satellite (MSAT)

MSAT is a proposed new communications system that will provide two-way mobile radio and telephone service throughout Canada by means of satellite. The MSAT system was conceived by Communications Canada to satisfy national and regional needs for improved and extended public and government mobile communications in isolated and sparsely populated areas. A strong business demand for the service has also developed in industries such as oil exploration and intercity trucking. The goal of the Department's MSAT Program is to assist Canadian industry in establishing a first generation commercial mobile satellite system in Canada by 1992.

In 1979, the Phase A concept feasibility studies were initiated. This work was completed in 1982 with positive indications that such a system would be feasible and commercially viable in Canada, over the long term. The Government then approved MSAT Project Definition Phase B with its major objectives being the definition and design of a first commercial system, the development of the required technology, the performance of commercial viability and socio-economic benefit studies and the definition of a post-launch communications program. In 1984, due to increasing commercial interest both in Canada and the United States a decision was taken to forego an initial government demonstration system, and to proceed directly to a commercial service offered by Telesat Canada. This commercial system is proposed to be implemented in co-operation with a U.S. mobile satellite operator who would implement a similar system for the United States. The Phase B

studies were completed, with strong confirmation of MSAT as a significant economic opportunity for Canada, given initial federal support and risk sharing.

While most of the MSAT Phase A and Phase B activities were sponsored by the Government, the Implementation Phase C/D of the program will be assumed by industry with the Government playing a support role. This Phase will continue during the period leading to the satellite launch. To date, the MSAT Joint Endeavour Agreement, which sets out the roles and responsibilities and general principles of mutual co-operation between Communications Canada and Telesat Canada, was signed in February 1987. It also outlines the general principles governing the negotiation of a lease of MSAT capacity from Telesat, worth up to $126.5 million, for use by federal government departments. In the spring of 1987, Communications Canada announced its domestic L-band spectrum allocation policy (SP 1530 MHz) for mobile satellite service as well as its telecommunications and regulatory policy for MSAT that would provide for minimum regulation wherever warranted. As well, Telesat and the Department have been actively considering the possibility of early trials followed by interim service, using channels leased from INMARSAT (International Maritime Satellite). In parallel, the Department and the Province of Ontario are co-operating for the provision of air ambulances serving the province's North that would eventually be served by MSAT. Phase C/D will also see the continuation of R&D support to industry by the federal government in the development of technology and products.

CRTC Cost Inquiry

The CRTC's mandate, with respect to the Cost Inquiry, was to monitor the rates and costing procedures of six telecommunications carriers. In June 1985, the Commission issued a Phase III decision of this inquiry, which laid out the procedures the carriers should follow

with regard to the pricing and costing of specific existing telecom-
munications services. The method of pricing and costing new tele-
communications services, as well as basic principles and approaches
related to depreciation and accounting changes, were previously
resolved in Phase I and II of the Cost Inquiry.

With the Phase III Cost Inquiry decision, the CRTC considered that
the Cost Inquiry, which was announced in 1972, had met its mandate and
accordingly, concluded the inquiry. Pricing and costing, as well as
other related issues which might emerge in the future will be
appropriately dealt with in separate public proceedings.

Open Systems Interconnection standards

Open Systems Interconnection (OSI) is a set of reference standards
that will allow the exchange of information between computer
communication systems regardless of manufacturer or geographical
location.

The development and implementation of OSI standards at both
national and international levels where distributed electronic data
processing and telecommunications are playing an increasingly important
role in national economic development is a vital element in maintaining
a competitive industrial environment in Canada. OSI will contribute to
an entrepreneurial environment in Canada by providing a framework for
the development of standardized computer communication products that
would be applicable not only in our domestic market but also in the
international marketplace. Open Systems Interconnection will also
contribute to the efficiency and effectiveness of business
communications in Canada by permitting the interworking of all types
of terminal and computer equipment components of the newly emerging
information systems and services built to this standard. More
specifically, the establishment and implementation in Canada of

OSI standards is fundamental to the full realization, through interconnection via our public telecommunications networks, of new information services such as the National Library Bibilographic Network, Telidon/Videotex Systems, Office Communications Systems, Electronic Payments, Messaging and Trade Information Systems.

While OSI standards are international standards being developed by the CCITT and ISO (International Organization for Standardization), they will have a major impact on domestic telecommunications carriers and Canadian manufacturers in the information technology field. It is for this reason that Canada, since 1979, has participated and continues to make a high level of contribution to the intense study activity in both the CCITT and the ISO that is directed towards the completion of these Open Systems Interconnection standards. As a result, Canada has made significant efforts to develop systems such as Telidon and the National Library network that incorporate the OSI architecture.

In November 1985, Communications Canada issued a public notice and discussion paper entitled The Implications of Open Systems Interconnection for Canada. The purpose of this notice was to assess the level of awareness and commitment to OSI in Canada, and to consider in detail the implications and to plan future OSI initiatives to ensure appropriate development and implementation of OSI to meet Canadian needs and objectives. In general the input received to the notice was significant (some 40 responses) and for the most part comprehensive and very positive. The Department will be meeting with industry, governments, and users to determine, based on these results, appropriate future initiatives to meet Canadian needs and objectives.

ISDN standards in Canada

In Canada, the development of ISDN service capabilities on existing telecommunications networks will be part of the evolution of the

digitization process that has taken place over the past ten years. Extensive capital investments have been made to build digital central office switches and transmission facilities. Canada is already well advanced towards achieving full digitization of its networks by the turn of the century through its high capacity digital microwave infrastructure spanning the country from coast to coast; the construction, well underway, of two Trans-Canada fibre optical systems; the availability of domestic satellite capacity for digital transmission; and the extensive number of regional digital transmission systems. For example, Bell Canada foresees that by 1990, some 80 percent of their toll trunks will have access to, and 40 percent of their local loops will terminate on, digital switches. Integrated digital network development, started ten years ago, is the cornerstone in the evolution of the Canadian system towards providing ISDN service capabilities.

The Canadian telecommunications industry is most active in the development of international ISDN standards under CCITT. This has given the opportunity to common carriers to plan for ISDN, to the manufacturing industry to carry out research and development for new products, and to business customers to begin identifying their needs in terms of ISDN services. A number of ISDN field trials in Canada are scheduled for the next few years to demonstrate ISDN technology, to assess new services in the marketplace, and to verify various approaches to the orderly evolution of existing networks to ISDN.

The time frame for the introduction of ISDN service in Canada will be greatly influenced by the progress of ISDN technology, the efficiency and cost of ISDN services that respond to the needs of business customers, and the suitability of ISDN to carry existing telecommunications services.

CONCLUSION

In this description of telecommunications in Canada, we have
provided an overview of the Canadian telecommunications industry
structure, networks and services, regulatory structure, and policy
developments. The mixture of private and governmental ownership of
carriers and the mixture of federal, provincial and municipal
regulation are key aspects of a complex structure which, as noted in
the Introduction, differs from the situation one finds in many other
countries. Nevertheless, Canada has one of the finest telecommuni-
cations systems in the world, which offers a very high level of service
and is at the forefront of technological developments in many areas,
such as digital switching and transmission, satellite communications,
fibre optics, protocols for communicating word-processors, videotex
technology, telemedicine, tele-education systems and office
automation.

APPENDIX A

SELECTED TELECOMMUNICATIONS

CARRIAGE MARKET SHARE STATISTICS

TABLE A.1

TOTAL TELECOMMUNICATIONS CARRIAGE MARKET BY GROUP, 1986

	Total operating revenues ($ millions)	Share (%)
Telecom Canada	10,309.1	86.8
Other telephone companies	748.0	6.3
CNCP Telecommunications	343.8	2.9
Teleglobe Canada	273.8	2.3
Radio common carriers	200.0	1.7
TOTAL	11,874.7	100.0

SOURCE: Annual reports and Communications Canada estimates.

NOTE: Revenues from cellular radio-telephone companies
are not included in these statistics.

TABLE A.2

TELECOMMUNICATIONS CARRIAGE MARKET BY COMPANY, 1986

	Total operating revenues ($ millions)	Share (%)
Telecom Canada		
B.C. Tel*	1,308.0	11.0
AGT	1,067.1	9.0
SaskTel	449.6	3.8
MTS	349.4	2.9
Bell Canada*	6,254.6	52.7
NBTel	256.6	2.2
Maritime Tel & Tel	336.4	2.8
Island Tel	35.9	0.3
Newfoundland Telephone	146.2	1.2
Telesat**	105.3	0.9
Subtotal	10,309.1	86.8
Other telephone companies		
'edmonton telephones'	238.2	2.0
Northern Tel	29.5	0.2
NorthwesTel	64.9	0.5
Québec-Tél.	182.7	1.5
Télébec Ltée.	114.3	1.0
Terra Nova Tel	44.4	0.4
Thunder Bay Tel	24.0	0.2
Others	50.0	0.4
Subtotal	748.0	6.3
CNCP Telecommunications	343.8	2.9
Teleglobe Canada	273.8	2.3
Radio common carriers	200.0	1.7
TOTAL	11,874.7	100.0

SOURCE: Annual reports and Communications Canada estimates.

NOTE: Revenues from cellular radio-telephone companies are not included.

* Telecommunications operations only.
** Does not include Telecom Canada transfer payments.