Communications CANADA

(1)

PARTICIPATION BY TELECOMMUNICATIONS CARRIERS IN PUBLIC DATA-PROCESSING

DEPARTMENT OF COMMUNICATIONS

1970

PARTICIPATION BY TELECOMMUNICATIONS CARRIERS IN PUBLIC DATA-PROCESSING

INTRODUCTION

THE CONCEPT OF THE COMPUTER UTILITY

During the decade of the 1960s, the previously disparate technologies of computers and communications came together to create an important new class of combined computer/communications systems. Such systems, often called "computer utilities", are defined more precisely in Part I. These systems employ telecommunications links and a variety of equipment and time-sharing[1] techniques to make available directly to customers in their own premises a wide range of information and data-processing services. The system overhead is shared among all users, with each paying a service charge that varies with the use made of the system. Ideally, the utility should be able to provide each user, whenever he needs it, with the equivalent of a private computer capability responsive to his immediate needs, but at a fraction of the cost of an individually owned system.

The applications of such systems, however, extend far beyond the field of computation. For, in addition to making computer power available in a convenient economical form a computer utility can be concerned with almost any service or function that can in some way be related to the processing, storage, collection and distribution of information. As a result, at least within the technically advanced nations, computer utilities promise eventually to make the computer as much a part of everyday life as the telephone is today. Out of this widespread availability of computer, or more correctly "information power", there will flow social changes and opportunities for human development that promise to make the next few decades among the most critical that mankind has ever faced. Consequently, Canadians are faced now with many fundamental problems of law and public policy whose proper resolution is of vital importance to the future of our country and to the life-style of each citizen.

(1) Definitions of technical terms used in this paper are contained both in the text where appropriate and in the glossary of terms, Appendix B.

PURPOSE OF THIS REPORT

Detailed Telecommission[1] studies on the subject of the computer utility are in process. However, a number of factors make it desirable that the specific question of the conditions, if any, under which the telecommunications carriers should be permitted to offer remote public data-processing services[2] be offered for public discussion at this time. This special report accordingly provides:

(a) Information concerning the various possible policy options for telecommunications carrier participation in public data-processing.

(b) Background material on the overall subject of computer utilities that will indicate something of its importance to the future of Canada and provide a general context for consideration of the specific question of carrier participation.

INTERDEPENDENCE OF COMPUTERS AND COMMUNICATIONS

The interest of the telecommunications carriers in the computer utility arises from the blurring of the boundaries between data-processing and communications that occur in the sorts of systems discussed in this report. The primary reason for this blurring is the total dependence of remote access systems upon data transmission lines; in addition many other important reasons have been advanced by both communications and computer interests.

(1) The Telecommission, announced by Communications Minister, Eric Kierans, on Sept. 18, 1969, is a comprehensive inquiry into telecommunications and comprises some 50 separate studies into aspects such as market prospects regulation, interconnection, wide-band distribution systems, technological possibilities, social environment, etc.

(2) See page 5.

(a) The computers required for the data-processing segment of a computer utility are perfectly capable of performing many "communications" functions normally regarded as being the prerogative of the communications carriers. Included here are functions such as signalling, store and forward message switching, multiplexing and message concentration.

(b) The communications carriers employ and in many cases manufacture an enormous variety of digital equipment including special purpose computers. Thus, they possess an extensive body of knowledge and experience in digital technology that is readily transferable to both the data-processing and communications segments of the computer utility.

(c) The optimum design of a computer utility demands a "systems approach" in which the emphasis is on the integration of functions like information transfer, storage, message switching, data compaction, computation, etc., rather than an arbitrary division into data-processing and communications segments.

(d) Much of the equipment employed by the carriers in the operation of their networks could be integrated with suitable computing equipment to perform many data-processing tasks for their customers.

As a result of this interdependence of computers and communications, there has been a tendency for many data-processing firms to attempt to diversify into the communications area (Bunker Ramo, Control Data, University Computing, etc.) and for communications carriers, notably CN/CP Telecommunications in Canada and Western Union in the United States, to enter the field of data-processing. The fact that the communications carriers are regulated monopolistic entities while the data-processing industries are highly competitive and unregulated, complicates the resultant situation.

A further complication arises from the fact that the existing telephone networks and their associated rate structures were, with few exceptions, designed for voice rather than data services. Many remote access applications, however, are distinguished by very long holding times, (hours instead of minutes), but rather low line utilization factors. Traffic tends to flow in rapid bursts, with long intervals between the bursts, and may also be highly asymetric -- the computer to customer data flow normally being considerably higher than that from customer to computer. As a result, computer users would like to see the current time and distance tariffs replaced by a charge based upon the amount of data transferred, or alternatively to see the current connection times, (of the order of several seconds), and minimum holding times -- (minutes), reduced to milliseconds and seconds respectively.

A few years ago the Canadian National and Canadian Pacific Telecommunications introduced their "Broadband" data switched network service as a step toward resolution of these difficulties. A further step was taken recently when the Trans-Canada Telephone System announced a new data transmission service "Multicom". The service will transmit data at medium and high speeds over separate switched network facilities. Also, both organizations have been actively working with computer users in developing various special private wire arrangements tailored to meet the needs of those users.

BASIC POLICY QUESTIONS CONCERNING CARRIERS

The foregoing considerations lead to a number of basic policy questions concerning the future role of the communications carriers in the computer utility field:

(a) Should communications common carriers be permitted to provide public data-processing services or should they be barred from the field?

(b) In the event that the carriers are permitted entry to the data-processing business, then:

(1) What services will they be permitted to offer:

(a) Only the use of their computer hardware;

ie., "raw computer power",[1] or

(b) A full range of software services as well?

(2) Should such services be tariffed?

(3) Should such services be provided by the carrier itself -- "horizontal"[2] diversification, or should they be offered through a separate corporate affilitate -- "vertical"[2] diversification?

(c) Should data-processing and other organizations be permitted to establish additional data communications networks or provide special communications services like third party switching or multiplexing in competition with the carriers? If the answer is yes, should the carriers be required to interconnect with these new networks; thereby allowing data-processing companies to use their switched facilities.

CURRENT FACTORS CONCERNING CARRIER RELATIONSHIP TO PUBLIC DATA-PROCESSING

1. Independent data-processing companies, in a brief to the government dated June 20, 1969, expressed concern about the entry of telecommunications carriers into the public data-processing business and requested that the government undertake a public enquiry.

2. Previously, in January 1969, CN/CP acquired a controlling interest in Computer Sciences Canada Limited and thus became the first Canadian telecommunications carrier to offer public data-processing. Quebec Telephone,

(1) For definition see Page 10

(2) For definition see Page 38

a provincially regulated company affiliated with General Telephone and Electronics, a U.S. Corporation, also offers public computational services. Other carriers, including Bell Canada, have expressed interest in entering the field.

3. Recent computer industry statements allege that, pending a clarification of the relationships between telecommunications carriers and public data-processing, the growth of the entire industry will be inhibited.

4. The F.C.C., in a notice of intended rule-making dated April 1, 1970, has proposed that U.S. telecommunications carriers, with the exception of AT&T,* be permitted, subject to a variety of constraints, to offer public data-processing services. This opens up the prospect of subsidiaries of U.S. carriers, ie., General Telephone; IT&T; Western Union, offering data-processing services in Canada while Canadian carriers are forbidden to do so.

RELATED TELECOMMISSION STUDIES

The importance of this subject has been recognized in the organization of the Telecommission and, in particular, in the studies grouped under the heading of "Information and Data Systems". These include:

-- The relationships between common carriers, computing companies, and information and data systems.

-- Computers and privacy.

-- Concept of a computer utility.

-- Long-term market prospects for computer services

-- Telecommunications services; present and anticipated needs of the computer industry and its customers

-- Institutional arrangements for optimizing developments of data banks in the public interest.

-- Problems in data transfer with particular regard to visual data.

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* AT&T is barred because the services will not be regulated and, under the terms of a 1956 consent agreement, AT&T is not permitted to engage in unregulated businesses.

PART I

CLASSIFICATION AND TECHNOLOGICAL UNCERTAINTIES

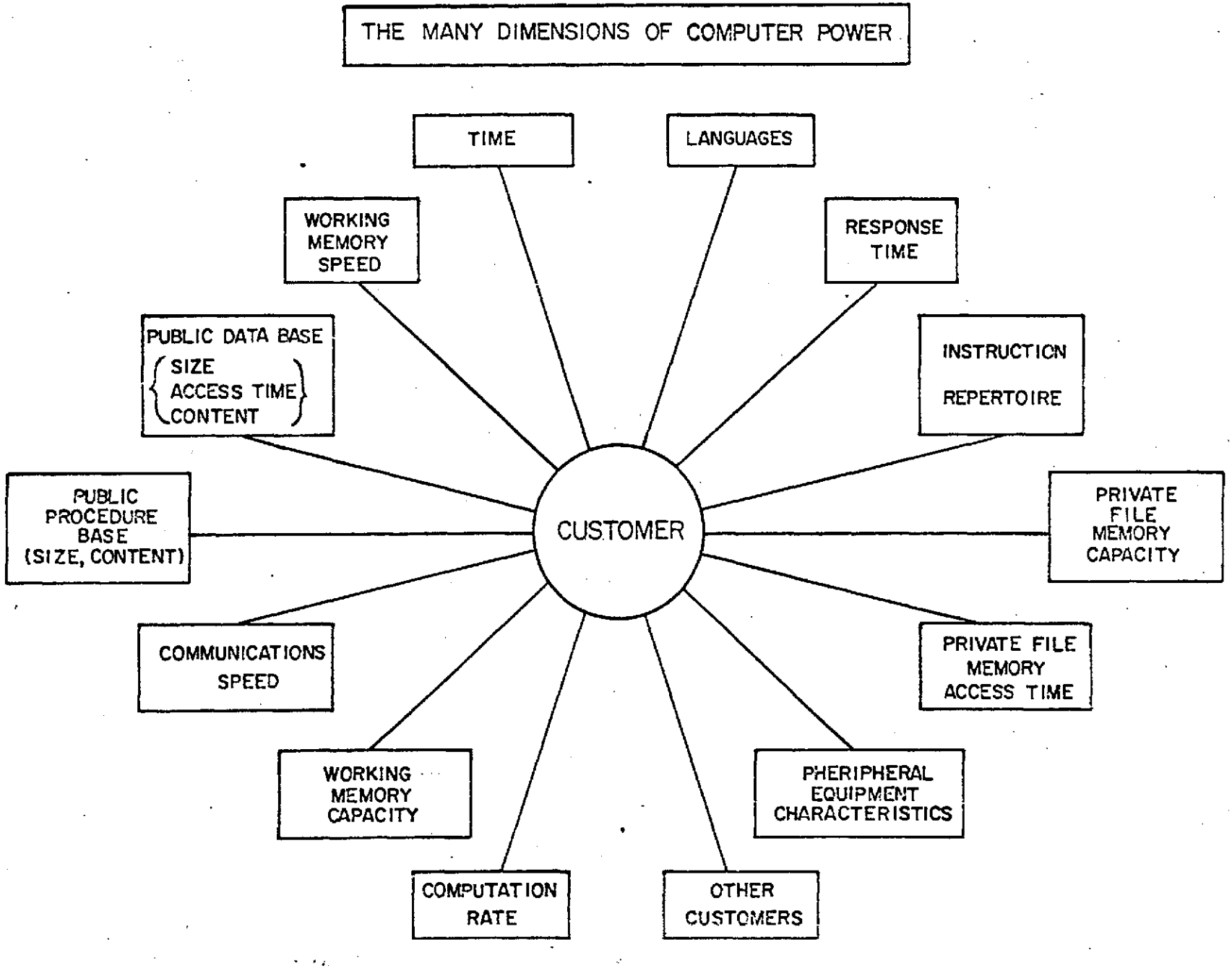
THE SHARING OF COMPUTER POWER

Computer utilities are a new class of resource sharing systems by which a complex commodity called "computer power" is shared in a convenient and economical manner among many geographically distributed customers. These new systems differ fundamentally from the normal computer service bureau in that the services are supplied directly to the user without requiring the physical transportation of data between the customer and the central processors. The data transportation, instead, is performed over communications links, and it is for this reason that the term "tele-data-processing system", ie., combined communications and data-processing system, is often used to describe the sorts of systems with which we are concerned.

Computer utilities also differ significantly from other resource sharing systems in the fact that computer power, or more correctly, "information power", is a much more complex commodity than, for example, electric power or telephone service. In it are contained elements of mathematics, of information retrieval, of communications in all of its myriad forms, of publishing, and of human and machine actions and interactions. Its definition involves complex combinations of such factors as: time, computation rates, instruction repertoires, data and procedures bases, peripheral equipment characteristics and usages, and communications speeds, capacities and access times. Figure I* is an attempt to portray something of this complexity. Computer utilities also differ from traditional utilities in that they operate in a competitive environment in which a number of firms may offer similar services in the same territory.

* See page 7-a

FIGURE 1


THE MANY DIMENSIONS OF COMPUTER POWER
TIME
LANGUAGES
WORKING MEMORY SPEED
RESPONSE TIME
PUBLIC DATA BASE
SIZE
ACCESS TIME
CONTENT
INSTRUCTION REPERTOIRE
PUBLIC PROCEDURE BASE (SIZE, CONTENT)
CUSTOMER
PRIVATE FILE MEMORY CAPACITY
COMMUNICATIONS SPEED
PRIVATE FILE MEMORY ACCESS TIME
WORKING MEMORY CAPACITY
PHERIPHERAL EQUIPMENT CHARACTERISTICS
COMPUTATION RATE
OTHER CUSTOMERS

BASIC COMPUTER UTILITY CATEGORIES

As might be expected with such a complex commodity, the systems employed in the distribution of computer power can take many different forms. These can be categorized on a functional, operating mode or institutional basis as follows:

FUNCTIONAL

Special Purpose - This is the oldest form and is exemplified by the familiar reservation and stock quotation systems. In it, the central processor is restricted to the performance of a single function or a group of related tasks specified in advance by the system designer.

General Purpose - These are systems which can handle many different kinds of tasks; ie., ultimately, any task for which a digital computer program can be written. In general, these tasks will not have been specified by or be known to the system designer.

OPERATING MODE

Batch Oriented - In such systems, each customer's programs are handled on a queuing or scheduled basis; ie., completing customer A's work before going to customer B, etc. The operation here is similar to that in a normal service bureau batch processor operating under the control of an "Operating System", except of course, for the fact that the data and programs are transmitted directly between the users and the computers over communications lines. The term "Remote Batch Processing" is often used to describe this type of operation.

Responsive or Time-Shared - The phrase "responsive" here carries the connotation of immediate access or "real time" operation and it is made economically feasible through a technique known as time-sharing. In a time-shared system, many customers are served at the same time with the computer switching from customer to customer at a rate that is short in

comparison to a typical human response time. Each user's program is thus run in the form of short bursts or quanta of computation so that all programs are multiplexed together in a continuously repeating cycle. Ideally the length of this cycle is short enough so that any single customer at a remote console is unaware of the intermittent nature of his service and feels that he is the sole user of the system.

Mixed Systems - Many systems operate in a mixed on-line and batch mode, where on-line service for problems up to a certain size or of a critical priority is provided, but other problems are run on a batch basis in the "background".

INSTITUTIONAL

Private - These are systems whose use is restricted to members of the owning organization.

Public - It is these systems which have generated the greatest popular interest and led to the use of the term "Computer Public Utility". As the term implies, they are operated as a public service, supplying computer power to many different customers outside of the owning organization.

COMBINATIONS OF FORMS

These different forms can be combined in many different ways. For example, we can have private general purpose systems like the pioneering MAC system of the Massachusetts Institute of Technology, private special purpose systems such as those used by individual airlines for reservation purposes, public special purpose systems, public and private multiple purpose systems, and a whole hierarchy of increasingly complex general purpose public systems which, in the limit, could encompass the entire computing power of the nation.

BASIC FUNCTIONAL ELEMENTS

In all of these different categories of computer utility, three functionally distinct elements can be identified. They are:

(a) The **basic** computer facilities, sometimes called "raw computer power". Facilities in this sense include basically the "Central Hardware" and the "Executive System" but might, in some cases, also include the terminal equipment on the customers' premises. "Central Hardware" could include such elements as mass storage systems -- core, drum, disk, video tape, etc.; working memory; data processors; input/output buffers and control equipment; switching facilities and data multiplexors. The "Executive System" comprises both hardware and software and is responsible for coordinating and controlling the overall operation of the computer utility. It is therefore responsible for the control of functions like scheduling, swapping, memory protection and look ahead, and may also perform certain bookkeeping and data conversion tasks. In addition, certain large compilers (FORTRAN, COBOL, etc.) and access control programs for information retrieval applications could, under certain circumstances, be regarded as elements of the Executive and thus qualify as "raw computer power".

(b) The telecommunications system which links the computer facilities to the remote users and which may also include the terminals on the customers' premises.

(c) The services provided by the utility: e.g. payroll, inventory control, information storage and retrieval, process control, etc. These are based upon data and programs, termed "application software" that is stored in the computer facilities and serves to organize those facilities so that they can perform useful work.

BUSINESS CATEGORIES

These functional elements provide a basis for categorizing the many different types of businesses that exist or might exist within the Computer Utility Industry.

(a) Supplier of Remote Computer Services

This type of business operates centralized information processing centers and makes raw computer power available via remote terminals directly to the customers on their own premises. Most organizations that supply this type of service (i.e. IBM, GE, SDL, Computel) also provide a host of special application programs. Some also perform certain secondary communications functions like line concentration and message preprocessing. Further, the computer utility may handle the leasing arrangements for communications circuits for its customers.

(b) Integrated Supplier of Special Services

The KEYDATA Corporation, represented in Canada by AGT Limited, the Credit Data Corporation and Bunker Ramo Corporation are examples of this type of business. As in the Remote Computer Service case, the companies in this category own and operate information processing centers. They differ, however, in that instead of supplying raw computer power, they provide special services to their customers who, in general, are not provided with a capability for performing their own programming. The services are made possible by special packaged programs tailored to the performance of specific business functions. Thus, in the case of AGT's KEYDATA services, these functions include invoicing, credit checking, inventory control, customer analysis and special report generation while for Bunker Ramo, the functions are those concerned with the operations of brokerage houses.

(c) Purveyor of Raw Computer Power

Since the term "raw computer power" refers to the facilities portion of a computer utility, a Purveyor of Raw Computer Power would be a firm which offers the use of such facilities, but no other services. Such an organization would represent a sub-class of the "Supplier of Remote Computer Services" category in that it does supply raw computer power but does not supply application programs other than the previously mentioned large compilers and information retrieval control programs.

(d) Telecommunications/Computer Utility Carrier

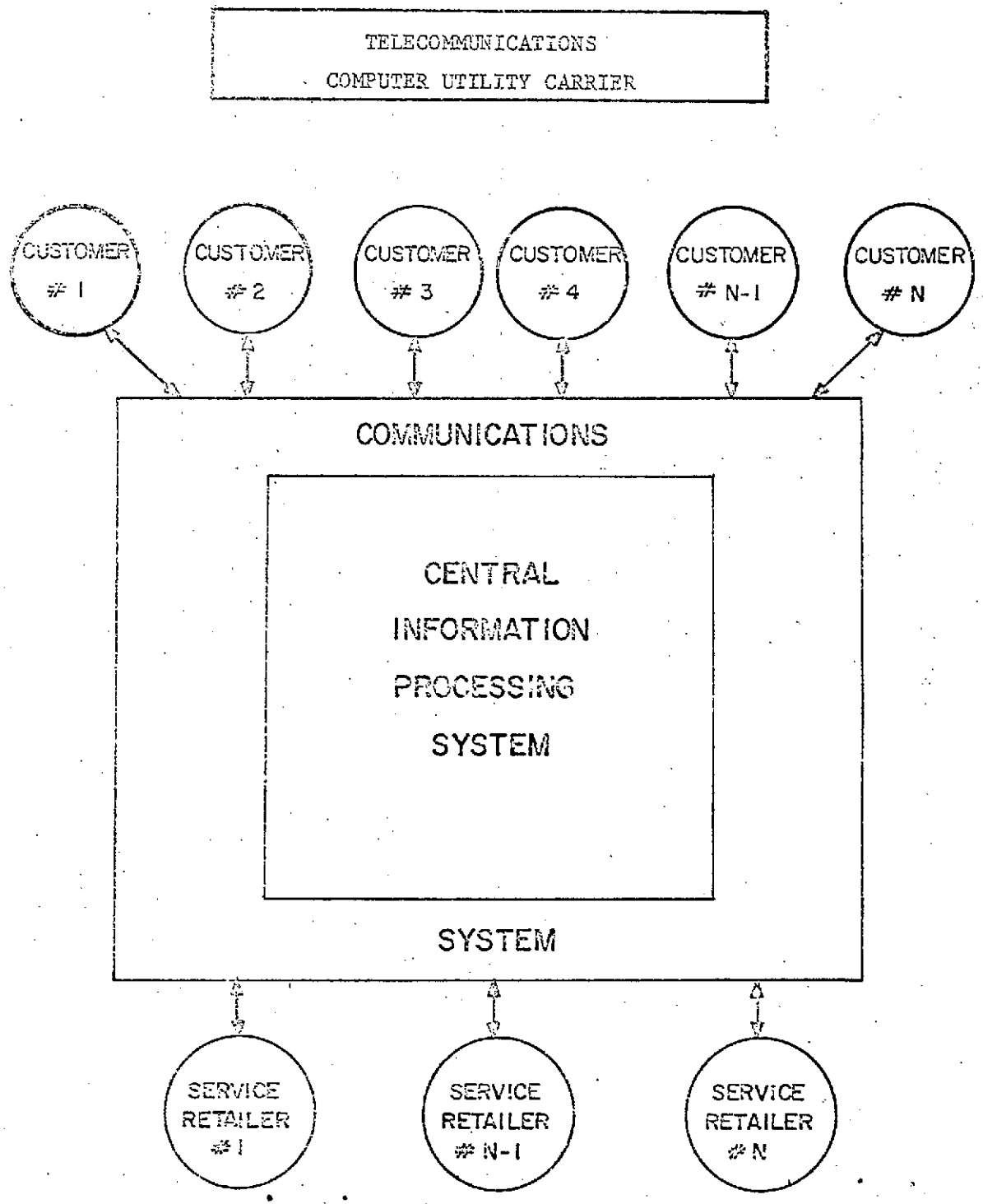
In a computer utility, there may be valid technical reasons, especially when the switching and data conversion aspects are considered, for combining many of the communications and data-processing functions. This leads to the concept of a new type of organization that could supply both "raw computer power" and telecommunications but not Application Services. In this report, such an organization is called a "Telecommunications/Computer Utility Carrier", and it is illustrated in Figure 2*.

(e) Independent Service Retailer

The concept of a Purveyor of Raw Computer Power implies the complementary concept of a purveyor of processed power or, as it is called in this report, an "Independent Service Retailer". Instead of owning or renting computers, these organizations would rent memory capacity and processing capability; ie., "raw computer power" from a Raw Computer Power Purveyor, fill the rented memory space with their own and their customers' proprietary data and programs, and then retail their services to their customers through the facilities provided by the telecommunications carriers and the Purveyors

*See page 12-a

FIGURE 2


TELECOMMUNICATIONS
COMPUTER UTILITY CARRIER
CUSTOMER #1
CUSTOMER #2
CUSTOMER #3
CUSTOMER #4
CUSTOMER #N-1
CUSTOMER #N
COMMUNICATIONS
CENTRAL INFORMATION PROCESSING SYSTEM
SYSTEM
SERVICE RETAILER #1
SERVICE RETAILER #N-1
SERVICE RETAILER #N

of Raw Computer Power. In other words, the service retailer provides the same services as the Supplier of Remote Computer Services but utilizes other organizations' facilities for their distribution.

This concept of the "Service Retailer" is as old as the concept of the computer utility and was originally suggested by Prof. John McCarthy of Stanford University at the MIT Centennial in 1961 where he introduced the term "cottage computing" to denote the activities that this report associates with the Independent Service Retailer. Despite this, to date, such organizations have not evolved to any significant degree but it has been argued that, with proper encouragement, they could be the instrument for a dramatic growth of the application services industry. If this were to happen, one would eventually expect to find a multitude of different organizations represented in this category. They could include private companies, foundations, governments, educational and charitable institutions and even individuals.

(f) Total Computer Utility

As an alternative to the sort of functional segmentation of the industry implied by the preceding categories, it is also possible to envisage an integration of application services, communications and computer power in integrated companies that operate as "Total Computer Utilities". In fact, even today in the United States one finds Western Union proposing to engage in every facet of Computer Utility business so that it will be able to provide its customers with any desired mix of raw computer power, data transmission and switching, and application services. The British Post Office also has similar plans.

TECHNOLOGICAL CONSIDERATIONS

The computer industry has been distinguished from its beginning by rapid technological change. Thus, in the twenty years that have passed since the first stored program computer became operational at Cambridge University three distinct generations of computers have appeared and a fourth is reported to be imminent.

For the policy planner, this dynamic characteristic of the computer industry introduces many difficulties, for there is always the danger that, by the time a policy is implemented, technological change will have altered the assumptions upon which it was based. At the present time, for example, there are several important areas of technological development that could have a major impact upon the future development of computer utilities. Three of particular importance which will also be discussed in greater detail in subsequent Telecommission studies are:

(1) The development of low cost, physically small, free standing computers of respectable power -- the so-called mini-computers. Even at their current prices, -- as low as $5-10,000-- these computers represent an attractive alternative to time-sharing for many applications. If progress in large scale integration (LSI) were to reduce their costs to say $1,000, then, in the absence of similar reductions in communications costs, a significant fraction of the computer utility market could be lost to the private machine.

(2) The development of low cost, compact, video recorders and video play-back systems, especially if combined with mini-computers for

search and selection, might provide some of the services that are currently postulated for data bank networks.

(3) Developments in communications, such as satellite technology, the use of digital modulation techniques, low-cost terminals and the development of economical wide-band two-way distribution systems could help counteract the impact of the private mini-computers and data stores. Satellite communications, in particular, could make possible world-wide information utilities and thus, have a major impact on plans based upon purely nationalistic considerations. Likewise, the incorporation of the previously mentioned mini-computers directly into the communications systems could lead to substantial improvements in communications performance as well as major cost reductions. In fact, the blurring of the boundaries between computers and processing that was mentioned earlier could spread until the two functions become totally merged into an integrated geographically distributed computer/communications system.

The whole question of optimum system architecture is one of the major technical uncertainties in the multiple access computer network field. For one thing, there is no general agreement as to the form that the central processing complexes should take. One of the difficulties involves the rather limited number of simultaneous users that the current state of the art of time-sharing permits a single general purpose computer to serve -- somewhere between one and two hundred in even the largest systems. In order to serve the

thousands of customers required by many of the proposed plans for mass utilization of computer utilities, new systems architecture approaches may therefore be required. In this connection some feel that the only way to realize the economies of scale promised by a truly large system is to adopt the super computer approach in which each central complex would contain a gigantic processor connected to an indefinitely expandable pool of memories. Others argue in favour of a multi-computer complex with pools of smaller processors (both general and special purpose) as well as memories and a few even visualize ultra parallel processors whose basic building blocks would be complete mini-computers instead of flip flops and logical elements.

Speaking more generally, we can have systems with distributed processing and/or data bases, centralized systems, master-slave systems, specialized, multi and general purpose networks, and so on. Each of these different possible structural forms exhibits unique operational, economic and technical characteristics and has important implications for the communications sub-systems, memories, processors, etc., from which the networks are constructed.

The rapidly developing wide band services represent another area of technical uncertainty with important implications for the future of computer utilities. Originally intended to be no more than a means of bringing improved television reception to viewers in areas where reception was poor or choice of program limited, Cable TV now promises to impact heavily upon the entire field of

telecommunications. Thus, in addition to providing viewers with a very wide choice of programs, cable systems could make possible a wide range of new services, many of which would involve two-way communication. Information retrieval services, for example, could include wide-band transmissions of pictorial material to the subscribers via cable and the use of narrow-band channels in the same cable for subscribers' queries and responses to a central computer. The implications of such a facility for computer assisted instruction and services like computerized shopping are significant.

PART II

FUNDAMENTAL CONSIDERATIONS

The advent of fully developed computer utilities will have social, economic, commercial and political consequences for society far broader than those created by the resolution of the specific issue of telecommunications carrier entry into, or exclusion from, the data-processing field. Some of these developments are unlikely to take place before a considerable number of years; some will take place in unexpected forms. The only constant is that their cumulative impact will be profound.

1. ECONOMIC CONSIDERATIONS

The Current Data-Processing Industry

At the end of 1969, the cumulative depreciated investment in computer systems in Canada was approximately $600 million. During 1969 the computer population in Canada rose to 1928 systems[(1)] where the term "system" includes both hardware and systems software. The revenue which computer suppliers obtained from these systems during 1969 was approximately $300 million,[(2)] up $40 million from 1968. Multi-subscriber time-sharing services generated about $6 million revenue during 1969.[(3&4)] Over the counter batch processing data centres generated approximately $15 million during 1969 and remote batch about $28 million.[(3)]

The distribution and rate of growth of computer installations in Canada is shown in Table No. 1, while Table No. 2 shows the distribution by computer size and industry. At the present time, the largest portion of the data-processing market is accounted for by the Toronto/Ottawa/Montreal

(1) Information Society of Canada - 1969 Census of Computers
(2) Department of Industry, Trade and Commerce Estimates
(3) "The Canadian Computer Industry" , Bunting & Co. Ltd., October 1969
(4) "The Data Service Industry in Canada" Richardson Securities, April 1970

areas, with over 50% of this activity in the province of Ontario. Quebec and the Maritime provinces account for 35% and the remaining 15% is distributed throughout Western Canada.

Growth Projections

Historically, both economic and technological forecasts of the data-processing industry have been notoriously unreliable. In the following examples two different but equally reputable approaches yield widely different results:

(a) Historical Extrapolation Approach

In this approach, the historical pattern of investment is computed from available data and then extrapolated into the future. Applying this method to the projection of capital investment, Table No. 1 shows that the rate of growth of computer installations has apparently levelled off at about 20% per annum.

If this rate is compounded annually and extrapolated to 1980, it results in a cumulative total of 15 thousand systems or a total investment of $5 billion, assuming an average cost of $430 thousand, less depreciation, per system.(5)

(b) Percentage of Gross National Product

Another method of assessing the growth of the computer market is to relate investment to the gross national product. At the present time, the gross cumulative investment of $600 million in computer systems is approximately .8 of 1% of the GNP, and is rising towards the U.S. figure of a little over 1%.(5)

(5) Trans-Canada Telephone System Telecommission Long Term Market Prospects For Computer Services

The Canadian GNP for 1980 has been estimated to be in the order of $181 billion[6] and, on this basis, gross investment in computer systems could be in the order of $1.8 billion by that time.

The problem with this approach is the assumption that the computer industry will represent a constant percentage of the GNP over the decade. This is probably unrealistic for an industry which most authorities agree is still in its infancy, and which may well be one of the three largest in the country by 1980. The Historical Extrapolation Approach seems to reflect this possibility, since its $5 billion figure represents an increase to about 3% of the expected 1980 GNP, and may therefore provide a more reliable prediction.

(c) The Transaction-Population Approach

A novel approach to the problem of predicting computer-industry growth has developed by a consultant[7] in a market study prepared for the Department of Communications. The study first defines a quantity called a "transaction", and then considers the number of transactions which might be involved in a variety of different computer utility application areas. Typical transactions could include making a reservation, asking for a stock quotation, registering a sale, transferring credits from one account to another, etc. Knowing the number of transactions and the rate at which they must be handled for a particular application, it becomes possible to calculate the computer and communication requirements and, therefore, the required capital investment for that application.

(6) TCTS - CNT/CPT Telecommission Market Analysis - Study 2(e)
(7) Mr. Lyman Richardson, President, T-Scan Ltd., Toronto

With the aid of this technique, the study concludes that the expected capital investment for all systems likely to be implemented in Canada by 1980 will be between $2.3 billion, if growth depends on normal market forces, and $6.3 billion if the government takes appropriate steps to stimulate the industry.

(d) A Comparative Canada - U.S. Approach

The above projections tend to assume that the Canadian computer needs will evolve in an international vacuum. In fact, we share a continent with the most computerized country on earth, the United States. Currently, our neighbours have a two and one-half to one lead over us in the number of installed computers per capita. The U.S. have a total of 63,000 computers for a per capita ratio of 2.5 per 10,000 population while Canada has a total of 2,000 computers for a per capita ratio of 1 per 10,000 population.

If we assume that it is desirable for Canada to stay abreast of the Americans and that public policies will be adopted to ensure this, then the figures we arrive at, based on American projections, are different again. Expert opinion predicts that the U.S. would spend $260 billion before 1980 to build and expand data-processing and telecommunications systems. Of this total, capital expenditures for telecommunications alone would be at least $100 billion. The remaining $160 billion would be required for computer systems and services.

Obviously, Canada cannot hope to match an investment of this magnitude, but even to equal the same per capita rate of growth, we would still be involved with a bill of $\frac{20}{200}$ x 260: $26 billion or

$2.6 billion per year, as compared with the current figure of less than $1 billion.

Of greater significance is the fact that even a $26 billion investment would merely maintain Canada's present position vis-a-vis the United States. To close the gap, an annual expenditure in the order of $5.2 billion or double the U.S. per capita investment would be needed. If we assume that this is split evenly between systems and services, then the 10-year capital investment required would be $26 billion for computer systems and communications combined or $16 billion for the computer systems portion.

The figure $1.6 billion per year is in line with what would be expected if many predictions concerning the growth of the data-processing industry come to pass. These predictions indicate that by the end of the decade, this industry could be one of the top three, not only in Canada but in most technologically advanced nations. In this connection, in 1969, the capital addition for one of the largest Canadian industries, the Canadian Electric Power and Gas Industry, was $1.535 billion.

Computer Services Revenue Projections

If we assume that the gross rate of return from computer systems investment must be between 30 and 40%, say 35%, then the revenue that would result for each of the previously described investment cases in 1980 would be:

Historical Extrapolation Approach	$ 1.75 billion
Gross National Product Approach	$ 0.63 billion
Transaction Approach	$ .79 billion to $2.2 billion
Stimulated Growth Approach	$ 5.6 billion

Table No. 1

COMPUTERS INSTALLED

BY PROVINCE AND MANUFACTURER

	ALTA	BC	MAN	NB	NFLD	NS	ONT	PEI	QUE	SASK	TOTAL	% Growth
IBM	65	81	55	15	10	14	555	1	251	22	1069	
DEC	23	8	9	1	1	5	107		21	8	183	
HON	12	12	6	1		1	78		38		148	
BUR	3	5	2	1	1	8	71		67	4	162	
UNI	12	16	3			2	59		33	5	130	
CDC	8	3	4	1	1	2	33		16	1	69	
CE	2	5		1			28		18		54	
NCR	5	1			1	4	19		16	1	47	
SDS	5	1				1	4		3	1	15	
COL							14				14	
OTHERS	3	4				2	20		7	1	37	
TOTAL 1969	138	136	79	20	14	39	988	1	470	43	1928	20
May 1968	119	107	69	16	9	31	811		410	41	1613	20
May 1967	86	93	57	13	6	25	644		332	23	1279	35
June 1966	69	70	34	12	6	17	443		280	17	948	33
June 1965	52	52	30	8	5	14	330		204	15	710	41
March 1964											502	

Information Processing Society of Canada
Census of Computers
1969

Table No. 2

COMPUTERS INSTALLED
BY INDUSTRY AND MONTHLY RENTAL

	UP TO $ 1,999	$ 2,000 TO $ 4,999	$ 5,000 TO $ 9,999	$10,000 TO $19,999	$20,000 TO $49,999	$50,000 AND OVER	TOTAL
PRIMARY/RESOURCE	26	34	19	9	5		93
CONSTRUCTION	16	14	9	2			41
MANUFACTURING	87	140	71	71	31	6	406
TRANSPORTATION	9	25	16	21	9	7	87
UTILITY	13	17	24	15	17	3	89
COMMUNICATION	19	14	4	5	1		43
DISTRIBUTION	30	66	32	29	3	1	161
FINANCIAL	25	43	41	57	22	4	192
OTHER SERVICES	143	70	39	22	19	12	305
SERVICE BUREAUX	25	49	26	28	13	7	148
GOVERNMENT	84	57	45	33	30	10	259
PETROLEUM	13	10	14	16	9	5	67
OTHERS	13	7	8	5	3	1	37
TOTAL	503	546	348	313	162	56	1928
MAY 1968	369	504	318	249	136	37	1613
MAY 1967	161	467	338	214	92	7	1279
JUNE 1966	83	370	285	134	76		948
JUNE 1965	78	300	116	168	45	3	710
MARCH 1964							502

Information Processing Society of Canada
Census of Computers
1969

2. FINANCIAL AND COMMERCIAL CONSIDERATIONS

The commercial data-processing industry is less than two decades old. For most of this period it has been dominated by the major hardware manufacturers who have also marketed data-processing services. During the same period, the principal characteristics of the industry were those of rapid, though uneven, growth (as high as 45% in some years) and of continuous innovation in services and products.

The nature of the industry changed with the commercial development, in the late '60s, of time-sharing techniques. During 1968 and the early part of 1969, numerous small to medium-sized independent companies were formed to exploit this new technology. In addition, new companies were created to sell specialized application services, such as those for the oil and gas industry.

Through the latter part of 1969 and continuing in 1970, the industry has experienced a period of re-adjustment brought about by an over-optimistic assessment of the potential for market growth and by the general economic slowdown, with a notable slackening in the rate of growth of government purchases of computational services. During the past twelve months a number of Canadian data-processing companies (i.e. Aquila Computing Services, Central Data Processors, BST) have been purchased by U.S. owned corporations.

Given the unpredictable nature of the market and the highly innovative nature of the industry, forecasts about its future have to be hedged with so many qualifications as to be of limited value to policy makers. Some authorities, for example, predict that the major hardware manufacturer will increase their already dominant share of the software and data-processing market. Other observers foresee an ever-expanding market for a wider and wider range of specialized applications, beyond the ability of any small group of firms to dominate -- although recognizing that the hardware manufacturers will continue to supply a substantial share of the expanding market.

All attempts to forecast the shape of the future are coloured by the present difficulties of the Canadian industry and in particular the shortage of badly needed working capital for the newly-formed companies. Nevertheless, and despite these qualifications, two possible and divergent directions for the long-term institutional and commercial development of the data-processing industry can be foreseen. They can be described as Pluralism and Rationalization:

(a) Pluralism

On the one hand, the highly innovative nature of the industry places a premium on the application of brain-power and imagination and these are qualities found just as frequently in small as in large establishments. In addition, the range of possible applications to meet demand and latent demand is so extensive that we can reasonably expect to see a continually expanding market for new entrepreneurs for the foreseeable future. The pattern of market growth, therefore, could be one of intense competition between a multitude of small, specialized companies. Together these companies, contrary to the present trend in the U.S. and Canada, could acquire a larger and more important share of the industry than they now have.

(b) Rationalization

On the other hand, the capital intensive nature of the industry and in particular the extensive capital resources required to underwrite research and development and to market the resultant products, places a premium on corporate size. In addition, the development of new applications is dependent upon the development of new hardware systems, and major operating systems, as they become larger and more generalized, will require larger and larger amounts of capital for their development. Therefore, the pattern of market growth could be one of rationalization into a relatively small number of large firms,

each able to provide customers with a multiplicity of products and services by means of a nation-wide network of data centers.

A fundamental consideration is that, at present, the major manufacturers -- all foreign-owned -- supply some 80% of the total commercial public processing market[1] in Canada. Canadian firms have a larger share (up to 40%) of the new tele-data processing, or time-sharing, market. Nevertheless, the largest single time-sharing supplier in Canada today is General Electric, a U.S. corporation, while other U.S.-owned firms such as IBM and Control Data are also active in the field. Also, as has been noted earlier, a number of Canadian companies have recently been sold to foreign buyers and similar sales in the future are, at the very least, likely.

On the basis of present trends, rationalization appears to be the more probable long-term direction for the industry. A continuation of these trends toward size and concentration could confront policy makers with a major issue: the desirability and means of ensuring, under conditions of such severe competitive pressure, a continuing Canadian presence in the data-processing industry. Its relevance should be borne in mind while considering the specific policy options discussed in this paper.

(1) For listing of companies offering data-processing in Canada, see Appendix "C".

3. APPLICATIONS

The combination of communications and computer technology makes feasible a broad range of data-processing applications that were previously impossible for technical or commercial reasons. Any complete list of possible applications would be extremely large. In fact, even today the range covers most of those tasks for which conventional computer systems are normally employed in addition to a host of others which only become feasible through the multi-user features. However, a partial list of applications can be compiled under six basic categories: (For details see Figs 3-7*).

Reference Services

All of the early commercial applications of on-line, time-shared systems involved multiple access by remote customers to a common data base. Services included airline and railway reservation services, order tallying and stock market quotation services. Current applications are being extended to specialized information networks such as police records, credit reports, medical and legal files and scientific and engineering data of all kinds. As computer utilities develop toward what one authority has called "the depository of the data base and information processing procedures of the community", their applications may encompass:

Business: Credit, real estate, marketing reports, regulations, prices, trade data.

Professional: Legal, medical, police, scientific, engineering, pharmacy, agriculture.

Consumer: Consumer reports, product specifications and prices; product availability; advertising, index of social services, employment data.

General Information: Political and economic data, historical, travel and traffic, weather, recreation, entertainment.

Financial Services

Few aspects of direct access data processing have received more attention than its potential application to banking and finance. The long-term trend of development would appear to be toward a so-called "cashless society" in which a personal "money key" could replace both the cheque and most normal cash transactions. More immediate applications include:

* See pages 29-a, 29-b, 29-c, 29-d, 29-e.

Investment networks concerned with security transactions, market analysis services and stock quotation services.

Insurance networks able to provide both routine services to insurance companies and even of generating tailor-made policies for individual customers.

Banking and credit networks including professional billing services and on-line teller terminals, sometimes intergrated with management information services.

General Business Services

The principal areas within this category include:

Production: Inventory control, scheduling, resource allocation.
Planning: System evaluation; market analysis; production planning.
Management Information: Personnel; sales reports; market reports.

General Computation Services

While calculation in one form or another is an element in all the service categories, three specific applications justify special treatment (see Fig 6): Design, including simulation and computer graphics; Business Computation, including cost-effectiveness analysis and Automated Laboratory Services including data reduction and control and monitoring of experiments.

Educational Services

Few areas of computer application, particularly in their interactive mode, hold greater long-term promise than in the field of education. Two broad new areas of development can be envisaged:

Reference: Academic disciplines; current affairs; social sports.
Instructional: Tutorial; simulation; dialogue; game playing.

Personal Services

A computer utility can provide many services to many users; it can also provide specific services to a single user. Indeed existing public systems already provide private storage facilities to which only the authorized user can have access. Such facilities can be provided to a user at his place of business for his private files, appointments calendar, message storage, or at his home for a multitude of personal records from tax files to recipes and shopping lists.

FIGURE 3

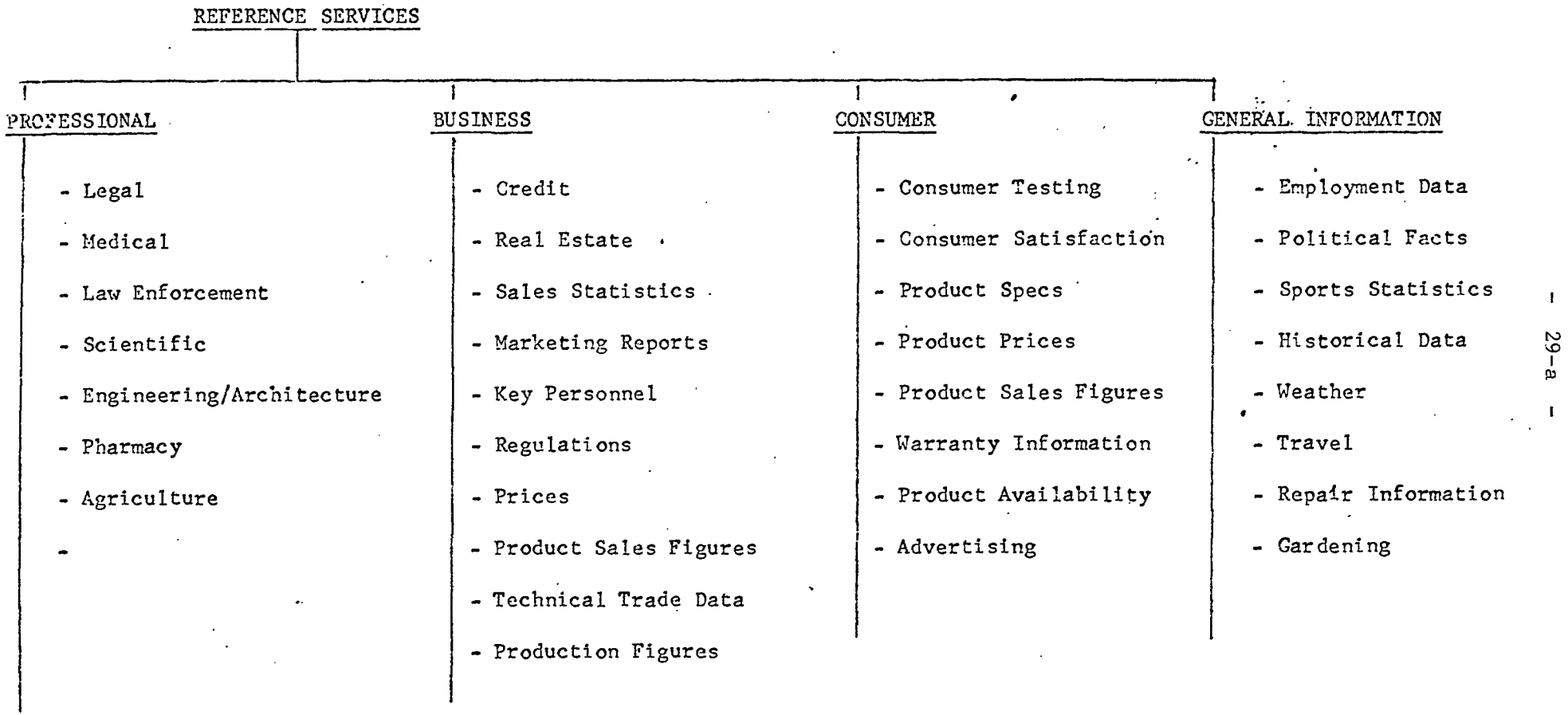

REFERENCE SERVICES
PROFESSIONAL
- Legal
- Medical
- Law Enforcement
- Scientific
- Engineering/Architecture
- Pharmacy
- Agriculture
-
BUSINESS
- Credit
- Real Estate
- Sales Statistics
- Marketing Reports
- Key Personnel
- Regulations
- Prices
- Product Sales Figures
- Technical Trade Data
- Production Figures
CONSUMER
- Consumer Testing
- Consumer Satisfaction
- Product Specs
- Product Prices
- Product Sales Figures
- Warranty Information
- Product Availability
- Advertising
GENERAL INFORMATION
- Employment Data
- Political Facts
- Sports Statistics
- Historical Data
- Weather
- Travel
- Repair Information
- Gardening

FIGURE 4

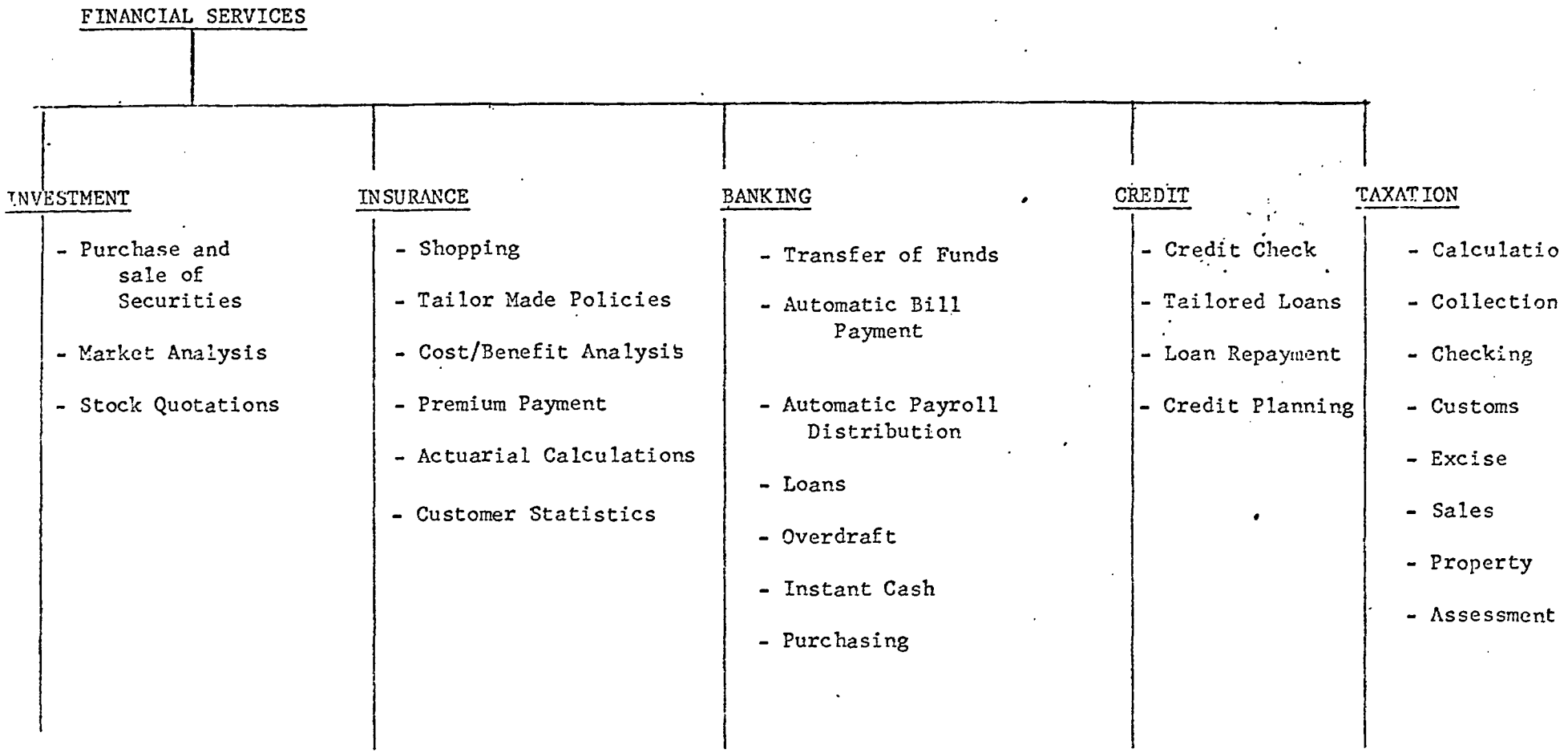

FINANCIAL SERVICES
INVESTMENT
- Purchase and sale of Securities
- Market Analysis
- Stock Quotations
INSURANCE
- Shopping
- Tailor Made Policies
- Cost/Benefit Analysis
- Premium Payment
- Actuarial Calculations
- Customer Statistics
BANKING
- Transfer of Funds
- Automatic Bill Payment
- Automatic Payroll Distribution
- Loans
- Overdraft
- Instant Cash
- Purchasing
CREDIT
- Credit Check
- Tailored Loans
- Loan Repayment
- Credit Planning
TAXATION
- Calculatio
- Collection
- Checking
- Customs
- Excise
- Sales
- Property
- Assessment

FIGURE 5

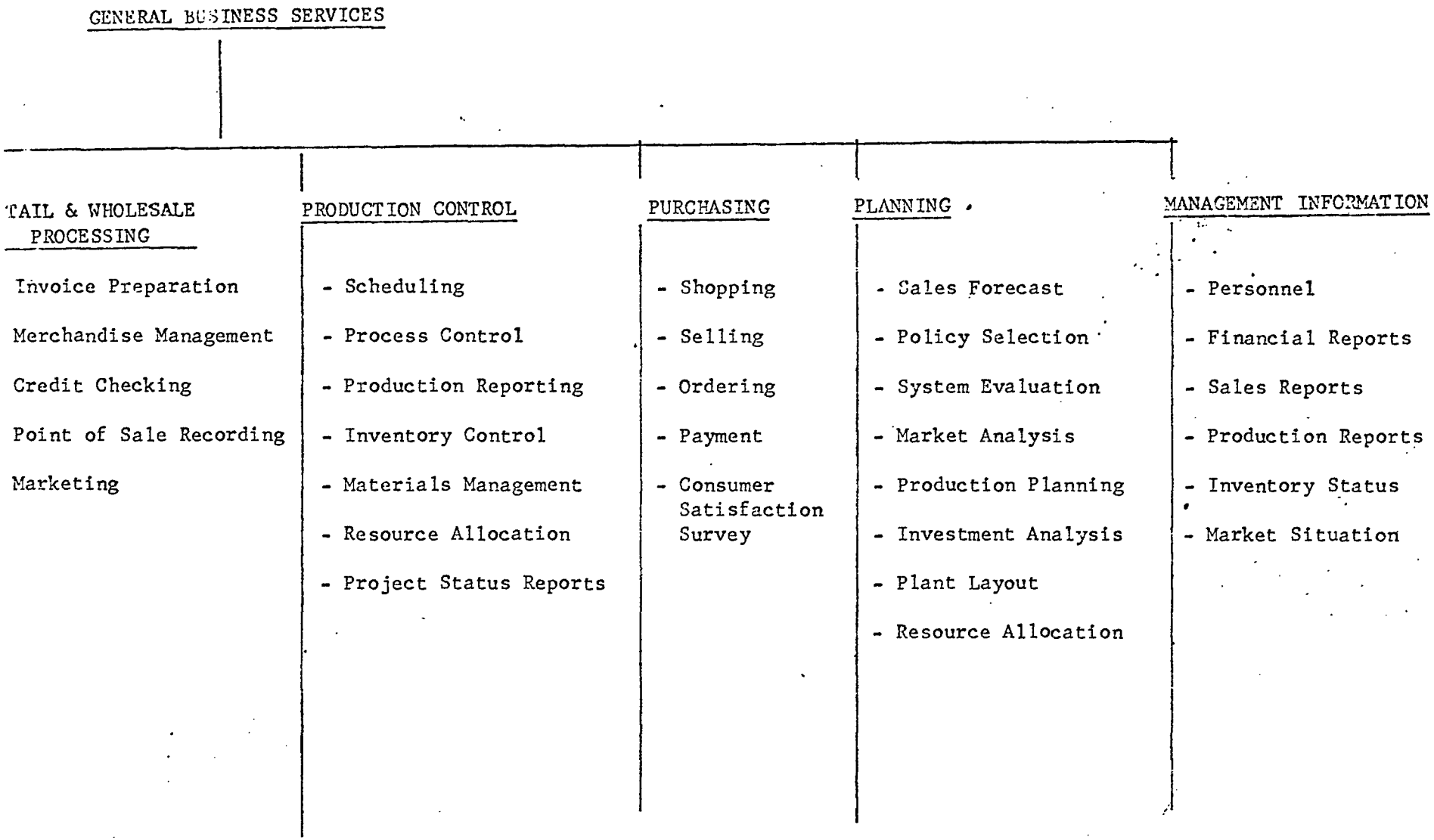

GENERAL BUSINESS SERVICES
TAIL & WHOLESALE PROCESSING
Invoice Preparation
Merchandise Management
Credit Checking
Point of Sale Recording
Marketing
PRODUCTION CONTROL
- Scheduling
- Process Control
- Production Reporting
- Inventory Control
- Materials Management
- Resource Allocation
- Project Status Reports
PURCHASING
- Shopping
- Selling
- Ordering
- Payment
- Consumer Satisfaction Survey
PLANNING
- Sales Forecast
- Policy Selection
- System Evaluation
- Market Analysis
- Production Planning
- Investment Analysis
- Plant Layout
- Resource Allocation
MANAGEMENT INFORMATION
- Personnel
- Financial Reports
- Sales Reports
- Production Reports
- Inventory Status
- Market Situation

FIGURE 6

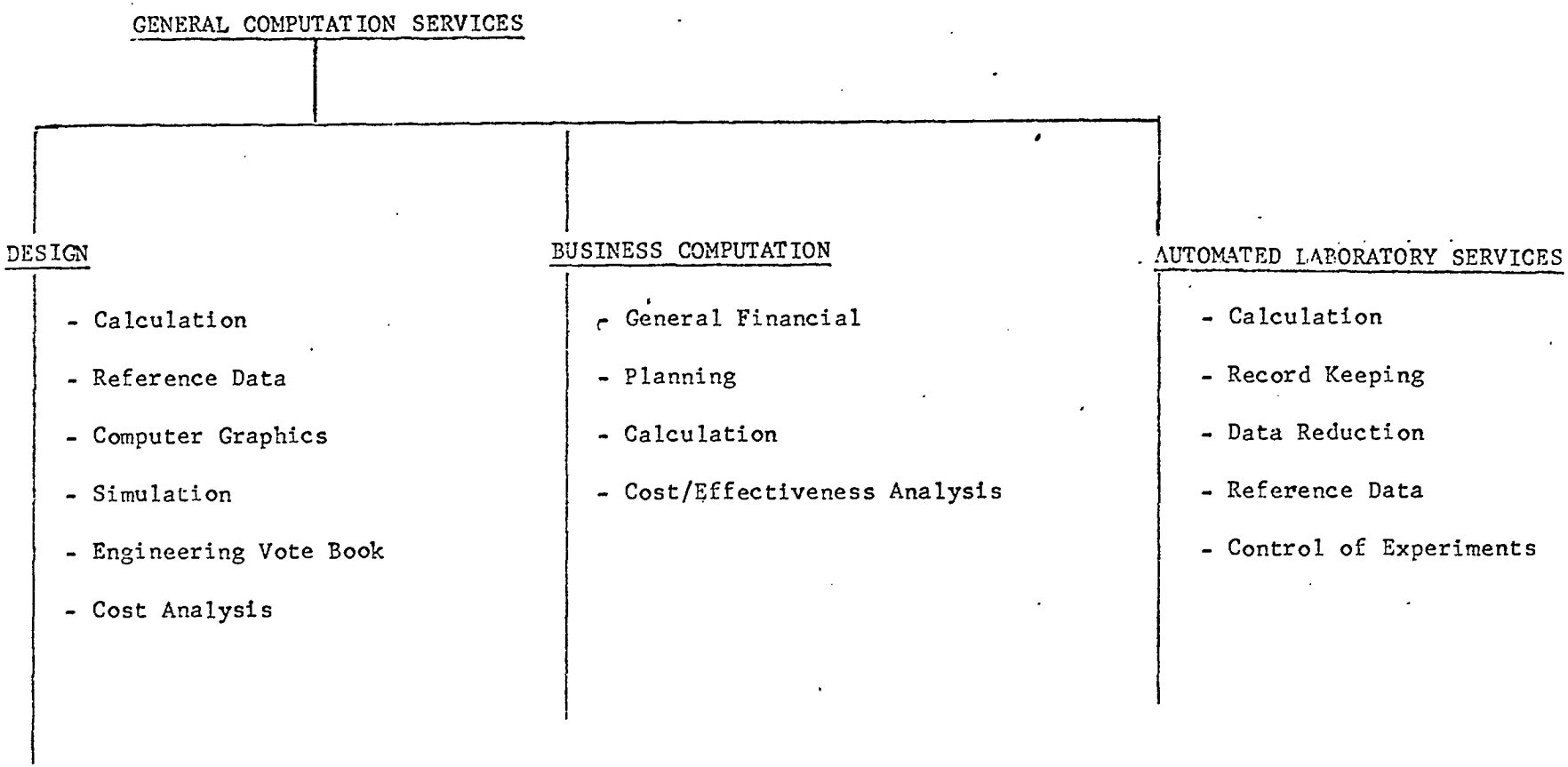
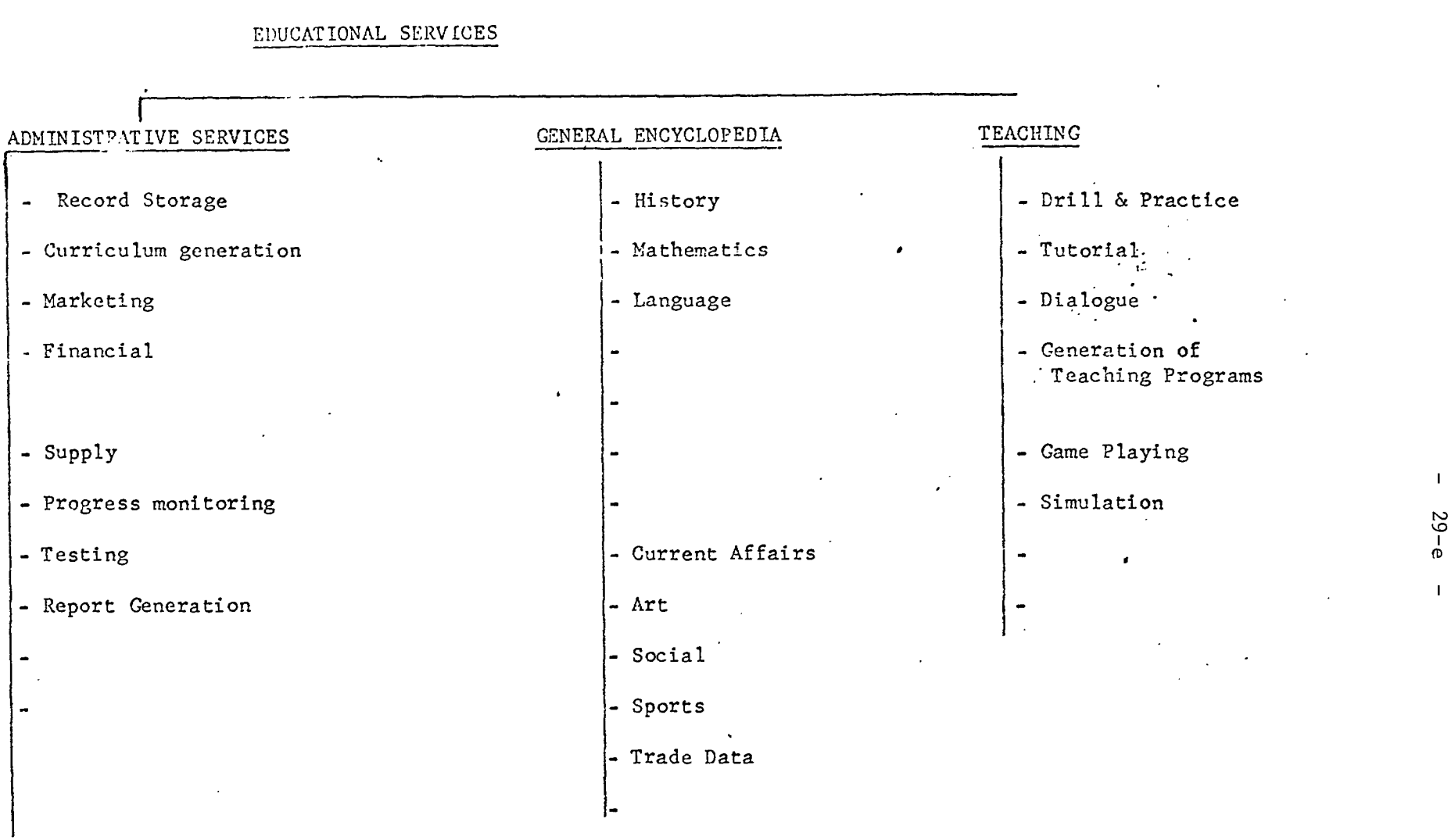

GENERAL COMPUTATION SERVICES
DESIGN
- Calculation
- Reference Data
- Computer Graphics
- Simulation
- Engineering Vote Book
- Cost Analysis
BUSINESS COMPUTATION
- General Financial
- Planning
- Calculation
- Cost/Effectiveness Analysis
AUTOMATED LABORATORY SERVICES
- Calculation
- Record Keeping
- Data Reduction
- Reference Data
- Control of Experiments

FIGURE 7


EDUCATIONAL SERVICES
ADMINISTRATIVE SERVICES
- Record Storage
- Curriculum generation
- Marketing
- Financial
- Supply
- Progress monitoring
- Testing
- Report Generation
GENERAL ENCYCLOPEDIA
- History
- Mathematics
- Language
- Current Affairs
- Art
- Social
- Sports
- Trade Data
TEACHING
- Drill & Practice
- Tutorial
- Dialogue
- Generation of Teaching Programs
- Game Playing
- Simulation

4. SOCIAL CONSIDERATIONS

All human societies can be regarded as information systems within which individuals and groups exchange ideas, opinions and information in a variety of ways and by a variety of mechanisms. A quantum increase in the volume, speed and efficiency with which information is exchanged, stored, processed and retrieved can produce a quantum change in the nature of the society within which such an event takes place. Just such a transformation of information quantity into social quality happened 500 years ago with the development of moveable type. It will, almost certainly, happen again through the application of computer technology.

The new society which may result from this technological advance has been variously described as "high technological", "technetronic" and, most commonly, a "post-industrial society". Within such a society the developments described in this paper will play a central role, affecting institutions such as industry, the universities and government, and almost all individuals. Certainly over the long term such sweeping concepts as the cashless society, individualized instruction, automated affluence, the wired city and a democracy founded on instantaneous referenda may become feasible.

It is equally possible, in the light of most historical experience, that society could be re-shaped to suit technological convenience: computer-communication links could be used to centralize decision-making, dividing society "into those who participate and those who do not"[1]; national data banks and even specialized data banks given their efficiency and magnitude, could erode personal privacy; interaction between and with computers could diminish personal interaction between people.

[1] Professor Léon Dion in the Report of the Task Force on Information

It is not the purpose of this paper to examine in depth the social promise and threat created by the marriage of computers and communication systems. Its purpose, however, is to point to the existence of both possibilities and to urge that neither be ignored.(2)

5. SOVEREIGNTY ASPECTS

Of more immediate urgency than the potential long and medium-term environmental consequences of communications computer applications are their possible impact upon Canadian sovereignty. During the next decade, market forces if unconstrained, may have the following effects:

1. Through foreign ownership of the computer utility industry, Canada may lose control of what most observers predict will eventually become the national largest and most vital industry, and the second or third largest by 1980.
2. Increasingly, Canadian computational needs may be served by north-south communications linked to U.S. computer utilities. Such a development would seriously constrain the development of an indigenous Canadian industry.

(1) Relevant Telecommission studies include an examination of the potential threat to personal privacy posed by the development of computerized information systems and data banks, and of the possible social, cultural, political and economic implications of telecommunications and data-processing technology being conducted under the heading of "The Telecommunications Environment".

3. Many application services of Canadian computer utilities and in particular those concerned with reference and instructional offerings, may be dominated by foreign content to the point where Canadian cultural identity could be submerged.

4. The location, beyond the borders of this country, of data banks containing information about Canadian institutions and individuals might render ineffective any Canadian laws concerning information contained in those systems.

Historically Canada has been unwilling to submit to unconstrained market forces where essential services are concerned. In the development of railroads, telecommunications, broadcasting networks, banking systems, highways and air services, the importance of sustaining an east-west axis has been recognized, and appropriate policy measures have been taken.

6 . A MAJOR NATIONAL PROGRAM

The size and complexity of the task Canada faces if her citizens are to benefit fully from the new levels of productivity and intellectual achievement promised by computer utilities implies a focussing of national purpose, creativity and capital into a coordinated effort. If most of the promises are to be fulfilled and the majority of dangers avoided, something more imaginative than either total laissez-faire or traditional regulatory restrictions will be needed.

So far we have spoken of systems open to diverse contributions and uses as merely something desirable. But the creation of national systems on the scale and of the potential described in this paper appears economically and politically impossible without a concerted effort from the broadest possible base, working within the context of a national objective. The magnitude of the task puts its realization beyond the reach of any existing single segment or group in Canada.

It has therefore been suggested that the Government of Canada serve as the focal point for a combined effort involving governments, computer companies, common carriers, universities, and major users, both actual and potential. This effort, expressed in appropriate institutional form, could examine, and where necessary use, such devices as standardization, coordination, rationalization, joint public-private ventures, incentives to promote research and development.

Careful attention would have to be paid to the institutional character of any co-ordinating body, its composition and its term of reference. For while specific programs could be administered by individual governmental agencies, a much larger body of opinion and expertise would be essential in examining such questions as the selection of computer services for meeting

specific problems; the commercial practices of the computer/communications industry, including charging and costing formulae used in the trade; the inter-connection of computer and communication services and particularly the equipment and technical criteria so that large-scale information systems can be effectively utilized.

Among objectives which could be the concern of a national cooperative undertaking are:

-- The definition of those Canadian social and economic needs which can be fulfilled by an integrated national computer/communications system or systems;

-- The creation, with the assistance of public policies as needed, of systems and programs designed to assure the equitable distribution of computer power across Canada and its availability to the maximum possible number of individuals and institutions.

-- The encouragement, by means of appropriate programs, of research and innovation within Canada in the application of computer/communications technology and systems.

-- The consideration of means, public and private, to prevent essential computer and data-processing services from coming under foreign control; to encourage the extension of services and systems on an east-west rather than north-south axis, and to assure that essential computer centers and data banks are established within Canada rather than beyond its borders.

-- The definition of criteria to be applied to the development of computerized information services and data banks utilizing communication links.

Any discussion of how Canadian national purpose is to be brought to bear on solving the problems of computer utilities might usefully examine the concept outlined by the Science Council of Canada's report entitled: "Towards a National Science Policy for Canada". In this important study on the future of Canadian science, the council introduced the concept of "Major Programs". Such programs were defined as "large, multi-disciplinary mission-oriented projects having as a goal the solution of some important economic or social problem" and were justified as follows:

"A most important, but by no means sole, reason for the major program approach to organization is that it seeks to provide a national focus for efforts aimed at solving national problems. .....

"Many other arguments can be advanced in favour of the major program approach. First, a concerted, co-ordinated and co-operative program is the most efficient way to make progress toward the solution of large-scale practical problems where many technical disciplines are involved. Traditionally, research and development for the needs of national defence has been carried out on a national scale, and no one would suggest that it would be effectively accomplished by leaving it to small-scale efforts by local units. ..... Today it should be a measure of a nation's maturity that it can apply its problem-solving resources on the national scale to progress on matters affecting the public interest other than the defence of sovereignty by military means.

"A major program approach is also called for by the increasing degree of organization that technological advance brings to society. In the past, problem-solving could be piecemeal, the goals of society were those of the individual and the more government stayed aloof the better. Nowadays, with the gathering of people into urban concentrations, with the high degree of interdependence created by technology and with increasing demands for efficiency in transportation, communications, energy supply, manufacturing, distribution

of food and goods, waste disposal, etc., society has closed in upon itself. One man's effluent is another man's intake. It has become clear that there is a public interest which is now always coincident with or optimized by the pursuit of private interests. ..... A total 'systems approach' may be essential."

The main thrust of the Science Council Report was directed towards the growth and development of Canadian science and technology but the arguments in favour of the "Major Program approach" apply just as strongly to any large national undertaking involving many diverse disciplines and, in particular, to the creation of an integrated national complex of computer utility networks.

Part III

BASIC POLICY OPTIONS AND CONSEQUENCES

INTRODUCTION

Previous sections of this report have stated that there is a natural alliance between computers and communications and that this alliance expresses itself in the form of computer utilities. This leads to the question of whether telecommunications carriers should or should not be allowed to offer public data-processing services. The carriers being regulated monopolies, some consideration must be given to the advantages and disadvantages of allowing them to enter an unregulated field.

The question is given greater pertinence by the fact that two regulated telecommunications companies, one of them federally regulated, have already begun offering data-processing services to the public.

The recent proposal by the Federal Communications Commission in the United States allowing telecommunications companies to operate unregulated computer utilities gives rise to the possibility that various American carriers may enter the Canadian market.

A further consideration is the fact that the Canadian data-processing industry is already largely controlled by foreign owners. Consequently, measures may be necessary to assure a strong and viable Canadian participation which will be responsive to Canadian needs and which will assure the most equitable distribution of the benefits of the computer to all regional and social groups.

A corollary of the question of common carrier entry is the need to determine what constraints should be placed upon them if they are allowed to offer data-processing. It is the purpose of this chapter to first summarize the arguments for and against carrier entry and then to discuss a number of different policies under which such entry might be permitted.

VERTICAL AND HORIZONTAL DIVERSIFICATION

In the discussion in this chapter, the terms "vertical" and "horizontal" diversification are used to describe two basically different approaches to carrier diversification. These concepts have come into relatively common use in the United States during the course of the Federal Communications Commission enquiry into the Interdependence of Computers and Communications. (1)

Horizontal Diversification

This approach enables the carrier to offer data-processing as a carrier with shared use of facilities, management, personnel and equipment between the data-processing and communications segments of the carriers' business.

Vertical Diversification

In this approach, the carrier establishes a corporate affiliate for the data-processing part of its business that is separate and apart from the parent.

VERTICAL DIVERSIFICATION SAFEGUARDS

In this chapter, whenever vertical diversification is discussed, it is assumed that the following safeguards designed to reduce the danger of unfair competition will apply:

(1) Absolute separation of financial, technical and management resources

(2) Prohibition of:

  (a) Cross subsidization and preferential treatment

  (b) Disclosure to the affiliate of proprietary information obtained by the carrier from competitors of the affiliate

(3) The requirement that the carriers immediately publish and receive approval for a comprehensive, clearly delineated list of data

(1) Author of the definitions cited above is Prof. Manley Irwin of the University of New Hampshire, an F.C.C. consultant.

transmission and raw computer offerings and charges

(4) Detailed monitoring of the implementation of these conditions, and adequate sanctions against infringement.

1. SUMMARY OF ARGUMENTS AND ALTERNATIVES

As a result of opinions generated during the course of the Telecommission, a number of the arguments for and against carrier participation in public data-processing can be summarized as follows:

Arguments in Favour of Participation

(1) Resources Available to the Carriers

As was mentioned in Part II, Section 5, the full exploitation of the power of the computer utilities in the interests of the Canadian people will require large expenditures and the mobilizing of all the applicable Canadian resources. The federally regulated telecommunications carriers command technical knowledge, experience and financial resources.

(2) Common Use of Equipment and Optimum System Design

The offering by the carriers of public data-processing and in particular raw computer power would facilitate more effective use of total facilities, the development of an optimum system design for national computer utility networks and hopefully reduced costs for both computer and communications services.

(3) National Objectives

As regulated entities, the carriers could be required to bring data-processing services to many small users and to remote and underdeveloped parts of Canada where they might otherwise be unavailable. The offering of public data-processing by the carriers would ensure that, under the coordinating influence of Canadian public policy, the resources enumerated in (1) above would be brought to bear in areas of greatest social and economic value.

(4) Growth of the Application-Service Industry

The existence of computer utility networks based on the offering of raw computer power by the telecommunications carriers as well as others might lead to a rapid growth of the unregulated application-service industry including the rise of a new class of entrepreneurs who would not need to own and operate their own computer facilities (see Independent Service Retailer, P.12). In many cases, this industry does not require large capital investment and competition here is clearly in the public interest.

(5) Need for Large Software Organizations

Despite the statements in (4) above, there are certain areas of the application-service industry which do require rather heavy capital investment. The creation of large data bases, the development of large industry wide application packages and the development of the software for major integrated systems: eg., automated banks, national medical networks, etc., all demand the coordinated work of hundreds of people. At the present time, there are few Canadian organizations large enough to undertake such efforts and the field is dominated by American corporations. The carriers, however, might be able to create several large viable Canadian software and systems organizations that could compete effectively with their American counterparts.

(6) Restraint on Undesirable Practices

Some U.S. computer manufacturers have established a practice which could spread through the industry of reserving perpetual proprietary rights to any programs run on their machines or to any knowledge imparted to them by their customers. If the carriers, as potentially powerful purchasers of computers, were forbidden to accept these undesirable conditions which the manufacturer seek to impose, a

national standard would be established and its general acceptance ensured by the operation of market forces.

(7) Canadian Ownership and Control

An obviously desirable objective in the national interest is that computer utility networks, operating in Canada, should be responsive in terms of ownership and control to Canadian public policy and law. The federally regulated telecommunications carriers (with the exception of British Columbia Telephone, which together with Quebec Telephone is affiliated with a United States corporation) are majority-owned by Canadians.

Arguments Against Participation

(1) Impact on Existing Data-Processing Companies

Many Canadian independent data-processing companies are undergoing a period of readjustment, and entry by the carriers into the field of public data-processing, it has been claimed, could intensify the competitive environment in which they operate.

(2) Cross-subsidization and Preferential Treatment

Many respondents to the Telecommission questionnaire (see Appendix A) criticized the propriety of allowing a carrier to offer data-processing services from a monopoly position unavailable to its competitors, alleging that small data-processing companies would be disadvantaged with respect to organizations on which they must depend for essential telecommunications services. If the data-processing services offered by a carrier were unregulated, it is claimed that they could be subsidized from telecommunications revenues. This would be harmful in two ways. First, charges to telecommunications users could be artificially inflated; and second, the carrier could be in a position to engage in unfair competition with its data-processing competitors by price-cutting.

Even if vertical diversification were prescribed, respondents claim there would still be many ways of giving preferential treatment to a quasi-autonomous subsidiary, as for example:

(a) early delivery of new equipment, advance notice of price and service changes and superior maintenance;

(b) special attention to the needs and competitive position of the subsidiary when considering whether to offer new services, the schedule for their introduction and the places or areas where they would be available; or

(c) the disclosure of proprietary information and development plans of competitors obtained through line-leasing arrangements.

(3) Obstacles to Effective Regulation

Bill C-11 to amend the Railway Act seeks to prevent cross-subsidization by subjecting all telecommunications services offered by the carriers to regulation, and requiring them to demonstrate the validity of the cost allocations on which tariffs are based. Historically, it has always been found difficult to identify true costs, even for particular elements of telecommunications services; for this reason, a tendency has developed to set total rates of return for the entire operation of the carrier, and to question the costs of specific services only when there is evidence of abuse. The enormous complexity of a horizontally integrated computer utility offering raw computer power, communications, and application services might make it extremely difficult for a regulatory body to arrive at a valid allocation of costs, but this difficulty could be largely overcome by insistence on vertical diversification. (Bill C-11 will permit the regulation of private wire offerings of raw computer power by the carriers).

(4) Slow Innovation by Carriers

Some respondents to the Telecommission questionnaire claimed that the carriers are slow to innovate and to introduce new techniques and devices. They further said that the needs of the computer utility industry demand modification of traditional tariffs, practices and customs that were originally established to satisfy the requirements of voice transmission.

(5) Dilution of Telecommunications Resources

The exploitation of recent developments which promise enormous improvement in the quality and diversity of telecommunications services will make heavy demands on the technical and management resources of the carriers. Since these resources are limited, there is a danger that diversification into public data-processing could detract from their ability to meet their primary telecommunications obligations.

2. BASIC POLICIES

If a decision was made to permit the federally regulated telecommunications carriers to participate in public data-processing, then the many possible policies that might be adopted seem to break down into five basically different approaches:

Policy A The carriers would be permitted to provide both raw computer power and application services via horizontal diversification but without regulation

Under this policy, the carriers would be providing data-processing services under conditions of unregulated competition and communications services as a regulated monopoly. Because of the horizontal structure,

however, there would be nothing to prevent sharing of equipment, plant and personnel between the two services.

It is claimed that this policy would offer possibilities for providing the technical and economic advantages of an integrated total systems approach and, at the same time, maintain the existing highly competitive data-processing market. On the other hand, in an unregulated environment the carrier would be free to subsidize the unregulated data-processing segment of his business from the "guaranteed" revenues of the regulated segment and the arguments concerning cross-subsidization and preferential treatment would apply.

Policy B Carriers would be permitted to provide both raw computer power and application services via horizontal diversification but as a regulated activity

Conceivably, this policy could avoid the difficulties of cross-subsidization of Policy A. For, with a regulatory commission approving the tariffs for both communications and data-processing, it would be easier than in Policy A for this commission to verify the correctness of the cost allocation procedures employed in the proposed tariffs. Further, since the service would be regulated, the socially desirable feature of equal access anywhere in Canada could also be more easily ensured. On the other hand, as mentioned in Section 1, there are serious regulatory problems in establishing true costs even for communications. As a result, there has been a tendency to set total rates of return for an entire carrier and to question specific service costs only when there is evidence of abuse. Consequently, in view of the enormous complexity of computer power, as

demonstrated in Part I, an Agency would be faced with a task of very great proportions in attempting logically to analyze a carrier's figures for a combined computer/communications service which also included applications services.

Policy C Carriers would be permitted to provide both raw computer power and application services via vertical diversification without regulation

This policy which is the one proposed by the F.C.C. in the United States attempts to overcome the problems of cross-subsidization by forcing the carrier to establish a separate subsidiary for the data-processing portions of its business. Sharing of personnel, common equipment and plant would be forbidden by law and the subsidiary would enjoy an autonomous corporate existence. A further variation of this policy would also forbid the sale of services by the subsidiary to any telecommunications carrier.

The most compelling arguments in favour of this policy are that it brushes aside the problems of regulation and the cost allocation difficulty, and could lead to the establishment of several large important software organizations. The main arguments against the policy have already been enumerated in section 1 of this chapter and involve the dilution of carrier resources and the danger of unfair competition. In addition, if the separations were total, this might have a bearing on the social justification for the carriers entering the data-processing business. For, from the point of view of the public, important reasons for permitting such entry involve the claimed economic dividends of the total, ie., combined communications/computer, systems approach and the possibility of promoting desirable social goals through regulation.

Policy D Carriers would be permitted to provide raw computer power via horizontal diversification on a regulated basis but would be completely barred from the application service field

This policy would make the telecommunications carriers "Telecommunications/ Computer Utility Carriers" as defined in Part I. It has been suggested that this might permit the public to reap the benefits of both optimized overall computer/ communications systems design and regulation in an area where it is feasible. The appropriate use of regulatory authority might assist in ensuring the widespread availability of computer power everywhere in Canada. Eliminating the need for heavy capital investment on the part of application service organizations might help the growth of the application services industry, as described in section 1 of this chapter.

Regulation of raw computer power offerings would seem to present fewer difficulties than in the complex applications services field. On the other hand, the difficulties of equitable allocation of costs between the computer and communications functions and of defining "raw computer power" would remain.

Objections to this policy that have been offered are:

(1) It would render a potentially large source of Canadian capital unavailable to the applications service industry and thus could hinder the growth of those portions of that industry where size and consequently large capital investments are important.

(2) If the expected advantages of integration were fully realized, the carriers would be placed in an advantaged competitive position in relation to independent suppliers of raw computer power.

(3) The long-term commercial viability of purveyors of raw computer power has yet to be fully demonstrated. While a substantial market for such facilities will always exist, arguments have been made that the facilities can be most economically provided as a "by-product" of integrated suppliers rather than as the sole offering of a computer power purveyor.

Policy E Carriers would be permitted to provide raw computer power, via horizontal diversification and application services via vertical diversification with the affiliate banned from selling services to any carrier and from selling raw computer power

This policy would permit the carriers to enter the application service business, subject to rigorous controls on a non-tariffed basis via an arms-length corporate affiliate and to also offer raw computer power on a tariffed basis through horizontal integration as in Policy D. In order to eliminate the possibility of indirect cross-subsidization through a captive market, the affiliate would be forbidden to sell to both its parent and any other carrier. In addition, it would also be prevented from offering raw computer power, either directly or as part of a service package which could wrap its own hardware and software costs into a single bundle*. If it were not for this latter prohibition, there might be a natural tendency for the carrier to offer raw computer power through its unregulated affiliate rather than directly on a regulated basis. This, it has been mentioned, could defeat one of the primary reasons for permitting carrier entry into the public data-processing field. In theory, this problem could be avoided by also tariffing the offerings of the vertical subsidiary, but this would create fundamental regulatory difficulties. Consequently, the policy requires the affiliate to obtain that power which it needs for its service packages from either the regulated carriers or a truly independent computer utility. For the purposes of the policy, a computer utility would not be regarded as independent if it were associated in any way with the carrier affiliate or any organization having an interest in that affiliate.

*This, of course, would not prohibit the affiliate from offering an integrated hardware/software service package in which the raw computer power component was obtained from another organization.

With respect to the raw computer power area, the advantages, disadvantages and impact of this policy would be identical to that of Policy D. An advantage over Policy D is based upon the claim that the carriers would be able to create several large viable Canadian software organizations that could compete effectively with their American counterparts.

APPENDIX A

SUMMARY OF RESPONSES TO THE COMPUTER/COMMUNICATIONS INQUIRY

This appendix summarizes the answers received in response to a questionnaire that was mailed to interested parties in the Canadian Communications and Computer industries and to major users of computers and communications.

The questions asked were:

1. Should any telecommunication carrier in Canada whether subject to Federal or Provincial jurisdiction, be permitted to provide data processing services for users outside of its own organization.

2. Should any non-carrier data processing organization be permitted to provide communication services for users.

3. Define what are telecommunication services and data processing services.

4. Should a computer service subsidiary of a carrier be allowed to sell its services to the carrier which controls the computer subsidiary.

5. The circumstances, if any, under which any or all of the services indicated in items 1 and 2 should be deemed subject to regulation by an appropriate governmental authority and the nature of the enabling legislation, or, whether the policies and objectives of the Federal Government would be served better by such services evolving in a free, competitive market and if so, whether changes in existing provision or law or regulations are needed.

6. What new telecommunication and processing services are or will be required to meet the present and anticipated needs of the computer industry and its customers.

7. In what respects and to what extent are present-day transmission facilities of common carriers inadequate to meet the requirements of computer technology, including those of accuracy, speed and bandwidth.

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8. Does the computer utility as an industry fit the "natural monopoly" format that ultimately calls for regulation.

The questionnaire was sent out to 131 different organizations in Canada. They included computer manufacturers, data processing companies, major users of computers, and the telecommunications carriers. About 60 replies were received from the most interested organizations and users, including the major common carriers. Several companies chose to answer the inquiry through the Canadian Business Equipment Manufacturers Association Inc. which represents 72 major companies and which presented a substantial brief on their behalf.

The text of each of the responses will be made available at the time of publication of the overall Telecommission report on "Policy Considerations with Respect to Computer Utilities".

The following summaries attempt to organize, group and simplify all these views as accurately as possible without judgement as to their validity or justification.

As will be indicated, the responses are summarized here in a very different order to that shown in the terms of reference. The summary deals first with the problem of definition in question 3. It then groups the two questions (questions 1 and 4) concerned with whether telecommunications carriers should be permitted to operate data processing services and, if so, whether a computer service subsidiary of a carrier should be allowed to sell services to the controlling carrier. Next, the summary groups the responses dealing with the converse question of whether data processing organizations should be permitted to offer communications services. Following this are given the responses to two questions (questions 6 and 7) concerned with the anticipated communications needs of the computer industry and its customers and concerned with the present inadequacies of existing communications services. Finally, there are gathered together the responses to two questions (questions 5 and 8) regarding the necessity for and the nature of government regulation of the computer utility industry and the relationship between data processing and communications. Responses were received from the parties listed at the end of this Appendix.

Summary of Responses to Question 3
of the
Study of the Relationships Between Common Carriers,
Computer Service Companies and their
Information and Data Systems

Question 3: Define what are telecommunication services and data processing services.

Responses:

Most respondents provided sound definitions of telecommunications services and data processing services in many different terms. However, all answers but one were consistent with the idea that the two services are distinct. The answers may be summarized as follows:

Telecommunications Services

Telecommunications services provide the means for transmitting information, whether data, images or sound, from one location to another without substantial change being performed in the content or form of the information transmitted.

The Radio Act, Revised Statutes of Canada, 1952, Chapter 233, Section 2(L), as amended, defines telecommunications in this way:

> "The transmission, emission or reception of signs, signals, writing, images or sounds or intelligence of any nature by wire, radio, visual or other electromagnetic systems".

Data Processing Services

Data processing services are concerned with the translation of data into meaningful information and involve such functions as storing, retrieving, analyzing, classifying, correlating, sorting, summarizing and reporting information.

To illustrate the type of definitions received by the respondents, three examples from three different classes of respondents are given below:

User (Definitions proposed by The Canadian Bankers' Association)

Telecommunications Services - the transmission by wire or wireless of voice or data information between two or more points through a network of facilities usually controlled by common carriers.

Data Processing Service - receipt of information in human readable, human hearable, or electronic coded form, followed by the formation of, or updating of records, the processing of this data in accordance with user's requirements, and the subsequent provision to the user of the results of the information processing.

Data Processing Company (Definitions proposed by Computrex Computer Centres Ltd.)

A "Telecommunication Service" supplies lines and necessary switching equipment and in so doing provide no data conversion or processing. As a result, data sent into the line by a user is transmitted to another user, or to a branch of the data processing organization at a remote point from whence the data was initiated. Just as in a business conversation conducted by phone, the telephone service provides the phones and lines that make the transaction possible. The telephone service supplies nothing else.

A Data Processing Service is an organization apart from the common carrier in every respect. It operates on the data by means of a computer and outputs the data in a different form from input. Data is transmitted via a common carrier which enters and leaves the transmission system in the same unaltered form for processing remotely and the results of computer processing may by returned via a common carrier (or telephone service company).

Common Carrier (Definitions proposed by the Trans-Canada Telephone Systems)

Telecommunications services to represent a transportation of generic data via electromagnetic means.

We would, therefore, define data processing to be the manipulation of generic data, possibly changing it, in order to produce new information; where "new" is a value judgment of the user.

Summary of the Responses to Questions 1 & 4
of the
Study of the Relationships Between Common Carriers,
Computer Service Companies and Their
Information and Data Systems

Question 1: Should any telecommunication carrier in Canada, whether subject to Federal or Provincial jurisdiction, be permitted to provide data processing services for users outside of its own organization?

Question 4: Should a computer service subsidiary of a carrier be allowed to sell its services to the carrier which controls the computer subsidiary?

Responses:

Broadly, the respondents who either favoured allowing the carriers to offer data processing or who saw no objection to such services included the manufacturers of computer equipment; some users in the pulp and paper, oil and of course, the carriers themselves. The major opponents of common carrier data processing services were the computer utility companies, the computer leasing companies, a few industrial users, and all but the one of the chartered banks. Two Federal Government agencies expressed reservations about the expansion of the carriers into data processing.

Many representations, both favourable and unfavourable, where stated subject to conditions or qualifications. For example, the Canadian Business Equipment Manufacturers Association - which, as noted, represents all major computer manufacturers - was willing to permit carrier data processing service subject to the following conditions:

(1) Operation of a common carriers data processing service by a separate and distinct subsidiary;

(2) Separate accounting and identification of joint costs shared by a carrier and its data processing subsidiary;

(3) Prohibition of the subsidizing of data processing subsidiaries by carriers;

(4) Non-discriminatory pricing and service by a carrier in the offering of communications facilities to its subsidiaries and to others;

(5) Curbing of disclosure by a carrier to its data processing subsidiary of information which the carrier has obtained from competitors of the subsidiary.

The Association also warned against the dilution by the carriers of the management and other resources available for providing telecommunications, and against the undertaking of undue financial risks by the carriers.

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Respondents opposed to permitting carrier data processing services questioned fairness of permitting a carrier to build its data processing upon the base of a communications monopoly barred to its data processing competitors. One Government official compared this danger to "dumping" of excess capacity into Canada by foreign computer utilities.

Some respondents suggested that small data processing companies would be placed at the mercy of a large competitor providing a service essentially to them. Others wondered whether regulation could deceptively separate carrier revenues and charges from communications and data processing. In reply, the supporters of carrier data processing stressed the protection which could be provided by vertical separation of parent carrier communications and subsidiary data processing. They pointed to the advantages of more effective utilization of the computers required for communications, to the benefits of shared technology and to the value of using the expertise possessed by the carriers. Some suggested that carrier data processing would bring data processing services to small users to whom such services would otherwise be denied.

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Summary of Responses to Question 2
of the
Study of the Relationships Between
Common Carriers, Computer Service Companies
and Their Information and Data Systems

Question 2: Should any non-carrier data processing organization be permitted to provide communication services for users?

Responses:

Because respondents seem to have interpreted Question 2 in different ways, it is difficult to provide a coherent summary of these responses. Some of the respondents interpreted the question as dealing with whether a non-carrier data processing organization or a group of such organizations should be permitted to establish a communications network independent of the existing common carrier facilities. Other respondents treated the question as dealing with the problem of whether a non-carrier data processing organization which leased communications facilities from a common carrier should be permitted to sublet those facilities to the data processing organizations customers. Still other respondents interpreted the question as concerned with whether a number of data processors could pool their communications needs by jointly leasing a communications facility from a common carrier and then subdividing it among themselves.

In addition a few respondents raised the issue of whether or not interconnection should be permitted between non-carrier data processing facilities and the public common carrier network. Several respondents also raised the issue of foreign attachments -- whether or not a non-carrier data processing organization should have the right to attach to common carrier facilities terminals, couplers or other devices not supplied by the common carrier.

Even among the respondent users of both data processing and telecommunications, opinions differed widely concerning the extent to which data processing organizations should be permitted to offer communications services.

In addition, an analysis of the responses to Question 2 is complicated by the close relationship between that question and Question 1. That is, a number of the respondents who argued in favour of permitting the data processing organizations to offer communications facilities appeared to do so on the assumption that the common carriers were to be permitted to offer data processing services. Thus, Consolidated-Bathurst Ltd. commented, "There seems little point in permitting a small restricted number of common carriers to offer Data Processing Services without permitting Data Processing Organizations to offer communication services."

Symbionics Systems Limited said, "If common carriers are allowed to provide data processing services then data processing organizations should be allowed to provide communication services." Whether these respondents would be willing to allow data processing organizations to provide communications facilities if the common carriers were precluded from providing data processing is not clear.

Affirmative Responses

Those respondents who favoured allowing Data Processing Organizations to provide communications facilities emphasized potential benefits to the public from increased competition and from specialized communications services. Imperial Oil Limited suggested that as a user, it would benefit from competitive services and would expect lower costs and more rapid introduction of technological developments. Canadian Industries Limited reasoned that if Data Processing Companies were permitted to provide communication services, this would foster economies of scale, would recognize the increasingly high proportion of communications used for data transmission and would provide a complete and efficient user service.

Chrysler Canada Limited responded "Yes" and noted that the computer service user would then be able to receive the benefits of data communications if he was unable to obtain his own facility.

The Ontario Paper Company Limited replied, "Data Processing Companies should be permitted to provide communication services if the customer so desires e.g. to obtain private communication to a central processor."

General Motors of Canada Limited replied "Yes, without restriction." The Ford Motor Company of Canada Limited suggested that Data Processing Companies should be permitted to provide communication services to their users, but that the communications should be limited to data processing applications. Ford pointed out that small users then could benefit from "packaged" options and from shared systems.

Noranda Mines Limited replied "Yes -- provided the communication services are leased from the common carrier."

MacMillan-Bloedel Limited stated, "We do not object to a non-carrier Data Processing Organization providing communication services for users" but added that rates for data processing and communications must be economically independent. Consolidated-Bathurst Limited would permit Data Processing Companies to provide communications services.

Collins Radio of Canada Limited distinguished between two types of communications services. The first, such as exchange telephone services, is in the public utility category and requires franchise protection. The other services are more private in nature and require neither dedication to public use nor public protection or privilege. Collins Radio would not limit private types of communication to franchised carriers.

Dow Chemical of Canada Limited replied simply, "Yes".

A number of responses suggested that data processing companies should be permitted to provide communications services subject to existing rules and regulations governing common carriers. The Canadian Business Equipment Manufacturers' Association took the position that a data processing organization should be permitted to act as a common carrier subject to existing rules governing entry into that business. C.B.E.M.A. noted, however, that a data processing organization which used telecommunications as an incidental part of providing data processing services would not be providing a telecommunication service, but rather a data processing service and, therefore, would not be a common carrier through this use of communications.

IBM Canada Limited agreed that any organization should be permitted to provide telecommunications services subject to general regulations. IBM added that a data processing company which provided common carrier communications should be required to offer its communications services to other data processing companies on a non-discriminatory basis. IBM suggested that data processing should be segregated from regulated communication services. IBM also noted that a data processing company which used a common carrier to provide communications ancillary to data processing should not be regulated.

Several respondents suggested that Data Processing Companies be permitted a limited right to provide communications services. Domtar would permit the provision of such services to users of the data processing facilities. Setak Computer Services Corporation Limited also would permit data processing organizations or groups of organizations to provide communication services for their own use but would not permit the provision of communications services apart from such data processing services since (Setak argued) this would foster monopoly. AGT Data Systems Limited again would permit data processors to purchase communications services and to share these with a few customers. Digital Analysis & Technical Assistance Ltd. argued that a data processing company should definitely be permitted to provide communications services provided "There is a data processing content in such communication services."

The response of Kates, Peat, Marwick & Co. was ". . . a qualified yes. Any organization...should be allowed to provide a dedicated leased network for a particular user company... . However, such an organization must not supply a switched network service to multiple users." The Kates firm also suggested that at one or more points on a private network a tie-in interface should be permitted to the common carriers switched network, subject to suitable technical specifications.

Computer Sharing of Canada asked that data processing companies be allowed to provide communication services for users so long as these services do not conflict with present common carrier business of general message switching and communications. Computer Sharing also made the permission to provide such services conditional on the inability of the carriers to meet such data processing requirements as an economical, commercial offering.

Greyhound Computer of Canada Ltd. would permit a data processing company to provide terminal-to-terminal communications as an aid to processing data -- for such needs as correcting programs or editing the data. But Greyhound added that users should not be provided with a means of circumventing normal communications channels for reasons unrelated to data processing. Greyhound noted that the use of a data processing company's computer facilities for routine communications would not benefit a computer utility since it involves high system overhead for the utility. Hence, Greyhound argued, the use of data processing communications facilities probably would be self-policing.

A significant argument in favour of permitting sub-leasing of communications was made by Gulf Oil Canada Ltd. Gulf commented, "The utilization of leased lines for data communication leads to extensive idle capacity which the users effectively pay for. For instance, if we could share time on a broadband link between Montreal, Toronto and Calgary either by subletting on our leased lines or buying time on someone else's lines, long distance transmission could become much more attractive to us and to other companies.

"The inability to sub-lease retards the growth of this function and results in economic waste through locked-in idle capacity."

A possible limitation on the communications service which might be offered by a data processing organization was suggested by Computrex Computer Centres Limited. Computrex suggested that even if a data processing company was not allowed to have a long distance communications network, the data processing company should be able to use new laser techniques or radar or an approved local microwave system within a city. This limited communications network might also include hard wire or coaxial cable within a building or city.

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Negative Responses

As one might expect, the common carriers objected to the provision of communication services by Data Processing Organizations. The Trans-Canada Telephone System responded:

> The question as stated must be answered in the negative if the intent is that such service would be provided on a non-regulated basis. If the intent of the question is to enquire whether processing organizations should be permitted to set up regulated telecommunication subsidiaries (in effect set up additional communication carriers) then the following factors must be borne in mind:
>
> (1) It would result in proliferation of telecommunications facilities. Where two structures can transport the same data, duplication is wasteful of resources. The only exception is in situations demanding physical separation of structures for the purpose of improving and maximizing continuity of service under conditions of natural disaster or acts of war.
>
> (2) Telecommunications usage cannot easily be segregated and handled on separate facility structures. In general, the user wants to talk, hear, see, and interact with computers and humans. It would be hard to believe that the public could be best served by having to deal with one company for its voice communications, with another company for its data communications, with another company for its data processing communications, and with yet another company for its video communications, etc. The future need is for simultaneous voice, data computer and visual interaction.
>
> (3) There would be little justice in any arrangement whereby regulated carriers in meeting their charter obligations must provide services to all areas -- while data processing communications vendors could select and service profitable high volume routes; including the sale of voice and non-computer data communications. Further, if the "cream-skimming" were permitted to occur, costs to the public for other communications would of necessity increase since the revenue support for many existing structures would be considerably reduced.
>
> (4) The question implies that there are no economies of scale in existing telecommunications structures. Economy of scale, where expensive physical networks are required, is one of the basic raisons d'etre of telecommunications utilities. There is little doubt, in the case of general random access usage, that one facility carrying many services is more economical and efficient than several arrangements providing one service per facility.

(5) An affirmative answer to the question implies that the carriers need not concern themselves with new telecommunications needs. Growth markets are essential if the telecommunications carriers are to survive.

(6) Regulation of a multitude of carriers is far more difficult that regulation of a few.

(7) Frequency allocation for a multitude of carriers is more difficult than for a few.

CN Telecommunications argued that no more than the present number of carriers can be supported by the business in Canada. The company stressed the need to protect telecommunications investments and referred to the effect of lower interest rates upon communications costs. CN Telecommunications noted that data processing company communications services would need to be funded at higher interest rates than would such services from the carriers, thus increasing the cost to Canada.

CN Telecommunications emphasized the "cream-skimming" argument, pointing out that common carriers must serve light density routes as well as high density routes.

Both CN Telecommunications and CP Telecommunications noted the advantage of economies of scale. The CP Telecommunications response stated, "Provision of telecommunications services should be restricted to a minimum number of competitive carrier groups to provide economies of scale, efficient use of the frequency spectrum and competitive incentives."

The "cream-skimming" argument occurred again in the response from Computer Sciences Canada Limited, a firm controlled by CN/CP: "Localized competition would possibly reduce the cost of data communications in profitable urban areas but would lead to increased costs elsewhere or would lead to government subsidy of common carriers." Computer Sciences Canada Limited denied the economic justification for a dedicated network for any data processing organization: "The total memory capacity of the approximately 2000 digital computers installed in Canada is estimated at 500 Megabits. One dedicated microwave link with a total transmission capability of 25 Megabits/second would be sufficient to exchange all information stored in the memories of all computers in Canada once every 20 seconds. This capability is orders of magnitude greater than any predictable requirement in the data processing industry."

The cream-skimming argument against data processing communications services was made by the Aluminum Company of Canada Ltd., as well as by the carriers.

The Canadian Bankers Association argued that where adequate common carrier communications facilities are available, it should not be necessary for a company engaged in data processing, such as a bank, to own and operate its own telecommunication facilities. The Association suggested that permission to establish private telecommunication facilities might be granted where required service was not provided on a satisfactory basis.

The Canadian Bankers Association also objected to sub-leasing of common carrier communications facilities by a user. The Bank of Montreal dissented on this point from the rest of the Association, believing that such sub-leasing should be allowed. The Bankers Association suggested that the carriers themselves should be allowed to lease communications facilities on a shared basis to two or more users.

Other arguments against permitting communications services by data processing companies were made by some users. A number of responses stressed the inefficiency of multiple communications systems. Cominco Limited replied, "No, since existence of two separate major telecommunications systems in Canada already creates problems requiring duplicate equipment at some points. Additional systems would compound this difficulty."

The Price Company Limited stated, "Non-carrier data processing organizations should probably not be permitted to provide communication services unless some means can be found to coordinate the various means of communication so that a high degree of efficiency may be maintained."

The reply of Cyanamid of Canada Ltd. stated, "No. Non-carrier data processing organizations should be permitted only to provide terminals and consulting services on a interconnection basis. It would be very difficult to service and to keep track of multiple suppliers."

RCA also favoured restriction of communications services to the common carriers to achieve "equitable and controlled services to any user."

One novel response was made by the Iron Ore Company of Canada, which returned separate responses from its activities as a common carrier and from its data processing department. As a common carrier, the Iron Ore Company favoured the joint operation of an over-all service by a data processing and communications organization. However, the data processing department argued that non-carrier data processing organizations should not be permitted to provide construction, operation or maintenance of outside physical plant. The data processing department warned against duplicate facilities and overcrowding of spectrums.

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Summary of Responses to Questions 6 and 7
of the
Study of the Relationships Between Common Carriers,
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Question 6: What new telecommunication and processing services are or will be required to meet the present and anticipated needs of the computer industry and its customers?

Question 7: In what respects and to what extent are present-day transmission facilities of common carriers inadequate to meet the requirements of computer technology, including those of accuracy, speed and bandwidth?

Responses:

The answers received should be discussed from the point of view expressed by three groups of respondents: Users of Data Processing Services, Common Carriers and the Computer Services Industry. The Computer Services associated with Common Carriers have tended to express desirable development of transmission facilities rather than inadequacies of present facilities.

Users of Data Processing Services

The data processing services are provided to the users by the computer services industry at a cost and within the limits of the facilities available and they are more concerned with the quality and the cost of services offered to them than with the problems associated with the development of these services. They also are not giving too much thought beyond the services required for their immediate needs, and their general comments were the following:

a) Cost

- The cost of teleprocessing services is too high. Lesser expensive methods of data transmission are required because the transmission cost often exceeds the computer cost.

- Present and future requirements dictate the need for less restricted and less costly services (e.g. Bell Telephone W.A.T.T.S. requires that a single master station initiates all calls in the network).

- Shared switching services for data terminal as well as for administrative terminal are required.

- The demand from the carriers that a terminal connector or data set be installed at each end of the line as do the transmission/reception devices is most annoying.

- Rates of charges for items considered non-standard appear to be high and unrealistic in view of the cost of the item.

- Common carriers should be required to expand the schedule bulk rates for communications packages based on total volumes of data and total mileage of transmission against charges based on private line circuit mileage or switched network time usage.

- Users must often move to leased line in order to have suitable speed and bandwidth transmission characteristics, and a leased line often exceeds their usage time requirements.

b) Improvement to the Teleprocessing Services

- Need increased capabilities for transmission from 60-48,000 BPS.

- Additional higher speed transmission circuits in a variety of bandwidths are required in smaller areas (e.g. London, Sarnia) to enable computer to computer, computer to CRT and facsimile transmission.

- Need more medium speed channels (1200-9600 baud).

- Need more very low speed channels (less than 200 baud) at low cost.

- Need very high bulk telecommunication facilities between major population centre with connected processing services to store and re-route data across lower speed facilities to nearby plant, zone, region, district customer and supplier locations and offices.

- Need interconnection between the two major common carriers and between the common carriers and the other communication company in order to get greater area coverage and interface at remote distances.

- Legislation should be introduced to require common carriers to permit interconnection of their facilities within competing carriers or private companies.

- One company requires wideband facilities to remote areas like N.W.T.

- Greater effort is needed from the carriers to improve accuracy, reduce noise, both in data channel and in their switching centres.

- Implementation of self-checking transmission codes is vital.

c) Equipment

- No unnecessary restriction should be applied to the linkage between data processing equipment and communications equipment.
- Interconnection of the common carrier switched network system with foreign attachments and user provided communication system should be mandatory, provided equipment meets interface standards.
- Users should be protected against the use of restrictive policies for equipment by the common carriers.
- Delivery time for communication equipment from the carrier is significantly longer than those quoted by other suppliers.
- There is also a lack of compatibility between computers of different manufacturers and users tend to be "locked in" to a manufacturer through use of proprietary software.
- Greater effort should be made to design teleprocessing equipment compatible with telecommunications facilities. All new developments must be compatible with what exists and individual utilities must be compatible with one another to realize the full potential teleprocessing.

d) System Design

- There is a need for system design for data transmission.
- It is difficult to obtain competent technical guidance from the carriers with respect to data communications.
- Users demand appears to be inadequate for the common carriers to develop systems other than those available.
- Common carriers are not flexible in meeting the needs of new systems.
- Need increased effort by common carriers to educate and train their employees in the special requirements of data transmission.

Common Carriers

The Common Carriers seem to have a fairly optimistic view compared to that of the users of data processing services. One contends that it has not experienced significant complaints from the Computer Services Industry in connection with the quality of the services and that sparse information is available on the services required by the industry and on the present inadequacies of existing facilities. A second Common Carrier proudly advances that the telecommunications technology of the Canadian carriers is second to none and is constantly being improved. Common Carriers general comments are the following:

- New rate packages are being developed, designed to meet the new characteristics of computer oriented information systems. New applications of transmission and switching systems are being developed to offer such services as switched wideband data, picture phone, touch-tone for data etc., as well as the possibility of processing in transit.

- New technology is being introduced into a large network on a continuing basis. Transmission facilities can handle data from the lowest bit per second rate into the megabit per second ranges, i.e. voice to full broadcast video.

- Noise has been reduced and new systems (error checking) have arisen to cope with this problem.

- Traditional rate packages have been geared to meeting a low volume market but a series of new rate packages have been put into affect to satisfy the need for higher speeds on a dedicated facility basis.

- On switched networks, costs are set in this way: (a) establishment of connection covered on the basis of minimum charge; (b) toll rates are largely a function of time and distance.

- Telex switched network, there is no minimum charge. Savings are realized by the use of call metering instead of automatic call ticketing.

- It is not the practice of the carriers to establish rates which are related to the number of anticipated errors in transmission.

- Computer to Computer transmission is available on private line or network carrier services to meet the vast majority of needs.

- The need for a very high switching speed network is at this time vague in Canada.

- Computer to and from high speed terminal is part of carrier's present offering.

- One carrier agrees to permit interconnections of users equipment subject to maintenance of technical standards to protect the integrity of the system.

- The other feels that more effort is required in the design of data sets and remote terminal business machines.

- Better cooperation and planning is needed between users, computer suppliers and the common carriers.

The Computer Services Industry

The Computer Services Industry is almost entirely dependent on the telecommunications companies, primarily the common carriers because in most cases data must be brought back and forth to the computer centre over large distances via telecommunications networks. The industry is always on the lookout for new ways to process data at lesser cost and for the creation of new needs which enable it to remain competitive. Since all new services must be matched by improved facilities and more flexibility from the communication carriers, the Computer Services Industry feels oppressed by the policies and high rates imposed by the carriers, and they have this to say:

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a) Cost

- Today's transmission facilities are too expensive for long distances. Off-peak use should be available for lower cost transmission.

- Common carrier tariffs should exclude the costs of common carrier provided terminal equipment.

- Common carriers should be forced to minimize artificial pricing structure. Users in remote locations have no incentive to install concentrators or FM multiplexors because of artificial prices imposed by the carriers.

- Rate structure may arbitrarily change and cause new equipment to be obsoleted a few weeks after the product is announced.

- Need a uniform tariff published and readily understandable by the user.

Communications Improvement

- Present day transmission facilities are adequate although by no means outstanding and they stand improvement.

- The 5 level code is inappropriate for data transmission and should be converted to a unified 8 level code (ASCII) to enhance the growth of computer utility.

- Current communications facilities lack transmission capability for effective intercomputer communications (2-3 Megabits per second) and for the development of distributed data banks.

- Need high speed in one direction with option to low speed in the other direction.

- Existing connection possibilities between users of the telephone network, including interoffice trunks are inadequate and not designed for the simultaneous access implied by share time usage in the home.

- To provide service to the widely separated population of Canada, there will be a requirement for a network system which will allow interconnection between low and high speed transmission.

On Common Carriers Policies

- Policies whereby user provided modems may only be used on the switched telephone networks through connector equipment provided by the telephone companies must be liberalized to benefit the majority of data processing users.

- Interconnection of common carrier leased and switched telecommunication services with privately owned communications services using privately owned equipment need to be allowed.

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- Restrictions on switched network multiplexing should be abolished.

- Burden of proof of non-compliance with channel performance standards should rest with the common carriers.

- Attachment of data devices should be governed by published uniform technical specifications.

- Common carriers should allow the sharing of package offering by separate users in order to make economic facilities accessible to smaller members of the data processing industry.

Technical Specifications

- There is a need for increased dialogue and liaison between telecommunications carriers, the data processing equipment suppliers and the data processing services suppliers to:

  a) provide a basis for proper planning by all parties;

  b) provide for the proper design and construction of telecommunications-oriented data processing systems;

  c) provide a basis for the interfacing of user equipment;

  d) provide for less conflict due to technological differences of approach.

- Standards and methods for data transmission should be given a complete review with industry participation.

Security

- Effective techniques will be required in both communications and processing to prevent unauthorized access, limit authorized access and to detect the penetration of the security system.

- Adequate legal and administrative safeguards will also be required.

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Summary of Responses to Questions 5 and 8 of the Study of the Relationships Between Common Carriers, Computer Service Companies and their Information and Data Systems

Question 5: The circumstances, if any, under which any or all of the services indicated in items 1 and 2 should be deemed subject to regulation by an appropriate governmental authority and the nature of the enabling legislation, or, whether the policies and objectives of the Federal Government would be served better by such services evolving in a free, competitive market and if so whether changes in existing provision or law or regulations are needed.

Question 8: Does the computer utility as an industry fit the "natural monopoly" format that ultimately calls for regulation?

Responses:

Because both Questions 5 and 8 were concerned with the extent to which the federal government should regulate either data processing or communications activities, the responses to these two questions have been treated together. Question 8 raised the issue of whether the computer utility could be regarded as a natural monopoly which required regulation in the same way as utilities such as electric line and power companies. Although a full response suggested that there was some possibility of such a monopoly emerging in the future, virtually all responses agreed that the present state of the Data Processing Industry did not justify regarding a computer utility as a "utility" in the judicial sense. Many responses emphasized that the Data Processing Industry is highly competitive and in no way monopolistic. Other points which were raised several times in response were the following:

(1) Entry into the Data Processing Industry is relatively easy.

(2) Capital requirements of the Data Processing Industry are low.

(3) The ratio of revenues to capital investment in the Data Processing Industry is comparatively high.

(4) The types of service which a computer utility may offer are so varied that it is likely that any single company can offer all types of services for which there is a demand.

(5) The demands upon the executive software of a computer and the costs of communication place a limit on the size of a computer utility which can be operated economically. This limit on the size of operation prevents any monolithic monopoly.

(6) The cost and quality of computer utility services are more dependent on the design of hardware and software than on the volume of business.

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A very high proportion of respondents also emphasized the necessity of protecting a free and competitive market for data processing. Perhaps the strongest general impression which one obtains in reading through all of the submissions is an emphasis upon competitive free enterprise and a desire to hold government regulation to a minimum.

Several responses commented on the danges that any regulation might fail to keep pace with such a dynamically developing industry as data processing services. CN Telecommunications, for example, warned that the rate of development and innovation in data processing services is so rapid that it would be very difficult to formulate regulations which would remain meaningful for any length of time. Hence, regulations might interfere with the flexibility of the industry to keep pace with new developments.

Although virtually every response stated that regulation of the computer service industry is unnecessary, several responses mentioned that regulation would seem appropriate concerning questions of security and privacy. The Trans-Canada Telephone System also mentioned specific action to provide certification of competence. TCTS added that regulation might apply rather than free competition in some cases where duplication of effort or lack of readily available data might adversely effect the Canadian economy. The TCTS brief referred to cases such as some national statistics, general medical information and perhaps legal data, and some credit information.

A few responses also suggested regulation to promote uniform standards. Imperial Oil Limited noted that controls and standards should be imposed on any interface with the public telephone and telegraph, so as to guard against interference. Canadian Industries Limited suggested that regulation might secure compatability among communication and data processing services. CIL urged standards to permit a user to move his computer system from one supplier of services to another.

Although Question 5 appeared to seek responses only on the extent to which communications and data processing combinations require regulation, a number of responses dealt with regulation of telecommunications more generally. Many responses indicated approval of the regulation of common carriers to insure standard published rates and non-discrimination among communications users. Consolidated-Bathurst Ltd. also noted that government regulation should insure consistency and uniformity where appropriate and should encourage the extension of services to parts of rural Canada where returns would not be immediate.

Some responses emphasized the value of requiring separate costing for the use of computers, and for the use of communications.

One brief, by Northern Electric, which proposed an extensive plan by which the common carriers would act as distributors of programs or information services on behalf of many others, suggested that regulation might govern the duty of the common carrier to act as a supplier on behalf of authors.

A number of comments on the regulation of the relationships between common carriers and data processors reiterated responses to Questions 1 and 2.

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LIST OF RESPONDENTS

Aluminum Company of Canada Ltd.,
Box 6090, 1 Place Ville Marie,
Montreal 101, Quebec.
Attn: R.W. Callon,
Manager, Systems Development
Department.

A.G.T. Data Systems Ltd.,
74 Victoria Street,
Toronto 210, Ontario.
Attn: G.A. Wanless, President.

Alphatext Systems Ltd.,
233 Gilmour Street,
Ottawa 4, Ontario.
Attn: G.A. McInnes, President.

British Columbia Forest Products Ltd.,
1190 Melville Street,
Vancouver 5, B.C.
Attn: W.R. Steen, Comptroller.

Burroughs Business Machines Ltd.,
801 York Mills Road,
Don Mills, Ontario.
Attn: F.J. Matas, Manager,
Sales Promotion Group III.

Canadian Business Equipment
Manufacturers Association Inc.,
1 Greensboro Drive,
Rexdale, Ontario.
Attn: G.D. Wynd, General Manager.

The Canadian Bankers' Association,
P.O. Box 282, Royal Trust Tower,
Toronto 111, Ontario.
Attn: J.H. Perry, Executive Director.

Canadian Datasystems,
2055 Peel Street,
Montreal 2, Quebec.
Attn: H. Botting, Assistant Editor.

Canadian General Electric Company Ltd.,
214 King Street, West,
Toronto 129, Ontario.
Attn: J.G.P. King, Manager,
Information Services Business Sec.

Canadian Industries Limited,
P.O. Box 10,
Montreal, Quebec.
Attn: J.H. Shipley, Vice-President.

Canadian Petroleum Association,
151 Slater Street,
Ottawa 4, Ontario.
Attn: J.M. MacNicol, Manager.

Chrysler Canada Limited,
P.O. Box 60,
Windsor, Ontario.
Attn: H.J. Fyall, Manager,
Organization, Systems and
Data Processing.

Canadian National Telecommunications,
Room 301, Blackburn Building,
85 Sparks Street,
Ottawa 4, Ontario.
Attn: K.J. MacDonald, Manager,
Special Services.

CP Telecommunications
Suite 518, Place du Canada,
Montreal 101, Quebec.
Attn: R.E. Allen, Assistant General
Manager, Computer Services.

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List of Respondents to the Inquiry (cont'd)

Collins Radio Company of Canada Ltd.,
150 Bartley Drive,
Toronto 16, Ontario.
Attn: G.J. Bury, Director of Marketing.

Cominco Limited,
1385 Cedar Avenue,
Trail, B.C.
Attn: J.E. Roberts, General Supervisor,
Data Processing Services.

Computer Sciences Canada Limited,
1200 Eglinton Avenue, East,
Don Mills, Ontario.
Attn: W.M. Richburg, President.

Computer Sharing of Canada,
4214 Dundas Street, West,
Toronto 18, Ontario.
Attn: B.A. Martin, Vice-President,
Technical.

Computrex Computer Centres Ltd.,
2000 Elveden House,
Calgary 2, Alberta.
Attn: G.M. Kernahan, P. Eng.,
President.

Consolidated-Bathurst Limited,
800 Dorchester Boulevard West,
Montreal, Quebec.
Attn: N.A. Grundy, Director,
Planning and Coordination.

Consolidated Computer Services Ltd.,
48 Yonge Street,
Toronto 1, Ontario.
Attn: M. Kutt, President.

Control Data Canada Ltd.,
50 Hallcrown Place,
Willowdale, Ontario.
Attn: W.G. Glover, President.

Cyanamid of Canada Limited,
P.O. Box 1039,
Montreal 101, Quebec.
Attn: J.R. Bruce, Director of
Data Processing.

Davis & Company,
Barristers & Solicitors,
14th Floor, Burrard Building,
1030 West Georgia Street,
Vancouver 5, B.C.
Attn: D.H. Paterson.

Domtar Limited,
Domtar House,
395 de Maisonneuve Blvd., West,
P.O. Box 7210,
Montreal 101, Quebec.
Attn: T.H. Lloyd, Director,
Computer Systems Development.

Dominion Bureau of Statistics,
Tunney's Pasture,
Ottawa, Ontario.
Attn: W.E. Duffett, Dominion Statistician.

Digital Analysis & Technical
Assistance Limited,
510, 310 - 9th Avenue, S.W.,
Calgary, Alberta.
Attn: J. Duby, P. Eng.,B.Sc.,B.A.,
M.A., D. Phil.

Dow Chemical of Canada Limited,
P.O. Box 1012,
Sarnia, Ontario.
Attn: C. Taylor, Supervisor,
Communications & Services.

Ford Motor Company of Canada Limited,
The Canadian Road,
Oakville, Ontario.
Attn: B.P. Prince, Manager,
Communications and Data
Processing, Finance.

General Computer Corporation Ltd.,
885 Don Mills Road,
Don Mills, Ontario.
Attn: R.H. Parker, President.

List of Respondents to the Inquiry (Cont'd)

General Motors of Canada Limited,
Oshawa, Ontario.
Attn: A.I. Omand, Administrator,
Data Processing Department.

Geodigit,
Chevron Standard Building,
415 - 3rd Street, S.W., 3rd Floor,
Calgary, Alberta.
Attn: J. Merland, Manager.

Greyhound Computer of Canada Ltd.,
65 Adelaide Street, East,
Toronto 1, Ontario.
Attn: G.B. Clarke, President.

Gulf Oil Canada Limited,
800 Bay Street,
Toronto 5, Ontario.
Attn: D.S. Blackmore,
Coordinator - Systems.

Honeywell Controls Limited,
740 Ellesmere Road,
Scarborough, Ontario.
Attn: R.E. Weber, Director of
Marketing, Electronic Data
Processing.

IBM Canada Limited,
1150 Eglinton Avenue, East,
Don Mills 402, Ontario.
Attn: J.E. Tapsell, Office of the
Director of Data Processing
Communications Relations.

Imperial Oil Limited,
111 St. Clair Avenue, West,
Toronto, Ontario.
Attn: E.D. Kingsbury, Manager,
Systems and Computer
Services Department.

Interprovincial Pipe Line Company,
Box 398,
10015 - 103 Avenue,
Edmonton 15, Alberta.
Attn: C.H. Bucklee, P. Eng.,
Manager Engineering.

Iron Ore Company of Canada,
Sept-Iles, Quebec.
Attn: H.E. Farnam, Jr.,
Vice President, Operations.

Kates, Peat, Marwick & Company,
Prudential Building,
4 King Street, West,
Toronto 1, Ontario.
Attn: G.S. Collins,, P. Eng.,
Partner, Electronic Systems
Engineering.

MacMillan Bloedel Limited,
1075 West Georgia Street,
Vancouver 5, B.C.
Attn: J.O. Miller, Director,
Computer & Operations Research Svcs.

Noranda Mines Limited,
Suite 1700,
44 King Street, West,
Toronto 1, Ontario.
Attn: A.H. Zimmerman, Vice-President-
Comptroller.

Northern Electric Company Limited,
P.O. Box 3511, Station 'C',
Ottawa, Ontario.
Attn: G.B. Thompson, Communications
Studies Group.

The Ontario Paper Company Limited,
Thorold, Ontario.
Attn: K.T. Waldock, Director,
Operations Research.

Olivetti Underwood Limited,
1390 Don Mills Road,
Don Mills, Ontario.
Attn: L. Amato, President.

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List of Respondents to the Inquiry (Cont'd)

The Price Company Limited,
65 St. Anne Street,
Quebec 4, Quebec.
Attn: R.E. Membery, Vice-President, Finance.

Québec Téléphone,
Rimouski, Quebec.
Attn: Julien Thuot, L.S.C., C.Adm., Vice-President-Finance & Treasurer.

R.C.A. Limited,
1001 Lenoir Street,
Montreal 207, Quebec.
Attn: H.B. Godwin, Vice-President, Defence Systems.

Systems Research Group,
130 Bloor Street, West,
Toronto 5, Ontario.
Attn: R.W. Judy, Principal.

Science Council of Canada,
7th Floor,
150 Kent Street,
Ottawa 4, Ontario.
Attn: P.D. McTaggart-Cowan, Executive Director.

Setak Computer Services Corporation Limited,
20 Spadina Road,
Toronto 4, Ontario.
Attn: J. Kates

Systems Dimensions Limited
770 Brookfield Road,
Ottawa 8, Ontario.
Attn: G.A. Fierheller, President.

Symbionics Systems Limited,
550 Berry Street,
Winnipeg 21, Manitoba.
Attn: B.A. Hodson, President.

T-Scan Limited,
155 Adelaide Street, West,
Toronto 1, Ontario.
Attn: L.E. Richardson, President.

Trans-Canada Telephone System,
1050 Beaver Hall Hill,
Montreal, Quebec.
Attn: T.O. Carss, Assitant Vice-President, (Planning) Bell Canada.

Sperry Rand Canada Limited,
Univac Division,
250 Bloor Street, East,
Toronto 5, Ontario.
Attn: E.J. Coady, Director of Marketing.

Victor Comptometer Limited,
P.O. Box 10,
Galt, Ontario.
Attn: W.H. Bell, President.

APPENDIX B

GLOSSARY OF TERMS

ALGOL

An acronym standing for Algorithmic Language. A special language created by an International Committee in 1958 and intended to become the standard international language for scientific processing.

APPLICATION SERVICES

A general term for the various tasks that a Computer Utility might perform, for example, payroll processing, information retrieval, invoicing, process control, etc.

APPLICATION SOFTWARE

The special programs which serve to organize the raw computer power provided by a computer so that it is able to perform application services.

HORIZONTAL DIVERSIFICATION

A term applied to an organization, ie., a telecommunications carrier which enters a business different than its normal field by integrating the new activities into the original business organization.

FLIP-FLOP

A bistable device having two input terminals. It can be caused to switch from one state to the other by application of a signal to the appropriate terminal.

FORTRAN

An acronym for FORmula TRANslation, a language and compiler for handling scientific problems, developed by IBM.

EXECUTIVE

A special program responsible for supervising the operation of a real-time computing system. It must handle input/output, allocate storage, establish priorities, keep track of work in progress, and activate the various operational programs.

FOREIGN ATTACHMENTS

A term used to describe equipment, ie., telephones, modems, data sets, displays, etc., connected to a telecommunications carrier's facilities but which is not supplied by the carrier.

INTERCONNECTION

A term used to describe the connection between different telecommunications carriers and/or telecommunications carriers and private systems so that signals pass freely from one system or carrier to the other.

MULTIPLEXING

The act of combining signals for many different sources into a common channel. This function is often performed by a multiplexor.

MULTIPLEXOR

A device, often a store-program computer, which handles the input/output functions of an on-line computing system having multiple communication channels.

RAW COMPUTER POWER

The facilities portion of a Computer Utility. This includes basically the central hardware and executive system but might, in some cases, also include terminal equipment on the customer's premises.

TIME-SHARED COMPUTER

A computer which switches from customer to customer at a rapid rate under the control of a scheduling formula that in the simplest case is an ordinary round robin. Each user's program is thus run in the form of short bursts of computation, and all programs are time multiplexed together in a continuously repeating cycle.

VERTICAL DIVERSIFICATION

A term applied to an organization, ie., telecommunications carrier, which enters a business different than its normal field by establishing a separate corporate subsidiary for conducting the new business.

APPENDIX C

LIST OF DATA-PROCESSING FIRMS IN CANADA

Abacus Office Services Limited
42 Charles East
Toronto, Ontario

Accounting & Data Processing
1470 Bleury
Montreal, Quebec

Addressing & Direct Dispatch
7171 Yonge Street
Toronto, Ontario

Administration & Finance
- Comtech Gr. Ltd.
9310 St. Laurent
Montreal, Quebec

AGT Management System Limited
74 Victoria Street
Toronto, Ontario

Alfa Data Limited
824 Fort Street
Vancouver/Victoria

Alphatex Systems Limited
233 Gilmour Street
Ottawa, Ontario

Anacor
2100 Drummond
Montreal, Quebec

ACS - Aquila Computer Services
635 Dorchester Street West
Montreal, Quebec

Argus
Computer Applications Limited
P.O. Box 5008
Victoria, B.C.

Automated Insurance Services
201 The West Mall
Toronto, Ontario

Bank of Montreal
129 St. James Street, West
Montreal, Ontario

Berall Management Service
8 Josephine Road
Toronto, Ontario

Berthiaume St. Pierre
Theriault & Associes
1 Place Ville Marie
Montreal, Quebec

Biro Inc.
1155 Dorchester Street
Montreal, Quebec

Birse Data Services Limited
114-7087 7th Avenue, S.W.
Calgary, Alberta

B & M Institute of Data Processing
277 Victoria
Toronto, Ontario

J. E. Brown & Associates
895 Fort Street
Victoria/Vancouver

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Burroughs Business Machines
801 York Mills Road
Don Mills, Ontario

Canada Keypunch Centre
291 1/2 Queenston Road
Hamilton, Ontario

Canadian General Electric
214 King Street, West
Toronto, Ontario

Canadian Imperial Bank of Commerce
25 King Street, West
Toronto, Ontario

CAP Limited
221 Dundas
London, Ontario

Capital Business Service
45 St. Claire West
Suite 701
Toronto, Ontario

Case Computer Appl. & Systems
2100 Eglinton West
Toronto, Ontario

Centi-Canada Ltee
1365 Place du Canada
Montreal, Quebec

Central Data Systems Limited
885 Dunsmiur
Vancouver/Victoria

Central Processing Services
20 Conway Drive
Kitchener, Ontario

Centre de Prog. Economique
5360 Jean Talon E.
Montreal, Quebec

Chinook Computer Services Ltd.
703 Chinook Professional Bldg.
Calgary, Alberta

Commercial Computer Services Inc.
4480 Cote De liesse Road
Montreal, Quebec

Computech Consulting Canada Ltd.
1177 West Hastings
Vancouver, B.C.

Computel Systems Limited
222 Laurier Avenue West
Ottawa, Ontario

Computer Consultants Limited
204-1823 Cornwall Street
Regina, Saskatchewan

CDP Computer Data Processors
550 - 6th Avenue, S.W.
Calgary, Alberta

Computer Sciences Canada
400 Laurier Street, West
Ottawa, Ontario

Computer Services
5140 Dundas Street, West
Toronto, Ontario

Computer Sharing of Canada
(Com-Share)
4214 Dundas West
Toronto, Ontario

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Computer Systems Engineering
Room 403, 1550 de Maisonneuve
Montreal, Quebec

Computrex Computer Centres Limited
424 Queen Street
Ottawa, Ontario

Comtech Group Limited
48 Yonge Street, Suite 300
Toronto 1, Ontario

Com-Tron Systems Limited
775 Adelaide Street
London, Ontario

Control Data Canada Limited
50 Hall Crown Place
Willowdale, Ontario

Control Land Surveys
13812 Buena Vista Road
Edmonton, Alberta

Cooper Keypunch Service
Suite 19, 1262 Don Mills,
Toronto, Ontario

Cover-All Computer Service
1335 Lawrence Avenue
Toronto, Ontario

Cybernetion Consultants Limited
10532 - 124 Street
Edmonton, Alberta

Cormack Data Centre Limited
737 Church Street
Toronto 285, Ontario

Data Accounting
55 Wentworth S.
Hamilton, Ontario

Data Keypunching Service
333 River Road
Ottawa, Ontario

Data Management Systems
47 Main E.
Lambeth, Ontario

Dataline Systems Limited
40 St. Clair Avenue, West
Toronto, Ontario

Datamation
160 Eglinton East
Toronto 12, Ontario

Datamation Centrex Limited
800 McLeod Building
PBX Edmonton, Alberta

Datapower
340 Gladstone Avenue
Ottawa, Ontario

Datapro London Limited
1925 Dundas Street
London, Ontario

Datatech Systems Limited
1061 Fort Street
Victoria, B.C.

Dearborn Computer of Canada
280 Ferndale Place Wloo
Kithcener, Ontario

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Delstar Data Processing Limited
3175 Beaubien
Montreal, Quebec

Digital Analysis & Technical
Assistance Limited
510 - 310 - 9th Avenue S.W.
Calgary, Alberta

Doctors Business Bureau
2788 Bathurst
Toronto 399, Ontario

EDP Associates
or EDP Data Centres Limited
2256 West 12th Avenue,
Vancouver, B.C.

Electronic Sys. Personnel Agency
Ontario Limited
250 Bloor Street, East
Suite 201
Toronto, Ontario

Empire Data Centres Limited
180 Montee de liesse
Montreal, Quebec

Etudes & Traitement de Donnees Inc.
71 St. Pierre, Room 313
Quebec

Fedder Data Centre Canada Limited
101 Richmond West
Toronto, Ontario

Financial Post
481 University Avneue
Toronto, Ontario

Geodigit
3rd Floor, 415 3 Street S.W.
Calgary, Alberta

G & N Associates Limited
74 Victoria
Toronto, Ontario

Grayhound Computer of Canada Ltd.
65 Adelaide Street, East
Toronto, Ontario

Guay Henri - Administration
760 Carré Bon Accueil
Ste-Foy, Quebec

Hamilton Data Processing Service
2171 King East
Hamilton, Ontario

Hillis-Hickling-Johnston
1530 Alberta
Regina, Saskatchewan

Honeywell Controls Limited
740 Ellesmere Road
Scarborough, Ontario

IBM Canada Limited
1150 Eglinton Avenue, East
Don Mills 402, Ontario

Information Sciences Industries
Canada Limited
1755 Woodward Drive
Ottawa 5, Ontario

Information Scolaire du Quebec
1550 de Maisonneuve West
Montreal, Quebec

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Keypunch Services Regd.
2052 Ste Catherine, West
Montreal, Quebec

LRB Programming and System Services
8230 Mayrand, Room 203
Montreal, Quebec

Mackie & Company Limited
377 Coloney Street
Winnipeg, Manitoba

Macro Data Systems
737 Church Street
Toronto 5, Ontario

MAI Canada Limited
4999 Ste Catherine, West
Montreal, Quebec

D. E. McMullen & Associates Limited
250 Bloor Street, East
Toronto 5, Ontario

MICR Systems Limited
600 Eglinton East
Toronto, Ontario

MJ Data Consultants Limited
501 - 237 7 Avenue S.W.
Calgary, Alberta

Monenco Computing Services Limited
Place Bonaventure
Montreal, Quebec

Montreal Computer Service Limited
8390 Mayrand
Montreal, Quebec

Moore Business Forms Limited
203 - 10111 124 Street
Edmonton, Alberta

Multiple Access General
Computer Corp. Ltd.
885 Don Mills Road
Don Mills, Ontario

Murrary Bulger & Assoc. Ltd.
Toronto Dominion Bank Tower
Toronto, Ontario

National Computing Services
40 St. Clair West
Toronto 7, Ontario

National Datacentre Corp.
West Pender Street
Vancouver, B.C.

NCR Data Processing
222 Landsdown Avenue
Toronto, Ontario

Offad Limited
6 Thorncliffe Square
Toronto, Ontario

Office Overload
151 Bloor Street West,
Toronto, Ontario

Paul Peel Jr.
1313-8510 111 Street,
Edmonton, Alberta

Petrex Data Agencies
263-1250 400-605 7 Avenue, S.W.
Calgary, Alberta

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Polycom Systems Limited
1300 Don Mills Road
Toronto, Ontario

Proconsul Computer Services
74 Victoria
Toronto, Ontario

Punch General Overload Services
3340 de la Pirade
Ste-Foy, Quebec

Rapid Data Limited
Lakeshore Blvd.
Toronto, Ontario

Recording & Statistical Company
650 King West
Toronto 2B, Ontario

Reynolds & Reynolds Canada Limited
100 Belfield Road
Rexdale, Ontario

Rotec Inc.
700 Crémazie
Montreal, Quebec

Riley's International Limited
(Riley's Datashare Int'l Ltd.)
631 - 8th Avenue S.W.
Calgary, Alberta

Saanes Publications Limited
25 Wellington West
Room 402
Toronto, Ontario

Samson Belair Cote Lacrois et Associes
Pl Victoria
Montreal, Quebec

Scarborough Data Processing Co.
1352 Kennedy Road
Toronto, Ontario

Score Services
133 Wynford Drive
Don Mills, Ontario

SDI Associates Limited
45 St. Claire Avenue West
11th Floor
Toronto 195, Ontario

Setak Computer Services Corp. Ltd.
20 Spadina Road
Toronto, Ontario

I.P. Sharp Associates
Dominion Centre Bank Tower
Toronto, Ontario

S.M.A. (Societe de Mathematiques
Appliquees) Inc.
1127 Laurier West
Montreal, Quebec

Softwarehouse Limited
233 Gilmour Street
Ottawa, Ontario

Sovereign Label & Seal
1a Banff Highway
Calgary, Alberta

Statistical Report & Tab.
3425 Dundas West,
Toronto, Ontario

Symbionics Systems Limited
550 Berry St. Jas,
Winnipeg, Manitoba

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Systems Dimension Limited
Place de Ville
320 Queen Street
Ottawa, Ontario

Systems & Management Services
4205 St. Denis
Montreal, Quebec

Systems Programming Services
1185a Brimley
Toronto, Ontario

Systems 73 Limited - International
Petrodata Inc.
700-540 5 Avenue S.W.
Calgary, Alberta

Technical Overload
5 Place Ville Marie
Montreal, Quebec

Tetrad Computer Appl.
740 Nichola Street
Vancouver, B.C.

Transamerica Computer Company
1980 Sherbrooke Street, West
Montreal, Quebec

Tronics Inc.
850 Lafleur Blvd.
LaSalle, Quebec

Univac (Sperry Rand Can Ltd.)
984 Bay Street
Toronto, Ontario

Universal Computer Applications Ltd.
69 Yonge Street, Room 606
Toronto 1, Ontario

Welby Computer Service
299 Waverley Street
Ottawa, Ontario

Western Computing Ltd.
328 - 10010 105 Street
Edmonton, Alberta

Western Research & Development
630 6th Avenue, S.W.
Calgary, Alberta

Wright Line of Canada
600 Eglinton East
Toronto 12, Ontario

Yetnikoff Trudeau Levi Cooper
& McGraw Inc.
491 Victoria Square
Montreal, Quebec

APPENDIX D

COMPUTERS/COMMUNICATIONS

DEVELOPMENTS IN OTHER COUNTRIES

It is helpful, when establishing Canadian policy, to have some understanding of what is happening in other countries. In this connection, this brief summary was prepared by the Department of Industry, Trade and Commerce.

COMPUTERS/COMMUNICATIONS

DEVELOPMENTS IN OTHER COUNTRIES

JAPAN

The Industrial Structural Council of the Ministry of International Trade and Industry has prepared a two part study entitled "A Report on Measures to be Taken for Information Processing and Information Industry". It reviews the current status of the EDP industry in Japan and outlines seven areas of government assistance. The report recommends mandatory training on basic computer usage in all colleges and high schools. The development of large scale sophisticated software through the establishment of a public corporation for systems development which will engage in major projects of national interest and involve private industry in the development of software with the assistance of government subsidiaries and long term loans is also recommended as is standardization of input/output, software, hardware, data codes, etc.

Only Nippon Telegraph and Telephone (NTT) can offer data communications and computer time-sharing services in Japan. However, potential computer users and government planners doubt that NTT has sufficient financial resources to make time-sharing services available at reasonable cost to a large number of potential users.

Domestic computer manufacturers are optimistic about the future of the medium and small-size computer market in Japan in part because they feel that time-sharing cannot develop rapidly enough in Japan to meet the needs of thousands of medium-size businesses which constitute the primary market for NTT's National Datacommunications Service (NDS). They seem to feel that the costs of NDS will be excessive in relation to the value of its services and they doubt that a single organization such as NTT could provide the type of counseling on modern management techniques and efficient utilization of computer technology that could be provided by a well-developed privately-owned computer service industry.

Showcase applications such as that at the Ministry of Labour which matches jobs with unemployed all over the country, and JETAC, an information storage and retrieval system for economic information supplied all over the world by the Japanese External Trade Organization (JETRO) are implemented on Japanese built computers.

The government supports an industry-wide research organization, Japan Electronic Industry Development Associations (JEIDA). It also makes low-cost money available to Japan Electronic Computer Co. (JECC), a company jointly owned by the domestic producers to rent their machines on easy terms. And through a complex network of exemption from anti-trust laws, tax rebates and loans, the government reinforces the detailed

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"administrative guidance" by MITI of every purchase of a sizable machine and every license agreement and joint-venture agreement in the industry. In order to buy a foreign computer, a Japanese businessman must prove at a face-to-face MITI inquisition that a domestic computer would not do the job.

Despite this help, all the Japanese manufacturers are in the red on computers. Luckily all six are big, prosperous manufacturers of communications and electrical equipment that can shoulder their computer losses. Most of them have a natural market in the keiretsu or family of companies grouped around a bank that like to do business with each other. And all the computer companies but Fujitsu have some kind of technical assistance tieup with a major American computer manufacturer.

BRITAIN

The Ministry of Technology has funded the formation of the National Computer Center in Manchester. NCC's aims are as follows:

- to assist in the rapid increase in the use of computers
- to simplify and reduce the cost of preparing work for computers
- to increase the numbers of trained systems analysts and programmers, and to improve their effectiveness.

In this connection it undertakes the following activities:

- NCC acts as a centre of information about computers, computer programs and computing. Its information services are continuously being expanded and up-dated.
- The training of systems analysts is given first priority. Much effort also goes into computer appreciation courses for high level management and computer education in schools.

  Standardised methods and techniques to help computer personnel to make the best use of their resources are being developed and put into effective use.
- A general advisory service is available to both users and potential users of computers. Widely experienced and highly qualified staff can be called upon for specialist advice when necessary. Opinions expressed by NCC are independent of any sectional interests.

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NCC develops and makes available both scientific and data processing computer programs for general and specific applications.

Feasibility studies and the design of computer systems for common interest groups are also undertaken.

In 1969, the British Post Office which operates the telecommunications facilities in the U.K., entered the computer service field by announcing the formation of the National Data Processing Service. Although the independent computer service firms in the U.K. objected to this development, the British Government did not interfere. The Post Office did accept a number of restrictions which would prevent it from becoming a monopoly in this field and is now regretting the extent to which it agreed to restrict itself in its operations.

It should be noted that NDPS is an integral part of the U.K. Post Office. It does not operate through an arms-length subsidiary. As a matter of fact the same equipment is utilized to provide internal post office data processing services and serve external user requirements. Also, NDPS staff operates in both areas.

In addition to NDPS a number of independent service firms and banks offer remote access computing. In fact, Barkley's, the largest bank, has recently merged its computer service activities with those of International Computer Ltd. (ICL).

The British Post Office has also recently initiated a gyro banking service in competition with the other banks. The Post Office hopes to utilize computers extensively in the operation of this service.

GERMANY

The German Post Office controls all communications facilities in this country, and is the only agency from which data communication facilities for data transmission are available. On May 5th it formed a company together with Siemens, Nixdorf, AEG/Telefunken and Olympia. The latter firms are all indigenous German computer/business equipment manufacturers. The new firm, Datel, will concentrate on the following activities:

1. computer time rentals to outside users via communication facilities

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2. sales and rentals of necessary terminals

3. software development to offer application services

4. consulting and training services for users on computer applications.

The German Post Office owns 40% in Datel, and Siemens, Nixdori, and AEG/Telefunken-Olympia 20% each.

Independent computer service firms including U.S. subsidiaries are also offering remote access services on communication facilities. However, the German Post Office will, as a matter of policy, discourage the formation of additional private networks.

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