FINAL REPORT

The Application of Fiber Optic Technology To The Access Network Evolution

APPENDIX F
Future Communication Services:
Analysis of Requirements

PREPARED FOR: Department of Communications
300 Slater Street
Ottawa, Ontario
K1A 0C8

Prepared by
Bell-Northern Research Ltd.
Ottawa, Ontario

OCTOBER 1983

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APPENDIX F TO THE REPORT OCTR 83-0003

(THE APPLICATION OF FIBER OPTIC TECHNOLOGY TO THE ACCESS NETWORK EVOLUTION)

TR 82-0060 November 1982

FUTURE COMMUNICATION SERVICES: ANALYSIS OF REQUIREMENTS

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keywords:

abstract: This report examines new and existing telecommunication services for a local access network. From a long list of potential services, a number of key services have been selected on the basis of exhibiting the highest market potential. Market segments, penetration rates, traffic and terminal requirements are then forecast for each of these services until 1992. The residential market, small and medium-sized businesses and large businesses are examined separately. These estimates will provide input for investigation of access network evolution and the development of a network architecture for a new loop system or systems. The report has been produced as part of a study of this subject funded by the Canadian Department of Communications.

security classification downgrading

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- refer to BNR CP570 paragraph 2.10-2.14

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SUMMARY

A characterization of new and future services in the access network has been performed. Various market research reports, statistical references and other sources of informations are reviewed, and a list of potential new services for the next 10 years [1992] is developed. Key services exhibiting the highest market potential are selected for further analysis.

The requirements of the residential, small and large businesses are forecasted, with traffic/penetration rates generated for each service in the short, medium and long term. Due to time constraints, no cross-impact analysis was performed.

The major conclusions of this study include:

- CATV and Pay TV will remain the dominant video services in this decade.

- Teleconferencing and Database Downloading will achieve high penetration in the business sector

Section 1 of this report includes the introduction. Section 2 contains the conclusions and recommendations.

The third section examines both the residential and Business Markets (sections 3.1 and 3.2 respectively), and provides an overview list of

existing and new services as well as a selection of key service opportunites. This analysis also examines recent trends partaining to the three markets (i.e. residential, small/medium and large businesses and provides a brief description of each including their size.

Each of the services selected is examined in the fourth section of this report. Market segments, penetrations and terminal requirements are determined for each of the three markets, for each service. The fifth section gives a preliminary extrapolation from the key services to a full list of services.

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1. INTRODUCTION

1.1 Objectives

The purpose of this report is to examine existing and new services which can be facilitated by new access network systems, to provide definitions of these services and to develop their requirements. This report will provide input for investigation of access network evolution and the development of a network architecture for a new access system or systems. The scope is limited to a ten year time frame, and to examination only of markets in urban centres.

1.2 Approach

In order to achieve the above objectives, market research reports, statistical references and other secondary sources of information (both internal and external) were used to develop an overall list of new service possibilities. From these sources, plus discussions with members of BNR, the list was refined to include only services that have the greatest potential market demand. The residential and business market segments have been analyzed separately to provide a fuller analysis.

Within each of these segments a list has been established of key services which offer the greatest market opportunity in the next ten years. For each of these services the appropriate market segments, the penetration, the usage patterns and the bandwidth has been defined in order to establish the service requirements.

With the results from the examination of a small list of key services, we will then extrapolate back to the longer list of services. The time frames will also be provided.

The "small" business market referred to in this report, includes both small and medium sized businesses.

For penetrations, both an optimistic and pessimistic forecast has been included. The optimistic forecast is an estimate assuming conditions which will have a favourable impact on the penetration of these services. The pessimistic view, is provided in brackets below the optimistic forecasts and assumes unfavourable conditions. In all cases, estimates contained in this report are Canadian, unless otherwise stated.

2. CONCLUSIONS

Services have been characterized in terms of penetration and network traffic, with an overview of terminal and network requirements. The potential market size has been determined for a list of key services within each of the primary market segments for the period 1982 to 1992. These forecasts, along with terminal requirements and traffic estimates will provide the necessary input for determination of requirements and design for new access systems.

This analysis also provides forecasts of the penetration of new services over the next ten years. Figure 1 shows the penetration curves for new and existing residential services. Figure 2 shows the penetration curves for small and medium-sized business, and Figure 3 for large business. These figures illustrate the expected development of the market for new services, in each of these market areas between 1982 and 1992.

The conclusions of this report, then, lie in its estimates of the impact on the network of various new services, and the supporting information. Some major points to note are:

- video services are not expected to emerge until early 1990's,
- home entertainment services such as CATV and Pay TV show the greatest traffic potential both in short term and the long term,
- database downloading is expected to achieve high growth by the end of this decade,
- teleconferencing is expected to achieve high usage by the end of this decade by both small and large business.

Finally, any study of this nature suffers from certain constraints in terms of time, resources or funding. In this case, one obvious need apparent to those of us involved in the study is for cross-impact analysis of various services to determine their effect on each other, and their effect on existing basic services (e.g. voice messaging on telephony, or on-demand video on CATV and Pay TV). Further work in this area, although outside the bounds of this DOC-funded contract, would be valuable.

FIGURE 1: TRAFFIC PENETRATIONS FOR NEW SERVICES (RESIDENTIAL)

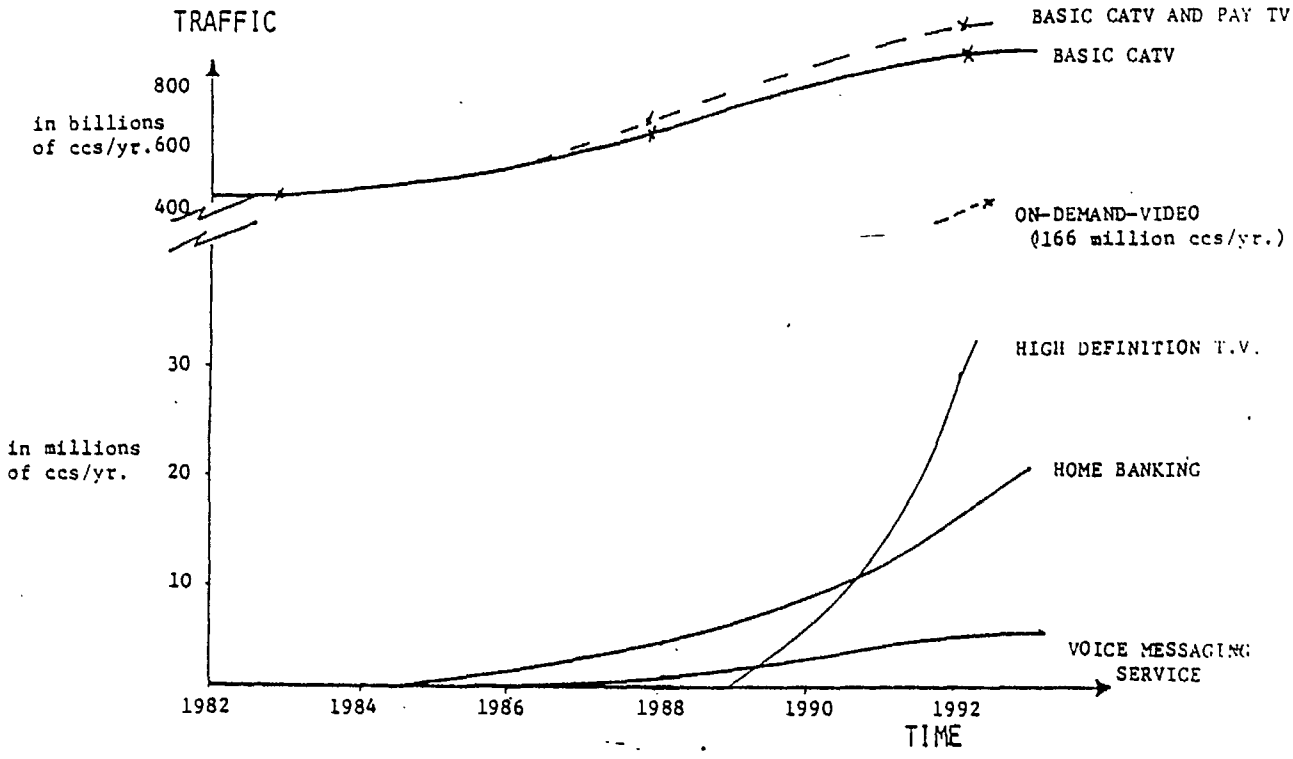


FIGURE 2: TRAFFIC/PENETRATION FOR NEW SERVICES (SMALL AND MEDIUM SIZED BUSINESS)

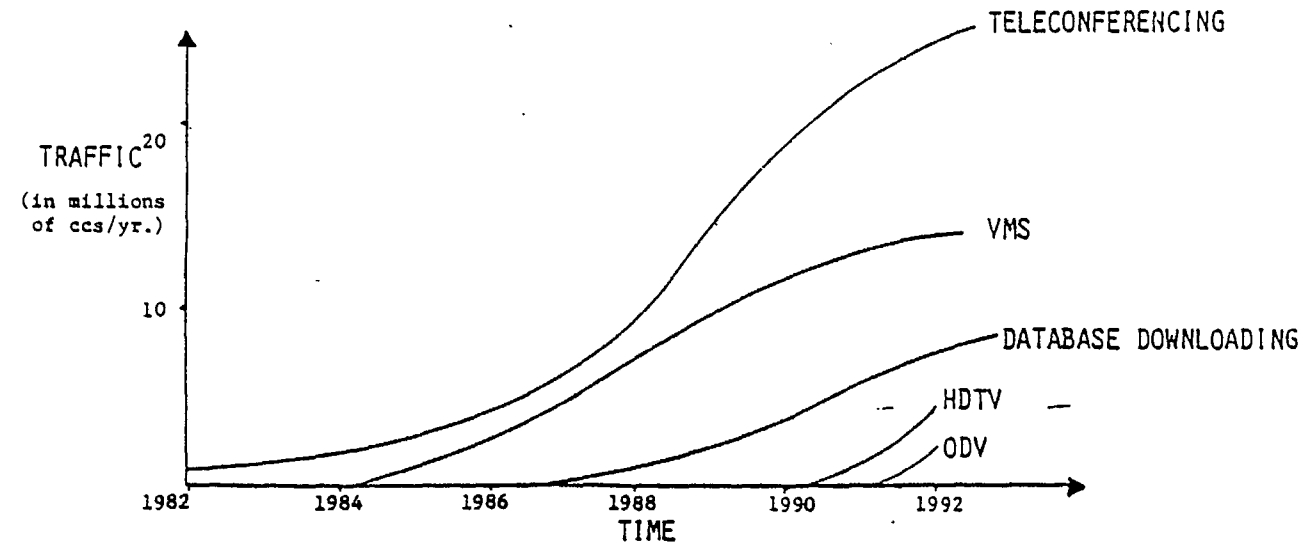
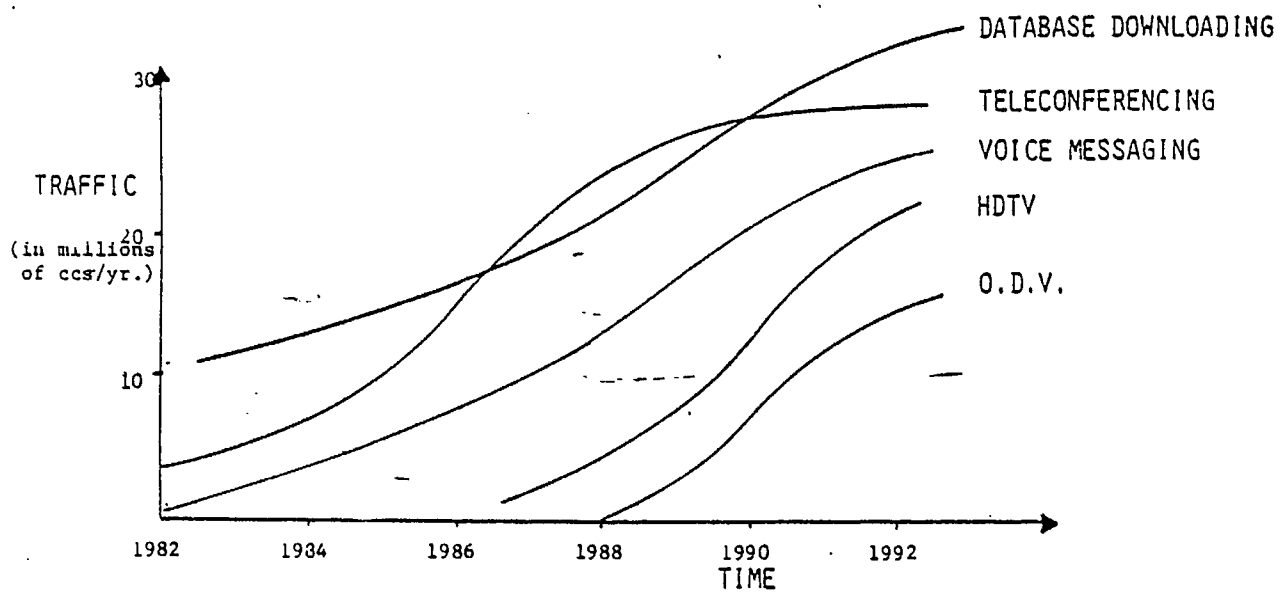


FIGURE 3: TRAFFIC PENETRATIONS FOR NEW SERVICES
(LARGE BUSINESSES)



3. RESIDENTIAL AND BUSINESS MARKETS

3.1 Residential Market

3.1.1 General

This section provides an assessment of new telecommunications services applicable to the residential market including major factors influencing consumer demand (sec 3.1.2) and an overview list of potential services (sec 3.1.3). Specific or key service opportunities (i.e. those displaying the greatest potential for introduction over the next decade) are described in sec 3.1.4; their selection has been based on current market indications/ trends and on existing and evolving technologies. The analysis further permitted the identification of specific time frames (within a ten year period) for potential introduction.

3.1.2 Factors Influencing Consumer Demand for New Services

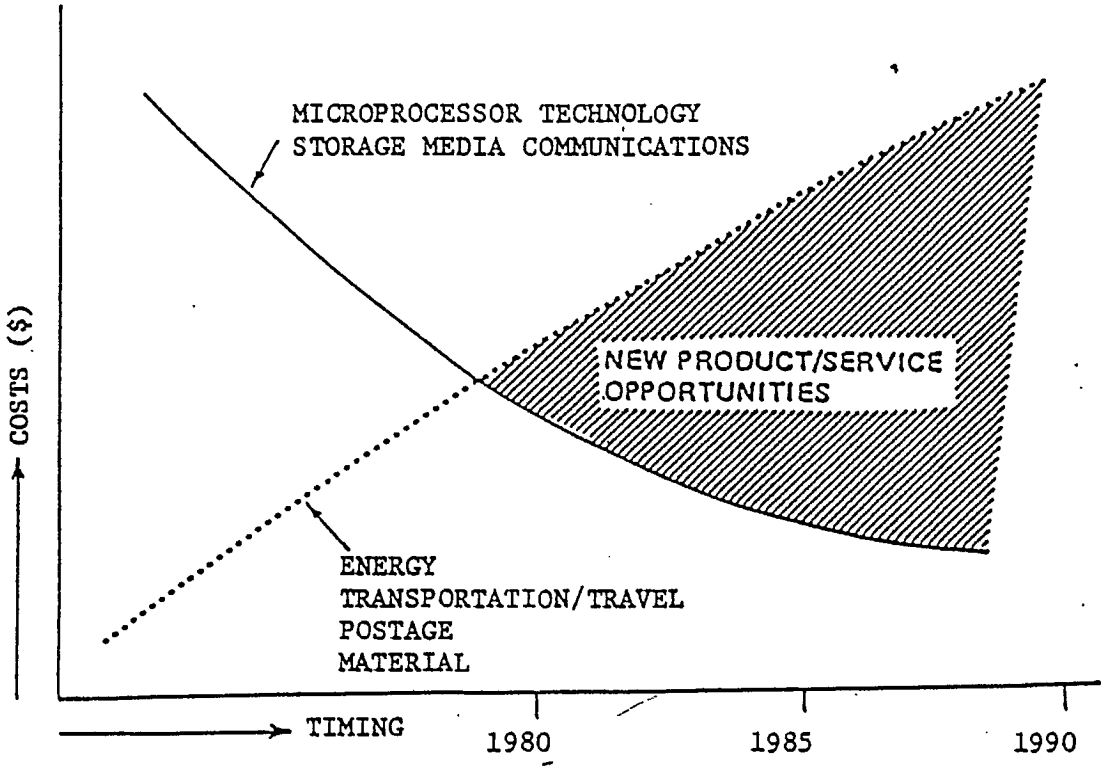
Several factors are currently viewed as being the main driving forces behind the development of the residential/home services market. These are primarily embodied in the changing social and economic conditions in the home and the availability of digital microprocessor technology.

More specifically the rapidly decreasing cost of microprocessor technology will continue to provide cost effective facilities for automating existing home functions and providing other capabilities previously unavailable in the home. These developments, coupled with the increasing costs of energy, transportation and other consumer costs, will serve to stimulate market demand for new products/services in the home [25].

In addition to the changing cost relationships presented above, the following factors are also driving developments in the home market:

- increasing importance of leisure and time away from stressful activities,
- growing consumer demand for stay-at-home activities/entertainment,
- increasing awareness and dependence on mass media,
- changing lifestyles including more working women and single-parent households,
- growth in the number of households and level of real personal spending,
- increasing importance of improved child and adult education.

Each of these factors is affecting lifestyles in a manner which will continue to accelerate the demand for special information/communications, entertainment and convenience services in the home. The relationship of these primary driving forces is depicted in Figure 4.



OTHER FACTORS:
- CHANGING LIFESTYLES
- INCREASING IMPORTANCE ON LEISURE/ENTERTAINMENT
- GREATER INFORMATIONAL NEEDS
- GROWTH IN NUMBER OF HOUSEHOLDS AND LEVEL OF REAL PERSONAL SPENDING

SOURCE [25]

Figure 4

3.1.3 Overview of Service Possibilities

Based on the conclusions derived from published literature and market and industry trends, three primary areas of study emerge. Broadly defined these include:

- entertainment,
- communications/information,
- security and controls.

Each of these encompasses a wide variety of Home Services, as illustrated in Table 1. Table 2 provides a list of service possibilities for the residential market, small business market and large business market.

Table 1

Classification of Home Services

Communications/information

- messaging – E-mail
  - VMS
  - fax
- information retrieval – (non-interactive) – teletex
  - (interactive) – videotext
  - database access
  - on demand video
  - on demand audio
- transactions – home banking
  - home shopping
- basic telephony – teledirectory

Security & Controls

- telemetry – security/alarms
  - energy management
  - autometer reading

Entertainment

- Pay TV – support and billing
  - pay per view
  - MATV (movienets)
- CATV
- remote games
- HDTV

Table 2

List of Service Possibilities

Telephony	Telemetry	Teleconferencing	Video
	Energy Management	Audio	On Demand Video
	Security/Alarms	Audio-Visual	High Definition TV
	Auto-Meter Reading	Videoconferencing	Video Archival Retrieval
		Computerconferencing	Video Publishing
			Video Education Systems
			Video Information Retrieval
			Video Surveillance

Entertainment Services	Information Services	Messaging
Cable TV	Home Banking (Telebanking)	Facsimile
Pay TV	Teletex	Voice Messaging Service
On Demand Audio	Videotex	Electronic Mail
Remote Games	Home Shopping (Teleshopping)	
MATV (Movienets)	Credit Card Checking	
	Data Communication	
	Charge Display	
	Opinion Polling	
	Teledirectory	
	Diary Service	
	Telecalculations	
	Database Downloading	
	Document Preparation	

Some of these services have already been introduced, either commercially or on a trial basis in various countries.

Although a significant degree of overlap does occur among the three primary market components, the timing and development of each will vary. This will primarily be dependent upon the relative perceived importance of new services to the consumer. Furthermore major trends relating to the purchase of home electronic products will shape the future direction of the home services market [24]. In particular, devices such as the home personal computer will provide the necessary terminal functions while representing the key interface to a wide variety of communication service possibilities. According to one source [25], service opportunities will generally lag behind equipment opportunities as they will be dependent upon the growth of installed home electronic devices.

Initially, opportunities in the residential market will emerge for a variety of stand-alone products and services.

Eventually, however these main driving forces will cause a merge of the various technologies involved to provide a totally integrated home services package including entertainment/education, information/communications and transactions.

3.1.4 Selection of Key Services

Based on the previously mentioned factors, and the conclusions derived from this analysis, Table 3 identifies the list of key services for the residential market. In addition, each service has been mapped onto a specific time frame (within a ten year period) for short, medium and long term introduction.

Table 3

List of Key Services
(Residential)

Time Frames	Short Term (1982-84)	Medium Term (1984-90)	Long Term (1990-92)
Services:	. Basic CATV	. Voice messaging	. On-demand video
	. Pay TV (support & billing)	. Telebanking	. HDTV
	. Security/alarms	. Energy management	. Videotext
	. Telephony	. Teletex	

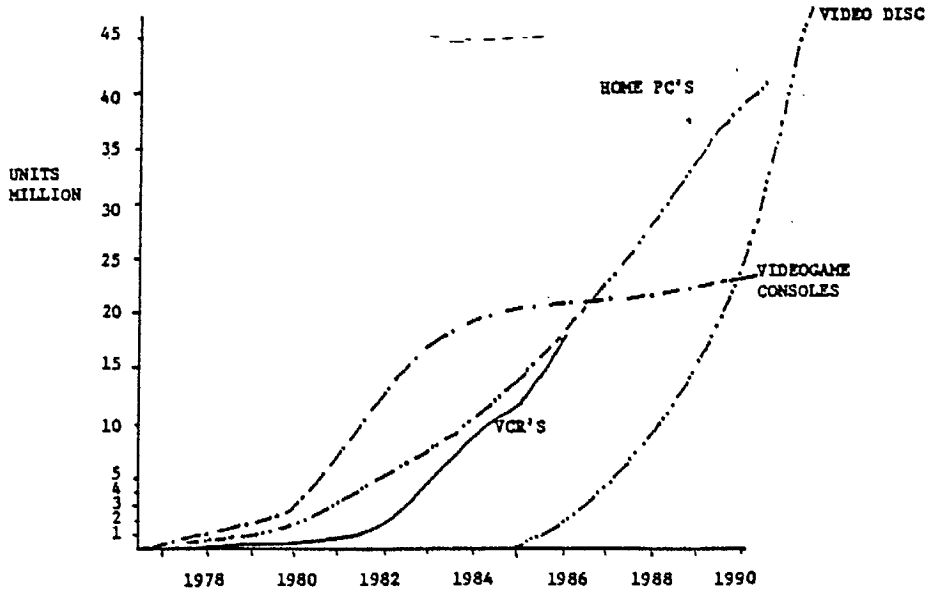
3.1.5 Primary Markets

The following section provides estimates as to the timing for development of the three primary service categories.

Although there may be a degree of uncertainty regarding the timing and development of specific services within the communications/information (except basic telephony) and security/control categories, there is little doubt that these will be preceded by entertainment oriented services. Consumer studies have shown that the increasing importance of stay-at-home activities and the declining costs of microprocessor technology have particularly affected the sales of home entertainment products [24], [25], [32].

Spending in this category is expected to increase from US $11.9 billion in the U.S. in 1979 to some US $52 billion in 1995. Furthermore electronic spending per household will increase from $154 in 1979 to $507 in 1995 and represent 26% of total consumer electronics spending. (For reference purposes, Figure 5 illustrates the projected growth of selected consumer electronic products.) Apart from electronic devices, entertainment applications are currently seen as the main driving force behind the rapid

FIGURE 5: GROWTH OF SELECTED CONSUMER ELECTRONICS PRODUCTS BY INSTALLED BASE (U.S.)



growth and the enormous volumes projected for the home personal computer (PC). In fact entertainment generates as much demand as all other applications combined. It has been stated that personal computers would not be positioned in such a growth stage were it not for the videogame industry. Eventually a crossover between videogame consoles and home PCs is envisioned as uni-functional machines (videogames) which will be supplanted by more powerful multi-functional machines for little or no price increment.

The prime consideration to consumers is that of utility. However, consumers will purchase improved entertainment products/services because the value becomes obvious to them. Similarly, home security and energy management (controls) are existing, ready-to-market services, i.e.

- technology and distribution channels are in place
- market demand has been tested
- economies of hardware and servicing seem attractive.

Security and control services comprise such functions as fire/smoke, burglary, medical alert or combinations of these, as well as energy management, e.g. appliance control (remote) and remote meter reading.

The primary driving force behind the implementation of fire and smoke detecting systems include both safety considerations, as well as the desire for lower insurance premiums. Similarly, security and intruder alert systems are of increasing practical value to consumers, especially as the need for more secure homes increases. Although the burglary rate in the U.S. has experienced a slight decrease in recent years, the average dollar volume of losses continues to increase at 10% per year.

Though to date most security and control devices have been standalone, substantial gains in efficiency appear once the intelligence of a microprocessor is added to tie various devices together as a single system. Furthermore, this "systems" approach will form the basis of a home control centre to which other data acquisition, control and communication functions can be added.

The communications/information services market is defined to consist of paid services which allow for incoming or outgoing information [24]. Information which is transmitted/received may be in the form of current awareness, entertainment, education, conversations, messages etc. In recent years, there has been a continuing trend towards the recognition of information as the most vital resource.

While this has created growing market interest in the development of enhanced communications/information services in the home, many of these new service concepts are little known to consumers. Developments in this area therefore will continue to revolve around improvements being made to existing telephone service. Features such as abbreviated dialling, call forwarding, and conference calling will provide added customer convenience while expanding the telephone's role beyond that of a mere "conversation port".

Other important factors driving the development of the residential communications/information market include the following:

- consumers desire a more convenient way to access home recreation, education and business management information
- consumers desire access to information that will fill a special need, i.e. hobbies, business, home repairs etc.
- shopping and banking from the home are seen as desirable and convenient services if confirmation receipts are available in the home

In particular, it is the interactive services such as home banking and home shopping that will have a major impact on life-styles and are seen as the main driving forces behind the evolution of communications/information services in the home.

While consumers have expressed an interest in having more convenient access to information such as news, weather, stock reports etc. these services have less tangible utility than those mentioned above. In addition, few consumers have any idea what a reasonable charge for such service(s) should be and the desirability of these therefore will have to be demonstrated.

Each of the three primary market components (residential) and key service opportunities are discussed in further detail in section 4.0.

3.1.6 Market Size

The following data provides a statistical profile of the Canadian residential market, including population and household demographics and projections. Table C-1 in Appendix C provides historical (enumerated) data and projections for the number of households in Canada over the period 1971-2001. These data, particularly those covering the period 1981-1991 have been used implicitly in the generation of the service penetration rates covered in section 4. Population and household projections for the main Census Metropolitan Areas (C.M.A.) in Canada are included (Table C-2). According to statistics Canada, a C.M.A. is defined as the main market area of an urbanized core (or continuous built-up area) having 100,000 or more population and is usually known by the largest city contained therein.

Some primary statistics for Canada are also provided below:

Primary Statistics

Population, June 1, 1980	23,891,700
% Change, 1976-80	+3.91
Current Population Growth Rate	10%/decade
Households, 1981 (est)	8,145.9
% Change, 1976-81	+15.6
Current Household Growth Rate	approx 1.2-1.3%/yr (approx 13%/decade)

3.2 Business Market

3.2.1 Needs

In order to establish which services will provide a high potential market demand, one has first to examine the needs of the business environment. Small business and large business needs have been examined separately, as they differ quite substantially.

Small businesses are very sensitive to costs and profit. Thus, small businesses are skeptical of new products and services. In order to be convinced that the purchase of a new product or service is necessary, a cost reduction, a saving in time which will lead to a cost reduction, or an increase in revenue must be proven.

A large business is not as profit-sensitive as the smaller businesses. A large business interface with the customer is remote. Information retrieval in this organization is critical, but the speed of retrieval is not as critical. Also a large business has a need for automation and the elimination of paper work. Stemming from this, a large organization's prime needs are to access corporate and external information, and improve person to person communication.

3.2.2 New Services for Business Markets

The main emphasis in this report is on the small and medium business markets. Although a significant degree of overlap occurs between the two, the main emphasis has been placed on the largely underpenetrated small business segment, although it is understood that access network evolution will be heavily influenced, if not dominated by large business requirements. Similarly the large business market will likely provide the proving grounds for many new services, especially in the use of new loop/network systems for interconnection to terminals and local area networks (LANs).

For purposes of this analysis large businesses will be defined as businesses with sales exceeding one hundred million, medium as one to one hundred million and small business as those having sales less than one million. Unfortunately the statistical data does not permit a clearer definition of small business, as is done in the United States. In the U.S., each business category (defined by Standard Industrial Classification codes) has its own set of requirements for providing a definition of small businesses. This eliminates the problem of classifying a business with high valued products (high sales) as being a large business when it is relatively small compared to the industry it is in, and employs only a few people.

Numerous magazines and reports have emphasized the need for an integrated office automation system in the future. This would comprise:

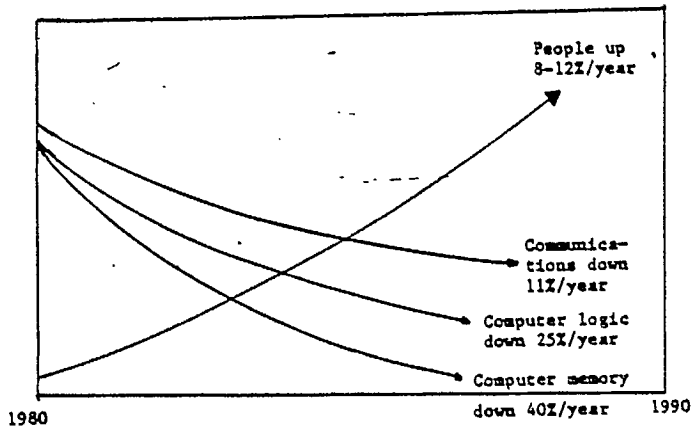
- basic telecommunications
- word processing
- electronic mail
- intelligent copiers

- teleconferencing
- storage, retrieval and filing
- database management
- data processing
- file searching

According to a SRI report on "The Payoff of Office Automation" [28], the benefits of this integrated system will be quite substantial in the future as expenses for personnel are increasing by 8-12% a year while the cost of communications is decreasing by 16%, of computer logic is decreasing by 25% and of computer memory is decreasing by 40%. (Refer to Figure 6.) It will also be important to have a link with the home, to enable managers and knowledge workers to work from their homes.

FIGURE 6

Projected Future Cost Increases



A list of services for business applications is shown in Table 4. The list contains services that are currently offered to businesses and services that are expected to be offered in the future as they exhibit high market potential. These services, along with residential services, can be classified in different functional categories as shown in Table 2.

Table 4

Overview List of Business Services

Basic Telephony
Security/Alarms
Energy Management
Electronic Mail
Credit Card Checking
Teleconferencing - Audio, Audiovisual and Videoconferencing
Videotex
Database Access
Teledirectory
Teleshopping
Diary Service
Facsimile
Telecalculation
Voice Messaging Service
Document Preparation
High Definition T.V.
On Demand Video
Video Surveillance
Publishing
Video Education System
Word Processing

An interesting application of a document distribution service is that of COSTPRO. Costpro was established specifically to simplify the movement of goods to market, which involved creating standard international forms and developing trade information standards. Since then Costpro has established an electronic forms system for use not only in export/import firms but anywhere. This system is capable of generating any form one desires, along with some graphic capabilities. Currently, there are 22 units in field trials in shipping industries, libraries and exporters. This is one of the many services which could be provided through a communications network for use of businesses, both large and small. The market and usage for the service does not look all that large, but it is a promising service for an integrated office system [41].

3.2.3 Selection of Key Services

In order to do a fuller analysis it is necessary to narrow down the selection of services to a few key business services. The justification for the selection of business services is based on an extensive literature search, present trends in telecommunications and discussion with experts both inside and outside of Bell-Northern Research.

The services on which we have focused our attention are listed in Table 5. Tables 6 and 7 further show the market segments that represent the highest market demand for each of these services, including small/medium and large businesses respectively.

Table 5

Key Services by Size of Business

Small and Medium Businesses	Large Businesses
Energy Management	High Definition T.V.
High Definition T.V.	On Demand Video
Teleconferencing	Teleconferencing
Voice Messaging Service	Voice Messaging System
Security/Alarms	Security/Alarms
	Database Downloading

Basic Telephony

Table 6

Small and Medium Business Services

Time	Short	Medium			Long	
Service / Business Category	Security/ Alarms	Energy Management	Telecon- ferencing	VMS	On Demand Video	HDTV
Retailers/Wholesalers	+	+		+		
Pharmacists	+	+				
Stockbrokers		+		+	+	
Travel Agents		+			+	
Manufacturing		+	+	+	+	
Accountants		+	+	+		
Lawyers		+	+	+		
Insurance Agents		+		+		
Real Estate Agents		+		+	+	
Hotels		+			+	+

Table 7

Large Business Services

Time	Short			Medium		Long
Service / Business Category	VMS	Database Downloading	Telecon-ferencing	HDTV	Videocon-ferencing	On Demand Video
Banks & Finance	+	+	+	+	+	+
Services - Hotels			+	+	+	+
Manufacturing	+	+	+	+	+	+
Retailers/Wholesalers	+					
Hospitals	+		+	+		+
Educational Facilities				+		+

3.2.4 Market Size

In order to determine service requirements for these services we must determine the number of businesses that will use each (market size) and the traffic generated by each business. To determine the market size we must know the number of businesses within each market and the penetration of the service. The first area that will be examined is the number of businesses within each market segment.

The data for the number of businesses within Census Metropolitan Areas is very hard to come by. Statistics Canada does not generate the data for this small an area, only by provincial and sub-provincial areas.

Thus in order to get an idea of the number of businesses in a census metropolitan area, Toronto will be examined.

An important trend occurring in Toronto and other cities in Canada is that organizations are decentralizing and continuing to move outside of the core area [26]. These trends are motivated by:

- quality of work life considerations
- easier access to and from employees' homes
- creation of more amenable settings
- cost of renting business accommodation.

The most important reason appears to be cost. An article in the Financial Times states that on average in Canada there is a $250/month/employee saving for a business in moving from the urban core to the suburbs in 1981 [26]. In the United States this saving is slightly lower at $100/month/employee, as there is not as great a rent differential between the urban core and the suburbs.

Using Toronto as an illustration of communications in Census Metropolitan Areas, there are more than 7,700 face to face linkages per week in Toronto. Of these, a 1975 consultants report (prepared for Bell Canada) estimated that 58% could be reduced with proper communication facilities. Of all the industries in Toronto, manufacturing seems to be a prime customer as manufacturing spends more on communication than any other sector, especially intra city communications, and has the largest number of locations. 63% of linkages are within the Toronto CMA [42].

The number of businesses and number of locations are shown in Table C-3 in Appendix C. Unfortunately there is no data for businesses with less than 250 employees (small businesses) in the Toronto census area.

The next best data, considering we are looking at the 25 Census Metropolitan Areas is that of Canada, also shown in Appendix C (Table C-4). For purposes of this analysis, the Toronto data will be used where possible while the Canadian data will be used everywhere else.

4. SERVICE CHARACTERISTICS

4.1 Telephony

4.1.1 General

The telephone is the most widely used device for home and business communications and information inquiry/exchange. Penetrations of basic telephone service have remained relatively constant in recent years while usage patterns have changed only slightly. In addition to basic telephony, a variety of extended telephone features/services are now offered which not only provide added customer convenience, but expand the telephone's role beyond that of a mere "conversation port". Apart from this role, the telephone is now also seen as:

- a message centre (voice message service)
- a personal tracking device (call forwarding)
- an information access point (teledirectory etc.)
- a bill paying terminal (pay-by-phone services)
- a conference port (conference calling)

In addition to these, numerous other capabilities have and are being developed which will extend an even wider variety of service initiatives to the home and office.

4.1.2 Residential Telephones

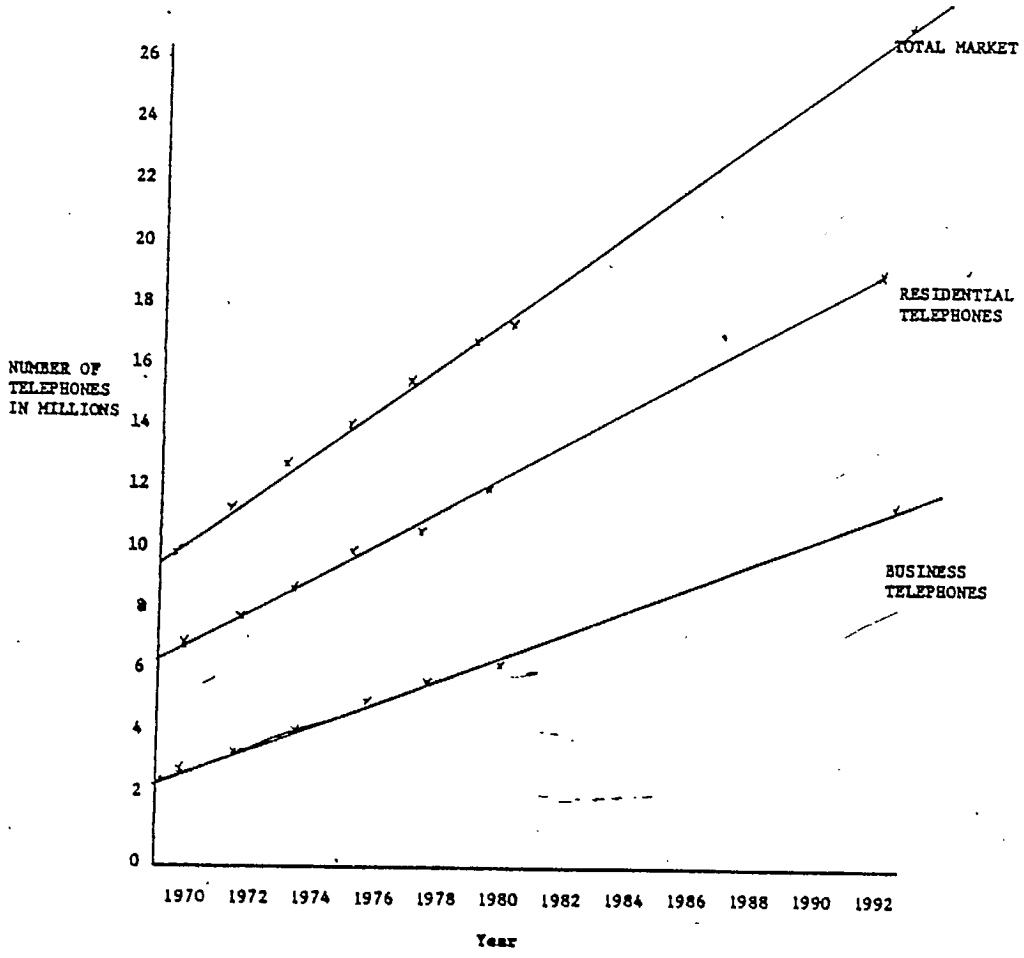
Penetration of basic home telephone service has been growing steadily at approximately 5% per year and is currently at 98% of Canadian households. There are some 12 million residential telephones in service and for each main station (i.e. excluding extensions), approximately 8 calls per day are made. The growth of telephones in Canada is illustrated in Figure 7.

4.1.3 Business Telephones

Over the last ten years, business telephones have grown at about 5% per year. This growth is likely to continue in the future, but at a slightly lower rate of about 4% per annum. In 1980, the number of business telephones was 5 million, by 1985 it will be 6.1 million and 8 million by 1990. The growth in the number of business telephones is shown in Figure 7.

Figure 7

Growth of Telephones in Canada



4.2 Consumer Entertainment Market

4.2.1 General

Existing and new services in the home entertainment market will continue to develop around the television and other emerging video technologies.

Through television, consumers have become used to video as the primary entertainment medium. Apart from standard TV formats, other more recent developments in video technologies are causing a gradual shift from purely audio supported software to video oriented programming. Devices such as video cassette, videotape and the newer videodisc recorders which allow for the recording of video as well as audio programming have experienced dramatic growth in recent years. As an example, it is estimated that U.S. sales of videodisc recorders will increase from $4 million (recorded in 1979) to some $340 million in 1985 [24].

Developments in projection system technology such as larger screen viewing systems, rear screen projection and high definition television (HDTV) will begin to capture appreciable market shares as they evolve towards more containerized units with brighter, sharper images for more "theatre-like" viewing at home. It has been estimated that by 1995 video device sales will reach some $11.6 billion (US) representing 44% of total sales of entertainment electronics spending. It is further expected that video technology will be an area of accelerated innovation and represent the key interface to new and evolving home services [25],[32].

In addition to improvements in video technology, it is expected that audio quality will also advance over the next decade. For example, stereo sound with both broadcast TV and videotape is now making an appearance, and high fidelity stereo audio have been associated with optical video discs for nearly a decade [16].

4.2.2 CATV and Pay TV

The growth of CATV and Pay TV is evidence of the opportunities which exist for provision of video entertainment. These offerings will lead consumers to expect greater choice and control over timing and content of programming.

Basic Cable TV, the most common form of cable service, offers the subscriber a means of receiving a greater number and variety of broadcasting stations beyond the receiving area of conventional television sets. Basic cable systems can now provide up to 35-50 channels of entertainment with the appropriate terminal devices, and in future capabilities will exist to provide over 100 channels. At present, basic cable services account for over 70% of cable revenues in the U.S.A. and virtually 100% in Canada. Current market CATV penetrations are estimated at 56% in the U.S. and 70% in Canada for all homes passed by cable. A comparative view of cable industry growth and selected statistics for Canada and the U.S.A. is provided in Tables C-5, C-6 in Appendix C.

Additional large markets were opened up to rapid cable growth during the 1970's by the emergence of pay cable (premium) TV services. (Although Pay TV services can be offered by other means such as MDS and STV, cable systems currently account for approximately 88% of all subscribers.) Through Pay TV, subscribers are offered uninterrupted, un-cut current movies, concert attractions, major sporting events and other entertainment not available on standard TV. Examples of such systems include Home Box Office (HBO) and Showtime.

In the U.S., the growth of Pay TV programming has been significant. Penetration rates have increased from 11.5% in 1978 to over 27% in 1980 [3],[39]. (Table C-7, Appendix C, illustrates the growth of the Pay TV industry in the U.S.)

Current Pay TV services include both pay-per-channel, as well as addressable pay-per-programme formats. With the former version, subscribers pay, typically, for a month's viewing at a time, regardless of the amount watched. Technically, all that is generally required is the removal of a trap outside the home to allow the pay channel to be received.

Although market acceptance has yet to be proven in Canada*, most industry representatives expect that once it is introduced, pay TV services will experience rapid growth and will penetrate 50% of Canadian households after five years.

Pay-per-programme pay television, is another application projected to offer high immediate return on investment [18]. This application requires an addressable descrambler which can be addressed individually (downstream) from the head end. Subscribers are then charged on the basis of the number of programmes which have been ordered by phone. The only inherent difficulty with this type of system is that last minute service demands could block the cablecasters switchboards (or potentially the telephone network). To date, pay-per-programme has most visibly been used for boxing events, with impressive financial results. In the U.S., some 500,000 homes are currently equipped to receive pay programmes. However, this number is expected to grow rapidly, and according to one source [34], could exceed some 20 million homes by 1987-88.

In addition to substantial growth in the number of Pay TV systems, there has been continued growth in the number of multi-tier (channel) systems in the U.S.A. Of the 3,072 pay-cable systems (shown in Table C-8, Appendix C), 572 offered more than one tier of pay. This figure represented an increase of over 24% compared to the previous year in the number of multi-tier systems being offered. In addition, the average tiered system offered 2.4 tiers in 1980, up from the previous average of 2.1 pay tiers in 1979 [3].

Future anticipated growth rates in the pay-cable industry indicate that by 1990 basic cable subscribers will number some 40-50 million, with an equal number of pay-cable subscribers. Similarly pay-cable revenues are expected to grow from the current level of some $800 million (or nearly $1 billion including STV and MDS) to over $7 billion by 1990 as more and more subscribers take more and more tiers [3].

A third form of Pay TV service yet to be demonstrated involves a two-way interactive capability for pay-per-view, or in the ultimate manifestation, movies on demand.

* (one such system, Teletheatre in Saskatchewan, has achieved only 2% penetration after two years of operation. Further licenses for pay TV services have yet to be issued, pending CRTC certification)

In light of the growth of multi-tier, pay-per-programme in the U.S., this represents a major opportunity to provide the return channel or upstream (2-way addressable) capability. This in fact would represent two main areas of enhanced service including pay-per-view programming (support), and data collection (billing/statistics).

To date, two-way cabling has been implemented in certain trial situations, such as Warner with its QUBE system, and Cox's INDAX system. Although much new cable construction is providing for two-way capability, the cost of upgrading existing facilities is substantial. Based on current conversion (and new construction) rates, two-way cabling will only represent service to some 30% of the available market by the end of the decade [3]. At present approximately 2% of U.S. TV homes are passed by currently operational or ready two-way cable.

These initial attempts at 2-way addressability are clearly pointing the direction towards fully interactive capabilities. In particular, the ability to "time-shift" viewing, is seen as being a major force behind consumer demand for such services.

Based on historic and anticipated growth rates, Table 8 has been generated and provides estimates of future market penetration of basic CATV and Pay TV services. Further interpretation of these data, in terms of traffic generated (i.e. CCS/yr), can be found in Appendix B, Figures B-1, B-2. Ultimately video on-demand would allow viewers to access programming from a video library immediately upon request. Apart from entertainment, educationally oriented programming is seen as a high potential user of on-demand video. In particular this service could make use of high definition television (HDTV), providing high quality programming (initially) to selected locations such as movie theatres, high-rental apartments etc. and eventually extending into the home. See sections 4.6 and 4.7 respectively.

Table 8

Penetration of Home Video Services by Type
(Canada)

Service	Current Est. (1979)	Short Term (1982-84)	Medium Term (1984-90)	Long Term (1990-92)
Basic Cable subscribers (mil)	4.1	5.9	7.3	8.9
homes passed (mil)	5.9	6.9	8.0	9.3
homes served (% of passed)	69%	85%	91%	95%
Pay TV subscribers (mil)	-	.6	1.8	3.6
penetration (% of basic cable sub.)	-	10%	25%	40%
Addressable (2-way) TV subscribers (mil)	-	-	.3	.9
penetration* (% of pay sub.)	-	-	16%	25%

* Based on projected sales of addressable converters (U.S.)

4.3 Security/Alarm Services

4.3.1 General

A security/alarm service would alert the appropriate authorities in the case of a fire or intrusion alarm. Many different levels of this service could be provided from a premium service for businesses and other commercial applications to a mass market service for residential customers. Additional services could be provided such as increasing the number of people that are warned in the event of an emergency. Ultimately this service could evolve to off-site video monitoring of the premises, which appears to have useful application as an extension of current in-house surveillance.

4.3.2 Residential Market

Several factors are contributing to increases in the demand for security/alarm services. Increasing crime rates, particularly residential burglaries, and police concerns with false alarms have raised consumer awareness on this subject. As an example, of the approximately 23,000 burglaries committed in Metropolitan Toronto in 1981, over 70% were committed in households and these had apprehension rates of 40% [40]. Changing demographics such as the growth in the number of upwardly mobile two-income families who leave their residences for extended periods of time also lends itself to a greater demand for security/alarm services.

In addition security and alarm systems using two-way capabilities are services which are already being offered in the U.S.A. and Canada and therefore represent an immediate near term opportunity. Current systems include burglar, fire or medical alert or combinations of these. Although there are no firm estimates in Canada, the current penetration of all U.S. homes is estimated at slightly less than 2%. Future penetrations are projected to be 7-10% by 1985 and 15% by 1990. Subscription revenues will grow from approximately $45 million, in 1980 to some $500 million by 1990 [32]. The growth of security/alarm services in the U.S.A., including subscription revenues and penetration rates is illustrated in Table A-14, Appendix A. Based on these figures, a forecast of the potential penetration rates in Canadian households has been generated, and is shown in table 9.

Table 9

Central Security Monitoring Services

Canada

	1982-84	1984-90	1990-92
Penetrations (% of households)	1% (.5)	3% (1)	7% (2)

The upper figures in Table 9, reflect an optimistic view concerning the demand for security/alarm services, following a similar path to that which is projected for the U.S. The figures contained in brackets however represent a more pessimistic scenario based on the number of marketing issues which remain unresolved concerning the introduction of these potential new services. Some of the main issues are:

- consumer awareness and acceptance of these new services are still uncertain
- price thresholds and elasticity have yet to be determined
- the relative value of these new services to the customer has yet to be proven

In addition to those presented above, other questions concerning technology and market entry strategies remain unanswered for numerous suppliers.

4.3.3 Business Markets

In the business environment applications for security/alarm services seem to be mainly concentrated in the small business segment. In order to get insurance many businesses are required to have ULC certified burglar alarm systems, which must be monitored by a ULC certified central station operated

by an alarm company. Thus many large businesses already have this type of service. In the future off-site video surveillance will be a significant feature for large businesses.

According to Comquest, the greatest impact of this service will be on retailers, who are the hardest hit by robberies. Banks and public institutions will also have a great need for a high quality system.

The traffic/penetration curve for Security/Alarm Services is shown in Figure B-3, Appendix B.

4.3.4 Terminal/Network Requirements

At the customer's end of the network, two forms of interface can be anticipated. The first will consist of parallel outputs from an alarm panel; the second would replace a number of parallel outputs with a serial data interface. A parallel interface would be expected to pass on contact closures or simple electrical signals; a serial interface would be expected to conform to RS232C and higher level protocols for access to the telecommunications loop.

In general, this kind of service requires some form of monitoring, at the other side of the network. Often, this will be undertaken by a third party. This will necessitate definition of an interface to a third party (vendor) monitoring processor, for such purposes as identification of alarms, faults and generation of billing data.

In the network, the bandwidth requirements of this service will generally be well under 300 b/s. There will be a need for supporting protocols to guarantee a level of security required.

4.4 Energy Management

4.4.1 Definition

Energy management service may be defined as the remote control and monitoring of energy consumption. Within this definition, various levels of service can be included, such as the remote control of energy consuming devices, directly (by switching on and off air conditioning, water heaters, lighting, etc.), or indirectly (through more effective control of temperature, humidity, etc.). Control is generally aimed at reducing peak time or overall usage, and thus costs. This service may also include off-site meter reading by utility companies. Currently, needs in this area are satisfied by a fragmented market of stand alone devices and systems; however, implementation of energy management as a communications service offers potential for cost saving through synergistic integration of facilities and sharing of equipment.

4.4.2 Residential Market

There are several prime motivating factors driving the development of home energy management and control services. These include:

- Consumers want help in saving energy and controlling energy costs.
- Increasing energy costs averaging at least 10% annually will drive consumers to use improved microprocessor based energy control systems.
- Combined solar and conventional systems will further spur this demand.
- Remote control of energy consuming heating/cooling systems and appliances will save energy costs and be convenient for working persons.
- Increased government influence and interest from utilities will have a significant impact on the penetration of home energy monitoring and control systems.

However, despite these factors, the implementation of energy management and monitoring services using two-way capabilities will likely not be feasible until at least the medium term (i.e. 84-88). Over the short term, existing homes will continue to add discrete products for separate control functions. Similarly, even to provide total space conditioning functions including those listed above, the home computer probably provides a more feasible short term alternative [25]. For residential energy management services to gain any real acceptance, it must be possible for the customer to realize meaningful savings for any investment required.

Numerous trial experiments using 2-way capabilities and involving automatic meter reading, load shedding and other forms of peak energy demand shifting are currently underway in North America. These trials are providing variable answers to questions concerning consumer acceptance, equipment and communications with subscriber located equipment. In addition, incentives are being devised and a base of empirical data on customer electricity use is being developed.

Although no firm estimates have been provided, it has been suggested that 2-way energy management and monitoring systems will follow a growth pattern similar to that of security and alarms. Furthermore, installation will largely be tied to new housing starts rather than the retrofitting of existing homes.

Table 10 provides estimates of the penetration of home energy management and control systems. Although these estimates appear somewhat conservative, several utilities and various governments have expressed interest in the development and implementation of home energy systems which could have a significant effect on penetration rates. Therefore the figures presented in brackets in Table 10 offer a more optimistic view of energy management and control penetrations assuming some form of influence by governments and utilities.

Table 10

Penetration of Residential Energy Management and Control Services

	1982-84	1984-90	1990-92
Penetrations (% of households)	-	.5%	1.5%
		(2)	(5)

4.4.3 Business Market

Energy management services using telecommunications networks, are more applicable to small businesses than large, as the small businesses are more cost sensitive and do not have their own energy management support group as a large business may have. (Large businesses will tend to provide in-house systems with minimal network impact.)

The largest market segment appears to be the retail small business market, which is very concerned with costs (although there is some applications to the large business market, especiallly apartment complexes, hotels etc). The utility companies will be promoting energy management for both residential and business markets as energy becomes scarce, especially during peak times. The utilities propose stimulating energy management through premium pricing peak time usage rates, thus encouraging off peak time energy consumption.

The small business market segments that would have a need for this service would be:

- retailers
- pharmacists
- wholesalers
- manufacturers

These would be the segments which are most likely to adopt this service. Eventually this service would have a universal appeal to most small and medium businesses. Also there would be some usage by large businesses, although this will not be universal as some companies, due to 24 hour shift, can only reduce energy consumption minimally. Segmentation doesn't make sense for this service in large businesses because it will be used by most industrial sectors.

Penetration curves for all telemetry services including security/alarms and energy management and controls for both residential and small business markets are shown in Figure B-3 Appendix B. Appendices A and B detail how these curves were derived.

4.4.4 Terminal/Network Requirements

Energy management, being a telemetry service very similar to security/alarm service, can be expected to exhibit terminal and network requirements very

close to those for security/alarm service. Again, both serial data and parallel terminal interfaces can be expected. Some form of monitoring centre (vendor) processor will be required, with a suitable network interface. Transmission rates required of the network will again be well under 300 b/s (Figure 8).

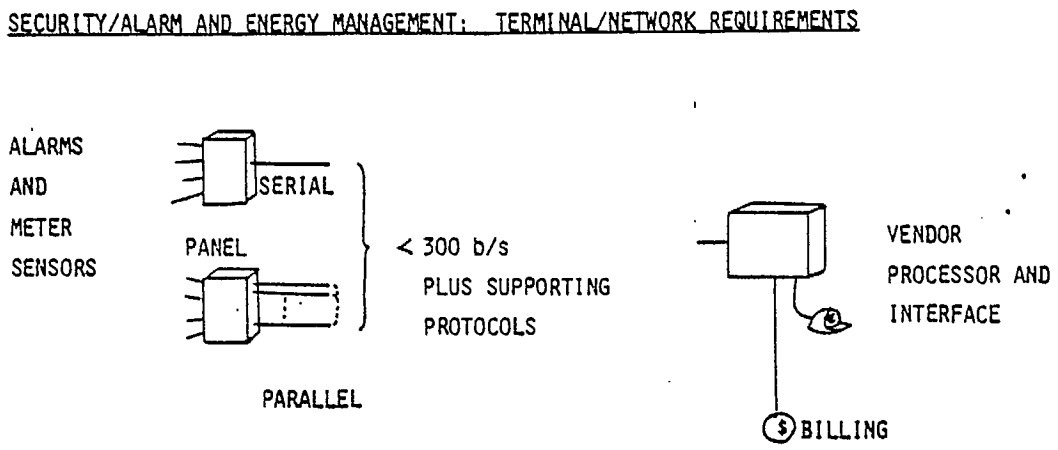


Figure 8

4.5 Teleconferencing

4.5.1 Definition

A teleconference is a remote interaction between three or more customers set up either automatically or by an operator. There are four types of teleconference:

a) audio conference
b) audio visual conference
c) videoconference
d) computer conference

For the purposes of this report, teleconferencing will include any conferring between 3 or more people.

Audio conferencing is verbal communication between three or more customers. Audio visual conferencing, gives the additional feature of having text/graphic/image communication as well. This could include the use of facsimile to reproduce, in hard copy or display form, documents at different conference locations. Video conferencing is the use of video for face to

face communications and for conveyance of full motion video. The last type of teleconference is the computer conference which includes the use of computer for electronic mail systems, which could be used either simultaneously or asynchronously with the conference. We will be looking at each of these areas separately.

From our literature search it appears that teleconferencing is already an important service now, and will increase in use and value in the future. There are four driving forces for teleconferencing:

1) increased cost of travel
2) growth of service sector, which is highly dependent on communications
3) growth of electronics -- lower cost of communications
4) office worker productivity (meetings, information exchange)

Teleconferencing has a number of different uses such as:

- meetings
- promotions
- motivation meetings
- seminars
- continuing professional education
- training
- press announcements
- speeches

In fact the major use for videoconferencing is for training and promotional meetings. Training promises to be a very 'useful use' of teleconferencing since about 70% of meetings between home office and agencies are for training purpose.

The benefits that teleconferencing offers include:

1) reduction of travel time,
2) greater flexibility in scheduling meetings,
3) better structured, high quality meetings.

Strategic Inc. predict that teleconferencing will reach saturation by 1990 of all firms but the very small. It is believed that teleconferencing can substitute up to 45% of all trips.

As shown in Figure 9, audio conferencing will represent the largest segment of the different types of conferencing until the mid 1980's, when audio plus graphic and video conferencing will take over. It is important to note that the penetration levels of each type of conferencing will vary quite a lot, depending on whether we are looking at small businesses or large. Thus it is important to look at these two market segments separately.

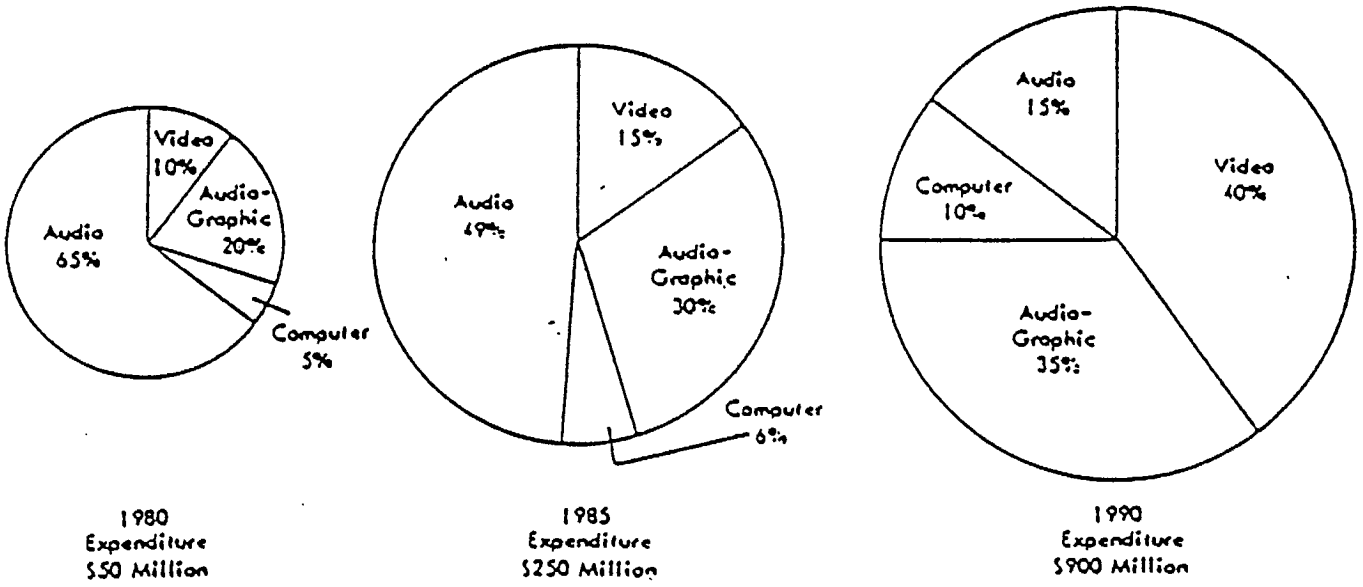
4.5.2 Small and Medium Sized Businesses

Audio conferencing will maintain the highest market share over the other types of conferencing. Currently small businesses do not generate enough

need for the other forms of conferencing to justify their installation. It is much more likely, if the need arises for computer conferencing, audio and graphic conferencing or videoconferencing, that the conference will be held in nearby hotel or similar facilities.

Figure 9

Growth of Different Types of Conferencing



Source: Gnostic Concepts

Source: Communications-News, Geneva, Illinois, May 1982
U.S. Figures

Within small businesses, the strongest market segments are those for accountants, lawyers and manufacturers. These segments will achieve the greatest benefit from teleconferencing through a reduction in travel costs.

The potential market segments are shown in Table 6 for small and medium businesses and Table 7 for large businesses. Teleconferencing in these tables includes all types of conferencing. Later on these different types of conferencing will have to be broken down to their different types in order to establish the penetration rates and bandwidth requirements.

4.5.3 Large Business

Large businesses have a great need for conferencing to reduce travel expenditures. Specifically, the following segments have and will have the greatest market demand:

Banks
Hotels, motels

Manufacturing
Other financial businesses

Currently Holiday Inn and numerous other hotels are establishing teleconferencing centres in their hotels in order to maintain their importance in the convention and conference business. People can then conduct the teleconference from these hotels, saving their company having to invest in a teleconference centre, while still realizing reduced travel costs.

Hotel teleconferencing will be very important in the future because it provides a 'neutral' site to carry on a meeting and also this provides a social contact which cannot be as easily fulfilled in a business environment.

Also, due to economies of scale, the hotels will be much more willing to provide a range of teleconferencing services, including audio conferencing, audio visual, and computer conferencing in addition to videoconferencing, which is the entry service in this segment. This is very important as these hotels will be at the leading edge of teleconferencing services because of their high usage rates and could justify the expenditures.

In 1980, Holiday Inn had 175 locations of videoconference rooms in over 130 different cities. Also other hotel chains are getting involved in this type of service such as Marriott Hotel chain and the Hilton chain [13]. Examples of users of hotel videoconferencing networks include the Ford corporation, which used the videoconferencing system to introduce new cars to 20,000 dealers and sales personnel in 38 cities. Merill Lynch used it to present seminars on Investment to 30 cities. Avon Product has used it for motivational sales meetings.

Strategic Incorporated estimated penetration rates for the different types of conferences, as shown in Table 11. Audio conferencing is expected to have saturated the market by 1990, computer conferencing by 1992 and video conferencing by 1995.

Table 11

Penetration Rates of Teleconferencing (U.S.)

	1981 (Actual)	1984	1986	1987	1990	1992	1995
Audio + Graphics Conferencing	77		50%		90%		
Computer Conferencing	5%	10%		50%		90%	
Video Conferencing			10%		50%		90%

Source: Electronic Conferencing Impact & Opportunities, Sept. 1981, Strategic Inc.

Referring back to Figure 9, it is interesting to note as percentage of total teleconferencing revenue, both audio visual and video will far exceed that of audio by 1990. The projected growth rate in teleconferencing expenditure, according to this analysis, is 34% per annum.

4.5.4 Teleconferencing Penetrations

For purposes of establishing the potential market size for teleconferencing, it is necessary to look at the different types of conferencing available.

The traffic/penetration curves for businesses are shown in Appendix B, Figures B-4, B-5. These curves are generated from market segmentation analysis which is shown in Tables B-3, B-4, B-5 and B-6 in Appendix B.

4.5.4a Audio Conferencing

As explained before, this is a very basic voice-only conference. By 1985, this service will have universal penetration of large businesses. The small business market is a little different. There are a number of market segments which will not have much use for this type of service, such as small businesses in agriculture. The relevant market segments for these services are shown on the following page along with their potential market penetration rates.

Estimates for the use of this service are also provided. These estimates take into consideration trends towards smaller PBXs, and trends of business rental companies also providing telephones with conferencing features to their clients.

Telephone companies (such as Bell Canada) presently offer various audio conferencing alternatives, both operator handled and services by which one can dial-up conferencing facilities using any type of phone.

It is important to note that as large businesses switch to more elaborate conferencing systems, their use of audio-only will decrease. Also the use of audio-only conferencing will decrease for small and medium businesses as these businesses have access to better conferencing services in hotels and other institutions.

4.5.4b Audio Visual Conferencing

Table 11 shows the expected penetration, of all businesses in the United States except the very small, of audio and video conferencing, estimated by Strategic Incorporated. It is important to note that these estimates are for U.S. markets, which are typically a few years ahead of their Canadian counterparts. For this reason we have modified these penetration rates to be more in line with the Canadian environment.

For large businesses, this service will have reached market saturation (in terms of penetration) by 1990 (optimistic view). If the economy continues in a recession, it is just as likely that this service will only reach about 50% penetration by 1990. Also included in the pessimistic scenarios is the possibility that only a few industries will supply this service to the majority of users - as the hotel industry is doing.

Small and medium businesses will not have as great a use for this service, because of the investment required in terminal equipment. Again, only the relevant segments mentioned for audio-only will show the greatest demand for this service. Also as more and more equipment is needed to perform the service, it is likely that these companies will simply rent the facilities from others, rather than incur the expense themselves.

4.5.4c Videoconferencing

This type of conferencing will only have minimal penetration outside of large hotel chains and telco studios in the next few years. The costs of installing such a system are prohibitive to most companies considering their usage, especially when these services will be provided by large hotels. Also, as mentioned previously there is a current trend towards moving organizations from the centre of the city to suburban areas where the rent is considerably cheaper. Another factor that will have an impact on video conferencing is that it is likely that head offices will have an internal video conference room, while the branch locations would rely on hotel or other off-site facilities.

Thus videoconferencing is likely to have a tremendous impact on large hotel chains, reaching 100% penetration by 1990, while still having some impact on banks and other financial institutions and manufacturing. The penetration rates for these are shown in Table B-5 in Appendix B. The penetration rates for videoconferencing developed by Strategic Incorporated (shown in Table 11), appear to be a little optimistic considering the present state of

development of videoconferencing. Also one must take into consideration that these penetration rates are for the United States, and that Canada typically lags behind the U.S. The expected traffic/penetration curve of videoconferencing in Canada is shown in Figure B-4, Appendix B.

Videoconferencing is likely to have only a small impact on medium size businesses by 1992, with virtually no penetration in small businesses. Any small or medium business that needs this service will use outside facilities, such as hotels.

4.5.4d Computer Conferencing

The expected penetration of computer conferencing is likely to be very small. Figure 9 forecasts that it will make up only 10% of total teleconferencing revenues by 1990 in the United States. Large businesses will use this as an add-on feature to their electronic mail. This service will have the largest impact on businesses that have a number of different locations (especially within one urban centre). This would facilitate intra-company communications, which currently represents about 45% of all communication.

One of the more important segments, as was described in section 3.2.4, is the manufacturing sector, as its communication requirements are the greatest. There is also an important segment of banking and financial institutions, which typically have numerous branches with a head office in urban centres.

This service is expected to have minor impact on the small and medium sized business markets.

The expected traffic/penetration curve is shown in Figure 10.

4.5.5 Terminal/Network Requirements

The terminal and network transmission requirements for audio-only teleconferencing will be fairly simple. Normal telephone sets, loudspeaking telephones, and group audio conference terminals will satisfy the requirements in this area. The transmission requirements can obviously be satisfied by the 4 kHz telephone network, although it is anticipated that some higher bandwidths for improved transmission performance will be offered before the end of the study period. The network resource of most significance for this service (and for the visual enhancements to it which follow) is the provision of voice bridging capability in the network, to enable point to multipoint connections to be established. Teleconferencing bridges, in addition to their basic function, will be required to support enhanced features, such as selection of the loudest speaker, compensation for network transmission losses, user control features, generation of statistical records and billing data.

The simplest level of audiovisual enhancement to audio teleconferencing will use display terminals for text and graphics. Much of the business communication needs in teleconferencing can be satisfied by display of text

information; however a significant enhancement in this area could be offered through the utilization of Telidon graphic technology to provide low cost business graphics. This level of visual enhancement can easily be supported in a network with data transmission capability between 1.2 and 4.8 kb/s.

There will be three major terminal requirements for audiovisual teleconferencing. The first will be for group text and graphic display. The types of terminal required in this case would be a Telidon decoder, modem and colour or black and white monitor. For individual text and graphic display, desk-top terminals are expected to become prevalent. Such terminals (and the modems to support them) are widely available now for text-only display. Graphic display capability will necessitate the inclusion of graphics decoding functions in desk-top terminals, similar to the modified Displayphones currently being used in the trial of iNET (the intelligent network service being offered by CCG). In addition to these display devices, some form of capture device will be required; in the case of text, this can obviously be satisfied by data entry at a keyboard; in the case of graphics, some form of information provider system will be required.

Some form of data bridging will be required in the network, to permit point to multipoint operation. Although there are analogies with voice bridging, in broad functional terms, and in terms of features such as user control, record-keeping and billing, it is expected that data bridging will need to be based upon a well defined data communications protocol structure.

Ultimately, high resolution display and capture terminals will become available. Such terminals would make it possible to capture and display (with hard-copy backup) images of facsimile quality. Thus, both image/document scanning devices will be required, as well as desk-top and group display terminals with resolution capable of displaying a single facsimile page (approximately 1,000 lines per screen horizontally).

The terminal and network requirements for video conferencing are quite different, at present, from those for audio and audiovisual teleconferencing. Currently, point to multipoint operation of videoconferencing has not been achieved by bridging, in the voice and data senses of the term. However, point to multipoint (broadcast) systems for unidirectional operation already exist, and two-way systems exist for point to point applications. Point to multipoint two-way operation can be expected to become available by the end of the study period (1992).

One significant factor which will ease the task of development of full two-way multipoint vidoeconferencing will be reduction in bandwidth required. Although bandwidth requirements for videoconferencing have come down from at least 45 Mb/s to approximately 3.0 and 1.5 Mb/s, there has, until recently, been some doubt about the adequacy of the quality at these lower speeds. However, technological progress continues, and it is now forecast that within 10 years, good quality videoconferencing will be possible at speeds between 200 and 250 kb/s.

Terminal/Network requirements for teleconferencing are shown in Figure 10.

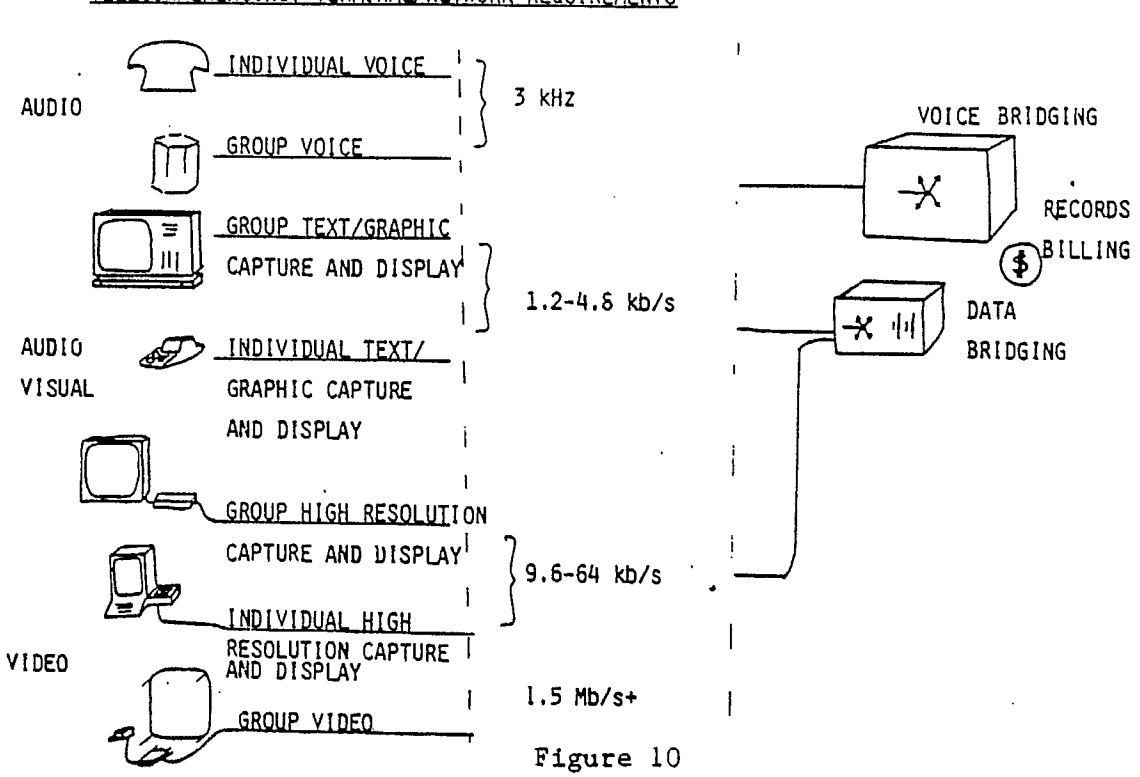


Figure 10

4.6 On Demand Video

4.6.1 Definition

Video on-demand (addressable systems tailored to individual requests from specific subscribers) allows the user access to programming from a "video library" immediately upon request. Immediate major uses include both entertainment, as well as educationally oriented programming for residential and business/industrial training applications.

4.6.2 Residential Market

As mentioned above, entertainment will remain an immediate major use of on-demand video. This will allow access to an unlimited array of entertainment programming (i.e. movies, games, major sporting events and other specialty programmes) from the convenience of the home, and at times chosen by the user. A second major opportunity exists to provide educationally oriented services and programming to the home. This is especially important as the need for enhanced child and adult education continues to increase.

Other main (consumer) benefits derived from an on-demand video system are as follows:

- potentially unlimited array of programming and complete flexibility to "time-shift" viewing
- eliminate the current and expected confusion regarding tapes, discs, formats etc.
- eliminate the requirement to purchase additional, expensive TV add-ons
- eliminate the need to purchase discs or cassettes which have limited utility after initial viewing
- convenience of access and play compared to the 'personal' video library (i.e. finding, loading, playing, rewinding, filing etc.).

However, owing to current technical limitations (i.e. lack of 2-way capability) in addition to high development cost and limited demand, on-demand services are viewed to be of longer term interest.

Residential penetration of on-demand video therefore will remain relatively moderate within the first few years of introduction (i.e. early 1990's), with major growth occurring after 1995.

Table 12 provides estimates of market penetration of on-demand video services in Canada. However, assuming a more pessimistic view (i.e. the above technical and marketing issues remain unresolved) it is further assumed that the potential introduction of on-demand video services will not be feasible until the post 1995 period, and therefore no further estimates are provided in Table 12.

Table 12

Penetration of On-Demand Video Services

(Canada)

(% TV households)	short term	medium term	long term
Penetration (% TV households)	-	-	2.7%
Subscribers (nil)	-	-	.3%
Usage (% of total viewing hrs)*	-	-	.7%

* Estimated annual usage is based on approximately 8 accesses/yr and average duration of 2 hrs

4.6.3 Business Market

In business, non broadcast video (an indication of the importance video has attained) has met increasing acceptance in recent years.

The benefits of on demand video for businesses are that it provides greater communication possibilities for such things as:

- training
- education
- promotion
- corporate communications
- documentation.

Also on-demand-video allows immediate access and wide distribution to these programs.

Training and corporate communications seem to be the most important uses. (The uses of video are shown in Table A-15, Appendix A).

From an International Television Association survey five major user groups were discovered for video services:

- business/industry
- medicine

- education
- government
- non profit organization.

In the U.S. the total number of users on non broadcast video is 27,000. New growth is expected from wholesalers, retailers and banks. In Canada on a per capita basis, educational institutes are the largest user of video with medical and government institutions following behind this. (See Appendix A, Tables A-16, A-17).

As mentioned earlier there is a trend towards corporate dispersal, with staff moving from the core of the city to the suburbs. This trend will stimulate the need for On Demand Video (ODV) between within Census Metropolitan Areas. One reason for this is that ODV will be mainly used for training and corporate communications. Consequently, the ability of ODV to provide remote access to centralized video storage will make it possible to serve several different branches of the same company.

The uses of this service could be:

- archival retrieval
- education
- communication (corporate) - internal public relations
- sales-promotion (numerous companies presently use videoconferencing for this)
- entertainment - hotels, bars and pubs
- surveillance

4.6.4 Penetrations

The projected traffic/penetration curves of on-demand video for both business and residential markets are shown in Figure B-6, Appendix B. The applications of on-demand video are not quite as extensive as those of all video, thus the projected penetration rates are not as high.

The markets and needs for this service are listed below. The main driving force for this service in the business environment will come from the desire to have educational and training programs on demand.

- Educational Institution
- Manufacturing
- Hotels
- Banks (training)
- Hospitals
- Government

4.6.5 Terminal/Network Requirements

For display of retrieved video information, standard NTSC monitors or television sets can be used. Consequently, investment in terminal equipment will be relatively small; the primary requirement will be for some form of

interface unit at the customer's premises to facilitate upstream signalling of control information.

In the basic transmission network, the downstream requirements for video information will be the nominal 5 or 6 MHz required for NTSC video will be needed. For upstream control signalling, very low data rates, well under 100 b/s, will be required (Figure 11).

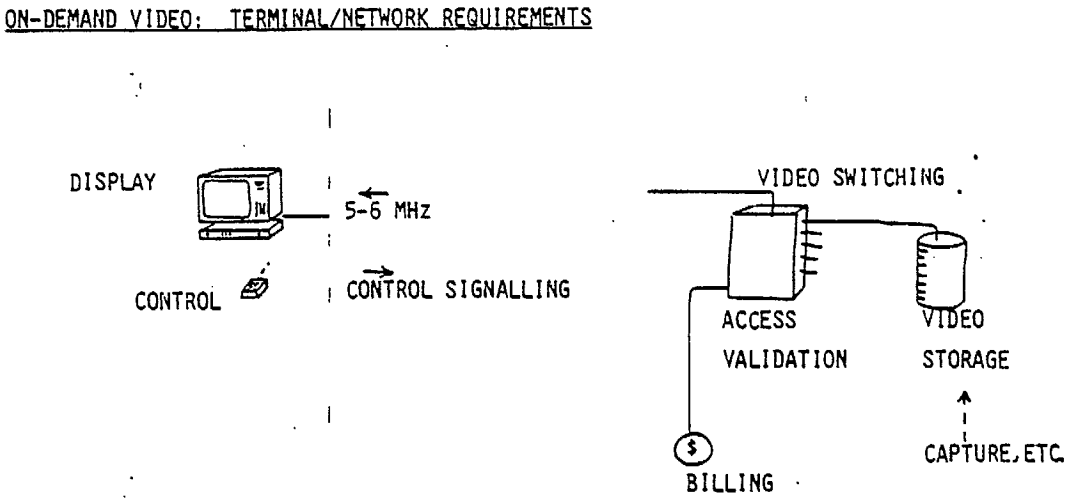


Figure 11

The two major network resources on which this service is dependent are, first, the provision of video (broadband) switching in the network, and secondly, the provision of a high capacity, random access video storage system. The video switching will be required to enable connection of a dedicated video channel to a specific customer terminal. It will also be expected to provide ancillary support functions, such as access validation, billing and statistics gathering. The video storage system will have to satisfy some complex logistical needs, such as virtual real-time access to material of high popularity, as well as retrieval of less frequently accessed information. A mix of multi-head videodisc playing units for automated access and semi-automated, of meter-assisted retrieval of archival material may be envisaged.

4.7 High Definition T.V.

4.7.1 General

High Definition Television (HDTV) provides a far greater level of image detail and picture clarity than standard (NTSC) television, even when displayed on the predominantly wider-screen TV formats. Although no firm standards have been set, a 1,125 line HDTV picture can resolve some five times as many picture elements (pixels) as standard 525 line television. As a result, high definition requires more frequency or bandwidth than standard TV (i.e. typically 20 MHz vs 5 MHz).

Although high definition TV has been available for a number of years, its use has been restricted to closed-circuit applications in medical schools and in business. More recently professional videotape machines have become available which allow for the recording of HDTV programming. As a result movie studios have become interested in producing movies using HDTV and broadcast networks are equally interested in using HDTV as a means of enhancing the quality of standard programming [23].

4.7.2 Residential Market

Owing to current technical limitations (i.e. lack of bandwidth to carry HDTV signal) high definition television is seen to be of longer term interest. Although it is technically feasible to offer HDTV programming using existing CATV plant, it has been estimated that five full video channels would have to be allocated to carry the signal for each HDTV programme service. This would rely heavily upon cable operators having significant amounts of idle channel capacity. However, recent estimates in the U.S. have indicated that more than 50% of cable systems still have 12 channels or less, with conversions to 50-100 channel (dual-cable) systems being slow and costly [3]. Other methods such as direct broadcast satellite (DBS) systems could also be used to provide HDTV programming, but the costs associated with DBS would tend to limit market demand.

According to sources in the U.S.A. [33], it is anticipated that HDTV will likely make its introduction into the U.S.A. via several routes. These include:

- major film studios (using HDTV as an augmentation to 35 mm film production)
- Japanese (and possibly American) manufactured videocassette and videodisc players
- closed-circuit programming to major market theatres and cable TV systems
- direct broadcast satellite (DBS) HDTV services.

Videocassette, videodisc and cable TV are likely to provide initial penetration of HDTV into the home through 1986, followed by the start up of HDTV (DBS) services in 1987. The demand for these is such that by 1990 some

320,000 HDTV videocassette/disc players will be sold and 3-4 HDTV DBS channels will be allocated in the U.S. [33].

Penetrations of HDTV (sets) will likely follow a similar path to that of colour TV and FM radio where high initial costs tend to limit market demand. It is expected that the first HDTV sets (26") will cost approximately $2,400 (U.S.), but this price is expected to drop to $650 by 1990 and $480 by 1999. Table 13 illustrates the projected growth of HDTV, compared to other conventional and emerging video technologies.

Based on the growth in sales of HDTV videocassette/disc players and HDTV sets, and the anticipated demand for HDTV DBS services, estimates of market penetration of HDTV in Canada have been generated (see table 14). These figures represent an aggregate of any or all forms of HDTV services that may be offered in 1990, and have been used in the generation of the penetration curves illustrated in Figure B-7, Appendix B. (see section 4.7.3).

Table 13

Video Device Penetration by Type

(percent of U.S. households)

ITEM	1967	1972	1977	1979	1985	1990	1995
Monochrome TV	98	99	99	99	97	90	70
Colour TV	26	61	81	90	98	99	99
Large Screen Systems	-	-	neg	neg	1	2	9
Videotape Recorders	-	-	neg	1.5	6	11	18
Videodisc Devices	-	-	-	neg	3	10	32
High Definition TV	-	-	-	-	neg	3	9

$480

$650

$2,400 (U.S.)

Table 14

Penetration of HDTV in Canada

Time:	Short Term	Medium Term	Long Term
Penetration % of TV Households	-	-	1% (.5%)
No. of Households (mils)	-	-	.1 (.05)

4.7.3 Business Market

One of the uses of high definition T.V. is for high quality image retrieval. This could be used for training of employees, public relations, marketing etc. Some of the possibilities are outlined in Table B-7 in Appendix B.

Another important use of high definition television is for entertainment in hotels, pubs and other places that have common entertainment facilities.

Hospitals have a great need for this service in conjunction with video training.

The uses of HDTV are much the same as those of ODV.

Thus the market segments which are important for this service are:

- hotels
- manufacturing business for training
- banking business for training
- hospitals
- education facilities.

The most likely path for evolution of HDTV in the business environment is via facsimile display systems. Already, high resolution displays are being incorporated into (relatively high cost) video conferencing studios, to enable remote display of typed, drawn and handwritten documents. Such documents are scanned in a way analogous to facsimile, with similar transmission techniques. As facsimile standards become established, compatibility between camera capture and document scanning can be expected to move towards integrated, high definition image/document and video display systems.

4.7.4 Penetrations

The traffic/penetration curves of HDTV, for both business and residential markets are shown in Figure B-7. The curve representing the business segment has been generated from Table B-8, Appendix B.

4.7.5 Terminal/Network Requirements

In a preceding paragraph, reference has already been made to the need for image or video capture devices, such as document scanners or HDTV cameras; in addition, high resolution displays will be required, by the for large group use, with video projection, or for individual or small group use, using high definition TV sets. In addition, high capacity, high resolution storage systems will be required.

In the network, bandwidths between 7 and 20 MHz will be required, depending upon the coding scheme implemented for transmission of HDTV signals (Figure 12).

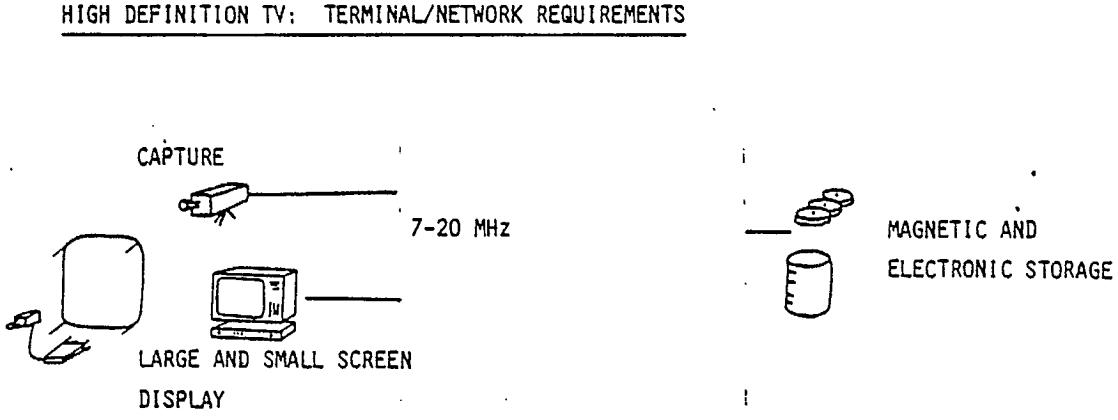


Figure 12

4.8 Database Downloading

4.8.1 Definition

This service involves the updating of computers in different locations. The major driving force for this service stems from the need of large organizations, with a few different locations to ensure that the information from one location is duplicated elsewhere. Also this can be used to retrieve information that is in a computer in a separate location, in other words, accessing a database that is in another location.

4.8.2 Business Market

The need for database downloading between locations of businesses become very great as the number of locations per business increase within an urban centre. As one can see from the distribution of industries, the banking industry seems to have a great requirement for this service with the

emergence of inter branch banking and the physical distribution of the branch locations.

Small and medium sized businesses also have a use for this type of service. These businesses can access databases, such as financial databases or even software. This service is not likely to have a very great market demand until the 1990's.

The traffic/penetration curves for database downloading (as described above) are shown in Figure B-8 Appendix B. These curves have been derived from the figures shown in Table B-8 in Appendix B.

4.8.3 Terminal/Network Requirements

The requirements for database downloading could be simply stated in terms of a data terminal, modem and a database; alternatively, a database, a subsidiary database, and a communication link between the two. In practice, the situation is more complex. The full implications of transactional information retrieval will be discussed in section 4.10.3, which considers the requirements of home banking. However, it can be stated in this section that the information to be retrieved could be presented in the form of voice, text, graphics or high resolution image (facsimile). The network transmission requirements could vary from 1.2 to 4.8 kb/s for text and/or graphics, through 4 kHz for voice information, to 9.6 to 64 kb/s for image and high resolution graphic information. Resources required, in addition to a database, which may be a part of the network, or which may be provided by a third party (vendor), it may be necessary to implement functions such as mediation between different databases, validation of users, interfaces to information providers, etc. (Figure 13).

TELEBANKING AND DATABASE DOWNLOADING: TERMINAL/NETWORK REQUIREMENTS

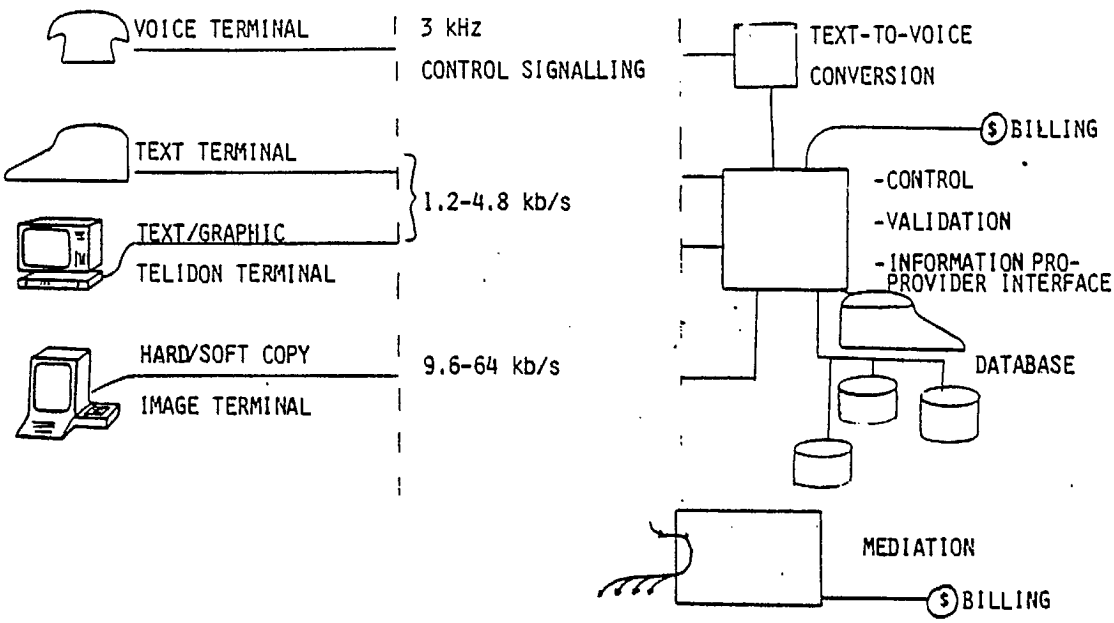


Figure 13

4.9 Voice Messaging Service

4.9.1 General

A voice messaging service is an asynchronous form of store-and-forward voice communication between two or more parties. A user leaves a message in the system requesting that the message be forwarded to another person. Added features of this service could include automatic call answering, call forwarding and time-specific message forwarding. Time-specific messaging would enable the message to be forwarded at a certain time. This would be helpful for meeting reminders etc.

A voice messaging service is important for the following reasons:

- circumvents unanswered or busy calls
- eliminates telephone tagging, i.e. trying to contact someone but just missing the return call because out of office
- results in communications cost saving, i.e. message forwarded at cheaper times
- results in increased productivity, that is time is not wasted in trying to get in contact with someone

4.9.2 Residential Market

Voice messaging is seen as a more efficient and cost effective means of transmitting messages between two or more parties. Current methods of distribution (e.g. mail) are extremely labour intensive and are becoming increasingly expensive. Furthermore the cost/performance characteristics of traditional mail service will continue to decline as newer more efficient means of storing and transmitting messages/data continue to proliferate throughout business and industry and eventually the residential market [40].

The primary motivating force behind the use of a voice messaging service is that it circumvents unanswered or busy calls. In 1980 it was estimated that approximately 14 billion calls were attempted (in Bell Canada's region only). Of these it was further estimated that approximately 2.8 billion or 20% were busy or "no answer" calls. For the residential market, this is seen as a minor source of inconvenience except under conditions where message content is of particular importance (i.e. delivery must be guaranteed), or when there is some degree of urgency involved and delivery time is therefore critical.

Other important uses of VMS may include:

. messages to dictation services
. personal reminders
. messages across time zones
. greetings etc.

Based on the various considerations presented above the penetrations for VMS as well as the number of messages generated per household per year on VMS have been provided in Table 15.

4.9.3 Business Market

Several companies are already implementing this service privately, such as Wang, IBM and ECS. Wang is putting a Voice Messaging System (VMS) on a newly introduced broadband system [19].

In market trials that have been carried out, VMS has been used for about two messages per day in its initial usage period. There is some evidence that there is a learning curve involved in the use of VMS; as such this usage is expected to increase as people get more used to the system. Another interesting result of the market trials is that banks have a great use of this service for broadcasting to all of their branches any changes in exchange rates, or interest rates [14].

3M's analysis of the usage of their VMS came up with the following:

- 25% reduction in call duration
- 30% reduction in message taking by secretaries
- 20% reduction in busy, no connect calls
- 25% reduction in memos

With these results 3M anticipated that use of VMS could result in savings of $500,000 per year [14].

Table 15

Penetration of VMS

(Canadian Households)

Time	Short Term	Medium Term	Long Term
Penetration (% of all households)	5% (2%)	20% (5%)	40% (15%)
No. of households (000's)	400	1,800	4,000
Total no. attempted calls/yr	1.17 bil	5.2 bil	11.7 bil
Total no. busy or no answer/hshld/yr (i.e. 20%)	575	577	575
Messages/hshld/yr on VMS			
- %	.5%	1.0%	2.0%
- no.	2.9	5.7	11.5

VMS has great market appeal due to the communications value of being able to leave a message for anyone, at any time. There also appear to be cost savings involved in this service.

The largest user would appear to be large business, whose communication needs appear to be the greatest. Some small businesses would have some use for this system, and as such it could be part of an integrated service package for small businesses. These markets segments are identified in Table B-10.

As described earlier, voice messaging's largest market appeal will be from large organizations. Small businesses are not likely to have a large demand for this service. The projected penetrations for this service are also shown in the same table.

Table 16 shows the Yankee Group's projected penetration for digital voice messaging in the United States for large business.

Table 16

Large Business Penetration of Digital Voice Messaging Service
(Percentage of Businesses)

	Expected Installations by 1983	Expected Installations by 1985
Manufacturing	17%	30%
Wholesale	15%	25%
Retail	9.6%	22.5%
Financial	12%	26%
Insurance	13%	20.4%
Education	10.3%	15.3%
Government	-	.33%
Other	16.5%	27.3%

Source: Yankee Group

These penetrations are further used as a basis to derive the traffic curves for both business and residential markets, shown in Figure B-8, Appendix B. The usage rates are taken from market trials of VMS. In their market trial 3M estimated .5 messages/day/employee. This is likely to increase with time as employees become more familiar with the service.

4.9.4 Terminal/Network Requirements

The terminal aspects of voice messaging are relatively simple. Basically, voice messaging can, in principle, be used by anyone with a telephone set. It is true however that to provide certain user control features, such as message editing, filing, retrieval and deletion, some form of upstream control signalling will be required. The information content of the signalling will be low, and it can be handled easily by a touch tone dial,

for example (less than 80 b/s), but such signalling is not easily implemented in a telephone network heavily populated with dial pulse telephone sets. Clearly, a new access system which facilitates upstream user signalling will be extremely beneficial in this context (Figure 15). The significant incremental requirement on the network for implementation of voice messaging will be the provision of voice storage facilities. In addition, some voice response, control and billing capability will be required (See Figure 14).

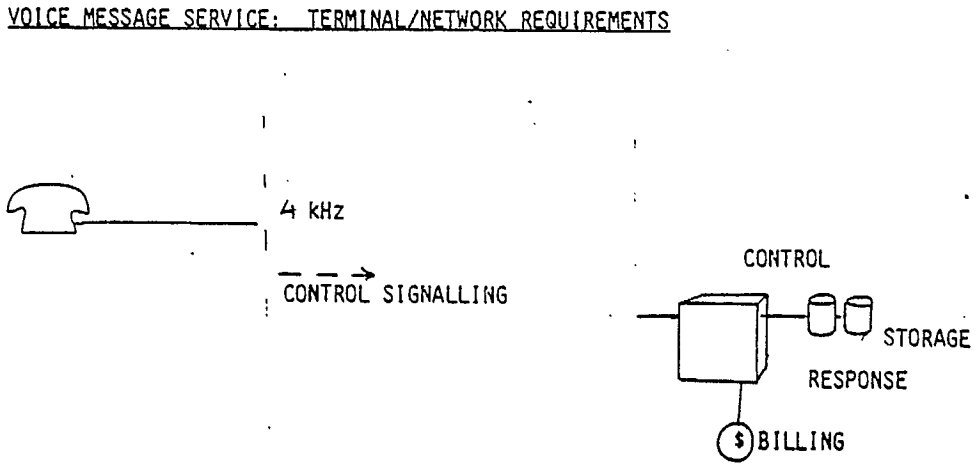


Figure 14

4.10 Home Banking - Electronic Funds Transfer (EFT)

4.10.1 Definition

Electronic funds transfer (EFT) services apply communications technology to common financial transactions, i.e. those typically handled by charge, cheque or cash. The residential customer will benefit from such a service by having access to a fast and secure method of paying bills for various items. Instead of writing cheques the user instructs the system to pay specific amounts to any one of a number of vendors, including merchants, retailers, financial institutes, utilities, credit-card companies, professionals etc. Updating financial files and transferring funds from one account to another is another major application of EFT services.

4.10.2 Market and Penetrations

There is already strong evidence of the growing trend towards the establishment of EFT services and home banking. In the U.S. a bill paying service offered by 35 financial institutions in 1977 had grown to some 200,000 accounts by 1979 [35]. These services are viewed by banking institutions as a more cost-effective way to handle additional customers without additional branches.

In addition, thousands of consumers in Canada are already making extensive use of automatic debiting and crediting facilities. Salaries, pensions, annuity payments and dividends are automatically deposited in their bank accounts. Similarly, automatic debit facilities are used to pay mortgages, loan payments, life insurance premiums, and cable TV payments.

Even more visible are the 500 or more automatic teller machines (ATMs) which are located across the country. All five of Canada's major banks are currently providing ATM services to their customers. Similarly according to recent estimates, there are more than 20,000 ATMs in the U.S.A. which will grow to some 70-75,000 by 1990 [35]. While not a true part of the "mainstream" of EFT, automatic teller machines will be an important factor in any EFT conversion. It is expected that on-line ATMs, linked directly to a bank's central computer will grow substantially in numbers in the next 3-5 years and will eventually find their way into such well travelled spots as major hotels and airports.

Apart from a gradual changeover to many types of automatic and electronic banking schemes, numerous trials of home banking systems are currently being conducted, or have already been concluded, in the U.S.A. [32].

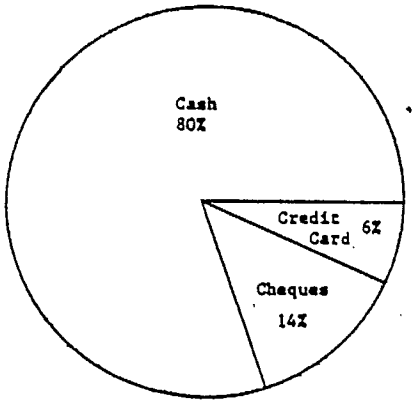
In terms of penetrations and usage of EFT, three main payment systems including cash, cheques and credit cards make up virtually all consumer transactions. Each of these has its own unique set of characteristics which makes it more or less amenable to home banking systems. By looking at the patterns of cash, credit cards and cheque utilization, it is possible to generate some tentative penetrations of EFT services.

Cash is the most common form of payment. On a volume basis it is estimated that cash sales constitute 80% of all money transactions, the majority of which are for less than one dollar [40]. The current volume of cash transactions in the U.S. is estimated to number some 200 billion annually. Therefore owing to their massive volume, small size and the fact that most take place outside the home, it is unlikely that home banking services would have any significant impact on cash transactions. There is a possibility, however, that the use of debit cards which can be used at point-of-sale terminals could be viewed as an alternative to cash since no credit is extended to the card holder. This in turn provides a further step towards less cash-dependency.

The current volume of business generated by credit card and cheque-based transactions (especially credit cards) are evidence of the importance consumers place on the security and convenience afforded by reduced cash usage. Furthermore, these two areas represent potential sources for diversion or substitution by electronic means. Figure 15 illustrates the distribution of cash, credit card and cheque based transactions.

Distribution of Cheque & Credit Card Transactions

(U.S.)



Type of Transaction	No./Yr.
Cash	200 billion
Cheque	35 billion
Credit Card	15 billion

Total number of cheque & credit card transactions

250 billion/yr.

(1980 estimates)

Figure 15

As can be noted in this figure, the total number of transactions generated by credit-cards and cheques equal some 15 billion and 35 billion respectively. Assuming consumer purchasing habits in Canada are similar to those in the U.S. this would suggest an aggregate total of some 5.0 billion cheque and credit card transactions per year.

It has been estimated that the greater part of all credit card activity represents uses which directly replace cash payments. Furthermore, it is estimated that approximately 50% of customers do not take full advantage of the credit extended to them (except as a float between the charge and the payment at the end of the month) and pay their accounts in full each month [40].

As a result, this is seen as a further influence (for banks) towards the introduction of debit cards which instantaneously deduct purchase amounts from the card holder's account.

The main emphasis therefore will be on diverting cheque-based transactions.

Unlike cash, the average cheque represents a $50 to $60 purchase. Furthermore, approximately 50% of the total volume of cheques are written by individuals, and 72% are written between individuals and businesses [40]. The average number of cheques written per household per year is estimated to be approximately 219. The breakdown of cheques written by category of expenditure (per household/per year) is provided in Table A-18, Appendix A. From this data, and based on the likely penetration of EFT systems within the various categories, Table A-19 provides estimates of the total number of cheques diverted per year as a result of the introduction of home banking systems. For the average household this would correspond to approximately 2.7 and 6.3 cheques diverted per month in the medium and long term, respectively, as shown in Table A-19.

According to estimates provided by the Yankee Group, home banking systems will penetrate approximately 10% of all U.S. homes by 1990. From this and the data covered above, both optimistic and pessimistic views of household penetration in Canada are presented in Table 17. In the optimistic case, penetrations will follow a path similar to those estimated for the U.S.A., but with a lag of one or two years. While the figures contained in brackets reflect a more conservative view in terms of penetrations, it is assumed that usage patterns (as shown in Table A-6) will remain unaffected. Traffic estimates for home banking services are detailed in Figure B-10, Appendix B.

Table 17

Penetration of Home Banking Services in Canada

	1982-84	1984-90	1990-92
Penetration (% households)	-	3% (2%)	7% (4%)
Usage (cheques diverted/month)	-	3	6.3

4.10.3 Terminal/Network Requirements

Home banking services, and the wider spectrum of transactional information services, which they represent, are extensions of the basic database access services described in section 4.8.3. A range of terminal types will be required, depending upon the medium which is used to present information to the user. For example, a basic telephone terminal, providing that it is capable of some form of upstream control signalling, can be used to access the information which is relayed as real or simulated speech. The control signals would be required to enable identification of account numbers,

verification of the user passwords, and information (in this case, funds) transfer and manipulation. Text, graphics and image data terminals would each facilitate presentation of information in their own formats. Image (facsimile) display terminals, should these penetrate the home, possibly through the implementation of high defintion television, would make it possible for the user to close information lot relatively high resolution, including retrieval and inspection of cheques. Generally, transaction services are expected to achieve a greater degree of success if a form of hard copy validation or receipt can be generated at the point of use. This suggests that text, graphics or image terminals would all require some form of printer associated with them. A document scanning device, associated with a residential image or facsimile display and/or hard copy terminal, would make it possible to transmit, and possibly to recognize automatically, signatures, although this is likely to be a long term development.

In the network, data transmission requirements will reflect the medium used to present information. For example, for voice, the 3 kHz telephone network, with control signalling mentioned previously, will suffice. For text and graphic information, 1.2 to 4.8 kb/s will be required; for high resolution image/facsimile information, 9.6 to 64 kb/s will be required.

The network and third party resources required to support telebanking and other transactional information services will be a more complex version of those required for database downloading. For example, the ability to access and transfer information between multiple databases, described as mediation in section 4.8.3, will be of paramount importance. Either real or virtual form-filling capability will be required, to enable users to enter information in a clearly defined format. Since financial information and funds are involved, a high degree of security will be required for user allogation.

Finally, one development worthy of specific note for telebanking and other transactional services is the "smart card". Trials in place in France have suggested a number of applications of this device for transaction services, including recording of balance, for both debit and credit card uses, and personon identification, amongst others.

5. MARKET FOR FULL SERVICE

In this section, the key service penetrations are extrapolated back to the list of full services. As a 'bulk' indicator of the relative importance of various services, total network traffic (in Canada) has been used as a parameter. More detailed service characteristics are contained in Appendix A and Appendix B.

5.1 Telemetry Services

Penetrations in traffic forecasts have been generated for security/alarm and energy management services. It is expected that these two services will comprise the bulk of the market for telemetry services, with minimal impact from other potential telemetry services. Accordingly, total network traffic (based on total number of messages) and penetrations for telemetry services are based entirely on the aggregate of security/alarm and energy management forecasts (see Figure 16).

5.2 Teleconferencing

For the purposes of this section, teleconferencing has been included under it own heading. This is because it effectively represents a new generation of multi-media, multi-channel services. Forecasts are summarized in Figure 17.

5.3 Video Services

The market, and hence the network requirements, for video services is expected to continue to be dominated by CATV and the closely-related Pay TV services. However, late in the study period, high definition TV and on demand video are expected to make an appearance in the market and an impact on the network. Figure 18 shows the aggregate forecast for the "new" video services; Figure 19 shows the anticipated growth of CATV and Pay TV, with the "new" video services (HDTV and on demand video) shown as incremental traffic.

5.4 Data Information Services

Within this category, database downloading and telebanking were selected as representative services from which a broader picture could be extrapolated for a range of similar services, which would include:

- videotex
- teleshopping
- credit card verification
- teledirectory
- word processing

Since this category includes a wide range of services, each of which has its own growth curve and limits of confidence, it was decided that a fairly wide range of forecasts should be generated for the aggregate view. Accordingly, two scenarios have been generated: the first assumes a pessimistic view of the market for these services, based only upon the pessimistic forecasts for the two services selected (telebanking and database downloading); the second scenario, which shows much higher network traffic, assumes that "other" data

services than telebanking and database downloading would generate traffic equal to about 50% of t ɜ combined traffic for telebanking and database downloading (rememberin that these were selected as market leaders). Consequently the second scenario is based upon 150% of the sum of the optimistic forecasts for telebanking and database downloading. These scenarios are represented in Figure 20.

5.5 Messaging

Voice messaging was selected as a service representative of a category which would also include electronic mail and text messaging services, as well as facsimile. The total market for services of this type has been assumed to be twice that of voice messaging. It should be noted that facsimile and electronic mail are not expected to have as high usage rates or penetrations as those of voice messaging. The total forecasts for messaging services are shown in Figure 21.

Figure 16

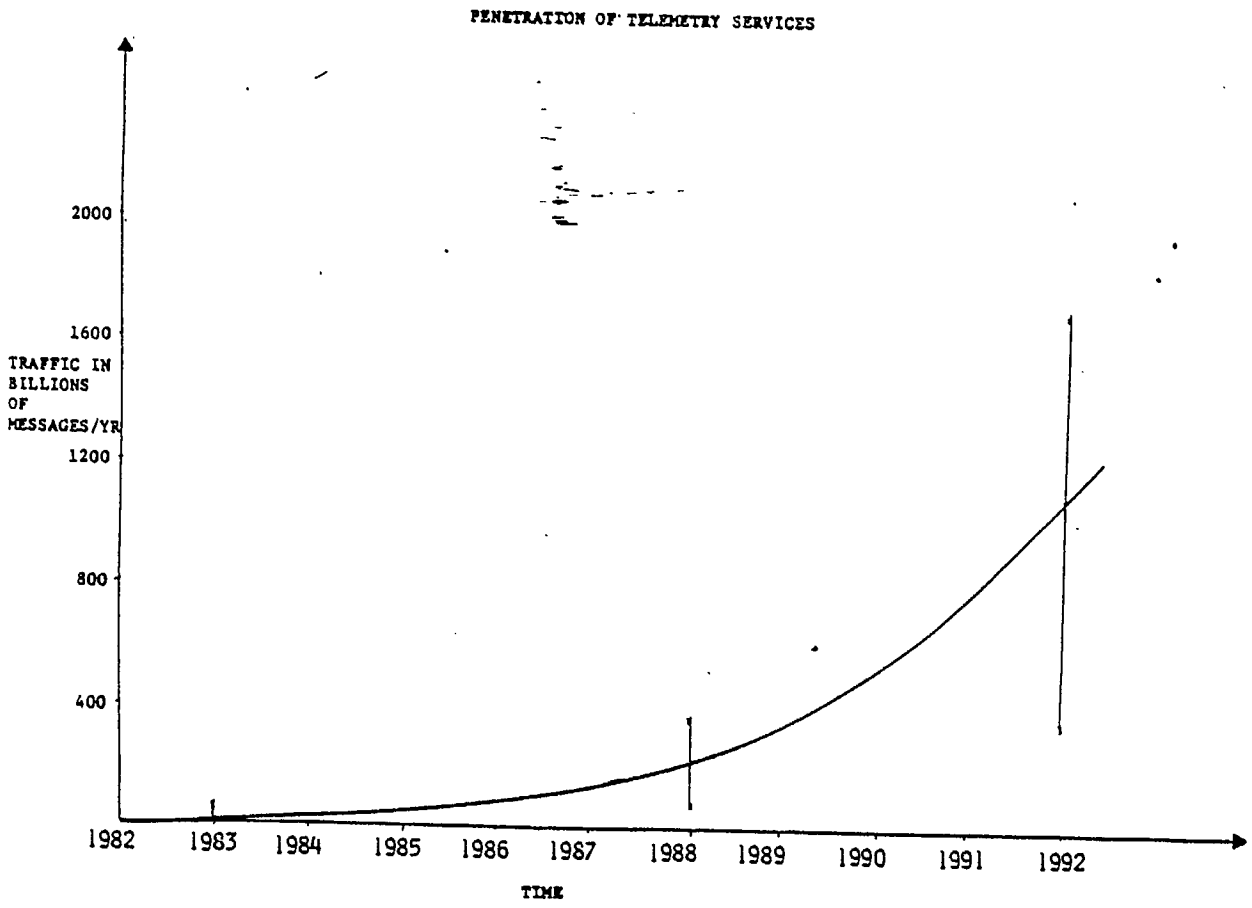


Figure 17: PENETRATION OF TELECONFERENCING

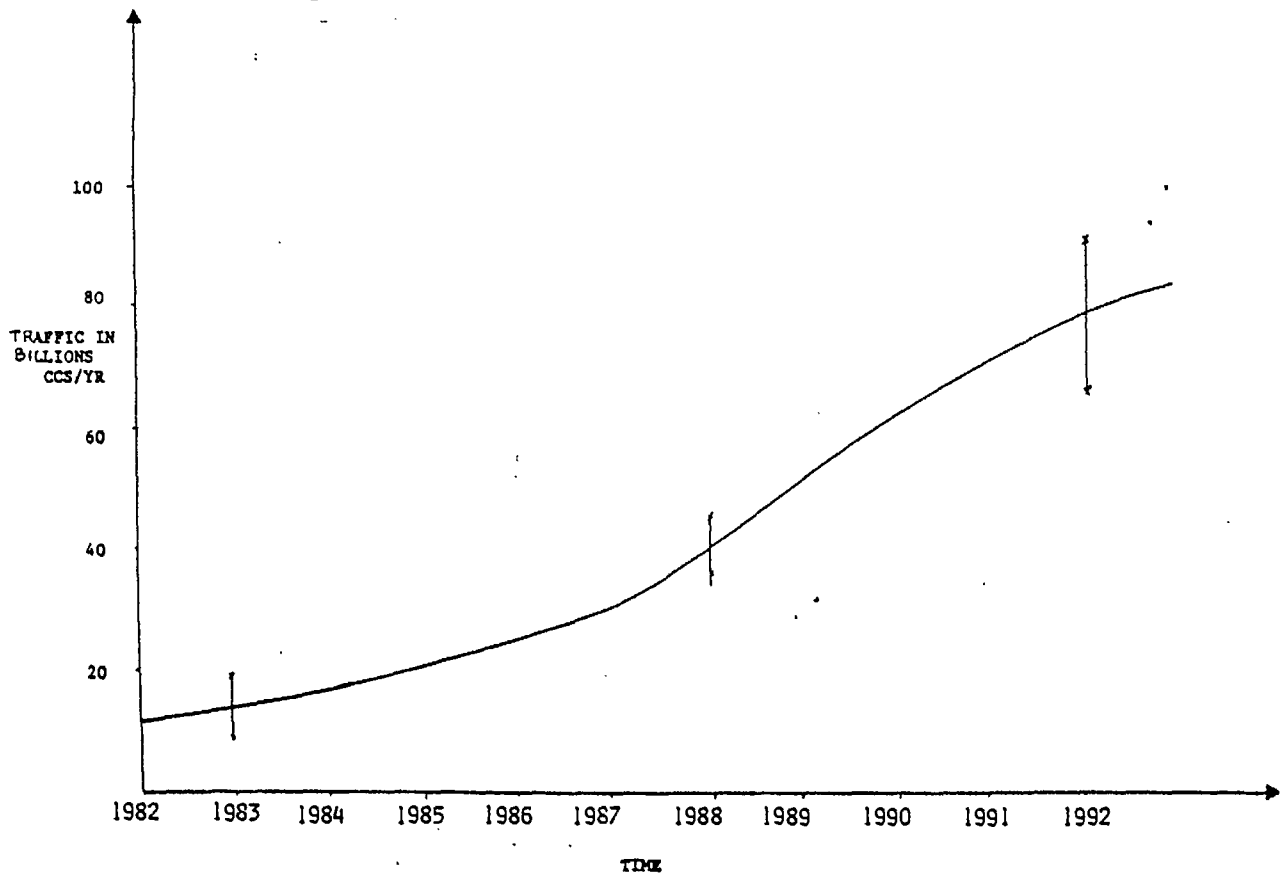


Figure 18: PENETRATIONS OF VIDEO SERVICES (CATV AND PAY TV)

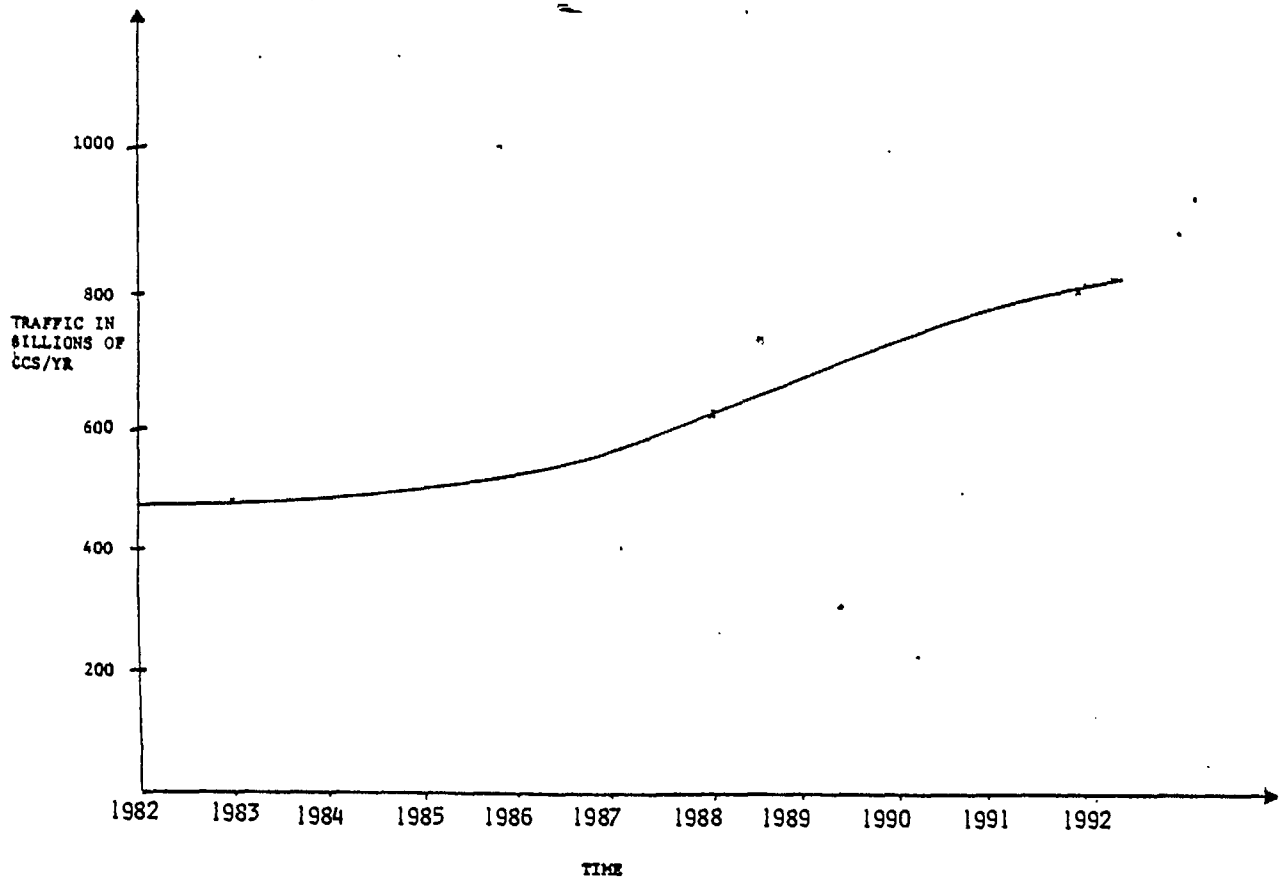


Figure 19: PENETRATION OF VIDEO SERVICES (HDTV AND ON-DEMAND VIDEO)

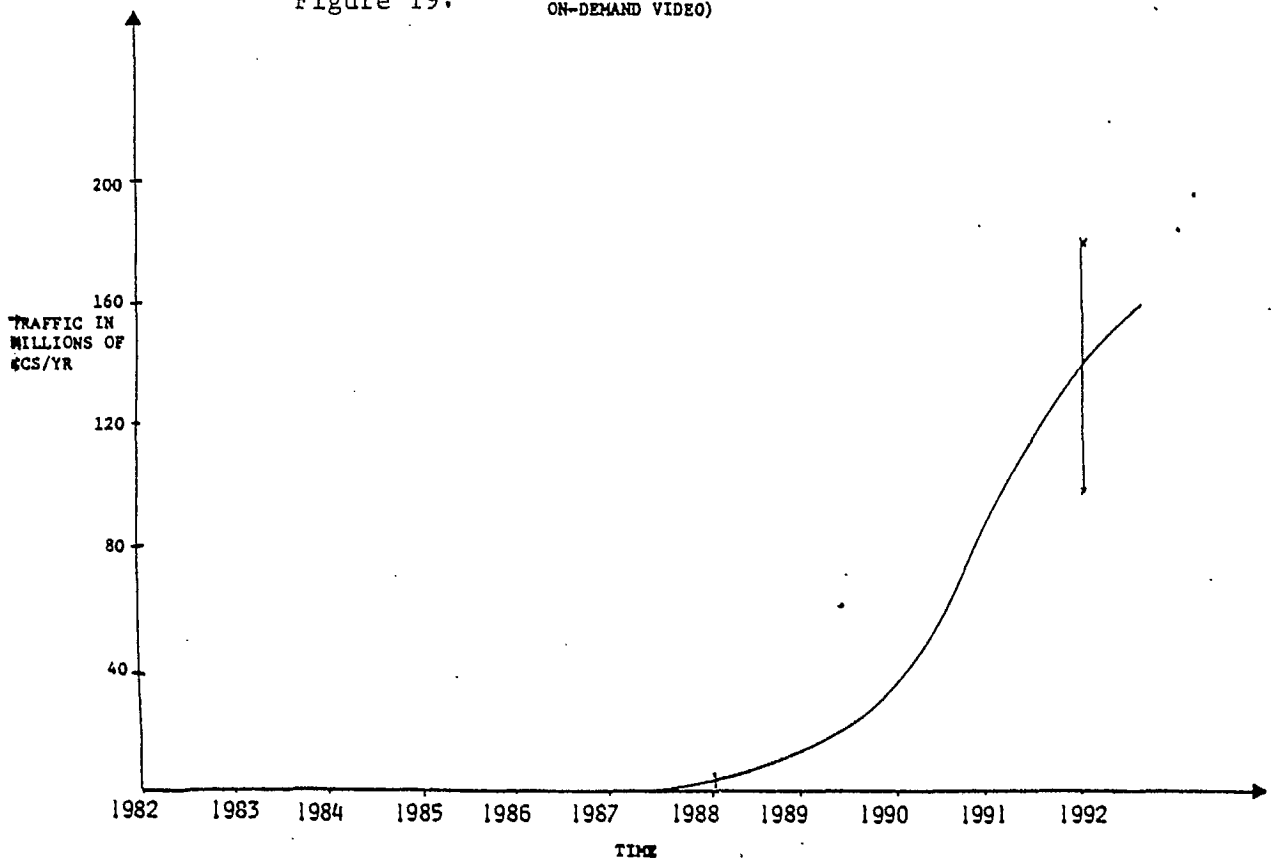


Figure 20: PENETRATION INFORMATION SERVICES

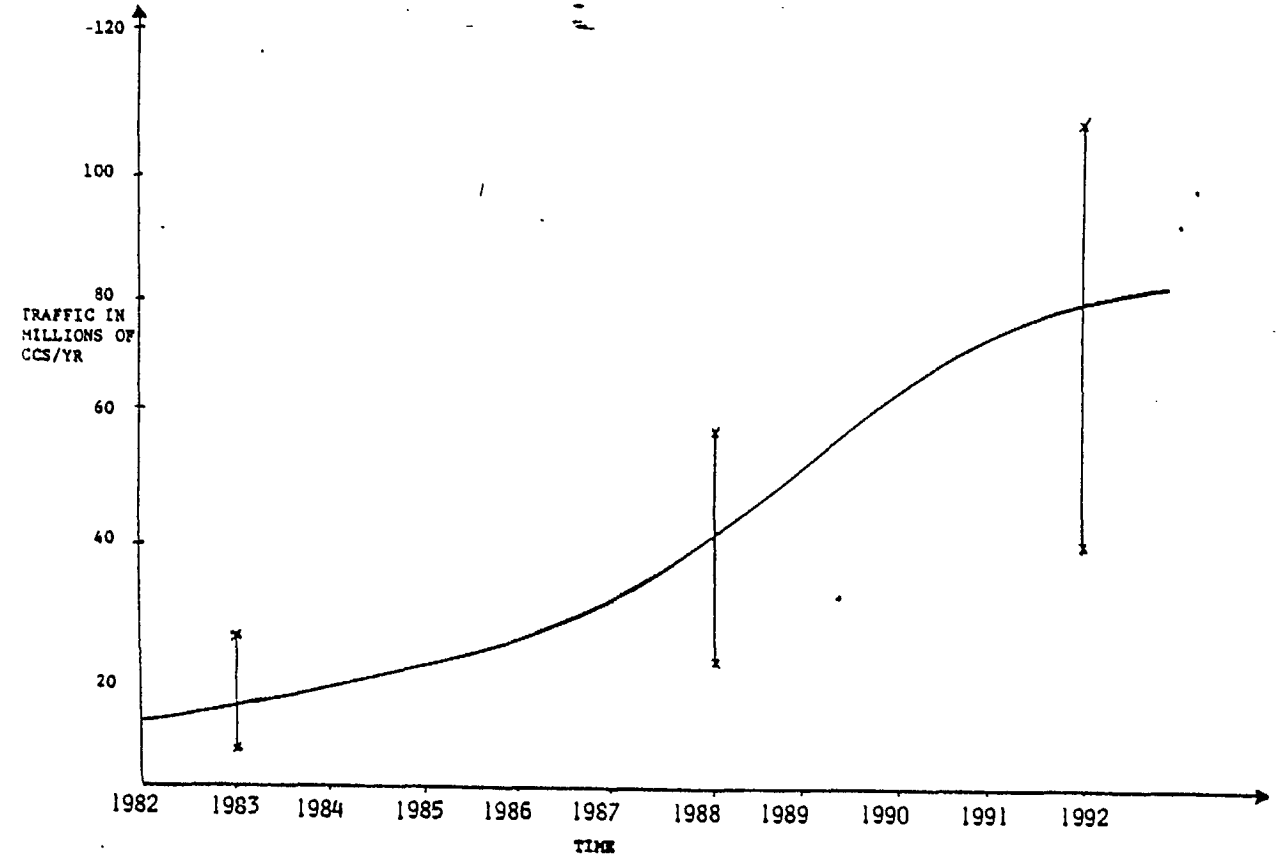
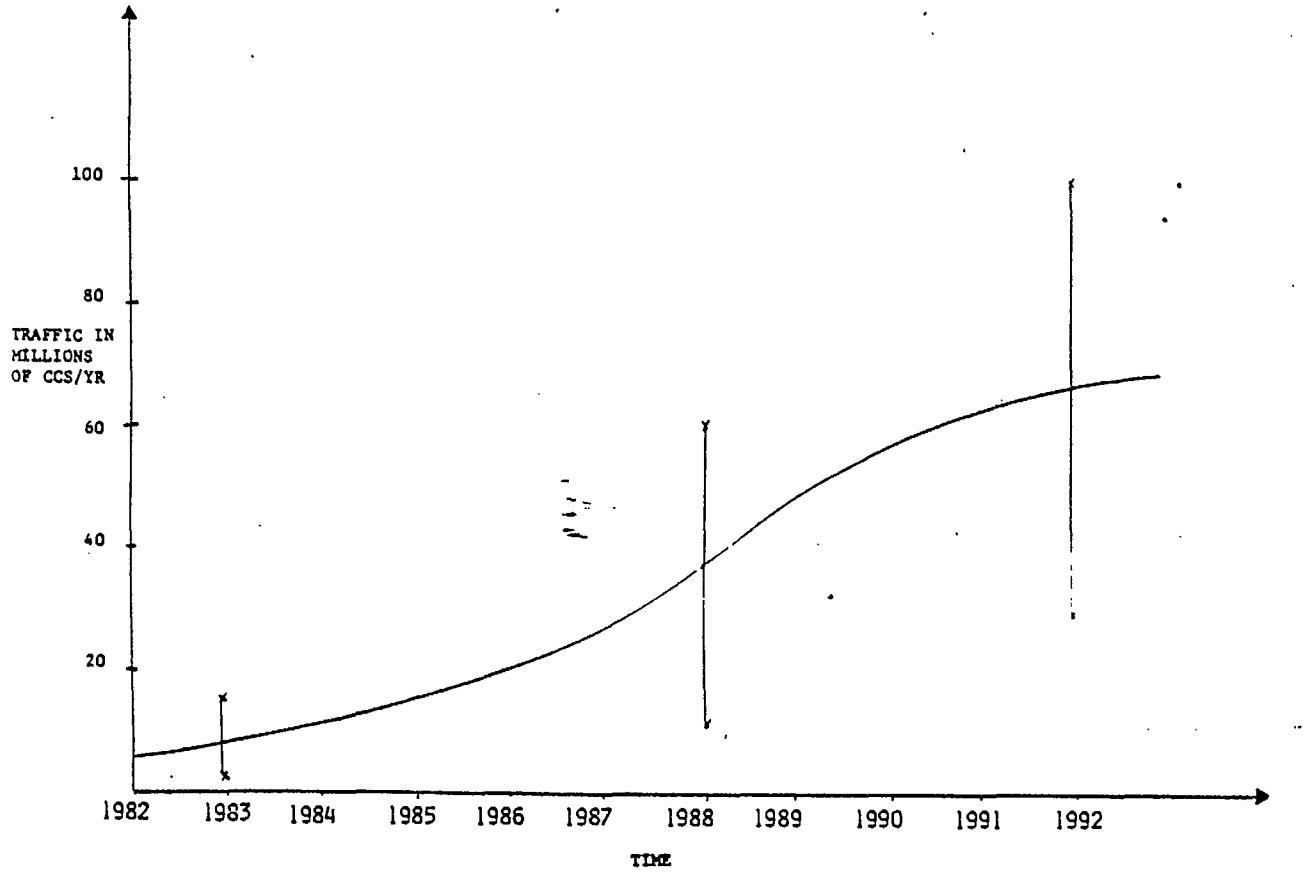


Figure 21: PENETRATION OF MESSAGING SERVICES



Appendix A

Summary of Service Characteristics

Table A-1

Basic CATV

YEAR	CUSTOMER TYPE	POTENTIAL MARKET SIZE	PENETRATION	NUMBER USING SERVICE	SERVICE BUSY PERIOD	HOLDING TIME	CCS/YEAR (millions)	BANDWIDTH
1983	Residential	7 million	85%	5,950,000	6-10 pm	6 hours/ day	463,881.6	5-6 MHz
1988	Residential	8 million	91%	7,300,000	6-10 pm	6.5 hrs/ day	621,784.8	
1992	Residential	10 million	95%	9,500,000	6-10 pm	6.8 hrs/ day	802,922.4	

Table A-2

Pay TV

YEAR	CUSTOMER TYPE	POTENTIAL MARKET SIZE	PENETRATION	NUMBER USING SERVICE (millions)	CALL FREQUENCY	SERVICE BUSY PERIOD	HOLDING TIME	CCS/YEAR (millions)	BANDWIDTH
1983	Residential	5.9 million	10%	.6	1/week	6-10 pm	1.8 hrs	2,021.8	5-6 MHz
1988	Residential	7.3 million	29%	2.1	1/week	6-10 pm	1.8 hrs	7,076.2	
1992	Residential	8.8 million	51%	4.5	2/week	6-10 pm	1.6 hrs	26,956.8	

Table A-3

Security/Alarm Services

YEAR	CUSTOMER TYPE	POTENTIAL MARKET SIZE (millions)	PENETRATION	NUMBER USING SERVICE	# ALARMS/YEAR	SERVICE BUSY PERIOD	ALARM MESSAGES/ YEAR	BANDWIDTH
1983	Residential	8.1	1% (.5)	81,450 40,500	3		0.3 0.15	300 bps
	Small Business			10,820 (1,803)	4 messages/ day/business	8-9 am 4-5 pm	10.8 (1.8)	
1988	Residential	9.2	3% (1%)	227,014 92,000	3		0.7 0.3	
	Small Business			146,857 (26,129)	4 messages/ day	8-9 am 4-5 pm	146.8 (26.1)	
1992	Residential	10.0	7% 2%	700,525 200,000	3		2.1 0.6	
	Small Business			235,162 (92,730)	4 messages/	8-9 am 4-5 pm	235.2 (92.7)	

Table A-4

Energy Management*

* Assumes polling 4 times a day

YEAR	CUSTOMER TYPE	POTENTIAL MARKET SIZE (millions)	PENETRATION	NUMBER USING SERVICE (thousands)	NUMBER OF MESSAGES/YEAR (millions)	BANDWIDTH
1983	Small Business	1.0	2% (0%)	20.8 (-)	30.0 (0)	300 bps
1988	Residential	9.2	2% (.5%)	184.7 (46.2)	270 (67)	
	Small Business	1.0	10% (.5%)	104.2 (5.2)	150 (7.5)	
1992	Residential	10.0	5% (1.5%)	500.4 (150.1)	720 (216)	
	Small Business	1.0	50% (1%)	521.0 (10.4)	750 (15)	

Table A-5

Teleconferencing: Audio

YEAR	CUSTOMER TYPE	POTENTIAL MARKET SIZE	PENETRATION	NUMBER USING SERVICE	CALL FREQUENCY	SERVICE BUSY PERIOD	HOLDING TIME	CCS/YEAR (millions)	BANDWIDTH
1983	Small Business			36,880 23,070	2/business/year	9-12 am 1-3 am	½ hour	2.0 (1.2)	1.2 - 9.6 kbps
	Large Business	464	99% (90%)	460 418	5 conferences/ business location/ year	9-12 am 1-3 am	½ hour	7.5 (6.8)	4 kHz
1988	Small Business			109,540 (54,540)	3/business/year	9-12 am 1-3 am	½ hour	8.9 (4.4)	
	Large Business	464	99% 90%	460 418	50/business location/ year	9-12 am 1-3 am	½ hour	24.8 (23.8)	
1992	Small Business			202,900 (156,620)	5/business/year	9-12 am 1-3 am	½ hour	27.3 (13.4)	
	Large Business	464	80% (75%)	371 (325)	75/business location/ year	9-12 am 1-3 am	½ hour	29.7 (27.1)	

Table A-6

Teleconferencing: Audio Visual

YEAR	CUSTOMER TYPE	POTENTIAL MARKET SIZE	PENETRATION	NUMBER USING SERVICE	CALL FREQUENCY	SERVICE BUSY PERIOD	HOLDING TIME	CCS/YEAR (millions)	BANDWIDTH
1983	Large Business	464	40%		60 conferences/ business/ year	9-12 am 1-3 am	1 hour	0.4 (0.3)	1.2-4.8 kbps High resolution
1988	Small Business			200 (100)	2 conferences/ year	9-12 am 1-3 am	1 hour	0.01 (0.007)	9.6-64 kbps
	Large Business	464	75% (55%)		20 conferences/ location/ year	9-12 am 1-3 am	1 hour	10 (7.3)	
1992	Small Business			1,000 (600)	5 conferences/ year	9-12 am 1-3 am	1 hour	7.2 (3.6)	
	Large Business	464	90% (70%)		40 conferences/ location/ year	9-12 am 1-3 am	1 hour	24 (18.7)	

Table A-7

Videoconferencing

YEAR	CUSTOMER TYPE	NUMBER USING SERVICE	NUMBER OF CONFERENCES	SERVICE BUSY PERIOD	HOLDING TIME	COST/YEAR (millions)	BANDWIDTH
1983	Large Business		1,700 (200)	9-12 am 1-3 pm	1½ hours	0.09 (0.01)	1.5 mbps
1988			16,000 (3,000)	9-12 am 1-3 pm		0.8 (0.2)	
1992			24,250 (8,500)	9-12 am 1-3 pm		1.3 (0.5)	

Table A-8

Computer Conferencing

YEAR	CUSTOMER TYPE	NUMBER OF CONFERENCES	CALL FREQUENCY	BUSY HOUR TRAFFIC	HOLDING TIME	CCS/ YEAR (thousands)	BANDWIDTH
1983	Large Business	496 (50)	20 conferences/ year	9-12 am 1-3 am	½ hour	8.9 (0.9)	3 kHz (voice channel)
1988	Large Business	14,130 (983)				254 (17.7)	
1992	Large Business	254,340 (17,694)				423.9 (16.6)	

Table A-9

On Demand Video

YEAR	CUSTOMER TYPE	POTENTIAL MARKET SIZE	PENETRATION	NUMBER USING SERVICE	CALL FREQUENCY	SERVICE BUSY PERIOD	HOLDING TIME	CCS/YEAR (millions)	BANDWIDTH
1988	Large Business			20 (-)	10/location 1 year	9-12 am 1-3 pm	2 hours	0.4 (-)	5.6 kHz
1992	Residential	10 million	4% 2.7	270,000	8/year	6-10 pm	1.5 hrs	116	
	Small Business			19,500 (-)	1/business	9-12 am 1-3 pm	2 hours	1.7 (0.6)	
	Large Business			91 (42)	100/location/year	9-12 am 1-3 pm	2 hours	19.7 (9.1)	

Table A-10

High Definition TV

YEAR	CUSTOMER TYPE	POTENTIAL MARKET SIZE	PENETRATION	NUMBER USING SERVICE	CALL FREQUENCY	SERVICE BUSY PERIOD	HOLDING TIME	CCS/YEAR (millions)	BANDWIDTH
1988	Large Business			23 (10)	100/business/year	Business hours	1 hour	7 (3)	20 MHz
1992	Residential	10 million	1% (.5%)	100,000 50,000			1 hour/day/residential user	36 18	
	Small Business			2,500 (250)	50/business/year	Business hours	1 hour	4.5 (2.3)	
	Large Business			94 (45)	100/business/year	Business hours	1 hour	27.1 (12.8)	

Table A-11

Database Downloading

YEAR	CUSTOMER TYPE	POTENTIAL MARKET SIZE	PENETRATION	NUMBER USING SERVICE	CALL FREQUENCY	SERVICE BUSY PERIOD	HOLDING TIME	CCS/YEAR (millions)	BANDWIDTH
1983	Large Business			Business Location 4,756 (1,806)	2 hours/ week	- night		17.2 (6.5)	3 kHz (voice)
1988	Small Business	1 million		1,000 (500)	50/busi- ness/year		1 hour	1.8 (0.9)	1.2-4.8 kbps (terminal)
	Large Business			9,162 Business Location (5,058)	2 hours/ week			32 (18.2)	9.6-64 kbps (hard/soft copy)
1992	Small Business	1 million	.05 (.01)	5,000 1,000	50/busi- ness/year		1 hour	9 (1.8)	
	Large Business			11,658 Business Location	2 hours/ week/ business location			42 (27)	

Table A-12

Voice Messaging Service

YEAR	CUSTOMER TYPE	POTENTIAL MARKET SIZE	PENETRATION	NUMBER USING SERVICE	CALL FREQUENCY	SERVICE BUSY PERIOD	HOLDING TIME	CCS/YEAR (millions)	BANDWIDTH
1983	Residential	8.1 million	5% (2%)	400,000 162,000	4/year		20 seconds	0.2 (0.1)	3 kHz
	Large Business			51 (14)	.5 mes- sages/ employee	9-12 am 1-3 pm	40 seconds	7.7 (3.5)	
1988	Residential	9.2 million	20% (5%)	1,850,000 460,000	6/year		20 seconds	1.9 (0.5)	
	Small Business			19,995 (7,800)	3/employ- ee/day	9-12 am 1-3 pm	40 seconds	12.0 (0.5)	
	Large Business			107 (61)	2 mes- sages/ employee/ day	9-12 am 1-3 pm	40 seconds	16.1 (9.2)	
1992	Residential	10 million	40% (15%)	400,000 150,000	8/year		20 seconds	5.8 (2.2)	
	Small Business			162,960 (32,800)	5/employ- ee/day	9-12 am 1-3 pm	40 seconds	12.3 (3.3)	
	Large Business			211 (127)	4/employ- ee/day	9-12 am 1-3 pm	40 seconds	31.7 (18.9)	

Table A-13

Home Banking

YEAR	CUSTOMER TYPE	POTENTIAL MARKET SIZE	PENETRATION	NUMBER USING SERVICE	CALL FREQUENCY	SERVICE BUSY PERIOD	HOLDING TIME	CCS/YEAR (millions)	BANDWIDTH
1988	Residential	9 million	3% (2%)	270,000 180,000	3/month	5-9 pm Thurs.-Fri.	15-30 seconds	4.8 (2.4)	3 kHz (voice)
1992	Residential	10 million	7% (4%)	700,000 (400,000)	6.3/month	5-9 pm Thurs.-Fri.	15-30 seconds	21.8 (10.9)	1.2-4.8 kbps (terminal) 9.6-64 kbps (hard/soft copy)

Table A-14

Central Security Monitoring Service Revenues

U.S. Penetration and Revenues

	1980	1982	1985	1990
Penetrations	2%	5%	10%	15%
Subscription Revenues ($ mls)	45	50	200	500

Source: IRD
Yankee Grp.

Table A-15

Uses of Video

USE	%
Employee Training	66.2
Orientation	62.1
Student Instruction	59.3
In-service Education	56.7
Public Relations	54.5
Continuing Education	49.1
Management Information	43.5
Documentation	42.6
Safety Instruction	40.0
News and Information	38.7
Sales and Marketing	29.7
Research	22.7
Entertainment	19.1
Shareholder Information	7.0
Other	5.4

Table A-16

Type of Organizations Using Non-Broadcast Video

	Number	%
Business/Industry	13,500	50%
Educational Institutions	5,000	18.5%
Medical Institutions	5,000	18.5%
Government	3,000	11%
Nonprofit	800	2%
Total	27,000	

Source: [44]

Table A-17

Nonbroadcast Expenditures by User Segments
(in millions)

Segment	Amount	% of Total
Business/Industry	$660	60%
Education	$165	15%
Government	132	12%
Medicine	110	10%
Nonprofit	33	3%
Total	1,100	100%

Table A-18

Use of Checks by Individuals

(U.S.)

Category	% of total	Number of checks per household per year
Food stores	9	20
Retail stores	15	33
Retail gasoline	4	9
Other businesses	16	35
Utilities	9	20
Insurance	4	9
Medical	4	9
Commercial banks and cash	11	23
Other financial institutions	5	11
Non-profit institutions	5	11
Governments	2	4
Individuals and unidentifiable	16	35
Total	100%	219

Source: [40]

Table A-19

Estimated Diversion of Cheques to EFT

	1982-84		1984-90		1990-92	
	Penetration of EFT	Cheques Diverted/Yr	Penetration of EFT	Cheques Diverted/Yr	Penetration of EFT	Cheques Diverted/Yr
Food Stores	-	-	-	-	-	-
Retail Stores	-	-	5%	1.6	10%	2
Retail Gasoline	-	-	-	-	-	-
Other Businesses	-	-	10%	1.6	50%	16.5
Utilities	-	-	50%	10	100%	20
Insurance	-	-	50%	4.5	100%	9
Medical	-	-	50%	4.5	100%	9
Commercial Banks and Cash	-	-	10%	2.3	20%	4.6
Other Financial Institutions	-	-	20%	2.2	100%	11
Non-Profit Institutions	-	-	-	-	-	-
Governments	-	-	50%	5.5	100%	4
Individuals Etc.	-	-	-	-	-	-
				32.2		76.1

Appendix B

Penetrations of New Services

Market Segmentation was only performed on the business market. The residential market is more homogeneous, in terms of their needs, so segmenting is not as important.

Note:
- All penetrations are in terms of Canadian market
- All figures in brackets represent pessimistic scenario
- 'Short term' refers to 1982-1984
- 'Medium term' refers to 1985-1989
- 'Long term' refers to 1990-1992

Table B-1

Projected Penetrations of Security/Alarm Systems

		Short Term	Medium Term	Large Term	No. of* Businesses
Small & Medium Businesses					
Retailers/Wholesalers		3% (.5%)	60% (10%)	90% (45%)	154,887
Pharmacists		3% (.5%)	60% (10%)	90% (45%)	7,000
Manufacturing		3% (.5%)	25% (5%)	50% (10%)	198,809
Usage (1 system/bus.)	optimistic	10,820	146,857	235,162	
	pessimistic	(1,803)	(26,129)	(92,730)	
(at 4 mess./day) messages/year		10,820,000 (1,803,000)	146,857,000 (26,129,000)	235,162,000 (92,730,000)	

* Canadian data was used to generate these figures.

Table B-2

Energy Management Penetration Rates

		Short Term	Medium Term	Large Term	No. of Businesses in Canada
Small Businesses					
All Small Businesses		2% (-)	10% (.5%)	50% (1%)	1,042,000
Usage (1/business)	optimistic	20,840	104,200	521,000	
	pessimistic	(-)	(5,210)	(10,400)	

Table B-3

Audio Conferencing Penetrations*

	Short Term (1982-1984)	Medium Term (1984-1990)	Long Term (1990-1992)	Businesses in Canada
Small & Medium Businesses				
Segments:				
Manufacturing	15% (10%)	50% (20%)	75% (40%)	185,200
Accountants	10% (5%)	20% (20%)	70% (30%)	84,000
Lawyers	10% (5%)	20% (10%)	70% (40%)	7,000
Usage				
No. of conferences/business	2	3	5	
No. of conferences	73,760 (46,140)	328,620 (163,620)	1,013,000 (496,400)	
Usage in CCS/year	1,991,520 (1,245,780)	8,872,740 (4,417,710)	27,351,000 (13,402,800)	
Large Businesses				
No. of locations/business = 40	99% (95%)	99% (90%)	99% (90%)	464
Usage	15 conferences/ business location/ year	50 conferences/ business location/ year	75 conferences/ business location/ year	
No. of conferences/year	276,000 (252,000)	918,720 (881,600)	965,120 (904,800)	1,102,464 (1,002,240)
In CCS/year	7,452,000 (6,804,000)	24,805,440 (23,803,200)	30,067,200 (28,188,000)	29,766,528 (27,060,480)

* Percentage of number of businesses in Canada

Note: Numbers in brackets are pessimistic Forecasts, while the ones above are optimistic Forecasts.

Table B-4

Audio Visual Conferencing

	Short Term	Medium Term	Long Term	No. of* Businesses
Small & Medium Businesses				
Manufacturing		1% (.5%)	20% (10%)	200,000
		2 conferences/yr	5 conferences/yr	
Usage (2 conferences/yr)		400 (200)	200,000 (100,000)	
CCS/year		14,400 (7,200)	7,200,000 (3,600,000)	
Large Businesses	40% (30%)	75% (55%)	90% (70%)	464
Usage	60 conferences/ business loct'n/ year	20 conferences/ business loct'n/ year	40 conferences/ business loct'n/ year	
	11,136 (8,352)	278,400 (204,160)	668,160 (519,680)	
No. of CCS/yr	400,896 (300,672)	10,022,400 (7,349,760)	24,053,760 (18,708,480)	

Note: Penetrations are in terms of percentage of businesses.
Assuming average length of conference is 1 hr (36 CCS).

* Number of businesses in Canada.

Table B-5

Projected Usage of Videoconferencing

	Short Term	Medium Term	Long Term
Large Businesses			
Hotels & other videoconference service companies (no. of facilities)	20	50	60
Usage	80/facility (10/facility)	250/facility (50/facility)	300/facility (100/facility)
Business Videoconference Facilities	2	5	25
Usage	50/year (-)	200/year (100/year)	250/year (100/year)
Number of Conferences/year	1,700 (200)	16,000 (3,000)	24,250 (8,500)
No. of CCS/year*	91,800 (10,800)	864,000 (162,000)	1,309,500 (459,000)

* Assuming average length of videoconference is 1½ hrs.

Table B-6

Projected Penetration of Computer Conferencing

	Short Term	Medium Term	Long Term	No. of Businesses	No. of Business Locations
Large Businesses					
Manufacturing	10% (1%)	30% (3%)	50% (10%)	205	20/business
Banks & Other					
Financial Institutes	10% (1%)	30% (2%)	50% (7%)	43	1,000/business
Usage	20 conferecnes/ business	1 conference/ location	1 conference/ location		
Number of conferences per year	496 (50)	14,130 (983)	23,550 (3,420)		
Number of CCS/year	8,928 (900)	254,340 (17,694)	423,900 (61,560)		

Assuming average conferencing is ½ hour.

Table B-7

On-Demand Video Projected Penetration

	Short Term	Medium Term	Long Term	Number of Businesses in Canada
Small Business				
Hotels			10% (5%)	250,000
Real Estate			5% (-)	100,000
Manufacturing			1% (-)	200,000
Usage				
No. of access/year (average of 1/business)		optimistic	32,000 (12,500)	
No. of CCS/year*		optimistic	1,728,000 CCS/year (675,000)	
Large Business			1992	
Banks (training) & Financial Institutions		10% (-)	30% (5%)	43
Services-Hotels		10% (-)	60% (50%)	25
Manufacturing		5% (-)	25% (10%)	205
Education		10%	45% (10%)	10
Medical		10%	40% (30%)	20
Usage (no. of access/ location/year) (40 locations/bus.)		10/location/yr	100	
Accesses/year		8,000	364,000 (168,000)	
CCS/year (average 54 CCS/access)*		432,000 (-)	19,656,000 (9,072,000)	

* Assuming average access is 1½ hours (for training etc.)

Table B-8

HDTV Projections

	Short	Medium	Long	No. of Businesses in Canada
Small Businesses				
Hotels			10% (5%)	25,000
Usage (no. of units/bus.) 1/bus.			2,500 (1,250)	
CCS/year - 50 access/HDTV unit (assuming 1 hour each)			4,500,000 (2,250,000)	
Large Businesses				
Services-Hotels (Bar etc.)		30% (25%)	70% (60%)	25
Manufacturing		5% (-)	30% (10%)	205
Education		5% (-)	30% (10%)	10
Medical		25% (20%)	60% (40%)	20
Usage				
units/location (assuming 40 locations)		1,860 (820)	7,520 (3,560)	
100 access/year 1 hour each		6,696,000 (2,952,000)	27,072,000 (12,816,000)	

Table B-9

Projected Market of Database Downloading

	Short Term	Medium Term	Long Term	No. of Businesses in Canada
Small Businesses	-	.001%	.05% (0.01%)	1,000,000
Number of businesses using service		1,000 500	5,000 1,000	
Usage (# of access/yr/business) (# of accesses/yr)		50/yr 50,000 25,000	50/yr 250,000 (50,000)	
CCS/year (average access = 36 CCS)		1,800,000 (900,000)	9,000,000 (1,800,000)	
Large Businesses				
Banks & Other Financial	80% (50%)	95% (75%)	95% (75%)	45
Manufacturing	30% (10%)	70% (40%)	90% (60%)	205
Other (including Real Estate)	10% (1%)	20% (5%)	30% (10%)	214
Usage (number of businesses location	4,756 (1,806)	9,162 (5,058)	11,658 (7,126)	
Number of CCS/year (average access = 72 CCS/location/ week or 3600 CCS/ year/location) (2 hrs/week)	17,121,600 (6,501,600)	32,983,200 (18,208,800)	41,968,800 (25,653,600)	

Table B-10

Consolidated Projected Penetration of Voice Messaging Service

	Short Term	Medium Term	Long Term	No. of Businesses in Canada
Small & Medium Businesses				
Retailers		25% (1%)	40% (5%)	144,000
Stockbrokers		25% (1%)	50% (10%)	7,000
Manufacturing		30% (2%)	50% (10%)	200,000
Accountants		20% (2%)	30% (10%)	84,000
Lawyers		20% (1%)	30% (7%)	7,000
Insurance Agents		20% (1%)	30% (7%)	31,000
Real Estate Agents		20% (1%)	30% (10%)	20,000
Usage Average no. of employees: 50/bus. Messages/year		3/employee/yr 29,992,500 (1,170,000)	5/employee/yr 40,740,000 (8,200,000)	
CCS/year (.4 CCS/message)		11,997,000 (468,000)	16,296,000 (3,280,000)	
Large Businesses				
Banks & Other Finance	10% (5%)	40% (20%)	99% (50%)	43
Manufacturing	20% (5%)	30% (20%)	60% (40%)	205
Retail/Wholesalers	5% (1%)	25% (10%)	40% (20%)	114
Usage	.5 messages/employee	.5 messages/employee/day	.5 messages/employee/day	
(Average 3000/employee/bus.) Messages/year	19,125,000 (8,625,000)	40,125,000 (22,875,000)	79,200,000 (47,250,000)	
CCS/year	7,650,000 (3,450,000)	16,050,000 (9,150,000)	31,680,000 (18,900,000)	

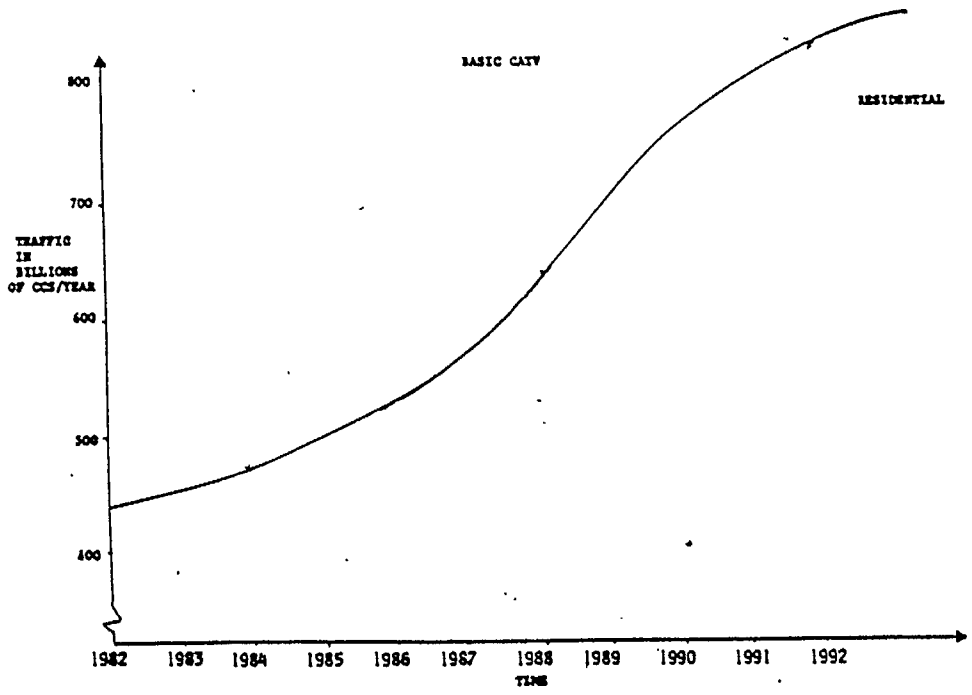


Figure B-1

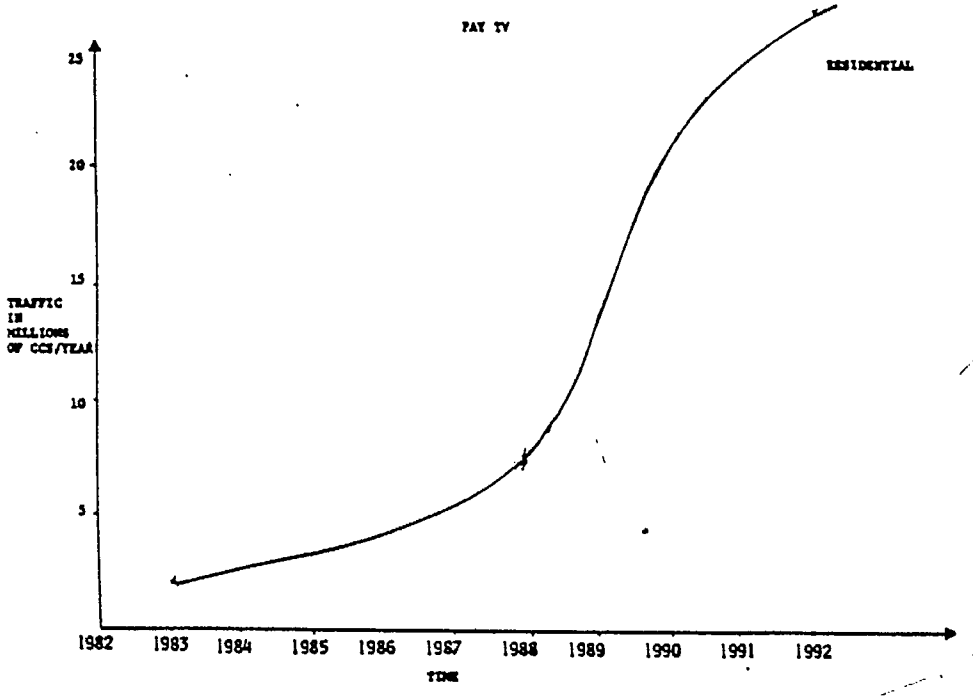


Figure B-2

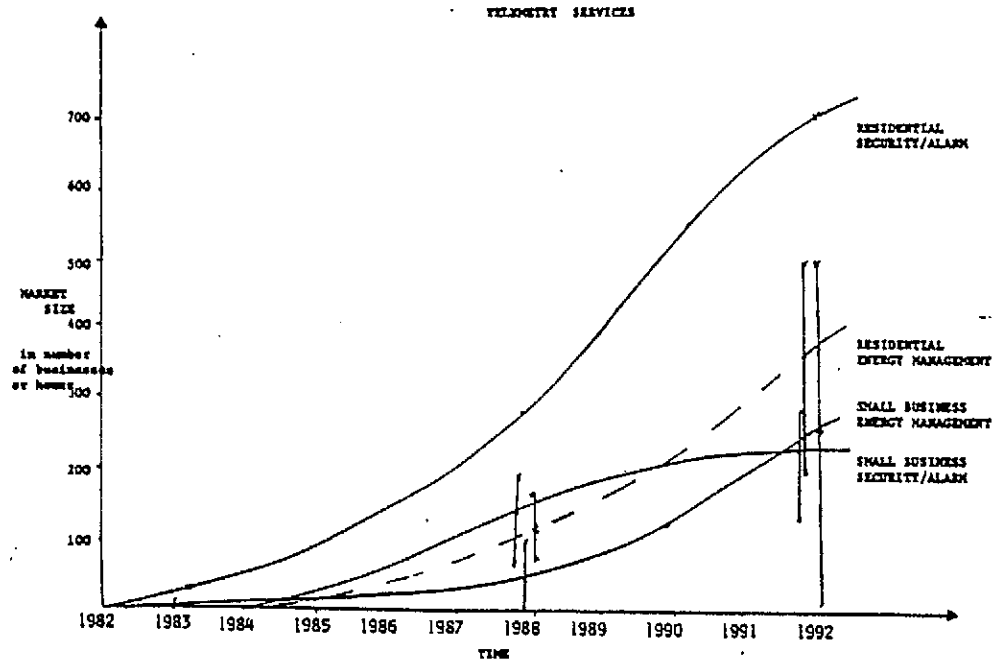


Figure B-3

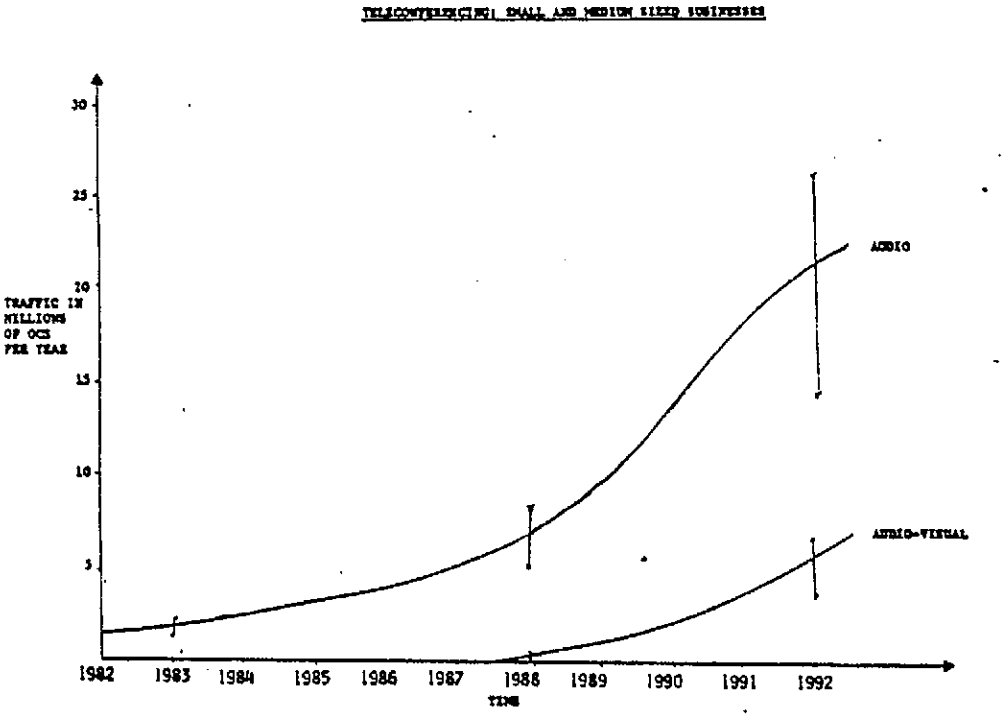


Figure B-4

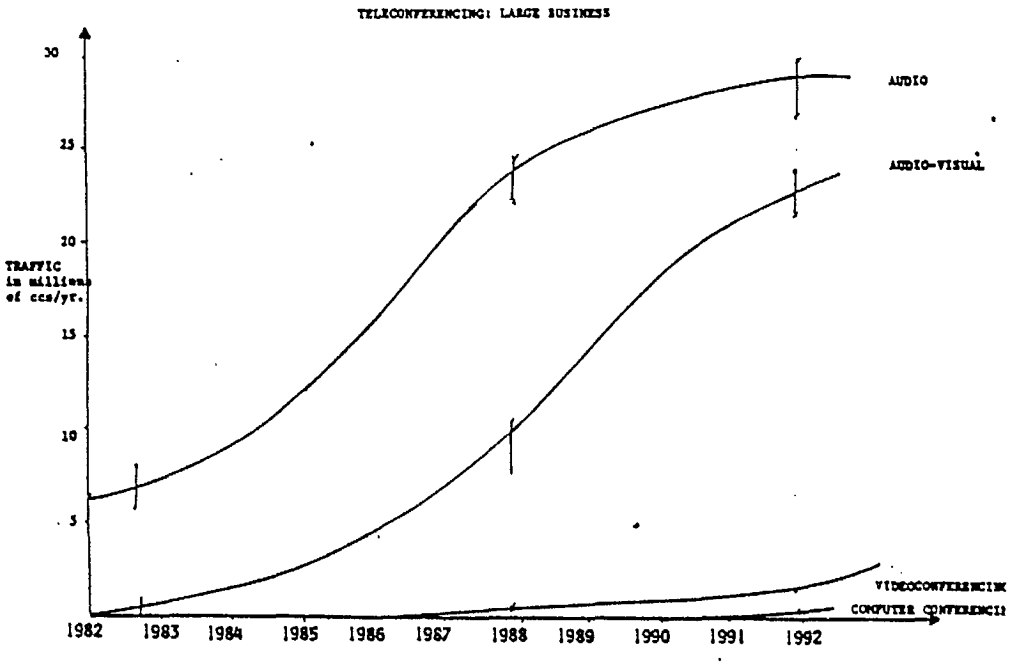


Figure B-5

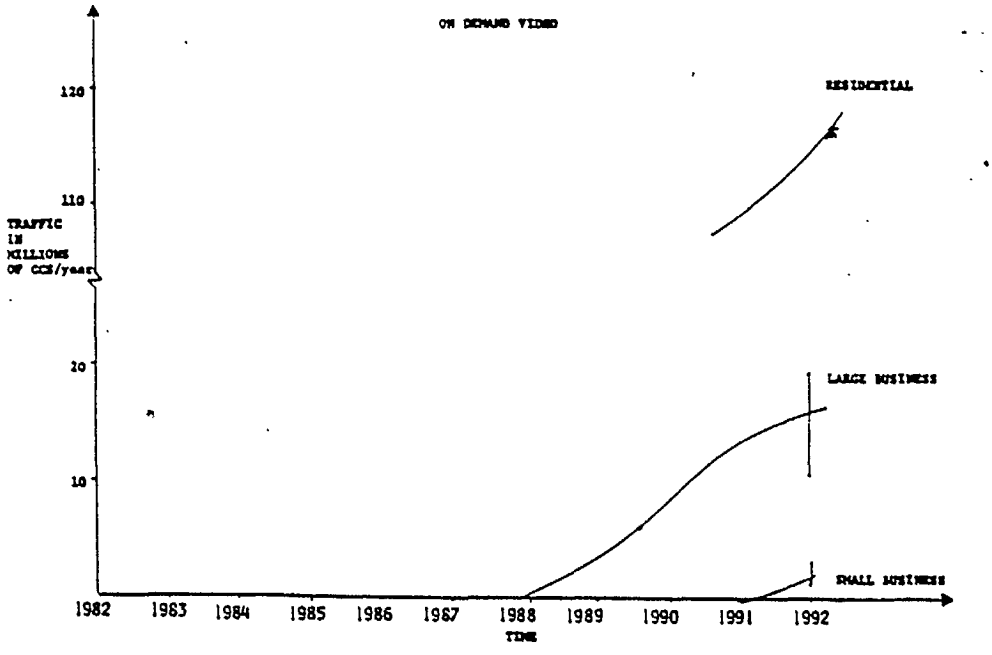


Figure B-6

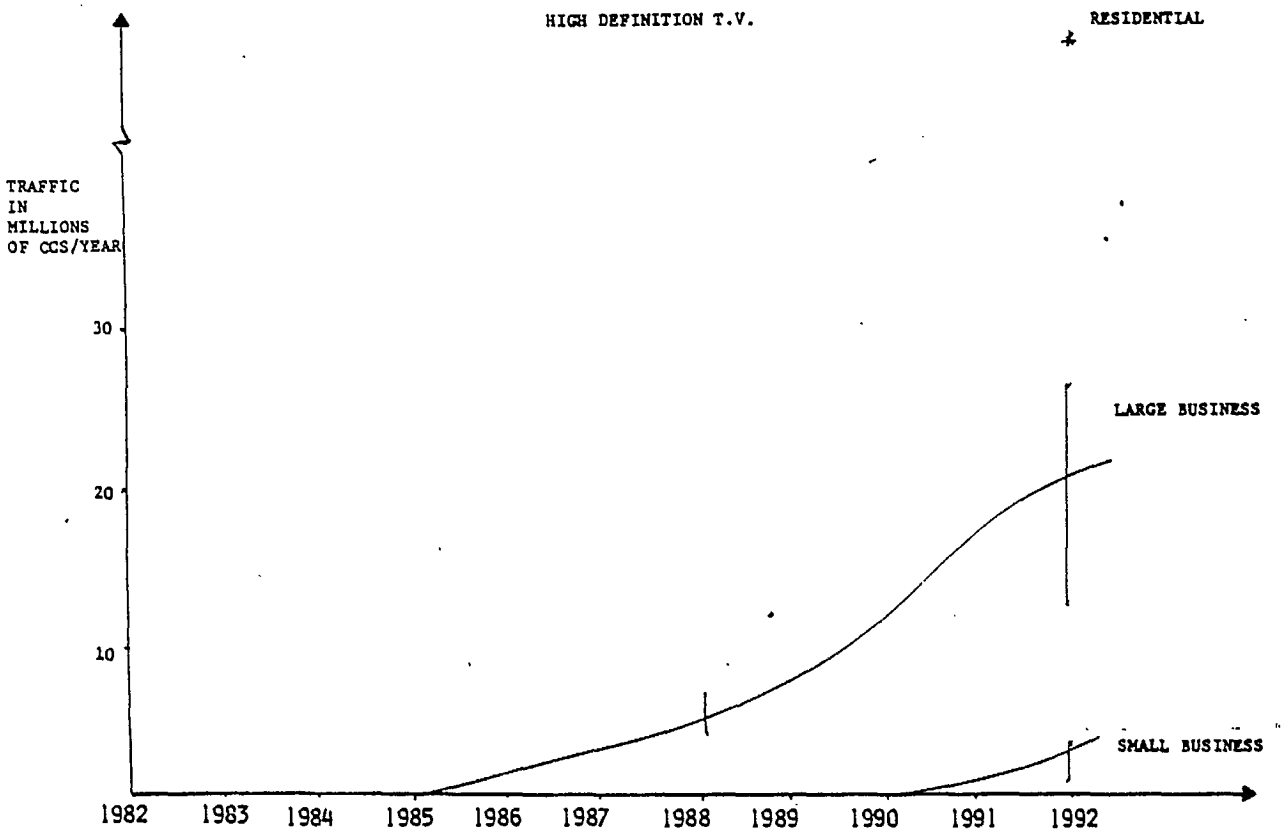
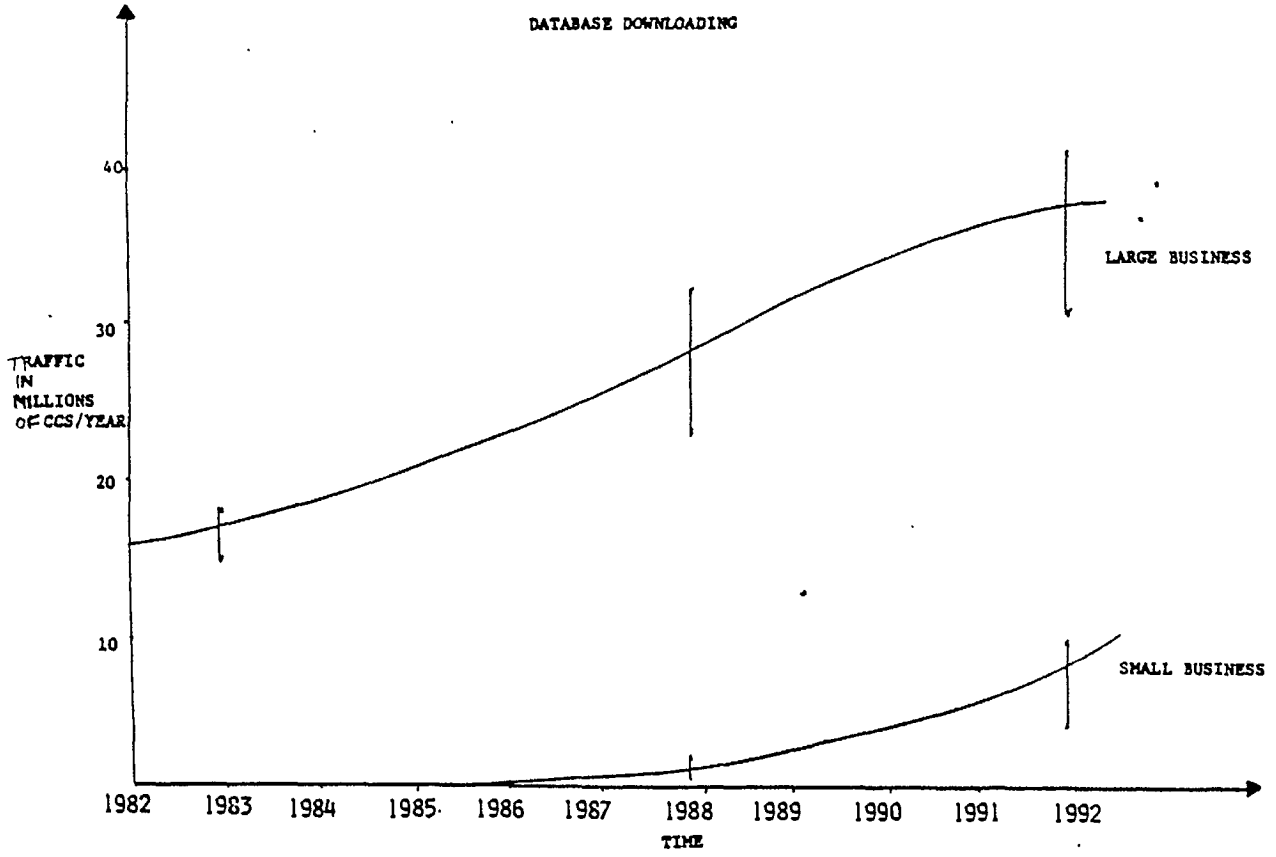


Figure B-7



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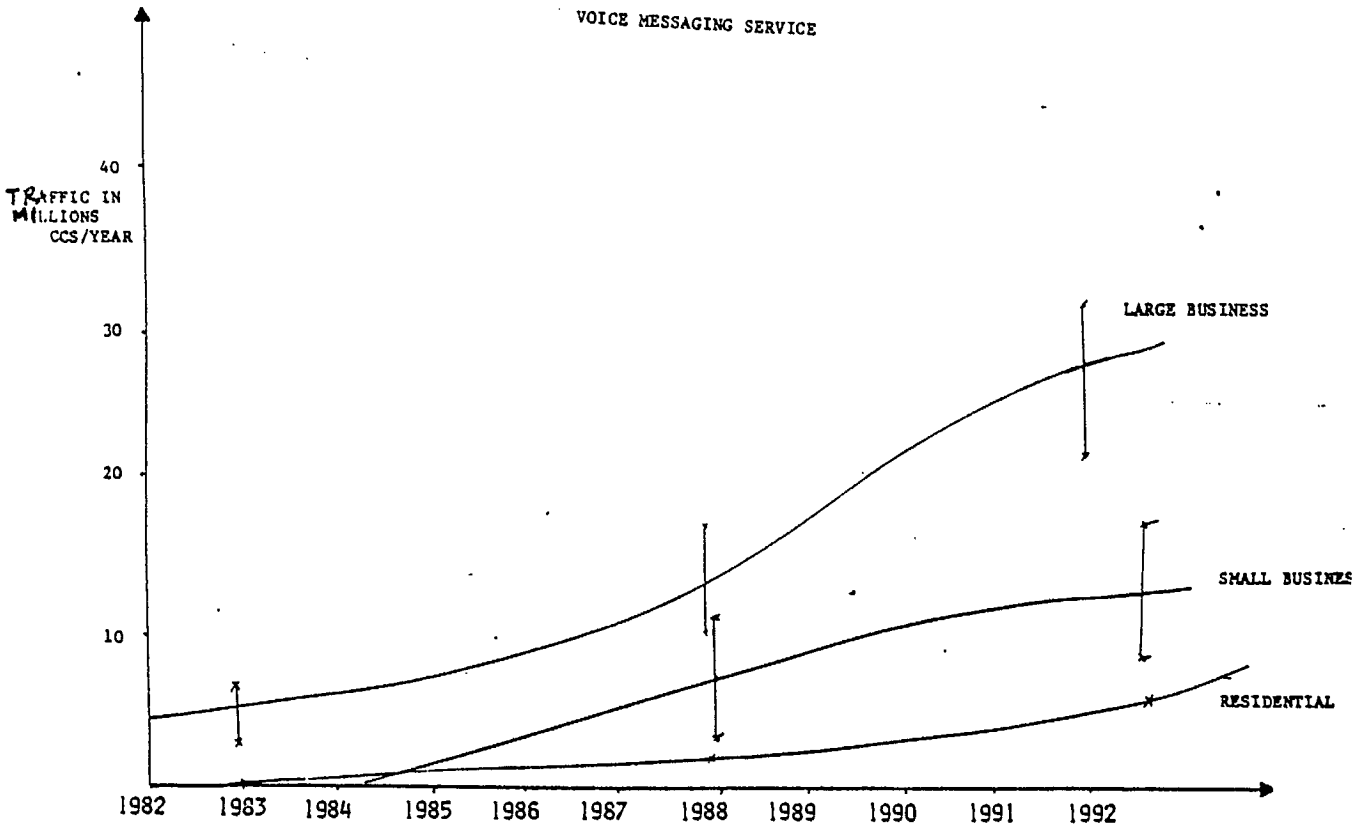

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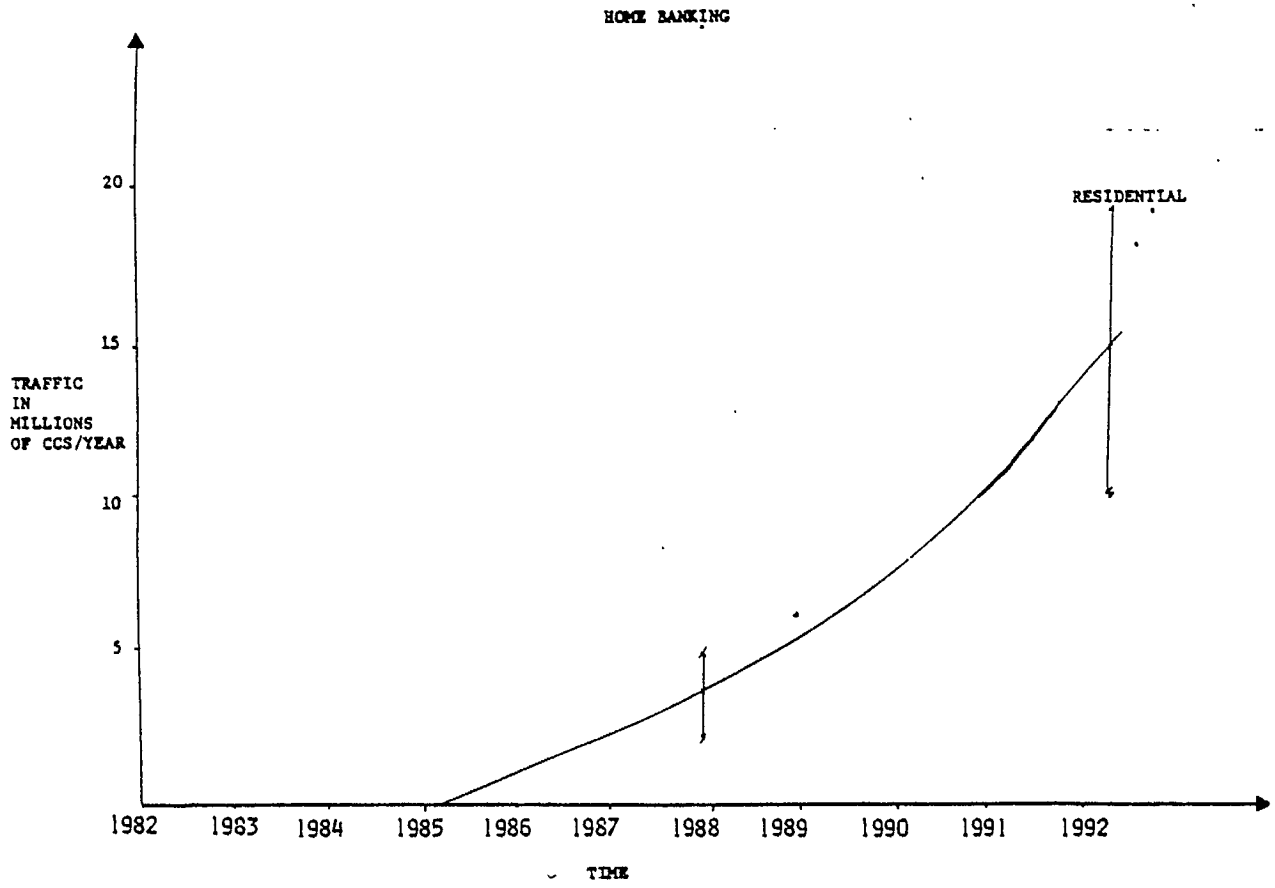

Figure B-10

Appendix C

Census and Business Statistics

Table C-1

Enumerated and Projected Number of Households
(1971-2001)

Province of Territory	1971	1976	1981	1986	1991	1996	2001
CANADA	6,062.8	7,045.4	8,145.9	9,233.8	10,007.5	10,724.8	11,561.0
Newfoundland	110.9	125.6	142.9	160.9	174.6	186.5	201.8
Prince Edward Island	28.0	30.5	33.3	36.1	37.6	38.7	40.5
Nova Scotia	209.2	229.9	252.6	274.0	285.3	293.3	304.5
New Brunswick	158.7	175.8	194.1	211.3	220.4	226.9	236.2
Québec	1,611.8	1,838.1	2,081.4	2,304.5	2,412.9	2,474.5	2,545.4
Ontario	2,234.5	2,660.0	3,146.6	3,646.3	4,047.9	4,447.2	4,906.2
Manitoba	289.8	320.4	353.1	382.4	396.4	408.9	426.4
Saskatchewan	268.8	268.5	267.7	259.1	234.5	203.3	173.2
Alberta	466.5	555.5	656.9	758.2	840.2	923.3	1,019.8
British Columbia	671.6	824.0	995.5	1,173.8	1,325.3	1,483.7	1,661.4
Yukon	5.2	6.6	8.2	10.0	11.7	13.6	15.7
Northwest Territories	7.7	10.4	13.4	17.1	20.8	24.9	29.7

Households (1976)

Urban	78.3%
Rural	21.7%
Owned	62%
Rented	38%

Source: [36]

Table C-2

Population and Household Projections for Top Census Metropolitan Areas in Canada
(1980-1985)

Metropolitan Area	Population 000's Estimated Projections			Households 000's Estimated Projections		
	1980	1982	1985	1980	1982	1985
Calgary	541	578	634	176	188	206
Chicoutimi-Jonquiere	129	129	129	35	35	35
Edmonton	622	652	699	196	206	220
Halifax	277	285	296	83	86	89
Hamilton	536	543	553	178	181	184
Kitchener	288	302	323	96	100	107
London	280	285	293	98	100	102
Montreal	2,816	2,830	2,850	992	996	1,004
Oshawa	145	149	155	47	48	50
Ottawa-Hull	739	754	776	243	248	255
Quebec	566	581	603	182	186	194
Regina	167	177	192	54	57	62
St. Catharines-Niagara	310	314	320	104	105	108
St. John's	151	155	161	39	40	42
Saint John	116	119	123	36	37	38
Saskatoon	147	154	166	48	50	54
Sudbury	154	152	150	46	45	45
Thunder Bay	121	122	123	40	40	40
Toronto	2,914	2,979	3,077	983	1,005	1,038
Vancouver	1,203	1,216	1,236	420	424	431
Victoria	230	236	245	85	88	91
Windsor	246	244	240	81	80	79
Winnipeg	586	598	616	201	205	212

Source: [36]

Table C-3

Number of Businesses in Toronto (CMA) by Industry and Locations

	Small Businesses 250-500 employees		Medium-sized Businesses 500-1000 employees		Large Businesses 1000 employees		TOTAL	
	no. of businesses	no. of locations	no. of businesses	no. of locations	no. of businesses	no. of locations	no. of businesses	no. of locations
Manufacturing	153	334	96	446	10	122	259	902
Retailers/Wholesalers	9	56	8	186	9	337	26	579
Hotels	9	19	7	9	3	14	19	42
Real Estate Agents	1	8	-	-	-	-	1	8
Insurance Agents	12	30	8	17	8	55	28	102
Lawyers	5	5	-		-		5	5
Accountants	3	5	-		-		3	5
Stockbrokers	2	2	2	6			4	8
Banks	5	164	-		8	903	12	944
Other Financial	4	7	-		-		4	8
Communications	3	10	2		6		11	39
Other Professional	19	22	10	33	4	39	33	60
Government	4	177	5	14	11	1206	20	1397
Institutions	3	5	12	15	10	31	25	51
Schools	4	13	5	21	8	515	17	547

Refer to [43]

Average number locations/business (Toronto) = 40

Table C-4

Number of Businesses in Canada by Industrial Classification and Sales (1978)

Sales (in millions of dollars)

	Small 1	Medium 1-100	Large 100	Total
Manufacturing/Construction	185,200	13,609	205	199,014
Utilities	41,000	2,032	45	43,077
Wholesale/Retail	137,200	17,687	114	155,001
Finance	269,300	3,168	43	272,511
Stockbrokers	7,000	-	-	7,000
Accountants	84,000			84,000
Real Estate	20,000			20,000
Insurance	31,000			31,000
Lawyers	7,000			7,000
Pharmacists	7,000			7,000
Other	216,297		44	216,341
TOTAL	1,004,997	36,496	451	1,041,944

Table C-5

Comparative Statistics for Canadian and U.S. Cable Industries

	CANADA (1979) (Canadian $)	U.S. (1979) (U.S. $)
Number of cable systems	482	4,150
Homes passed by cable	5,900,000	34,000,000 (1981)
Homes served as percent of homes passed by cable	68.7%	55.0%
Homes served as percent of TV households	55.3%	24.0%
Subscribers	4,100,000	14,100,000
Average subscriber rate	$6.50	$7.37
Average pay cable monthly fee	0	$8.44
Pay cable revenues	0	$355,371,636
Operating revenues	$313,700,000	$1,817,144,960
Net income	$25,100,000	$199,328,409
Total assets	$632,200,000	$3,211,574,387

Canadian source: Statistics Canada 1979 Report on Cable Television

U.S. source: NCTA, March 1981

Table C-6

Cable Industry Growth in Canada and U.S.

	Year	Cable Systems	Subscribers (in millions)
CANADA	1975	388	2.8
	1976	403	3.1
	1977	427	3.4
	1978	467	3.7
	1979	482	4.1
Percentage growth over five years - 46%			
U.S.	1975	3,506	9.8
	1976	3,681	10.8
	1977	3,832	11.9
	1978	3,875	13.0
	1979	4,150	14.1
Percentage growth over five years - 90%			

Canadian source: Statistics Canada 1979 Report on Cable Television

U.S. source: NCTA, March 1981

Table C-7

GROWTH OF PAY CABLE INDUSTRY - UNITED STATES

Year	Pay cable subs. (in millions)	Systems with pay cable	Percent of penetration of homes passed	Percent of penetration of basic cable
1976	.766	253	11.5	24.3
1977	1.174	441	11.5	22.5
1978	2.353	789	16.2	30.9
1979 June 30	4.334	1,498	19.9	37.7
1979 Dec. 30	5.731	1,822	22.3	41.3
1980 Sept. 30	9.143	3,072	27.9	50.6
1990 (est)	40-50 Mil			

Source: NCTA, March 1981
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