STUDY OF USER NEEDS AND MARKET TRENDS IN TELECOMMUNICATIONS PRODUCTS AND SERVICES

Final Report

Prepared for:

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Prepared by:

Hickling Corporation

in association with

MPR Teltech Limited

and

Microelectronics Industry Consultants

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Executive Summary

1. Introduction

This study of telecommunications products and services focuses on the market trends for new products and services as defined by the users as opposed to the developers of technology. The determination of market potential has required a blending of technology forecasting together with an analysis of user needs in order to arrive at a realistic market potential.

The two factors that are most likely to affect the significant market penetration of a new telecommunication service are (1) the availability and accessibility of the required technological in frastructure or network, and (2) the interest and need of consumers in the particular service. The fast pace of technological development has moved the concept of the telecommunications market in the year 2003 (the study is looking at a 10 year timeframe) from a common network to a range of networks and therefore a range of market opportunities.

Moreover, the traditional distinctions between computer science, broadcasting and telecommunications are becoming blurred. Largely as a result of the merging of new technologies, the separation between market segments is becoming blurred. More people will be able to work and shop at home and consult business associates, experts and doctors from their homes. A whole range of products and services such as intelligent video terminals and personal digital assistants that have been identified in the study and are described below can be used just as easily at home, in the office or for teaching or medical care.

2. Review of Products and Services

Teleshopping and Other Transactions

Three broad information-based services are examined: teleshopping, banking and other financial transactions, and real estate. In general, user interest is very high, especially in the age bracket below 49 years.

Major factors affecting the widespread acceptance of these services will depend largely on the usefulness and uniqueness of services available, user friendliness -- largely to do with the type of displays and information accessed, rather than the capacity to process data, and accessibility -- the service is there when you want it.

Costs of terminals will be similar to that of small personal computers with enhanced video displays, costing between $1500 and $2500. The cost to the consumer can be assessed in several ways: the cost of the terminal hardware, the access to the network service, i.e. a basic subscription fee, and finally, the cost-per-use, depending on the actual usage, much like long-distance charges today.

In the short term, narrow band ISDN will be sufficient to supply the infrastructure for these services, though over the next ten years, a broad-band ISDN service,possibly supplied by optical fibres will be required to handle the complexity and volume of transactions.

Distance Education and Training Services

Distance education or training involves the delivery of educational and training materials to students located remotely via telephone or satellite links. Advantages include broad coverage, sharing of scarce resources, customized learning, and scheduling convenience, particularly for adult students.

For business, this can translate to major dollar savings per student, which is significant, given that the total training market for the US is $100 billion.

For institutions, costs for the new technology can be a major barrier. Individuals also can face serious cost barriers, but one option is to have educational services and technology delivered at the community level, where costs can be shared among many.

Technical characteristics are similar to those for teleshopping above, although in some instances, higher video definition might be required, with the ensuing incremental bandwidth requirements.

Personal Digital Assistant

The Personal Digital Assistant (PDA) integrates many functions under one package: daytimer, personal organizer, pager, intelligent gateway to databases and reference libraries, organizer of information and transactions, and eventually language translator, etc. Initially, it is likely to recognize handwriting, and later voice commands.

In terms of user applications, the PDA appears to have universal appeal in all segments: home, business, and institutional, though not all its features are equally appreciated.

Technical characteristics include a small -- possibly a "palmtop" -- terminal, possibly multimedia, with small video, using stylus and textual input.

Infrastructure requirements will initially involve narrowband ISDN, later broadband ISDN, and eventually, in the wireless generation, the necessary segment of the radiospectrum.

Price would initially be around $500 to $1000, but would be expected to drop to $300 in the year 2000. It is expected that by 2002, they will have a 40% penetration in business, and a 5-10% penetration in the home.

Fax Transactions

Generally, the fax allows the transfer of information, on paper or in electronic format, from one remote site to another using telephone lines. Fax services currently make up the second largest component of telecommunication revenues after the basic telephone service. Future faxes will be faster, higher resolution, offer grey scale and colour, and will support a full range of electronic data: e-mail, multimedia, etc. Users will include not only businesses, but also homes.

One trend is the merging of paper fax with modem-based faxes, which signal a move towards electronic and multimedia transmissions.

The present generation of fax machined uses the existing analogue telecommunications networks, but future generations will require increased bandwidth.

The Group 4 fax machines currently on the market require a narrow band digital network to operate to their full capability, although they can operate presently at a diminished capacity on an analogue network.

Costs are expected to decrease.

Market expectations are for 50 million fax devices in the US by the year 2000, which translates to 150 million globally, and 5 million in Canada.

Videoconferencing

Videoconferencing is the meeting of people from remote locations through two-way video terminals. A special application is telemedicine, which extends the videoconferencing also to transmission of medical data. Home users would see videoconferencing as a form of a videophone, which would allow them to see and be seen their callers. This has obvious advantages from a human contact view pint, although some users feel camera shy and self conscious.

Business users of videoconferencing see primarily savings in business travel and greater ease in setting meetings. At present, clear audio is still more important than video. Picture quality, i.e. resolution and motion, is limited by the availability of required bandwith.

For telemedicine, videoconferencing and multimedia offer the potential of remote diagnosis of a patient, reduced requirements for transporting patients and their families, case reviews for doctors in remote areas, and in some cases, improved micrographs.

Costs for a videoconferencing unit can range between $30,000 and $100,000 per node, and are expected to falls to as low as $5,000 by the year 2000.

High Definition Television

High Definition Television (HDTV) delivers a television picture displaying 1050 to 1260 individual line, providing twice the detail of current television, and a ratio of height to width that is much closer to the proportions of a movie theatre screen.

Homes would use it for enhanced entertainment. Businesses would use it for videoconferencing requiring high resolution images, eg. for marketing presentation to clients. There could also be application in education.

Consumer reaction has been less than overwhelming, particularly given the high initial price of $5-6,000. This is expected to drop to less than $2,000 in the year 2000.

Broadcast standards will have to be agreed upon, and implemented.

Estimated Canadian market for 2002 is 300,000 units, or $60 million.

Interactive Media Services

Interactive services provide two-way or multi-way links between the user and sources of entertainment. They include such services as news services, video-on-demand, pay-per-view, and virtual reality.

Interest is highest for home users, this type of interactive entertainment meets the need for greater customization and choice, and provides a broad range of new options. Business and government might want to use this type of service for greater access to information databases.

Terminals would include enhanced television sets with greater user input functions in the "remote control" unit, all the way to a PC-based system, for the more serious home user. Infrastructure will include initially a mix of Cable TV with telephone commands, but narrow band ISDN will provide support for a wide range of services. Later, the high quality video signal will inevitably require broadband ISDN, possibly with an optical backbone.

Costs residential interactive entertainment terminals will be within the present range of consumer television equipment, $400-600.

More complex personal computer-based terminals will include the cost of the non-dedicated PC, plus an ISDN terminal adaptor, which initially will be available for $1,000 - $1,500.

Marginal costs for adding these services to an ISDN network are fairly low, but a broadband ISDN network would be very costly to deploy. Cumulative market projection for the year 2003 could range from $16,000,000 to $20,000,000.

Wireless Personal Communication Services

Wireless communication applications include voice, pager, text, fax, data and still or moving images. The highest profile service is voice, with the introduction of the cellular telephone, and in the near future, the public cordless telephone service, or Personal Communication Service (PCS). Close on the heels will come the digital cellular telephone. Pagers could be displaced by these services, unless they can continue to offer significant advantages, eg. low price.

Users are very price conscious. Home users would need only basic service, no frills. They want simplicity, not several telephone systems.

IVHS

Intelligent vehicle highway systems (IVHS) allow information to be received in vehicles on traffic congestion, road conditions, or position/navigation services. The same technology could be used to determine the use of highways by vehicles for the purpose of charging toll fees. The potential application areas are travel advisory, fleet management, traffic management, mobile office (extension of office capability into the vehicle), occupant activities (increase enjoyment, provide access to a vast activity library) and vehicle control.

Users need up to data traffic flow information. They need to know where accidents have occurred, where there is construction, how the weather is affecting driving conditions, etc.

Easy user access is very important.

Packages can range from the simplest of two-way radio links to computer generated video mapping and synthesized voice direction. It is necessary to harness telecommunications and computer technology for use in IVHS.

Units currently under development will be available for less than $500 and fit into the palm of the hand, although in-car equipment is expected to cost up to $1500. The external support, which could include satellite and other monitoring systems, plus electronic collection of tolls, parking and fuel costs will be high.

One estimate for the US market for car-road technology is for $200 billion over the next twenty years.

Medical Telemetry and Personal Monitors

A personal monitor is an alarm and location device which alerts services (police, health, etc.) that the person carrying the device needs assistance if a preset of circumstances occurs i.e. a fall or no movement for long periods of time.

A medical telemetry system is a system which monitors and transmits indications of a person's physical condition (i.e. heart rate, blood pressure, etc.) to a medical centre which monitors the transmissions and alerts an attendant in the case of emergency.

With advances in biomedicine providing more opportunities for direct, continuous monitoring of problematic health conditions, the need for wireless personal to provide telemetry of this information is increasing.

Many businesses would like to have real-time knowledge of the location of certain groups of employees - sales people, for example - so that they could more efficiently and effectively deploy these people.

The terminal requirements are likely to be quite different for different applications within the medical telemetry and personal monitoring services category. In other words, these terminals cannot be considered "consumer" items. This terminal specialization will result in much higher terminal costs than generic PCS terminals, for example. The technology for the wireless access portion of these terminals is likely to be able to be "borrowed" from the more generic PCS terminals, but the unique data input and control requirements will necessitate custom terminal development for each application.

The markets to be addressed within this service category are extremely diverse. The relatively small size of the market for each niche application will require a separate business case to determine the economics of development, on an application-by- application basis.

3. Market Assessment

The study has concluded that there are three major market components which will generate significant sales; terminal hardware and software, service fees for network connections, and program fees. Given the study's mandate, we have focussed on the likely hardware/software combinations and provided in Chapter 14 a range market sizes. Overall market figures for the

home, business and institutional sectors are as follows: PC-based terminals ($8-14 billion); enhanced video terminals ($5-7 billion); wireless devices ($300 million-$1.2 billion).

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1.

Introduction

This Study of telecommunications products and services focuses on the market trends for new products and services as defined by the *users* as opposed to the developers of technology. Determining market potential requires a blending of technology forecasting together with an analysis of user needs in order to arrive at a realistic market potential.

1.1 Overview of Recent Market Trends

The market, in Canada and abroad, for the services outlined above is potentially large but it is also volatile. A good example of this unpredictability is Alex, Bell Canada's foray into computer home shopping and other information services to the home. This demonstration suggests that users have particular requirements which have to be served if the service is to be successful. Launched in April, 1990, Alex lists more than 400 on-line databases. Subscribers can make reservations from an auto-rental agency, check weather forecasts, do bank transactions, scan stock markets and so on. While the system has some 31,000 subscribers, only ten percent actually make use of it. The reasons for this according to some analysts are that most information provided by Alex is already available in newspapers, radio and cable television at comparable cost. No other services such as video games are provided as inducements to subscribe. Bell seems likely to discontinue the service because of the poor response.[1]

What seems to be clear is that technology does not usually sell itself - it has to be packaged and marketed in a way that is appealing to consumers and businesses and meets their real needs. The development of wireless systems by the telecommunications industry is moving the public aggressively toward the age of Personal Communication Services (PCS). PCS will bring the full power of communications mobility to the mass market - a mobility that today is enjoyed by only a few people who can afford cellular telephones and service.

The location-independent services, in turn, will create a paradigm shift in the way the world views telephony and communications; indeed, PCS will reshape our industry, our community, and our personal lives. For example:

- Our view of the telephone will change. No longer will the telephone be a shared fixture, but rather a personal item that people can carry with them most, if not all, of the time. At home, for instance, each family member could have his or her own phone and all members could make and receive calls simultaneously. And as telephones become more personal, smaller devices will emerge. They might be worn much like jewellery or as part of a wristwatch; or they could be built into a portable radio or CD player.

- The concept of just-in-time communications will emerge, shattering today's statistic that 80 percent of the calls we make do not reach the intended recipient. Being able to reach people wherever they are located will end the rounds of telephone tag that sap productivity today and will accelerate the pace of business to an unprecedented level.

- The importance of call-management services will also come to the fore, ensuring that the whole premise of PCS remains a benefit and does not become a nuisance. Call-management capabilities will enable users to control who reaches them, at what times, and under what circumstances[2].

The success of analog cordless and cellular phones in the residential and mobile markets demonstrates the potential of PCS. The realization of PCS from a service concept to reality, however, will depend on radio access techniques and intelligent networks. An intelligent network, developing as the Advanced Intelligent Network (AIN) in the US, is required to tie together wireless access islands of coverage. AIN is critical to user roaming and mobility. By augmenting the current public network infrastructure with digital wireless access and then expanding network service flexibility with AIN technology, radio coverage areas can be networked quickly and cost-effectively. The new wireless access systems and additions to the AIN platform will create a new platform for PCS[3].

Other new telecommunications markets are developing. For example CitiService is a financial information service, produced by British Telecom (BT) and available via Prestel. It is one of the databases in Prestel's business information package, which offers electronic services for the business market. CitiService was one of the first systems to offer an affordable dial-up market prices service. Market research undertaken by BT to ascertain users' perception of the service showed that most users access CitiService from PCs and consider it to be a good value for money. CitiService is only available in videotex mode. There are various equipment options available to users of CitiService, and choice will depend upon location and the anticipated frequency and volume of usage:

- *Computer interfaces for PC users*: CitiService can be accessed via an autodial modem and suitable comms software;
- *TV adapters*: Home users can access the service by using a TV adapter which plugs into the aerial socket and jack plug socket of the telephone line; and
- *Dedicated terminals*: Dedicated Prestel sets offer colour terminals, full alpha-numeric keyboards, plus 16 pages of memory.

CitiService provides financial information direct from the marketplace, with real-time prices from stock markets, money markets, foreign exchanges, futures, options and commodities markets. It also includes news, analysis, research, statistics and commentary. It is available 24 hours a day, seven days a week[4].

In the U.S., the Keyline Home Service provides a large number of domestic consumers in the US with a communication channel for 24 hour/day access to a wide range of products, financial services and information. Equipped with their Keyline home terminals, consumers will be able to browse, order, purchase, pay for and arrange delivery of the products and services of leading mail order, retailing and financial institutions. Service Providers who join Keyline will be able to offer their products under a high level of automation, with packaged software responding to incoming home terminal communications linked to product data bases, payment and fulfillment systems. Whilst consumers can pay for goods purchased through their terminals with all normal forms of payment and with a high level of security, Keyline is also pioneering the use of Smart Cards, and providing Smart Card reading and writing capability integrated within every terminal[5].

1.2 Factors Likely to Affect Future Market Trends

The two factors that are most likely to affect the significant market penetration of a new telecommunication service are (1) the availability and accessibility of the required technological infrastructure or network, and (2) the interest and need of consumers in the particular service. The examination of these two factors is a central theme to this entire report.

The changing vision of the evolution of telecommunications and consequently of market strategies is illustrated in two diagrams (Figures 1-1 and 1-2) prepared by the OECD. The current vision shows how the fast pace of technological development has moved the concept for the year 2000 from a common network to a range of networks and therefore a range of market opportunities. Canadian companies are pursuing these opportunities with market strategies designed to provide them with a market niche.

The introduction of the new telecommunications technologies requires also a close look at related standards, technical and business issues. For example:

- Standards bodies - at regional, national, and global levels - are wrestling with standards, spectrum allocation, and regulatory issues, and with the impact that Personal Communications Services will have on competition and industrial development. The speed at which standards are adopted universally has a direct bearing on the widespread adoption of a new technology;

- New and established players are mounting many different market and technical trials. More importantly, traditional forms of market segmentation are quickly vanishing, as the technologies underlying broadcasting and telecommunications, computers and videoterminals are becoming integrated into one system; and

- Industry is examining how to build the total network infrastructure, including the signalling schemes and intelligent networking elements, required to deliver location and access-independent services. The availability of these infrastructures, as well advances in multiplexing and signal compression technologies to effectively multiply the capacity of existing networks will affect profoundly the timeframe within which many of these services will become widely available.

In order for firms to flourish in the changing communications environment, they must have access to large and growing markets. The Canadian domestic market is too small to generate the production economies necessary for global competitiveness. The consequence is that

Canadian suppliers can prosper only if they compete internationally. It is difficult, however, to enter export markets without a domestic market base.

The Study is focussed primarily on defining Canadian user needs and the potential Canadian market. It also includes an examination of market demands and prospects in other countries.

International Market Trends in Information Technology[6]

- IT literacy gaps among countries are shrinking rapidly.
- The IT cost-benefit relationship is different among countries.
- Government support or policies have varying effects on IT (in general, the level of regulation and restriction is decreasing).
- Standardization in different countries affects globalization - more standards are now being developed, increasing diffusion levels.
- *Technology cross-substitution* is another diffusion variable - i.e. it depends on what the new technology is replacing, this can be different across countries.
- *Technology availability* is different across countries - initial technology developers focus on domestic demand and worry about exports later (some exceptions apply, Korea and Taiwan, for example).

Figure 1-1:

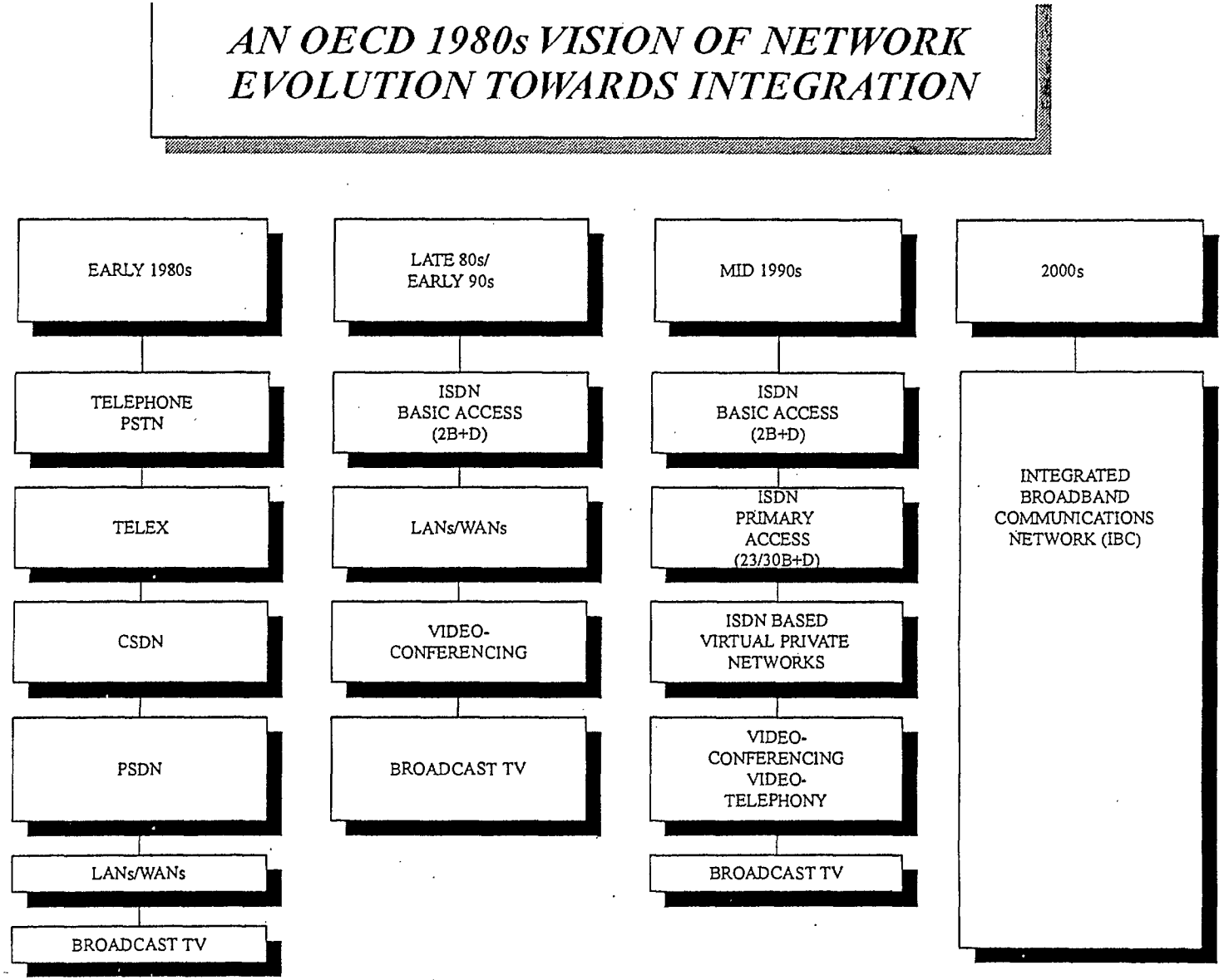
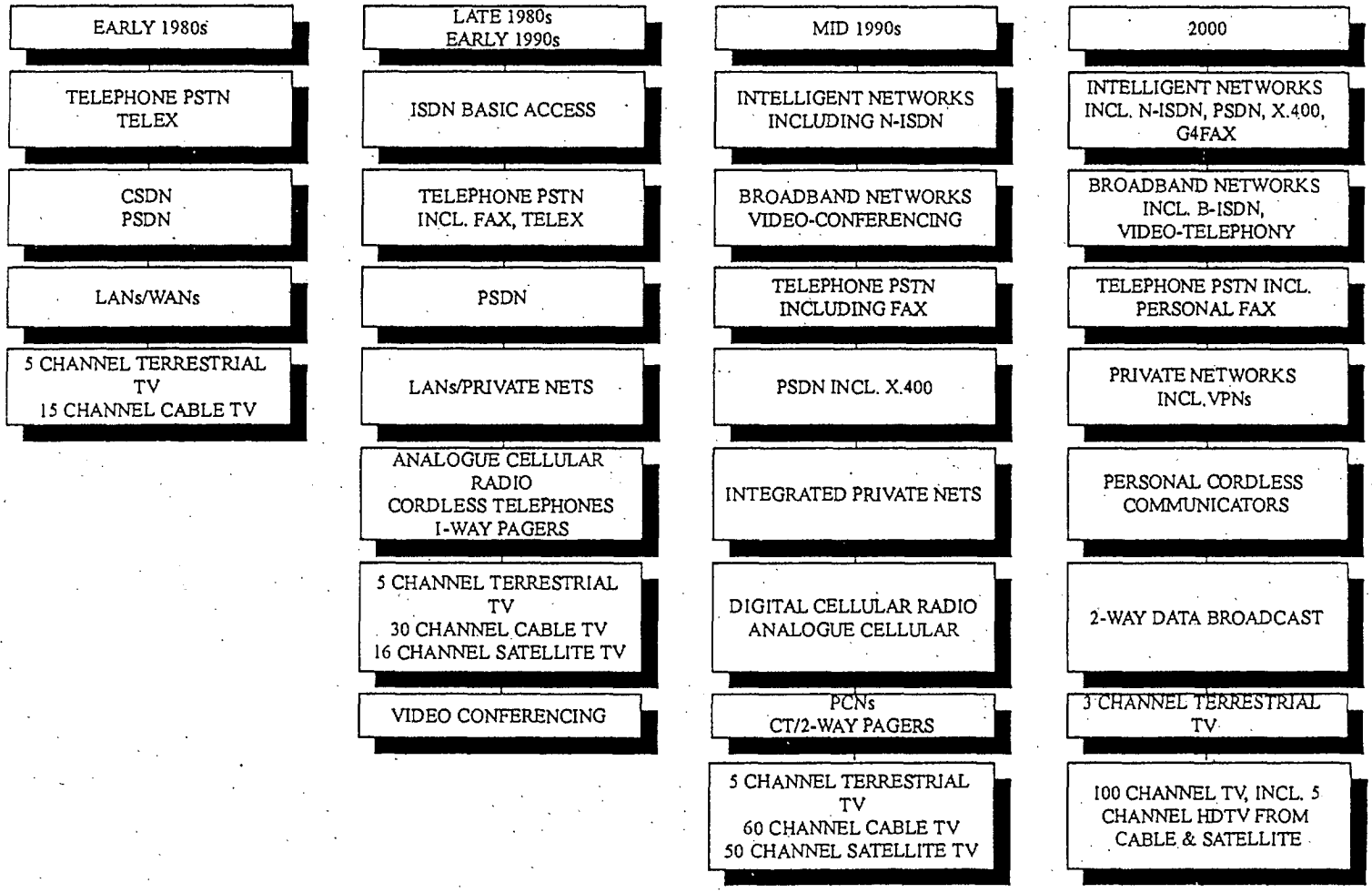

AN OECD 1980s VISION OF NETWORK EVOLUTION TOWARDS INTEGRATION
EARLY 1980s
TELEPHONE PSTN
TELEX
CSDN
PSDN
LANs/WANs
BROADCAST TV
LATE 80s/ EARLY 90s
ISDN BASIC ACCESS (2B+D)
LANs/WANs
VIDEO-CONFERENCING
BROADCAST TV
MID 1990s
ISDN BASIC ACCESS (2B+D)
ISDN PRIMARY ACCESS (23/30B+D)
ISDN BASED VIRTUAL PRIVATE NETWORKS
VIDEO-CONFERENCING VIDEO-TELEPHONY
BROADCAST TV
2000s
INTEGRATED BROADBAND COMMUNICATIONS NETWORK (IBC)

Figure 1-2:

AN OECD 1990s VISION OF NETWORK EVOLUTION TOWARDS DIVERSITY



References to Chapter 1

1. Globe & Mail, April 21, 1991.

2. Telesis Issue No.94

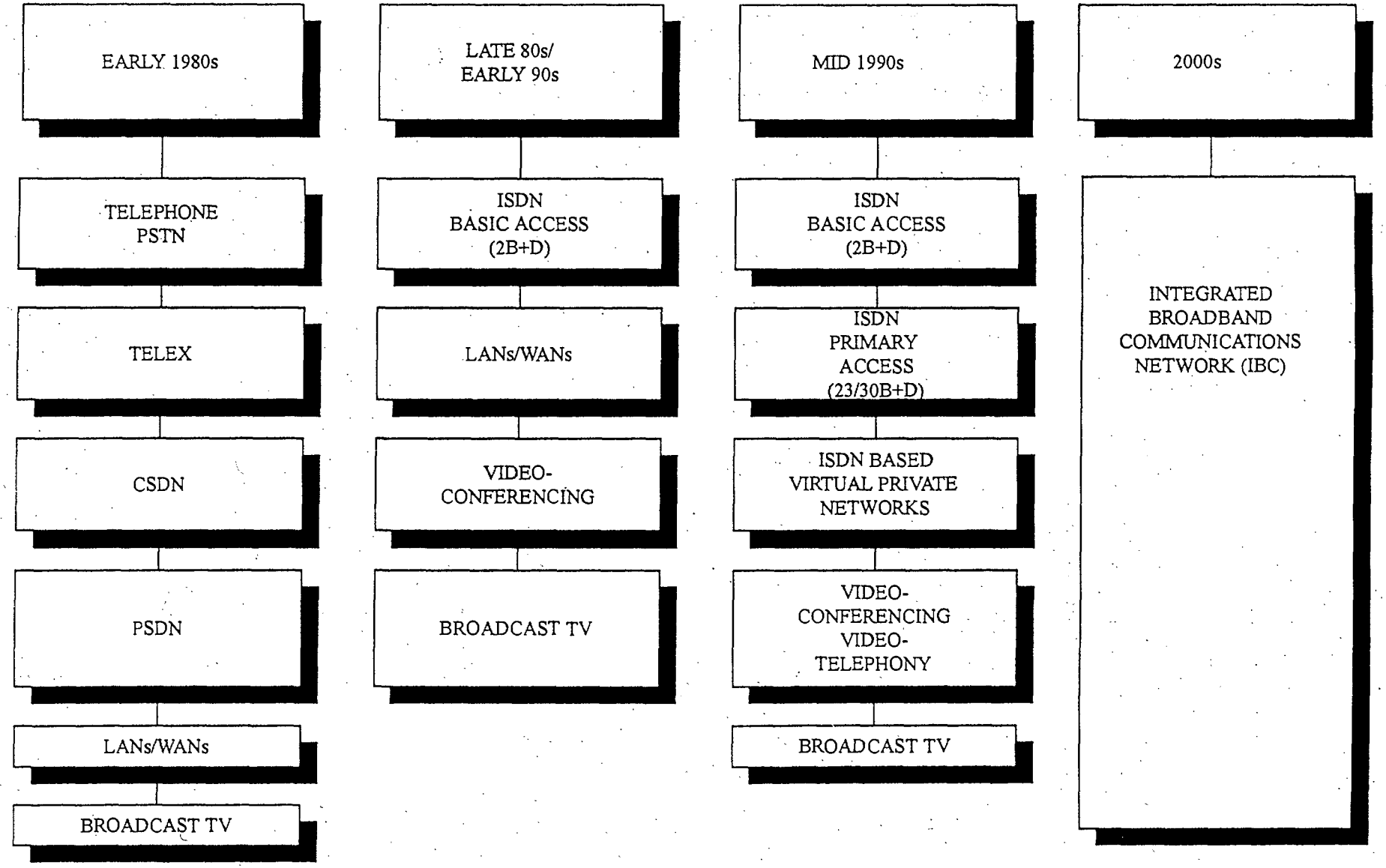
3. Telephony; December 23, 1991, 221(26), p.18-21.

4. Online Business Information, January, 1992, p.2-18.

5. IDATE, 12th International Conference Proceedings, 1990; p.415-41, Montpellier, France.

6. Poppel and Goldstein, "Information Technology: The Billion Dollar Opportunity", p68.

AN OECD 1980s VISION OF NETWORK EVOLUTION TOWARDS INTEGRATION



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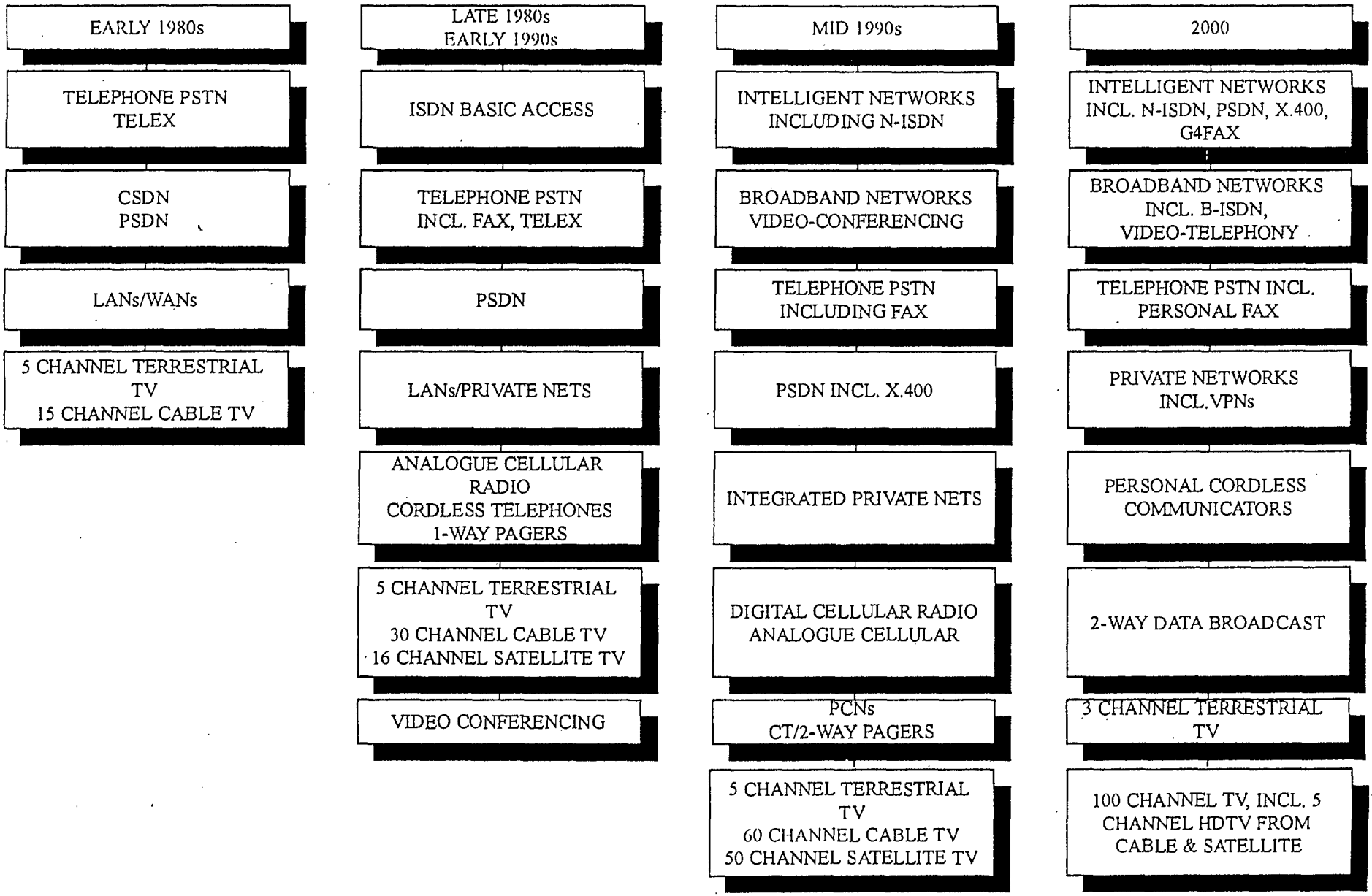

2.

Methodology

2.1 Overview

The implementation of this study presented some interesting methodological challenges.

It is generally accepted that telecommunication products and services to be available in 5 to 10 years, are at best a moving target. In this area, services often become obsolete after six to eighteen months. Even telecommunication infrastructures, which used to have a useful life span of 25 years, now have a planning life of three to five years.

Moreover, the traditional distinctions between computer science, broadcasting and telecommunications are becoming rapidly blurred. Largely as a result of the merging of new technologies, the distinction between market segments is also becoming blurred. More people will be able to work and shop at home, and consult business associates, experts and doctors from their homes. Devices such as intelligent video terminals and personal digital assistants can be used just as easily at home as in the office.

The project team spent considerable time finding an appropriate way to segment the various services, and this was reflected in the many drafts of the table of contents which were developed. One recurring issue was how to distinguish between a service, eg. a multi-media channel, and an application, eg. medical health service. We finally agreed upon an effective,

although not perfect, list of ten major products and services, which have attracted significant attention. These are presented in Chapters 3 to 12. Of necessity, the scope of the project did not allow an in-depth and comprehensive examination of each of these.

The study also focuses on future user requirements, and prediction of user needs, as was mentioned in the previous chapter regarding the Alex network, is at best a hazardous game.

Our approach is to present, within the scope of the study, a good overview of the best available knowledge on what the next five to ten years are likely to bring to Canada, based on what people need and technology can deliver.

2.2 Project Methodology

The methodology for this study consisted of three phases: data collection, analysis and synthesis, and presentation of conclusions.

2.2.1 Data Collection

Most of the data was collected from secondary sources, of which review of existing literature was a significant component. We sought in particular reports which focused on user needs and market trends in the time horizon of the study, i.e. five to ten years into the future. All relevant information are annotated in the text of the report as to their provenance.

A second source of data came from expert interviews, which also focused on user attitudes and requirements. Interviewees fell into two broad categories. The first kind consisted of individuals representing a major user constituency, who spent a significant part of their time identifying that community's future requirements in telecommunications, eg.a director of a board of education. Others represented suppliers of equipment or services, who, because of their corporate position, spent significant time in the study of user needs, eg. a vice president of marketing. A list of potential 35 interviewees was generated from various sources. Twenty experts were selected and interviewed, and their names and positions, together with the interview guide, are listed in Appendices B and C. The results of the interviews are integrated in the main body of the report, and are annotated as such. Three broad market segments were targeted: home users, business users, and institutional users, specifically those working in education and medical care.

Lastly, direct input from end users was sought through three focus groups. One for the business constituency, and two for the home user segment. For each focus group, eight

participants were selected from various databases. Participants had to meet a number of different criteria, namely they had to earn a minimum level of income, own or lease a certain number of communication appliances, and not work for the telecommunications industry.

Under the guidance of a focus group leader, participants were asked general questions, then shown two videos illustrating in a dramatic way various advanced telecommunications services. These were used to provide a context to the discussion, and served to elicit responses from the group to specific questions: would they like to use the service? Would they feel positive/negative towards it? How would it improve or impede their life? What aspects attracted them? How much would they be willing to pay for the service.

The results of the three focus groups were rich and varied. No quantitative data was collected, but very good sets of attitudes and perceptions were recorded. Conclusions from the focus group discussions are integrated in the main body of the report, and the detailed notes are presented in Appendix D.

2.2.2 Analysis and Synthesis

To arrive at an overall assessment of the market or scenario, all the above data were organized by the ten main service or product groups, in Chapters 3 to 12.

Under each heading representing a future telecommunication service or product, a number of subheadings can be found:

Definition: A description of the service/product in terms of what it provides to the user, what the user can do with it and how it will affect the way the user performs tasks related to the service/product. As much as possible, no technological jargon is used - the definition is in end user terms.

Potential Application Advantages: What does the service/product provide which is better/cheaper, is more effective, or is less time consuming than that provided by current services/products? Again, the advantages are described strictly in terms of advantages to the user, without technological jargon.

User Needs, attitudes and perceptions: This section describes what is known about how potential users feel about the service/product, what needs they want the service/product to satisfy, and what perceptions, correct or otherwise, they have about the service/product, including their willingness to pay for it. Three groups of users are identified, as each group

may have different needs, attitudes or perceptions: home, business/government and education/health.

Technical characteristics: This section describes the technical characteristics of the service/product. It details the user interface, the network structure, and the various other components which make up the product/service.

Infrastructure requirements: This section describes the infrastructure that is required for the service/product to exist. For the services/products described, the infrastructure consists of the networks which must exist (i.e. fibre optic, wideband, broadband, base stations, etc.).

Costs: This section covers the cost for the potential services/products, as well as the expected cost of the end-user terminal, where available.

Market assessment: This section describes what is known about current trends regarding the service/product in the marketplace, both in Canada and where possible, internationally. Information such as estimated sales volume, supply and demand, technology improvements and their expected market acceptance, etc. are included.

Given that there are seven sub-headings for each service or product, and there are ten such products/services, this represents a total of *seventy cells* into which our collected data was organized and structured.

2.2.3 Conclusions

Instead of case studies, the final report now includes scenarios which describe the likely deployment of the various services and products. Three scenarios are chosen, based on each of the three major user segments: home, business, and institutional users. In addition, some overall market estimates are calculated for the key terminal equipment which will likely be deployed.

3.

Teleshopping and Other Transactions

Services in this category include a broad range of interactive information services to the home, such as interactive consumer shopping, from groceries to automobiles; banking, financial informational and transaction services; real estate; and other information services into the home, such as electronic telephone directory, entertainment information, bulletin boards, etc. Real estate has been singled out from consumer shopping because some specialized systems are already in place, and user needs in this area are different than for other purchases.

Services are expected to be accessed through a common terminal which could be as simple as the telephone or more complicated, such as the personal computer. Operating companies will deliver services across established networks. Features will depend on software and the individual nature of the services. Voice activation is a possible feature for future services.

Teleshopping: Teleshopping allows users to order merchandise and have it delivered to them without leaving their homes. Future teleshopping services will allow users to interactively scroll through items on a terminal, likely a television or home computer, from a variety of distributors and select and order the items directly through that terminal.

Banking and financial transactions: Banking and access to financial information will be available through a home computer or interactive television hook up to a network of services.

Users could pay bills, transfer between accounts, query accounts, manage investment portfolios, and receive stock market quotations through a single terminal. Detailed services will include[1]:

- Banking done at home. Anytime, in fact, almost anywhere, depending on the type of terminal required. Means fewer trips to the bank.
- Future services will allow other banking from home - RSP's, bonds, mutual funds, mortgages, loans, etc., through interactive videoconferencing.
- Banks will provide interactive/on-line educational services about their products and services. Trips to the bank will be lessened even further.

Real estate: Services into the home will consist of interactive networks through the television or home computer which allow users to specify features and specifications for a house (i.e. price, number of bedrooms, garage, location, near schools, etc.) and obtain information on houses which meet the selection criteria. The system would also provide sellers with information on recently sold homes in their area and general market trends. The information will be available in a multimedia format, including still or moving video, audio, graphics and text.

3.1 Potential Application Advantages

Teleshopping: Users cannot currently shop at home interactively. Teleshopping networks present items for sale, but the user has no choice on what is offered. Alco, to order merchandise, the user must use the telephone, rather than order imtes interactively through the television terminal. Catalogue teleshopping allows users to view their choice of items, but does not offer catalogue updates, such as new items or price changes. Future teleshopping services will have the advantage that users can select what they want to shop for, they can get inventory information to know how long they will wait for delivery, they will have a wide variety of items available, and will not have to leave their house to make a purchase. Teleshopping will be leisurely, available 24 hours per day and without the addition of overbearing sales people.

Real Estate: Databases which exist today contain detailed information on properties and allow specified user selection. These systems are being used by two of Canada's biggest realtors and by various real estate boards. As yet, the systems are not widely distributed. Users must go to a real estate office to do their searches. Bringing these information services into the homes of consumers will allow a broader user base. It will allow potential sellers or buyers to have information for which they would normally have to hire a real estate agent. Users will save time touring neighbourhoods, scanning through multiple listing books, which are already out

of date by the time they are printed, and do some "homework" before taking the big step of contacting an agent to view properties for sale or to list their own home for sale.

Banking and financial transactions: These type of services will offer users direct access to their own financial interests and to up-to-date financial information, allowing them to make decisions on the management of these interests. The main advantage of on-line services into the home is that the information is always available, always current and provides access to more information than is currently available to non-financial or non-bank users.

The current focus is on transaction processing and on providing services for which there is no "value added" by going to the branch (i.e. paying a bill, transferring between accounts, etc.). It is recognized that this is a continually evolving service.

Information and transactional services in which no value is added at the branch are the main area in which telecommunications technologies can assist. By taking the branch out of the loop, there is an increase in the number of transactions which can be performed, the flexibility of the services (i.e. 24 hours per day) and the control which users have over their banking.

Technology will allow for more "robustness" in services. Videos on products and services will be available through interactive banking services, users will be able to access other services, such as purchase of RSP's. They can learn about services by video conference with knowledgeable service providers. Users in more remote areas will benefit by having all information available to them - since banks cannot afford to have an expert in all areas in every branch, they will have a central pool of product experts, dealing with customers through multimedia videoconferencing.

Banks will actually be able to develop better relationships with users because with less effort on no-value-added services, they can concentrate efforts on more personal services, such as reviewing banking transactions on an individual basis from transaction records and suggesting/offering services which better match user needs[2].

3.2 User Needs, Attitudes and Perceptions

General to Home Information Services: In one user study[3], interest in home-based information services was very strong for those under the age of 45. Those from 45-55 years old showed strong interest in individual services but were less certain of the overall offering. The group over 55 years of age showed stronger interest than those 45-55, perhaps reflecting the attractiveness of electronic delivery to those less mobile.

Overall interest did not vary greatly with education, occupation, and family household income, although demographic differences showed up in individual service preferences. The services perceived to have the greatest value were:

- Home computer based security and learning services; and
- Network based banking and shopping services.

Users cite the following reasons:

- Substantial time savings and convenience (perform shopping and banking 24 hours per day without having to travel;
- Tightened control over personal lives through home security and home management software;
- Expanded experience and knowledge base (interactive learning and shopping services and business support services such as insurance and investment advisors and interactive advertising; consumers could learn more at home);
- Some economic advantages (electronic based shopping and banking services and through better management of household finances); and
- Self-enhancement (through on-line learning, interactive video games - parents see an opportunity to interact with their children, building the parent-child relationship).

Banking and financial transactions: Users are receptive to current services offered by Canadian banks. The TD's telephone banking service[4] has had increases of twelve percent per month in the number of users and the number of transactions made over the last year. However, users are concerned that they must still go to the bank for cash transactions (deposits/withdrawals)[5].

Many potential users are still technology averse, especially those in the 40-49 and 60-69 age groups. However, given this, the aging population is creating a large market of this group of users. In the older age group, lack of mobility will make home banking very attractive. The ability to access accounts and pay bills without leaving the home, 24 hours per day is very appealing. These services will also be available to travellers, who will have access to their accounts from anywhere in the world (especially appealing to "snowbirds").

User friendliness is key if technology based services are to be popular. Products with which users are already familiar, such as the telephone, are seen as the way to go. Users are interested in data display - not data processing. Low cost, reliable and easy to use services which are clearly an improvement on the status quo will stimulate use.

Pricing of services is a sensitive issue. Users already feel they are overcharged for banking services. They cannot justify the cost of paying (more) for services unless they actually use the service or see it demonstrated. They are very hesitant to spend on something that is relatively unknown, especially when technology is involved. User fees can take on different forms: the cost of the terminal, the user fee for the network hook-up, and the user charge for each transaction.

As long as the service is *user pay*, i.e users pay for what they use, response will be better than subscription type services, especially for a new type of banking service. Users can use the system and get used to it without making an ongoing financial commitment.

Banks, as users of telecommunications services directly from the telcos, want reliability at low cost. Estimates put the cost to the bank of 1-800 services at 50 cents per minute. Banks want their services to pay for themselves[6].

Real Estate: Users feel that the following features are important in any advanced real estate services[7]:

- Users want to save time "curb kicking, open house hopping, and flipping through two-inch multiple listing guides".
- Users want to be able to tell agents what is important to them and receive a list of houses which match the required features.
- Users want to have access to every home on the market which matches their needs, without the risk of passing one over.
- Users want to do quick searches to find specific features, some of which are not yet accessible because they appear in the "additional features" section of the listings.
- Users want to be able to use the service in their homes, generally with the help of an agent.
- Users who are undecided about purchasing a home want to access the system without sales pressure.

- Agents want to be able to make more sales in less time.
- Police and fire departments want to buy into the technology so they can easily call up homes involved in an emergency and get such information as layout, size, number of bedrooms and heating fuel.

HICKLING User group:

Our user groups held as part of this project had the following views about teleshopping:

Positive

- You can advertise home business or warehouse business, without any large infrastructure, or retail outlets.
- You could use it for simple goods, groceries.
- Comparison shopping can be made more easily, as well as finding and selecting stores with merchandise in stock.
- Teleshopping would be similar to catalogue shopping.
- Still picture or motion might not be very different.

Negative

- The type of shopping would be limited, you can buy only what you need or specifically want -- it would be difficult to really browse.
- Also, teleshopping does not allow the user to feel the quality of goods, or the texture of materials or textiles.
- Users expressed fear that communications lines will not be available.
- Teleshopping does not satisfy the "mood" needs for going out of the house to shop.
- What about increased vulnerability to unsolicited sales pitches?

What people are willing to pay:

- End-users felt they should not pay much more than the basic AV service. They might want to pay for access to service, but not to buy a full unit just for that.
- There was also concern whether prices would be higher initially, to cover the transition period, and the costs of setting up the system.
- Suppliers and businesses were definitely attracted to teleshopping, especially if it will increase sales. This would be the same as taking a bigger ad in the Yellow pages.

3.3 Technical Characteristics

The video component of communication becomes increasingly important to achieve the full potential of these types of information services. Initially, the terminals that will be employed in homes will be personal computers running telecommunications applications. The precursors to these applications exist in the presently available multimedia applications that utilize CD-ROM drives with personal computers. Within ten years, the penetration of personal computers into homes should be much greater, due to lower costs for performance, availability of many more useful home applications and user interfaces/operating systems that make personal computers much easier to use without extensive training.

Another possibility for home video terminals to be used with these services is for market availability of adapters for consumer television sets to allow some of the more basic services to be implemented without major consumer investment in personal computer equipment. This latter terminal solution is less desirable from a technical standpoint, since the service possibilities are likely to be severely constrained in this case[8].

3.4 Infrastructure Requirements

The telecommunications network requirements for the deployment of these types of services will represent an evolutionary path of digital networks with increasing bandwidth and increasing possibilities for end user control of network functionalities. Initial versions of many of these services will become possible to implement with the general availability of Integrated Services Digital Network (ISDN) Basic Rate Interface (BRI) throughout major population centres in Canada[9]. The use of the BRI's 144 kB network capabilities in two 64 kB "B" channels and

one 16 kB "D" channel can be provided over the "twisted pair" wiring that presently characterizes most telephone company residential access wiring. Many of the present network switching systems are ISDN compatible, and require only ISDN line cards for each user access that desires access to an ISDN service.

By the end of the ten year period of this study it is likely that service requirements and terminal equipment capabilities will have developed to the point of requiring much more bandwidth, and much more flexibility in connection control than will be available with the "narrowband" ISDN and "twisted pair" network technology. At this point, Broadband ISDN[10], optical fibre-based networks are likely to provide the infrastructure backbone, while telecommunications access to homes is likely to become fibre-based[11] as well by the end of the decade.

3.5 Costs

Terminal costs for the most effective approach to teleshopping and other transaction services can best be approximated based on personal computers with reasonably good video capabilities, multimedia applications, and ISDN terminal adapters. This estimation would place the initial user terminal retail cost in the $1500 - 2500 range. This would also provide the home with a good general purpose computer system. The marginal cost of actually using the services will be small in comparison. As ISDN terminal adapters become more common, this portion of the terminal costs should rapidly decrease to allow terminal systems costs to approach the lower end of the identified range.

The network costs for narrowband ISDN comprise a number of components. Firstly, all switching systems that are to provide ISDN service must be digital switches. Such switches are typically multi-million dollar investments for telephone companies, so these require a great deal of business justification. There are often maintenance and operational justifications for these switches, in addition to the new revenues that are expected from the switches' new service capabilities, so only some of the switching modernization costs may need to be recoverable from such new services as those described in this section. Additionally, many of the network switches in Canada have already been upgraded to digital switches.

The effective implementation of ISDN also requires the telephone companies to install a modern digital signalling network, based on the CCITT international signalling system 7 standards (standard accepted by the International Telephone and Telegraph Consultative Committee). This signalling network is necessary for call control, service control and other inter-switch communications, such as network management functions. These signalling networks also represent multi-million dollar investments on the part of the telephone companies. These are viewed as telecommunications infrastructure, and are justified by a number of business factors,

including new service revenues, decreased maintenance costs, and international inter-operability. This combination of factors means that the total signalling system costs may be recovered from a number of service offerings and operational savings factors. The reasonable allocation of such shared system costs to specific services, such as those described in this section, is an extensive subject area, including legal, regulatory and competitive business issues. Thus, a clear indication of what portion of these costs should be attributed to the services under consideration is not possible.

ISDN line cards are necessary for each ISDN access on a digital switch. These cards are roughly twice as expensive as a standard line card. Since the line card cost represents only a portion of the total per-subscriber costs, the net cost of providing ISDN service to a residential subscriber is approximately 1.5 times as much as standard telephone service[12].

Banking and financial transactions: Users are willing to pay regular bank transaction fees to start with. Current telebanking systems, which are precursors to new consumer services, do not pay for themselves. However, as costs to provide the advanced services decrease, costs charged to consumers are not likely to increase - at least not until a substantial number of users are making use of the service[13].

General services: In the current Alex service, terminals are leased for $7.95 per month. There is a usage charge of $.10 per minute. In addition the service providers may charge for access to the service (this depends on the type of service). Present thinking suggests that it will be better to mirror the present telephone pricing i.e. charge a monthly service charge (subscription to the service) with free basic service and charges for additional services (equivalent to long distance charges). There are cost barriers in the short term but not in the long term. Hardware costs will be driven by the trends in computer costs. Services will be an add-on to the PC computing platform[14].

3.6 Market Assessment

The French Minitel service is usually used as a general comparison for the market success of these types of services. With the Minitel service, the French telephone company was able to remove the paper copy of the telephone directory. Bell's Alex service is still competing against traditional information dissemination services. The French government also widely distributed terminals free of charge. All access to the directory was via Minitel. This leverage is not available in Canada. Alex was the first attempt to market an audio/video service to a market which was used to audio. It was probably ahead of its time in terms of consumer acceptance. The first users were probably relatively advanced in their knowledge of telecommunications etc.[15]. Future services will be different and will likely be marketed to the large service

providers. The increase in the availability for interactive services on an improved infrastructure will change the market characteristics drastically.

Transactional services are expected to be part of a package which allows access to various services through the same terminal. Users will be charged only for the services they use.

Banking and financial transactions: Too much technology all at once will limit the market. To be successful, the technology that is implemented must be user friendly. Use of the telephone, even an enhanced one, as a terminal allows the bank to hit a full market since everyone has a telephone and everyone knows how to use one. It takes time for people to change to a new way of doing things and they must see value added from the way they are used to doing it. It will take time for users to become accustomed to not having a direct paper trail, although new services will allow this on client request. Many people are still hesitant to deposit to an ATM because they don't trust the technology with their money. This trend will continue for some time to come.

It is expected that the concern over not being able to make deposits/withdrawals by telephone will diminish. Actual manual deposits have been steadily decreasing, most are now through automatic, electronic means. For withdrawals, debit and credit cards will become used even more. "Cash back" services will be offered by retailers (Provigo in Québec was already doing this), and the network of established ATM's make a trip to the bank unnecessary for the purpose of obtaining cash. However, while users will still have to leave the home for withdrawals, there will simply be more places to access the cash in the account.

Most people use a bank. Home banking services are directed at the total market. The size of the market will depend on users' acceptance of change in the way they do their banking and in their trust in the technology. The market potential is large[16].

References to Chapter 3

1. George Coleman, Assistant General Manager Personal Access Banking, Toronto Dominion Bank, personal interview, January 28, 1993.

2. Coleman, ibid.

3. Poppel and Goldstein, "Information Technology: The Billion Dollar Opportunity", p55.

4. Coleman, ibid.

5. Sloan, Leonard, "Banking from home by computer flops", The Ottawa Citizen, February 27, 1989, pA14.

6. Coleman, ibid.

7. Kainz, Alana, "High-tech House Hunting", The Ottawa Citizen, December 19, 1992, pG1.

8. MPR Teltech, internal reports.

9. Cerf, V..; "Networks", Scientific American, September 1991, p47

10. Cerf, ibid. p48.

11. MPR Teltech, internal reports.

12. MPR Teltech, internal reports.

13. Coleman, ibid.

14. Cathy Carlson, Director of Network Services, Bell Canada, personal interview, February 4, 1993.

15. Carlson, ibid.

16. Coleman, ibid.

4.

Distance Education and Training Services

Broadly defined, distance education describes the delivery of educational and training materials to students via satellite or telephone line[1]. Distance education allows learners to be remotely linked to the teaching/information source. In its various forms, distance education can include electronic information and transaction services, as well as interactive multimedia services. Interaction may take place between learners and teaching sources using voice, text and still or moving images.

Advanced educational and training systems will provide interactive access to improved information representation, through highly interactive, high realism (e.g. virtual reality, 3-D) simulation systems mixed with video.

4.1 Potential Application Advantages

Distance education via a home computer or an interactive television allows learners and teaching resources to be linked in real time. Current training and education systems using high-tech lack

reality. Future distance education will allow students to have more realism and more focus on specific tasks, communicated through visually rich learning materials. Two way video, combined with information transfer between terminals will allow the students to actually see the instructor and respond through the terminal to instructions.

Distance learning allows a maximum number of participants to learn new information and techniques at a very cost efficient rate, since one instructor can reach many locations without the added effort of travel time, both for the instructor and the participant.

Clear advantages to distance education, in general, are[2]:

- Broad coverage - instructors can reach many people in remote locations;
- Scarce resource sharing - one instructor serves more students and school systems. Organizations can share the cost of specialized training. Video from the schools to the home can be used as a tool to support the curriculum[3].
- Customized learning - training can be canned and on-demand, allowing for self-guided, user tailored instruction; and
- Convenience - People can fit education into their busy lifestyles at their own convenience.

These advantages will be further enhanced in the future by such features as full multimedia.

Telecommunications can benefit various areas of instruction, as well as administrative areas. Different schools specialize in different areas. Advanced telecommunications would allow these programs to reach more students, without expanding the current program costs (except for infrastructure requirements). The program for the deaf in Burnaby, British Columbia, is one example - it serves only those people with hearing difficulties in the region - the district would like to expand the program, through technology, to other deaf users in remote areas[4].

Access to distance education would also benefit students who are unable to travel, such as those with disabilities or in hospital, and also the group of students with social problems who are unable to learn in a group environment or who are disruptive.

Changes which are expected to be seen in the school systems include:

- Teachers will be facilitators, coordinators, managers of learning.
- Students will become more independent, self-directed learners

- School/learning hours will be more flexible - schools will open earlier in the morning and stay open later at night.
- School resources will be available as never before, through electronic means.
- The concept of life long learning will become even more apparent - distance education will benefit continuing education programs and more people will use them because technology will allow them to be reached with the same resources. Flexibility will appeal to continuing education users.
- Home learning will supplement what is learned in class, packaged multimedia sessions will be accessible, but will require support from educators and will not be stand alone.

4.2 User Needs, Attitudes and Perceptions

Home: Scheduling is a major problem of adult learners today. Adult learners can't afford to reschedule their lives around and drive to classes that meet every Tuesday and Thursday - it's much easier to catch the course at work or at home[5]. They show a positive interest for home learning through interactive multimedia[6].

Business/Government: Distance learning will become increasingly important as (America) competes in the global marketplace. The combined forces of an aging population and the need for continuous retraining of the workforce suggests that new approaches are needed to provide ongoing educational opportunities for employees and for nontraditional college students[7].

Businesses users of distance training want to spread scarce resources to the widest audience possible. Users want to get training to remote locations, such as branch offices more cost effectively. They want more or higher quality training at the same or reduced cost (dollars saved in running duplicate courses in different locations can be used to achieve this objective).

Education/Health: Institutions want to offer a broader curriculum in a cost effective way. Distance education allows them to deliver specialized classes to schools which could otherwise not support them.

In one educational setting in which students had interactive video on demand to support their curriculum, there was very high student acceptance. Parents were even more excited about it[8].

School districts would like to have data links providing full broadband multimedia - audio, video, graphics and data, in full interactive mode, in all of their schools. This would assist administratively for access to student information, as well as allowing cross courses or tutorial instruction programmes with secondary students assisting elementary students[9].

Distance education will not be stand alone - users will not accept courses by video, but will require support from teachers and other aspects of technology, i.e. interactive assignments, visual materials, etc. Courses will be based on support materials enhanced by interactive instruction.

Networks that link educators as well as administrators will be important. These telecommunications links must be intra and extramural, providing access to a variety of services. Remote links to allow distance education services to remote locations will also be required.

Cost will be a major barrier for schools. The service will have to have clear benefits relative to costs. The educational sector has very little budget for expanding programs. Technological advances must be attained with current budgets and offer the ability to more effectively educate students if they are to be successful. Additional resources may be available for specialized programs, such as the school for the deaf, otherwise, funding must come from existing budgets. A further barrier is the lack of experience with technology. This barrier could be overcome by building stronger links between schools and business. The State of the Art school in Burnaby B.C. had input from MPR, IBM and BC Tel. This may be what is needed to stimulate activity and technology acceptance.

In the medical community, especially in Canada, many service providers are isolated. Remote instruction is very well accepted. However, if instead of a one week training course in Vancouver, students have to stay at home in their remote communities and take the course interactively through video, they are less happy because of the loss of a travel opportunity[10].

A major impact will be seen in medical education, where inputs from many locations will be brought together. It is important to have wide access to the service, and not just limit it to a few groups which can access[11].

4.3 Technical Characteristics

In order to bring these types of education and training services into the home, the basic home terminal characteristics are quite similar to those discussed in section 3.3. The visual component of the information exchange process is critical to the learning process. Thus the

video definition (and consequently bandwidth) requirements may be higher for these services than those described in section 3.5. In addition, a large interactive component is to be expected for effective education and training services. This may impose additional requirements on the user interface for these services. Application software will also be important including video help and "groupware".

In this case, there may be an intervening step before the services reach directly into the home. Scenarios are likely to develop where higher quality and more diversity in education and training are brought much closer to the home through the use of advanced terminal equipment in, for example, local schools, recreation complexes and libraries. This allows the terminal costs to be initially born by institutions, and thus pooled among end users. This step would provide a significant portion of the benefits ascribed to distance education and training directly into the home[12].

4.4 Infrastructure Requirements

Assuming that the video definition and interactivity requirements for the education and training services are very similar to the requirements for the teleshopping and transaction services, then the infrastructure considerations discussed in section 3.4 would be applicable.

If, however, the video definition and interactivity requirements for the education and training services are more stringent than the requirements for the teleshopping and transaction services, then the network must be sufficiently enhanced. Since better video capabilities implies increased bandwidth, these services may initially require a Broadband ISDN network. In the five year time frame, this conclusion would support the intermediate scenario described above, where such network support is provided to more local venues, but not directly into the home. A fibre-based network to such locations could be more easily justified, since the concentration of end users at each location could be multiplexed to more fully utilize the network capabilities. Fibre hook-ups to homes and rural communities will provide broadband capability, allowing full interaction between the user and the program source. More remote communities will likely be linked by satellite, which will allow the user to receive the program, but will not allow the same degree of interaction.

In the longer term, fibre-based network access directly to the home should be able to support the requirements for the education and training services. The critical network capability in this time frame is for more flexible connection control[13].

4.5 Costs

The availability of broadband networks will be essential to the widespread implementation of distance education. The pressure on education costs demands that there must be a cost or social benefit to the introduction of these services. The services can be provided via landbased links or satellite. The cost components for a full distance education link involves:

- Programming costs;
- Transmission costs; and
- Terminal costs.

Programming Costs can be offset by sharing of programs (courses) developed by different institutions throughout the country and internationally. Some agreements have already been established within Canada and other countries.

Transmission Costs will be tarrifed at rates which will drop rapidly as use of broadband services increases. The capital costs for facilities will be part of the overall costs of upgrading the broadcasting or telecommunications infrastructure. ISDN networks provide the capability for transmitting full motion video, but not selectivity of the channels. This will require broadband networks, probably not widely available for 5-10 years. Satellite communications provide full motion video channels but there is not sufficient capacity for individual selection of programs. In the foreseeable future, that is not likely to change. This means that urban and rural areas served by fibre links will always have a more flexible service than that available from satellite links.

Terminal Costs are dropping rapidly. Computer costs, local area network costs and the required software is improving in quality and is not likely to be the limiting factor in applying these services. Computer prices are dropping by typically 30% per year. Video conferencing equipment when connected to a big screen, may provide one means for supplying distance education services. They are presently provided over mainly 2*56Kbps links which are not high enough quality for education. 354Kbps improves the quality. Video conferencing equipment has dropped from $100,000 per node, two years ago to a recent announcement by PictureTel of equipment which will run at 356Kbps and cost $18,000.

4.6 Market Assessment

There will be a continued increase in the use of technology for education. At the present time, experience with technology is not at a high enough level to realize its full potential. As more technology is used, experience will grow and more opportunities will evolve[14].

The number of regular students will not be affected by distance education - most are already enrolled in the school system. The number of adult learners will increase, however the services to serve them will also serve to offer "reach out" programs to regular students wanting to enroll in a program offered in a school other than their own.

There is generally "lots of interest" in technology in the schools from all education districts. As the expertise increases, more funding will be allocated to the growth of technology based learning methods.

Training is presently a $100 billion market in the United States. Advanced training applications using telecommunications provides better training and significant savings. However, it is necessary to be able to demonstrate the benefits to the customer because of the high initial cost. One example was given of the training program for an insurance company where their training cost was reduced from $800,000 to $100,000 by using remote video-based training[15].

Skeptics have questioned the electronic delivery of education, citing issues such as teaching quality, academic honesty, contact with instructors and testing control. However, studies have shown that students from remote locations using distance training techniques perform on an equally well as classroom students[16]. The long-term success of distance learning is dependent upon the recognition of the learner's needs and technological advancements which allow expansion of the electronic systems needed to convey these programs[17].

References to Chapter 4.

1. Vanston, K.; Marsh, J; Hinton, S; "New Telecommunications Services for Business and Society 1990-2010: Volume 5, Video Communications: Forecasts of Markets and Technologies", Technology Futures Inc., 1992, p24.

2. Vanston, ibid, p29.

3. Cameron Young, Business Development Manager - Advanced Technology Division, personal interview, February 4, 1993.

4. Dr. Blake Ford, Director of Instruction - Staff Development and Program Support, Burnaby School District, personal interview, February 1, 1993.

5. Borthwick, S.; "The Learning Curve: Telecommunications Training in the 1990's", Business Communications Review, November 1990: p23.

6. Cameron Young, Business Development Manager - Advanced Technology Division, personal interview, February 4, 1993.

7. Vanston, ibid., p25.

8. Cameron Young, ibid.

9. Blake Ford, ibid.

10. Cameron Young, ibid.

11. Fergus Heywood, Manager Management Information Systems, Greater Victoria Hospital Society, personal interview, February 12, 1993.

12. MPR Teltech, internal reports.

13. MPR Teltech, internal reports.

14. Blake Ford, ibid.

15. Bill Currie, DVS Communications, personal interview, February 8, 1993.

16. Vanston, ibid., p.28.

17. Vanston, ibid., p.25.

5.

Personal Digital Assistant

The concept of a personal digital assistant (PDA) is best described by John Sculley, Chairman of Apple Computer: "The big idea is that it is not a tool, it's an assistant. A tool is a lawn mower. An assistant is when you hire someone else to cut the grass"[1]. The PDA is based on advanced electronic hardware and sophisticated software in a portable package. Future PDA's will be successors to the general pen-based computer and the high-end pocket organizer.

Today's PDA's are able to recognize printed handwriting and graphics drawn onto its screen, organize the information, and communicate it to others. Upgrades to a PDA, using plug-in "smart" or memory cards can convert a PDA into a reference library, a travel navigator, a language translator, a receiver for paging type messages, or an electronic copy of *War and Peace*[2].

Communications with computer networks will be accomplished at first by a wired connection, but advanced technology will allow wireless communication, although coverage may not be ubiquitous within a ten year time frame. PDA's will also have a built-in facsimile and data modem, allowing it to receive electronic information from almost anywhere in the world.

Future personal digital assistants may incorporate a voice recognition capability so that it responds to a user's voice commands. The PDA will take notes, receive and deliver messages

and answer requests for information by speaking to the user. The PDA will provide a capability to conduct data retrieval from remote databases without complicated instructions from the user.

In the future, the PDA may also be able to accept or reject electronic mail and act on mail, depending on its requirements. It could pay bills or re-direct them (i.e. re-direct property tax bill to the bank for payment from a tax account). With interconnectivity to a banking system, the agent could ensure sufficient funds existed in an account to cover a payment and transfer funds from another account, if necessary.

The PDA would allow personalization of communication services through automatic messaging, screening and routing of calls and prioritizing of information. Users could program the calls they want to receive or reject, based on properties of the incoming call, time of day, etc. Video conferencing services could be set up so that certain calls are screened or redirected, or that only audio is provided to certain callers.

Using PDAs, businesses will hold meetings differently. Each person will have a note taking PDA. Information will be downloaded into it through a wireless in-building system. In the boardroom, discussion materials will be downloaded into each person's PDA. Full video conferencing will be available on the PDA, wired into the room, but wireless into the PDA[3].

5.1 Potential Application Advantages

As the name indicates, the personal digital assistant provides individuals with the advantages of a personal assistant. In this regard, the device is flexible, easy to use and does not require constant user attention. It can perform programmed activities without user interaction, such as monitoring communications and alerting the user when necessary.

It could perform electronic transactions, such as bill payment, yet be programmed to alert the user of discrepancies in charges or changes in status. It would perform roll-ups on annual information for budgeting or tax purposes.

The overall benefit is that the user is not forced to sift through all incoming information, which would be a very time consuming exercise. The personal digital assistant is programmed to perform many of the onerous tasks of daily life, leaving the user more time to do more important things.

The PDA will have an intelligent search capability for on-line services, including databases. Search times will be shortened; all the user will have to do is identify needs. Telecommunications and the computer will mere to form a single products[4].

5.2 User Needs, Attitudes and Perceptions

Home: Life is becoming increasingly complicated, especially in terms of the information that flows into and out of the home. Individuals need better ways to plan, organize and control this flow of information. The personal digital assistant may be compared to each individual having his/her own personal secretary, so that the individual need only provide general direction and instruction, and the assistant will sort, file, send and receive information, schedule appointments, and so forth[5].

Individuals also spend a great deal of time trying to locate pertinent information. This may be as basic as which store has the best price on coffee this week, or who is the best person to be called to repair a VCR. This could also be quite complicated, however, such as locating suppliers for an esoteric hobby, or determining residential Radon risk maps within a particular geographic area. The personal digital assistant would be able to tirelessly search information resources to locate **only** the desired information, based upon the unique search criteria specified by the user[6].

The configuration of PDAs must combine the information richness we associate with computers with the low cost, convenience, ease of use and ultra-portability associated with consumer electronics[7].

Business/Government: Secretarial and administrative support functions require a significant proportion of overhead expenses in an office environment, whether public or private sector. Additionally, a significant percentage of each office worker's time is typically spent looking for information, as well as sorting and filtering input information. The personal digital assistant would minimize these aspects of work activities, allowing the individual user to focus his/her time on creative activities, such as formulating ideas and/or more emotionally sensitive activities, such as working with people.

Specific user needs for a personal digital assistant are the ability to interconnect with a host computer from a remote location and to receive electronic mail. In essence, what is required is an "office in a pocket" which can provide any computer application possible. The assistant must be part of a "bigger picture", rather than a stand alone unit[8]. Workers will be more mobile and will have more flexible hours and location of work. A personal digital assistant must adapt to these conditions[9].

Requirements involve increased voicemail services, including integration with the PDA to allow speech detection, coding of messages by their content and priority setting[10].

Education/Health: As well as streamlining many of the secretarial and administrative activities, as mentioned above, the personal digital assistant could personalize each user's education or health care, and apply unique information resources as required for each individual. For example, the PDA could be used for locating an appropriate medical specialist based on unusual symptoms as well as the individual's health history.

Another perspective on user needs would be the application of the personal digital assistant to the work of health care professionals, or teachers. A general practitioner could make a medical diagnosis in "consultation with" the most up-to-date, pertinent medical information by using the assistant to effortlessly find and retrieve this information[11]. A PDA can be designed for a specific profession. For example, a doctor's PDA might be prescription based, while a lawyers would contain legal documents. Artists, landscapers, architects, or anyone who is graphically oriented could make use of floor plans or blueprints stored in the device[12].

HICKLING Focus Group

The Hickling Focus Groups had the following reactions to the PDA/Knowledge Navigator demonstration:

Positive

- Consumers like the access to databases quite a lot, for research and education. The daytimer/personal diary feature of the "knowledge navigator" had somewhat less of an attraction. On the other hand, that feature could be great to keep a family on track, much better than sticking notes on a fridge.
- Speed of data access looks dramatic in the video demonstrations, but will it be true?
- Multi tasking -- great, also as an educational tool.
- Voice-activation/recognition would also be useful and desirable.

Negative

- Some users were concerned about reliability -- in terms of the daytimer function, "nothing beats pencil and paper".

- Who enters and maintains all the data bases?
- Impact on labour force -- these types of interactive terminals and "knowledge navigators" will inevitably replace people; also it could increase the alienation and the gap between the "haves" and "have nots".
- Not everyone needs such highpowered database searching capacity. In some cases, users need personal contact for business.

5.3 Technical Characteristics

The concept of a useful personal digital assistant incorporates an extremely small terminal - current thought categorizes the size as "palmtop" - with an easy-to-use interface. The information processing and communications capabilities for these terminals seems to explicitly include multimedia. The current trend seems to be toward small video screens and stylus input, with the terminal interpreting handwritten instructions and textual input. These terminals are expected to depend heavily on telecommunications, and are visualized as accessing the telecommunications networks through a seamless, wireless user access system.

Farther into the future, voice recognition technology may progress to the point of allowing a voice interface between the user and these terminals. In addition, the video capabilities of these personal digital assistants are expected to substantially improve over the next ten years[13].

5.4 Infrastructure Requirements

The backbone networks necessary to support the widespread use of personal digital assistants are essentially the same as those described earlier in this section. Initially, the narrowband (144 kB) ISDN networks will provide transport for these services, and later, the broadband ISDN networks will provide the increased bandwidth necessary to support the enhanced video capabilities.

The mobility aspect of these services implied by the wireless access expected, however, will place additional requirements on the infrastructure. The "seamless" appearance of the global telecommunications infrastructure desired by such users means that the wireless access technologies will need to be ubiquitous, and governed by international telecommunications standards to ensure terminal compatibility in different geographical locations. In addition, the

networks will require additional intelligence to be able to locate each terminal and apply the appropriate service profile (including billing)[14].

5.5 Costs

Initial terminals are expected to be available in the $500 - $1000 retail price range. As sales of these terminals become much greater over the next several years, economies of scale, competition and technological progress should allow these prices to be reduced, or more advanced capabilities to be added at the same price levels. A price drop on liquid crystal display technology is one factor, in particular, which could bring organizer prices down. A projected price for the year 2000 is around $300[15].

The additional network costs necessary to support the proliferation of the personal digital assistants are likely to be negligible in the backbone network, with the possible exception of enhanced intelligence and service control requirements. The ubiquitous wireless access network, however, will likely require extensive capital investment. Since international agreement has not yet been reached on universal standards for such wireless access, some volatility is expected in the development of applied technology in this area over the next several years[16].

5.6 Market Assessment

The initial market opportunity for personal digital assistants can be realistically estimated from the existing market for personal notebook computers. It is likely that the eventual market opportunity can be greatly expanded from this level as useful applications become generally available, as terminal prices decrease, and as wireless telecommunications access becomes more widespread and standardized[17]. The market needs to be educated on what new technology will do. This, done through proper marketing, will provide a stimulus[18]. A further determinant will be the availability of the PCS and cellular infrastructure, which will play a part in the market success of future PDAs[19].

Cost will be an initial barrier. Businesses will adopt the services first because it will provide direct benefits. As use increases and prices fall, consumers will begin to use them. Open systems and a healthy third party market will stimulate sales. Incentives and education processes will also help. The education must be geared to adoption, answering the user's question "What will it do for me?"[20].

PDAs will see the same type of acceptance and cost depreciation as microwaves, VCR's and answering machines. Markets will depend on the telecommunications companies, computing companies, the features of PDA's and other small communication devices and the interactions among them. Alliances will be formed between innovators and monopolies to pull specific elements together such as that formed by General Magic..

Penetration for business by 2002 will not be more than what PCs are today - about 40%. In the home, perhaps a five to ten percent penetration is possible.

References to Chapter 5.

1. "Newton: The Information Taskmaster", Popular Science, September, 1992, p46.
2. ibid, p47.
3. Greg Dalzell, Market Development Manager, Personal Interactive Electronics, Apple Canada, personal interview, February 8, 1993.
4. Dalzell, ibid.
5. Tesler, L.; "Networked Computing in the 1990s", Scientific American, September 1991, p55
6. MPR Teltech, internal reports.
7. "Newton: The Information Taskmaster", Popular Science, September, 1992, p48.
8. Junior Ali, Vice President Marketing, Sony Canada, personal interview, February 1, 1993.
9. Sudhir Joshi, Director of Telecommunications Industry Marketing, IBM Canada, personal interview, February 4, 1993.
10. Dalzell, personal interview, February 8, 1993.
11. MPR Teltech, Internal reports
12. "Newton: The Information Taskmaster", ibid., p49.
13. MPR Teltech, internal reports.
14. Lakhani, A., and Schaffnit, T.; "Intelligent Networks: A Modular Approach", Telephony, October 23, 1989, p48.
15. Junior Ali, ibid.
16. MPR Teltech, internal reports.
17. MPR Teltech, internal reports.
18. Junior Ali, ibid.
19. Sudhir Joshi, ibid.
20. Dalzell, ibid.

6.

FAX Transactions

FAX services currently make up the second largest component of telecommunications revenues, after the basic telephone service[1]. Generally the FAX allows the transfer of information, on paper or in electronic format, from one remote site to another across telephone lines. Future FAX services will expand on today's services, both in technology and applications. Speed, colour and higher resolution will be the first technological advances. New services will include FAX databases which users can query by FAX and receive a FAXed response. Services will be similar to those described under section 3.1, Home Shopping and Other Transactions. When there is a requirement for complex characters which cannot be produced easily on a standard screen, or for updates to bills, catalogues, travel itineraries, etc., FAX can be used to transfer the images.

FAX cards, installed in personal computers currently allow users to transfer electronic information without having to make a paper copy. FAX modem and voicemail interface cards, as well as NTSC video interface cards are now commercially available, and can be installed in a PC, providing full communications capability. Multimedia FAX will allow users to attach voice messages, still or moving images or graphics, or data files to their FAX transmissions.

FAX cards or machines will have sub-addresses which will allow them to be addressed within a network. This will allow FAX from one PC to another, on a different network. New FAX machines will be hand held glass handwriting tablets on which users can write with a special

pen and FAX the result. FAX will become wireless with the availability of new wireless services.

6.1 Potential Application Advantages

Established standards and protocols already exist for FAX. New major extensions have recently been approved for FAX. This means that all FAX machines can "talk" to each other. The new standard will ensure that this remains true. Future FAX will be faster, more versatile (beer resolution, colour), interactive, and will support e-mail and multimedia (including video). Individual FAX machines or FAX cards will be addressable on a network. All of these features will increase the benefits of FAX. Demand for FAX and FAX services will allow the price to continue to fall, giving access to FAX services to a wide variety of users[2].

6.2 User Needs, Attitudes and Perceptions

Home: The proliferation of the number of FAX communications over the past few years attests to the inherent utility of this mode of communications. The need to extend these capabilities directly into homes becomes greater as more consumer-oriented transactions become possible. Already, registration for evening courses, "mail order" merchandise orders, and getting messages through to busy office locations provide some justification for home FAX capabilities. As the trend toward more "working at home" continues, the associated necessity of home FAX capabilities will grow. Coupled with these developments is the merging of E-mail and FAX, as personal computers become more common in homes. With appropriate software applications and FAX modems becoming less expensive and more useful, the FAX concept is most likely to continue to evolve toward more electronic media, rather than the original FAX hardcopy on paper idea[3].

Business/Government: FAX has grown from an esoteric novelty to a key business communication tool within a very short time. The need to rapidly send a visual image has driven this growth. This is the same need that is driving the expectations for full motion video communications, and very high resolution static image transfer. The evolution of FAX toward better meeting users' needs for image communication is likely to incorporate more electronic media, and could become a portion of the multimedia communications services of the future. Dedicated FAX machines are likely to be displaced by telecommunications-equipped photocopiers and personal computers running multimedia applications. The need is for easy to understand user interfaces, and inter-operability with other applications, such as word processors, E-mail, and desktop publishing[4].

Education/Health: Future FAX services will offer similar advantages to these sectors as they will for business. However, unique needs, such as security on student and patient records and access to large databases will be required here.

6.3 Technical Characteristics

The following characteristics will evolve with future FAX[5]:

- Binary file and ASCII message transfer;
- Increased resolution to 600 dpi;
- Increased speed to 64Kbps on ISDN;
- Password security;
- Open document architecture;
- Gray Scale and colour;
- FAX and e-mail integration;
- Audio messaging;
- Hand held "glass" FAX using Hobbit chip (send hand written notes, e-mail and video via cellular telephone to another FAX machine);
- Multimedia FAX from one machine to another Microphone II, by Software Ventures - sound, images, video, documents);
- Postscript FAX - send computer generated postscript file directly to a FAX machine, or to a remote laser printer;
- FAX servers - complement LANs, when a FAX arrives at server, it is routed to an individual's workstation or departmental laser printer; and
- Store, forward, e-mail conversion, etc.

In brief, the next generation will bring an integration of a wide range of FAX-related services, on a PC-platform.

6.4 Infrastructure Requirements

The present generation of FAX machines is supported by the existing analog telecommunications networks. The Group 4 FAX machines that are just coming to market require digital networks, such as narrowband ISDN, to be effectively deployed. These newer machines include the capability to downgrade their performance to use older networks, but this mode of operation virtually eliminates any performance advantages that they possess. The rapid rollout of ISDN service is viewed as the minimal network support requirement for the evolution of FAX beyond existing capabilities.

Beyond the narrowband ISDN, very high resolution images require greater bandwidth in order to be transmitted over networks within reasonable amounts of time. Such image transfer may, in the future, be considered as a form of FAX. These types of special FAX applications would require broadband ISDN telecommunications networks for support[6].

6.5 Costs

Generic FAX terminals are expected to continue to decrease in price, while new higher capability, higher priced terminal equipment enters the market. Additionally, the personal computer FAX modems will be displaced by ISDN terminal adapters as ISDN network access becomes more common (and more economical).

Marginal network costs for future FAX services are basically insignificant, if the assumption of an initial narrowband ISDN network infrastructure is taken. FAX will merely be one of the numerous services that will be facilitated by ISDN.

In the longer term, broadband ISDN networks are expected to be justified as infrastructure to support a wide range of telecommunications services. The more advanced forms of FAX, if FAX does remain as a distinct service category, will be readily accommodated within such an infrastructure[7].

6.6 Market Assessment

In 1991, there were a total of 35 million FAX units installed worldwide, of which 12 million units in the US, and 800,000 in Canada. This represents a one billion dollar industry in Canada ($750 million in long distance charges alone). Equipment costs have dropped, approaching personal and consumer thresholds. Sales have recently decreased and levelled off at 2 million units per year globally. New standards will address future FAX issues. This will create a second "explosion" in FAX, especially in PC FAX cards. By the year 2000, the forecast is for 50 million FAX devices in offices in the US. This translates to about 150 million globally and four to five million in Canada, for office application[8].

By the year 2000, the forecast is also for an installed base of 50 million FAX units in US *homes*, 150 million globally, and 5 million in Canada.

With computer FAX, the emphasis is shifting to PC and host system software, modems, network interfaces and intelligent network services. As a result, more development is taking place in North America and less in the Far East. These technologies, along with compression, coding and modulation for the mobile environment, are a good match to Canadian technological capabilities.

References for Chapter 6.

1. St. Arnaud, Bill; "Future FAX: New Developments in Multimedia FAX Technology", VISION 2000, 1992.

2. ibid.

3. MPR Teltech, Internal reports

4. MPR Teltech, Internal reports

5. St. Arnaud, ibid.

6. MPR Teltech, Internal reports

7. MPR Teltech, Internal reports

8. St. Arnaud, ibid.

7.

Videoconferencing

Videoconferencing is the meeting of people from remote locations through two-way video terminals. It is the personalization of communication through high quality full motion video as well as voice.

Telemedicine: Telemedicine, a special application of videoconferencing and multimedia, involves the transmission of heart and breathing sounds, patient images, bacteria and tissue slides, X-rays, and electrocardiograms over distances. The future of telemedicine involves the real time transmission of all types of medical imaging (x-ray, nuclear medicine, MRI), packaged in a total multimedia environment, including two-way videoconferencing[1].

Other services will be transmission of medical information, such as blood pressure, blood tests, etc., from a patient's home to a medical practitioner across telephone lines.

Interactive video will allow users to have access to unlimited amounts of medical information. Instead of going to a doctor, users may be able to receive the same level of care from their homes. In cases where it would normally be necessary to move a patient to a bigger hospital, travel may not be necessary if telemedicine can be used. Expert diagnostic systems are still a longer way off.

7.1 Potential Application Advantages

Home: The main advantage for home use of this service is the video telephone. A telephone with video capability for casual calling would allow callers to see the person/people to whom they are speaking. Other advantages related to this capability include telecommuting, distance learning and entertainment, which are described separately in this report.

Business: Some of the advantages which have been attributed to videoconferencing in a business environment are:

- Better interaction between company units, faster decision making, and substantial cost savings[2];
- Displaced travel costs - videoconference meetings save on the time and expense of travelling to remote meetings[3];
- Increased effectiveness, achieved by having all necessary participants "present" at meetings, rather than only those who could make the trip[4]; and
- Facilitation of teamwork amongst people who would otherwise never have met face-to-face[5].

Further advantages will be gained when videoconferencing systems begin to allow integration of data and full motion, high quality video[6].

Education/Health: Videoconferencing offers advantages in both education and health, which are similar to those already mentioned above. Medical teams can video conference on patient issues, increasing the people involved in diagnosis. *Telemedicine* involves the transmission of heart and breathing sounds, patient images, bacteria and tissue slides, X-rays, and electrocardiograms over distances. With this type of information available, face-to-face, remote diagnosis is possible between physicians as doctors at remote sites examine patients and, at the same time, interact with specialists. Interactive video, consulting and diagnostic services, electronic medical records and continuing education are other applications of this technology[7].

Specifically, telemedicine offers the following benefits[8]:

- Diagnosis of a patient remotely; reduce the need to transport a patient before stabilizing the patient's condition;

- Assist local physicians to provide adequate care while reducing the need to transport patients and sometimes families;
- Allow doctors to remotely have the same type of case reviews which a doctor in a major centre can do;
- Doctors can do the rounds of a number of locations from one site;
- Advanced systems without video compression can give better images of micrographs than looking through the microscope due to the use of a bigger screen. In this application, it is essential to distinguish between shades of colour and not just different colours.
- Medically fragile individuals can avoid travel[9].

Current health costs are contributing to increasing public debt. Videoconferencing, combined with interactive multimedia services, offers an alternative in healthcare delivery. Healthcare which can be delivered to homes from a central service can operate at significantly lower costs than hospitals can provide care for today. Even a ten percent reduction in hospital costs is a large amount of money[10].

7.2 User Needs, Attitudes and Perceptions

Home: Home consumers will need low cost, high quality images to stimulate interest and acceptance. The systems must also gain acceptance in other markets first. The systems will have to be "in vogue", since video is only useful if the person you wish to contact also has it[11].

Business/Government: At present, the audio component in videoconferencing is more important than the video component. Poor video is tolerated more than poor sound, but the expectations of video will increase as the basic availability is taken for granted. This is based on how expectations of picture and sound quality change over time - ten years from now, users will expect what is today called "studio quality".

A certain amount of affordability and functionality is required. Although there are many ways to deliver the services envisioned for the future, the best way will be the winner - determined by how they satisfy user needs, cost being one of the most important factors[12].

Services must provide significant advantages to the user. The advantages must be significant enough that the consumer will change their way of doing things and be willing to pay for the service. If services don't change/enrich our lives, they won't be adopted - at any cost. Doing something cheaper is an enrichment, but it should do so by making operations more efficient; otherwise, why change.

As part of the Telecommunications Research Institute of Ontario's (TRIO) Telepresence project, videoconferencing was well used. Sending images at 56KBps is the main application. Coding delays are presently too large for full video transmission. It is applicable for small numbers of people. BNR has found in the course of using videoconferencing that travelling has not been reduced. Instead, videoconferencing has increased the opportunities to discuss issues and encourage collaboration in person. In 5-10 years, it is expected that the increased video quality will provide a communication medium that *does* decrease the need for travel. A typical application of the technology is to use it to see and recognize people at a meeting, then use the video capability for showing images rather than the participants. The video may not be ideal for first time meetings as people do not get to know one another. The system does not allow participants to observe others reactions[13].

Education/Health: In a recent broadband trial in the Greater Victoria Hospital Society[14], user acceptance of videoconferencing was good. The staff made excellent use of the service and it was heavily booked. Staff do not want to go back to the old methods. In promoting the service, the technology is irrelevant to users. What is important to the user is the application and its performance.

Specific user needs with regard to medical applications are:

- Clear images (i.e. in some cases, compressed video is inadequate);
- Large, high definition screens when many people are involved;
- Mobility of screens and cameras;
- Attention to the "human engineering" of the system, i.e. how the system interfaces with its users; and
- Current configurations must be application specific.

The cost of the proposed commercial service is more attractive than presently used services. A detailed analysis suggests that for services such as videoconferencing, the broadband networks are cheaper and will come down in price as usage increases. It is believed that there are cost savings over sending people out of town on meetings. Within town, the savings are

less obvious. There are significant intangible benefits through time saving (not having to travel) and people are more available for meetings because they can participate from their own workplace.

A study at the University of Ottawa Heart Institute indicated the following requirements[15]:

- Resolution must be adequate, and this is application specific;
- Broadband networks or high speed LANs are necessary for widespread use of the services;
- Delays in the system must be minimized to be attractive to users - image transfer is acceptable, but loading of images from storage or from a remote site must take less than a second; and
- Based on the above point, full motion video would only be acceptable if hardware and software is powerful enough to avoid delays in screen updates.

In this study, too, the cost was thought to be reasonable, given the almost constant reduction in computing costs and reasonably priced telecommunications links.

Telemedicine is not expected to be the "same as" being there. Touch, feel and smell is also needed. It is understood that a technological means of information transmission is not equal to "feel and touch". However, it is much better than nothing, which is what some remote communities now face. It comes very close to "being there" and can transmit very useful information. To date, services have been acceptable to users and patients. The patient benefits because valuable information can be transmitted[16].

Users want to transfer more information in order to provide better investigation of medical conditions. "Community health care" is needed, where services usually only found at main hospitals can be obtained at regional health centres, or at home. Patients want more access to medical information - through the simplest form, i.e. interactive television, without leaving the home. Future services must do things that can't be done now (i.e. electronic house calls), without requiring large infrastructure costs (not including the broadband network).

Services must be provided in such a way that patients feel comfortable, they receive all the information they require and they get the same reassurance from the medical community as they do with face to face contact.

Transducer technology will be important in order to deliver proper signals across communication lines. The transducers will have to be simple and user friendly, as they will be operated by the patient from home, in some cases.

HICKLING Focus Group Reactions

The Hickling focus groups reacted as follows to the videoconferencing service:

Positive

- Users saw the positive side, and the increased capacity to communicate over long distances.
- Videoconferencing would also be useful for initial marketing contacts, especially in the first few meetings with a new client. This would allow you to bring the product to client. For this, there would be a need for a good high resolution video signal.

Negative

- People were afraid they would loose human contact, because of the ease of distance communications. There would be also a loss of opportunities for travel, walking, exercise.
- Users fell that the service would bring up a new worry about their appearances, especially if they are camera shy.
- For still pictures (vs. full motion video), users felt they would loose body language communications.
- What about busy circuits -- do we just wait?
- Loss of privacy, security in public pay videophone situations.

Willingness to pay

- Again, it was difficult to judge people's willingness to pay. This depends largely on circumstances and the type of business. Business users right now do not see video as essential, only as a luxury. However, should their clients in Honk Kong or New York start using video, then it will rapidly become a necessity for them also.

7.3 Technical Characteristics

The major technical advancement which will allow high quality videoconferencing on regular ISDN networks are "codecs on a chip". These digitize the analog signals from cameras and microphones and use a mathematical algorithm to compress the data for transmission. Inverse multiplexers and video switches will also play major roles in the future of video conferencing[17].

Desktop video, involving multimedia will also evolve. These will be a compact terminal which provides two-way sound, colour-motion video, and the means to establish a connection with a similar device at another location[18].

7.4 Infrastructure Requirements

Access to well priced bandwidth will be necessary. There are many ways to approach the integrated communication system e.g. FAX or an extension of videoconferencing which will incorporate equivalents of e-mail, fax, modem etc. The future communication links will hinge around the computer and agreed international computer standards. A large proportion of the connections to the subscriber side of the central office are already fibre. While the fibres are presently used to provide low data rates, as demand for bandwidth increases, broadband services will be made available on these fibres. This should not be a limiting factor on the provision of the services, provided pricing is commensurate with the market[19].

Uncompressed video requires a band width of 45 Mb/s. Compression techniques can reduce this to as low as 56 Kb/s, however, the minimum bandwidth is far from the desirable bandwidth[20].

7.5 Costs

Presently a videoconferencing unit costs $45,000 per node. A total link is approximately $110,000 for a system using 2*56KBPS, i.e. a standard telephone connection. This includes a videoconferencing unit at each user node, plus a videocompressor module or codecs which will allow the transmission of images along normal telephone lines. The cost comes down significantly if the scan rate is reduced. Future pricing on computer based equipment will come down very significantly.

Increasingly sophisticated equipment will become available at declining costs. Costs are expected to fall to $15,000 in 1995 and $5,000 by the year 2000 for fixed and roll about systems. This compares to today's cost of $30,000 to over $100,000[21].

In addition, we can expect increased user charges for the use of networks. New York presently charges for local calls. Similar charges may be applied for future communication links[22].

7.6 Market Assessment

The introduction of international standards, eg. the adoption of Px64 data compression standard, will make users more comfortable in purchasing a videoconferencing system because it ensures some level of compatibility between vendors. Globalization of the technology, as a cost-effective alternative to travel is seen as an important driver for the market.

Researchers generally feel that pricing will not be a major concern in the long term as prices of hardware, software, and eventually network links will come into line with market requirements[23].

There will be greater acceptance of videoconferencing within organizational structures. Early adopters will be those with specialized applications and the money to make them reality. These are the medical community, post secondary education and large corporations[24]. Another example is the justice system, which is currently adopting the technology in the US. The potential range of applications in health care is significant. Emphasis is required on identifying the range of applications of the basic technology[25].

The US infrastructure will develop more quickly than in Canada, based on their more competitive environment. There is no incentive to move quickly for Canadian telecommunication companies (telcos). There is a substantial initial cost incurment. Investment would come sooner if it appeared that the opportunity may be lost by waiting. This is based on regulations which do not allow telcos companies to provide video. Since cable companies are generating more revenue in other areas, they are not interested in videoconferencing systems[26].

The costs of a mass market infrastructure is still high. Current cable networks could expand fibre into a subdivision, but not into the home. Fibre used in this way could serve 2000-2500 homes. Assuming no regulatory change, in 10 years, medium to major centres will be served by one dominant broadband supplier to the home. One to two services to businesses will be as common as cable television. However, if regulations change, which is predicted, telcos will not concede services.

Telemedicine: Canada as a whole is a niche market for this service. With much of our population spread out in remote northern locations and all the major medical centres in the south, the ability to serve communities will depend on telemedicine services. The first use of these services has been in remote communities where patients haven't a great deal of choice in medical facilities. In urban areas, access to medical care is much better. Urban users may be more resistant to the changing structure of health care. However, with the continued emphasis on "community health care", larger hospitals will only take in those in real need of constant monitoring and care. Those who can be aided through distance medicine will be. There must still be a definite benefit/cost advantage if governments are going to spend already limited health care dollars on these services. Also, the timing for the infrastructure for transfer of medical imaging data is still uncertain[27].

References for Chapter 7.

1. Dr. Max House,Director of Telemedicine Agency, Memorial University of Newfoundland, personal interview, January 28, 1993.

2. Vanston, K.; Marsh, J; Hinton, S; "New Telecommunications Services for Business and Society 1990-2010: Volume 5, Video Communications: Forecasts of Markets and Technologies", Technology Futures Inc., 1992.

3. Angus, Elizabeth; "Future Applications for Telecommunications Technology", Angus Telemanagement Group, Ajax, Ontario, November 5, 1992, p3.

4. ibid, p3.

5. ibid, p3.

6. Cameron Young, Business Development Manager, Advanced Technology Division, MPR Teltech Ltd., personal interview, February 4, 1993.

7. Vanston, ibid, p.29.

8. Fergus Heywood, Manager Management Information Systems, Greater Victoria Hospital Society, personal interview, February 12, 1993.

9. Max House, ibid.

10. Sudhir Joshi, Director of Telecommunications Industry Marketing, IBM Canada, personal interview, February 4, 1993.

11. Cameron Young, Business Development Manager, Advanced Technology Division, MPR Teltech Ltd., personal interview, February 4, 1993.

12. Sudhir Joshi, ibid.

13. Peter Leach, President, Telecommunications Research Institute of Ontario (TRIO), personal interview, February 9, 1993.

14. Fergus Heywood, ibid.

15. Nicolas Georganas, Dean, Faculty of Engineering, University of Ottawa, personal interview, February 8, 1993.

16. Max House, ibid.

17. Angus, Elizabeth; "Future Applications for Telecommunications Technology", Angus Telemanagement Group, Ajax, Ontario, November 1992, p5.

18. ibid, p5.

19. Leach, ibid.

20. Angus, ibid p.5.

21. Vanston, ibid p.14

22. Leach, ibid.

23. Leach, ibid.

24. Cameron Young, ibid.

25. Fergus Heywood, ibid.

26. Cameron Young, ibid.

27. Max House, ibid.

8.

High Definition Television

High Definition Television provides television viewing on a receiver which is capable of displaying a picture using 1050 to 1260 individual lines on the screen. This provides twice the picture detail of current television. The screen also has a movie screen height to width ratio and digital quality sound. The incoming signal is digitized, processed, stored in memory as a frame, and displayed 60 times per second. All of this serves to make the television sound and picture more realistic[1].

8.1 Potential Application Advantages

The television screen displays four times the resolution seen on current televisions. The quality of sound is improved and the screen ratio provides closer to real life proportions. This high quality representation is a significant advantage in special applications, such as medical imaging and videoconferencing, where the quality of the image is especially important.

The advantages of the higher resolution of HDTV becomes particularly apparent for screens larger than 33 inches.

8.2 User Needs, Attitudes and Perceptions

Home: With all other factors equal, consumers find HDTV to be dramatically better than current systems. However, one can expect that consumers will be wary. There must be clear advantages to making such a large expenditure, especially near the beginning of the technology adoption. Consumers have concern about the scope and diversity of the programming that will be available in HDTV format, especially initially. HDTV will serve a certain portion of the population for a certain type of programming. Many users will want to upgrade current systems, rather than replace it. Systems must be affordable and reliable. Early adopters will be higher earners who represent the same market for today's large screen televisions. With current technology, it is possible to build a 36" diagonal "hang on the wall" HDTV, however this product is not likely to be widely distributed for another ten years[2].

Users' preferences towards HDTV vary with program subject matter, distance from the set, picture quality of the alternative standard television sets, screen size, and colour tone[3]. Therefore, preference for HDTV is highly conditional and context dependent, with wide swings in side-by-side comparisons.

Average annual family expenditure on consumer electronics is $540. This makes consumers especially sensitive to *value* for these products. In the future, consumers will demand more enjoyment from their home entertainment. The lifespan of the product is a variable which affects sales, as do warranties, especially in Canada[4].

There is a perceived growth in demand for TV which utilizes the new aspect ratio (16/9) which is compatible with future HDTV. Direct Broadcast Satellite (DBS) will offer products in the wide screen[5].

Business/Government: The use of HDTV may be considered as an enabling technology for effective videoconferencing and enterprise video broadcasting, since the need for high quality video is an inherent requirement for many types of video communications. For example, a marketing presentation to a major customer would require crisp, clear video of the product and the presenter. As well, the human aspects of "body language" can best be telecommunicated through high definition video, while the psychologically important vocal inflections can best be conveyed by high quality audio. In order to meet the human interaction needs of an executive-level video conference, HDTV would be required[6].

Education/Health: Similar to the discussion in the previous section, many applications for videoconferencing in the education and health areas will require HDTV quality sound and video. For example, the remote diagnosis of a medical problem may require an intuitive, subjective assessment of the patient's general, overall level of coherence. Without the clues

provided by subtle nuances in speech and appearance, such an assessment may not be possible. For another medical example, suppose that during surgery, the operating surgeon wishes to remotely consult with a panel of appropriate internal specialists. The remote specialists would require an extremely clear view of the problem area within the surgical site.

For education, many applications may not critically require the video clarity provided by HDTV, but it is easy to identify many areas which could greatly benefit from such video quality. Particularly in the case of technical training courses, where students watch an instructor complete a complicated manual task, and then attempt to perform the task themselves, an extremely clear view of the demonstration task would be critical. In addition, the display of certain graphical information in an educational situation may require the resolution of HDTV. One such example would be detailed maps, and another would be works of visual art.

8.3 Technical Characteristics

The HDTV terminals will feature a wider aspect ratio screen, greatly increased screen resolution and high quality sound. These terminals are likely to employ 100% digital information transfer, as opposed to the analog basis of current- generation television technology. This digital basis will allow the use of digital signal processing for error correction as well as special effects. In addition, the sound quality possible with digitized information should be similar to that presently obtained from compact disc equipment.

Although an international standard for HDTV has yet to be agreed, the basic bandwidth expectations for a residential or basic office HDTV channel is 20 Mb/s[7]. A "digital pipeline" is required into the home. The introduction of HDTV may stimulate this. Once the connection is available, the variety of possible services expands rapidly. Over a certain bandwidth, one HDTV program could be offered, or on the same channel, four conventional programs are possible. The user will select what they want based on the terminal equipment, hence the agility of the terminal[8].

High Definition VCR's will be launched in 1995. They will be digital receivers with the ability to decode whatever channel is required - the entire spectrum of channels could be recorded for a certain time period and then different channels can be selected from the recording by selectively decoding[9].

8.4 Infrastructure Requirements

Two different scenarios emerge in the consideration of infrastructure necessary to support HDTV. Broadcast-type HDTV service (point to multi-point) can be supported on the coaxial cable of existing CATV networks. The larger bandwidth required for HDTV would limit the number of possible channels to many less than for conventional television. Additionally, the electronic components of these networks would need to be upgraded.

The other case, that in which two-way HDTV communication is necessary, would require a broadband ISDN network with flexible control of high bandwidth connections. For residential applications, the availability of this type of network is highly unlikely without fibre-based access to the home[10].

8.5 Costs

The terminal prices for residential-type (receive-only) sets is likely to be initially in the $5000 - $6000 range. With the development of significant consumer demand for these sets, economies of scale and technical improvements could be expected to reduce the costs to less than $2000 within 5 years of introduction. Price projections for HDTV are shown below and are based on the decay price for 34" large screen televisions:

- Introduction - 1995 - $5,000-6,000
- 1996 - price drop to $4-$5K
- 1997 - price drop to $3-$4K
- 1998 - price drop to $2-$3K
- 1999 - <$2K[11].

The broadband ISDN networks that would be required to support switched connections of the bandwidths necessary for HDTV would be extremely costly to deploy on a wide scale. It is more likely that such networks will be deployed only to very specific locations during the next five years, to support the specific services or users that will provide economic justification for the network. As the broadband switching technologies develop and network costs decrease, more locations will be added to the broadband ISDN networks[12].

8.6 Market Assessment

Expectation is that HDTV will be launched for the 1996 Olympics in Atlanta. First installations will be for "public viewing", to generate interest. The FCC is expected to allow a 10 year time frame for introduction, likely starting in 1995. Whether or not "advanced television" is used as a stepping stone to full HDTV will depend on the time frame of the FCC. A longer window would increase the likelihood of advanced television as a precursor to HDTV. A shorter time frame, on the other hand, will prompt manufacturers into lowering costs as soon as possible on HDTV[13]. Barriers to adoption will be price and uncertainty about service offerings. Stimulus will come from more research on consumer reaction for quality and service. Early adopters will be higher earners who represent the same market for today's large screen televisions[14,15].

In the year of introduction expected to be 1995, sales will be 10,000-15,000 units. By 2002, sales are projected to be in the area of 300,000 per annum in Canada. This relates to current Canadian television sales of 120,000/yr for large screen and 1,350,000/yr for all other sizes. Sales volume will relate to a "threshold price". The threshold prices for VCRs occurred at $1000 and again at $800. At these prices, the number of consumers willing to purchase a VCR increased dramatically. As yet, the threshold price for HDTV has not been determined[16].

The advantages of HDTV, relative to the price of initial equipment, may limit the initial residential market to only affluent, early adopters. The speed at which the residential market develops would seem to be largely dependent on decreasing prices for equipment, and the public perception of substantial benefits from the new technology. The claim that the technology is as revolutionary as colour TV in the 1950's is questionable[17].

The higher resolution possible with HDTV will allow larger screens to be more effectively deployed. Such larger screens imply that groups of people would be able to watch the same screen at the same time. This may create a market for big screen HDTV broadcast reception equipment along similar lines to the development of the original market for traditional big screen television sets; for example, sports bars. This audience concentration aspect may also create an educational market for HDTV broadcast reception equipment for local schools, as described in section 4.3.

In addition, a market for HDTV in premium quality videoconferencing applications may be expected. This would initially be a small, but well-budgeted target segment[18]. For specialized groups, such as the medical and educational communities, there is yet to be real application of advanced video technology. As general services become offered, these communities will pick out the aspects of the technology which best suit their purposes. To this point, their attitude has been "wait and see". For the education system, the possibility of highly compressed, multiple channel services is appealing. Other markets are CAD/CAM and remote sensing[19].

Standards are becoming less restrictive. The goal is to establish a common basis, but to leave as much flexibility as possible. Based on early projections in the US, there will be agreement on standards this year. The first advanced television services is expected to be transmitted in 1996 as noted above, and all broadcasters will have to transmit services by 1999[20].

Japan currently operates about 12 hours/day of HDTV. The service is analog and delivered by satellite. In Canada, we can expect to see flexible, digital based advanced television services as a general consumer trend, however, this will be cost and service dependent[21].

References for Chapter 8.

1. United States Department of Commerce, "The Scope of the High Definition Television Market and its Implications for Competitiveness", 1992.
2. Dr. Paul Hearty, Director, Advanced Television Laboratory, Communications Research Centre, personal interview, February 1, 1993.
3. United States Department of Commerce, ibid.
4. Junior Ali, Senior Vice President Marketing, Sony Canada, personal interview, February 1, 1993.
5. Carol Darling, Advanced Broadcasting Systems of Canada, personal interview, February 5, 1993.
6. MPR Teltech, internal reports.
7. MPR Teltech, internal reports.
8. Paul Hearty, ibid.
9. Junior Ali, ibid.
10. MPR Teltech, internal reports.
11. Junior Ali, ibid.
12. MPR Teltech, internal reports.
13. Junior Ali, ibid.
14. Paul Hearty, ibid.
15. United States Department of Commerce, ibid.
16. Junior Ali, ibid.
17. United States Department of Commerce, ibid.
18. MPR Teltech, internal reports.
19. Paul Hearty, ibid.
20. Carol Darling, ibid.

21. Paul Hearty, ibid.

9.

Interactive Media Services

Interactive services provide two-way or multi-way links between the user and sources of entertainment or information. The following examples are discussed: news services, interactive television (video-on-demand, pay-per-view), and virtual reality. For most of these services, video into the home is the pivotal point. Once the point is reached at which it is generally accepted, other service requirements will appear[1].

Current video services are unable to offer "directed" services because of the large portion of market share that is required to justify the expense of a full video channel. An example of this is the Arts & Entertainment Channel, which originally was designed to offer very narrow programming. As it developed, it began to offer more and more general programming in order to increase its audience[2].

The next few years will see the adoption of significant improvements in enabling affordable digital video signal processing, including effective data compression. This will result in the availability of more channels. Future channels will operate on one-quarter to one-fifth of the bandwidth of today's channels. This will result in the offering by telecommunications and cable companies (depending on CRTC rules, etc.) of a variety of new directed services. These new services will be possible because, by using only one quarter to one fifth of the bandwidth of today's channels, they have a much lower operating cost. To pay for itself, a channel requires to have a 20-30 percent market share. New services, using advanced video compression, are

viable with only a five to six percent market share. These services will be offered through a variety of media - cable, off-air, fibre, twisted pair, satellite.

News services: An interactive news system could be as simple as receiving a newspaper in an electronic format, rather than in printed copy. Alternatively, a further generation of this service could give users full interactive access to news networks via their home computer or an interactive television network. This would allow users to scan news headings and select the headings on which they wish to see more information. News information would be provided in full multimedia format, providing text, audio and full motion video.

Interactive television: Services such as video-on-demand and pay-per-view would provide an expanded choice of packaged news, information and entertainment services individualized to users or on demand. Examples of program delivery are an on-screen catalogue of movies or television series. Users can select the program they wish to watch and have it begin at their convenience. This would be virtually the same as having a fully stocked video library in their living rooms. As well as movies, regular television series would be available, with brief capsule descriptions to allow viewers to make their choice.

Virtual reality: A computer generated environment in which the user participates, as if part of the environment. For example, by wearing an electronic glove, a user can control a hand on a video screen.

9.1 Potential Application Advantages

Current information and entertainment services into the home are limited in providing interactivity. Increased levels of interactivity will allow users to select the type of information and entertainment services which they receive. The introduction of personalized services will permit greater flexibility for consumers in balancing their work and family responsibilities. The following areas have been identified as having potential as offered services:

News: Currently, news is delivered in a general format, directed at a mass audience. Interactive news networks would allow users to select only the news in which they are interested and allow them to get as much information on that particular item as available. Users could also have access to news databases, where they can call up a story from a year ago to provide background for something that is going on in the present.

Interactive television: Video-on-demand and pay-per-view allow users to select their own television programming. Users can interactively order up movies and other entertainment

through their television (or potentially, home computer) and have them play at their convenience - users can watch what they want, when they want.

Virtual reality: This technology is applicable to games, travel and education/training programs. Each of these areas benefits from the interaction of the technology, which absorbs the user into it. Simulators which mimic reality can be used for such things as driver training, music lessons or physical rehabilitation. Virtual reality allows users to actually become part of the computer generated reality, where their own movements control characters on the computer screen.

9.2 User Needs, Attitudes and Perceptions

Home: Residential users have a need to become active participants in their own leisure-time activities. The increasing level of user interaction employed in the evolution of computer-based games provides a preview of the user needs for interactive network-based services. Whether the user motivation is toward acquiring skills, or toward escapism, the increased choices possible with interactive media services allow the selection of information or programs that are better able to address each individual's unique personal needs, including his/her level of interactive participation[3]. Services which seem to generate the most consumer interest are those which provide a significant benefit and for which there is currently no alternative. An example of this is that while there is reasonable interest for video-on-demand services, there is significantly more demand for interactive educational services into the home[4].

There will be an increasing need for a "more agile" home terminal. The progression will be compressed video, new media offerings multiplexed into larger packages (requiring de-multiplexing, and interactive capability). For these services, the terminal will have to accept digital data[5].

Users are unsure of their requirements because of the lack of knowledge about what technology can offer. User needs can better be determined by first establishing a cost effective service and allowing users to experiment.

The Canadian Cable Television Association (CCTA) has identified two significant factors which will influence the future communications environment: 1) the consumer's choice for personalization, choice and quality in services; and 2) technological advancement. Consumers are interested in greater control over their choice of television services. That is, many people want a small basic package with all other programming services being optional. The association has also determined that consumers like to "buy Canadian", but will not sacrifice quality, value, choice or convenience to get it[6].

New services need to be well articulated and those who do not want to receive them must be able to opt out. The CCTA's current submission to the CRTC states that the regulator will require flexibility to adapt to new developments in programming, technology and financing.

Price is an important factor for consumers, particularly in the area of new program packages. One third of cable subscribers in a CCTA survey said they would pay a reasonable price for new services. The same research indicates that the public is prepared to pay for entertainment and favours the pay-per-view concept which provides convenience, choice of programming, reasonable price and is a service that consumers can easily understand - many have seen it in some form.

Business/Government: In an office environment, there is an ongoing need to locate information that is relevant to work activities. Library database searches represent one of the currently available approaches to locate such information. The development of knowledge-bases and the connection of many such repositories of information together is presently under way. Knowledge workers will need easy access to these network-based information resources. Interactive media services could help to provide such easy access. In addition, media-based examples, illustrations or descriptions related to the information could be more effectively communicated.

In the future, technology will be used to provide just-in-time knowledge instruction. In business and private life there will be a need or desire to know instantly about new developments, (in-depth knowledge, not just cursory information). Business will not be able to accept slow access to new developments but must be able to get the information and detailed knowledge to the necessary people as required[7]. Many of these services have also been described in Chapter 5, which describes the Personal Digital Assistant.

Education/Health:

Particularly in the area of education, interactive media services are expected to be able to better meet the educational needs of a diversity of students. By having interactive, subject-specific courses available whenever they are needed, each student could progress at his/her own pace through required and optional courses in public education, for example. This has also been discussed in Chapter 4.

9.3 Technical Characteristics

The interactive nature of these services requires user input. The terminals that will be used for such services are likely to develop along different paths, depending upon the particular market being addressed.

For the home entertainment market, television sets are likely to be enhanced by including more functionality (such as provisions for user input) in the "remote" control.

Existing personal computers already provide for a great deal of user interactivity, through various input and output devices. This type of terminal equipment can be used for network-based interactive media services through the addition of appropriate networking software applications and provision of the proper interface to the network. This type of terminal is more likely to be used for "serious" home services as well those services targeted for office users[8].

The main thrusts which will affect technology change in the cable television industry over the next ten years are the move to digital signal transmission and fibre-optic distribution networks. Ongoing developments in computer software and hardware, consumer electronics and broadband delivery facilities will also enable a major expansion of products[9].

9.4 Infrastructure Requirements

The existing CATV systems are primarily designed as distribution systems, and have been architecturally configured to maximize their effectiveness in this regard. Cable television's distribution technology will continue to evolve to increase delivery capability. Two separate configurations in cable network architecture are possible; the concept of the fibre node or fibre-to-the-curb which would extend fibre down to groupings of under 200 subscribers and the regional hub approach which provides for the interconnection of cable television systems. These changes will essentially be complete by the year 2000[10]. This will involve a $7 billion investment in Canada.

This "single point to all network access points" network design precludes much interactivity. Some degree of user input can be incorporated by utilizing telephone networks to program CATV converters for pay-per-view, etc., but the inherent lack of flexibility in CATV network designs limits their potential for interactive services. For video-on-demand, a unique video channel must be devoted to each user. Alternatively, a sufficient portion of a very high bandwidth channel must be available for each user to download compressed video in less than

real time. In either case, CATV networks would need to be architecturally redesigned if they were to provide such functionality.

On the telecommunications companies side, interactive services are already supported to a certain extent by existing telephone and data networks. As more media communication requirements are added to the services, however, existing telephone networks are too slow to be effectively used. Data networks are generally private, and have a limited number of users. Such networks can often support interactive media services, but only within each network's limited user base. As more users are added to such networks, network performance typically deteriorates.

Initially, narrowband ISDN networks will provide sufficient support for a wide range of interactive media services. However, narrowband ISDN is not sufficient to carry full-motion studio-quality video, and can only carry still images with some delay. As these services develop over the next decade, however, the requirement for better quality video will be reflected in the necessity of providing broadband ISDN networks to support such services[11]. We can expect that fibre will be used as a backbone for the network. Fibre to the curb will still provide broadband services to be delivered to the home through a short distance of twisted pair cable, which already exists (technology is ADSL and HDSL, providing T1 bandwidth). Presently, the cost of fibre to the curb is 2 orders of magnitude less than fibre to the home in infrastructure costs[12].

9.5 Costs

The terminal prices for residential interactive entertainment services are likely to be within the present range of consumer television equipment prices. As discussed above, this approach would represent a limited level of possible interactivity.

The personal computer-based terminal approach will use a non-dedicated personal computer to run the interactive media software applications. Besides software costs, the only additional terminal cost would be (initially) for an ISDN terminal adaptor. The retail price of this adaptor should approach existing personal computer modem prices as a larger market develops. Initially, these terminal adaptors are likely to be available only in the $1000 - 1500 price range.

The marginal network costs for the addition of these interactive media services are fairly low, if an initial narrowband ISDN network infrastructure is implemented for a large number of new services. The broadband ISDN networks that would be required to support higher quality video for interactive media services would be extremely costly to deploy on a wide scale[13].

9.6 Market Assessment

Seventy-seven percent of Canadian homes now watch television via cable, up from 57 percent in 1980. This represents more than 7.6 million households which subscribe to basic cable services, of which an estimated 3.7 million have access to optional services. Cable television distributes a wide range of Canadian satellite-to-cable pay and specialty services to national audiences. Cable is also the principal resource for community participation and access to the television medium. The cable industry intends to strengthen its distribution system in order to provide new programming services directed at improved consumer choice[14].

The cable industry will be responding to the competitive threat of the US Direct Broadcasting Service (DBS) by offering more services on the grounds that most Canadians would choose the Canadian alternative. By employing digital video compression technology, satellites will distribute the latest movies at different times giving subscribers the power to order programming on demand. Cable television will also, in this time period, be offering competitive near-video-on-demand.

One obvious target market for interactive media services is the residential entertainment market. Service providers will attempt to provide general and niche offerings. The success of these offerings will still be determined by consumer demand. Those which meet user requirements will be successful. To identify winners, providers of services will increasingly resort to experiments and demonstrations. This will assist them in deciding what services to provide to best take advantage of the changing economics which the technology has allowed. Service providers want to be sure that they are offering products and services that consumers want[15]. The industry has a limited enthusiasm at present due to the significant investment required and the unclear picture as to the rewards to be obtained from providing the new services[16].

The industry is still trying to identify the complementary (revenue generating) services which will be provided. Examples are packaged news services, wire services and services related to the broadcasting business. Multichannel pay per view will be implemented. Other independent services can be provided in which the customer will call up whatever services he requires. Pay per view is the main focus of the cable industry in the US. Proposals which have been submitted include 50+ channels of pay per view.

The hardware pricing is key. The digital box to decompress the incoming signals must be less than $300 at market launch. The box will be kept simple at first with the capability of upgrading for additional services and features.

The limitations for network support for these types of services has been discussed above, but, from a marketing perspective, only marginal service enhancements over the present pay-per-

view type of arrangement are possible until broadband ISDN (or similar capability CATV networks) are readily available directly to homes. This situation is extremely unlikely within five years, but becomes more likely within ten years. The competition for these types of services is video and video game rental stores. Since the prices for rentals is quite low, the market penetration of similar network-based services is likely to be quite low unless the total price of the network-based services is competitive with the rental prices.

The situation for office-type interactive media services may be more promising. The growth of broadband network connections to office locations is likely to progress rapidly, initially to support videoconferencing and HDTV services, as discussed in chapters ? and 8. Interactive media services relating to intra-enterprise training are likely to become a priority as an outgrowth of the availability of videoconferencing, as mentioned in Chapter 4. In the next stage of market acceptance, the media-based retrieval, processing and communication of information will become office priorities. CD-ROM information bases, and personal computer software that uses these resources will pre-date the availability and necessity of network-based services. The diversity and volatility of information, however, is likely to rapidly make network-based services imperative in many information areas.

Most of these services will be price-sensitive. If the prices for interactive media services are too high, then textual information (as opposed to media-based) will continue to be used . Some niche areas will still be relatively price-insensitive, however. Interactive media services to serve these areas will most likely lead the office market for interactive media services[17].

Business has not yet caught on to the trend, but with availability of lower cost equipment and the future needs, it is anticipated that the business market will show a very rapid upsurge in demand in the future. The services are presently provided at localized sights not transmitted over distances. This will change as new equipment evolves and broadband communication services are expanded. The greatest barrier to adoption of the multimedia services is lack of appreciation of the potential of the technology. In most cases it is evaluated just as a replacement for the present way of doing things without necessarily providing any further value added, (what cannot be touched, cannot be appreciated). An analogy is the time that it took for personal computing to be accepted. Its growth accelerated when pricing dropped and the user interface improved[18].

In ten years, interactive media services will also be available from the broadcasting and telecommunications industry. Freenets may even be upgraded to provide some broader interactivity. Alex is limited in the services it provides and the subscribers it has attracted. It may be that technology is not the reason for the limited use but rather inadequate marketing and the inability to attract enough service providers. Videoway, the interactive broadcasting service provided by Videotron has been more successful, however, a recent analysis of its market

indicated that the largest use was in video games for adults. There is no clear indication as yet of how these interactive services will be widely used, other than to support leisure activities.

Within 5-7 years, the introduction of agile terminals will begin[19]. Depending on infrastructure, an optimistic projection for 2003 is a multimedia terminal in 80% of Canadian households, for a market of $16 to $20 million. Subscriptions will be similar to what we pay today for basic telephone and basic cable - about $20 per month. User fees will be on a demand basis, much like today's 900 services. The success of services will be totally based on the value of the service offered to consumers. The business market would see similar penetration[20].

References for Chapter 9.

1. Cameron Young, Business Development Manager, Advanced Technology Division, MPR Teltech Ltd., personal interview, February 4, 1993.
2. Dr. Paul Hearty, Director, Advanced Television Laboratory, Communications Research Centre, personal interview, February 1, 1993.
3. MPR Teltech, internal reports.
4. Cameron Young, ibid.
5. Paul Hearty, ibid.
6. Ken Stein, President & CEO, Canadian Cable Television Association, personal interview, February 11, 1993.
7. Bill Currie, DVS Communications, personal interview, February 8, 1993.
8. MPR Teltech, internal reports.
9. Ken Stein, ibid.
10. Ken Stein, ibid.
11. MPR Teltech, internal reports.
12. Sudhir Joshi, Director of Telecommunications Industry Marketing, IBM Canada, personal interview, February 4, 1993.
13. MPR Teltech, internal reports.
14. Ken Stein, ibid.
15. Paul Hearty, ibid.
16. Carol Darling, Advanced Broadcasting Systems of Canada, personal interview, February 5, 1993.
17. MPR Teltech, internal reports.
18. Bill Currie, ibid.
19. Paul Hearty, ibid.
20. Sudhir Joshi, ibid.

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General Wireless Communication Services

This category of services allows general access to a variety of communication and data transfer services. Applications include, but are not limited to voice, pager, text, fax, data and still/moving image. Access to some of these services through wireless networks is already available. Cellular and portable telephones are common. Some new services allow fax machines and modems to work within a wireless network. Movement towards digital networks will significantly increase the level of service and the features offered.

The specific services involved with wireless general communications services are described below.

Voice: Wireless voice communication is currently the highest profile service in wireless communication. It allows people to have voice communication through a hand held telephone from anywhere within a given range. Cellular service allows conversations to be held in fast moving vehicles. A service which has recently been introduced and which will be available by mid-1994 is a public cordless telephone service, called Personal Communication Service, which will allow users to send and receive calls from pocket-sized telephones whenever they are within 150 to 200 meters from a "base station". Base stations will be placed in public places such as shopping malls, city intersections and airports. Users will have two-way communication capability at home, at work and at public locations using the same telephone set.

The future outlook for PCS is ubiquitous coverage[1]. Using satellite technology, service will be "anyone, anytime, anywhere in the world".

Features in personal communicators would allow users to easily transmit an emergency signal and location in the event of an emergency. The system would likely be part of a personal communication system which would have emergency alert and location as a special feature.

Pager: Personal pagers are small, wireless receivers clipped onto a person's clothing which are linked into a central messaging system. When a person dials the pager number, the pager beeps, notifying the wearer to call their service to obtain the message. More advanced pagers display the number of the person calling. Pagers fill a market niche - they are cheaper than a wireless telephone, yet allow the user to have continuous contact with those needing to communicate with them. Future pagers could offer an emergency location feature, as described for voice communications. Future pagers will also provide a message-back feature.

Wireless data communication (text, data, FAX): Wireless data communication is the communication of electronic information (fax, data, text) between two devices which have no wired connection between them. Current systems have not developed far enough to allow this to occur effectively. Because the information that is transmitted is a series of 1's and 0's, 100% of the signal must be received. Anyone who has ever used a cellular telephone knows that this is not current reality. Future wireless data communication would allow mobile and remote users to have wireless access to their office computer networks, their home computer, banking and financial services to which they subscribe, etc. Development in specialized terminal technology could allow users to perform stock market transactions while sitting on their boat in the middle of Lake Superior or transfer data files to their head office in Vancouver while flying from Toronto to Halifax. Future FAX could allow users to query a FAX database, such as a real estate agent sending in a request from their car FAX to their main office to FAX details to them on a specific property.

Video: Video telephone communications will evolve from the current cellular telephone system and the videophones which have recently been developed by AT&T. These will allow users to see a full motion image of the person with whom they are speaking across a wireless network.

Summary: A full range of communication and data transfer services will develop from systems which currently provide wireless voice communication. Services and features will be added as the technology becomes available and as demand for the services increase.

10.1 Potential Application Advantages

The advantage between wired and wireless telecommunications is clear. Instead of directing a communication to a fixed, wired outlet, the communication is directed to a person, whatever their location. Evolution of services will increase the advantages.

The integration of communication services through a digital network will bring about significant changes in lifestyles. More people can work out of their homes which will impact the costs of operating a business, transportation requirements and environmental protection costs[2].

Voice: The main advantage to wireless voice communication is its "anywhere, anytime" capability. Other advantages are defined by the features which become available as the technology develops. Emergency location is a potential feature with clear advantages. Currently, 911 is the only emergency system available. An emergency alert and positioning feature on a personal communication device would allow police and emergency crews to efficiently locate and arrive at the emergency scene without having to get the information from the user, who may not be able to provide it.

Pager: Pagers are a cheap method of notifying a person when someone is trying to reach them. Advances in pagers will allow broader areas of coverage (including international) and increased information transfer through alphanumeric displays. Emergency alert and location systems would offer advantages for pagers in the same way they would for wireless voice units.

Wireless data communication (text, data, FAX): The following advantages have been identified for the wireless transmission of data:

Mobility: Mobility is identified as a prime benefit because both voice and data terminals are no longer constrained by their communications link to a specific geographical location.

Flexible terminal layout: If data can be transmitted without dedicated wires, layout of equipment need no longer be based around interconnection requirements. This also allows for quick and simple modification of equipment layout, especially with local area networks.

Reduced installation costs: A significant portion of a data terminal's cost can be its installation into a network. In the case of voice terminals, it is as high as 60% of the total cost. Subsequent reorganization costs, whether the move is temporary or permanent, are also reduced.

Removal of unsightly cabling links: An active office with a large quantity of equipment that relies on networked communications may not have the space for large amounts of cabling. This

is a particular problem in buildings that were erected a decade or so ago and did not have the saturation wiring technology built into them at construction.

Communications in hostile environments: There are applications in industry where it is undesirable or expensive to install wired links because of the nature of the environment involved.

Video: Wireless video communications offers the advantages of wireless voice communication, with the added feature of seeing the person with whom you are speaking.

10.2 User Needs, Attitudes and Perceptions

Home:

Voice: Demand for service climbs dramatically as the cost of equipment falls, regardless of price tariffs remaining constant or increasing. This indicates that home users are very sensitive to cost and that many are ignorant of the pay-per-use cost of using cellular radio when they start to use the service[3]. A greater proportion of new subscribers would use their telephone for personal conversations, rather than for business if costs were lower. A lower cost would also attract younger, lower income, non-professionals into the cellular market.

Potential home users are interested in ways to reduce the cost of wireless voice communication, for example they show interest in no-frills, featureless telephones and "regional" subscriptions (i.e. the service is limited to a certain radius of a home base). These users, however, find that audio quality is an important factor.

Home users have indicated that non-business benefits of cellular communications are strong motives for entering the market. These include increased safety and security in the event of an accident or emergency. On the other hand, there would be little demand for enhanced service features for users who intend to use their cellular service for non-business purposes, although enhanced privacy features would be acquired by over half of the market. Security against unauthorized use of their telephone is also a desired feature.

Users will not tolerate for long a multitude of telephone devices which are only usable in particular situations (i.e. cellular vs. PCS). Recently, users have indicated worry about the threat of personal injury from high electromagnetic frequencies. This issue is under further study, but is clearly important to users. Public concern over the use of hand held mobile telephones while driving is evident and may push the market for hands free operational units[4].

Pager: Dedicated pagers must be sufficiently smaller or cheaper than cordless personal telephone sets in order to warrant provision of a separate paging service. If the paging terminal could be built into a wristwatch, for example, and provided with a tactile alerting mechanism, then it would offer distinct advantages over the inclusion of paging functionality in a "shirt pocket" personal communicator[5].

Wireless data communication (text, data, FAX): The development, market acceptance and proliferation of personal digital assistants (see chapter 5) is directly related to the realization of a residential user need for wireless data communication. The wireless feature is an integral part of the personal digital assistant concept[6].

Video: The need for residential users to have the mobility associated with wireless access in conjunction with video communication seems to be possible farther into the future. Until the necessity of the video portion of multi-media terminal applications develops into wide acceptance, it seems unlikely that the residential user will recognize any substantial need for wireless video service[7].

Business/Government:

Voice: Business/government users show the following needs, attitudes and perceptions[8]:

- They require good voice quality.
- Security against unauthorized use is important.
- They require the ability from the network to provide high concentration usage.
- New systems should provide the ability to operate with existing PABX and key systems.
- Systems must have the ability to work without interference in an office environment.
- Compatibility of equipment from different equipment vendors must exist.
- Availability of handover between base stations is important.
- Users require the availability of cordless Centrex.
- For a mobile service, users look for maximum coverage in order to use their mobile telephone in any area they choose.

- Only 40% of users believe that the ability to complete work while on the road is an important benefit[9].

- Demand for new features from current users: hands-free (voice recognition) dialling, call/message screening, priority service permitting calls to go through in emergency, incoming call display.

If prices remain the same, typical cellular users will continue to be in the higher income, professional market. These users like the feeling of using innovative technologies and are relatively insensitive to the price of enhanced features. The only price sensitivity they seem to show is that they would generally be willing to use a restricted area service in exchange for lower cost.

Pager: As standard, generic cordless telephones proliferate, the functionality presently associated with dedicated pagers is likely to be included in the telephones. Such a "commodity" type market for personal cordless telephones is likely to erode the price differential between telephones and pagers[10].

Wireless data communication (text, data, FAX): Users need portability (small, lightweight terminals, reasonable battery life), coverage, ubiquity of service (interconnectivity to PSTN or packet switched networks, use with a variety of terminals, adaptability to current in-house practices, procedures, protocols), features (voice backup, privacy, security, wide ranges of data rates - 1200 Bps to 56 KBps with most in 2400 to 4800 Bps), low service prices (terminal prices not as much of a concern[11].

Users need help in defining their requirements, particularly in small to medium sized organizations.

Most frequently mentioned user applications are: computer-aided vehicle/personnel dispatch, input to databases (sales order entry, delivery status), database access/inquiry (checking order or inventory status), text messaging, vehicle location and monitoring.

Video: As is the case for the residential user, the need for office users to have the mobility associated with wireless access in conjunction with video communication seems to be reasonable only farther into the future. Until the necessity of the video portion of multi-media terminal applications develops into wide acceptance, it seems likely that the office user will recognize only very limited, specialized needs for wireless video service[12].

Education/Health:

Voice: The cordless personal voice communicator is expected to become ubiquitous within the next ten years. As is the case for home and office users, the education/health need for such "anywhere, anytime" communications is well-established. In fact, the present wide-spread use of pagers in the medical area provides a good indication that this may be one of the areas of greatest need for cordless personal voice communications.

Pager: As discussed above, the functionality presently associated with dedicated pagers is likely to be included in generic, personal cordless telephones. From a user standpoint, it would be desirable to have paging capabilities built into a "shirt pocket" sized cordless telephone. Once again, this situation would virtually eliminate the future need for dedicated pagers for education/health applications.

Wireless data communications (text, data, FAX): The development, market acceptance and proliferation of personal digital assistants (see chapter 5) is directly related to the realization of a general education/health user need for wireless data communication. In the education/health area, however, some unique applications for wireless data communications may be developed sooner to address specific needs. For example, the wireless electronic equivalent of a patient's chart in a hospital setting could record the procedures performed, the doctors/nurses comments, medications prescribed, etc., and also integrate some of the functionalities described in Chapter 12.

Video: As is the case for the residential user, the need for education/health users to have the mobility associated with wireless access in conjunction with video communication seems to be reasonable only farther into the future. Until the necessity of the video portion of multi-media terminal applications develops into wide acceptance, it seems likely that wireless video service will be required only to meet very limited, specialized needs in the education/health areas[13].

Hickling Focus Group Reactions

The focus groups had the following reactions to the concept of wireless communications:

Positive

- Wireless personal communicators, as exemplified by cellular phones, were seen by some business people as essential: "You need information quickly, for global competitiveness". Video was not sees as necessary, except for special data transmission (eg.CAD information on a new product).

- Personal wireless communicators are essential if one work outside of the office.

Negative

- Some offices and agencies do not want to promote work at home, because it reduces worker exchange and contacts. Thus they discourage these type of services.

Willingness to pay

- Again it is very difficult to measure and depends on a given situation. In some businesses, there is no need for wireless communications, thus the service has no value.

10.3 Technical Characteristics

Voice: PCS comprises a large number of points at which the telephone system can be accessed through a base station, together with the necessary support, administration and billing systems. PCS is not a network in itself, simply a collection of public access points for a cordless telephone.

The PCS can act as a pager and can make and receive calls, but will not operate from moving vehicles. The system will operate with satellites outside of urban areas where direct line of sight to the satellite is possible[14].

Cellular voice is rapidly moving to a digital network which will triple the number of conversations that can currently be carried on the analog network.

Wireless data communication (text, data, FAX): Spread spectrum radio, nationwide wireless networks, cellular modem, packet radio, directed infrared, microwave in-building.

Video: A wireless video terminal would require approximately 64 kB (one ISDN B channel) of bandwidth to provide a very basic motion video service. This bandwidth is about one order of magnitude greater than that required for wireless voice or data communication services. Although this capability may be technically possible to incorporate into the design of a small, portable terminal, the expense of the terminal, and the required radio frequency spectrum are likely to delay the development of such terminals[15].

10.4 Infrastructure Requirements

The network support for general wireless personal communication services will most likely be provided by a combination of networks. The narrowband ISDN network, with it's separate signalling capabilities is likely to provide the initial backbone network, and to provide integration of the various wireless access networks. Wireless PBXs will provide the wireless access network for the majority of office users. This is also expected to be the case for the institutional locations which are common in the education and health areas. Telepoint service is likely to provide wireless access in public areas, such as airports and shopping malls. Micro-cellular coverage has been proposed to provide wireless access in residential areas[16].

10.5 Costs

The terminal costs for cordless personal communicators are expected to be less than that of presently available cellular terminals. It is expected that, with the availability of standards, these terminals will become "commodity" items, much like present telephone sets. This situation would result in much lower terminal prices.

The wireless access portions of the network would require substantial capital investments, but this would not necessarily need to be justified through the expected future value of local usage and subscription charges. Alternative long distance carriers may make these investments to facilitate direct customer access for their long distance services, and partially rationalize the investment decision through the expectation of future long distance revenue streams[17]. As an example, Rogers cantel is investing $100 million over the next year alone in its digital mobile project[18].

10.6 Market Assessment

Cellular telephone service currently covers 83 percent of the Canadian population in terms of geographic coverage. Rogers Cantel has the only national license for providing this service. Other license holders are regional based. Rogers also has national licenses for paging and air to ground service[19].

The transition from cellular analogue to digital communication services will have an enormous positive impact on the scope and pricing of the mobile telephone business. Digital cellular will be widely available in about one year and will eventually be less expensive than analog (three

digital conversations can be carried over each analog channel). The lower cost per unit of digital mobiles will influence market direction.

Market penetration could be influenced by the public worry about health hazards due to electromagnetic frequencies. This may simply be a perception problem since to date the evidence is inconclusive on whether there is a real issue or not. If it is real, the technology exists to correct it, again at a price. Public concern over the safety of hand held mobile phones in cars is evident and may push the market for hands free operational units with a consequent lowering of price (voice activated units have in fact been in the market for two years).

Cellular and personal communication services (PCS) are currently evolving along separate tracks. Eventually, the market will demand a single device which will serve all user requirements covering stationary and moving positions, paging and air to ground communications. The major factor driving the market will be the shift in how people are reached - from calling locations to calling persons.

At the present time, cellular is more expensive than PCS because of the greater power requirements. PCS will attract a consumer market not a business market. Its more immediate application will be the replacement of the home cordless telephone. It is not known if PCS will be a big seller in the long run - PCS will only catch on if large numbers of base stations are installed (tens of thousands). Furthermore, PCS may get bypassed by digital cellular which is expected to eventually be as inexpensive as PCS.

We are on the verge of a real revolution in all kinds of communications as a result of introducing a digital network. There will in the future, possibly in this time period, be no differentiation in how voice, data and image are received. This integration of communication services can be provided now through satellite, at a price.

Voice: This is expected to be a very rapid growth market area, based on the history of cellular service expansion. Initial applications are most likely to be mainly wireless PBXs in office areas. Telepoints will next be established in public areas to (hopefully) operate with the cordless personal communicators that office users already carry with them to use with their wireless PBXs[20].

The market for CT2+ products is well established in Hong Kong, where it is the current standard. Sony has been making terminals for the region for quite some time and is ready to move into the North American market as soon as the standards and infrastructure are in place[21]. Sony expects to be a major CT2+ supplier in Canada, but expect that the market will be initially for one-way calling as the technology for two-way calling is expensive. A subscription rate of $6.00 per month (likely added to the standard fee) elicits highest interest

from those polled. A PCS unit with a pager feature would allow the user to be notified of incoming calls - they would then have to return the call.

Pager: The market opportunity for dedicated pagers seems to be decreasing. Some possible growth could be expected in this area if sufficient pager miniaturization progress is achieved[22].

Wireless data communication (text, data, FAX): The most active industries in acquiring/exploring mobile data services are: public safety and urban government agencies; trucking and courier/delivery services; public utilities (gas; electric telco); office automation equipment service; computer sales and service; appliance repair and service; taxi and limousine services; chemical and pharmaceutical manufacturing companies; airlines; federal and state governments.

References for Chapter 10.

1. "The Three Stages of PCNs", Telephoney, January, 1993.
2. George Fierheller, Chairman and CEO, Rogers Cantel Mobile, personal interview, February 5, 1993.
3. Tuttlebee, "Cordless Telecommunications in Europe", 1992.
4. George Fierheller, ibid.
5. MPR Teltech, Internal reports
6. MPR Teltech, Internal reports
7. MPR Teltech, Internal reports
8. Tuttlebee.
9. "Cellular Service Demand Study".
10. MPR Teltech, Internal reports
11. Dataquest.
12. MPR Teltech, Internal reports
13. MPR Teltech, Internal reports
14. George Fierheller, ibid.
15. MPR Teltech, Internal reports
16. MPR Teltech, Internal reports
17. MPR Teltech, Internal reports
18. George Fierheller, ibid.
19. George Fierheller, ibid.
20. MPR Teltech, Internal reports
21. Junior Ali, Senior Vice President Marketing, Sony Canada, personal interview, February 1, 1993.

22. MPR Teltech, Internal reports

11.

Intelligent Vehicle Highway Systems

Intelligent vehicle highway systems (IVHS) allow information to be received in vehicles on traffic congestion, road conditions, or position/navigation services. The same technology could be used to determine the use of highways by vehicles for the purpose of charging toll fees. The potential application areas are travel advisory, fleet management, traffic management, mobile office (extension of office capability into the vehicle), occupant activities (increase enjoyment, provide access to a vast activity library) and vehicle control.

IVHS will mainly supply information and control; information for drivers and control for operators of transportation systems (from a social point of view). Devices will be owned by drivers and systems will be operated by transportation agencies. The first steps are to monitor traffic flow, spot tie-ups, adjust traffic control lights and tell drivers of alternate routes. Second stage systems will allow vehicles to travel in tighter bunches, with fewer accidents[1].

Current initiatives are U.S. federal, with each state also pursuing their own initiatives; and in Canada, provincial initiatives in Ontario, Quebec and B.C[2]. The federal government operates a technical R&D program, coordinates and supports research. Communications Canada deals with the radio spectrum regulations. EMR provides maps in digitized formats[3].

Highway 401 in Toronto already has monitoring devices. Information goes into a central communications centre which broadcasts to message signs. There are plans to develop an in-car traffic information system[4].

11.1 Potential Application Advantages

This technology could allow users to have more information on the route they intend to travel and allow them to make alternative plans based on positional/navigational information. For the purposes of charging tolls, this system avoids slowing traffic at toll booths, as well as avoiding the costs of constructing them and paying collectors.

Improved services can increase the efficiency and effectiveness of information dissemination - getting better information to drivers sooner.

IVHS will provide better safety, efficiency of traffic movement, smooth traffic flows to reduce environmental damage, improvements in productivity (especially in trucking - providing more efficient verification and regulatory compliance checks), improvements in the convenience of driving by providing a wider range of information.

Speed limits can be based on road conditions and broadcast into vehicles. If there is an accident or ice ahead, the speed limit would be lowered and the driver would be notified.

There are advantages for police forces. Any car with IVHS could be potentially be tracked and located at all times. This implies that monitoring of speed and other traffic violations could also be monitored. Consumers are wary in this area.

The annual cost of traffic congestion on US urban expressways, according to the American Automobile Manufacturers Association (AAMA), is 2 billion hours of delays, $100 billion in lost productivity, $130 billion in accidents and nine billion liters of wasted fuel. IVHS systems that allow vehicles to travel closer together and provide information to deal quickly with congestion can lower fuel consumption by 12 percent, emissions by 15 percent and accidents by 18 percent[5].

In commuter transportation, these systems will allow a central dispatch to collect data electronically, providing exact locations of vehicles. These reports can be used to spot problems and estimate the arrival times of the vehicles at each stop.

11.2 User Needs, Attitudes and Perceptions

Users need up to date traffic flow information. They need to know where accidents have occurred, where there is construction, how the weather is affecting driving conditions, etc.

Easy user access is very important. It is of the utmost importance that the design of driver support systems are centered around the needs and, especially, the limitations of the driver. Areas of concern are human perceptual, physical, and cognitive capacities, as well as individual driver motivational factors. Adding a support system will change the driving task in unforeseen ways[6]. Voice synthesizers would allow hands free and, more importantly, eyes free operation. The human factor must be considered in all aspects of the system because, if systems are not easily used they can create more problems than they solve. Another possibility is that a second person will be required in the vehicle just to operate the system.

A further human factors issue is in the information which drivers receive. The information must be in a form that drivers can understand. This can include language, but should also consider the use of universal auditory and visual symbols[7].

There are information privacy concerns. The "big brother" concept is potentially there. Transportation operators and law enforcement agencies will be able to locate and track vehicles. Trucking operators have already made it clear that they don't like to be "overseen", but they are attracted by the productivity benefits[8].

In rental vehicles, drivers are usually tourists and would save time using an IVHS system which provides maps and directions. They are more likely to use this type of system than local drivers, especially since they don't have to purchase the equipment, but only rent it as part of the car.

For local residents, who know all of the alternate routes, the attractiveness is in traffic flow information which will allow them to determine the best possible route. The cost of this service would be cheaper than mapping and direction services.

Information must be provided in real time for it to be useful and in a wider variety than is currently available. A car radio which will carry higher quality information than that currently available has zero incremental cost. Therefore, any new device must provide a much better service to justify the cost.

Identified user preferences are[9]:

- Knowledge of the vehicle's map position, relative to a destination;

- Recording of vehicle use and manner of driving statistics for each trip, separately for each driver, where required;
- Record of en-route events;
- Competitive price, including all inclusive life cycle cost (interest has been shown within a price range of $700 to $3000);
- Easy to use input-output interfaces;
- Position accuracy;
- Operational availability, especially for monitoring vehicle handling and control.
- Environmental robustness - "industrial" units are required, with long term parts and labour warranties, not flimsy consumer gadgets;
- Portability.

Hickling Focus Groups

The reaction to IVHS by the focus groups included the following comment:

- The first service users want is reliable traffic information and road conditions, followed by an automatic pilot function. People also liked video-multimedia channel used to transmit diagnostic pictures and medical telemetry from the moving ambulance, as seen in the video demonstration.

11.3 Technical Characteristics

Packages can range from the simplest of two-way radio links to computer generated video mapping and synthesized voice direction. It is necessary to harness telecommunications and computer technology for use in IVHS.

The in-car systems will consists of various components, including distance sensors, heading sensors, heading change sensors, engine diagnostics, vehicle headways (to maintain front and rear headways and side distances), environmental sensors, visual scanners, driver condition

sensors (including medical diagnostics), computer, software, information display device, audio devices, control consoles, communications equipment[10].

Systems external to vehicles will include road side - proximity beacons, electronic traffic and street signs, electronic parking meters and gates, variable message signs, electronic billboards, cellular grid antennae, HAR monopole or cable antennas, radio transmitter/receivers; ground stations - Loran C master transmitter and slave stations, satellite for differential geographic positioning; operations centres; base stations; central control - traffic, emergency services, community services; mobile information services - vehicle navigation centre[11].

11.4 Infrastructure Requirements

Infrastructure is being implemented by public agencies. It will be made more available to receiving units. The infrastructure, in some limited form, can be developed within current budgets. Berlin has a network of line-of-sight beacons which only add 3-5 percent to the cost of traffic signals.

The current cellular "star" services could be used in some modified form. Devices could plug into this network and download information. On the other hand, mobile communication services and IVHS services may find themselves in direct competition.

11.5 Costs

Units currently under development will be available for less than $500 and fit into the palm of the hand[12], although in-car equipment is expected to cost up to $1500. The external support costs, which could include satellite and other monitoring systems, plus electronic collection of tolls, parking and fuel costs will be high[13].

11.6 Market Assessment

The Intelligent Vehicle and Highway Society of America, a Washington based group, estimates the US market for car-road technology at $200 billion over the next twenty years. This could mean a market of $5 to $10 billion for Canada by 2003.

Currently, there are several barriers to market entry. The concept has not been fully explained to the public. The details of how the technology and the institutions will fit together is not

clear. We are still in the early stages of development. Standards will also be a barrier initially[14].

Other services which can add value could prompt users to spend on these systems. In Japan, IVHS systems indicate golf courses and course operators broadcast vacant tee-off times over the systems. This type of service, or paid advertising would make the systems cheaper and more attractive. Some (perhaps many) private information sources will exist and these will help to drive the market.

Enforcement may play a role in the market, especially for systems that provide added safety, such as rail crossing warnings, icy bridges, etc. Just as seat belts are mandatory, so could some form of IVHS.

Japan has 250,000 vehicles equipped with navigation systems. These cater mostly to the upscale "yuppie" market. Some of the designs are strictly directional, i.e. how to get from A to B. There is no real time updates of traffic information. There is no large scale implementation as yet, however the Japanese are moving to a common standard[15].

References for Chapter 11.

1. Pritchard, Timothy, "Smart Cars Down the Road", The Globe and Mail, February 1, 1993, pB1.

2. Pritchard, ibid.

3. Bill Johnson, Transport Canada, Secretary for the Canadian Round Table on IVHS, personal interview, February 4, 1993.

4. Pritchard, ibid.

5. Pritchard, ibid.

6. "An Overview of Available and Developing Highway Vehicle Electronic Technologies", TDS-90-01/TP 10473E, Transportation Technology and Energy Branch, Ministry of Transportation, Ontario; Transport Canada, Transportation Development Centre; October, 1990, p90.

7. "An Overview of Available and Developing Highway Vehicle Electronic Technologies", ibid.

8. Bill Johnson, ibid.

9. "Mobile Information Systems Impact Study", TDS-88-07/TP 9360E, Ontario Ministry of Transportation, Research and Development Branch and Transport Canada, Transportation Development Centre, August, 1988, p112-115.

10. "Mobile Information Systems Impact Study", ibid.

11. "Mobile Information Systems Impact Study", ibid.

12. Bill Johnson, ibid.

13. Pritchard, ibid.

14. Bill Johnson, ibid.

15. Bill Johnson, ibid.

12.

Medical Telemetry and Personal Monitor

A personal monitor is an alarm and location device which alerts services (police, health, etc.) that the person carrying the device needs assistance should some predetermined events occur i.e. a fall or no movement for long periods of time. A medical telemetry system is a system which monitors and transmits indications of a person's physical condition (i.e. heart rate, blood pressure, etc.) to a medical centre which monitors the transmissions and alerts an attendant in the case of emergency.

12.1 Potential Application Advantages

Personal monitors do not currently have medical telemetry systems and it is often the case where it takes an active movement (i.e. pushing a button) on the part of the user to activate the alert. Telemetry systems could continuously monitor individuals from a remote location and determine if an emergency occurs.

12.2 User Needs, Attitudes and Perceptions

Home: With advances in biomedicine providing more opportunities for direct, continuous monitoring of problematic health conditions, the need for wireless personal devices to provide telemetry of this information is increasing.

The aging trend in Canadian demographics also creates a growing need for personal monitoring. Relatives may be more likely to let older people remain at home, by themselves, if they feel that personal monitoring will bring timely aid to the older person as required[1].

Business/Government: Many businesses would like to have real-time knowledge of the location of certain groups of employees - sales people, for example - so that they could more efficiently and effectively deploy these people. There are obvious, sinister implications that can be drawn from the wide-spread availability of this technology.

Government uses for such technology could range from critical medical monitoring of high-profile political leaders, to better control of probationary conditions for criminals released from physical detention through the use of personal monitoring devices[2].

Education/Health: Certain of the health uses of these services have been discussed above, but other uses relate more directly to institutions. For example, a nursing home might use personal monitoring with personal locator capabilities to ensure that residents that are subject to confusion and disorientation could be rapidly located if they wander away from the institution. Hospitals may use continuous monitoring of critical conditions, or vital signs, implemented through wireless access to allow mobility of the patients. Such functionalities may be combined with other applications, such as the wireless patient chart described in section 10.2[3].

12.3 Technical Characteristics

The terminal equipment necessary to implement these medical telemetry and personal monitoring systems is likely to be developed specifically to address the needs of each particular application. The wireless transmission of the small amounts of data that would typically be required for these applications could be easily supported by current technology. The technical complications generally arise in designing the data input portions of the terminal equipment. For example, monitoring the critical factors associated with a cardiac patient might entail designing an entire EKG function into the terminal.

Similar problems relate to the location information capabilities desired for certain applications. The sending of location information represents only a small amount of data, and is easily accomplished. However, the determination of correct location information presently requires a capability to call up satellite resources and to interpret the responses[4].

12.4 Infrastructure Requirements

Synergies exist between infrastructure requirements for these services and the infrastructure that is likely to be rapidly implemented to support wireless communications services - particularly PCS. Various wireless access networks, as described in Section 10.4, are likely to be able to support the specialized medical telemetry and personal monitoring applications. This is a desirable situation, since the smaller market opportunities associated with these applications would be unlikely to justify dedicated, separate network infrastructures.

12.5 Costs

As discussed in Section 12.3, the terminal requirements are likely to be quite different for different applications within the medical telemetry and personal monitoring services category. In other words, these terminals cannot be considered "consumer" items. This terminal specialization will result in much higher terminal costs than generic PCS terminals, for example. The technology for the wireless access portion of these terminals is likely to be able to be "borrowed" from the more generic PCS terminals, but the unique data input and control requirements will necessitate custom terminal development for each application. In addition, more stringent environmental requirements, particularly for medical applications, are likely to result in more terminal design complexities and increased costs.

12.6 Market Assessment

The markets to be addressed within this service category are extremely diverse. The relatively small size of the market for each niche application will require a separate business plan to determine the economics of development, on an application-by- application basis.

In some cases, however, the extreme importance of implementing the particular application will almost eliminate economic considerations. Examples of such "cost-is-no-object" applications may be: monitoring of a critical predictive parameter for high-risk cardiac patients, or probationary monitoring of sex predators.

The social issues associated with potential misuse of such monitoring techniques will need to be addressed before wide-spread market or political acceptance of these services can reasonably be expected. For example, imagine the personal monitoring possibilities for control of political dissidents within a repressive regime.

The driving forces for medical telemetry are the ability to provide a more uniform level of medical services to the whole population, and to allow people to go about their normal activities with a minimum of disruption and to reduce costs. Basic capabilities can be provided at this time. However, further technological innovations for microsensors and electronic hardware are necessary to broaden the scope of telemetry which people can use at all times.

A logical extension of the telemetry is to be able to store and transmit information via the personal communication system or 2-way pager which eventually everyone will possess. This will minimize the required investment in transmission/receiving equipment required to serve a limited number of users. Emergency calling features can be built into the equipment, similar to a 911 service. Any features which integrates the service into mass market equipment will make the service more acceptable to the users.

In any event, these services will likely depend on the wireless access infrastructures associated with PCS service, and the applications will most likely be developed after such infrastructures are already in place. The net result is that this category of services is likely to develop later in time than PCS service. This assessment of a later implementation of most medical telemetry and personal monitoring applications is also supported by the large diversity of applications, and the small market size for each application.

References for Chapter 12.

1. MPR Teltech, Internal reports

2. MPR Teltech, Internal reports

3. MPR Teltech, Internal reports

4. MPR Teltech, Internal reports

13.

Conclusions: Scenarios

We are on the verge of a real revolution in all kinds of communications as a result of introducing a digital network. There will in the future, possibly in this time period, be no differentiation in how voice, data and image are received.

George Fierheller, Chairman and CEO, Rogers Cantel Mobile

The single most important conclusion from this study is the irresistible drive towards a comprehensive integration of technologies and services: telecommunications, information technologies, computer science, and consumer electronics will be linked up, and brought together in a variety of multi-media packages and services. The distinction between individual markets will disappear. The clear boundaries between home and office will become fuzzy. What follows are some of the highlights of how tomorrow might look, presented in the form of scenarios for the three general market segments: home, business, and institutions. What is apparent is that some new services will find applications equally at home as in the office, such as personal digital assistants, or wireless personal communicator devices.

13.1 The End-User Perspective

A key dimension of this study has been as much as possible to present our analysis from the end-user's viewpoint. The essence of this viewpoint has been captured largely by the results

of our focus groups. The **Hickling Focus groups** expressed the following views regarding this future vision of the world of telecommunications:

Positive

- Technologies must be user friendly, voice activation is a big attraction.
- The service should make life easier.
- Users want reliability of systems -- no crashes.

Negative

- Some users are skeptical about specific technologies being available in 5-10 years.
- They are afraid of invasion of privacy, especially when using personal communication devices and public videophones.
- Many are worried about the reliability of systems -- computer networks crash today, and will still crash tomorrow. What does that mean to the reliability of our communication networks?
- Will voice activation eliminate need for writing in the long run?
- Ethical impact: What about negative impact on jobs, displaced workers, increased alienation, frustration, decreased human contacts?
- Older people and less educated people are often scared, terrified of using computer-based technologies.
- Some technologies could be abused. The time allowed for decision-making is too short, there is a need for time for reflection, eg. in car.

Willingness to pay

- Difficult to establish the price threshold of various products and services. However, in general, users would use some form of cost/benefit approach, based on the time and energy saved. Another issue is whether users should pay per use or for the basic service.

- General agreement that will have to pay more, extra from current service.
- How many new screens or interactive terminals will be needed -- one for each application in the home, or will the same hardware be used for all applications?
- What are the generic differences between the various services: eg teleshopping and database scanning?

13.2 The Home Market

A major new service in the home will be videoconferencing and its derivative, the video telephone. A telephone with video capability for casual calling would allow callers to see the person/people to whom they are speaking. This will have important impact on telecommuting, distance learning and entertainment.

Videoconferencing and telephony will be further enhanced by the High Definition Television or HDTV screen, which displays four times the resolution seen on current televisions. The quality of sound will also be improved and the screen ratio will provide closer to real life proportions. This high quality representation will have a significant advantage in special applications, such as medical imaging and videoconferencing, where the quality of the image is especially important.

The advantages of the higher resolution of HDTV will become particularly apparent for screens larger than 33 inches.

In the future teleshopping services will be much more pervasive. Teleshopping will allow users to interactively scroll through items on a terminal, likely a television or home computer, from a variety of distributors and select and order the items directly through that terminal. Future teleshopping services will have the advantage that users can select what they want to shop for, they can get inventory information to know how long they will wait for delivery, they will have a wide variety of items available, and will not have to leave their house to make a purchase. Teleshopping will be leisurely, available 24 hours per day and without the addition of overbearing sales people.

Banking and access to financial information will also be available through a home computer or interactive television hook up to a network of services. Users will be able to pay bills, transfer between accounts, query accounts, manage investment portfolios, and receive stock market quotations through a single terminal. Detailed services will include:

- Banking done at home. Anytime, in fact, almost anywhere, depending on the type of terminal required. Means fewer trips to the bank.

- Future services will allow other banking from home - RSP's, bonds, mutual funds, mortgages, loans, etc., through interactive videoconferencing.

- Banks will provide interactive/on-line educational services about their products and services. Trips to the bank will be lessened even further.

Another service for the home user related to teleshopping will involve Real Estate, and will allow a broader user base. It will allow potential sellers or buyers to have information for which they would normally have to hire a real estate agent. Users will save time touring neighbourhoods, scanning through multiple listing books, which are already out of date by the time they are printed, and do some "homework" before taking the big step of contacting an agent to view properties for sale or to list their own home for sale.

FAX communications will also become more prevalent in homes. The need for home FAX will become greater as more consumer-oriented transactions become possible. Already, registration for evening courses, "mail order" merchandise orders, and getting messages through to busy office locations provide some justification for home FAX capabilities. As the trend toward more "working at home" continues, the associated necessity of home FAX capabilities will grow. Coupled with these developments is the merging of E-mail and FAX, as personal computers become more common in homes. With appropriate software applications and FAX modems becoming less expensive and more useful, the FAX concept will continue to evolve toward more electronic media, rather than the original FAX hardcopy on paper idea.

A new brand of interactive media services will also be available. Initially, it could provide a new form of news services as simple as receiving a newspaper in an electronic format, rather than in printed copy. Later, this service could give users full interactive access to news networks via their home computer or an interactive television network. This would allow users to scan news headings and select the headings on which they wish to see more information. News information would be provided in full multimedia format, providing text, audio and full motion video.

Related services such as video-on-demand and pay-per-view will provide an expanded choice of packaged news, information and entertainment services individualized to users or on demand. Examples of program delivery are an on-screen catalogue of movies or television series. Users will be able to select the program they wish to watch and have it begin at their convenience. This would be virtually the same as having a fully stocked video library in their living rooms. As well as movies, regular television series would be available, with brief capsule descriptions to allow viewers to make their choice.

Users will also find new services available in their own cars. Intelligent vehicle highway systems (IVHS) will allow vehicles to receive information on traffic congestion, road conditions, or position/navigation services. The same technology could be used to determine the use of highways by vehicles for the purpose of charging toll fees. The potential application areas will be travel advisory, fleet management, traffic management, mobile office (extension of office capability into the vehicle), occupant activities (increase enjoyment, provide access to a vast activity library) and vehicle control.

IVHS will provide principally information for drivers and control for operators of transportation systems (from a social point of view). Devices will be owned by drivers and systems will be operated by transportation agencies. The first steps will be to monitor traffic flow, spot tie-ups, adjust traffic control lights and tell drivers of alternate routes. Second stage systems will allow vehicles to travel in tighter bunches, with fewer accidents.

Personal monitors and telemetry will also change significantly how we deal with family members requiring closer supervision.

The aging trend in societal demographics in Canada also creates a growing need for personal monitoring. Relatives may be more likely to let older people remain at home, by themselves, if they feel that personal monitoring will bring timely aid to the older person as required.

With advances in biomedicine providing more opportunities for direct, continuous monitoring of problematic health conditions, the need for wireless personal devices to provide telemetry of this information is increasing.

13.3 The Business/Government Market

Next to the telephone, the FAX has become the single most important business communication tool. FAX has grown from an esoteric novelty to a key business communication tool within a very short time. The need to rapidly send a visual image has driven this growth. This is the same need that is driving the expectations for full motion video communications, and very high resolution static image transfer. The evolution of FAX toward better meeting users' needs for image communication is likely to incorporate more electronic media, and could become a portion of the multimedia communications services of the future. Dedicated FAX machines are likely to be displaced by telecommunications-equipped photocopiers and personal computers

running multimedia applications. The need is for easy-to-understand user interfaces, and inter-operability with other applications, such as word processors, E-mail, and desktop publishing.

Business relations and travel patterns will undergo a change with the growing use of videoconferencing. Some of the advantages of videoconferencing in a business environment will be:

- Better interaction between company units, faster decision making, and substantial cost savings;
- Displaced travel costs - videoconference meetings save on the time and expense of travelling to remote meetings;
- Increased effectiveness, achieved by having all necessary participants "present" at meetings, rather than only those who could make the trip; and
- Facilitation of teamwork amongst people who would otherwise never have met face-to-face.

Further advantages will be gained when videoconferencing systems begin to allow integration of data and full motion, high quality video.

One of the tools that could revolutionize the day-to-day routine of how we manage time and information will be the Personal Digital Assistant or PDA. The PDA is based on advanced electronic hardware and sophisticated software in a portable package. Future PDA's will be successors to the general pen-based computer and the high-end pocket organizer.

Today's PDA's are able to recognize printed handwriting and graphics drawn onto its screen, organize the information, and communicate it to others. Upgrades to a PDA, using plug-in "smart" or memory cards will convert a PDA into a reference library, a travel navigator, a language translator, a receiver for paging type messages, or an electronic copy of War and Peace.

Communications with computer networks will be accomplished at first by a wired connection, but advanced technology will allow wireless communication, although coverage may not be ubiquitous within a ten year time frame. PDA's will also have a built-in facsimile and data modem, allowing it to receive electronic information from almost anywhere in the world.

Future personal digital assistants will likely incorporate a voice recognition capability so that it responds to a user's voice commands. The PDA will take notes, receive and deliver messages and answer requests for information by speaking to the user. The PDA will provide

a capability to conduct data retrieval from remote databases without complicated instructions from the user.

In the future, the PDA will also be able to accept or reject electronic mail and act on mail, depending on its requirements. It could pay bills or re-direct them (i.e. re-direct property tax bill to the bank for payment from a tax account). With a link to a banking system, the agent will be able to ensure sufficient funds existed in an account to cover a payment and transfer funds from another account, if necessary.

The PDA will allow personalization of communication services through automatic messaging, screening and routing of calls and prioritizing of information. Users could program the calls they want to receive or reject, based on properties of the incoming call, time of day, etc. Video conferencing services could be set up so that certain calls are screened or redirected, or that only audio is provided to certain callers.

Using PDAs, businesses will hold meetings differently. Each person will have a note taking PDA. Information will be downloaded into it through a wireless in-building system. In the boardroom, discussion materials will be downloaded into each person's PDA. Full videoconferencing will be available on the PDA, wired into the room, but wireless into the PDA.

Personal wireless communicators will also change our telephone habits. Wireless voice communication is currently the highest profile service in wireless communication. It allows people to have voice communication through a hand held telephone from anywhere within a given range. Cellular service allows conversations to be held in fast moving vehicles. Personal Communication Service will allow users to send and receive calls from pocket-sized telephones whenever they are within 150 to 200 meters from a "base station". Base stations will be placed in public places such as shopping malls, city intersections and airports. Users will have two-way communication capability at home, at work and at public locations using the same telephone set.

The future outlook for PCS is ubiquitous coverage. Using satellite technology, service will be "anyone, anytime, anywhere in the world".

One particular feature in personal communicators will allow users to easily transmit an emergency signal and location in the event of an emergency. The system will likely be part of a personal communication system which would have emergency alert and location as a special feature.

Wireless data communication is the communication of electronic information (fax, data, text) between two devices which have no wired connection between them. Future wireless data

communication will allow mobile and remote users to have wireless access to their office computer networks, their home computer, banking and financial services to which they subscribe, etc. Development in specialized terminal technology will allow users to perform stock market transactions while sitting on their boat in the middle of Lake Superior or transfer data files to their head office in Vancouver while flying from Toronto to Halifax. Future FAX will allow users to query a FAX database, such as a real estate agent sending in a request from their car FAX to their main office to FAX details to them on a specific property.

Video telephone communications will evolve from the current cellular telephone system and the videophones which have recently been developed by AT&T. These will allow users to see a full motion image of the person with whom they are speaking across a wireless network.

13.4 The Institutional Market: Education, Health Care

A major impact of telecommunications on the education sector will be in the form of new capabilities to deliver distance education. Future distance education will allow students to have more realism and more focus on specific tasks, communicated through visually rich learning materials. Two way video, combined with information transfer between terminals will allow the students to actually see the instructor and respond through the terminal to instructions.

Distance learning allows a maximum number of participants to learn new information and techniques at a very cost efficient rate, since one instructor can reach many locations without the added effort of travel time, both for the instructor and the participant.

Changes which are expected to be seen in the school systems include:

- Teachers will be facilitators, coordinators, managers of learning.
- Students will become more independent, self-directed learners.
- School/learning hours will be more flexible - schools will open earlier in the morning and stay open later at night.
- School resources will be available as never before, through electronic means.
- The concept of life long learning will become even more apparent - distance education will benefit continuing education programs and more people will use them because technology will allow them to be reached with the same resources. Flexibility will appeal to continuing education users.

- Home learning will supplement what is learned in class, packaged multimedia sessions will be accessible, but will require support from educators and will not be stand alone.

Videoconferencing will offer advantages in both education and health, which are similar to those already mentioned above. Medical teams will use video conference for discussing patient issues, and increasing the people involved in diagnosis. *Telemedicine* involves the transmission of heart and breathing sounds, patient images, bacteria and tissue slides, X-rays, and electrocardiograms over distances. With this type of information available, face-to-face, remote diagnosis will become possible between physicians as doctors at remote sites examine patients and, at the same time, interact with specialists. Interactive video, consulting and diagnostic services, electronic medical records and continuing education are other applications of this technology.

Personal monitors and medical telemetry will gain new grounds. A personal monitor is an alarm and location device which alerts services (police, health, etc.) that the person carrying the device needs assistance should a predetermined event occur i.e. a fall or no movement for long periods of time. A medical telemetry system is a system which monitors and transmits indications of a person's physical condition (i.e. heart rate, blood pressure, etc.) to a medical centre which monitors the transmissions and alerts an attendant in the case of emergency.

Personal monitors do not currently have medical telemetry systems and it is often the case where it takes an active movement (i.e. pushing a button) on the part of the user to activate the alert. Telemetry systems could continuously monitor individuals from a remote location and determine if an emergency occurs.

A nursing home will use personal monitoring with personal locator capabilities to ensure that residents that are subject to confusion and disorientation could be rapidly located if they wander away from the institution. Hospitals will use continuous monitoring of critical conditions, or vital signs, implemented through wireless access to allow mobility of the patients. Such functionalities may be combined with other applications, such as a wireless patient chart.

14.

Overall Market Assessment

Assessing the market for all new telecommunication products and services depends among other factors on how the market is defined in terms of segments and services. There are three major market components which will generate significant sales:

1. Sales of the terminal hardware/software at the user end point, eg. the enhanced video terminal, the PC-based multi-media interactive terminal, the mobile personal communicator, or the HDTV wall screen.

2. Sales resulting from the service fees to cover network connections, and usage. This would be analogous to the basic telephone connection fee, and other fees such as long distance fees charged by telephone utilities. In some cities, eg New York, subscribers are now charged for local calls. Users would pay for a hook-up to a broadband network, as well as for the use of a channel for a specific interactive session: video on demand, a videoconference, or a teleshopping expedition. These fees should be sufficient to provide an adequate return on investment for the investors in the network infrastructure. What is clear from the preceeding chapters is the commonality in infrastructure requirements. Many of the applications in this report will need to use the same kind of network capability: broadband, fibre, etc. A key issue will be to determine the relative allocation of these infrastructures to each application.

3. Lastly, sales resulting from the use, rental, or access to special programs, databases, video entertainment, or educational sessions. This would cover the *content* of the information or entertainment base which users will be buying. These fees should be adequate to provide a return to the producers, directors, collectors, librarians, etc. that package the information in the first place.

It is expected that the revenues generated from the second (network fees) and third (program fees) market categories will significantly outweigh the first (terminal hardware/software).

For the scope of the study, however, we will focus primarily on the first category, namely the most likely hardware/software combinations, and provide a range of likely market size.

14.1 Home Market

SERVICES		HARDWARE/SOFTWARE		
Service Type	Mkt.Size	PC-plat.	Enh. TV	Wireless
Teleshopping	H	●	○	
Distance Education	M	●	○	
PDA	M			●
FAX	H	●	○	
Videoconference Videophone	H	●	○	
HDTV	M		●	
Interactive Media	V.H.	●	○	
Wireless (voice)	M			●
IVHS	L			●
Medical Telemetry	L			●

Legend: Service market penetration: V.H. = >75%; H = 50-75%; M = 25-50%; L = < 25%.
Hardware/software application: ● = high level of interaction, flexibility, control;
○ = limited interaction, flexibility or control.

The table above shows how the various services to the home are likely to be served by general types of hardware/software terminals. The level of market penetration for each service, is based on data collected in the preceding chapters, as synthesized by the project team.

We see the home market served essentially by three broad categories of hardware/software terminals.

1. PC-based platforms

At the high end, there is likely to be a PC-based platform or terminal, with a full multi-media capability, videophone, voice recognition, stylus input, digital interface with ISDN network, etc. This is a reasonable forecast, since today, fax modem/voicemail cards are available for $400 including software, and the price of an NTSC videocards (allowing a PC screen to display a full motion TV broadcast signal) can be $600 with software.

Having all multimedia services available on a PC is a reasonable assumption. This would include such interactive services as teleshopping, banking, and other home transactions; fax, videoconferencing (or more likely from the home videophone), and all other interactive multimedia services.

We assume that such a terminal might cost $1500 at the low end, up to $4000 for a fully loaded system, for an average cost of $3200. We further assume that in 2003, 20 to 30% of households will have such a terminal, which is comparable to the penetration of ordinary PC terminals today. For 10 million Canadian households, this will generate a cumulative market of $6 to $10 billion in 2003.

2. Enhanced video terminal

A second piece of equipment will be the enhanced video terminal, similar to today's television set, but with an enhanced "remote control", with limited user interaction. It would be ideal for interactive media and video-on-demand, some teleshopping, and distance education. It could display faxes, and might even serve as a videophone. It is referred to as an agile terminal, without any of the sophisticated interaction and user interface that a PC terminal can provide. These terminals will be less costly, and will accordingly enjoy a much higher market penetration.

Assuming a cost of $400 per unit, and a 50 - 90% market penetration, with 10 million Canadian households, this would generate a cumulative market of $2 to $4 billion. We further assume that this market would also include those households with the high-end terminal, since it is likely that there will be more than one terminal in each household.

3. Wireless devices

The wireless category will focus primarily on voice communications. However, given the personal nature of the service, it is impossible in the scope of the study to distinguish between business and home applications. For short distance Personal Communication Service, estimates for the number of units sold in Canada by 2003 have varied from 2 to 10 million. Units could cost in the range of $50 to $100; and cellular terminals will likely be around $250 to $300, for an average unit price of $125. This would generate a total cumulative market of $300 million to $1.2 billion, by 2003.

For medical telemetry, a subset of personal wireless communications, no reliable data was found. Personal terminals can vary in price from $100 for a simple emergency call button on a PCS, to a full multi-functional metabolic monitoring system, including EEG, EKG, defibrillators, etc., worth over $200,000.

14.2 Business Market

The business market can be analyzed in a similar way to the domestic market, in that it will be served by three broad types of terminal: PC-platform workstations with integrated multimedia capability, providing electronic ordering, banking (the business version of teleshopping), fax, desk-top videophone, and other forms of interactive information access; non-desk top video terminals, especially for group videoconferencing, distance education, and interactive media, all of which could be hooked up to HDTV screens; and wireless.

SERVICES		HARDWARE/SOFTWARE		
Service Type	**Mkt.Size**	**PC-plat.**	**Video**	**Wireless**
Teleshopping	M	●		
Distance Education	H	●	●	
PDA	M			●
FAX	V.H	●		
Videoconference Videophone	V.H	●	●	
HDTV	M		●	
Interactive Media	V.H.	●	●	
Wireless (voice)	V.H.			●
IVHS	L			●
Medical Telemetry	L			n/a

Legend: Service market penetration: V.H. = >75%; H = 50-75%; M = 25-50%; L = < 25%.
Hardware/software application: ● = high level of interaction, flexibility, control;
○ = limited interaction, flexibility or control.

1. PC-platforms

There is no reliable data for the number of PCs which will be bought by business by 2003; we estimate between 5 and 10 million units will be sold over the next ten years. Assuming an average cost of a multimedia, fully loaded terminal as described above at $3800, this would represent a cumulative market of $2 to 4 billion.

2. Video system

For business video capability, the market for non-desk-top video systems, which can serve as nodes for videoconferencing, was estimated at $700 million annually in the US, for 1996 (ISDN News, the Yankee Group 1992). This would be equivalent to $70 million in Canada for that year, or $700 million over ten years by 2003.

Wireless was discussed in the previous section.

14.3 Institutional Market: Education, Health Care

SERVICES	
Service Type	**Mkt.Size**
Teleshopping	L
Distance Education	V.H
PDA	H
FAX	V.H
Videoconference Videophone	V.H
HDTV	M
Interactive Media	V.H.
Wireless (voice)	L
IVHS	L
Medical Telemetry	V.H.

Legend: Service market penetration: V.H. = >75%; H = 50-75%; M = 25-50%; L = < 25%.

Little reliable data was found on actual markets for equipment in the institutional market.

Some basic assumptions can be made, however, both in the educational and health sectors, which can provide a theoretical reference point.

1. Education

In 1989, according to Statistics Canada, there were 5.8 million students, 5 million elementary and secondary school students, 817,000 post secondary student. Total spending on education in 1988-89 was close to $41 billion. Assuming an average of 25 students per classroom, this comes to 230,000 classrooms. Placing one videoconferencing unit in each classroom at $10,000 would create a potential market of $2 billion over the next ten years.

In 1988, there were approximately 1250 hospitals in Canada. For full video conferencing in each hospital for image transfer and training, assuming one unit per hospital at $10,000, would provide a market of $12 million. Assuming that 10% of these hospitals provide a remote medical service, which would require an enhanced multimedia terminal at $25,000, this would provide a theoretical market of $3 million.