COMMUNICATING IN VERMONT

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The Vermont Business Roundtable is a non-profit, non-partisan organization of 120 chief executive officers representing geographic diversity and all major sectors of the Vermont economy. The Roundtable is committed to sustaining a sound economy and preserving Vermont's unique quality of life by studying and making recommendations on statewide public policy issues.

COMMUNICATING IN VERMONT

Communicating - giving and receiving information - is an important part of our lives. We write letters, meet with people, make phone calls, watch TV and read books, magazines, and newspapers. In addition, many of us have broadened our ability to communicate through the use of electronic mail, electronic access to information including the Internet, electronic access to business, education, health care, government, banking, and much more. Vermonters, determined not to be left behind in the global information age, have embraced new ways to use telecommunications networks.

Now more than ever, we depend on advanced telecommunications networks for our social and economic well-being, *but how much do we know about them?* It's worth understanding some basics about how telecommunications networks support the many ways we communicate; this will help create public policy that attracts the type of telecon-ununications investment needed to keep Vermont competitive.

How much network do we use?

The telephone network was initially developed to carry voice communications. Today, carrying this kind of information is quite simple when compared to the challenges and demands of data, computers, and video transmission. The **amount of information** we transmit or receive, the **speed** at which we want the information to travel across the network, and how much **time** we plan to spend on the network are all important components of using a network. Network *providers* take this into account when building their networks, while network *users* take this into account when deciding which technology to purchase. More than two million voice and data calls are completed in Vermont every day.

When we make a voice phone call, we deliver short bursts of conversation. For example, a simple sentence like *"How are you John?"* contains 17 characters of information. With a two second pause waiting for a response, the total time to transmit

the question is approximately four seconds. Voice calls transmit an average of four characters per second - they don't require much information, speed, or time.

The transmission of data (computer data, taxes, images, video) requires more network capacity than voice calls. The network technology determines the speed at which the information can travel and therefore the amount of time spent on the network. It's a bit like filling a swimming pool. If the water is the data and the amount of information is the amount of water needed to fill the pool, then the technology that you choose (garden hose vs. fire hose vs. opening up the fire hydrant) determines the speed at which the water can travel and how much time you will spend filling the pool. A garden hose may be fine if you've got a kiddy pool to fill, a fire hose will be better for your in-ground pool, but an Olympic-sized pool will be more efficiently filled by opening up the fire hydrant.

Here are some comparisons:

Application	**Data Reguirements**
voice	4 characters/second
9,600 baud modem	1,000 characters/second
14,400 baud modem	1,400 characters/second
33,600 baud modem	3,300 characters/second
video (1.5 meg)	150,000 characters/second

The difference in data requirements helps to explain why there are different telecommunications products from which to choose, from plain old telephone service over a copper wire to a T3 circuit over fiber optic cable, with many variations (including ISDN, TI circuits, coaxial cable, satellite transmission, cellular service, and more) in between.

The Information Superhighway analogy is a good one, because telecommunications traffic needs room to travel, just like cars. If we say a voice call requires a two-lane road for a conversation going between two parties, then a TV-quality interactive video transmission would require a 24-lane highway. Trying to get TV-quality interactive video transmission over one twisted pair of copper wires would be like trying to fit rush hour traffic from the Los Angeles Freeway onto I-89.

Application	**Roadway** Lanes **Reguired**
voice	2-lane road
9,600 baud	2-lane road
28,800 baud	3 -lane road
56,000 baud	4-lane highway
minor video	6-lane highway
major video	16-lane highway
TV quality	244ane highway

Network *users* must determine the right capacity for their application and purchase the telecommunications products and services that best match their needs. Network *providers,* like those who build our roads and highways, must determine communications traffic flows -- which applications are being used where, what time of day and for how long. They then plan and build their networks accordingly.

Planning for future network capacity has become increasingly challenging to network providers as our use of the network changes. For example, business phone calls last just under four minutes on average. Residential phone calls average 15 minutes. Networks have been built based on that average usage. But the relatively new phenomenon, calls to the Internet *averaging* more than 60 minutes, has created more demand for network capacity than network planners originally envisioned, requiring greater capital investment from network providers.

How are we **using the network?**

Vermont has done a good job attracting capital investment from many telecommunications network providers by demonstrating its sophisticated use of advanced telecommunications products and services. More than $1 billion is currently invested in Vermont's communications networks (wireless and wireline). By helping network providers understand that Vermont is an attractive market for them, we will be more likely to attract the necessary capital investment needed for our networks to keep up with our growing use of and dependency on telecommunications. Let's take a look at how Vermont's networks are being used today.

Video Applications

The demand for video is growing at an astounding rate. Business, government, health care, and education leaders have all recognized and capitalized on the value of video conference meetings. A sampling of how interactive video is being used in Vermont includes:

- Fletcher Allen Health Care has video conferencing with hospitals and medical practitioners in several Vermont communities. Their state-of-the-art system enables doctors to consult with one another on patient cases, allows patients to have a consultation with a specialist without traveling from their region of the state, even makes it possible for a patient to receive a second opinion without having to undergo a medical procedure for a second time.

- The University of Vermont, Vermont Technical College, Champlain College and some area high schools have expanded their reach by establishing distance learning networks across the state. Students can actively participate in courses at these campuses from video conferencing facilities nearer their homes.

- Vermont Interactive Television provides statewide video conferencing capabilities that are used for a wide variety of purposes including distance learning, business meetings, public hearings, discussion of government policy and more. VIT's video conferencing can also hook into video conferencing networks worldwide.

- Proximity offers video conferencing facilities at the Radisson Hotel in Burlington. Travelers visiting Vermont have used the facilities to participate in business meetings in another part of the country or the world without cutting their vacation short. Local businesses have used them to save on the expense of airfare to another location. Attorneys have taken depositions without the need for extensive travel. The possibilities are endless.

- Ben & Jerry's is one of dozens of businesses using video conferencing between their own locations to save the time and money associated with traveling.

- Resolution, Inc. has near term plans to do remote video editing over triple ISDN lines.

- Using ISDN lines, Governor Dean was able to participate in an important conference in Washington D.C. without leaving his office in Vermont.

How video conferencing works on the network depends on the demands for picture quality. It is far more important for a hospital to have crystal clear full motion video when examining patients than is needed for Ben & Jerry's internal business meeting.

Many of these applications, for example Vermont Interactive Television and Ben & Jerry's, use high-capacity phone lines hard-wired from one of their video conferencing locations to another. Commonly used technologies for this type of transmission include T3, TI, 56K and other high-capacity, digital, dedicated phone lines. This "point-to-point" service is available anywhere in Vermont.

Others prefer to be able to dial up a video conferencing location without having to have a dedicated wire between the two locations, just as a regular telephone call doesn't have a direct wire between two locations but rather routes through a larger network of cables and wires. Fletcher Allen Health Care and Proximity are examples of video conferencing applications that use the public switched network. The most common technology used for this type of video is ISDN (Integrated Services Digital Network), a high-capacity digital transmission that works on the public switched network. While this service is available in many parts of Vermont, it is dependent on being within a certain range of a telephone central office.

Video applications can be served today through a local telco network and/or a combination of the local network and an interstate telco provider such as AT&T, MCI, Sprint, Frontier or other major telco vendors. Cost is based on:

1. Transmission speed of the data (baud rate)

2. Desired quality of the picture
3. Distance between the points of transmission
4. Duration of use

The day of a video phone in each home is not yet here. The hardware is still expensive and the voice network isn't designed to support full deployment of this application. As more and more fiber is deployed at the local levels, a digital telco network is being developed. As hardware costs drop and become less demanding on the telephone networks, video phones will become a reality.

Computer Applications

Bigger, better, faster, more! Computers and their users crave more speed each day. As highly sophisticated graphics-intensive programs are developed to create dazzling artistry on the screen, the need for faster computers, modems, and transmission increases. With the increased popularity of the Internet and the ability to transfer larger data files more quickly for less money, thanks to improved technology, nearly every sector of the business, education, health care, and government communities use computers to supply and receive information through the network. While a regular telephone line can handle data calls using modems, the demand for high-speed computer connectivity over high-capacity phone lines is increasing in Vermont.

For example, kids from preschool through high school and beyond are using the Internet and other on line services to learn in new and exciting ways. Dairy farmers use their computers to hook into agricultural databases across the country. Vermont Public Radio moves studio quality sound around the state and The Lane Press, Inc. moves full color images across the country via ISDN lines. There are hundreds of examples -- here are just a few more:

· Banks are using private high speed networks to interconnect the banking requirements of each branch back to the main office.

· Small businesses can purchase private telco lines engineered to handle only computer conversations. These networks are often point-to-point but an increased number of businesses are using dial-up data network technology like ISDN that routes their computer transmission along a digital path on the public switched network.

· Retail operations are using private networks to connect their computers in an effort to manage inventories within each store. This solution can allow stores to find items they need in other branch stores thereby meeting the demands of customers and increasing sales and profits along with improved inventory management.

· Individual and/or residential users can connect to the Internet using higher speeds of transmissions up to 28,800 baud using the local network and a local call to a specialized

Internet provider, but more Internet users are choosing ISDN for faster, higher quality web-browsing.

Several methods of connectivity exist for computer needs. The *amount of data* we transmit or receive, the *speed* at which we want the information to travel across the network, and how much *time* we plan to spend on the network are all factors in computer connectivity decisions.

Plain old telephone service using a modem often suffices for home users or businesses with minimal data to transfer or receive. The next step up is usually ISDN, a high-speed digital service that allows more data to be moved more quickly over the public switched network. The only requirement is that both ends of the connection must be ISDN. (If I have ISDN and the other end has a standard telco line, it is like pouring all that "rush-hour" traffic from a six-lane highway onto a one-lane exit ramp.)

Internet providers are setting up high speed computer networks. There are several providers throughout Vermont. National and international providers such as Prodigy, America On Line, Microsoft Network, and CompuServe are expanding connectivity and speeds of their networks. These companies however, set up and improve their network nodes dependent on population to recapture the costs of the network set-up charges.

Several companies are setting up data switching networks. These networks are often called "Frame Relay" networks. Frame Relay provides the opportunity to set up a private intra-company network exactly like the retail example provided above. It's an easier and sometimes less expensive method of connectivity between multiple computers.

Service Accessories

In addition to phone line connectivity, additional service accessories are being developed at a rapid rate. Telephone companies often refer to these services as "value added" services. Telephone companies must invest heavily in additional software for their switches to make many of these services available. By mid 1997, Vermont's switches will be 100% digital. Following is a list that highlights many services offered in Vermont today:

- Call Answering services (voice mail) are similar to answering machines but will answer a caller even when the line that was called is in use, which an answering machine can't do. Call Answering services provide excellent remote "check-in" options and even allow for call forwarding to remote locations, pagers, fax machines, and fax mail systems. People temporarily in shelters in Burlington (Burlington Emergency Shelter and COTS) have enhanced their ability to find employment by having Call Answering, not the shelter, answer the phone calls of prospective employers.

- Call forwarding re-routes your calls to any telephone number including cellular phones or 800 service numbers.

- Voice recording services allow you to record with your own voice a message to callers when you've changed phone numbers for any reason.

- Voice prompted automatic call distribution services allow you to distribute calls based on the type of call (e.g. I=sales, 2=customer service, 3=repair, 4=switchboard).

- Additional convenient features are provided such as Call Trace, Call Waiting, Call Return, Caller ID, Speed Dialing, Ring Mate, and Repeat Dial.

- Centrex service allows you to use the telco's switching network rather than buying your own PBX phone system. The benefits can often outweigh the cost of a new telephone system while employing the continued improvements and growing features of the telco's switching platform.

- Conference calling services now incorporate both operator-assisted conference calling, 800 meet-me conference calling, and one-way or broadcast conference calling.

- Departmental or Account Coding of calls is a feature that provides businesses the ability to receive monthly billing by caller, department, or client. The benefits are:
  - Provides accounting for call volume by internal department
  - Allows telemarketing managers to review outbound calls by person
  - Allows lawyers and accountants to identify calls by client (the monthly bill reports toll calls and phone time for billing clients)

- Allows real estate offices to provide monthly billing of toll calls to independent brokers
- Provides a method of billing employees for personal calls
- Provides a security lock on the phone system (if you don't have a code, you can't make a toll call).

- No answer transfer for inbound 800 callers allows 800 calls to be transferred to a second destination in the event of four rings and no answer.

- Percent allocation of inbound 800 calls provides large telemarketing operations with an option of dividing certain percentages of calls to multiple call answer centers.

- Broadcast fax is now available whereby a single document can be taxed to a single center with a listing of numbers for final fax destinations. Companies are using this feature in place of mailings. Think of the improved communications for stock brokers and investment brokers. They can now fax important and late breaking news to their clients as often as necessary.

· Pre-paid calling cards are now available throughout Vermont. They are usually sold in denominations of $5, $10, $20 and $50.

Cellular Communications

In the late 80's Vermont was first introduced to the world of cellular telephone access. The first network was built by Contel Cellular with a highly limited network. The public's desire and strong demand grew faster than the network capability.

Today, Vermont enjoys the choice of two elaborate cellular networks offered by two highly respected and competitive cellular network providers, Bell Atlantic NYNEX Mobile and Atlantic Cellular. Unlike the late 80's when a cellular phone cost $400 and worked only in Burlington, today anyone can have a cellular phone free with a twelve month commitment to the service, and cellular phones work within 80% of Vermont. This elaborate network has evolved rapidly (eight years) when compared to other network providers and services. The achievement of this fantastic service in such a short period is now highly appreciated by an estimated 100,000 cellular users within Vermont (an estimated 25% of the population).

Significant improvements are still being established by both companies. The list of applications for cellular phones continues to grow.

· Today, from your car or your favorite restaurant, with a cellular phone you can:

· Receive a phone call
· Initiate a phone call
· Send or receive a fax
· Receive voice mail
· Send or receive data via your computer

· Today, Vermont field sales reps have improved sales and profits for their companies. They can increase their effectiveness by:
· Calling clients or prospects while on the road
· Receiving emergency customer calls while on the move
· Setting appointments while on the move
· Uploading their orders to the home office

· Busy executives increase their effectiveness while driving on long trips

· Individual users enjoy the security a cellular phone provides for those unexpected emergencies while traveling across snow covered roads.

· Boaters, hunters, hikers, and campers are using cellular phones for security.

There is ' no end in sight to the growing demands of Vermont business and residential users. And the cellular companies are eager to grow and build their networks to meet the demands as both companies move toward providing stronger cellular coverage throughout 100% of Vermont.

One year ago, you needed a strong three-watt cellular phone to have satisfactory service. Today, a hand-held cellular phone the size of a calculator will work with a high level of satisfaction within 70% of the state. It is estimated that within six months that same phone will work within 100% of Vermont if the cellular companies receive the cooperation they need from towns for expanded cell site requirements.

Do we know what it costs?

Billing Services

Vermont businesses have a host of services being offered from all telco providers. Here is a list of such services and information on how a business can use these services:

· Monthly billing can now be delivered on CD ROM or diskette. This allows a business to evaluate their own billing data.

· Special computer software is available from long distance carriers allowing users access to "ready-to-go" evaluation reports. These reports sort data up to 80 different ways. These reports include such information as:
· Outbound calls generated by time of day
· Top 20 area codes dialed
· Top 20 exchanges dialed
· Call volume by department
· Call volume by employee or telephone number
· Inbound 800 call volume by time of day
· Inbound 800 call volume that received busy signals
· Inbound 800 call ID of callers who couldn't get through for call back
· Inbound 800 mapping of volume by area code, zip code, or ad evaluation
· Traffic reporting for internal network evaluation

· Billing can also be transn-dtted via phone modems.

· Several monthly printed call reports are also available for analysis.

In Summary

Vermonters are exercising their well-known ingenuity to find new and innovative uses for the network. There is no reason to believe that this talent will do anything other than accelerate. The availability and increasing versatility of the network is spurring many new forms of creative endeavor such as desktop publishing, new entrepreneurial

businesses, services and applications that were not envisaged a decade ago. For almost two years, the Vermont Business Roundtable has been taking an active role in understanding and improving the dialogue surrounding the rapid changes in telecommunications technology and applications. After gaining a comprehensive understanding of the wide array of applications that are available, the Roundtable Telecommunications Task Force was then able to more fully understand and explain the technology and its strategic importance and value.

The challenge will be to see that market growth is met with commensurate network growth and investment. Vermont is committed to a public network built with private funds. Traditional pricing structures resulting from negotiated tradeoffs and social ratemaking under years of regulation were summarily eliminated by the Telecommunications Act of 1996. Prices in a highly competitive market must now reflect costs. This means that regulatory perks such as highpriced toll and low-priced local service which was not a problem in the past may go away as the information-hungry Internet users get on and stay on for hours at a clip consuming both network capacity and bandwidth.

One challenge will be to balance the interests of consumers, institutions, and business users on one side, and providers and telecommunications investors on the other.

Another challenge will be to educate ourselves about the myriad of applications emerging for telecommunications and information technology in our homes, communities, institutions, and businesses. Vermonters are a self-sufficient lot even in a connected society. One model under exploration is the idea of developing a virtual community wherein Vermonters from all backgrounds can gather and share information on the use and benefits of telecommunications technology. This is an idea promulgated by the Public Service Department and the Public Service Board in partnership with the Vermont Business Roundtable.

GLOSSARY OF TERMS

56K Digital Line: A private, dedicated digital line that transmits voice or data at 56 Kbps.

Baud/Baud Rate: Baud rate is a unit of signaling speed in data communications. The speed in baud is the number of times per second a signal is altered from analog voice signals (sound waves) to digital signals for the computer (a binary system that understands only two states - on and off) or from digital to analog.

Baud Modem: A modem (modulator/demodulator) is the computer equipment that allows analog voice signals to be translated into digital signals for the computer. Modems are generally sold based on how quickly (which band rate) they can translate those signals.

CD-ROM: Short for Compact Disc-Read Only Memory, CD-ROM is a disc that contains data. An alternative to magnetic tapes and floppy discs, CD-ROMs have even greater storage capacity - for example, an entire encyclopedia can be stored and accessed from one CD-ROM.

Characters of Information: Each letter, space, number, special character (e.g., bullets, trade marks, etc.) and punctuation mark represents a character of information, so in the sentence *How are you John?* there are 13 letters, three spaces, and one 4uestion mark for a total of 17 characters of information.

Coaxial Cable: A widely used type of cable that consists of a central metal conductor surrounded by an insulating material that is in turn wrapped by a second conductor, the whole encased in an insulating sheath. It is used especially in cable television networks for carrying video due to its wide bandwidth. (Bandwidth is the relative range of frequencies that can be passed without distortion by a transmission medium. The greater the bandwidth, the greater is the information carrying capacity of the transmission medium.)

Frame Relay: A digital packet switching service that provides high-speed lines to multiple locations within an organization (such as a bank that needs data connections with and between all its branch offices). Packet switching is a digital data transmission method that divides data into standard-sized pieces, called packets, that have addresses and can be transported across a network to the right location quickly and efficiently. (Other private digital services transmit data between two points but cannot select from among several points for data delivery)

ISDN: Short for Integrated Services Digital Network, ISDN is a high-speed (128 Kbps - thousands of bits per second) digital service that uses the public switched telephone network to provide end-to-end digital connectivity for simultaneous transmission of voice and/or data.

Minor/Major Quality Video: While not technical terms, these descriptions of video quality represent the range of clarity and smoothness of movement that can be achieved over video conferencing, computer or television equipment. Minor video sends fewer frames per second which makes the person being viewed appear to have jerky movements with a delay between when he speaks and when the viewer hears the voice. Major video sends enough frames per second to allow the movements of the person being viewed to be smoother and her voice to match her speaking, but the sharpness of the images and movements are TV quality.

Network Capacity: The total number of telephone transactions (voice calls, data calls, taxes, video calls, etc.) that can be accommodated on the telephone network represents the network capacity. Each call uses a portion of the total network capacity. In a simplistic example, if a telephone network has enough telephone wires, cables, and switches to handle 1000 voice calls, each voice call uses 1/1000 *Ih* of the total network

capacity, each data call using a 9,600 baud modem would use 250/1000ths (one quarter) of the total network capacity and so on (see page 2).

Network Node: Locations across the country that information service providers (like America **Oif** Line, CompuServe, and others) establish for subscribers to call to connect with their services. Each node can have hundreds of telephone lines connecting to huge banks of equipment that is compatible with the computer modems or ISDN equipment that their subscribers will be using.

PBX: Short for Private Branch Exchange, a PBX is a piece of equipment installed on the user's premises that functions as a switch and permits a user to receive incoming calls, to dial any other telephone on the premises, to access an outside trunk to the public switched network or to another PBX. In addition, PBXs offer a wide variety of call-control and call-accounting features.

T-1: AT-1 is a digital circuit that transmits voice or data at 1.544 Mbps (millions of bits per second). Short for binary digit, a bit is the smallest unit of digital information used by electronic information processing. Most digital circuits are private dedicated lines between two locations rather than being part of the public switched network where any caller can be switched to any one of the millions of telephones around the world.

T-3: A T-3 is a digital circuit that transmits voice or data at 44.6 Mbps.

Telco Network: Short for telephone company network, generally referring to the public switched network and private digital lines and circuits that telephone companies own and operate to provide services for their customers.

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