Vermont Telecommunications Plan

SEPTEMBER 2004

Department of Public Service

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Preface

This edition of the *Vermont Telecommunications Plan* is a milestone in a process that began more than two years ago. It is a process that has tapped the knowledge, opinion, ideas, and critical thinking of hundreds of people who represent themselves or one of a wide range of organizations. Although this draft represents the voice of the Public Service Department (PSD) and not any particular participant in the input process, the contributions of all who assisted the PSD to date have been invaluable. It has been up to the PSD to use the information and analysis available to it to come up with a document that addresses the public interest as a whole. This document is a successor to a "Public Comment Draft" issued in March of 2004 and a "Final Draft" issued in June 2004. Both of these drafts were revised after consideration of comments received by the PSD at six public hearings held in April and July, and various written comments. This edition of the *Vermont Telecommunications Plan* is the fourth, following editions released in 1992, 1996, and 2000 and therefore "v. 4.0" has been added to the title at the bottom of each page. This document supplants the 2000 edition as the official, adopted version of the *Vermont Telecommunications Plan*.

The *Plan* as written is not intended to be an exhaustive list of all possible policies or desirable actions with regard to telecommunications in Vermont. Changes in circumstances, unforeseen events, and other contingencies may require actions by the State and others that are different from those envisioned by the *Plan*. Nevertheless, the *Plan* does represent a serious effort to identify and prepare guidance for dealing with important issues that will affect the provision and use of telecommunications in Vermont in the future.

A Look into the Future

Telecommunications in Vermont has come very far in a relatively short time. Twenty-five years ago most people got basic phone service from "Ma Bell," long distance calling was expensive, and many Vermonters were lucky if they could pull in a few television stations over the air. Ten years ago, cellular phones were often "car phones" and only a small minority of Vermonters had them. Meanwhile, a few brave souls were just starting to figure out how they could bring something called the Internet to their homes. How could advances in telecommunications impact Vermonters' everyday lives in the future? Here are just some of the possibilities.

- Imagine that a majority of Vermonters don't use conventional wired phones or cellular phones anymore but instead use personal wireless phones that pull their Internet-based phone service wirelessly off of whatever Internet connection is available where they are at the time. This could be their home broadband connection and wireless home network, a data-enabled cellular network when they are on the road, or a public wireless broadband "hot spot" in a local downtown.
- Broadband service matures to the point that high-quality streaming video services, like high-quality streaming audio services today, become widely available. Instead of a few cable or satellite video tiers with similar programming packages, there are a wide variety of subscription video services selling a variety of programming packages to customers. Personal Video Recorders become storehouses of downloaded audio and video content available on demand.
- The amount and quality of on-line educational content available to Vermonters from around the world grows in quantity and quality. Broadband services allow Vermonters to access rich educational content that uses video, audio, text, real-time communication and stored material as appropriate. This gives Vermonters of all ages greater access to customized learning opportunities that meet their specific needs. Furthermore, Vermont is able to leverage its high per-capita level of higher education institutions to become a provider of on-line education to the world. Vermont institutions combine on-line opportunities with the state's special natural and learning environments to entice students of all ages to come to Vermont for low-residency education programs.
- Electronic medical records allow Vermonters to have ownership of their own personal health record and share it as needed with their health care providers. Linking one's health care providers to home health monitoring devices and to personal health observation diaries becomes more feasible and effective because data communications services are so prevalent in the home. Providers and patients are better have better tools for deciding what care is needed, and what is not.
- High-speed telecommunications tear down barriers for Vermont businesses and workers to interact with the world while being located in Vermont. Vermont is better able to market itself as a place that has motivated

employees who value the high quality of life in the Green Mountain State. Vacationers are able to stay in touch on their wireless phones and other communications devices, while visiting business people talk about how they can move their businesses and new jobs to the state they enjoy visiting so much.

- Always-on, affordable, convenient, Internet access becomes so widespread that electronic transactions become the norm at work and in Vermonters' personal lives. Vermonters routinely get "on-line, not in line" not only for renewing a driver's license and filing taxes but also for everything from taking out a business loan to applying for an local zoning permit.

Like any look into the future, things are not likely to turn out exactly as described here, and there will be surprises. As the universal desire to communicate finds new ways to express itself, life in Vermont will continue to evolve as it has in the past. It is up to Vermonters to make the most of that evolution.

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Executive Summary

Telecommunications services are an integral part of everyday life, and are growing ever more important. The *Vermont Telecommunications Plan*, this document, considers a wide range of issues affecting the provision and use of telecommunications in Vermont. The plan addresses telecommunications in a broad sense, from telephone and data services to cable TV and the Internet. Vermont law directs the Public Service Department (PSD) to prepare and periodically revise a telecommunications plan covering a seven-year period. This edition of the plan is its fourth (following plans issued in 1992, 1996, and 2000). It has been significantly revised from the prior versions. The changes are intended in part to make the plan more useful and easier to read for greater number of users, more action- and implementation-oriented, and more readily updated in the future. The plan has benefited in its development from input provided by a wide range of users and service providers over a period of more than two years.

DRIVERS OF CHANGE AND ACTION

While many things remain the same in the telecommunications industry, change is the biggest constant. Many of these changes drive the policies and actions found in the plan. Perhaps the most compelling driver is the increasing economic importance of telecommunications and broadband telecommunications in particular. Vermont's economy will be enhanced if served by robust telecommunications, and just as importantly it can be handicapped by a weak telecommunications infrastructure. The exact economic impact of improved telecommunications is hard to quantify. Other states that have commissioned special studies have produced eye-catching results. If California followed Vermont's economy, the results of a California study would suggest that closing the gap between broadband and telephone penetration would add $5.4 billion in Gross State Product and 40,000 jobs in Vermont over 10 years. Yet one quarter of Vermont organizations still do not use the Internet, and of those that do, more than a third still do not make business-to-business transactions over the Internet.

Technological change is altering the possibilities in telecommunications. Data transmission was once an ancillary use of telephone networks. Voice service will, in the near future, become an ancillary service of a network that is evolved and designed principally to handle data. Cable communications are evolving from a means to deliver better TV signal to a full-service voice, video and data platform. If the primary service to homes and businesses becomes a high-speed data service, a wide range of applications become possible. Yet many existing legacy policies deal with telecommunications as a predominantly voice service.

The use of wireless technology to deliver services is also increasing in importance. It is no longer a niche service—about 45% of both households and businesses subscribe to wireless telephone service in Vermont. This figure continues to grow. According to one industry forecast, two thirds of U.S. households will use wireless as their only phone by 2015. The Federal Communications

Commission (FCC) has allowed landline numbers to be ported to wireless phones, making this evolution more likely. Vermonters surveyed generally believe that wireless coverage in Vermont is not good, and even a majority of households without the service believe better wireless coverage is moderately or somewhat important. Wireless Internet access is also exploding in popularity.

Vermont must prepare for and adapt to pressures and trends in the telecommunications industry and law. Federal policy, especially policy administered through the FCC, more and more tends to shrink the role of states in crafting policy for emerging services. The emergence of early-stage competition in the local telephone market in Vermont signals the need to get ready for even bigger changes to come. The increase in the number of potential competitors means that the PSD and Public Service Board (PSB) must make choices about where to focus time and energy. Changes in the telecommunications marketplace, as well as changes in federal law and technology in many cases call for a review of existing state regulations.

Despite competition, there are likely to be only a limited number of physical networks in Vermont. Reliability is important to public safety and economic activity. Preserving and enhancing reliability and key elements of service quality is as important as ever.

The telecommunications systems that support state government and other public sector users are in a period of transition. Creation of the Department of Information and Innovation (DII) was a major milestone in managing state government telecommunications on an enterprise-wide basis. The plan identifies ways to reinforce this progress.

VISION

As this plan looks to the state's telecommunications future, it is important to have a sense of what that future should look like. The following are key characteristics of that future. In some of these areas Vermont has already made substantial progress, and in others substantial progress is still required.

- All Vermonters will have ready access to affordable broadband services.
- Vermont's wireless infrastructure will be a high-quality asset to the community and economy.
- Vermont will have a telecommunications environment that encourages and rewards service providers who innovate using technology and who creatively develop, implement, and market services to address consumer needs.
- Vermont will have an environment that encourages a steady stream of required investment.
- Vermont's telecommunications industry environment will support and nurture service quality and reliability.
- Vermonters will have competitive choices in telecommunications whenever possible, and where competition is weak or infeasible, appropriate safeguards will be in place.

- Users of telecommunications technology will have the freedom and capacity to apply the technology in ways that meet their needs, including new and innovative ways.
- All regions of the state will have comparable access to telecommunications services.
- Telecommunications services will provide options for disabled Vermonters and not restrict communication with other members of society.
- Consumer protections and information will shield those who are especially vulnerable to loss of essential communications services and help all consumers buy on a fair and equitable basis in the telecommunications marketplace.
- Vermont will sustain affordability of the legacy voice telephone service it has inherited through a period of transition to an emerging set of services and a new telecommunications marketplace.
- The telecommunications environment in Vermont will continue to sustain important public benefits, including access to emergency services.
- The state's telecommunications networks and services will sustain local voices that allow Vermonters to communicate with Vermonters.
- The public sector will apply proven but innovative technologies to provide superior public service.
- The public and private sectors in Vermont will work together to advance common aims.

Achieving such a future will involve the efforts of many people and organizations.

HOW THE PLAN IS ORGANIZED

This edition of the plan has two major parts, each with four sections. The first part of the plan contains four technical reports, and the second part contains policies, strategies, and action plans. A glossary of terms and acronyms is located at the end of the document. The plan is intended to be modular and to serve the needs both of those who are looking for information related to the telecommunications industry in Vermont and those who are looking for the plan's word on various elements of telecommunications policy. While readers are encouraged to read the whole plan, it is organized to make it easier for those who need to find only a part of the information it contains.

Section 1, "Telecommunications Trends for 2004 and Beyond," examines the importance of telecommunications to the economy and summarizes trends in telecommunications technology, business, and regulation that may affect the industry in Vermont. Section 2, "Vermont Telecommunications Initiatives and Activities," provides an overview of what providers and users of telecommunications in Vermont are doing in the field. Section 3, "Telecommunications Almanac," contains various facts, figures, and maps related to use, price, availability, and other information about the telecommunications industry in Vermont. Section 4, "Public Input Process and Survey Results," summarizes the public input process used in the development of the plan and provides detailed results

from one of the elements of that process, the telephone surveys conducted for the PSD in late 2003. These four sections will be useful to those who are simply seeking information about the state of telecommunications in Vermont and factors influencing it. They also provide useful context for the sections of the second part.

Part 2 of the *Plan* contains Section 5 through Section 8. Within each of the sections of the second part, readers will find a succession of bulleted items on various topics labeled, "Policies," or "Strategies/Action Plans." "Policies" are intended to guide on-going activities or provide direction for situations as they arise. "Strategies/Action Plans" outline approaches or specific steps to address issues more proactively. Section 5, "Universal Service," deals with access to and affordability of telecommunications services for Vermonters. Section 6, "Telecom Infrastructure and Service Development," shines a light on ways to get the networks and applications that Vermonters need. It also addresses ways to encourage Vermonters to take advantage of the opportunities that developments in telecommunications provide. Section 7, "Telecommunications and Public Sector Use," lays out a program for state government and related public-sector telecommunications users. Section 8, "Vermont Telecom Regulatory Policy," defines policies and desired actions that are within the realm of Vermont's PSB, PSD, and Enhanced 9-1-1 Board. Some users may find the policies that relate to their area of interest in only one of these sections, and each section may be read on a stand-alone basis. Other readers will find the policies they are looking for across multiple sections.

SUMMARY OF POLICIES, STRATEGIES, AND ACTION PLANS

This plan addresses a wide range of tools in the state's toolbox for promoting telecommunications networks and services that meet the needs of Vermont and Vermonters. Implementation will not be the purview of one agency or organization alone, but will require efforts from people and organizations in state government, in the industry, at the local and regional levels, from private sector users, and from institutions with a public interest. Each of the respective sections in Part II of the plan provides additional detail concerning policies, strategies, and action plans summarized here.

Under the heading of "Universal Service," the plan:

- Calls for advocacy for federal universal service programs that adequately support availability of telephone and broadband in rural states like Vermont at affordable rates;
- Provides support for the idea that broadband service is the emerging basic service;
- Calls for implementation of a state fund to help offset the cost of providing telephone and broadband services in parts of the state with a high cost of service;
- Calls for re-examining the base of support for the Vermont Universal Service Fund in light of changes in telecommunications technology and regulation,

in order to assure continued financial support for the E 9-1-1, Telecommunications Relay, Adaptive Equipment, and Lifeline programs;

- Supports reduced taxes on telecommunications, especially infrastructure investment, uniform property tax treatment of cable and telephone company infrastructure, and limits to new taxes on telecommunications services for non-telecommunications purposes; and
- Continues to support technologies that support communications by persons with disabilities, including some new technologies.

In the section on "Infrastructure and Service Development," the plan:

- Sets goals for Vermont's infrastructure that support broadband and wireless services, promote reliability, and access to competitive telecommunications services;
- Sets infrastructure objectives including 90% broadband availability by 2007 and universal broadband availability by 2010, reliability improvements to Vermont's interexchange networks, additional telecommunications links to national and international high-speed networks, 100% mobile wireless coverage along Vermont's highways, and "Wi-Fi" in downtowns and key travel and tourism locations;
- Supports continuation of efforts to aggregate demand in rural communities to attract broadband services;
- Supports greater utilization of existing grant and loan programs to support telecom infrastructure development;
- Prefers private investment as the primary means of financing telecommunications infrastructure improvements in Vermont, but contemplates some forms of direct public investment in infrastructure to facilitate private-sector telecommunications services in areas where private investment fails to meet state needs;
- Calls for examination of ways that the public sector has supported telecommunications investment in other states;
- Favors steps to make it easier and more affordable for telecommunications service providers to use public road and rail rights-of-way to provide service in the state;
- Supports greater inclusion of planning for telecommunications services in the development of downtowns and business and industrial parks;
- Encourages better local and regional planning and zoning to provide paths for successful deployments of wireless services, including both commercial and public safety wireless;
- Prefers collocation of wireless facilities and use of existing structures where available and careful site selection and development to reduce the visual impact of wireless facilities;
- Favors reducing the number of lower-impact wireless facilities that must go through dual local zoning and Act 250 reviews;
- Calls for steps to increase use of state-owned sites to support wireless infrastructure deployment;
- Supports re-establishment of an extension program to help small businesses effectively use and take advantage of telecommunication technology; and

- Calls for creation of a joint marketing program between the state and the industry to accelerate broadband adoption in the state and thereby support greater investment.

Regarding "Public Sector Telecommunications Use," this document:

- Supports greater coordination of state telecommunications service purchases and telecommunications networks owned and operated by the state;
- Calls for the state to leverage its purchasing power, spare telecommunications capacity, and space in state buildings to support telecommunications service providers who make new investments, expand service, and improve prices to serve the broader community in addition to meeting state government needs;
- Supports collaboration between the DII and the Vermont Institutes on an Educational Communications Network that would be the successor to both K12Net and the Interactive Learning Network;
- Anticipates the implementation of a state enterprise instant messaging platform and the ability to integrate different communication tools as needed, including website applications, e-mail, instant messaging, remote network access, databases, plus wireline and wireless voice;
- Supports establishment of a technology migration path for state telephone services to packet-data voice services (such as voice over Internet Protocol);
- Calls for a capital budgeting commitment to an upgraded state mobile communications network that can support the State Police, other state users, as well as local emergency responders and that will support mobile data applications and improve interoperability;
- Calls for a platform of telecommunications services to support increased use of telecommuting in state government, supported by personnel policies, management guidelines, and training;
- Favors sustaining the existing Vermont Interactive Television (VIT) network and expertise in the near term at least;
- Favors expansion of state government desktop or conference room teleconferencing to improve interoffice collaboration and reduce travel needs; and
- Supports steps to better manage state electronic information assets with privacy implications.

Finally, as part of "Regulatory Policy" the plan:

- Supports action to implement a reformed framework of state regulation for a telecommunications marketplace with greater competition and more nondominant service providers;
- Calls for a new alternative regulation plan for Verizon at the expiration of the current alternative regulation plan;
- Favors developing alternative regulation plans for independent telephone companies;
- Calls for alternative regulation plans to include expectations for network modernization and investment, service quality, and pricing flexibility within safeguards, and calls for these plans to be consistent with the state of competition;

- Supports an examination of what ways there may be to achieve greater consolidation of consumer protection roles now performed by the PSD, PSB, and Attorney General in competitive telecom markets, while still preserving features that serve consumers well and that help inform key policymakers;
- Supports the availability of open telecommunications networks in Vermont that provide flexibility to competitive retail service providers and freedom to users in how they put telecom services to work;
- States the continued importance of unbundled network elements and services;
- Favors increases in the level of interconnection and traffic exchange between carriers for voice and data communications;
- Favors continued forbearance in state regulation of wireless and voice over Internet Protocol (VoIP), with certain specific limited exceptions;
- Supports upgrades in telecommunications service providers' networks to more consistently provide high-speed data services, plus redundant and physically diverse facilities and power back-up to provide greater reliability;
- Supports continuation of rules that provide telecom and cable companies fair and nondiscriminatory access to utility poles;
- Favors reforming and simplifying state regulations regarding local and instate long distance rates, especially rules and rates that affect intercarrier payments, making it easier for companies to compete in offering Vermonters new calling plan choices;
- Favors re-examining at the same time state regulations on the number of rate centers and the use of "virtual numbers;"
- Favors examining the effect of lowering intrastate "special access" prices;
- Supports local number portability;
- Supports continued full funding of E 9-1-1 and measures to provide greater accountability for spending of money from the Vermont Universal Service Fund for E 9-1-1-related activities;
- Calls for steps to prepare Vermont's E 9-1-1 system for VoIP and increased competition, and better educate Vermont's consumers who rely more heavily on wireless telephone E 9-1-1 service;
- Supports adjustments to future cable line extension formulas to better account for levels of satellite dish penetration and increased use of cable company services by business subscribers;
- Supports increased use of Geographic Information System (GIS) technology to improve the process of determining and reporting cable company obligations to extend lines;
- Calls for cable franchises that provide local content, public interest programming, and two-way digital capabilities and encourage cable operators to make investments and offer new services;
- Calls for community needs and the demand for Public, Educational, and Governmental (PEG) access programming and services, balanced by cost considerations, to drive the level of cable company support for PEG access;

- Supports PEG access that includes live origination of programming from the community, local video production and training, and the use of digital video tools;
- Calls for renewed progress on a network to collect, distribute and show PEG programming from and on cable systems around the state;
- Supports providing the PSB with the authority to suspend requirements on cable companies to file tariffs;
- Supports the participation of electric utilities in facilitating or improving wireless and wired telecommunications in Vermont within limits that protect safety, electric reliability, and electric rates;
- Favors continued support of regulations that protect the privacy of telecommunications consumers and continued monitoring of the privacy implications of new technologies and legal developments; and
- Favors greater options for electronic filing of documents with the PSB and PSD.

NEAR-TERM PRIORITIES AND ACTION PLANS

By statute, this plan covers a seven-year period. Some objectives of the plan will require substantial lengths of time to achieve or will require the right opportunity. Some policies reflect ongoing priorities. The plan calls for dozens of actions. In some cases priorities will change or be driven by forces not of the state's own choosing. That said, a relatively small number of action items contained in the plan and listed below provide a place for the state to start its work of implementation.

Four initiatives represent a good first step toward encouraging the expansion of needed services and providing assistance to users. These are:

- Support for community aggregation programs (see pp. 6-6—6-7);
- Development and promotion of an improved model zoning bylaw covering placement of wireless facilities (see pp. 6-10—6-12);
- Renewed support for an extension program to support the application of telecommunications technology by small business (see pp 6-13—6-14); and
- Development of a public-private joint marketing effort to accelerate the adoption of broadband services throughout Vermont (see p. 6-15).

Three legislative actions will help the state adapt to changes in the telecommunications industry, law, and technology:

- Creation of a state fund for telephone and broadband in areas with a high cost to provide service (see pp. 5-4—5-8);
- Authorizing greater regulatory flexibility for voice services on the Internet (see 8-18—8-21); and
- Allowing detariffing of cable TV services (see pp. 8-44—8-45).

The pace of change in the telecommunications industry requires constant attention by the PSB and PSD. Three complicated issues should be priorities for the state's regulators to finish or begin work:

- Revising rules to allow reduced oversight of nondominant carriers and update consumer protection rules to reflect today's marketplace (see pp 8-2—8-4 and 8-7—8-10);
- Creating a new alternative regulation plan for Verizon and developing alternative regulation plans for independent telephone companies in line with current objectives (see pp. 8-4—8-6); and
- Investigating wholesale local calling areas and access charges, along with associated issues (see pp. 8-25—8-28, 8-29—8-30, and 8-31—8-34).

State government is bound to take a major step when it decides shortly how to continue or replace the data telecommunications service contracts that expire in 2004. Four other actions to meet public sector telecommunications needs should also be priorities:

- Creating a combined successor to K12Net and the Vermont Interactive Learning Network (see pp. 7-4—7-5 and 7-13);
- Upgrading the state's mobile communications network for public safety (see pp. 7-6—7-9);
- Establishing a Montpelier VIT site (see pp. 7-11—7-12); and
- Issuing a state privacy policy for electronic information and conducting a privacy audit of state electronic information assets (see p. 7-14).

While the other actions called for in the plan are also important and may also be appropriate to address in the near term, the actions listed above would represent significant progress over the next 12-24 months.

Part I: Technical Reports

Telecommunications Trends for 2004 and Beyond

Vermont's telecommunications networks and services will be heavily influenced by national and global trends in telecommunications over the next seven years. Change is a constant in telecom, and the field of telecommunications continues a rapid pace of development. Telecommunications in many forms continues to become more Internet-like and wireless technology has continued to evolve and grow, sometimes in unexpected directions. The financial strength of the telecommunications sector has changed drastically. Regulation, under the leadership of a changed Federal Communications Commission (FCC), continues to react to these circumstances and play out the changes started by the Telecommunications Act of 1996. Meanwhile, telecommunications is no less important to the economy and broadband services have begun to change from a niche to a key economic necessity. This report looks at how the economic needs of Vermont drive the state's needs for advancements in telecommunications, at technological drivers in telecom, and at the financial, regulatory, and other trends that are shaping the industry.

A. Telecommunications and Economic Development

There is a new consensus that telecommunications infrastructure and services are key supports of the present and future economy in Vermont and the U.S. Information technology was a key contributor to increases in productivity since the mid-1990s. While computer advances were notable for a significant time before that point, it was not until the latter 1990s that U.S. Gross Domestic Product (GDP) began to grow at an annual rate of 4.1 percent per year, significantly higher than the rate of 2.4 percent per year in the first half of the decade. Widespread adoption of networking technology and the Internet in particular began in the mid-1990s. This makes computer communications, and not just information technology generally, an excellent candidate for the cause of this remarkable productivity growth. Decreases in the cost of computer equipment and equipment used for computer networking sustained this development.[1] The size of "the Internet Economy," online transactions and the services, infrastructure, capital and labor that support it, is staggering. According to a study by the University of Texas and Cisco Systems: "[T]he Internet economy will cross $800 billion [by 2006]. Today the Internet has enabled a new business model that Forester Research calls 'Dynamic Trade,' which is fundamentally altering the creation, delivery and pricing of products and services."[2] Yet the increases in productivity noted here impact the traditional economy as well as the "Internet Economy." Vermont fails to keep pace with advancements in telecommunications networking at its economic peril.

"Today the Internet has enabled a new business model…which is fundamentally altering the creation, delivery and pricing of products and services."

Vermont faces constrained job and income growth prospects through 2007.[3] Yet perhaps unlike periods in the past when increases in economic activity or growth in developed areas were the drivers for improved or expanded telecommunications, the present situation is somewhat different. The most important

drivers of future requirements for Vermont's telecommunications infrastructure and services are not growth in economic activity or growth in developed areas, although these are likely to have some impact. Instead, the most important drivers of future requirements for Vermont's telecommunications infrastructure and services are competition, technological change and the economic and other opportunities that change affords. Four major sectors drive Vermont's economy: (i) manufacturing, (ii) hospitality and tourism, (iii) education and health care, and (iv) agriculture and natural resource-based production.[4] All of these sectors depend more and more on high-speed, reliable telecommunications service. Manufacturing in the United States is increasingly dependent on information technology and business-to-business networking that enhances productivity and enables American products to compete against cheap labor in a global marketplace. Broadband telecommunications fills a dual role for hospitality and tourism, providing a key marketing channel as well as an important amenity for travelers. Good wireless service is now considered vital by many travelers. Increasingly sophisticated communication over distance is ever more a mode of delivery for education and health care. Even agricultural and natural resource producers rely on modern telecommunications to access markets, suppliers, and information.

Other illustrations abound as to why an advanced telecommunications infrastructure is a key support for the Vermont economy. Vermont loses young workers at a rate more than three times the national average.[5] Young people, who are more likely to be tech-savvy, are unlikely to be attracted to a state that does not have an up-to-date set of broadband and wireless services. Conversely, Vermont has had a high level of in-migration, including high-skilled professionals.[6] High-quality broadband telecommunications services are essential to providing workers who have specialized skills the security that they can live and work in Vermont and still tap into economic activity in a national and global marketplace. Post September 11, 2001, real estate professionals indicate that there is increased activity from homebuyers who are relocating from major metropolitan areas to seek out Vermont's perceived safety and security.[7] Distance learning opportunities and access to on-line job search information is important to the vitality of Vermont's future workforce.[8] While all these examples of the importance of telecommunications to specific economic sectors or specific examples of economic development help to illustrate a point, the larger point is that telecommunications is important as a general support structure to the Vermont economy. Without advancing infrastructure and services, Vermont cannot reach its potential.

How important is it that Vermont's telecommunications networks continue to evolve and improve? Other states that have performed detailed studies of the economic promise of next-generation broadband services have drawn startling conclusions. Groups in both California and Michigan commissioned studies by Gartner Consulting to examine the economic impact of an accelerated broadband infrastructure. In the California study, Gartner modeled the economic impact of an increase in Gross State Product (GSP) over ten years resulting from an increase in broadband penetration from present levels to a level about halfway to the extent of telephone penetration. Gartner's model showed an increase in $376 billion in California's GSP and an additional 2 million jobs over 10 years.[9] If California's economy followed Vermont's, a proportional increase for Vermont would be $5.4 billion in GSP and 40,000 jobs (or roughly the current workforce

of IBM in Vermont times six).[10] A similar Gartner study for the LinkMichigan initiative put the 10-year Michigan GSP increase from a state-wide broadband infrastructure at $440 billion along with a nearly half a million increase in jobs over the same period. The highest projected growth rate was in sectors offering high pay and requiring high skills: information, utilities, professional, scientific, and technical services, and finance and insurance.[11] These estimates were based in part on International Telecommunications Union (ITU) studies showing that "teledensity"—the density of communications connections per capita—is strongly correlated with a country's Gross Domestic Product. A key to obtaining the benefits that Gartner highlighted is increasing the level of adoption of broadband connections. This is due to the axiom that the value of a network increases exponentially with increases in the number of users.

Lest one think that Vermont should strive to reach a single benchmark level of service, such as ubiquitous broadband, it is important to note that the broadband goal is in the process of evolving. What "broadband" is today is likely not to be considered "broadband" tomorrow. Indeed, the title of the California study was "One Gigabit or Bust." While such speeds may seem extravagant, consider the following analogy:

> Only 20 years ago, the average business desktop computing device required a mere 9.6 kilobits per second (Kbps) of bandwidth. Today the average business desktop is networked using 100 megabits per second (Mbps)—an exponential increase of 10^5 the power. If we apply a similar increase to the U.S. Federal Communications Commission (FCC) definition of today's broadband at 200 Kbps, we'll require a speed of 20 gigabits within 20 years. Consequently, one gigabit broadband to every education institution, business and home by 2010 is a realistic goal.[12]

Meeting the future telecommunications needs of Vermont's economy will require a sustained effort.

B. Trends In Technology

For many decades, voice telephone service has been the core telecommunications service. Data communications is surpassing voice in this role, but while this is happening, the way voice is delivered to customers is changing. The old model of a communications channel linking two people over wires is bending to accommodate the maturation of packet and wireless technologies.

FAST PACKET SERVICES

For much of the history of the telecommunications industry, its services have been provisioned over circuits and circuit switching. Circuits are dedicated communications paths established between users, either on an on-demand or permanent basis and circuit switching establishes a dedicated path of communication (or a dedicated time slot within the shared path of communication) for the duration of a communications session. When one makes a phone call, the telephone network has traditionally established a circuit between the caller and the called party.

A little less than ten years ago, so-called "fast packet" services (distinguished from previous generations of slower packet data services, like the X.25 service) were just beginning to take hold in Vermont. Frame relay, still an important fast packet service, provided an important alternative to networks of dedicated high-speed point-to-point data circuits, such as T-1 circuits. (See Figure 1.1.) A customer with a location requiring connectivity to a number of other locations could obtain a single connection to the frame relay network instead of multiple connections to the multiple sites or "daisy chaining" sites together. In Vermont, frame relay also was the vehicle that introduced data connectivity options at points in between 56 kbps and 1.544 Mbps for those customers who had a greater need for speed than a 56K data line would provide, but could not afford a full T-1.

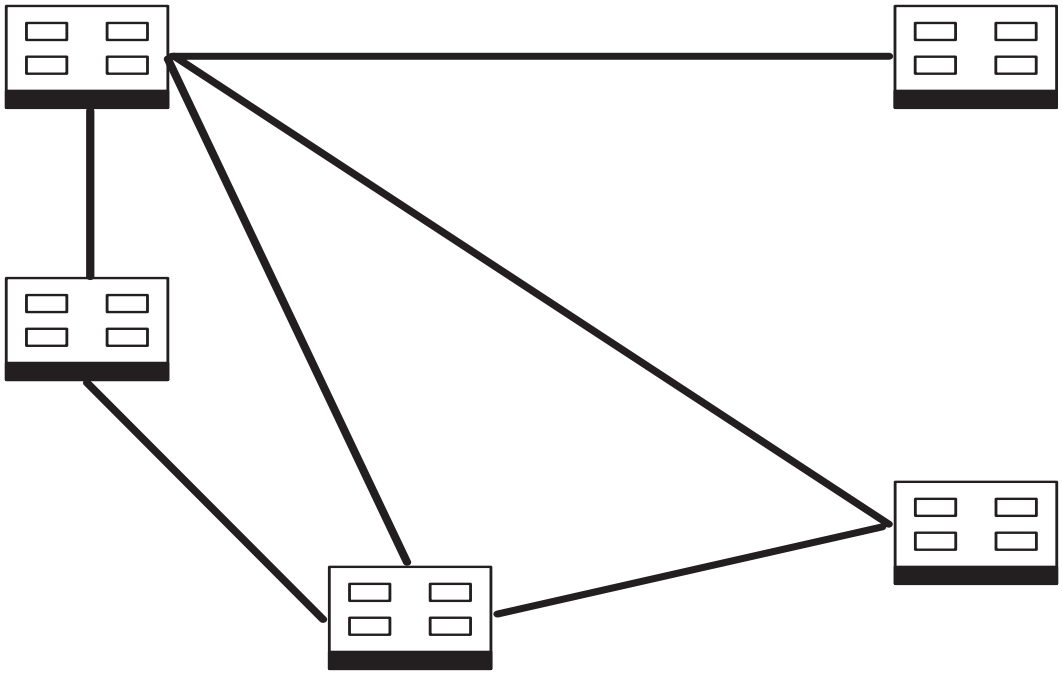
Packet-based services break streams of communication into piece parts (the "packets") and route the pieces of many individual communications through a network or networks of common channels, reassembling the parts at their destination. Packet-based services use communications bandwidth more efficiently

Types of Fast Packet Services

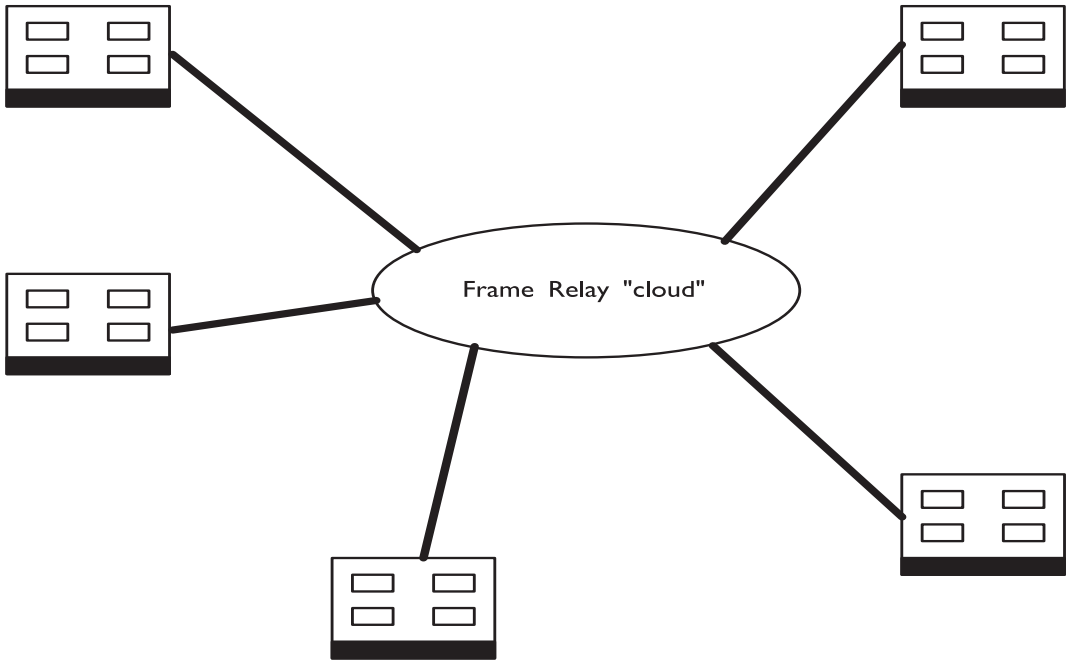
The diversity and capability of fast packet services have increased in recent years. Carriers use a variety of protocols to manage and deliver packets. These protocols are not necessarily mutually exclusive; in some cases a protocol of one type will transit a network operating under a protocol of another type, such as when IP packets are encapsulated in ATM packets to transit an ATM network. Here are a number of the major types of fast packet services (not all of which are widely deployed in Vermont).

- **Frame Relay** is a relatively simple fast packet switching that originated in the telco networks. It can supplant networks of point-to-point dedicated circuits with "virtual circuits" provisioned over a shared wide area network.
- **Asynchronous Transfer Mode (ATM)**, a "cell relay" service, offers potentially greater data transmission rates and a greater ability to predictably manage different kinds of packet data streams, including ones with quality-of-service requirements, such as voice and video. (ATM is the basis of the Vermont Interactive Learning Network.) However, ATM offers this management capability at the price of high "overhead" of packets used not for transmission of the data payload, but management of the service. A competing trend is the use of data transmission protocols that have become widespread first in computer networking.
- **Internet Protocol (IP)** is a language of the Internet which is increasingly the basis for managed, "native" IP networks. Frequently it is a networking protocol used as a means for carrying communications through networks using other underlying protocols.
- **Ethernet** is the dominant protocol of the Local Area Network (LAN) that has invaded telecommunications networks in a big way. It is a highly mature line of networking protocols with a very large base of equipment manufacturers. While the availability of traffic prioritization is its weak point, it is seen as a relatively inexpensive way to deliver very high speeds (10 Megabit, 100 Megabit, Gigabit and higher) from the backbone to the desktop over one protocol.
- **Multi-Protocol Label Switching (MPLS)** works with other protocols like ATM, IP, and frame relay, adding "labels" that enhance the ability of packets to transit networks based on these protocols and maintain managed quality of service.
- **Resilient Packet Rings (RPR)** feature Ethernet's ability to efficiently transport very large amounts of data, with little overhead. However, the RPR protocol has been designed to operate over rings, and quickly re-direct traffic in case of a cut in the ring. It also has built-in support for prioritizing different kinds of traffic.

Figure 1.1:
Point-to-point networks vs. frame relay



When point-to-point connections are used to link many sites, the result may be a complex network.



Frame Relay, ATM, and similar services provide individual sites with a single link to a "cloud" through which connections are made to all other desired sites.

than circuit-based services by using those parts of a communications session where the parties are not "saying" anything to transmit packets from other communications. Packet-based services were once exclusively the province of data services. Data transmission has usually been much more tolerant of packet-based services' traditional drawbacks in the face of congestion, such as the possibility that packets would be delayed in transmission or not arrive in the order in which they were sent. Increasingly, packet-based services are sophisticated about how they manage and prioritize packets, or are able to provide large enough transmission capacities to forestall congestion. In short, packet-based services are becoming the dominant means of telecommunications and are in the process of supplanting circuit-based communications for even the transmission of voice and video communication.

Unlike voice service, which is an integrated network offering universal access through multiple carriers, fast packet services are more likely to be offered as unconnected networks by individual providers. (IP, the protocol of the Internet, is a notable exception.) In part this is due to the fact that there are different protocols (ATM, Ethernet, etc.) Even the same services offered by different providers do not necessarily make up an integrated network. For example, Vermont does not have a frame relay network, but multiple frame relay networks. Customers must choose a single provider. If that provider does not service all the customer's locations then alternate arrangements must be made, such as linking to the fast packet provider at some location through leased point-to-point dedicated circuits.

VOICE OVER PACKET NETWORKS

Voice is data, not voice and data. That is the essence of the application of packet technology to the provision of voice services. The transport of voice over packet-switched networks will become increasingly important over the next seven years, increasingly working its way into a larger and larger proportion of the voice system.

[W]here IP telephony is used either with separately provisioned bandwidth or with supporting quality-of-service technologies, it has proven to be competitive with circuit-switched technologies.
--Computer Science and Telecommunications Board, The Internet's Coming of Age

In the traditional circuit-switched network, a series of switches create a set of dedicated pathways to transmit each call and then tear down that pathway at the end of the call. Packet networks are like the Star Trek transporter, breaking down communications into small pieces of information, routing them through the network flexibly and reassembling them at the communication's end point.[13] The transmission of voice over packet networks can take a variety of forms. In some cases the packets will travel over the public Internet and in other cases they will travel over private networks monitored closely for quality of service. Some specific applications of voice over packet networks include:

- Voice over the Internet. New service providers like Vonage (www.vonage.com) and Packet 8 (www.packet8.net) increasingly try to market their services as something more than the "making a call on the computer" model, offering a regular telephone number and adapters that allow customers to utilize a regular phone. One source places the number of U.S. households making Internet calls with standard phones at 100,000 in 2003, and estimates growth to 4 million households by 2007.[14]

The Difference Between Packet and Circuit Switching

Circuit switching is the traditional way of making sure that the voice of one person in a call is routed to the party on the other end of the call. Circuit switching sets up and ties up the entire capacity of a caller-to-caller circuit for the entire length of a call, even though voice communication is full of pauses. Turning the voice communication into packets of data and routing them over a shared packet-switched data network inherently makes more efficient use of the network, as the pauses in one communication's use of the network provide opportunities for another communication to use the same capacity. Depending on the network (or piece of the network), that other communication may be other voice traffic, or any other form of packetized data, allowing voice to share a single network with more traditional data traffic. Indeed, individual voice conversations do not require high data speeds. Early attempts to use packet networks for voice were hampered by voice's requirement that the packets arrive without delay and in the correct order so as to form an intelligible conversation—requirements that are not present to make an intelligible e-mail message, for example, because it is not real-time communication. However, there are now more sophisticated options for managing the traffic on packet networks that address these problems. There are also many data networks with enough spare capacity that voice traffic need never compete with other data.

- Private-network voice-over-IP. Packetized voice data can be carried over the same local or wide-area network that links an organization's computers, and indeed the computers and the phones can be networked together. Voice-over-IP allows an organization to manage (and pay for) one network instead of two and use excess capacity in a data network. IP voice systems offer flexibility in assignment and re-assignment of extensions and can be upgraded with software. Data from In-Stat/MDR indicates that applications like this are becoming commonplace in larger organizations—89% of large organizations currently have an IP VPN (Virtual Private Network), or plan to have one within two years. About half of all organizations using or planning to use IP VPNs plan to carry voice traffic on the VPN.[15]
- Carrier-class packetized voice. Local and long distance carriers are turning to packet data networks as a cheaper and more flexible way to create an ability to carry more calls over the same facilities, whether that is a local loop or a long-haul line. New generation digital mobile voice services are based on packet networks. These packetized voice services are invisible to consumers, appearing to be fully integrated into the traditional voice network. And indeed they are.

Cable companies are increasingly looking to packetized voice for their entry into local telephone service over their cable plant.

Many circuit switches are still likely to have a useful life that will extend through the next seven-year period, and perhaps beyond it. Certainly at least some service providers with existing investments in circuit switches will seek to extend the life of those investments. There will be fewer natural opportunities due to switch capacity exhaust to migrate early to packet switches in Vermont than there will be in some high-population states. Nevertheless, the overall trend toward packet switching suggests that the voice network of the future will be a data network at heart.

THE INCREASING IMPORTANCE OF SPECIAL ACCESS

While a wide variety of services from point-to-point dedicated lines to Digital Subscriber Lines (DSL) and fast packet services fall under the regulatory category of "special access," some older and more traditional services as well as the new entrants have grown in importance. Once a set of premium services with

premium pricing for a small number of business and institutional users, services like T-1 lines are now more important to a wider variety of users. They provide the "backhaul" or the "middle mile" for new DSL and wireless Internet offerings. Smaller and smaller businesses and organizations are tapping T-1 offerings by combining multiple voice lines and high-speed data over a single line. T-1s provide a ubiquitous means of accessing other networks that may not be ubiquitous, such as fast packet switched services. In the past, these services were packaged as premium services. Now, with services like T-1 serving as a key element in so many new service offerings, this status may be changing.

VIRTUAL PRIVATE NETWORKS

Virtual Private Networks (VPNs) offer the ability to emulate a network of private leased data lines with a connection to a public shared network, such as the Internet or a single provider's data network. This greatly increases the possibilities for creating wide area networks due to reduced costs and the flexibility of using the widespread accessibility of the Internet and IP services. End users using a connection to the Internet can create VPNs. Creating quality-of-service levels is more difficult when VPNs are provided using the public Internet. Some telecommunications service providers offer managed VPN service: when points are connected via the same service provider's network, the service provider can realize a VPN with a managed quality of service. VPNs and especially VPN services offer the potential to enhance the readiness of Vermont locations to participate in distributed work.

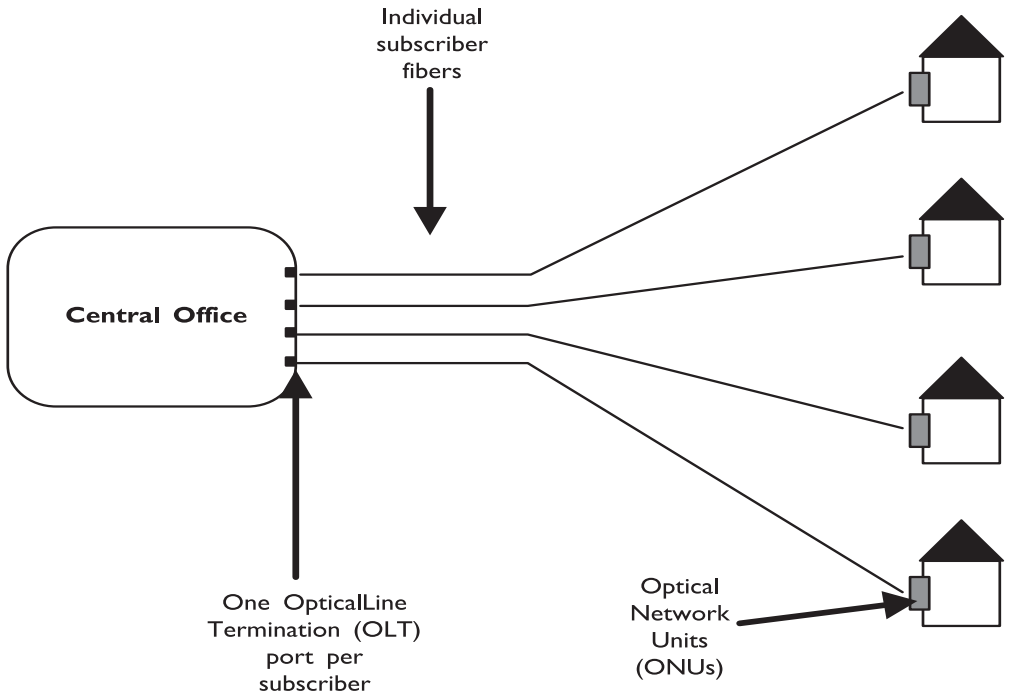
FIBER OPTIC COST TRENDS

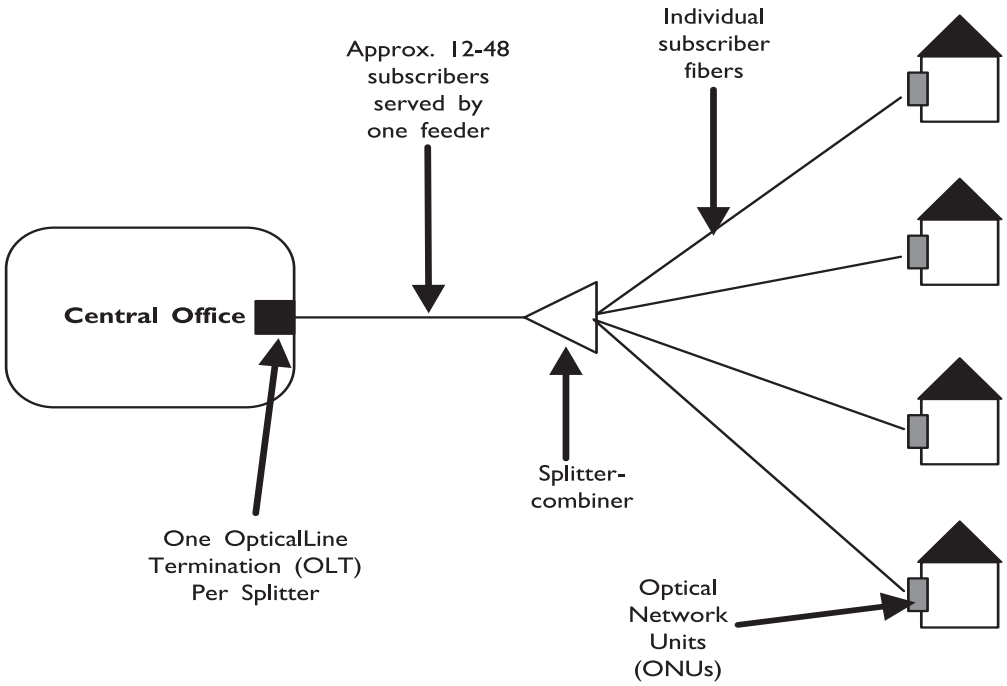
For high capacity, low maintenance and an ability to support future increased bandwidth needs, it is difficult to beat fiber optics. Fiber is now the dominant medium on long- and medium-haul telecommunications routes. Cable companies have largely completed rebuilding their all-coaxial networks to a hybrid fiber-coaxial design that uses the glass fibers to connect headends with local neighborhoods. Telephone companies are using fiber in the "local loop," in the "feeder" portion that connects central office and equipment cabinets in the field. Fiber optic strands have taken over telecommunications backbones, increasingly displace copper in telephone feeder plant, and replace coaxial cable in connections between headends and nodes. The question

PONs vs. Home-Run Fiber Systems

Two major approaches to Fiber-to-the-User systems are the Passive Optical Network (PON) and home-run systems. (See Figure 1.2.) In some ways, a home run system is the model of simplicity—each subscriber has an individual fiber strand running from a central office location to their own premise. This is much like the telephone network in its simplest form, only with fiber strands replacing copper twisted pairs. Home run systems offer maximum flexibility for deployment of services, very high bandwidth in both upstream and downstream directions, and the greatest number of options for competition. A PON sends lightwaves down a single fiber strand shared by a group of customers to a splitter in the field. The splitter is small, relatively simple, unpowered and "passive." It simply divides the signal received from the central office and sends it down all the individual subscriber drops. The Optical Network Units (ONUs) at each subscriber location are programmed to only "read" the portion of the signal intended for the subscriber. All ONUs share the reverse-path bandwidth in a coordinated fashion, and reverse signals are combined at the splitter-combiner. The architecture of a PON is in some ways more like that of cable networks than conventional telephone networks. PONs are generally cheaper than home run systems, as costs for some of the fiber and electronics are spread among multiple users. While bandwidth is certainly more plentiful than under coaxial systems, users on a splitter do share the bandwidth available on the feeder fiber.

Figure 1.2:
Home run and PONs fiber systems





then becomes, when will fiber finally extend all the way to the home and business? For some business and institutional users located next to the fiber rings of certain service providers' networks, this is already the case, but when will it be commonplace? There is little doubt that all-fiber networks are technologically superior to the legacy coaxial and twisted-pair copper networks. The main barrier has been economic. The expensive labor involved in hanging or burying fiber and the cost of the sophisticated electronics result in higher up-front costs. The opportunities for offsetting those costs come in the form of lower maintenance and higher reliability, fiber's ability to transmit signals over longer distances than copper without regeneration, opportunities for more revenue over an infrastructure that can support voice, video, and very high-speed data and the high likelihood that the fiber network, (unlike copper and coax) will retain its essential usefulness for decades. Already there is an emerging consensus that fiber-to-the-user probably has roughly the same cost as copper in a significant "greenfield" development. Already developed areas present a greater challenge.

Cost estimates for fiber-to-the-user systems vary widely and depend on factors like the density of customers, pole attachment costs, burial options and whether the system is an upgrade of an existing system, a new build, or an overbuild. Key components in the cost equation are the costs of the electronics that sit at the user premises and the price trend for these components is downward. A glut in fiber production has also driven down the price of cables containing dozens of individual fiber strands.

While the cost of fiber-to-the-user systems represent a major investment, these seem the most likely systems to deliver data transfer rates exceeding today's broadband.

POWER LINE COMMUNICATIONS

Some in the telecommunications and electricity industries have been hailing the development of a so-called "third wire" for delivering broadband telecommunications to users, a wire that already runs to nearly every home and business in the country. Electric lines, which deliver electric power using low frequencies, can also carry broadband communications at high frequencies. The ability of power lines to provide broadband communications is well established. What is less certain is whether companies using this technology will be able to adapt the electric power grid, which is not specially designed for communications, to communications purposes economically, competitive with other service delivery platforms.

The typical model of broadband over power lines has the communications service "injected" on to medium-voltage power lines past the substation. Since high-speed communications does not readily pass through transformers, some sort of device is required to route communications to and from customers' premises and the medium voltage line. This may be a device that connects the medium and low voltage lines, bypassing the transformer. Connecting with the low voltage line means that communications are available anywhere an electric outlet is available by plugging in a device such as a power line to Ethernet converter. An alternative strategy connects the medium voltage line communica-

tions to a wireless transmitter, which provides the link to users in the immediately surrounding area. (See also subsection on unlicensed wireless communications, below.) Regardless of how the connection is made between the user and the medium voltage line, all users served by the medium voltage line share the total bandwidth capacity of the line, which tends to decrease with distance between the user and the injection point.

A major economic advantage of broadband over power lines is that there is little need to run new lines. In 2003, a survey of 100 utilities across the U.S. showed that one third were using, planning, or considering broadband over power line deployments.[16] However, customer densities still impact the economics of the technology. In particular, since transformers are barriers to overcome, it is more economical for the technology when more customers share a single transformer. In Vermont, many areas have a low density of customers per transformer. (In rural areas, the density can be as low as one customer per transformer.) Furthermore, the FCC is still examining how great is the potential for power line communications to "leak" and cause interference with various wireless transmissions. While FCC Chairman Michael Powell has signaled early support for the technology, certain interests such as Ham Radio operators are opposing it. In short, powerline communication is a promising technology that could play a part in providing either broadband coverage in unserved areas or additional choices to served areas, but the degree to which it will be commercially successful is still uncertain.

WIRELESS VOICE BYPASS

About two in five Americans now have a wireless phone and 61% of U.S. households had a wireless phone by mid-2001. Three to five percent of wireless customers use their wireless phone as their only phone. This number is growing, and the growth can be expected to accelerate. According to one forecast, by 2015 more than two thirds of North American households can be expected to use a wireless phone as their primary voice line.[17] According to a Yankee Group survey, about 15% of all wireless phone customers say they will jettison their wired phone in the next five years. According to a Management Network Group Inc. survey, about 19 million Americans would likely switch their landline numbers to a wireless phone number if the FCC allowed such switches, a move that could cost landline companies $14 billion a year.[18] The FCC in fact subsequently issued such an order in November 2003. While Vermont will almost certainly lag behind this trend, it will nevertheless be likely to have a significant impact here as well. An increased reliance by Americans on wireless phones as their primary voice connections will mean that users will expect a higher level of reliability and coverage from the service. It also suggests that landline telephone companies need to plan for a migration away from traditional voice service as the mainstay of their business.

INTERNET2 AND IPV6

The original Internet evolved and migrated from an "internetwork" connecting the networks of a relatively exclusive "club" of government agencies, educational institutions and selected companies to the wide-open "superhighway"

we see today. Similar "clubs" of high-powered sites are still active today. Very high-speed research and development networks are prototyping applications including high-quality multimedia collaboration and virtual reality environments that may drive the further development of the Internet. The University of Vermont participates in the Internet2 network with over 200 other universities around the U.S.

Another evolution in the Internet is in its core routing and data packaging standard. IPv6 is the successor to IPv4, which is the standard that is currently widely deployed. While the transition from IPv4 to IPv6 has not progressed rapidly, IPv6 offers improvements that help remove barriers to even more widespread use of IP. First, IPv6 offers a vastly expanded address pool that will allow individuals and devices to be assigned static IP addresses with a freedom that is not possible today. This will facilitate applications that require lots of addresses that can be "seen" by the public network and do not change, such as IP wireless devices. IPv6 also provides improved options for security and for establishing service quality levels on IP networks. While IPv6 is still far from widely adopted, the movement to improve IP for a new generation of networks bodes well for the adoption of IP as the general-purpose telecommunications protocol.

Table 1.1:
Number of addresses in IPv4 and IPv6

Number of Addresses in IPv4	4,294,967,296
Population of Earth (2001)	6,170,000,000
Number of Addresses in IPv6	340,282,366,920,938,463,463,374,607,431,768,211,456

Source: http://ipv6.internet2.edu/

INSTANT MESSAGING

The stereotype of instant messaging (IM) is of a lightweight "chatting" tool firmly in the realm of teenagers. This stereotype belies the fact that "IM" and its close relatives (such as wireless text messaging and web chat pages) have grown up. IM occupies a space in between e-mail and phone calling; it is based in text but is real-time.

While IM retains its social element, it is also an increasingly serious tool. On September 11, when text messaging was in some cases the only way for people in the affected areas to communicate via overwhelmed wireless networks, it showed clearly how text messaging can be a very efficient communications medium in a high-volume situation. Businesses are increasingly using IM in their collaboration systems as a way to increase informal communication and collaboration among employees. IM has now been incorporated into groupware systems like Lotus Notes. Chat is also an increasingly important tool in customer service, providing customer service representatives a tool to communicate real-time with multiple customers. Two-way wireless text message systems can be as important (or more so) to a person who is hearing- or speech-impaired, as a cell phone is to someone without those impairments.

Although rooted in text, IM systems are now capable of carrying attachments, like e-mail, or presenting themselves in various non-text forms, such as pictures, video, or voice. IM services are offering the ability to initiate PC-to-phone calls.

Instant messaging is an important means of transmitting files in the current generation of peer-to-peer file sharing services, the heirs to Napster. The ability to send voice, files, or video over broadband connections presages the use of an evolved IM system for robust multimedia real-time communication. While voice or video communication over the public Internet are currently sometimes second-rate, the interface provided by IM programs and the large base of users mean that IM service providers are poised to capitalize on improvements in the level of service. This could ultimately provide another means of bypassing more traditional voice telephone communications. Furthermore, as the functional difference between IM servers and telecom company switches becomes fuzzier (each providing real-time routing of multimedia messages or communications between users), the basis for regulatory differences may become less distinct.

A feature that IM services offer that is not offered by most other real-time communications services is that of "presence." IM systems provide users the ability to broadcast their level of availability to communicate to other users. In contrast, on the telephone network a user must make a call to find out whether or not a person is available. Presence provides the metaphorical ability for a person to open their door wide open, crack it, or shut it tight. In a world where people increasingly have the ability (if not always the desire) to be connected continuously, the idea of presence is powerful. The concept of actively managing one's announced availability to communicate is powerful enough to spread to other communications media.

A serious problem with the world of IM and text messaging is the lack of widespread interconnection between messaging systems. In the U.S., users of dominant IM systems by AOL, Microsoft, and Yahoo cannot communicate with each other. Wireless text messaging systems may not be able to trade messages. This bears a resemblance to the early days of the telephone systems when multiple telephone systems serving the same city were not interconnected. And unlike the days of mutually incompatible Compuserve and AOL e-mail systems, there is no IM equivalent to the user base of Internet e-mail. Since networks are inherently more valuable the more users there are connected to them, there must be strong pressure for either eventual widespread interconnection and interoperability or the emergence of a single dominant IM provider. The current competition among IM providers has led to a proliferation of features and low (in fact free) usage prices. Interconnection and the development of interoperability standards is the alternative outcome to domination of IM by a single provider in addressing the incompatibility issues that the multiple providers raise.

TRENDS IN WIRELESS TECHNOLOGY

UNLICENSED WIRELESS DATA SERVICES

While operation in most of the radio spectrum requires an FCC license, in a limited number of spectrum ranges, the FCC permits unlicensed use of radio frequencies for a wide range of uses. Examples of these bands are 900 MHz, 2.4 GHz, and 5 GHz. Many people are familiar with digital cordless phones that operate in the 900 MHz and 2.4 GHz ranges. These are just two of the devices operating in these bands.

Service providers using free, unlicensed spectrum have been first to market with high-speed wireless data services in many areas (including Vermont). This is despite the billions of dollars spent on wireless spectrum licenses in the 1990s, much of it for high-speed data services. Unlicensed spectrum has a number of disadvantages. It can be especially subject to interference, since multiple uncoordinated users can attempt to use the same frequency in the same area. (In practice, this interference is less likely to happen in low-density areas and commercial users of the same unlicensed band have an incentive to work around their mutual problem.) The FCC regulates the manufacturers of devices for these bands, prescribing transmission strategies to limit the effects of interference, including limiting the power of transmitters and prescribing certain modulation techniques. Low power limits the range of these services. Nevertheless, unlicensed services have proven to have a number of economic advantages. Devices for operation in these bands have often been developed for the mass market originally. Wi-Fi wireless networking is an excellent example. It was originally deployed primarily as a way of creating wireless Local Area Networks (LANs). In some areas service providers or neighborhood co-ops (or just "generous" or security-lax network operators) discovered that the "LAN" could cover a neighborhood, a small downtown or a village depending on the antenna placement. Relatively low-cost equipment (due to the mass-market customer base and scale of production), a relatively large pool of innovating service providers (due to the lack of license restriction), and a relatively large base of users having or able to get compatible equipment (due to the 802.11b standard and other standards) has meant that service providers have been able to tinker, stretch, and expand the range of these systems. An increasing number of vendors are now making fixed wireless products for Wireless Internet Service Providers (WISPs) using unlicensed spectrum. Companies like Intel and Nokia have formed a consortium to extend the success of Wi-Fi by creating an industry standard for wireless wide area networks called 802.16 or WiMax. This standard could reduce the cost of equipment for mobile or fixed wireless Internet access that has an operating range of miles. The technology is expected to be broadly available in 2006.[19] The FCC is actively investigating granting more spectrum for wireless broadband and it seems not a question of whether unlicensed wireless applications will grow, but how much.

LICENCED WIRELESS DATA SERVICES

Service providers with licensed frequencies are also rolling out new wireless data services. This includes service providers using cellular or PCS frequencies. Third-generation or 3G wireless services represent a shift from a voice-oriented personal wireless services system to a data-oriented mobile packet data network, on which voice is one application. This will change the way that wireless services are used in a way similar to the way that DSL is changing the way that ordinary copper telephone lines are used. High-speed Internet access, transmission of remote mobile video or photography, and mobile remote connection to office LANs all become possible. Mobile packet data services such as cellular digital packet data (CDPD) have been available in the past but represent niche services. Widespread adoption of wireless packet data services will be a byproduct of the transition to delivering wireless voice services via a 3G packet network. In the U.S., a major barrier to the deployment of 3G services is the

lack of allocated spectrum, unlike in Europe where spectrum has already been allocated. In the U.S., the military occupies the spectrum that has been allocated for global 3G services. A contentious debate has been raging at the federal level about whether and how to make available that spectrum or other spectrum. Certain wireless carriers in the U.S. have deployed "3G" services using existing spectrum. In Vermont, this includes Sprint PCS and Verizon Wireless. The announced data rates for these "3G" services are up to 144 kbps. Forthcoming services are expected to provide faster data transfer rates. Verizon Wireless has announced a nation-wide rollout of an even faster wireless data service with typical download speeds of 300-500 kbps, although the initial deployment is limited to a handful of major metropolitan areas. A potential barrier to additional deployment is the cost of licenses for new spectrum if and when it becomes available. 3G services are also likely to require still more wireless antenna sites with each covering a smaller area. These sites may not typically require new tower installations of the size of previous wireless service deployments.

Licensed spectrum in the lower 700 MHz frequency range is another possibility for bringing high-speed Internet access to Vermont. This range is in the portion of the spectrum used by UHF TV signals on channels 52-59 and is being freed up as part of the migration to digital TV broadcasting. Under new FCC rules, this spectrum may be used for fixed, mobile, or broadcast services. Licenses for this spectrum have already been auctioned, although until the TV users have migrated, new lower 700 MHz providers must operate so as to avoid interference with the existing TV licensees. In Vermont, both Qualcomm and Vermont Telephone (VTel) won auctions for license areas covering all of Vermont. Since Vermont is not a major market, the economic viability of 700 MHz Internet access is likely to depend heavily on the extent to which manufacturers can produce volumes of equipment for the national market of service providers in the band. Vermont has fewer existing TV users that need to vacate the 700 MHz band, making it a promising location for early deployment once equipment is available.

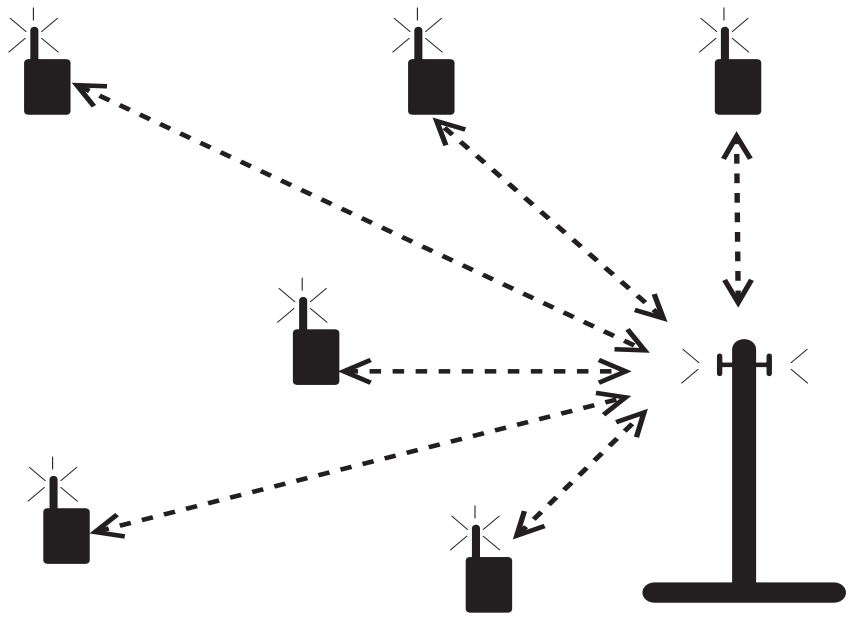
ALTERNATIVE DEPLOYMENT STRATEGIES FOR WIRELESS SYSTEMS

Strategies for deploying wireless services continue to evolve away from the "tower on a hilltop" model, although towers will continue to have some role especially in the more sparsely populated areas. Alternatives that require more transmitters and receivers (but smaller ones) can be expected to grow. This is especially true for services operating in higher frequencies (which naturally weaken faster with distance and are more easily blocked by obstacles), or operating with lower-powered user equipment.

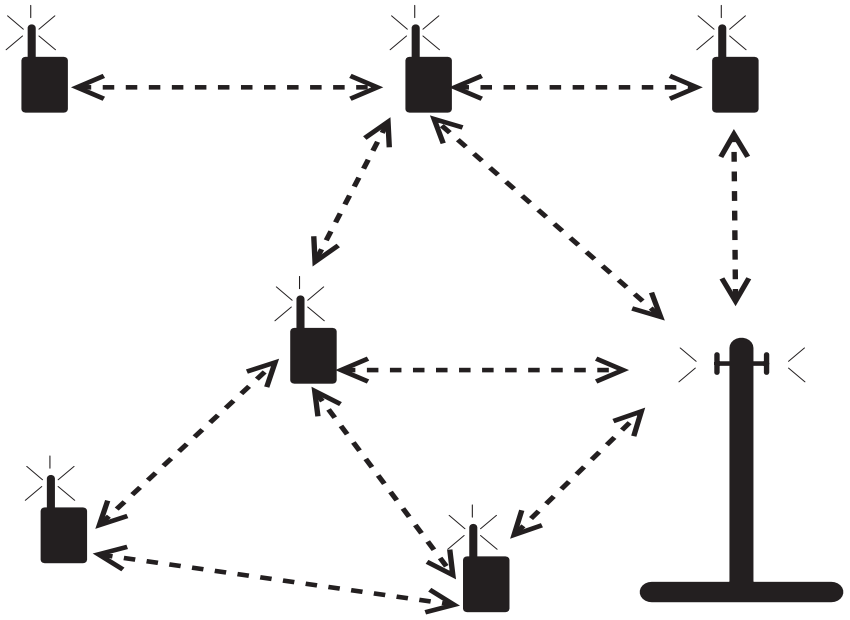
In *mesh routing* each user's wireless device acts not only as a send-and-receive station for communication with a base station, but as a router that is capable of passing along communication between another end user's device and a base station or still another end user's device. (See Figure 1.3.) In many ways this mesh of communications paths is like the way the Internet operates and it is a natural for wireless packet-data services. Its key advantage is the ability to overcome distance and line-of-sight requirements between a base station and distant users because communication can hop from site to site. Furthermore, a greater

Figure 1.3:

Conventional wireless routing vs. mesh routing



In a conventional point-to-multipoint wireless network, all users must communicate directly with the base station.



Mesh routing provides multiple paths back to a base station, even for those users that may not have line-of-sight.

number of users increases the robustness of the network, providing a greater number of communication paths.

The size of available base stations continues to shrink. Installations might formerly have had high-power antennas perched atop high towers or other structures with large outbuildings containing electronics. Now some of these may be micro cells with cabinet-sized base stations, 4-6 foot antennas, and more flexible siting. Looking toward the future, other installations may be pico cells that may have antennas not much bigger than that on a cell phone. Smaller wireless equipment offers greater flexibility in the deployment of service; unfortunately they are most attractive in the areas of highest traffic or in indoor locations like malls.

Alternative deployments to the tower continue to grow in frequency. In Vermont, silos have become a surprisingly popular location for deploying antennas. One possible means of covering a roadway is to connect a string of small antennas to a base station with fiber optic or coaxial cable strung along utility poles. This method has been used more often in providing service to large indoor environments like stadiums and convention centers. The experience gained by the industry in this regard may translate into greater interest in using this deployment tool. Other alternative strategies for deploying service, especially in very large rural areas, include base stations and antennas mounted to aircraft, hot air balloons, or blimps. While worth watching, these deployment strategies do not yet have a proven track record and should not be depended upon to deliver service to Vermont anytime soon. Unfortunately, if a rural area does not have an available existing tall structure, a tower or monopole still may be the most cost-effective proven way of providing service to dispersed users.

Satellite phones are sometimes thought of as an alternative to terrestrial wireless services. They are unlikely to replace terrestrial wireless services in Vermont over the period of this plan for several reasons. Satellite phone communication is more easily blocked by obstructions such as buildings due to the need to communicate with a distant overhead satellite. Satellite phone equipment is somewhat bulkier and therefore less attractive to users. Satellite launches are expensive, capital-intensive, and riskier than terrestrial construction. Because of these disadvantages combined with satellite's key advantages of (i) widespread coverage even in remote areas and (ii) the ability to provide a back-up to terrestrial phone service, satellite phone service is most likely to be marketed as a niche service with a premium price, discouraging widespread adoption. Because Vermont is part of a larger market of wireless customers who travel between areas, the demand for terrestrial wireless service and network development in Vermont depends not only on the demand of local users but that of out-of-state users.

WIRELESS TELEMETRY

Requirements that wireless service providers make available more detailed information about caller location is part of the FCC's "Phase II" requirements for wireless E 9-1-1. This will accelerate the development of wireless telemetry, in particular the remote collection and analysis of data on the movement and location of people or objects, such as vehicles. While this raises serious

privacy concerns, it also raises the possibility of a large number of new applications. Transportation applications, such as enhanced traffic management and better coordination of multi-modal trips (such as walking/bus or car/train) are one possibility. Customized selling or advertising based on a combination of the individual's personal preferences and location is another opportunity (or threat, depending on one's point of view).

SATELLITE DATA

The satellite data services market has expanded since the last edition of the *Vermont Telecommunications Plan* and indications are that this platform for delivering data services in Vermont will continue to develop and mature. Two-way service for the residential or small office user has now become commonplace. Satellite service providers, for a variety of prices, offer a variety of tiers of service from consumer-grade Internet access at speeds comparable to cable modems, to wide area networking services at speeds comparable to T-1 levels of service. Satellite provides a key advantage: the ability to reach locations out of reach of services like DSL or cable. For this reason, it is likely to be an important means of filling in the high-speed access map in the immediate future. The ability to reach where there is little or no competition has also tended to allow the service to obtain a price premium compared to cable or DSL services. Satellite data services are not an exact substitute for terrestrial data services. Today, these services are delivered via satellites in high geostationary orbits, which appear from earth not to move in the sky and allow dishes to be pointed at them. This high orbit means that an approximately half-second round-trip delay is introduced into communications. (You can observe this on the television news in the interviews via satellite of reporters in remote locations.) For many applications, such as web surfing or e-mail, this produces no noticeable effects. It may be long enough, however, to complicate such applications as remote access to a LAN. Real-time voice and video communications operating over the data service would also be noticeably degraded.

TRENDS IN CABLE NETWORKS

CABLE CONVERGENCE

While cable operators in Vermont have not yet been active either here or in other parts of the country in introducing telephone services, major cable operators elsewhere have been promoting telephone-over-cable systems. There are in excess of 2.5 million subscribers already around the country and cable operators could take a significant market share of local telephone lines over the coming years. Earlier efforts at cable telephony used systems that mimicked the circuit-switching system of traditional telephone networks. New offerings are expected to be voice over cable system operators' private IP networks. The same systems that are used to offer cable modem service are being leveraged and extended to offer voice service. These services offer the same kinds of cost advantages as other VoIP services and prices for some services are striking—such as a $34.95 Cablevision package that includes unlimited local and long distance service.[20]

Table 1.2:
Cable phone subscribers

Comcast	1,367
Cox	839
Insight	42
Charter	26
Cablevision	12
Total	2,286

In thousands, as of June 30, 2003

Source: Company reports and UBS estimates

DOCSIS

Cable Labs' DOCSIS (Data Over Cable Service Interface Specification) provides the basis for the development of standardized equipment that enables the offering of new or improved services over the cable network. DOCSIS 1.0 defined standardized ways of communicating high-speed Internet traffic over the channels of the cable network. DOCSIS 1.1 offered the ability to define various tiers of service or levels of quality that could be offered to different kinds of customers. DOCSIS 2.0 specification should enable increased "upstream" throughput, making possible symmetric data services.

ISP ACCESS TO CABLE SYSTEMS

The emergence of cable modem service as the most common form of broadband Internet access has sparked debate about the future of the Internet access marketplace. For dial-up Internet service, a multitude of Internet Service Providers (ISPs) have used the common infrastructure of the telephone network to offer service. Cable systems are considerably less open. Generally speaking, cable systems are only open to the cable company's affiliated Internet service, or the affiliate and a small number of other ISPs who have negotiated private deals with the cable operator. Small cable operators may have unaffiliated ISPs on their system. In Vermont, Duncan Cable's carriage of SoVerNet is an example. These arrangements are not typically open to all comers. A call that went up in the late 1990s for "open access" on cable systems was blunted by a subsequent decision by the FCC that cable modem services were neither "cable services" and therefore subject to local franchising authorities, nor "telecommunications services" subject to common carrier regulation. Instead, it found that they were "information services," the same federal regulatory classification under which dial-up ISPs have fallen. In contrast, in the 2001 Vermont Public Service Board (PSB) decision granting Adelphia Cable new franchises, the PSB tentatively concluded that cable modem service was not a cable service under Vermont law but was a telecommunications service. The Federal 9th Circuit Court of Appeals in the so-called "Brand X" decision recently overturned the FCC's decision. The Ninth Circuit, upholding its finding in an earlier case, found cable modem service to have both a "telecommunications service" component and an "information service" component. Unless overturned on appeal, the decision will be returned to the FCC for further deliberation.

Although classification of cable modem as a "telecommunications service," at least in part, provides regulators with additional tools for ensuring that cable operators do not discriminate among content riding on their services, it may do little to provide unaffiliated ISPs access to cable systems. The FCC has indicated that even if cable modem service is a "telecommunications service," it may consider it an interstate telecommunications service, pre-empting state regulation. It has also indicated it could forbear from much of the regulation it would have the power to impose on an interstate telecommunications service. In brief, there is a significant likelihood that cable systems will be closed to most ISPs for the foreseeable future.

VIDEO ON DEMAND/DIGITAL VIDEO RECORDERS

Video on demand (VOD) and the Digital Video Recorder (DVR) represent new modes of programming delivery on cable or satellite systems offering consumers the ability to watch programming when they want to watch it. Programming may be offered on either a subscription model, a pay-as-you-go model, or both. VOD rollouts are happening now on cable systems across the country, including in Vermont. VOD essentially operates like a high-quality streaming video system, but is limited to the cable system. It offers consumers more control over what they are watching, but how much control operators and content providers will grant them and what the business model requires are still open questions. At issue are such things as the amount of programming that will be offered on a VOD basis, the presence of advertising and the ability (or lack thereof) to skip it. The viability (and importance) of VOD will also be affected by the success of DVRs (e.g. TiVo) and Internet streaming video. The former seems poised to mount serious competition to VOD services. There are at least 4 million households with DVRs, and Forrester Research predicts that by 2004, 27 percent of U.S. homes will have DVRs and one-third will have VOD.[21] Cable companies and satellite companies alike are integrating DVRs into their digital set-top boxes. DVRs especially are poised to change the way advertisers use the television medium by allowing users the freedom to skip ads.

OTHER TELECOMMUNICATIONS TECHNOLOGY TRENDS

SATELLITE RADIO

In late 2001 and early 2002 two new services, Sirius and XM, launched, each delivering a hundred or more channels of music and talk radio via digital satellite transmission. These services, while offering a diversity of radio programming previously unavailable in any one area, are also national in scope. This is an advantage for long-distance travelers who do not want interrupted coverage or to hunt for new stations. It also means that the programming does not have a local element. Commercial-free and subscription-based (at $10-13/mo.), these services are currently a premium offering. They are likely to remain viable at least as a niche service, but it is possible that they could become more popular. (The inclusion of satellite radio systems in some new cars by major automakers suggests this could be the case.) To the extent that these systems begin to reduce the listenership of local terrestrial radio and the business case for local radio stations, Vermont may see an erosion of that mode of communication, both for everyday communication and for such things as emergency broadcasts.

DIGITAL BROADCAST TV

Digital broadcast TV, not to be confused with digital cable TV, will offer viewers in one over-the-air broadcast signal either one high-definition television (HDTV) programming stream, multiple standard-resolution simulcasts, or a standard resolution broadcast and "datacasting," the transmission of high-speed data in the broadcast signal. "Datacasting" offers the possibility of providing high-speed data efficiently to anyone who can receive a TV signal. Unfortunately it is one-

way, and without an effective return path, it is questionable how many users will obtain the necessary hardware to receive datacasts. A key challenge with the conversion to broadcast digital TV will be the need to re-construct the antennas of the TV stations in Vermont, many of which are located on mountaintop sites including Mt. Mansfield, Burke Mountain, Rutland, and Mt. Ascutney. Currently the federal deadline overseen by the FCC for a full transition to digital broadcast TV is by the end of 2006 or when the penetration rate for digital television receivers reaches 85 percent. Until then, broadcasters are occupying two sets of frequency spectrums for simultaneous analog and digital broadcast. Once the threshold for all digital broadcast is met, broadcasters will be obligated to return their excess spectrum (including 700 MHz spectrum), which will then be available for other purposes. The transition to digital broadcasting suffers from something of a chicken-and-egg problem that many observers anticipate will delay the final transition and return of spectrum. Broadcasters are reluctant to produce digital broadcast programming without an installed base of digital receivers. Consumers are reluctant to buy TVs that include digital receivers without plentiful digital programming. Further complicating the situation is the fact that the majority of consumers receive programming via cable and satellite. These outlets have been reluctant to commit to carrying digital broadcast programming which, unlike digital cable, has the potential to use more bandwidth per channel, not less. In an effort to circumvent the impasse, the FCC has required that half the TVs with screens of 36 inches or more sold in this country have digital tuners by 2007.

C. Other Industry Trends and Developments

FEDERAL PREEMPTION

A number of unfolding developments may erode Vermont's ability to directly influence the development of its telecommunications infrastructure. Over the past several years, a number of decisions have been made at the federal level to limit state authority over new or emerging services. These new and emerging services are becoming increasingly important parts of the telecommunications network. The Telecommunications Act of 1996 pre-empted state authority for personal wireless services (including cellular and PCS service) over rates and health standards and limited authority over siting. Perhaps more importantly, the FCC in 2002 issued decisions declaring that DSL service and cable modem services are interstate "information services," which could have the effect of removing their underlying networks from state regulation. Even though the Ninth Circuit Court of Appeals recently overturned the FCC's decision on cable modem services by ruling that cable modem service had both telecommunications and information service components, that decision still leaves the FCC with considerable leeway to remove cable modem facilities from state oversight.

At the same time as services like DSL and cable Internet access have been declared interstate services, the FCC has frozen the interstate/intrastate separations ratio for a period of five years. This freeze expires in July 2006. This means that interstate revenue can continue to grow while intrastate sources of revenue, from second lines and local minutes of use, threaten to stagnate.

As a practical matter, some of these decisions do not radically change the likely outcome of regulation in Vermont. It seems unlikely, for example, that the PSB would regulate the price of wireless service at this point even if it had the authority to do so. Two key and related areas where it could make a difference are on issues of open access and the availability of key elements of a broadband infrastructure. In the cable modem case, the FCC essentially decided that the transport element and the services riding on it were one and the same. While the FCC's recent decision on DSL was very similar, it may not necessarily mean that states do not still maintain the ability to regulate the facilities used to provide DSL, keeping them open for other services or service providers. It does at least create sufficient confusion about that issue to threaten the concept of open network architecture.

What are "separations" and why do they matter?

States and the FCC have traditionally split the regulation of telecommunications services. Some services, such as local exchange service (the piece between the customer and their local switch), are considered to have both interstate (federal) and intrastate components. "Separations" is the process for dividing up the costs and revenue for these services. State regulators are responsible for establishing rates that will cover the intrastate portion of the costs and the FCC is responsible for establishing rates to cover the interstate portion of the costs. Services are classified as "interstate" or "intrastate," and the revenue earned on each goes to the interstate and intrastate requirements, respectively.

On one issue, there is the possibility that federal preemption could impact regulation in Vermont greatly. In 2001, the FCC issued a Notice of Proposed Rulemaking (NPRM) on the subject of developing a unified intercarrier compensation regime.[22] Intercarrier compensation is the system of payments that telecommunications companies make to each other to originate, terminate, or transport each other's calls. This compensation varies by a number of factors, including whether the call made is local or long distance, interstate or intrastate, wireline or wireless, or circuit-switched. Technology and competition together are reducing the viability of this system by introducing ambiguities and inconsistencies into the system and providing opportunities and incentives for companies to seek out a more favorable rate of intercarrier compensation. The NPRM proposed a simplified "bill and keep" system for all forms of intercarrier compensation, one where companies would generally recover their costs from their own customers and not each other. Significantly, the NPRM contemplates the possibility that this could extend not only to interstate charges, but to intrastate charges regulated by state public utility commissions, including the PSB. Since the NPRM there has been little formal action in the docket by the FCC, but a wide range of companies have engaged in private negotiations in an effort to come up with a consensus proposal. As of mid-2004, these efforts had not yet borne fruit and the results were uncertain.

FINANCING CONSTRAINTS ON INFRASTRUCTURE INVESTMENT

Telecommunications investment has endured a period of unfriendly capital markets, making investment that much more challenging in Vermont's market. Although nearly all segments of the telecommunications industry have been affected by the tightening of capital investment, one indicator of the challenge is

the level of spending by the newer entrants to the telecom marketplace; capital spending by competitive local exchange carriers (CLECs) was $10.7 billion in 2002, down from $21.7 billion in 2000.[23] There are several potential or actual bases on which capital funding for telecom (including cable) investment in Vermont can rest.

- National commercial capital markets. These are most significant for companies with a footprint that extends beyond Vermont. The financial markets are likely to be wary of many telecom investments for the near to mid term at least, due to the collapse of so many firms around the country in this market. The companies most obviously affected by this situation are upstart competitors to incumbent local exchange telephone companies and expanding wireless carriers. While this situation is serious, and affects national and regional telecommunications companies operating in Vermont (such as Verizon and Adelphia), it may perhaps have changed things less for Vermont than some areas of the country because some significant local companies have never had meaningful access to these markets.
- Vendor financing. During the heyday of the telecom bubble, many telecom manufacturers self-financed the purchase of their equipment and facilities by service providers. Many of these loans have defaulted, leaving manufacturers in a weakened position.
- Venture capital. The small number of appropriately sized venture capital funds focused on Vermont is a problem that the Department of Economic Development has recognized and worked to change. Venture capital funding has not been significant so far for telecom in Vermont. Venture capital funding also imposes severe constraints about payback periods and rates of return that are not compatible with investment in long-lived, long-payback investments in telecom.
- Local bank financing. This is an important source of financing for small, locally based companies providing competitive telephone, cable, or high-speed Internet service. It has its limits, as it is a conservative funding source with little special understanding of telecom investment.
- Revenue reinvestment. Use of a revenue stream to finance investment has been important for several categories of companies. Some companies, such as cable companies, have a certain degree of freedom (due to few competitors and no effective rate regulation) to raise prices, providing more money for major reconstruction or expansions of systems. A number of relatively non-diversified independent telephone companies have very low debt-to-equity ratios, indicating that revenue has sufficed to finance the company's investments to a significant extent. Some locally-owned Internet service providers or cable companies expanding into high-speed data services have used the revenue from their existing lines of business or a slow "pay as you go" model to incrementally finance their new venture by necessity, due to a relative lack of alternative financing. Revenue reinvestment may be less likely to happen as a matter of course when the company is heavily diversified, has a geographically broad footprint, and does not have a mechanism that strongly ties earnings to investment.
- Federal loan and grant programs. A number of programs, especially through USDA's Rural Utilities Service (RUS), have traditionally existed to fund

infrastructure improvements in rural areas. These programs have not been widely used in Vermont. The most recently passed Farm Bill contained some new loan and grant programs for broadband service deployment. Other proposals for broadband investment programs have come up from time to time in Congress in recent years. A key obstacle may be that information about these programs is difficult to obtain and regulations about the use of funds may make it unclear what projects in Vermont would qualify for funding.

- Local or state-level public investment. There have been few examples in Vermont of direct public investment. The City of Burlington's Burlington Telecom is a notable exception and has deployed fiber optics to serve city and school telecom needs. It is now starting to make this infrastructure available to other enterprises in the city, including on a wholesale basis to other service providers. The Department of Public Safety (DPS) has recently made a major investment in upgrading a statewide voice and data microwave system, but this system is only for use by public-sector agencies. In some other jurisdictions, direct public investment has been more prominent in developing systems ranging from long-haul fiber optic routes to new cable TV systems to fiber-to-the-home integrated voice, video, and high-speed data delivery systems. They are frequently controversial and have been so in Vermont. In some cases, jurisdictions are attracted to public financing tools such as bonding because the long term of public bonds is similar to the expected useful life of certain (but not all) telecom infrastructure elements, like fiber optic strands.
- Local or state-level loans or tax incentives. This has not been a source of funding thus far in Vermont. Arguably, a number of state tax structures currently create a disincentive to investment. This includes the sales-and-use tax, which is imposed on telecommunications equipment and facilities purchases. Also, the taxation of cable outside plant property at fair market value instead of net book, as telecom facilities are, can potentially lead to large property tax increases when cable plant is rebuilt to enable new services.
- Traditional utility-based financing. This is not a special "source" of funding *per se*. The combination of a captive base of customers and regulatory approval to recover through rates a stable rate of return over long periods on prudently made investments creates special conditions for private investment. A few companies—namely the independent incumbent (non-Verizon) telephone companies—fall into this category, and they have had different investment patterns than Verizon or the competitors in Verizon's service territory. Nearly all of these companies have invested heavily in recent years in modernizing their networks and rolling out DSL service widely. Unlike competitive upstarts, they still have near-monopoly control over their base of telephone customers. Their monopoly service includes a basic, essential service, telephone. Unlike Verizon, they are rate-of-return regulated, meaning that that their earnings are directly related to their levels of investment (assuming that their rates are under possibility of regular review). Under Verizon's price-cap regulation plan, investment is more discretionary, assuming the company can otherwise meet the expectations of the alternative regulation plan. The differing form of regulation is not the sole factor contributing to the differences between the companies. A number of inde-

pendents have taken advantage of low-cost RUS loans. Several are locally owned and less diversified with comparatively fewer alternative investments close at hand. Also, most independents have benefited from a federal pooling mechanism that allows them to pool a portion of their costs and revenue. This pool links the companies' compensation much more strongly to the amount they invest in services like DSL than to the amount of revenue they collect from them (which is returned to the pool), greatly reducing the riskiness of the investment.

- Market pre-qualification. This too is not a source of funding *per se*, but a means of improving the case for financing from some source. A number of companies operating in Vermont with limited access to financing have used this tool by only building in a locale or along a route when they have pre-sold service to a number of customers or have in place an "anchor tenant" for their service.

In summary, the availability and terms of financing for telecom ventures is a key element in the continued development of Vermont's telecommunications networks. Some industry players have not seen dramatic changes in the sources and types of financing that they use. For others, the burst of the "telecom bubble" has left them more constrained.

TELEPHONE NUMBERS

Telephone numbers seem mundane, but their assignment and availability are key issues that have a significant impact on Vermonters. There continue to be significant developments in this area, as Vermont continues to monitor the rate of depletion of numbers in the 802 area code, sees consumers have more opportunities to keep their telephone numbers, and witnesses pressures to weaken the tie between telephone numbers and local geography.

A preeminent numbering issue in Vermont is the preservation of Vermont as a state with a single area code, 802, which is highly identified with the state. According to the April 2004 forecast issued by the North American Numbering Plan Administrator (NANPA), the 802 area code NPA (numbering plan area) is forecast to exhaust, or run out of new unused and useable blocks of numbers in the first quarter of 2012. This new deadline has been pushed back almost five years since the 2002 forecast. These forecasts have seen significant volatility, in some cases moving back, and in other cases accelerating. Once the reserve of number blocks in the 802 NPA dips below a certain reserve, an additional area code for Vermont is almost inevitable and once implemented, irreversible. Therefore, it is important to postpone this point as long as possible.

In 2002, the PSB implemented thousands block pooling in Vermont, a significant step to extend the life of the 802 area code. Shortages of numbers in NPAs are caused not so much by a shortage of individual telephone numbers but a shortage of continuous blocks of numbers. In years past, telephone numbers were assigned to telephone companies in blocks of 10,000 numbers. If an incumbent company needed a new block of numbers to accommodate growth in an exchange or a new competitor needed numbers to begin providing service to an exchange, 10,000 numbers were assigned to the company even if its imme-

diate or even foreseeable need was much less. Now numbers may be assigned in blocks of only 1,000 numbers, which greatly increases the efficiency with which numbers may be assigned.

To understand how the implementation of thousands block pooling is extending the life of the 802 area code, it is helpful to examine a few key statistics. First, Vermont has 141 telephone exchanges. Each telephone company serving customers in an exchange requires at least one block of numbers—more if it has a greater number of customers. There are 800 possible NXX codes in the area code and 54 are unavailable for assignment to customers, having been reserved for special purposes. Hypothetically then, if every exchange in Vermont had multiple competitors serving it and each competitor served every exchange in the state, there could only be five telephone companies at most, including the incumbent, in a competitive market. Since there are more than six CLECs operating in Vermont, and in some exchanges telephone companies are already using multiple NXXs, it is fortunate that not all competitors have requested NXXs in all telephone exchanges. Nevertheless, a number

Figure 1.4:
NXX code utilization in area code 802

June 2003

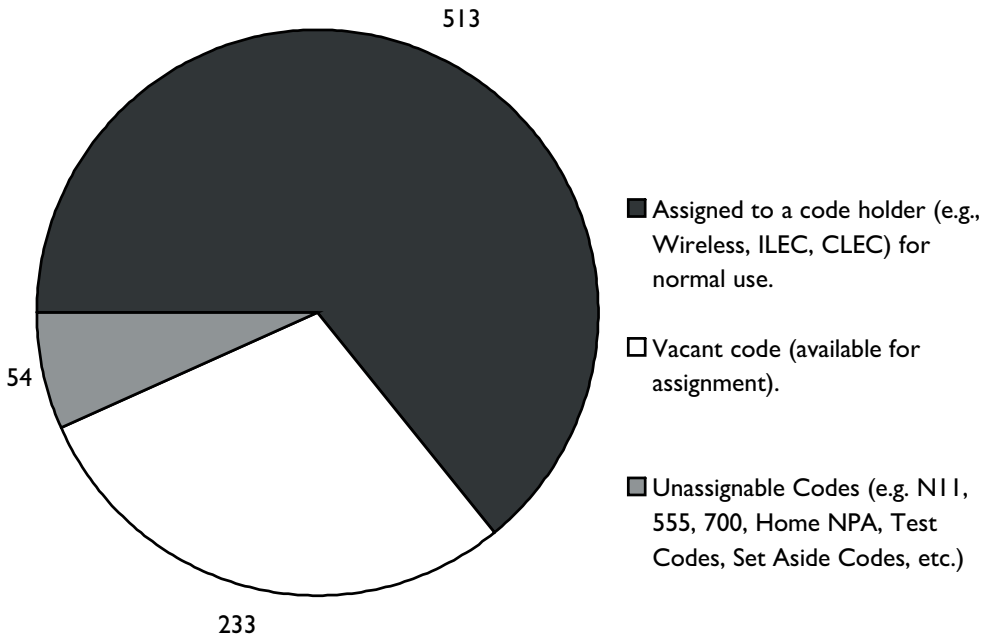
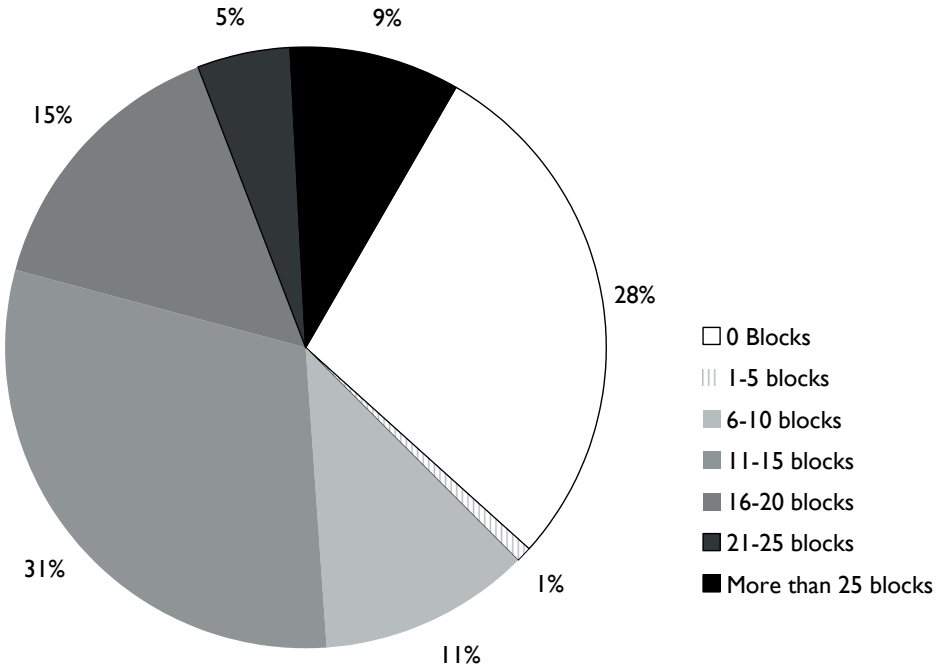


Figure 1.5:
Percentage of exchanges with donated blocks available

June 2004



of CLECs and to a lesser extent wireless companies, have requested blocks in a significant portion of the 101 exchanges served by Verizon. As a result, only about one third of the available NXX codes in the 802 area code remain unassigned. (See Figure 1.4.) Prior to thousands block pooling, requests by only two or three new CLECs or wireless carriers for NXXs in all or most Verizon exchanges would have faced the state with an area code split (dividing the state into two parts, and assigning all customers in one part a new area code) or overlay (assigning new phone numbers only out of a new area code statewide, which would require all calls be dialed with an area code). This was a distinct possibility. Now, requests for a block from most carriers will be filled not by a whole NXX, but by only 1/10th of an NXX, a thousands block. As Figure 1.5 shows, a majority of exchanges in Vermont had more than ten available blocks as of June 2004 that carriers have "donated" out of little-used portions of their assigned NXXs. Several of the larger exchanges most likely to see additional requests for thousands blocks due to growth or new carriers (Burlington, Rutland, and Montpelier) had much larger reserves of donated blocks (66 blocks, 72 blocks, and 55 blocks, respectively). The 28% of exchanges with no donated blocks belong to independent telephone companies that are not yet required to pool numbers. (Although it is possible that may change in the future). In short, thousands block pooling has created a buffer, a reserve of blocks that will delay the need to open up new NXXs in many exchanges.

While much of the risk of a jeopardy situation for the 802 NPA has been removed, there are still scenarios under which the NPA could be rapidly depleted. Since not all CLECs are required to pool, a request by 2 or 3 such carriers for NXXs in most of Verizon's exchanges could remove most of the remaining NXXs. A CLEC that was not required to pool would also not be able to port the numbers of new customers from their prior carriers, which would be a competitive disadvantage to most CLECs.

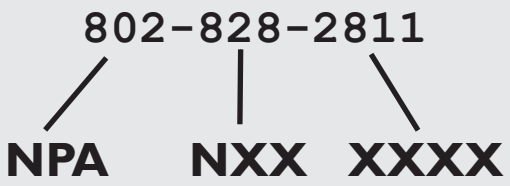
Local Number Portability (LNP), a federal requirement that gives consumers the ability to take their number with them when they change carriers, is now a reality for most consumers, although not for customers of independent telephone companies and a handful of CLECs. Wireless carriers have recently been required to port numbers between each other, increasing competitive choices for wireless telephone customers. Now that both wireless and wireline industries have been required to port numbers, the FCC has ordered porting of numbers between wireless and wireline services. This

Anatomy of a Telephone Number

The telephone industry uses certain combinations of letters to refer generically to the various parts of a ten-digit telephone number.

- The *NPA*, or Numbering Plan Area, refers to the portion of the number occupied by the area code.
- The *NXX* or "central office code" refers to the first three digits of a seven-digit telephone number, or the first three digits after an area code. NXXs are usually associated with a particular telephone exchange. The letter "N" means a digit between 2 and 9, inclusive. The letter "X" stands for any digit between 0 and 9, inclusive.
- The last four digits, *XXXX*, can also be any digit between 0 and 9, inclusive.

An NXX is also known as a "ten thousands block." An NXX plus the first digit of the "XXXX" series of digits is known as a "thousands block."



will greatly increase the ability of consumers to substitute wireless telephone service for their traditional access lines. In addition, only carriers who have implemented LNP are required to participate in thousands block pooling, so the growth in LNP is contributing to the life of the 802 area code.

Traditionally, there has been a strong correlation at many levels between telephone numbers and geography. This correlation has been used in telephone ratemaking. Area codes have been assigned to specific states or regions within states; and NXX codes to particular local exchanges. Customers only received telephone numbers associated with their particular geographic location (unless they paid significant charges for foreign exchange service), and usage charges for making telephone calls were often based on the distance between the called and calling parties. A number of trends have been weakening the correlation between location and telephone numbers.

- The cost of long-haul transport of traffic has decreased dramatically, especially with the national glut in long-distance fiber optic capacity. This has encouraged long distance companies to reduce or eliminate differences in price between long haul and short haul traffic. The increased use of Internet or IP based systems for transporting voice has only strengthened the trend.
- Mobile telephone service has further weakened the connection between a telephone number's apparent location and the user's actual location. While wireless telephone numbers are assigned to particular telephone exchanges, they typically give their users very large regional or even national "local" calling areas. Wireless companies routinely assign subscribers telephone numbers associated not with their exchange of residence, but with a nearby exchange. The FCC has determined that wireline companies could port such numbers from wireless companies, even though the customer might have a telephone number different than their physical exchange. Furthermore, since the location of mobile phones changes and since decreased roaming charges are now offered on many wireless calling plans, there are few barriers to a user having a telephone number in one locality but spending significant time on the phone at some distance away from that locality.
- Competition in the local market has brought with it de-emphasis on switching traffic locally and a greater use of transport. CLECs in Vermont are likely to haul all their calls to a single point in the state for switching, or even to an out-of-state switch. Verizon and competitors may also need to bring local traffic they exchange with each other to a single point of connection. With the increased use of longer-haul transport for even local calls, there are more situations where the costs for a local telephone company to transport a call over distance are similar to the costs to transport it locally.

Indeed one of the most significant ways in which local and long distance calls differ is in their regulatory treatment, especially in the differences in intercarrier compensation paid to complete calls. Long distance calls are subject to access charges while local calls are subject to the lower reciprocal compensation (which may involve no exchange of money between carriers). While Verizon's access charge rates have declined significantly, independent telephone companies still depend heavily on them. Regulatory differences between local and long distance calls are no longer as strongly reinforced by transport costs. Network design

creates tensions with the regulatory framework as carriers and users attempt to introduce new ways of using telephone numbers that blur the distinction between local and long distance. One way this has manifested itself in Vermont is the use of remote or "virtual" numbers. Essentially, customers obtain a telephone number in an exchange that is distant from their physical location at rates below the expensive rates that would have been charged for foreign exchange service in the past. The most notable use of these numbers has been to provide ISPs with dial-up Internet access numbers around the state. This practice has been the subject of two investigations. One was an arbitration of an interconnection dispute between Verizon and the CLEX Global NAPs in which the PSB ruled against the way in which Global NAPs was deploying "virtual NXXs." Docket 6209 is the PSB's long-running investigation into the use of these numbers generally. Even as the PSB threatens to crack down on the use of virtual telephone numbers in Vermont, Vonage and other Internet-based telephony providers have begun to offer subscribers their choice of local or remote area codes around the country when they sign up for service, additional remote numbers for only $5/month, and the ability to take numbers when moving to a new location (a feature that mobile phones already offer).

Number portability and the new services that offer new number choices create new opportunities for consumers. These put pressure on the traditional regulation of number usage, and while the pressure on the 802 area code has decreased significantly, this may well be only a temporary reprieve.

ACCESS LINE GROWTH

An indicator of the change moving through the telecommunications industry is the change in access line growth by incumbent Local Exchange Carriers (LECs), which over the history of the industry dependably has risen. From 2000 to 2002, the incumbent LEC share of access lines declined by about 9 million (4.7%). This change is probably due to several factors including wireless phone substitution, a slowing in the demand for second lines due to slowing demand for dial-up Internet access, and competition. The total demand for lines has not gone down, and the total number of lines served by incumbents is not going down, just changing in nature. More lines are being provided at wholesale, not retail, and more line equivalents are being provided over special access circuits like T-1s. Taking these factors into account, line and line equivalents served by incumbent LECs increased by about six million between 2000 and 2001.[24]

BROADBAND ADOPTION TRENDS

While there is considerable debate in some circles about the depth of demand for broadband services, broadband nationally is in fact continuing to grow at very respectable rates. While broadband households are still a fraction of total households, this fraction continues to grow despite the current economic climate. At year end 2002, almost a quarter of online households nationwide used either DSL or cable modems. In New England, 33% of online households were broadband households.[25] By 2004, another survey estimated that 39% of U.S. adult

Internet users have a broadband connection at home.[26] Broadband continues to be adopted at rates that are consistent with past trends in the adoption of consumer electronic devices and services. A typical pattern of technology adoption follows an "S" curve. (See Figure 1.6.) Broadband has been in the lower, shallow part of the curve, since the early phase of adoption. In fact, the rate of adoption for broadband by households has been similar to that of their adoption of Internet access itself. It is easy to forget that Internet access penetration took approximately eight years to exceed 20% of U.S. households. It was not until 2001 that the percentage of households with Internet service exceeded 50%.[27]

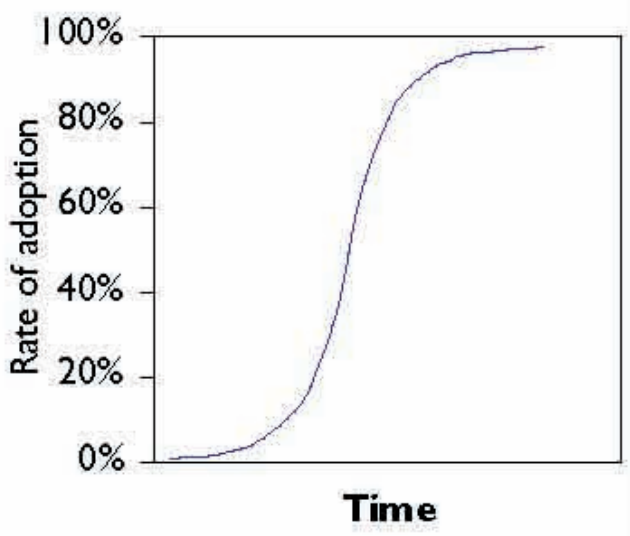
Table 1.3:
Years for past consumer technologies to exceed 20% penetration rate of U.S. households

	Years
Radio	5
Television	6
Pay Cable	14
VCRs	8
Internet Access	8

Source: Vanston, Lawrence K., "Residential Broadband Forecasts." Technology Futures, 2002.

These numbers give no reason for complacency. A reasonable forecast of broadband penetration could put broadband penetration levels in only five years near the point where Internet penetration levels are now or even higher—at 60%-80% of U.S. households. This could be true even if not all households have access to broadband. In ten years it is very possible that three quarters or more of U.S. households will have broadband service.[28] What is currently a relatively respectable level of broadband penetration in Vermont is unlikely to stay that way. Vermont subscribership must continue to grow strongly in order to keep up with probable growth in the use of this technology in other states and countries.

Figure 1.6:
The "S-curve" for technology adoption rates



Cable modem service adoption leads DSL nationally. A 2003 investigation by the FCC concluded that approximately 71% of U.S. households had access to cable modem service, with a take rate of about 11%, while DSL was probably available to less than half of Regional Bell Operating Company customers.[29] DSL subscription rose significantly in 2003, however. In March 2003, an estimated 67% of home broadband users nationally connected via cable modem, compared to 28% by DSL, 4% by wireless or satellite and 1% by T-1 or Fiber-to-the-Home services.[30] By February 2004, 54% of home broadband users connected with cable modems, 42% with DSL and 3% with wireless or satellite. Cable modem subscribership did not decline; instead, DSL subscribership grew more rapidly.[31]

THE UNBUNDLING DEBATE

The Telecommunications Act of 1996 set the stage for the FCC to require that the Regional Bell Operating Companies (RBOCs), such as Verizon, provide access by competitors to their services and network. Services are available for resale at a wholesale discount, and pieces of their networks (such as the local loop, local switching, interoffice transport, and dark fiber) are available at discounted unbundled network element (UNE) rates. Competitors have been allowed to recombine all of the UNEs needed to provide the "platform" for a complete service (UNE-P). As the Act passes its eighth anniversary, the future of unbundling is clouded with uncertainty. The FCC has made several attempts to implement unbundling rules, only to have them repeatedly struck down in court. The most recent of these undertakings came in mid-2003 in during the FCC's "third triennial review."[32] In March 2004, the D.C. Circuit Court of Appeals overturned in part and upheld in part the FCC's rules. Significantly, the court upheld rules that did not require unbundling of next-generation networks but struck down rules that allowed states discretion in making determinations about competitors' access to UNEs. In August 2004, the FCC issued interim rules continuing access by CLECs to RBOC switching, enterprise market loops, and dedicated transport elements on terms contained in interconnection agreements in effect on June 15, 2004, but only for six months. After six, months, if new permanent rules are not in place, the interim rules allow RBOCs to increase prices by at least 15% on for elements serving existing customers, and allow greater increases for elements to serve new customers. The interim rules expire at the end of 12 months. FCC Chairman Michael Powell has stated that he intends to complete new permanent rules by the end of the first six-month period and has also stated a lack of enthusiasm for preserving UNE-P.[33] Verizon and other RBOCs have gone to court to block the FCC from implementing its interim rules pending a final rulemaking. At this point it is difficult to predict exactly what unbundling requirements for Verizon and the other RBOCs will look like, even in the relatively near future, but it is likely that competitors will enjoy reduced access and higher prices on at least some UNEs.

D. Conclusions

Trends point to future telecommunications networks that are packet-based, have both wired and mobile elements, flexibly carry a wide variety of applications, and are on a path in increasingly high speeds. Change is a common theme among telecommunications trends.

- The telecommunications industry is seeing the progression of a number of disruptive technologies, including voice over packet networks, increased use of mobile services, and the maturation of multimedia, Internet-based alternatives to traditional voice.
- Broadband communications are in the process of maturing into a new basic, multi-purpose communications platform and the bar for what can be considered broadband speed may very well rise in the foreseeable future.
- Regulation is in a period of change, driven both by changes in technology and law and policy. Regulatory bodies will face pressure to change and adapt.

Vermont may not rest on its laurels if it is to continue to have necessary levels of telecommunications services. A key challenge for Vermont is the question of where financing for future needed investments in Vermont's telecommunications network will come from. Competitive and wireless providers lack the access to capital sources that were common a few years ago. Adelphia is emerging from bankruptcy and is significantly constrained. Verizon is no longer operating under traditional regulation and is a company with a multitude of investment pressures outside the state. At the same time, continued sustained progress must be made to upgrade and extend Vermont's telecommunications infrastructure if Vermont is to maintain its economic vitality. While broadband and wireless service and infrastructure should continue to advance, there is uncertainty about how rapidly and whether it will reach all corners of the state. Making sure that every Vermonter continues to have access to affordable high-quality telephone and data telecommunications services from one or more service providers in a new, increasingly competitive environment will be an essential task for the state.

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[10] These figures were derived by multiplying Gartner's California numbers by fractions derived by Vermont's GSP and civilian labor force by the figures for California. Year 2001 Gross State Product numbers were obtained from the U.S. Dept. of Commerce, Bureau of Economic Analysis and Sept. 2003 labor force statistics were obtained from the U.S. Dept. of Labor, Bureau of Labor Statistics. The readers are cautioned that the Vermont economic impact figures are, at best, an estimate of an estimate.

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[31] Horrigan, John B. *Pew Internet Project Data Memo*. Pew Internet & American Life Project. 2004.
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Vermont Telecommunications Initiatives and Activities

Vermont is a state of much activity related to the development of a telecommunications future. Telecommunications service providers, users, advocates, and others are all responsible for a long list of ways in which Vermont organizations and Vermonters are applying, developing, or facilitating the developments in telecommunications technology. This document collects and describes a cross-section of this activity.

The Public Service Department (PSD) collected information about these initiatives and activities in a variety of ways. Formal and informal interviews with key users and service providers are an important and continuing means of collecting information on "who is doing what" in Vermont. Furthermore, in June and July 2002, the PSD, in conjunction with the Vermont Broadband Council, the Vermont State Colleges, the Vermont Rural Development Council, the Department of Economic Development, the Vermont Telecommunications Advancement Center, and the Offices of Senators Jim Jeffords and Patrick Leahy invited a range of Vermont institutions, state agencies, business consumers, and non-profits to a meeting entitled "High-Speed Telecommunications Services in Vermont: Increasing Demand to Improve Access," held July 26, 2002, at Vermont Technical College. As part of this effort, the PSD sponsored a questionnaire that was sent to the invitees and was designed in part to identify the many ways that the organizations participating in the conference were using high-speed telecommunications and their efforts to promote Vermonters' access and use of the technology. This was by no means intended to take a comprehensive inventory of all activity related to high-speed telecommunications in Vermont, but it helped to catalog many interesting examples.

The Vermont Telecommunications Plan is also charged with an assessment of the current state telecommunications system. To that end, the PSD conducted a series of interviews with various state agency personnel in the spring and summer of 2002. The use of telecommunications and telecommunications-related concerns pervade state government. It is not possible to capture

Figure 2.1:
Vermont.gov: Vermont's new e-government portal

completely all the activity of state government in this area in a short document. What follows includes a summary of the major areas of activity, with highlights on the activities of several agencies, especially those facing significant changes.

A. Service Providers

INCUMBENT TELEPHONE COMPANIES

INDEPENDENT TELEPHONE COMPANIES

Independent telephone companies (ITCs) have existed across the country for decades, in many cases since the area served first received telephone service. ITCs are different from their large Regional Bell Operating Company (RBOC) counterparts and even from each other. Some ITCs are part of national corporations, other ITCs exist as a result of larger companies divesting properties, and still others originated and remain as small, family-owned businesses. Often times, ITC markets are in rural areas of the country where costs to serve are higher than national averages and demand is constrained by lower population densities. The nine Vermont ITCs are no different and in fact each fits one of the categories listed above. These companies collectively provide local telephone service to roughly 15% of Vermont's access lines. Since the last Telecommunications Plan, ownership of some of these companies has changed hands. Another small telephone company, Citizens Tel Co. of Hammond, NY purchased Topsham Telephone.

The relationship between Vermont regulators and the Vermont ITCs has been one of traditional utility rate of return regulation: (i) monitoring for adherence to acceptable levels of service quality; (ii) rate making to ensure just, reasonable, and non-discriminatory charges to consumers; (iii) oversight and approval of expenses and investment to ensure modern networks. This relationship has manifested itself in both formal proceedings and informal negotiations amongst the Public Service Board (PSB), PSD and ITCs, including periodic review of each company's cost of service and earnings. During 2001 and 2002, settlements reached between companies and the PSD were approved by the PSB and achieved annual revenue reductions totaling approximately $2.6 million. In the area of broadband deployment, many ITCs have been leaders, and collectively the ITCs have deployed Digital Subscriber Line (DSL) service throughout nearly all of their service

Accomplishments of Two Independent Phone Companies Since the Last Telecom Plan

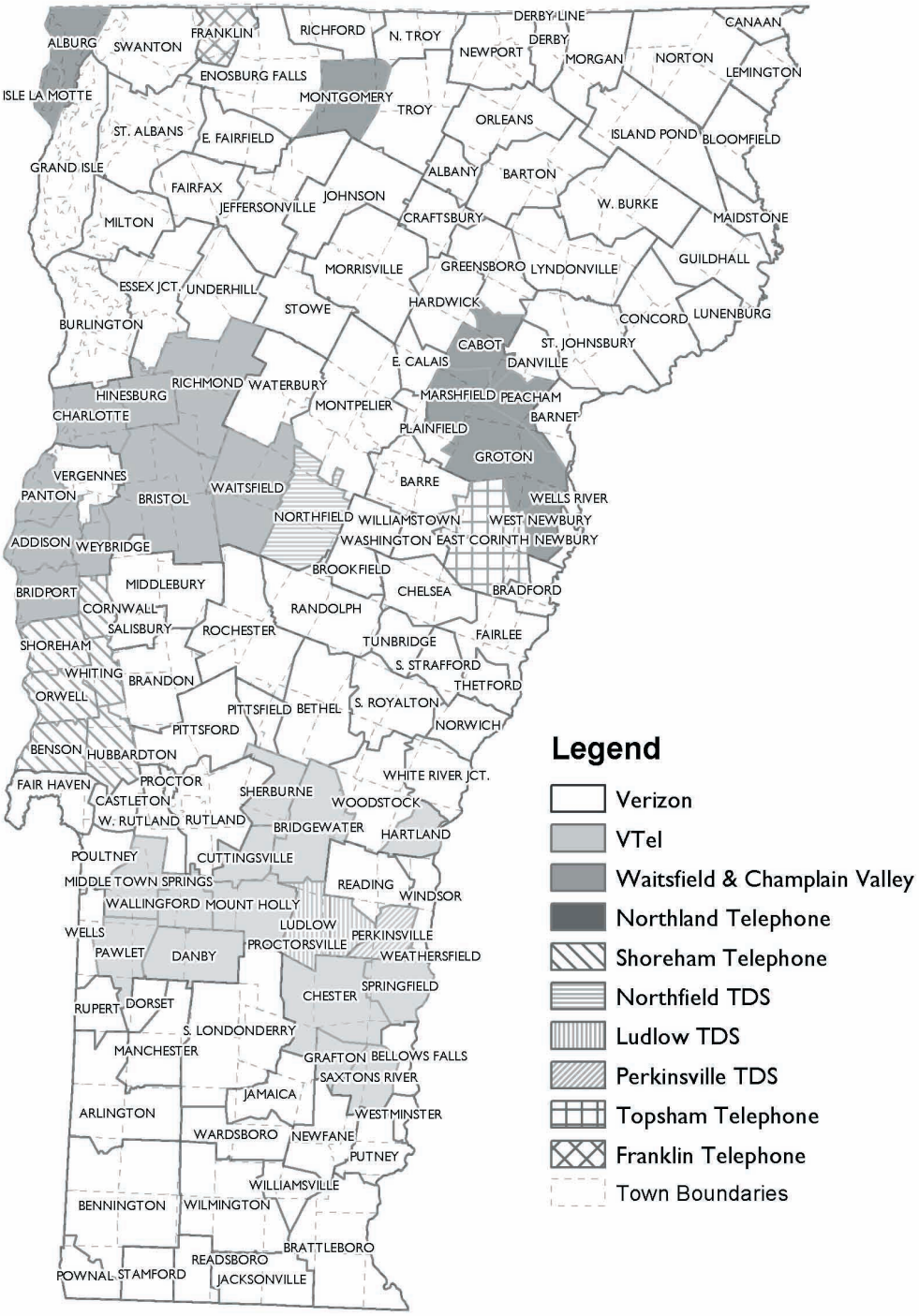
VTel (21,717 access lines)

- Vermont's largest independent telephone company.
- Eliminated its voice auto-attendant for incoming calls to its service center and achieved a call-answer time of 99% calls answered in 20 seconds or less.
- Made DSL available to 99% of customers, with 21% of customers taking DSL at year's end 2002.
- Increased DSL speeds from 900 kbps to 7 Mbps.

Franklin Telephone (889 access lines)

- Vermont's smallest independent telephone company.
- Made DSL available to 98% of their customers.
- Converted interexchange facilities to fiber optics.
- Introduced retail in-state and interstate long distance service.

Figure 2.2:
Incumbent telephone companies



territory. ITCs have consistently met and exceeded generic service quality benchmarks that the PSB established for telephone companies.

Competition has not developed as quickly or extensively in ITC territories, and these companies do not have the same obligations as Verizon does to sell wholesale services and elements to competitors. Competition does exist to an extent, such as between cable companies and ITCs for broadband service in some locations. Competition for voice services from wireless providers and Voice over Internet Protocol (VoIP) is nascent. Although ITCs have long been the best remaining example of the traditional model of telecommunications in Vermont, these companies are anticipating a future that increasingly looks different due to changes in technology, the market, and regulatory policy.

VERIZON

The period since the last Telecommunications Plan has seen several diverse and important events related to Vermont's largest telephone company. The national merger of Bell Atlantic and GTE (following on the heels of the previous merger with NYNEX) created the combined company, Verizon, one of the largest telecommunications providers in the world. It has rolled-out DSL in some exchanges (although not to the extent that the independent telephone companies have, relatively speaking). Verizon continues to operate in Vermont under an Alternative Regulation Plan, adopted by the PSB in March 2000 pursuant to authority provided by the General Assembly under 30 V.S.A. §226b. The "Alt-Reg" Plan, which runs for five years, provides Verizon both incentives and regulatory flexibility to deploy new services and technologies and to respond to changes in the marketplace rapidly. The plan when issued provided for certain scheduled rate reductions over its life. It is due to expire April 22, 2005. The plan also created a service quality plan and set penalties for poor performance as measured under the plan. Under the plan Verizon created the Vermont Interactive Learning Network (ILN), and the plan required Verizon to provide unspecified benefits in the form of new or innovative service.

Verizon was also successful in obtaining approval for its request for authority to provide state-to-state long distance services originating in Vermont from the Federal Communications Commission (FCC). The Telecommunications Act of 1996 allows a former regional Bell such as Verizon to seek FCC approval to enter the long distance market in its local service territory. As part of the approval process, the FCC is required to consult the relevant state commission (in this instance the PSB) on the question of whether or not Verizon had irrevocably opened itself up to competition at the local level. The PSB issued a conditionally favorable recommendation to the FCC on August 7, 2001. The FCC approved

Accomplishments of Verizon Since the Last Telecom Plan

- Reduced intrastate access charges levied on long distance companies from $.10/minute to $.03/minute.
- Reduced monthly dial tone local rates for businesses and residences by $1.00 and $.40, respectively.
- Installed DSL in 26 exchanges.
- Introduced "Transparent LAN service" and Gigabit Ethernet service, among others.
- Introduced unlimited local usage service packages.
- Introduced (by approval of the FCC) retail interstate long distance services.
- Adopted a Performance Assurance Plan for its wholesale services.

Verizon's request and Verizon began offering long distance service on April 30, 2002.

CABLE COMPANIES

Since the last plan, there has been a large volume of activity in the cable industry in Vermont. Cable has gone from a delivery of television to a provider of data and video services. Most cable customers in Vermont now have access to high-speed Internet access over cable, often called cable modem services. By the end of 2003, cable customers served by a only a handful of the very smallest operators lacked access to these new services, while major cable system operators in Vermont offered cable modem service to most customers and were on the verge of offering cable modem services to all cable customers. In fact, Internet access services are now a key weapon in cable operators' arsenals to combat erosion of their customer base. At the end of 2003, Adelphia also introduced a limited selection of programming in high-definition format, as well as Personal Video Recorders (PVRs). To support the introduction of new data and other services, cable operators have recently spent millions of dollars to upgrade the capacity of their systems and provide two-way communications capacity. These systems are capable of providing hundreds of digital and analog channels.

According to Charter Communications, Vermont's second-largest cable operator spent $18.3M to upgrade or rebuild all 567 miles of its cable plant over 3 years prior to the recent renewal of its franchise.

The PSB has granted a number of new or renewed cable franchises over the past several years, including three franchises granted to Adelphia operating companies for various pieces of its Vermont footprint shortly before and after the last Telecommunications Plan. In addition, franchises were granted to Duncan Cable for several towns in southern Vermont, (including principally West Dover) and North Country Cable for a range of towns in northern Vermont. The PSB renewed the franchise of Charter Communications, the second-largest cable operator in Vermont in 2003, and it renewed the franchise of White Mountain Cable, operating in the far northeast corner of the state, in 2002. Gateway Cable, in southern Vermont, received approval to be purchased by neighboring Duncan Cable in 2003.

Cable Evolution

The last five years

- Rebuilt nearly all systems to a hybrid fiber optic-coaxial cable design.
- Introduced digital-format channels.
- Increased bandwidth and offered more channels in packages.
- Introduced high-speed Internet access.

The next five years

- Personal Video Recorders and/or Video-on-Demand
- Telephone service
- High-Definition Television Programming

Adelphia has constructed 338 miles of line extensions in Vermont, a fraction of the approximately 1,600 miles of line extensions that it was obligated to build under its franchise obligations and prior settlements of litigation. The PSB opened an investigation into Adelphia's compliance with its obligations. The PSD and Adelphia reached a settlement in the case, which was approved by the PSB. The settlement sets annual mileage requirements beginning in 2004 that add up to Adelphia completing 1,262 miles of line extensions in rural areas by December 31, 2008. For Adelphia's future planned line exten-

Figure 2.3:
Vermont cable companies

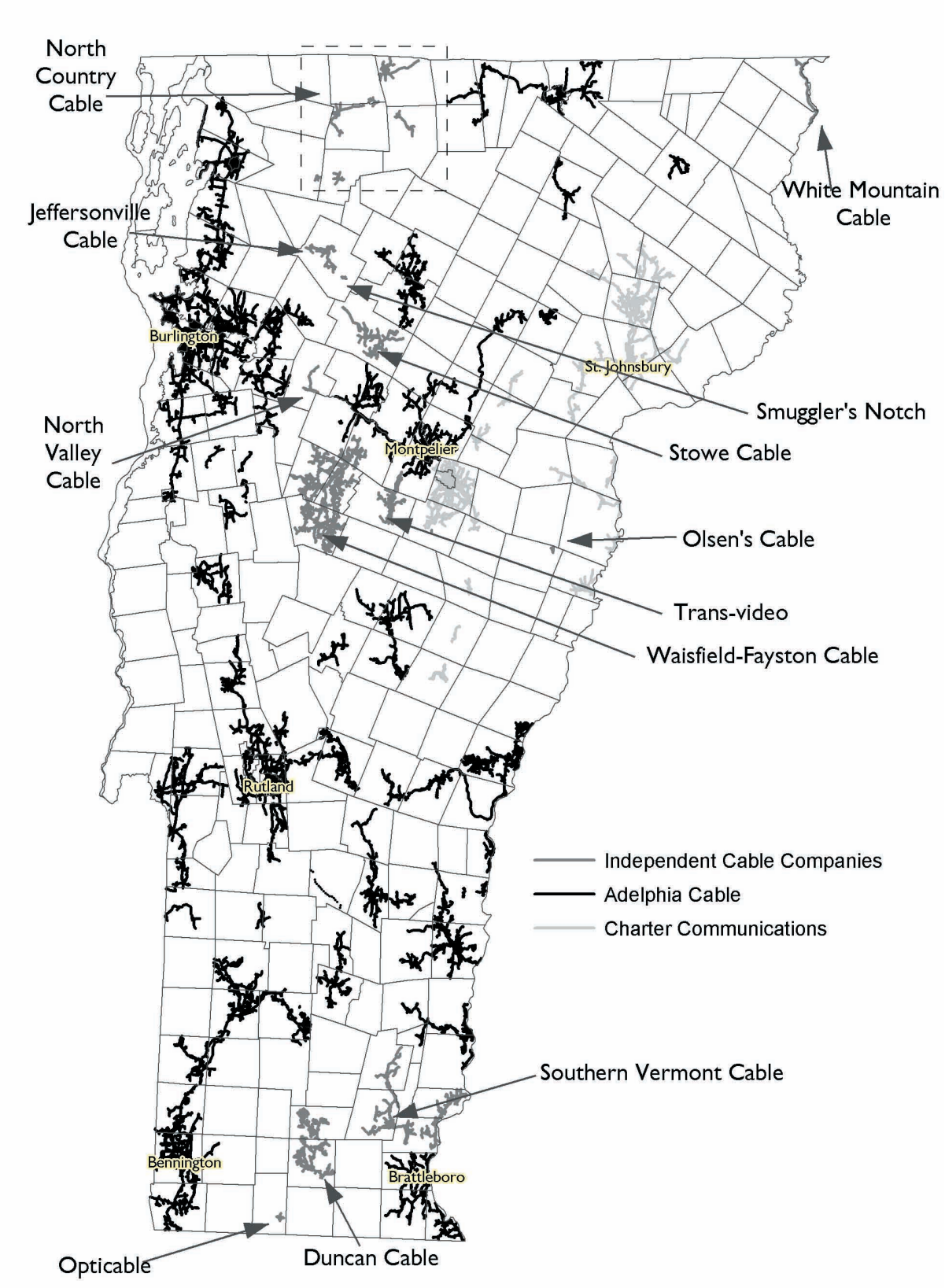
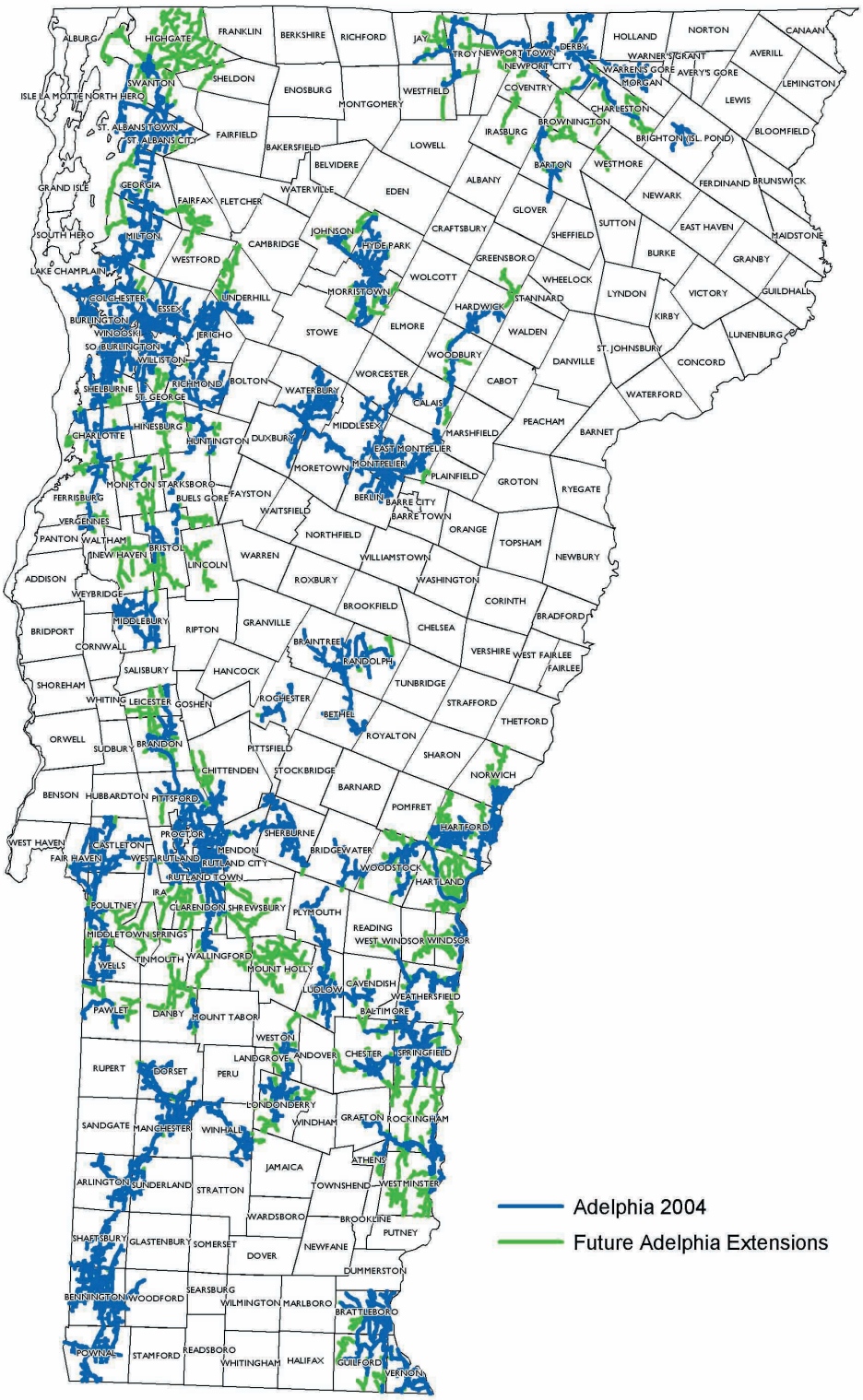


Figure 2.4:
Adelphia future line extensions



sions, see Figure 2.4. In lieu of fines for various issues raised in ongoing PSB proceedings, the company agreed to build 150 to 300 additional miles of service into rural areas that would be unlikely to qualify for line extensions in the foreseeable future if the agreement were not in place. Construction on the additional mileage may begin immediately and must be completed by December 31, 2009. To ensure Adelphia fulfills its obligation to build, the company must post a bond to secure any penalties due if the company fails to build on schedule. The bond amount starts at $5 million in 2003, and increases to $9 million in 2008. If in any year Adelphia fails to meet its building obligation by more than 20 miles, the entire cumulative bond amount must be posted on demand of the PSD.

COMPETITIVE AND ALTERNATIVE INFRASTRUCTURE PROVIDERS

CLECS

The significant weakening of capital markets for telecom companies, notably in 2000 and 2001, has slowed the progress of Competitive Local Exchange Carriers (CLECs), but not halted it. Telcove, formerly known as Adelphia Business Solutions and Hyperion, filed for protection under Chapter 11 of the U.S. Bankruptcy Code in 2002 following a spin-off from parent company Adelphia Communications and shortly before a Chapter 11 filing by Adelphia itself. Throughout the bankruptcy Telcove has limited its network growth, but has continued to provide service in Vermont. Telcove filed a reorganization plan in 2003 with the bankruptcy court and will likely emerge from bankruptcy in 2004. Numerous other CLECs filed for bankruptcy and either liquidated (typically selling their customer bases to another company) or reorganized. CTC Communications and MCI WorldCom were two CLECs with a significant presence in Vermont that underwent reorganization. Fortunately, no Vermont customers experienced interruption of local service due to the financial failure of a CLEC and only in one instance was long-distance service interrupted. Onestar faced a large-scale disconnection of its Vermont customers in the wake of a failure to pay Verizon for use of its underlying network. Nevertheless, other CLECs have weathered the storm. Lightship Telecommunications has established a Vermont presence and provides services to businesses. SoVerNet, which began as an Internet Service Provider (ISP), has evolved to be a provider of Internet, data, and telephone services to business and residential customers. National long distance providers AT&T and MCI also introduced their mass-market local residential and business service offerings into Vermont by leasing and reselling facilities owned by Verizon. Many CLECs now face a new round of challenges because of shifting federal rules regarding the terms on which they lease network elements from Verizon. (See "The Unbundling Debate" in Section 1, "Telecommunications Trends.") A federal appeals court threw out many of the FCC's rules governing the wholesale relationship between CLECs and companies like Verizon. It seems likely that new rules will be less favorable to those competitors that lease facilities from incumbents. AT&T has already announced that it intends to stop marketing intended to acquire new residential customers (although it will continue to serve existing customers and will not turn away those requesting service).

MUNICIPAL NETWORKS

Nationally, a number of municipalities or government consortia have entered into the business of providing telecommunications services to consumers or merely providing the infrastructure over which various carriers can provide services. In Vermont, there are a small number of municipalities who have taken steps down this road to a greater or lesser extent. The most notable is the City of Burlington. Originally, the city formed a joint venture with private investors to build a citywide fiber optic network offering voice, video, and data to city residents and businesses. When the financing for this venture could not be secured, the city adopted a more incremental approach. Burlington constructed a fiber optic network connecting municipal and school buildings, financing the project out of current and projected spending on telecommunications services. The city provides its own voice and data connectivity internally, and contracts for external connectivity and the switching of its voice services. The City of Burlington filed with the PSB under the trade name Burlington Telecom for authority to offer telecommunications services to entities other than city agencies. It offers fast Ethernet services to businesses and institutions along its existing fiber routes that wish to interconnect locations within the city or connect to outside service providers at the collocation center maintained by the city. The city retains the option of building out to additional business customers and to residents at a future time.

Elsewhere, the City of Montpelier, with the participation of the Vermont Broadband Council, is examining the construction of a wireless network to connect city locations for data services. Montpelier is also looking at forming a buying consortium of businesses and institutions to share bandwidth on a very high-speed Internet connection, which would be connected to individual locations via point-to-point wireless connections. At a much more preliminary stage, the Village of Morrisville obtained a municipal charter change in 2001 that allows the municipal power and water utility to offer telecommunications services. To date, the village has not actively pursued this option.

WIRELESS PROVIDERS

The last several years have seen a flurry of activity as a number of new service providers and real estate developers have made proposals to establish new towers or other types of new antenna sites. The result has been the introduction of services by two new wireless carriers, Sprint PCS and Nextel, in addition to the existing cellular service providers, RCC Wireless (d/b/a Unicel), Verizon Wireless, and U.S. Cellular. New service so far is limited in its availability.

Table 2.1:
Cellular and PCS companies marketing service in Vermont 2000 and 2004

January 2000	January 2004
RCC (Cellular One)	RCC (Unicel)
Bell Atlantic Mobile	Verizon Wireless
U.S. Cellular	U.S. Cellular
	Sprint PCS
	Nextel

There has been a degree of variability in the potential new entrants into the wireless market in Vermont. VTel sold its spectrum licenses to AT&T. Devon Mobile, an Adelphia affiliate, had been actively seeking sites in Vermont, but filed for Chapter 11 bankruptcy protection in 2002 and was subsequently liquidated. Licenses previously held by Devon were

acquired by Verizon and U.S. Cellular and have increased the licensed footprint of these two carriers in Vermont. Other national carriers who hold FCC licenses for Vermont include T-Mobile and AT&T Wireless.[1] AT&T Wireless is in the process of being acquired by Cingular.

The range of services offered by wireless service providers has expanded, as have the diversity of siting requirements. Digital cellular service is now more commonplace and offers greater clarity, though frequently with a more limited range. PCS (Personal Communications Service), currently offered by Sprint PCS is also a digital service operating at a higher frequency and requiring more antennas to cover the same area. Text messaging and walkie-talkie-like push-to-talk features are examples of new variations on plain wireless voice service. Some providers have introduced mobile Internet-access services while a handful of small Vermont ISPs have begun using license-free wireless spectrum to provide high-speed fixed wireless Internet access.

Different Types of Digital Wireless Service

While invisible to most consumers, there is an ongoing conversion in the radio frequency modulation scheme used by Vermont carriers. This conversion is capital-intensive. In the initial conversion from analog to digital wireless service, the first carriers to convert migrated to the formats Time Division Multiple Access (TDMA), used by Unicel, or Code Division Multiple Access (CDMA), used by Sprint PCS and Verizon. (Nextel uses a standard, iDen, not used by other carriers) CDMA has flourished, but national carriers like AT&T Wireless and Cingular have begun to migrate away from TDMA to a third family of standards known as, the Global Standard for Mobile communications/General Packet Radio Service (GSM/GPRS), which is used throughout Europe and much of the globe. GSM was originally adopted in the U.S. by carriers with a relatively small market share, such as T-Mobile. However, with AT&T Wireless and Cingular migrating to GSM, increasing numbers of out-of-state visitors might have had greatly limited use of their phones in Vermont. Fortunately, Unicel has announced that it will also be migrating to the GSM/GPRS standard, allowing visitors using this standard to roam on its network.

Finally, some wireless carriers have begun to show signs that they will compete seriously in Vermont for wireline customers. An especially notable sign in this direction is RCC's successful bid for designation as an Eligible Telecommunications Carrier (ETC) in exchanges served by Verizon. This designation, obtainable by carriers that provide an equivalent to basic telephone service, will qualify RCC Wireless for support from the Federal Universal Service Fund equivalent to that for which Verizon now qualifies. RCC has subsequently applied for ETC designation in exchanges served by independent telephone companies, and that application has gone before the PSB.

INTERNET SERVICE PROVIDERS

The Internet Service Provider business has reached a plateau and a turning point in Vermont, as it has elsewhere. Vermont-based and national ISPs have made considerable progress in signing up Vermont residents and businesses. Yet with the migration to broadband services beginning to pick up steam, ISPs who only sell dial-up service face an uncertain future. While it is unlikely that dial-up is going to disappear overnight, it is clearly a legacy business line. Some ISPs, like SoVerNet and Powershift Online, have responded by entering the CLEC market, which allows them to access telephone company lines at reduced rates for providing DSL service. Other ISPs, mirroring a trend in the national market among small ISPs, are experimenting with wireless delivery of high-speed

service (coining the term Wireless ISP, or WISP, pronounced like the word "wisp"). Such efforts are still nascent, and it remains to be seen whether small ISPs not affiliated with phone, cable, or wireless phone companies will manage the transition to broadband delivery.

B. Vermont State Government Telecommunications

MAJOR STATE GOVERNMENT COMMUNICATIONS NETWORKS

The state of Vermont is a major user and consumer of telecommunications services. Despite this fact, there is not a single unitary state government communications system. State government has at least four major communications "networks," at least in concept.

The Wide Area Network (WAN) that is administered by the Department of Information and Innovation (DII) is state government's wide area network. This network, formerly known as GOVnet, interconnects state government local area networks and provides Internet access to state agencies; it also provides Internet access to some K12 schools. It is primarily a leased network. The backbone of the network consists of links provided by Telcove's 10Mbps Fastlane Ethernet service that are upgradeable to 100Mbps. As part of this network, the DII also owns and operates fiber rings that serve the Montpelier and Waterbury office complexes.

The DII also oversees and manages the state's voice telecommunications contracts. The contracts overseen by the division include Centrex, toll-free service, long distance, voice mail, payphone service (all with Verizon), some cellular service (Unicel), inside wiring contracts, and contracts for the repair and installation of phones. Centrex lines managed by the DII number approximately 12,000 while toll-free lines number approximately 200. Certain organizations affiliated with state government, such as UVM, Area Agencies on Aging, and

Table 2.2:
Major state government communications networks

Network	Agencies that use it	What they use it for	Owned or leased
GOVnet	Much of state government, many K-12 schools	Wide area networking and Internet access	Leased
Public switched telephone lines	All of state government	Voice telephone	Leased
Public Safety microwave and fiber backbone	Public Safety, Transportation, Forest & Parks, Corrections, local and federal agencies	Voice telephone, wide area networking, backhaul of mobile voice and data	Owned
Public Safety mobile radio network	Public Safety, Transportation, Forest & Parks, Corrections, local and federal agencies	Mobile voice and data communication	Owned

Regional Planning Commissions may buy through the state's contracts and are supported by DII Telecommunications.

The largest network owned and operated by state government is the Department of Public Safety's (DPS) voice and data network. For many years the DPS operated an analog microwave network connecting twenty-nine mountaintops and other points around the state which include the DPS headquarters in Waterbury, and twelve State Police offices. The DPS completed the process of rebuilding the system in 2003. It upgraded existing links to a digital microwave system except a link from Montpelier to Williston, which runs over fiber. The new system can carry voice and expanded data traffic. The core of the network has OC-3 speeds, with T-1 speeds on spurs from the core "ring." The network includes a PBX to provide voice service. Locations not served directly by the network can be connected to points on the network via circuits leased from service providers. This network provides various communications services to multiple users including the Agencies of Transportation, Human Services, Natural Resources, and via tail circuits, local police offices.

The fourth "network" which complements and interconnects with the third is the state's wireless mobile network, operated by DPS. At this point it is a voice communications system, though mobile data is under consideration. Two-way radio base/repeater stations are linked to each other and to dispatch through the point-to-point microwave network. DPS also maintains two-way radio systems for many state, local, and federal agencies including the Agency of Transportation, Fish and Wildlife Department, Corrections, Forest and Parks as well as multiple municipal systems serving more than twenty-five fire departments and fourteen rescue organizations.

In addition to these four major "networks," various state agencies lease miscellaneous frame relay or point-to-point circuits. There are also slightly more than a dozen point-to-point high-speed wireless links between nearby buildings operated independently by various state agencies for such purposes as extending a Local Area Network (LAN)

TWO AGENCIES WITH EXPANDING NEEDS

Two organizations in state government have visions of future communications needs that show striking growth: The Agency of Transportation (VTrans) and the Vermont Department of Health (VDH), in the Agency of Human Services. VTrans is planning for a future where communications are more heavily integrated into the transportation (especially the highway) system, to provide a greater management of the resource and interaction with the traveling public. It already has communication links with a far-flung collection of workers, offices, and devices. These include mobile voice communications with VTrans truck drivers on the road, cell phones for other traveling employees, voice communications with district garages, leased data links for connection to a central maintenance database, low speed one- or two-way links to weigh-in-motion stations, continuous traffic information sensors, and traffic signals.

VTrans is planning for a future where communications is more heavily integrated into the transportation system.

In the future, VTrans will seek to expand its remote collection of data about the status of the network, with sensors that detect traffic flows or weather conditions and remote cameras for a real-time view of road conditions. Expanded remote control is desired, for example, to remotely update traffic signs to reflect road conditions perhaps many miles on the road ahead. Improved mobile communication will be important. Currently, there are holes in the radio coverage to the agency's trucks. Cellular service gaps mean that in some cases employees on the road depend on pagers. More continuous and automated mobile communication with the trucks would provide opportunities for better fleet management, dispatching, and reporting of road conditions. Improved communication with the public will also be important. VTrans has implemented a "5-1-1" system that allows the public to call that abbreviated dialing code to reach a variety of information about road, weather, and traffic conditions, plus traveler information such as the location of nearby services or attractions. Wireless phone activity levels or locations could even be used to help identify areas of traffic congestion. Many of these future applications of communications technology come together under the heading of an "Intelligent Transportation System."

Communications are becoming an increasingly important issue for the Health Department as it seeks to improve its preparedness for public health emergencies, including but not limited to bioterrorism. There is a need for a robust communications system linking a wide variety of people and locations including the Department's Burlington headquarters, its twelve district offices, local officials, state leadership, hospitals, clinics, doctors' offices, public safety officials, staff in the field in an emergency, and a "hot site" that could be used to manage a crisis in the event of the loss of the use of primary offices.

The VDH relies heavily on e-mail to provide an efficient and fast method of distributing information to district offices and outside partners on a day-to-day basis. That communication would become even more important in a crisis when there would be little time to make large volumes of calls and perhaps a stressed voice telephone network. The VDH also wants to see robust interconnection of "sentinel locations" (hospitals, doctor's offices, and clinics) to the National Electronic Disease Surveillance System. This is a database system that allows these sentinel locations to report information on cases that, when analyzed, could reveal a pattern indicating a developing epidemic, bioterror attack, or other public health emergency; it would also allow alerts to be communicated to these sites rapidly in the event of a threat. The VDH seeks to have Internet connectivity to these sentinel locations at T-1 or better speeds and seeks to have a redundant means of connectivity. It would also like to see at least 95% of its local government partners connected to the Health Department via e-mail. The VDH also uses and relies heavily on the GOVnet system and is concerned about its redundancy. (It also uses a limited number of leased T-1 lines and point-to-point wireless connections for short-haul LAN extensions between buildings.)

The Vermont Department of Health wants to see robust interconnection of "sentinel locations"--hospitals, doctor's offices, and clinics.

Personal wireless service and other radio communication are an important part of VDH's communications capability, especially in the event of a crisis requiring the deployment of field personnel. The VDH would like to have greater interoperability with the public safety communications system. Gaps in cellular coverage in the vicinity of the Vermont Yankee plant are a particular concern.

CONNECTING FAR-FLUNG WORKERS AND PARTNERS

Vermont state government is an organization centered on its Montpelier, Waterbury, and Burlington offices, but with a presence that is diffused throughout the state through district offices, partners in the community, and workers at home or in the field. The need to connect dispersed workforce with voice and data communications appears poised to grow and there are indications that parts of state government are preparing for such a change.

Connections between district state government buildings and main offices frequently occurs via the major telecommunications networks described above. Sometimes, there are exceptions when departments and agencies use leased lines to connect district buildings for data purposes. An example is the Department of Employment and Training (DET), which has a wireless link between DET's central office at 5 Green Mountain Drive and GOVnet at 133 State Street in Montpelier, plus one T-1 circuit as a backup. Another example is the Department of Buildings and General Services, which leases a T-1 between its Montpelier and Middlesex office and lower-speed links connecting the Barre Lottery Commission office, the Governor's Commission on Women, and a number of rest areas/visitor centers.

A number of agencies need connectivity with remote sites that are not state government buildings. DPS runs the Vermont Incident Based Reporting System (VIBRS) Network, which connects State Police barracks and many (though not all) state, county, and local law-enforcement agencies in the state for criminal history information, wants and warrants, dispatch reporting, statistics, e-mail, fleet management, and mapping. Depending on usage levels, sites are connected via frame relay at levels from 56 Kbps to 1.5 Mbps.

In some cases a Virtual Private Network (VPN) over the Internet is being examined or implemented as a way of bringing remote agency or non-agency sites onto the agency's network. The Agency of Human Services (AHS) has established a pilot program to set up "patch" satellite offices in Community Action partners' offices located in smaller communities, to better serve populations with limited ability to travel. VPN provides the AHS connectivity. VPNs have been or are being examined to connect with partners in departments such as Health (requesting and reporting on lab tests), Developmental and Mental Health (connecting with community agencies like Washington County Mental Health), Aging (connecting with Area Agencies on Aging), and Social and Rehabilitative Services (connecting with Parent-Child Centers). DII is implementing a VPN solution over its WAN as well. Departments and agencies participating in a pilot include Personnel, Commerce and Community Development, Legislative Council, and VTrans. This option is now available to agencies that wish to connect to a remote office or a worker at home. The GOVnet VPN solution is now available to state agencies that develop and implement a security plan with GOVnet.

Planning or implementation of work-at-home arrangements is proceeding in a formal way in a limited number of offices throughout state government. The Department of Prevention, Assistance, Transition, and Health Access (PATH) has

pursued a work-at-home pilot. In some cases, telework is emerging as a potential strategic choice. VDH has identified a need to be able to support employees working from home or other remote sites to mitigate the possibility of offices becoming unavailable through accident, attack, or disaster.

ELECTRONIC ACCESS AND INTERACTION

The ability of the public to interact with state government on-line in Vermont has been developing. A new portal site for Vermont state government (vermont.gov) is now up and running. A number of departments and agencies also have a relatively well-developed web presence such as Economic Development (www.thinkvermont.com) and Tourism and Marketing (www.1-800-vermont.com).

The Department of Libraries' (DOL) text-based Telnet Vermont Automated Libraries System (VALS) was one of the original means of access to card catalogs, state government databases, and the Internet. Although this system is largely obsolete due to web-based access to information and widespread Internet access, DOL still performs a role in public access to information around the state. DOL in 2001 gave out $25,000 in federal money to help subsidize high-speed Internet connections at public libraries. This money was phased out over three years and came with filtering requirements unacceptable to many public libraries. Also in 2001, the Gates Foundation put more than 175 public access computers in 65 Vermont public libraries. Largely due to cable modem connections provided by Adelphia Cable as part of its franchise, as of mid-2004, 71% of Vermont public libraries had high-speed Internet connections.

C. Educational Telecommunications

VIDEOCONFERENCING AND DISTANCE LEARNING

Videoconferencing and distance learning are linked in Vermont because the two largest distance learning networks in the state, Vermont Interactive Television (VIT) and the Vermont Interactive Learning Network (ILN) have distance education as their largest use. On-line education is an important aspect of distance learning and other users including state government use video conferencing, especially VIT.

VIDEOCONFERENCING

Vermont Interactive Television, which is administered through the Vermont State Colleges, links thirteen sites with a hub site in Randolph via T-1 lines. Connections to videoconferencing sites throughout the world are made via 3 ISDN lines. VIT is also in the process of developing a capability to stream video from the system over the Internet, and it maintains a consulting and service relationship with the Department of Corrections related to that Department's videoconferencing installations at many correctional facilities in the state. ILN links 60+

high schools, the Vermont Department of Education, the Vermont State House, and UVM. ILN sites are connected to a video bridge in Montpelier via Verizon's ATM network. ILN also has the ability to connect via a gateway with other videoconferencing sites throughout the world via a high-capacity ISDN line (Primary Rate Interface). VIT also has the ability to feed video at several sites into local cable systems via Public, Educational, and Governmental (PEG) channels. UVM has a videoconferencing system on campus that links to regional, national and worldwide sites, plus a regional center in Springfield at the Howard Dean Educational Center. UVM has the capability to connect to ILN, VIT, corporate sites and any video conferencing system world wide, via T-1 and ISDN. It also maintains a satellite system to downlink events.

H.320 vs. H.323 Videoconferencing Standards

Two major communications standards are found in Vermont's videoconferencing networks. The standard H.320 was developed for circuit-switched connections such as ISDN (but also useable via dedicated T-1 connections). The VIT network has its technology roots in the H.320 standard. H.320 is what allows VIT to dial up off-network sites via ISDN. ILN uses H.323, a videoconferencing standard designed for packet-switched networks such as the Internet. H.323 is widely used in Internet-based videoconferencing systems. VIT has installed an H.323 bridge that facilitates the interconnection of conferences using the different standards. As telecommunications converges more and more on packet-switched and IP-based networks (see Section 1), the H.323 standard could become more important for a wider range of videoconferencing applications.

Both VIT and ILN receive public support: VIT via an annual state appropriation, and ILN through the five-year Verizon alternative regulation plan. ILN's long-term financial sustainability is still in doubt as the arrangement with Verizon is due to expire in the first half of 2005. In 2002 and 2003 the Vermont Public Education Partnership charged a Distance Learning Task Force to study a unified public distance learning support model. After a series of studies and reports, the task force published the "Final Conclusions and Recommendations of the Distance Learning Task Force" in July 2003. The primary conclusion, based on a market analysis, was that the status quo of three networks would be the most cost effective model at the present time. The study found that, in order to integrate ILN with VIT, there would be a need to make expenditures to overcome differences in the level of service offered at the ILN sites and technology differences between the two types of networks. It also concluded that the demand for additional sites by VIT customers would likely be the highest during the workday when ILN sites were least likely to be available. It also concluded that there was significant uncertainty about the future administration, financing, and governance of ILN after the end of the Verizon alternative regulation plan. Nevertheless, the report endorsed continuing collaboration and coordination among VIT, UVM, and ILN to look at the use of high school ILN sites, technical issues, connectivity, and protocols. It also encouraged VIT and UVM to work closely together to see if immediate benefits could be gained from consolidating the resources of their respective networks.

State government is an important current and potential user of videoconferencing services for a number of different uses. Public meetings and hearings are often held over the VIT network. The State House ILN site would also be available for a similar purpose, but the Legislative Rules Committee has not yet been able to develop rules for its use. There are other applications as well. Corrections has

Table 2.3:
Vermont videoconferencing distance learning networks

	UVM Distance Learning Network	Vermont Interactive Television	Vermont Interactive Learning Network
Organization	University of Vermont	Vermont State Colleges	Partnership: Vermont Institutes, Vermont Dept. of Ed., and Verizon
Primary Customers	Higher Education	Education, Government, Non-profit, Businesses - instate, domestic and international	K - 12 Schools
Years of Experience	9	16	5
Payroll Provider/ Administrative Support Agency	University of Vermont	Vermont State Colleges	Vermont Institutes
Ultimate Board Responsible	UVM Board of Trustees	VSC Board of Trustees	VI Board - Vermont Board of Education
Policy/ Management Committee	DCE Dean's Council selected by the Dean of Continuing Education	VIT Coordinating Council - appointed byGovernor via Executive Order forover-sight of policies, funding and growth	Sub-committee of the VI Board of Directors
Facilities	5 Classrooms & Studio at UVM, 3 Regional sites around state (ISDN), 3 Commercial Partners, Satellite downlink and outside ISDN connectivity	14 Fixed Sites (T1), outside ISDN Connectivity, Satellite Downlink, and Video Streaming	60+ High Schools, 2 at VI; 1 at DOE; 1 at Statehouse; 1 at UVM (T1); outside ISDN connectivity; video streaming
Funding	User charges and University of Vermont Continuing Education	User charges and State of Vermont	Verizon alt-reg plan, Worldcom settle-ment and federal grants
Budget:	FY03	FY03	
Personnel	$129,305	$883,000	$203,200
Operations	$31,435	$170,000	
Rent	$62,109	In kind value $400,000	
Connectivity	$159,720	$120,000	$800,000 in kind
Staff	3 F/T 12 P/T	12 F/T 39 P/T	2 F/T 1 P/T
Technology Support	UVM - DLN personnel	VIT Personnel.	ILN - VI Personnel
Scheduling	UVM - DLN personnel	VIT personnel	ILN - VI Personnel
Content Development	Content developed by UVM faculty and staff	Limited content development	Developed by local users, higher ed partners, external non-profit & govern-mental partners, plus commercially produced content.
Marketing Resources	Provided by Continuing Education in-house, marketing staff, outreach coordinators	Director of Marketing - $35,000 budget; Plus all staff are involved in marketing	Marketing provided by the Field Coor-dinator
Instructor Training.	Extensive instructor training and course conversion provided.	All presenters/instructors provided with individualized orientation seminar. Longer sessions provided as requested.	Training provided by the Field Coordi-nator

taken steps to use videoconferencing to substitute for the transport of prisoners. VDH is exploring how teleconferencing could facilitate meetings or professional development at the system's twelve district offices. DET is exploring how to offer training for trades professions at least partially over distance learning. It hopes to better attract badly needed apprentices who may not have time to travel for classes.

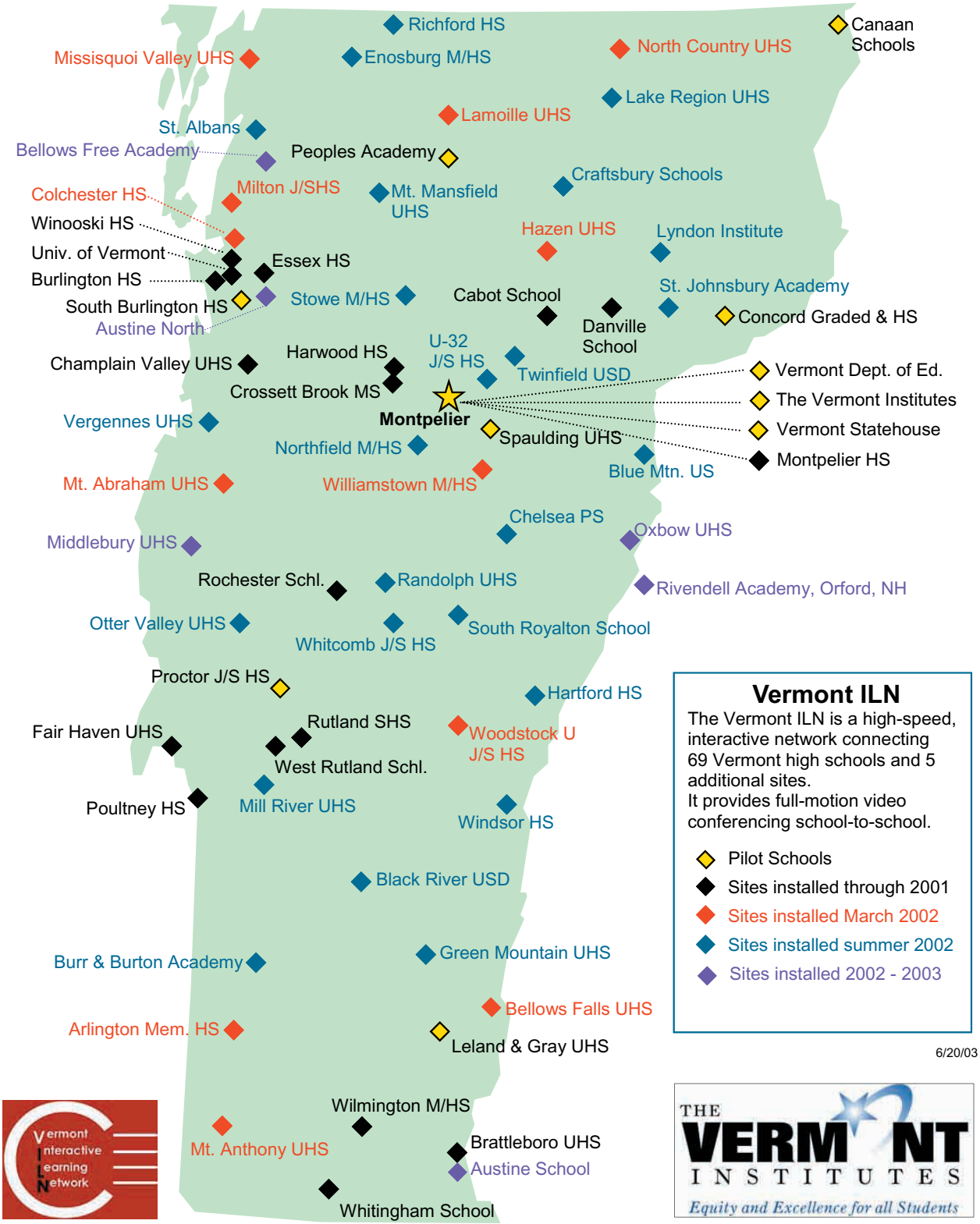
DISTANCE LEARNING

Videoconference-based distance learning is a form of distance education used in both K12 and higher education in Vermont. UVM maintains on-campus distance learning classrooms and a fully equipped production television studio, as well as offering video-conference-based distance learning. The ILN is available for course sharing between schools (mostly high schools) in cases where students in one school wish to take a course not available in their school but which is available in another school through the network. The ILN also provides professional development, Internet curriculum resources, technical assistance and networking among local educators, the state Department of Education, the Vermont Institutes (VI), and other service providers that become part of the network. VI provides training for the technology coordinators on how to run the equipment and training for teachers on how to both use the equipment and incorporate the ILN into their classroom teaching activities. VIT provides a venue both for the Vermont State Colleges to deliver distance learning and for other institutions who do not have their own systems. VIT can also supplement distance learning systems, such as the UVM network.

On-line learning is the major mode of distance learning that may not involve videoconferencing. In addition to the many in- and out-of-state colleges and other organizations offering Internet-based coursework, Community College of Vermont is moving aggressively into the realm of on-line, web-based learning, and a number of other Vermont institutions are offering on-line learning as well. UVM offers asynchronous (non-real time) online courses, and it is also using a synchronous online system, which allows people to take an online course in real time from their desktops utilizing document sharing and an audio component. UVM offers up to 30 online courses during the summer session and between 10-15 during each fall and spring term.

Matching educational populations with quality distance education content is a current issue. The Department of Education has been working to identify and promote standards for the integration of technology into curriculum and standards for assessment of distance learning. It has supported the creation of Vita-learn, an organization of K12 staff to design, organize, and offer professional development on technology integration. The Vermont Institutes also provides training and other resources for Vermont providers of services to educators, including personnel at the Department of Education, UVM, VT World-class Teaching Organization for the National Board Certification for Vermont Teachers, VT Historical Society, VSA/VSBA, Union Institutes and University, St. Michael's College, VI Teacher Leaders, TQE/TQN, and more.

Figure 2.5:
Vermont interactive learning network



Distance Learning at Institutions in Vermont

In late 2002 the Public Service Department and the Education Department sent a questionnaire on distance learning to educational institutions and providers in Vermont. The following organizations completed and returned the questionnaire:

- University of Vermont
- Community College of Vermont
- Vermont Interactive Television
- Lyndon State College
- Champlain College Online
- The Vermont Institutes
- World Learning/School for International Training
- Johnson State College
- Southern Vermont College
- Vermont Law School
- Regional Educational Television Network (RETN)
- Castleton State College

These organizations said they offered distance learning services to undergraduate or graduate students:

- University of Vermont
- Community College of Vermont
- Vermont Interactive Television
- Lyndon State College
- Champlain College Online
- The Vermont Institutes
- World Learning/School for International Training
- Johnson State College
- Southern Vermont College
- Vermont Law School
- Castleton State College

These organizations said they offered distance learning services to secondary school students:

- University of Vermont
- Community College of Vermont
- Vermont Interactive Television
- The Vermont Institutes
- RETN

The following responders said that they provided distance education in the context of some form of workforce education (employee development, professional development, worker retraining, etc.)

- University of Vermont
- Community College of Vermont
- Vermont Interactive Television
- Lyndon State College
- Champlain College Online
- The Vermont Institutes
- World Learning/School for International Training
- Johnson State College
- Southern Vermont College
- RETN

Internet access is sometimes a prerequisite for access to distance learning. These Vermont distance learning programs required at least some students to have their own Internet access:

- University of Vermont
- Community College of Vermont
- Lyndon State College
- Champlain College Online
- The Vermont Institutes
- World Learning/School for International Training
- Johnson State College
- Southern Vermont College
- Castleton State College

The questionnaire also identified some ways that institutions in Vermont are taking advantage of on-line and interactive video distance learning. Nearly all of the organizations responding use the Internet in some form in their distance learning, indicating that distance education in Vermont has moved far beyond the early days when distance education was nearly synonymous with some form of television. Nevertheless, two-way interactive video, either over videoconferencing systems or the Internet, was in use by a large majority of respondents. Responses also belie the notion that distance learning and classroom learning are an either/or affair. All respondents but RETN indicated that they offered distance learning programs that combined distance learning and classroom learning in the same course or offering. Finally, distance learning appears to be here to stay; all respondents answered that they have plans to expand or improve distance learning capacities in the next two years.

There is one notable area in which state government has not moved in the direction of distance learning. The state's staff training and development resource, the Cyprian Learning Center, is interested in pursuing distance learning opportunities but has not due to budgetary considerations.

INTERNET2: THE REALLY FAST FUTURE

Vermont has a connection to the future of the Internet through the University of Vermont. UVM, with initial National Science Foundation EPScoR support, is a member of Internet2, the very high-speed research network on which members are prototyping the applications of the future for the Internet. At UVM these are high-end science applications, for example environmental modeling. Although the backbone of Internet2 does not run through Vermont (or New England for that matter), UVM connects via a very high-speed aggregation point in Massachusetts, a "GigaPoP," it shares with a number of other New England universities. In 2002, the National Institutes of Health program at UVM applied for a supplement to its infrastructure to extend Internet2 connectivity to a number of Vermont higher educational institutions including Middlebury College, Norwich University, St. Michael's College, and the Vermont State Colleges. Unfortunately, the grant application was not funded and only limited funds were provided to make hardware investments to facilitate these connections when they come on line.

At the secondary education level, VI is currently applying for partnership status, which will allow it to work on the development of the K-12 aspect of Internet2 and position the ILN for possible eventual migration to the Internet2 network.

D. Other Public-Interest Activities and Initiatives

ELECTRIC UTILITIES

Electric utilities have played an important supporting role in the development of the other "poles and wires" infrastructures. The fiber optic network constructed using VELCO transmission facilities has greatly contributed to the development of cable systems and alternative telecom providers in Vermont's recent past. Other utilities have provided additional opportunities to telecommunications providers. Central Vermont Public Service Corporation (CVPS) entered into an agreement with NEON Optica Inc. in which CVPS provided permission for them to install fiber optic cable on its transmission system in the Brattleboro area. This contract included the installation by NEON of approximately three miles of fiber optic cable attached to CVPS transmission poles. After installation, ownership of the fiber cable was transferred to CVPS.

Green Mountain Power in Its Own Words

"Most of our services are provided over the web. For traditional customers we provide access to energy usage data and tools that allow customers to evaluate and affect their usage. For contractors we provide access to daily work orders and building/wiring diagrams. A lot of data is pushed through the pipes. Without high-speed access these services are usable but unattractive.

"We continually explore the use of our 'rights-of-way' as a delivery vehicle for access to high-speed telecommunication from a provider perspective. From a 'demand-user' perspective, we are continually focused on new uses of our web-based customer service technology for delivering efficient energy services as well as new ways that customers can have more 'control' over their usage on a time-sensitive basis.

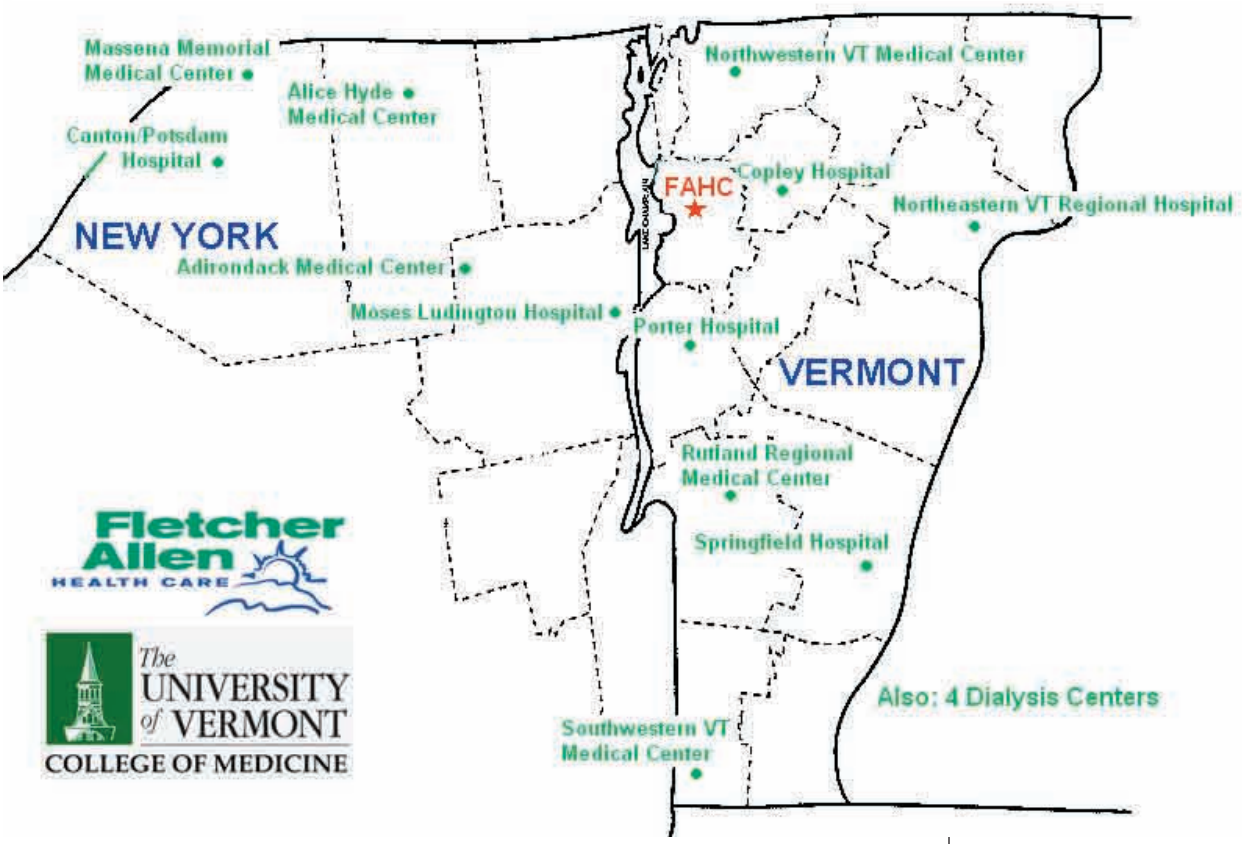
"Along with providing increased data services to our customers, we are planning on taking advantage of high-speed lines to allow our workers to access data in the field. Having that data helps our workforce efficiency and enables us to respond faster during emergencies and outages. Other initiatives we are looking at are: automated meter reading, outage tracking via the web, and remote interrogation of large customer meters for load response and energy efficiency."

The Company granted NEON the exclusive and indefeasible right-of-use (IRU) of the fiber optic cable, except for twelve fibers which are reserved for Company use. Vermont Electric Cooperative has been actively pursing ways to obtain a fiber optic communications system linking its substations to better monitor and manage its service, and leverage that infrastructure to cause additional telecom service to be offered to its members. Electric utilities are also relying on mobile communications to manage and dispatch field crews, improving efficiency and power outage response times. CVPS has leveraged fiber and wireless infrastructure to build disaster recovery capabilities, improve its connectivity to third party providers and to reduce the overall cost for the telecommunications services that it requires to manage its territory. Other Vermont electric utilities are taking advantage of telecommunications in a variety of ways. (See sidebar on Green Mountain Power.)

HEALTH CARE

Many have held high hopes that telemedicine, the application of telecommunications technology to the treatment of patients at a distance, can improve the quality and cost of health care in rural areas. Telemedicine conjures up images of high-technology live remote consultations with doctors many miles away. While there are examples of this, telecommunications technology is also being applied

Figure 2.6:
Telemedicine outreach sites



in many more systemic ways in Vermont like linking health care providers into networks of information.

Figure 2.7:
FAST STAR at FAHC

Fletcher Allen Health Care (FAHC) has ventured into what commonly comes to mind when thinking of telemedicine. Its videoconferencing systems allow multiple ISDN lines to be bonded together to produce high-quality videoconferences on demand that are dialed as a telephone call. This system links FAHC with hospitals in Vermont and Northern New York that have similar technology. The systems come with a camera for face-to-face conferencing, a hand-held camera for exams, and the ability to plug in ultrasonic imaging equipment. The system is commonly used in the specialties of dermatology, vascular surgery, trauma, renal dialysis, pulmonology, and psychiatry. The system is also installed in a handful of surgeons' homes, allowing them to participate almost instantaneously in emergency consultations. FAHC's tele-trauma program has received grant support from the federal Department of Commerce and the Office for the Advancement of Telehealth. In Vermont, collecting on insurance billing for telemedicine consultations can sometimes be problematic. (Medicare will cover consultations by interactive video.) In addition to treating patients, a major use of the system is in medical continuing education, in the form of grand rounds. Providing rural physicians with the ability to discuss patient cases with each other increases their sense of connectedness to the profession in addition to improving the medical information they receive.

An extension of the remote consultation concept relies on the wireless telephone infrastructure. FAHC is also conducting a test of 1-way video and 2-way audio conferencing between its emergency department and ambulance over cellular lines, which has been dubbed "FAST STAR" (for Fletcher Allen Specialized Telemedicine for Supporting Transfer and Rescue). A federal grant from the U.S. Department of Transportation supports this project. The test uses multiple lines to provide sufficient bandwidth for the capability. The hope is that doctors can ascertain critical information about an emergency patient in transport and provide life-saving instructions to the emergency medical technicians. The test does not involve the transport of actual patients until the technology can be proven to work reliably. A key factor in the success or failure of the test will be the reliability of the state's wireless services.

Telecommunications technology is also improving rural access to medical information in the medical specialties. For instance, doctors at rural hospitals in rural upstate New York can view radiology images processed by FAHC and posted to a secure website.

Telecommunications technology is linking hospitals and physician practices into regional networks that

FAHC Telemedicine Project Statistics

- Spending by FAHC on telecommunications services for telemedicine: approx. $140,000/yr.
- Number of videoconference grand rounds sessions in 2001: about 750.
- Cost per Polycom videoconferencing unit: approx. $6,000.
- Cost of a video bridge to handle up to 15 connections: approx. $4,500/mo.
- Approximate ISDN line costs for a 384 kbps conference: $35/hr.
- Number of conferencing units available for use at any given time on the FAHC campus: approx. 12.
- Number of conferencing units available at each partner hospital in New York and Vermont: 1-3.
- Staff required at partner hospital sites to support conferencing equipment: 0.2 full time equivalent.
- Support staff for project at FAHC: 2.5 full time equivalent technicians and 1 project coordinator.

allow greater integration of scheduling, billing, and medical information across sites. For example, Rutland Regional Medical Center (RRMC) uses a wide area network to provide connectivity to five physician practices that the hospital owns as well as three offsite administrative locations. RRMC offers remote access options to physicians in order for them to receive patient information from their offices and their homes, including a Virtual Private Network which physicians utilize via cable modems, DSL, etc. RRMC is educating physicians and their office staff in the value of using high speed telecommunications to improve their access to patient information and patient care.

Telecommunications is not only a tool for doctors and hospitals. The Visiting Nurses Association (VNA) Alliance of New Hampshire and Vermont, which serves 72 Vermont towns from Orange County to the Massachusetts border, has demonstrated telecommunications applications in home health care. Funded by a $400,000 USDA grant, the Alliance is demonstrating ways to extend the reach of health care providers so that patients can stay in their own homes. Half the grant has gone to pay for individual monitoring units in patient homes, which allows remote monitoring of things such as vital signs and establishes a means for patients to check-in with care providers daily. Connections are made either via a telephone line or satellite link. The other half of the grant went to pay for laptops for visiting nurses. These laptops allow nurses to carry and collect patient information in electronic form, and synch up that information with the VNA's main computer system via modem at the end of the day from their own homes.

COMMUNITY AGGREGATORS

The Vermont Council on Rural Development (VCRD) has been active in advancing the community aggregation concept in Vermont, especially in the Northeast Kingdom. Essentially, the concept involves identifying potential customers for broadband services in unserved or underserved rural communities and then using the identified demand to solicit services from a provider, either informally or through a Request-for-Proposals (RFP) process. (See sidebar, "The Community Aggregation Process.") Initial efforts were made in the towns of Brighton, Hardwick, Barton, and Burke that showed both some initial success and some of the difficulty in reaching a critical mass in unserved rural areas. Barton very quickly received an offer from a local ISP to begin offering wireless service. Brighton received good news about plans for Adelphia to offer cable modem service in parts of town. While there was at least some interest in nearly all areas studied, low potential customer density has slowed efforts and made it difficult to sustain rapid progress. Recently, VCRD has supported additional planning efforts in Waterford, Westfield, Marshfield/Plainfield, and Brandon. In many instances communities are partially served, and efforts have turned to focus on the most rural parts of the rural communities, which lie out beyond villages and town centers. The VCRD has also established an on-line registry at www.vtruralbroadband.org where Vermonters can go to register their interest in participating in a community broadband project.

The Community Aggregation Process

The following steps are a general model for the community aggregation process encouraged by the Vermont Council on Rural Development. The specific process used varies from community to community.

Identify Community Leadership
Identify a local community-based organization that can take responsibility for any broadband project until the project is completed.

Broadband Service Potential
Determine if any broadband services can be implemented for the town (based on population density, geography, etc.).

Demand Methodology
Determine if the demand for broadband could be quantified without doing a town survey (survey already done, data from other sources i.e. Town Meeting).

Conduct Survey
Conduct a demand survey of residents and businesses, if required (obtain mailing lists, cleanse lists, tailor survey introduction letter(s), mail, tabulate results).

Broadband Demand Report
Prepare and deliver survey results reports to community organization with recommendations for next steps.

Send RFI
Prepare an Request-for-Information (RFI) to be sent by the community organization to potential broadband vendors.

Assist Community Organization
Provide facilitative assistance reviewing RFI responses and in the selection of a preferred broadband vendor.

Market Service
Help the community and the preferred vendor market the broadband service within the service area to get a critical mass of customers.

PUBLIC ACCESS ORGANIZATIONS

In Vermont, the ranks of Public, Educational, and Government (PEG) access channels now exceed 25 statewide. A movement distributed through various local communities has organized channels, some highly developed, some bare-bones, that show government meetings, local educational content, and provide a venue for members of the community to express themselves on a variety of topics. PEG groups, at their base, provide a way for community members to show community content on cable systems, but they also provide access to video production and editing equipment and training. The various local PEG access entities are loosely affiliated as the Vermont Access Network (VAN). VAN is pursuing the development of a state-wide PEG access network, using bandwidth committed by Adelphia Cable as part of PSB Docket 6101/6223 Order dated July 2000.

As part of the digital convergence of multi-media telecommunications, some PEG access centers are transitioning into community media centers. These are places where traditional video training and equipment is being supplanted by multi-media computer training with a future view to digital two-way interactivity. The most notable example of this is Channel 17/Town Meeting Television in Burlington, from which has sprung Cyberskills/Vermont. Cyberskills/Vermont provides computer skills training to community members, small businesses, and a workforce development program to entry-level job seekers. Cyberskills for Vermont Nonprofits provides technology planning and consulting along with subsidized training and support to Vermont nonprofits.

APPLYING TELECOMMUNICATIONS TECHNOLOGY

A variety of small organizations in Vermont help businesses identify the ways in which they can better use telecommunications. These include:

- The Vermont Information Technology Center (VITC) has worked closely with the Vermont Telecom Advancement Center, the Department of Economic Development, the Human Resource Investment Council, the Lake Champlain Regional Chamber of Commerce, the New England Governors Conference, and other organizations to promote understanding of the advantages to be gained by the availability of high-speed telecommunications services in Vermont and the New England region. VITC initiated and sponsors the Vermont chapter of InfraGard, the national FBI information security activity. The chapter currently has about 120 members representing governmental, educational, and private sector Vermont organizations. VITC has a US Department of Labor grant covering a range of information technology activities and administers a training grant as a sub-grantee to the Vermont Department of Employment and Training.
- The Vermont Manufacturing Extension Center (VMEC) is a resource to help manufacturing companies in Vermont be more competitive. It provides technical assistance in operations, layout, process improvement, lean manufacturing, marketing, business issues, and technology. VMEC helps Vermont manufacturers understand how to get the most value out of their technology investments and help with requirements definition, planning, and implementation of technology related projects, which may include high-speed telecommunications.
- The Vermont Small Business Development Center (SBDC) assists start-ups and strengthens existing business entities through high quality, no cost counseling, and high quality, affordable training programs in general business management. SBDC's business development services are directed at educating businesses on broadband, use of the Internet and business to business on the Internet.

VERMONT BROADBAND COUNCIL

The Vermont Broadband Council was formed in 2002 to increase economic development, expand educational and job opportunities, and improve the overall quality of life in Vermont through increased use of high-speed telecommunications, primarily high- speed Internet. The Council's approach is to develop demonstration projects that will allow people to use the tools and services available through high-speed telecommunications. In 2003, the Council has been working on a proposed wireless network in Montpelier (see the subsection above, "Municipal Networks"). The Council has received funding through an approximately $200,000 federal grant and through contributions of its members, including PKC Corporation, GMP, CVPS, Verizon, the Verizon Foundation, UVM, the Windham Foundation, Symquest, and the Vermont State Colleges.

PUBLIC SERVICE REGULATION AND PLANNING

The PSD and the PSB continue to fill unique roles with influence on the telecommunications industry in Vermont. The PSB is a quasi-judicial board that supervises the rates, quality of service, and overall financial management of Vermont's public utilities. The PSD represents the public interest in matters before the PSB, responds to consumer complaints, and constitutes the state's agency for planning activities in telecommunications. They both play a role in managing state and federal money dedicated for various forms of universal service support and advocating for the state's interests at the federal level.

While a large part of the work of the PSD is related to regulation, planning for Vermont's telecommunications future involves much more than regulatory policy, as this section of the plan clearly shows. The PSD and in some circumstances the PSB act as authorities within Vermont state government on technical matters related to telecommunications. The PSD also continues to track broadband deployment trends and the introduction of new services by communications companies in Vermont. It seeks to catalyze the improvement of Vermont's telecommunications networks through non-regulatory means by collaborating with partners in fields such as economic development, state purchasing, public safety, and education. The PSD's planning for Vermont's telecommunications future must consider all of these avenues for development.

(Endnotes)

[1] Both AT&T Wireless and T-Mobile have had limited facilities in Vermont, but have not begun to activate customers in the Vermont market.

Telecommunications Almanac

This section provides key data about the status of telecommunications in Vermont. These statistics and other data provide important indicators of where Vermont has been doing well in meeting its telecommunications needs, and where there is room for further improvement.

A. Telecommunications Adoption Statistics

TELEPHONE PENETRATION

Vermont has in recent times consistently ranked high in the level of residents with telephone access, one of the most basic levels of telecommunications connectivity. Vermont is one of the top four states in the level of telephone pene-

Table 3.1:
Telephone penetration by state

Percentage of Households with Telephone Service			
State	*Nov-83*	*Nov-02*	*Change*
Maine	90.7%	98.3%	7.6%
Pennsylvania	95.1%	98.1%	3.0%
Colorado	94.4%	97.8%	3.4%
Vermont	**92.7%**	**97.6%**	**4.9%**
Minnesota	96.4%	97.4%	1.1%
New Jersey	94.1%	97.3%	3.2%
New Hampshire	95.0%	97.2%	2.3%
Iowa	95.4%	97.1%	1.7%
Connecticut	95.5%	97.0%	1.5%
Hawaii	94.6%	96.9%	2.3%
California	91.7%	96.8%	5.1%
Delaware	95.0%	96.8%	1.8%
Missouri	92.1%	96.8%	4.7%
Oregon	91.2%	96.8%	5.6%
Wisconsin	94.8%	96.8%	2.0%
Massachusetts	94.3%	96.7%	2.4%
Utah	90.3%	96.7%	6.4%
Maryland	96.3%	96.6%	0.3%
Alaska	83.8%	96.3%	12.5%
Ohio	92.2%	96.3%	4.1%
New York	90.8%	96.0%	5.2%
Washington	92.5%	95.9%	3.5%
Nebraska	94.0%	95.8%	1.8%
Idaho	89.5%	95.6%	6.1%
Arizona	88.8%	95.5%	6.8%

Table 3.2:
Telephone penetration by state continued

Percentage of Households with Telephone Service			
State	*Nov-83*	*Nov-02*	*Change*
Rhode Island	93.3%	95.5%	2.2%
Virginia	93.1%	95.3%	2.2%
Total United States	**91.4%**	**95.3%**	**3.9%**
Nevada	89.4%	95.2%	5.8%
Kansas	94.9%	95.1%	0.2%
District of Columbia	94.7%	95.0%	0.3%
North Dakota	95.1%	94.9%	-0.2%
South Dakota	92.7%	94.9%	2.2%
Florida	85.5%	94.8%	9.3%
Kentucky	86.9%	94.7%	7.8%
West Virginia	88.1%	94.6%	6.5%
Texas	89.0%	94.5%	5.5%
North Carolina	89.3%	94.3%	5.0%
Tennessee	87.6%	94.0%	6.4%
Oklahoma	91.5%	93.5%	2.0%
South Carolina	81.8%	93.5%	11.7%
Wyoming	89.7%	93.5%	3.8%
Indiana	90.3%	93.2%	2.9%
Michigan	93.8%	93.2%	-0.6%
Montana	92.8%	93.2%	0.4%
Illinois	95.0%	93.0%	-2.0%
Louisiana	88.9%	93.0%	4.1%
Arkansas	88.2%	92.5%	4.3%
Georgia	88.9%	92.4%	3.5%
Alabama	87.9%	92.0%	4.1%
Mississippi	82.4%	91.7%	9.3%
New Mexico	85.3%	90.3%	5.0%

Source: FCC, *Trends in Telephone Service*, 2003.

Table 3.3:
Telephone penetration 1984-2002

	1984	1997	2000	2002
Vermont--All Households	91.5%	93.9%	95.6%	98.0%
United States--All Households	91.8%	94.0%	94.5%	95.5%
Vermont--Low Income Households*	75.3%	84.6%	92.9%	94.9%
United States--Low Income Households*	80.1%	86.0%	87.5%	89.1%

*Defined as households with less than $10,000 in 1984 dollars, or $17.427 in 2002 dollars.

Source: FCC, *Telephone Penetration by Income by State*, 2003.

tration. Even among low-income Vermonters telephone penetration is very high, exceeding 95%. (Differences in same-year percentages in Tables 3.1 through 3.3 reflect the source data of the two Federal Communications Commission (FCC) reports used in creating the tables; the FCC collects data monthly and the data listed are from different months of the year.)

Table 3.4:
Vermont computer-owning households

Year	Percent of households with a computer	
	Vermont	*U.S.*
1998	48.7	42.1
2000	53.7	51.0
2001	60.4	56.5

Source: U.S. Dept. of Commerce, NTIA "Falling Through the Net" / "A Nation Online" series.

Table 3.5:
Vermont Internet households

Year	Percent of households with Internet service	
	Vermont	*U.S.*
1998	31.8	26.2
2000	46.7	41.5
2001	53.4	50.5

Source: U.S. Dept. of Commerce, NTIA "Falling Through the Net" / "A Nation Online" series.

Table 3.6:
Broadband Internet households

Percent of households with broadband service	
Vermont	*U.S.*
17	22

Sources: BusinessWeek, "The E-Biz Surprise," May 12, 2003, p.68; PSD Nov. 2003 residential telephone survey.

COMPUTER AND INTERNET ACCESS ADOPTION

In recent years Vermont has consistently ranked slightly ahead of the national average in both computer ownership and in subscribership to Internet service. These statistics are available through periodic special studies conducted by the Census Bureau and the Bureau of Labor Statistics as part of its monthly Current Population Study. Table 3.4 shows figures for computer ownership and Table 3.5 shows the census figures for Internet access. A year 2003 estimate for the level of Internet access obtained from the Public Service Department's (PSD) telephone survey conducted in connection with the plan is found in Section 4, Figure 4.18. Statistics on the level of subscribership to broadband Internet service are somewhat harder to obtain, especially for purposes of comparing Vermont to other states. One commercial estimate from early 2003 of broadband Internet penetration among all U.S. households reports that approximately 22% of homes in the U.S. had high-speed Internet service.[1] Results from the PSD's telephone survey of Vermont households in November 2003 indicated that about 17% of all Vermont households subscribed to broadband Internet service. Table 3.7 shows the number of high-speed lines in Vermont and selected states. After a slow start, the number of reported high-speed lines in Vermont has grown during most six-month periods at a percentage rate that meets or exceeds national average rates for growth. The FCC statistics used to produce this table may in fact under-represent high-speed lines in Vermont, as only service providers with more than 10,000 lines are required to report to the FCC.

Table 3.7:
High-speed lines, selected states 2000-2003

	June 2000	Dec. 2000		June 2001		Dec. 2001	
	Lines	*Lines*	*% Change*	*Lines*	*% Change*	*Lines*	*% Change*
Vermont	1,551	7,773	401%	16,230	109%	21,795	34%
Maine	17,864	26,266	47%	38,149	45%	49,523	30%
New Hampshire	33,045	42,364	28%	55,658	31%	71,200	28%
Massachusetts	185,365	289,447	56%	357,256	23%	505,819	42%
New York	342,743	603,487	76%	893,032	48%	1,199,159	34%
Utah	19,612	35,970	83%	55,103	53%	72,977	32%
West Virginia	1,835	6,498	254%	16,697	157%	32,848	97%
New Mexico	2,929	28,497	873%	20,482	-28%	31,940	56%
Washington	118,723	195,628	65%	227,066	16%	335,667	48%
Iowa	49,159	58,199	18%	72,583	25%	82,024	13%
Nationwide	4,367,434	7,069,874	62%	9,616,341	36%	12,792,812	33%

	June 2002		Dec. 2002		June 2003		Dec. 2003	
	Lines	*% Change*	*Lines*	*% Change*	*Lines*	*% Change*	*Lines*	*% Change*
Vermont	29,990	38%	32,814	9%	39,773	21%	44,724	12%
Maine	61,406	24%	73,061	19%	85,615	17%	99,200	16%
New Hampshire	86,200	21%	102,590	19%	118,879	16%	149,180	25%
Massachusetts	583,627	15%	679,084	16%	821,135	21%	919,638	12%
New York	1,406,894	17%	1,725,296	23%	1,997,340	16%	2,262,804	13%
Utah	93,928	29%	121,744	30%	135,007	11%	162,905	21%
West Virginia	58,209	77%	78,980	36%	90,173	14%	100,937	12%
New Mexico	44,942	41%	57,956	29%	71,969	24%	91,736	27%
Washington	422,348	26%	485,063	15%	577,378	19%	672,247	16%
Iowa	102,932	25%	121,053	18%	162,257	34%	191,464	18%
Nationwide	16,202,540	27%	19,881,549	23%	23,459,671	18%	28,230,149	20%

Source: FCC

B. Service Availability

BROADBAND SERVICE AVAILABILITY

Broadband coverage continues to expand in Vermont. The Public Service Department (PSD) and the Department of Economic Development, with the cooperation of service providers, have engaged in an effort to map this progress and estimate the percentage of Vermonters who have access to services such as cable modem service and Digital Subscriber Line (DSL). Figure 3.1 displays the estimated extent of DSL coverage in Vermont, while Figure 3.2 displays the estimated extent of cable modem coverage. Figure 3.3 shows the combined areas served by DSL and cable modem service in Vermont and the areas where the services overlap. Figure 3.4 shows the estimated coverage by Wireless Internet

Figure 3.1:
DSL coverage May 2004

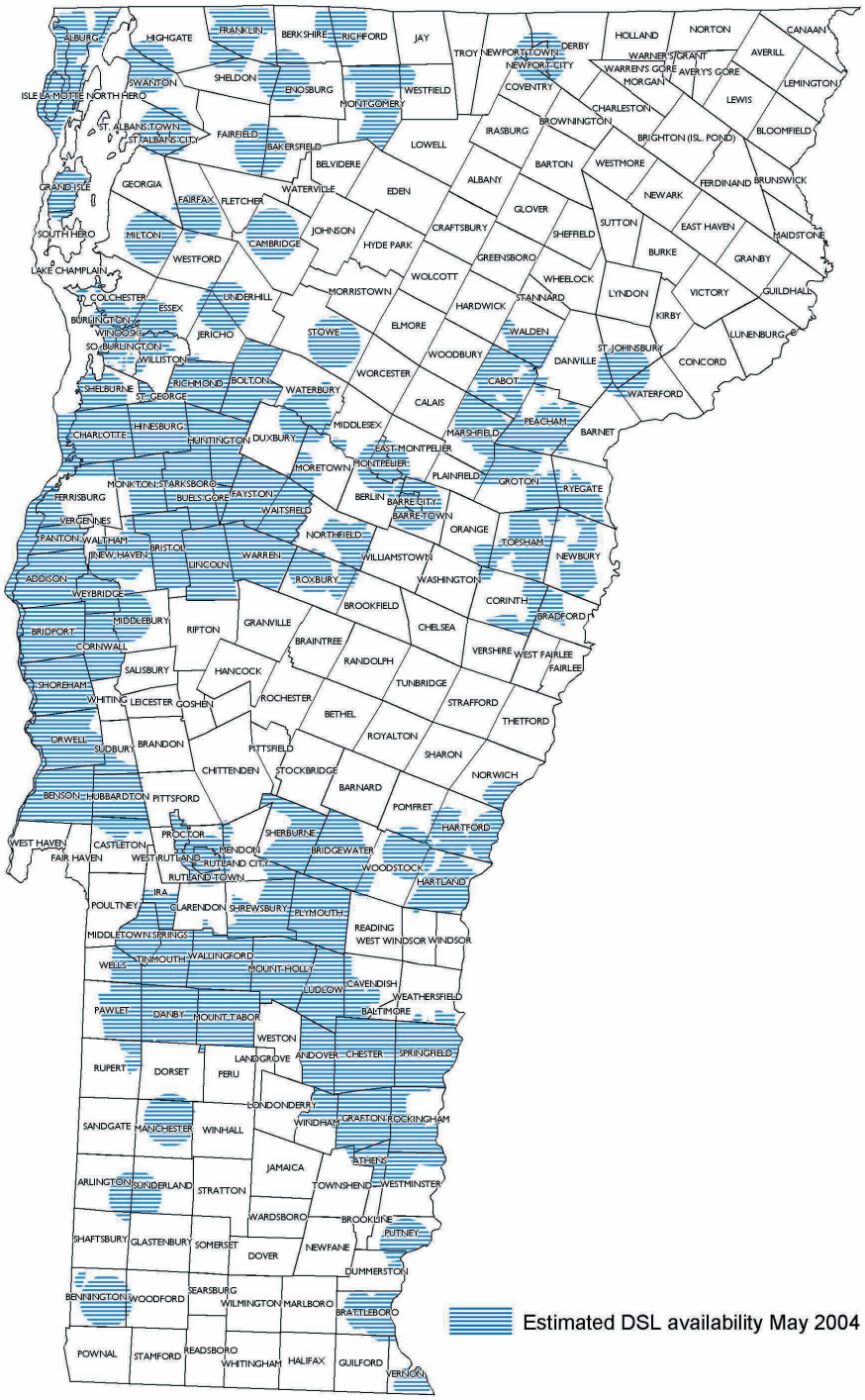


Figure 3.2:

Cable modem coverage May 2004

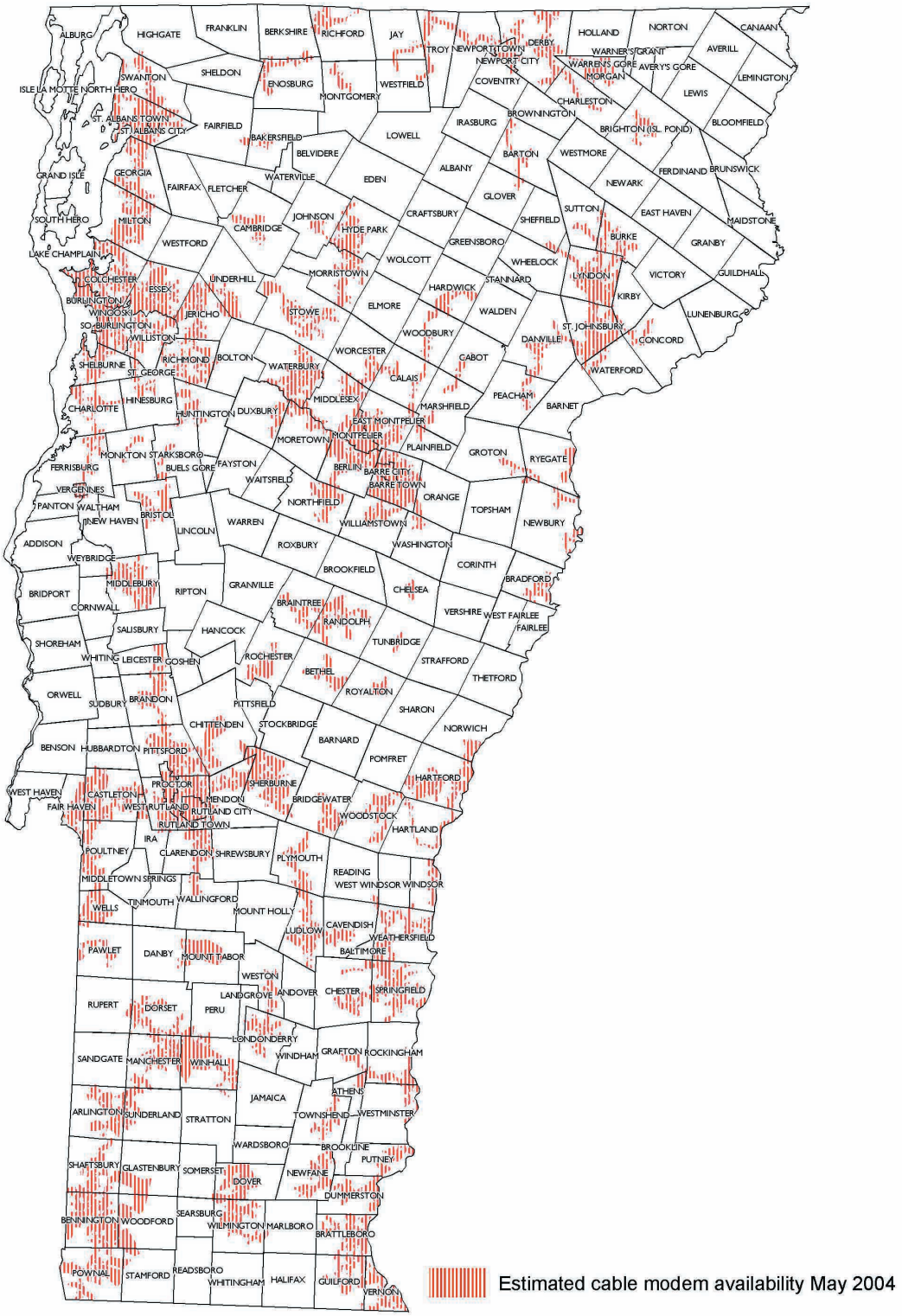


Figure 3.3:
Combined DSL and cable modem coverage

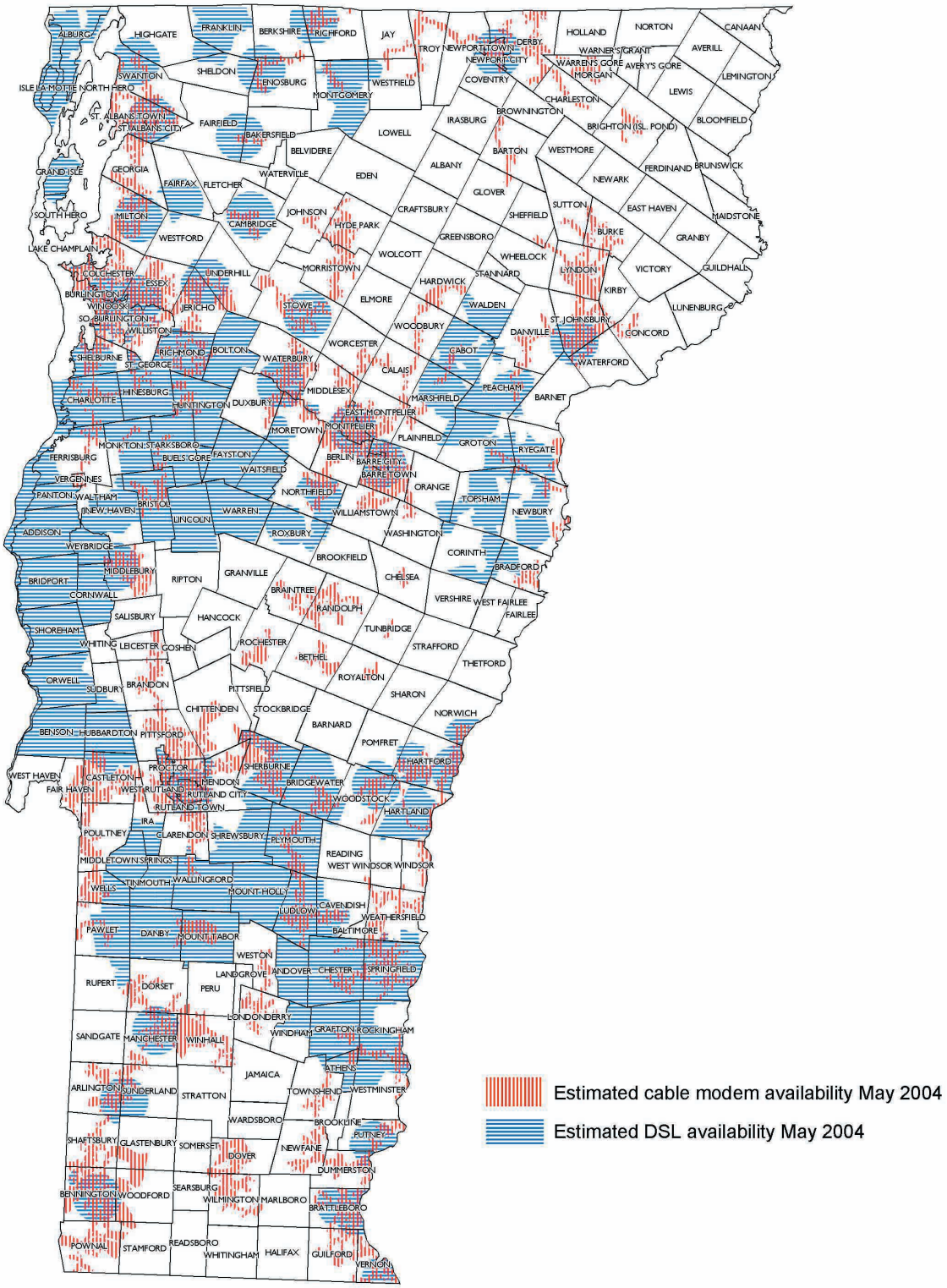


Figure 3.4:
Wireless ISP broadband coverage

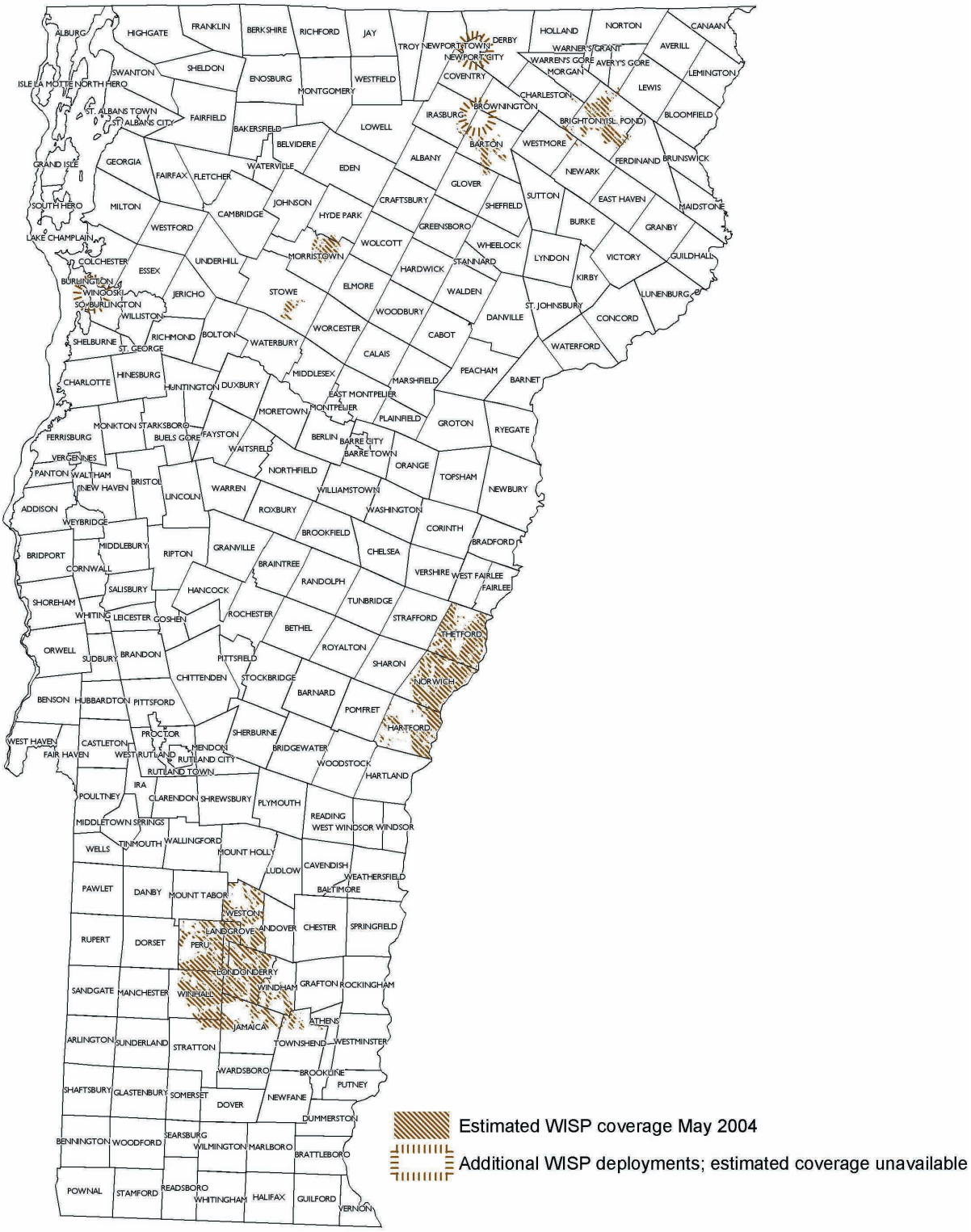


Figure 3.5:
Broadband service and population density

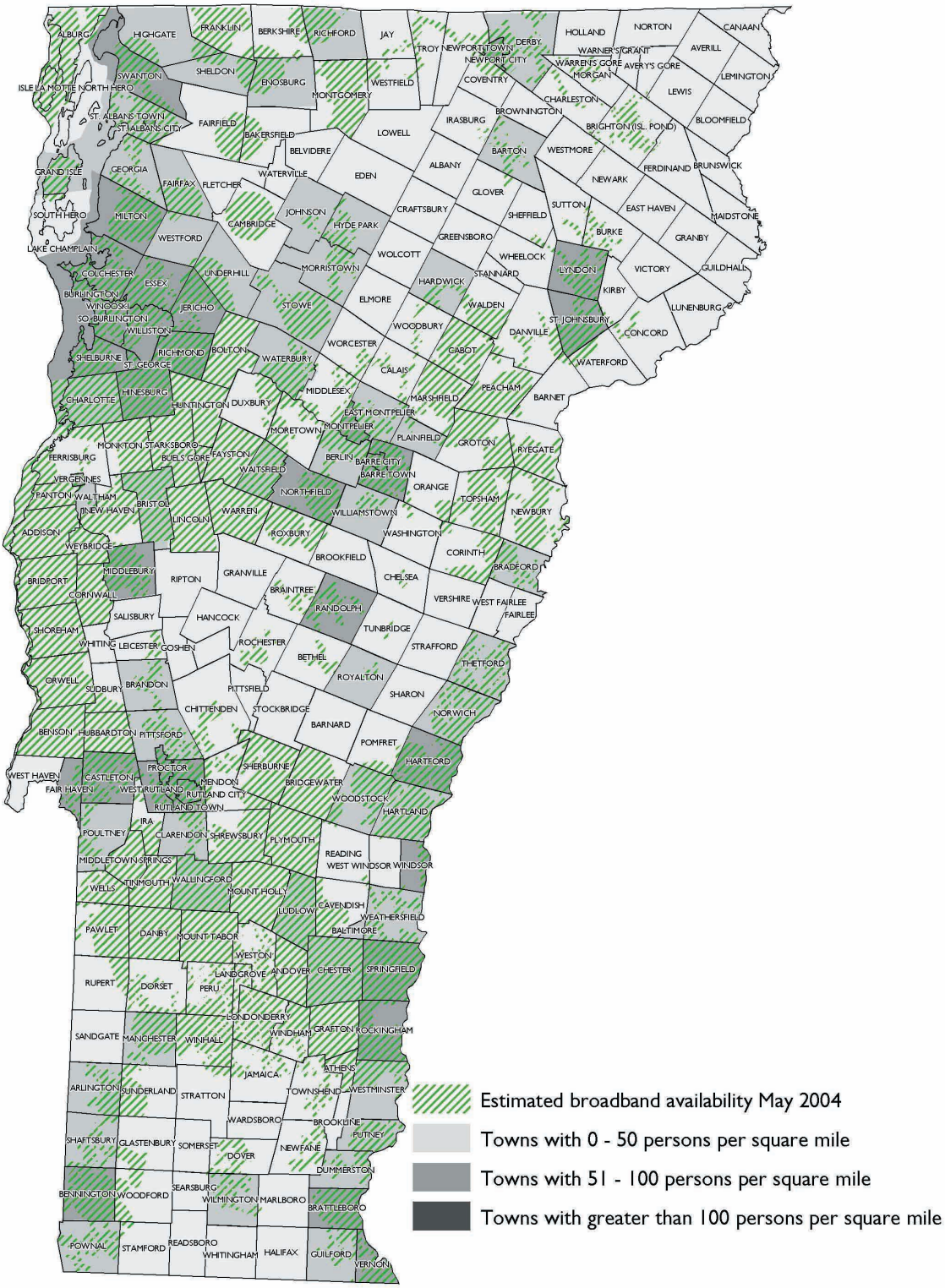


Table 3.8:
Broadband availability in Vermont by county--2003

County	Total Population 2000	Total Pop - Cable Modem Coverage	Cable %	Total Pop - DSL Coverage	DSL %	Total Pop: Cable modem or DSL Coverage	Cable modem or DSL Coverage %
Grand Isle	6,901	-	-	1,933	28.01	1,933	28.0
Franklin	45,417	26,632	58.64	24,010	52.87	30,895	68.0
Orleans	26,277	-	-	5,794	22.05	5,794	22.1
Essex	6,459	668	10.3	-	-	668	10.3
Lamoille	23,233	12,338	53.1	3,560	15.3	12,338	53.1
Chittenden	146,571	130,943	89.3	108,930	74.3	139,132	94.9
Washington	58,039	46,470	80.1	41,345	71.2	51,981	89.6
Caledonia	29,702	20,139	67.8	7,042	23.7	20,471	68.9
Addison	35,974	17,078	47.5	26,193	72.8	30,571	85.0
Orange	28,226	10,725	38.0	1,178	4.2	12,016	42.6
Rutland	63,400	49,785	78.5	34,428	54.3	58,676	92.5
Windsor	57,418	23,299	40.6	27,666	48.2	35,604	62.0
Bennington	36,994	31,677	85.6	17,793	48.1	32,014	86.5
Windham	44,216	24,757	56.0	14,179	32.1	26,238	59.3
State of Vermont	608,827	394,511	64.8	314,051	51.6	458,331	75.3

Estimating Broadband Coverage in Vermont

Using Geographic Information Systems (GIS) software, the Department of Economic Development and its contractor, the Technology Policy Group (TPG) of Ohio State University, were able to develop the estimates in this plan with the assistance of the PSD. TPG first estimated the geographic extent of DSL and cable modem service. It was possible to generate a map of the areas served by cable systems with modem service using maps of served roads submitted by cable companies to the PSD with their annual reports. Estimating DSL coverage was trickier. Some telephone companies provide DSL service essentially throughout their telephone exchanges, and these exchanges were shaded in their entirety. In other instances, TPG estimated the possible "reach" of DSL services from known service locations provided by telephone companies. This method, while not exact, provides one of the best methods for estimating DSL known to be in use at this time. Still, these estimates should not be assumed to have greater precision than they actually have. To convert the estimated geographic extent of broadband service into an estimate of the population to which the service is available, TPG used year 2000 U.S. Census information. The population of the census blocks overlain by broadband service areas was used to calculate an estimate of the population in areas served by broadband. Again, this is an imprecise estimate, but the numbers produced are consistent with what might be expected, given what else is known about the penetration of cable TV service and the percentage of the population served by telephone companies offering DSL.

Service Providers (WISPs). (For both DSL and WISP services, coverage for higher-priced broadband services marketed to businesses is slightly greater than shown; these figures show only areas covered by mass-market broadband services.) Figure 3.5 displays the combined coverage with a population density overlay. High-speed access via satellite is not displayed. As the telephone survey detailed in Section 4 reveals, only a small fraction of Vermonters currently obtain broadband access via satellite or wireless. While denser locations in Vermont are more likely to have broadband service available there are also low-density areas that have broadband service, especially DSL and wireless broadband. Table 3.8 shows an estimate of the percentage of the population with access to broadband service, broken down by county. (For an explanation of the method by which these maps and coverage estimates were generated, please see the sidebar, "Estimating Broadband Coverage in Vermont.") Additional maps depicting 2002 cable modem and DSL availability can be found at http://www.state.vt.us/psd/Menu_options/Telecomm_files/telplan4maps.html.

CABLE TV AVAILABILITY

Cable service has slowly continued to expand in Vermont. A significant expansion can be expected with an agreement by Adelphia Cable to complete its agreed-to line extensions. Figure 3.6 displays the extent of cable service in Vermont. (See also Figure 2.3 in Section 2, "Telecommunications Initiatives and Activities," for a map of cable systems by operator.) Results of the PSD telephone survey presented in Section 4, Survey Results and Public Input Process, indicate that about 65% of Vermonters either have cable TV service or have cable facilities running by their homes so that they could subscribe if they wanted to do so.

C. Comparative Prices

LOCAL TELEPHONE

RETAIL RATES

The local telephone rates of Vermont's ten incumbent telephone companies (Verizon and the nine independents) are important elements in Vermonters' telephone bills, although dial tone rates do not tell the whole story. Table 3.9 shows the rates, current as of the end of 2003, two key rates regulated by the Public Service Board (PSB): the local dial tone rate and the per-minute charges that companies charge for calls made to the consumer's home exchange and their extended area service (EAS) local calling area. While most consumers are charged by the minute for local calls, most also have a cap on the total amount they will be charged for local usage in addition to the monthly local charge. Table 3.10 shows how much customers who use various levels of local usage would be charged by various incumbent local companies, minus state sales tax and federal excise tax (which together add an additional 9% to the bill). Statistics filed with the FCC indicate that the average Verizon-Vermont customer made about 1500 minutes of local calls per month in 2002.[2] Although many people believe that local telephone rates are set entirely at the state level, there

Figure 3.6:
Cable TV coverage 2004

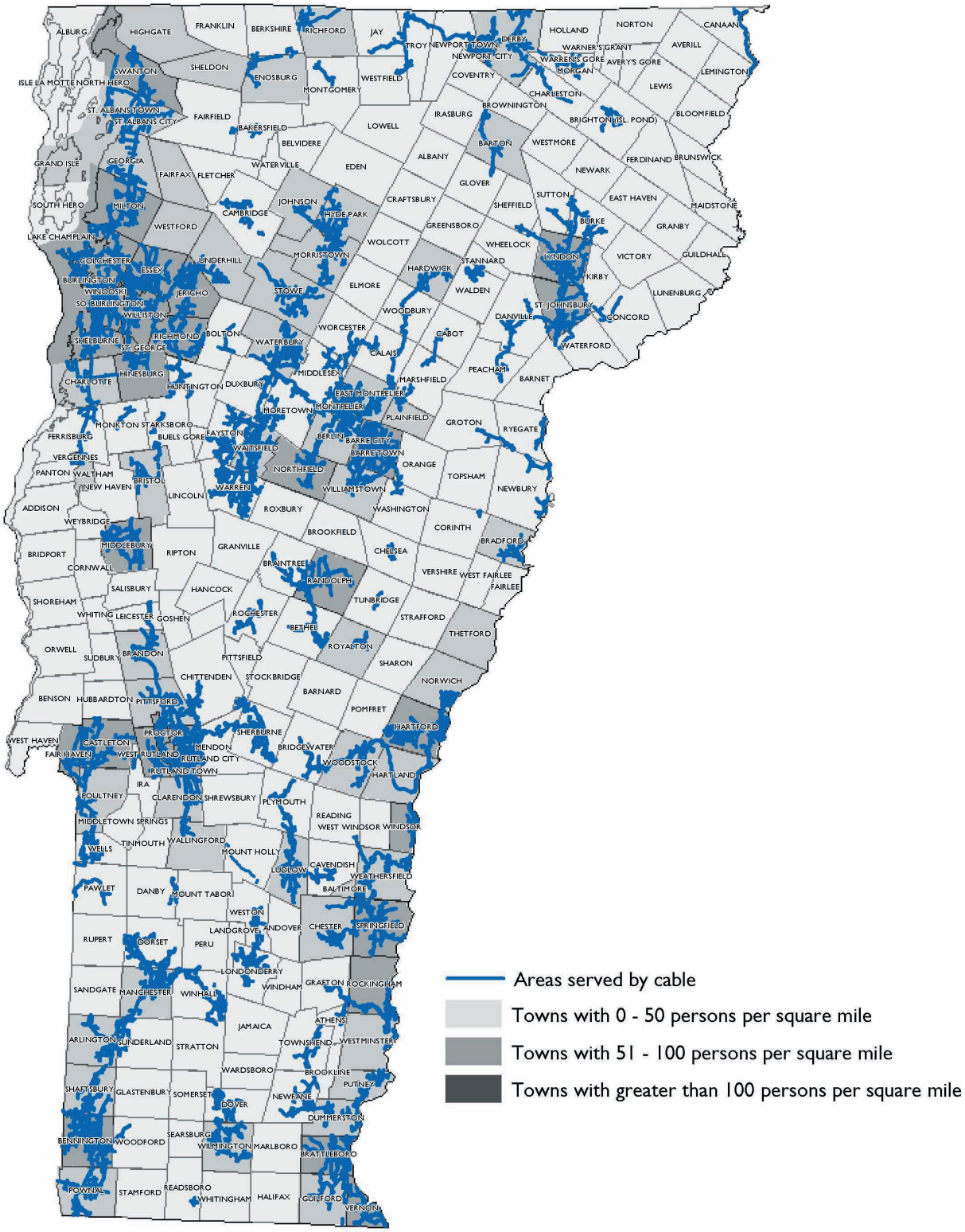


Table 3.9:
Incumbent telephone company local rates 2003

Company	LMS Rate (Cents/Minute of Use)				Dial Tone Local Rate with Touch Tone		Local Usage Caps	
	Home Exchange		*EAS*					
	Peak	*Off-Peak*	*Peak*	*Off-Peak*	*Residential*	*Business*	*Residential*	*Business*
Verizon	2.2	0.5	2.2	0.5	$13.15	$32.00	$26.25	$43.27
VTel	2.2	0.5	2.2	0.5	$12.70	$23.25	$25.00	$35.00
Fairpoint	1.0	0.5	2.5	0.5	$13.20	$23.65	$24.00	$38.00
WCVT*	1.0	0.5	2.2	1.0	$13.40	$26.40	$28.00	$38.00
Shoreham	2.0	0.5	3.5	0.5	$14.95	$25.30	$30.00	$30.00
Topsham	0.0	0.0	3.5	1.5	$11.35	$18.10	N/A	N/A
Franklin	0.0	0.0	3.0	1.0	$10.00	$18.00	N\A	N\A
Northfield	TDS Co's have declining rate structure, 300 minutes or less - No Chg; 301-600 minutes - 2.5 cents; 601-901 minutes - 1.5 cents; 901+ minutes - .05 cents				$14.90	$23.65	N\A	N\A
Ludlow					$12.90	$21.65	N\A	N\A
Perkinsville					$12.90	$21.65	N\A	N\A

Notes: Dial tone rates do not include mileage charges, where applicable. Residential caps are in addition to dial tone rates. Residential rates reflect rate with lowest level of included usage.

*In the Waitsfield exchange, the business local usage cap is $62.

are rate components of local telephone service which are regulated by the FCC and which make up a significant portion of the local telephone bill. In addition to the monthly dial tone rate and local usage charges, the federal and state rates included in Table 3.10 are:

- The federal Subscriber Line Charge (SLC);
- The Federal Universal Service Charge;
- The Vermont Universal Service Charge; and
- Local Number Portability charges.

The SLC, which is like a second dial tone charge, is the largest of these charges, at or near $6.50 for each company. The Verizon aggregate charges also include a $1.95 credit to pass through federal high-cost support that Verizon receives from the federal universal service fund. Comparable support that the independent telephone companies receive has been built into their local rates.

A majority of the incumbent telephone companies have reduced their Vermont-regulated local rates since the last plan in 2000. Table 3.11 shows rate changes since the last plan. The biggest single reduction was in the Verizon business dial tone rate, which used to be the highest in New England.

Comparing telephone rates in different states is becoming increasingly difficult. Different states vary in the options for flat-rated service versus measured service and small or large local calling areas. Different states are served by a variety of incumbent local companies with various rates. In addition, competition has

Table 3.10:
Incumbent telephone company aggregate local charges 2003

Company	Residential Charges				Business Charges			
	100 local minutes	*1000 local minutes*	*1500 local minutes*	*2000 local minutes*	*100 local minutes*	*1000 local minutes*	*1500 local minutes*	*2000 local minutes*
Verizon*	$20.07	$29.54	$36.38	$42.45	$36.34	$44.64	$51.48	$58.31
VTel*	$21.38	$27.41	$31.51	$38.35	$32.07	$37.54	$41.64	$48.47
Fairpoint	$21.66	$31.92	$37.61	$43.31	$32.24	$42.50	$48.19	$53.89
Waitsfield and Champlain Valley Telecom	$21.92	$32.62	$38.57	$44.52	$35.08	$45.79	$51.74	$57.69
Shoreham Telephone	$23.94	$38.75	$46.98	$52.68	$34.42	$49.23	$57.46	$63.16
Topsham Telephone	$19.92	$31.31	$37.64	$43.97	$26.75	$38.14	$44.47	$50.80
Franklin Telephone	$18.30	$27.41	$32.47	$37.54	$26.40	$35.51	$40.57	$45.64
TDS Northfield	$22.24	$34.90	$37.44	$39.97	$31.11	$43.76	$46.30	$48.83
TDS Ludlow	$20.22	$32.88	$35.41	$37.94	$29.08	$41.74	$44.27	$46.80
TDS Perkinsville	$20.22	$32.88	$35.41	$37.94	$29.08	$41.74	$44.27	$46.80

Rates include all fees and charges except state sales tax and federal excise tax. Cost calculated with half peak local usage minutes and half off-peak minutes. For companies with different home and EAS rates, calculated with half of the peak and off-peak minutes at EAS rates.

* VTel charges assume customer subscribes to PlainTalk package when cost-effective. Verizon charges assume customer subscribes to standard use local calling package when cost-effective. Tables 3.12 and 3.13 do not make this assumption, and this accounts for the difference between Verizon charges listed in this table under the 1000 minute columns and the Verizon charges listed in those other two tables.

Table 3.11:
Changes to ILEC dial tone and local usage rates 2000-2003

Company	Residential Dial Tone Local Rate with Touch Tone		Business Dial Tone Local Rate with Touch Tone		LMS Rate (Cents/Minute of Use)			
					Home Exchange Peak Usage Rate		*EAS Peak Usage Rate*	
	2000	*2003*	*2000*	*2003*	*2000*	*2003*	*2000*	*2003*
Northland/ Fairpoint	$20.40	$13.20	$30.85	$23.65	2.0	1.0	3.5	2.5
Northfield	$16.55	$14.90	$27.00	$23.65	No change in rates but minutes included in base rate increased from 180 to 300.			
WCVT	$13.90	$13.40	$28.70	$26.40			3.0	2.2
Shoreham	$15.95	$14.95	$29.71	$28.71			5.0	3.5
Topsham	$13.35	$11.35	$20.10	$18.10				
Franklin	$11.00	$10.00	$19.00	$18.00				
Bell Atlantic/ Verizon	$13.65	$13.15	$41.06	$32.00				

Notes: Dial tone rates do not include mileage charges, where applicable. Verizon 2000 dial tone rates are for rate group 7. Residential rates reflect rate with lowest level of included usage.

Table 3.12:
Average RBOC residential rates by state

State	Res. Rate		State	Res. Rate
Nevada	$16.68		Tennessee	$23.60
New Jersey	$16.72		Louisiana	$23.80
Iowa*	$17.07		Oregon	$24.31
California	$17.40		Idaho	$24.58
Delaware*	$18.07		Colorado	$24.81
Oklahoma	$19.53		North Dakota	$24.81
Kansas	$19.71		Hawaii	$25.12
Connecticut	$20.16		South Dakota	$25.37
Indiana	$20.47		Arkansas	$25.55
Washington	$20.56		Montana	$25.95
Texas	$20.70		Massachusetts	$26.17
D. C.	$20.85		Maine	$26.55
Ohio	$20.85		Nebraska	$26.62
Florida	$20.86		Alabama	$26.63
North Carolina	$21.02		Rhode Island	$27.17
Alaska	$21.06		Maryland	$27.36
Utah	$21.21		Michigan	$27.67
Missouri	$21.27		Mississippi	$28.78
New Hampshire*	$21.53		Kentucky	$28.84
New Mexico	$21.65		Georgia	$28.99
South Carolina*	$21.65		West Virginia	$29.13
Pennsylvania	$21.78		New York	$30.06
Illinois	$21.92		Wyoming	$30.22
Arizona	$22.80		Virginia	$31.30
Minnesota	$22.82		**Vermont**	**$32.10**
			Wisconsin	$35.27
Median:	$23.60			

* Multiple density zones reported. Figure is for middle density zone.

Source: Gregg, Billy Jack, "A Survey of Unbundled Network Element Prices in the United States (Updated July 1, 2003)", West Virginia Public Service Commission, except unpublished corrected Vermont rate obtained from Mr. Gregg via e-mail to Christopher Campbell August 14, 2003.

Rates include subscriber line charge, state and federal USF charges and credits, and are based on flat-rated plans where available or otherwise on measured plan rate plus 100 five-minute business day calls and 100 five-minute off-peak calls.

Table 3.13 :
Average RBOC business rates by state

State	Bus. Rate		State	Bus. Rate
Illinois	$13.41		Texas	$43.54
California	$16.41		Connecticut	$44.01
Iowa*	$17.85		Montana	$44.35
Pennsylvania	$19.83		Florida	$44.61
D. C.	$21.09		Arkansas	$44.83
New Jersey	$22.78		Arizona	$44.87
Massachusetts	$22.79		South Dakota	$45.52
Wisconsin	$23.28		Kentucky	$45.59
Maryland	$23.93		Oklahoma	$45.62
Michigan	$24.38		New Mexico	$45.94
Nevada	$27.73		South Carolina*	$46.50
Rhode Island	$29.22		Louisiana	$46.52
New York	$30.20		New Hampshire*	$46.93
Wyoming	$30.22		Colorado	$48.04
Ohio	$31.30		**Vermont**	**$48.39**
Kansas	$32.01		Maine	$48.62
Utah	$32.37		Alabama	$49.56
Delaware*	$33.14		Missouri	$50.41
Alaska	$35.37		Mississippi	$50.82
North Dakota	$35.66		Indiana	$53.34
Nebraska	$38.03		Hawaii	$53.68
Idaho	$39.59		Minnesota	$54.27
Oregon	$40.52		Tennessee	$59.22
Washington	$40.84		West Virginia	$60.44
North Carolina	$43.00		Georgia	$63.64
			Virginia	$78.75
Median Rate	$43.54			

* Multiple density zones reported. Figure is for middle density zone.

Source: Gregg, Billy Jack, "A Survey of Unbundled Network Element Prices in the United States (Updated July 1, 2003)", West Virginia Public Service Commission, except unpublished corrected Vermont rate obtained from Mr. Gregg via e-mail to Christopher Campbell August 14, 2003.

Rates include subscriber line charge, state and federal USF charges and credits, and are based on flat-rated plans where available or otherwise on measured plan rate plus 100 five-minute business day calls and 100 five-minute off-peak calls.

penetrated residential and business markets to various degrees around the country. Competitors' plans increasingly bundle local service as part of a package with other services, and companies like Verizon have responded in kind. All but the smallest businesses have additional options for local service through Centrex, PBXs, or integrated voice-and-data T-1 lines. Furthermore wireless and voice-over-IP offerings substitute for local offerings to a certain degree. Nevertheless, Tables 3.12 and 3.13 display one type of state-to-state comparison, average rates for areas served by the Regional Bell Operating Companies (RBOCs)—Verizon, BellSouth, SBC, and Qwest. Telephone rates in Vermont are relatively high compared to other states, which is not surprising since the costs to serve Vermont are relatively high. This comparison also does not fully reflect the following two factors that will change the actual rates paid by individual consumers.

Table 3.14:
Selected competitive company rates

	Residential Rate		Business Rate	
	Measured	*Unlimited*	*Measured*	*Unlimited*
MCI	--	$54.38	--	$57.73
SoVerNet	$45.62	$50.63	$58.89	$79.56

Rates include all fees and charges except state sales tax and federal excise tax. Measured plans cost calculated with 750 peak local usage minutes and 750 off-peak minutes. MCI residential plan also comes with 200 long distance minutes included.

- Users who make fewer calls will pay less while users who use more will pay more. More than 40% of the residential rate and one quarter of the business rate for Vermont listed in the tables are from the charges on a hypothetical 1,000 minutes of usage, split 50/50 between peak and off-peak hours. Most of the states' rates listed are for flat-rated plans. (Unlimited local calling plans were recently re-introduced in Vermont, but at rates exceeding those listed in the tables.)
- Low-income consumers on Lifeline rates receive a significant discount. Vermont has a relatively high Lifeline credit.

It is also important to note that the local telephone rates noted in Tables 3.12 and 3.13 combine the state-and federally-set rates. In recent years federal subscriber line charges and universal service charges have increased, and these charges also vary by state with Vermont being relatively high.

Finally, a number of competitors now offer local telephone service to residents and businesses. While the majority of local service competitors primarily focus on multiline businesses and data, Table 3.14 shows the rates for two competitors' local service offerings to residents and small businesses with single lines. These offerings do not seek to undercut incumbent offerings on the price of basic dial tone. Instead, they seek to appeal to consumers with bundles of service combining dial tone with local or long distance calling minutes, custom calling features, or even broadband service.

WHOLESALE RATES

Competition can be influenced by the rates set for services and elements that RBOCs like Verizon must sell to competitors. Although unbundling is a federal

Table 3.15:
Unbundled loop rates by state

Lowest Rate in Each State

State	Loop Rate		State	Loop Rate
Illinois	$2.59		Utah	$11.41
D. C.	$4.29		Maine	$11.44
Minnesota	$5.83		Tennessee	$11.74
Colorado	$5.91		Nevada	$11.75
Ohio	$5.93		Arkansas	$11.86
Washington	$6.05		Kansas	$11.86
New York	$7.70		New Hampshire	$11.97
Vermont	**$7.72**		Mississippi	$12.03
Indiana	$8.03		North Carolina	$12.11
New Jersey	$8.12		Nebraska	$12.14
California	$8.24		Oklahoma	$12.14
Michigan	$8.47		Texas	$12.14
Connecticut	$8.95		Alabama	$12.58
Arizona	$9.05		Iowa	$12.69
Maryland	$9.51		Missouri	$12.71
Wisconsin	$9.51		Louisiana	$12.90
Delaware	$10.07		North Dakota	$13.53
Georgia	$10.24		Oregon	$13.95
Pennsylvania	$10.25		West Virginia	$14.49
Hawaii	$10.44		Alaska	$14.92
Kentucky	$10.56		South Carolina	$14.94
Florida	$10.69		South Dakota	$15.20
Virginia	$10.74		Idaho	$15.65
Massachusetts	$10.81		New Mexico	$16.04
Rhode Island	$11.19		Wyoming	$19.91
			Montana	$23.10
Median Rate	$11.41			

Source: Gregg, Billy Jack, "A Survey of Unbundled Network Element Prices in the United States (Updated July 1, 2003)", West Virginia Public Service Commission.

Table 3.16:
Unbundled loop rates by state

Highest Rate in Each State

State	Loop Rate		State	Loop Rate
D. C.	$4.29		Kansas	$23.34
Indiana	$8.99		New Mexico	$23.70
Ohio	$9.52		Massachusetts	$24.32
New Jersey	$10.92		New Hampshire	$25.00
Illinois	$11.40		Oklahoma	$26.25
Michigan	$12.54		Iowa	$26.39
Alaska	$14.92		South Carolina	$26.72
Wisconsin	$15.25		Florida	$26.97
New York	$15.51		Montana	$29.29
Minnesota	$15.66		Tennessee	$29.37
Delaware	$16.67		Virginia	$29.40
Pennsylvania	$16.75		Georgia	$30.44
Washington	$18.70		Kentucky	$31.11
Maine	$18.75		Colorado	$32.74
Texas	$18.98		North Carolina	$33.65
Utah	$19.11		Alabama	$34.34
Rhode Island	$19.13		Arizona	$36.44
California	$19.69		Idaho	$40.50
Connecticut	$19.69		Wyoming	$40.98
Missouri	$19.74		West Virginia	$43.44
Maryland	$20.57		Mississippi	$43.85
Vermont	**$21.63**		Louisiana	$48.43
South Dakota	$21.77		North Dakota	$51.65
Hawaii	$21.91		Oregon	$56.21
Arkansas	$23.34		Nebraska	$62.50
			Nevada	$66.31
Median Rate	$23.34			

Source: Gregg, Billy Jack, "A Survey of Unbundled Network Element Prices in the United States (Updated July 1, 2003)", West Virginia Public Service Commission.

Table 3.17:
Unbundled loop rates by state

Average Rate in Each State

State	Loop Rate		State	Loop Rate
Alabama	$17.60		Missouri	$15.19
Alaska			Montana	$23.72
Arizona	$12.12		Nebraska	$14.04
Arkansas	$13.09		Nevada	$19.83
California	$9.82		New Hampshire	$16.21
Colorado	$15.85		New Jersey	$9.52
Connecticut	$12.49		New Mexico	$18.52
D. C.			New York	$11.49
Delaware	$12.05		North Carolina	$15.88
Florida	$15.27		North Dakota	$16.28
Georgia	$13.14		Ohio	$7.01
Hawaii			Oklahoma	$14.84
Idaho	$20.21		Oregon	$15.00
Illinois	$9.81		Pennsylvania	$13.81
Indiana	$8.20		Rhode Island	$13.93
Iowa	$15.94		South Carolina	$17.60
Kansas	$14.04		South Dakota	$18.84
Kentucky	$18.04		Tennessee	$14.92
Louisiana	$17.30		Texas	$14.15
Maine	$16.19		Utah	$13.03
Maryland	$11.26		Vermont	$14.41
Massachusetts	$13.93		Virginia	$13.60
Michigan	$10.15		Washington	$14.20
Minnesota	$12.86		West Virginia	$20.41
Mississippi	$23.12		Wisconsin	$10.18
			Wyoming	$23.39

Source: Gregg, Billy Jack, "A Survey of Unbundled Network Element Prices in the United States (Updated July 1, 2003)", West Virginia Public Service Commission.

obligation under the Telecommunications Act of 1996, individual states set wholesale rates according to costing methodologies established by the FCC. Different states have different costs and different state public utility commissions have performed wholesale rate investigations at various points in time after 1997. A key benchmark price is the cost of a loop—the link between a customer and a central office. Loop rates are geographically deaveraged in each state—states are required by the FCC to have lower wholesale loop rates in lower-cost zones and higher rates in higher-cost zones. Table 3.15 lists the loop price in the lowest-priced zone by state. For its lowest-cost zone, Vermont has one of the lowest wholesale loop rates among the states. (This zone essentially only includes Burlington, South Burlington, Winooski, parts of Colchester, and small parts of Shelburne, Essex, and Williston.) Tables 3.16 and 3.17 list by state the rate for the highest priced zone and the average of loop rates across all zones. For the high-priced zone and the average, Vermont ranks near the middle of the pack.[3]

HIGH-SPEED DATA

Broadband rates began in 2003 to undergo an evolution. Originally service providers introduced these services to the mass market at price points in the $40-$50 range and above. Subsequently, DSL providers, which in many areas have trailed cable modem providers in subscribers, have attempted to regain the initiative with price cuts. In some instances cable modem providers have responded

Table 3.18:
Selected consumer broadband rates

Provider	Service	Region	Rate	Note
Adelphia Cable	Cable modem	Vermont, various U.S.	$42.95	$54.95 without cable TV
Verizon	DSL	Vermont, various U.S.	$34.95	
VTel	DSL	Southern Vermont	$34.95	
SoVerNet	DSL	Vermont	$35.94	$37.44 without phone service
Charter Communications	Cable modem	Northeast Vermont, various U.S.	$39.99	
Cablevision	Cable modem	various U.S.	$44.95	$49.95 without cable TV
Cox Cable	Cable modem	various U.S.	$35.00	$49.95-69.95 without cable TV. Prices vary regionally, up to $52 with cable in some areas.
Earthlink	Cable Modem	various U.S.	$41.95	$45.95 in Boston and Seattle
Earthlink	DSL	various U.S.	$49.95	
Comcast	Cable modem	various U.S.	$42.95	$57.95 without cable TV
Qwest	DSL	various western U.S.	$39.99	$44.99 without a phone package
Yahoo/SBC	DSL	various U.S.	$59.99	

Prices were web-published rates in effect the week of June 28, 2004, and do not reflect limited-time promotional and term commitment offers.
Prices are for services with a minimum nominal speed of 200 kbps in both directions. Other service levels/speeds may be offered at other prices.

in kind. Table 3.18 displays a range of selected broadband prices from Vermont and around the country. At this stage broadband prices from national providers are set less on a state-to-state basis—as telephone rates are—but instead tend to be set on a national or regional basis. Therefore, rates in Vermont tend to be comparable to other locations around the country. In February 2004, the Pew Internet and American Life Project asked broadband users nationwide about the price they pay for service in a survey. DSL users reported an average monthly bill of about $38, while the average reported cable modem bill was about $41.[4] Table 3.18 displays a necessarily simplified picture. Many service providers have also tried to appeal to a wider range of customers by offering various tiers of service. Higher prices are linked to features like faster upload or download speeds or static IP addresses. Conversely, some providers have marketed "broadband lite" services that offer speeds just a few times greater than dial-up. As a result, there have been a wide range of broadband services available around the country (and to a fair extent, in Vermont) in the $25-$100 price range. The prices displayed in Table 3.18 are for services with nominal download speeds in excess of 786 kbps and nominal upload speeds in excess of 200 kbps (although these speeds may not always be guaranteed). Companies have also been offering a variety of discounts for term commitments and service bundles with phone and television service.

ACCESS CHARGES

Access charges are payments made by long distance companies to local telephone companies for access to the local network and its callers. Long distance companies pay on both the originating end and terminating end of the call. Although access charges tend to be expressed in terms of per-minute rates they are, in fact, a variety of usage and non-usage sensitive charges. Intrastate access charges are regulated by the PSB and interstate access charges by the FCC. Verizon has reduced intrastate access charges significantly as part of the year 2000 alternative regulation plan, from about $.10/min. end-to-end to about $.03/min. This has allowed for significant reductions in long distance rates for calls in Vermont. Table 3.20 shows access charge rates for Vermont's incumbent telephone companies, and Figure 3.7 compares a composite of usage-sensitive access charge rates for the various companies. Access charge rates remain significantly higher among independent telephone companies. The FCC has over the years reduced interstate access charges to relatively low levels. Table 3.19 shows the rate for Verizon, the National Exchange Carrier Association (NECA) and the national average. (Most independent telephone companies use the NECA rates.) Verizon's usage-sensitive interstate access charge rates are below half a cent per minute.

Table 3.19:
Interstate access charges

	Verizon	NECA	National Average
Originating per minute	$0.0044	$0.0165	$0.0050
Terminating per minute	$0.0042	$0.0165	$0.0049

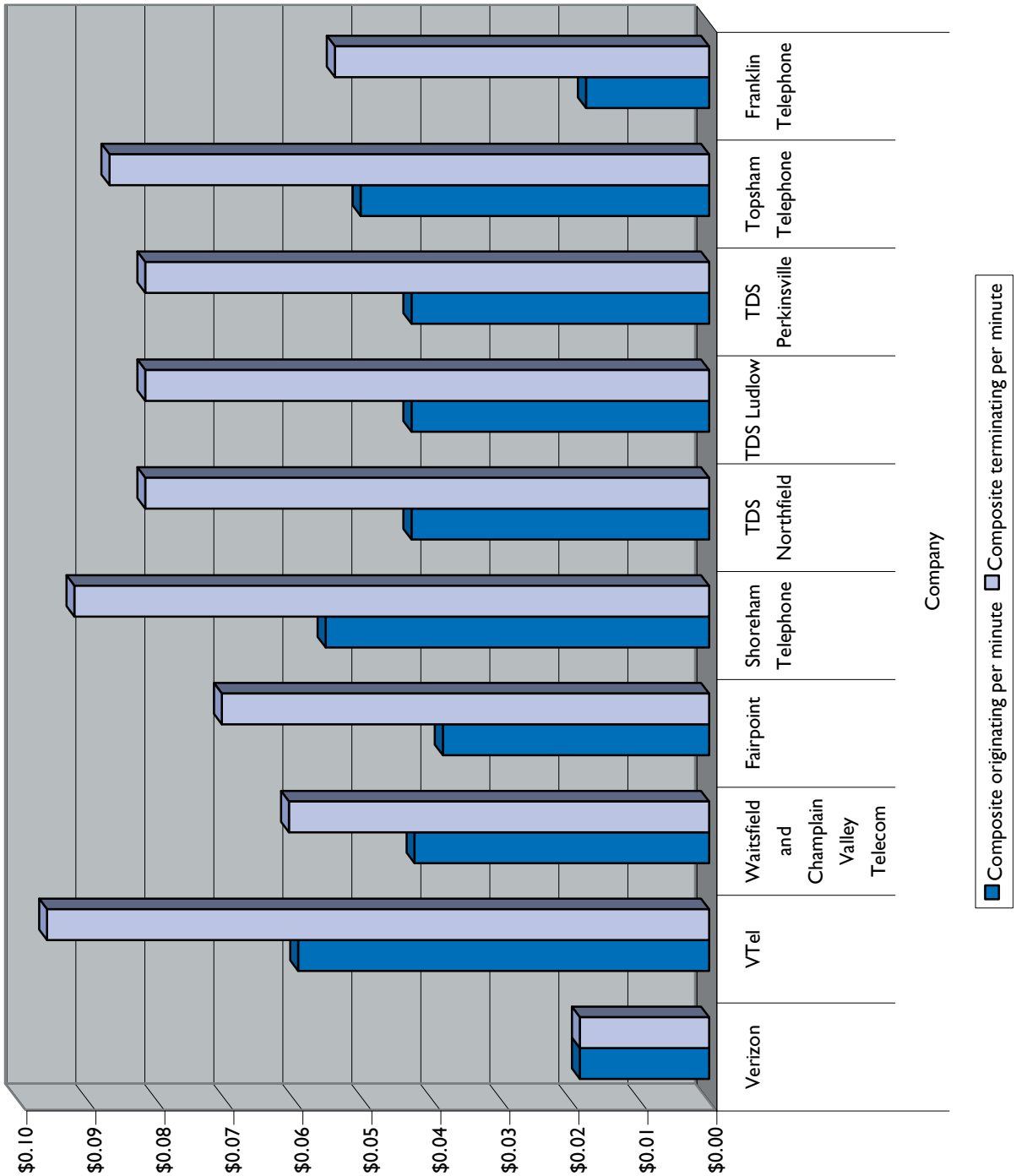
Source: FCC, "Universal Service Monitoring Report." 2003. Data for period 7/1/02 through 6/30/03. Does not include non-traffic sensitive rate elements.

Table 3.20:
Incumbent telephone company intrastate access charges

Rate Element	Company									
	Verizon	*VTel*	*Waitsfield and Champlain Valley Telecom*	*Fairpoint*	*Shoreham Telephone*	*TDS Northfield*	*TDS Ludlow*	*TDS Perkinsville*	*Topsham Telephone*	*Franklin Telephone*
CCL Originating per minute	$0.000000	$0.006900	$0.003450	$0.004418	$0.006900	$0.004740	$0.004740	$0.004740	$0.006900	$0.006900
CCL Terminating per minute	$0.000000	$0.043300	$0.021650	$0.036435	$0.043300	$0.043300	$0.043300	$0.043300	$0.043300	$0.043300
Local transport - Circuit Connection - per minute	$0.000731	$0.007500	$0.004892	$0.007500	$0.008400	$0.008400	$0.008400	$0.008400	$0.008400	$0.008400
Local transport - per mile per minute	$0.000127	$0.000680	$0.000344	$0.000680	$0.000423	$0.000423	$0.000423	$0.000423	$0.002411	$0.000423
Local switching per minute	$0.010262	$0.045140	$0.034341	$0.026678	$0.035200	$0.030000	$0.030000	$0.030000	$0.035200	$0.000290
Composite originating per minute	$0.018740	$0.059540	$0.042683	$0.038596	$0.055576	$0.043140	$0.043140	$0.043140	$0.050500	$0.017840
Composite terminating per minute	$0.018740	$0.095940	$0.060883	$0.070613	$0.091976	$0.081700	$0.081700	$0.081700	$0.086900	$0.054240
Total originating and terminating per minute	$0.037480	$0.155480	$0.103566	$0.109209	$0.147552	$0.124840	$0.124840	$0.124840	$0.137400	$0.072081

Assumes 10 miles of local transport, except 61 miles for Verizon, 5.32 miles of local transport for Franklin and 12 miles for Shoreham. Does not include non-usage sensitive elements or tandem switching. Also assumes measured Verizon host-remote local termination only.

Figure 3.7:
Incumbent telephone company intrastate access charges



D. Telecommunications and Cable Company Statistics

TELEPHONE ACCESS LINES

Table 3.21 displays the number of telephone access lines among incumbent companies. Verizon has the largest share of lines by far, as it has historically. It also has the greatest diversity of residential, business, payphone, and special access lines.

The number of Competitive Local Exchange Carrier (CLEC) lines in Vermont is relatively small. The FCC, which collects data on the number of access lines by competitive and incumbent local exchange carriers every six months, does not report competitor statistics for Vermont because of the very small number of competitors reporting. (Companies with fewer than 10,000 lines in a state are not required to report.)

TELEPHONE CONSUMER COMPLAINTS

The PSD's Consumer Affairs and Public Information Division receives and resolves consumer complaints about companies and services under the jurisdiction of the PSB. Complaints about various forms of telephone service represent the largest number of complaints the PSD receives. Table 3.22 shows complaint numbers for telephone companies over the years 2000-2003. Complaints about long distance services made up more than half of the complaints about telephone

Table 3.21:
2003 incumbent telephone company access lines

	Business	Public (Includes Semi-Public Pay Telephones)	Residential	Special Access Lines (non-switched)	*Local Private Lines	Total
Franklin Telephone	38	1	841	-	-	880
Ludlow Telephone	1,198	-	4,231	-	-	5,429
Northfield Telephone	629	-	2,494	-	-	3,123
Northland Telephone	357	-	5,868	-	-	6,225
Perkinsville Telephone	108	-	861	-	-	969
Shoreham Telephone	363	-	3,342	8	-	3,713
Topsham Telephone	108	-	1,522	-	-	1,630
Verizon Vermont	106,394	2,210	230,238	132,955	26,487	498,284
Vermont Telephone	4,502	-	16,717	308	-	21,527
Waitsfield/Fayston	3,614	-	17,422	335	-	21,371
Total	117,311	2,211	283,536	133,606	26,487	563,151

Source: annual reports 2003

*Local Private Lines - defined in the FCC account as a special services circuit with either a serial number or telephone number format.

Table 3.22:
Telephone consumer complaints 2000-2003

	2001 total access lines	2003	2002	2001	2000
Incumbent Local Exchange Companies					
Fairpoint-Northland Telephone	6,286	5	3	12	15
Franklin Telephone	863	-			
Ludlow-TDS Telecom	5,749	2			3
Northfield-TDS Telecom	3,874	2	1	2	1
Perkinsville-TDS Telecom	989	-			
Shoreham Telephone	3,824	2			1
Topsham Telephone	1,548	-		1	1
Verizon	449,470	269	247	280	274
Vermont Telephone	21,818	14	8	6	12
Waitsfield/Champlain Valley Tel.	21,604	4	2	7	9
*Competitive Local Exchange Companies**					
CTC	na	2	3		1
Excel	na	6			
Lightship	na	2	2	5	3
MCI	na	15			
NUI	na	1			
OneStar	na	8	8	4	
Sovernet	na	2			
Telcove	na	7	1	5	
Z-Tel	na	2	1		
*Toll Companies with 5 or more complaints**					
America's Digital Satellite Telephone	na	7	8		
America's Telenetwork	na			5	
AT&T	na	155	108	280	273
Broadwing	na		6		
Business Options	na		18		
Excel	na		4	18	19
IDT	na		6		
MCI	na	95	129	111	145
OneStar	na	7	6		
Optical Telecom	na	5	9		
Qwest	na		10	31	24
Sprint	na	24	16	19	13
Talk.Com	na		3	9	
Universal Broadband Communications	na	7	25		
Vartec	na		3		6
World Comm. Satellite Systems	na	6	46		
Other	na		35	46	59

*Customer base information is not available for competitive local exchange companies and toll companies

service. In these statistics, "complaint" means consumer contact with the PSD in which the consumer was dissatisfied with the action taken by the company prior to his or her contact with the PSD, and, following investigation, the PSD concluded that there is something the utility reasonably could or should have done to resolve the complaint prior to the consumer having to contact the PSD. These are the complaints categorized by the PSD as "escalations" or "interventions."

CABLE SUBSCRIBERS

There are almost 140,000 cable connections in Vermont. Table 3.23 breaks down subscribership by company. Most cable subscribers in Vermont are customers of Adelphia Cable, which has networks in most regions of the state. Charter Communications is a distant second in cable subscribers in Vermont, although, like Adelphia, it is one of the largest cable companies nationwide. The remaining Vermont cable systems are very small systems with local ownership.

Table 3.23:
Cable subscribers

Company	Year 2001 subscribers	Year 2003 subscribers
Adelphia Cable	112,535	114,649
Charter Communications (formerly Helicon Cable)	12,390	12,624
Waitsfield-Fayston Cable	3,700	3,677
Gateway Cablevision	1,887	
*Duncan Cable TV	1,054	2,412
Trans-Video, Inc	1,419	1,562
Southern Vermont Cable	1,396	1,409
North Country Cablevision	1,028	1,112
Stowe Cablevision	934	939
Smugglers Notch CATV	500	547
Jeffersonville Cable TV	335	303
White Mountain	295	250
North Valley Cable Systems	138	138
Opticable	120	90
Olsen's TV & Radio Repair	40	40
Total Cable Connections	137,771	139,752

* Duncan bought Gateway 9/03

Souce: Annual Reports

(Endnotes)

[1] BusinessWeek. "The E-Biz Surprise." May 12, 2003, p.68.

[2] Comments of Vermont PSB re: FCC 03-249, CC Docket No. 96-45. January 14, 2004, p. 6.

[3] Rankings by state for other Unbundled Network Element rates are available in "A Survey of Unbundled Network Element Prices in the United States (Updated July 1, 2003)" by Billy Jack Gregg, Director of the Consumer Advocated Division of the West Virginia Public Service Commission.

[4] Horrigan, John B. *Pew Internet Project Data Memo*. Pew Internet & American Life Project. 2004, p. 5.

Public Input Process and Survey Results

A. Introduction

There are a wide variety of people and organizations that shape telecommunications policy and are impacted by it. Service providers, users, and government agencies all have vital information and ideas to contribute to the development of Vermont's telecommunications future. Statute requires the Public Service Department (PSD) to consult with a range of people and groups when developing this plan including:

- members of the public
- representatives of telephone utilities and other providers
- other interested state agencies

In addition, the PSD is obligated to conduct a survey of Vermont residents and businesses in cooperation with the Agency of Commerce and Community Development (ACCD) and to conduct public hearings on the plan. The purpose of this section is to briefly outline the steps the PSD took to fulfill these mandates, and to publish at length the results of the telephone survey of Vermont households and nonresidential telecommunications consumers.

B. Overview of the Public Input Process

The public input process for the development of the fourth edition of the *Vermont Telecommunications Plan* spanned a period of more than two years and gathered input in a variety of ways. This included a public hearing, interviews with telecommunications service providers, state agencies, and major institutional users, and a series of "sector group" meetings with various categories of telecommunications users.

The PSD held a "scoping" public hearing early on in the development process in May 2002 over the network of Vermont Interactive Television (VIT). In addition, at the request of members of the deaf community, the PSD met separately in an American Sign Language-interpreted session with representatives of the Vermont Association of the Deaf at the PSD's offices in June 2002.

The PSD, in conjunction with the Department of Economic Development, conducted eleven in-depth interviews with technical, financial, and regulatory representatives of a cross-section of telephone companies, cable companies, wireless service providers, and Internet service providers. The Departments held these interviews in December 2002 and January 2003. The companies interviewed were:

- Cable television provider North Country Cable;
- Incumbent telephone companies Verizon, Waitsfield and Champlain Valley Telecom, and Topsham Telephone;
- Competitive local telephone company Adelphia Business Solutions (now known as Telcove);
- Competitive local telephone company and Internet Service Provider SoVerNet;
- Internet service providers Powershift Online and North Country Broadband;
- Wireless telephone service providers RCC Wireless (currently known as Unicel) and U.S. Unwired (doing business as Sprint PCS).

These interviews, which lasted half a day each, covered a variety of public policy, business financing, and technology development topics. Some of the findings contributed to a study report the PSD and the Department of Economic Development prepared pursuant to Act 144 of the 2002 legislative session. The Departments published this report, the "High-Speed Telecommunications Financing Study," in February 2003.

To help fulfill its statutory charge to plan for the needs of state government as a user of telecommunications, the PSD also briefly interviewed representatives of a range of state government users. These interviews focused on how various agencies were using telecommunications, as well as upcoming challenges and opportunities. The PSD also expanded the range of these interviews and spoke with representatives of important public institutions. These interviews took place over the period March 2002 through January 2003, and in some instances prompted subsequent follow-up meetings. Agencies, departments, and institutions interviewed included:

- the Office of the Chief Information Officer
- the Department of Public Safety
- the Department of Education
- the Department of Health
- the Agency of Human Services
- the Agency of Transportation
- the Department of Libraries
- the Department of Employment and Training
- the Agency of Commerce and Community Development
- the Department of Buildings and General Services
- the Department of Personnel
- the Enhanced 9-1-1 Board
- the Vermont State Colleges
- the University of Vermont
- Norwich University
- Fletcher Allen Health Care
- Vermont Interactive Television

- The Vermont Institutes.

The PSD also sought to get input from a wide range of telecommunications users in an informal setting. To do this, the PSD conducted a series of "sector group" meetings. Each group consisted of about eight to twelve individuals from a variety of technical and non-technical backgrounds. These sessions each lasted for the greater part of a day. The groups were:

- Business and Economic Development
- Health Care
- Higher Education and Training
- K12 Education
- Government

The Windham Regional Commission also co-sponsored with the PSD a cross-sector "regional group" meeting with participants drawn from around the south-eastern Vermont area. All of these meetings worked as brainstorming sessions that allowed the PSD to hear participants discuss ideas and concerns in a semi-formal manner.

In March 2004, the PSD issued a "Public Comment Draft" and conducted a series of four public hearings in April. One hearing was held over VIT, and three were held in person in Burlington, Rutland, and Bennington. The PSD also received written comments from a variety of service providers, local and regional officials, state agencies, and private citizens. In June 2004, the PSD issued a "Final Draft" of the plan and opened a final round of public hearings and written comments. An additional public hearing held over VIT and a final public hearing, conducted jointly with the Vermont House Commerce Committee and the Vermont Senate Finance Committee, were conducted in July 2004.

C. Telephone Surveys

Although public hearings and small-group interviews are useful for collecting input in depth from a range of consumers and service providers, collecting information about the use, attitudes and opinions of a very broad spectrum of telecommunications users requires a different tool. A major work product in the development of the *Vermont Telecommunications Plan* is a statistically valid, scientifically sampled telephone survey of Vermont residential and nonresidential consumers. This survey (which consisted of two separate samples and two separate but related questionnaires) was conducted on the PSD's behalf in November 2003. It asked both factual questions about Vermonters' use of telecommunications services and questions about Vermonters attitudes and opinions on a handful of telecommunications-related issues. The PSD conducted similar residential surveys in 1988, 1995, and 1999, and a similar nonresidential survey at the end of 1999/beginning of 2000. The results of the residential and nonresidential surveys follow below, along with accompanying commentary.

OVERVIEW

The nonresidential survey targeted both businesses and other nonresidential organizations that would have business telephone lines. The residential telephone survey reached people at home, but asked not only about Vermonters' home usage, but also a variety of questions about their telecommunications use outside the home, plus views on telecommunications issues. The surveys included the following areas for investigation:

- Telephone lines;
- The local telephone service market
- Views on local calling area;
- Telephone company service quality expectations;
- Wireless and cellular service;
- The Internet;
- Telecommuting; and
- Demographics.

The residential survey covered the following additional topics:

- Residents' likes and dislikes regarding their local phone service;
- Household phone line market demands;
- Payphone market demands;
- Cable and satellite (dish) television; and
- Public access television.

Interpretation of Tables and Figures

It is important to note that many of the wordings of the variable labels and value labels in the data tables and charts are largely abbreviated descriptions of the questionnaire items and available response categories. Responses deemed not appropriate for classification have been grouped together under the "Other" code. In addition, the "Don't Know" or "Refused" category includes those respondents who did not know their answer to a question or declined to answer it.

The last column of data in some tables is marked "cumulative." This column is simply a sum of all previous categories of response and the current category of response. Its primary usefulness is to gauge some ordered or ranked meaning.

CHARACTERISTICS OF NONRESIDENTIAL RESPONDENTS

The businesses and organizations interviewed were, not surprisingly, small. Large majorities had only one location, located in Vermont, and served people or organizations largely in Vermont. Researchers asked respondents for the amount of telephone lines their organizations had for voice and fax communications. Table 4.1 depicts the results—most organizations had five or fewer lines. In addition, most organizations spent less than $500/month on telecommunica-

Table 4.1:
Nonresidential number of lines for voice and fax

Number	Percent
1-5	83.8
6-10	8.2
11-15	3.5
16 - 20	1.6
21 - 25	0.8
More than 25	1.9

Residential and Non-Residential Survey Methodology

Using a quantitative research design, RKM Research and Communications, completed 401 interviews among Vermont non-residential organizations and 401 interviews among Vermont households. All non-residential telephone interviews were conducted between October 30 and November 11, 2003. All residential telephone interviews were conducted between November 2 and November 16, 2003. Paid, trained and professionally supervised interviewers conducted all interviews.

The PSD provided a fully representative, probabilistic sample of non-residential organizations in Vermont. The population universe for the non-residential survey theoretically includes every non-residential landline telephone number in Vermont. The residential household sample was purchased from Genesys Sampling Systems, utilizing a random digit dial (RDD) MOD1 sample methodology and ID-PLUS process. This sampling methodology provides a pure, simple random probabilistic sample, while identifying non-productive numbers to reduce the cost by increasing productivity.

One survey instrument was used to elicit information from all Vermont non-residential organizations, and one from all residential organizations. In the residential survey, respondents qualified for the survey if they confirmed they were at least eighteen years of age, and were the person who knew "the most about the telephone and Internet services" that their household used. The sample unit for the non-residential study is a non-residential organization in Vermont, which could include a variety of businesses, governmental agencies, non-profits, schools, colleges, universities and other non-residential organizations. The key to eligibility is a landline that is linked to a non-residential establishment in Vermont. Respondents qualified for the survey if they confirmed they were a non-residential organization, and if they were the person most knowledgeable about their organization's telecommunication needs in Vermont.

Data analysis was performed by the Center for Research and Public Policy (CRPP). Facets of the study completed by CRPP's senior staff included: data validation, logic checks, computer analysis, analysis, report writing, and crosstabulations.

Completion rates are a critical aspect of any telephone research survey. Because one group of people might be easier to reach than another group, it is important that concentrated efforts are made to reach all groups to an equal degree. A high completion rate means that a high percentage of the customers within the original sample were actually contacted, and the resulting sample is not biased toward one potential audience. A high completion rate many times indicates an interest in the topic. RKM Research and Communications achieved a response rate of 63.6% for the non-residential survey and 63.5% for the residential survey. Statistically, a sample of 401 surveys represents a margin for error of +/-4.9% at a 95% confidence level. In theory, this sample of Vermont non-residential organizations will differ no more than +/-4.9% if all Vermont non-residential organizations were contacted and included in the survey. That is, if random probability sampling procedures were reiterated over and over again, sample results may be expected to approximate the large population values within plus or minus +/4.9% -- 95 out of 100 times.

Readers of this report should note that any survey is analogous to a snapshot in time and results are only reflective of the time period in which the survey was undertaken. Should a concerted public information or relations campaign be undertaken during or shortly after the fielding of the survey, the results contained herein may be expected to change and should be, therefore, carefully interpreted and extrapolated. Furthermore, it is important to note that all surveys contain some component of "sampling error." Utilizing strict random probability procedures has significantly reduced error that is attributable to systematic bias. This sample was strictly random in that selection of each potential respondent was an independent event, based on known probabilities. Each qualified non-residential organization in Vermont had an equal chance for participating in the study. Statistical random error, however, can never be eliminated but may be significantly reduced by increasing sample size.

tions service, as shown in Table 4.5. A large proportion of respondents reported that their organization was based out of a residence. Because the sample drew heavily on small businesses and organizations, the survey results should not be seen as representative of major employers.

Respondents were asked in an open-ended question, "Are there changes in Vermont policies affecting telecommunications that you would like to see?" Table 4.7 shows the results, categorized into groups after the survey was

Table 4.2:
Nonresidential number of locations in Vermont

Locations	Percent
1	87.0
2	8.2
3	2.0
4	1.0
5	0.5
7	0.2
10	0.2
11	0.2
30	0.2
35	0.2

Table 4.3:
Is the organization's primary location in Vermont?

	Percent
Yes	98.0
No	2.0

Table 4.4:
Location of people organization serves

Location	Percent
Mostly in VT	61.8
Mostly outside VT	13.5
Equal in & out	24.7

Table 4.5:
Nonresidential amount spent per month on telecommunications

Amount spent	Percent
Less than $100	20.7
$100 to less than $500	42.4
$500 to less than $1000	10.5
$1000 to less than $1500	3.5
$1500 to less than $2000	1.0
$2000 to less than $2500	1.2
$2500 to less than $3000	0.2
$3000 to less than $4000	1.0
$4000 or more	11.7

Table 4.6:
Is the company's primary location in a residence in Vermont?

	Percent
Yes	41.9
No	58.1

Table 4.7:
Changes in Vermont polices affecting telecommunications you would like to see--nonresidential

	Percent
Better wireless service	17.2
Lower costs/prices/fees/taxes	9.2
Better broadband service	4.7
More competition or choice	2.5

completed. While a majority of respondents did not supply a specific suggestion, among those that did, getting wireless coverage was the most commonly mentioned issue (17.2% of respondents). More than a third of those respondents saying that there should be a change in policy in favor of better wireless service (6.5% of all respondents) specifically mentioned building more towers in their response. (One and a half percent of all respondents stated a preference for limiting tower numbers or visual impact.) Requests for lower costs or prices in a variety of forms—lower rates, fewer taxes, bigger calling areas, etc.—were the second most common type of policy change suggested. Policies for better broadband service and more competition or choice were the next most commonly stated. A very small number of respondents mentioned a variety of other issues, including restrictions on spam, telemarketing problems, and cable issues.

CHARACTERISTICS OF RESIDENTIAL RESPONDENTS

In the nonresidential survey, researchers asked respondents to identify their age, education level, sex. and household income. The results for these questions are found in Tables 4.8, 4.9, 4.10, and 4.11.

Table 4.8:
Residential respondents' age

Age	Percent
18 to 25	5.2
26 to 35	16.0
36 to 45	17.0
46 to 55	11.4
55 to 65	19.2
66 and over	18.7

Table 4.8:
Residential respondents' education

Education	Percent
Grades 1st to 8th	1.5
Grades 9th to 11th	3.2
High school graduate	30.7
Some college	23.4
College graduate	25.2
Graduate degree	15.5
Refused	0.5

Table 4.10:
Residential respondents' gender

Gender	Percent
Male	39.9
Female	60.1

Table 4.11:
Residential respondents' income

Income	Percent
Less than $10,000	1.7
$10,000 to less than $15,000	4.5
$15,000 to less than $20,000	5.0
$20,000 to less than $25,000	7.2
$25,000 to less than $35,000	15.2
$35,000 to less than $50,000	18.0
$50,000 to les than $75,000	21.2
$75,000 or more	13.2
No answer	5.7
Refused	8.2

THE LOCAL TELEPHONE SERVICE MARKET

Researchers asked respondents for the name of the company that provided their households with local telephone service and nonresidential organizations with the largest number of lines for voice and fax communication to their organization. Verizon is still clearly the largest telephone service provider in the state by far, although competitors have begun to take away retail customers. Just under three quarters (72.1%) of nonresidential respondents reported having Verizon as the company with the largest number of telephone lines. Table 4.12 summarizes the rest of the nonresidential results. Three quarters (75.6%) of households reported having Verizon as the company handling their local telephone services. Table 4.13 summarizes the residential results as collected.

Table 4.12:
Telephone companies serving the nonresidential market

What company provides the largest number of telephone lines?	Percent
Verizon	72.1
VTel	4.5
Waitsfeld and Champlain Valley Telecom	4.2
SoVerNet	3.0
Lightship	3.0
Fairpoint	2.4
TDS	2.0
MCI	1.2
AT & T	1.2
Telcove	1.0
Topsham	0.5
Shoreham	0.2
Franklin	0.2
CTC	0.2
Other	3.0
Refused	1.0

Table 4.13:
Telephone companies serving the residential market

What company provides your local telephone service?	Percent
Verizon	75.6
VTel	5.7
MCI	5.0
Waitsfield Champlain Valley Telecom	5.0
TDS	2.2
AT & T	1.7
Shoreham	1.5
Fairpoint	0.5
SoVerNet	0.2
Topsham	0.2
Other	1.2
Don't Know	1.0

Figure 4.1:
Organizations with contracts to purchase voice & fax service for a period of time

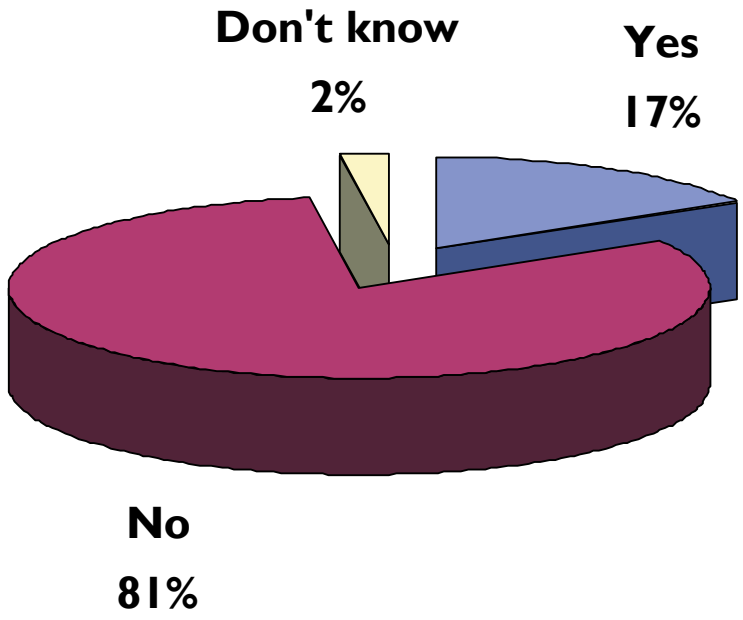


Figure 4.2:
Households expecting to add or drop a phone line in the next 6 months

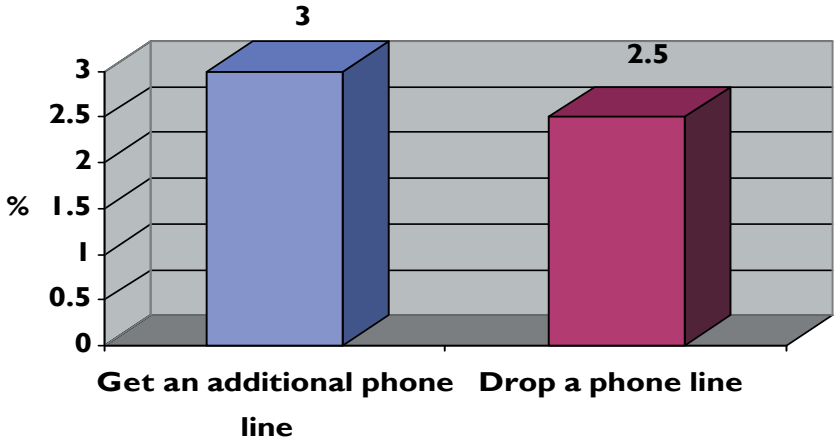


Table 4.14:
Households planning to add a line in next six months

Percent saying "yes"		
1995	*1999*	*2003*
2	9	3

Table 4.15:
Number of residential lines

Number of different phone numbers	Percent
1	90.8
2	8.0
3	1.2

Table 4.16:
Households with multiple lines 1999 and 2003

Percent reporting two or more telephone numbers	
1999	*2003*
21	9

Table 4.17:
Residential fax or computer lines

Number of additional phone lines connected to fax or computer	Percent
None	62.2
1 fax/modem line	35.1
2 fax/modem lines	2.7

Table 4.18:
Things liked most about local telephone service--residential

	Percent
Reliability	26.4
No answer	17.5
Good customer service	13.2
Good plans/calling plans	9.5
Low cost	9.5
Convenient/local	9.2
Nothing	14.7

Long-term contracts are a tool that companies use to reduce "churn," or the rate at which current customers leave the company's service. Contracts for telephone service are more common for businesses than residents, and the nonresidential survey asked a question to determine how common. Less than one fifth of all nonresidential respondents (16.5%) suggested having a contract to purchase voice and fax telephone service for a period of time. A large majority (81.3%) did not.

Table 4:19
Things liked least about local telephone service--residential

	Percent
High cost	27.4
No answer	26.2
Poor plans/calling plans	9.7
Poor customer service	5.5
No other choice	3.0
Not reliable	2.7
Nothing	25.4

Reports in the media indicate that the growth in telephone lines as leveled off its historical upward path. The residential survey asked questions about additional lines. While only a few respondents (3.0%) expect to have an additional phone line installed in the next six months, a large majority (96.3%) does not. And, three respondents (0.7%) did not know or were unsure. Further, only 2.5% expect to be dropping a phone line installed at their residence, while a large majority (96.8%) does not. The level of interest in second lines has changed significantly since the 1999 survey. Tables 4.14 and 4.16 show that not only have the number of households with multiple telephone numbers dropped by more than half, but the level of interest in obtaining additional lines in the near future has returned in 2003 to a level comparable to that of 1995 after a spike in 1999. Quite possibly 1999 represents a point near the peak of demand for second lines for use with dial-up access to the Internet.

In an open ended-format question, researchers also asked respondents what they liked most about their local telephone service. Table 4.18 summarizes the results. Further, respondents were asked what they liked least about their local telephone service. Table 4.19 summarizes the results.

LOCAL CALLING AREAS

Vermont last expanded the size of its local calling areas in the late 1990s. With long distance prices having fallen and a range of companies—wireless companies, local telephone companies, and VoIP telephone providers—offering plans with large or unlimited "buckets" of long distance minutes at no additional charge, the surveys asked Vermonter how they felt about their local calling areas.

Just over three quarters of residents interviewed (76.1%) suggested being satisfied with the size of their local calling area, while one fifth (20.9%) indicated not being satisfied. A few (3.0%) noted not knowing, or being unsure. (See Figure 4.3.) This figure is essentially unchanged from the PSD's survey in 1999. More than three quarters of residential respondents (76.1%) reported being very (54.4%) or somewhat (21.7%) interested in having the whole state as their local calling area, while 24.0% noted being not very interested (12.0%), or not interested at all (12.0%). In the nonresidential survey, just over two thirds of respondents (67.3%) reported being very (50.1%) or somewhat (17.2%) interested in

Figure 4.3:
Residential users satisfied with local calling area

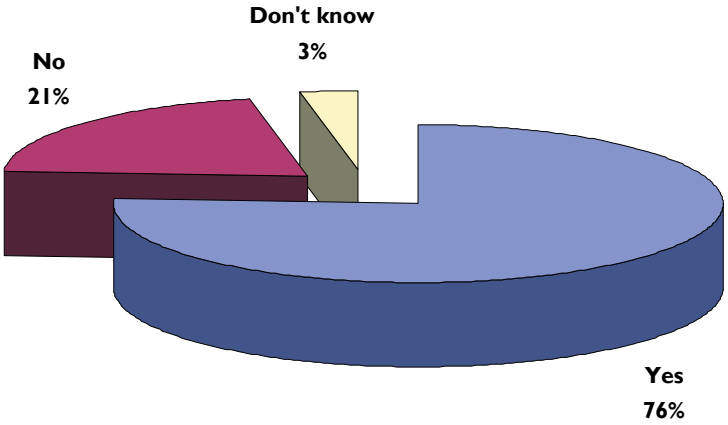


Figure 4.4:
Residential users interested in having the whole state as local calling area

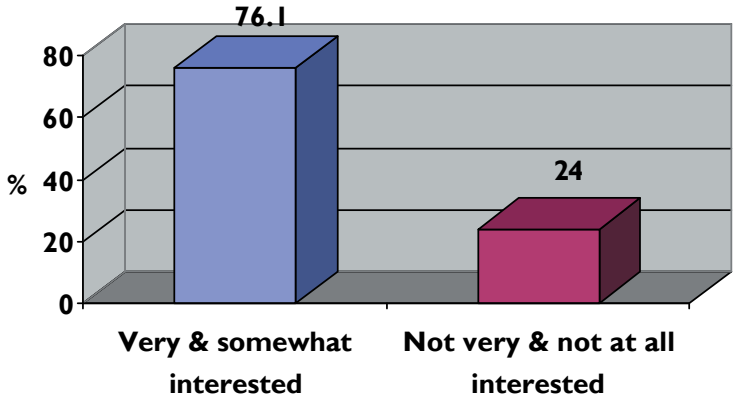


Figure 4.5:
Nonresidential interest in having the whole state as local calling area

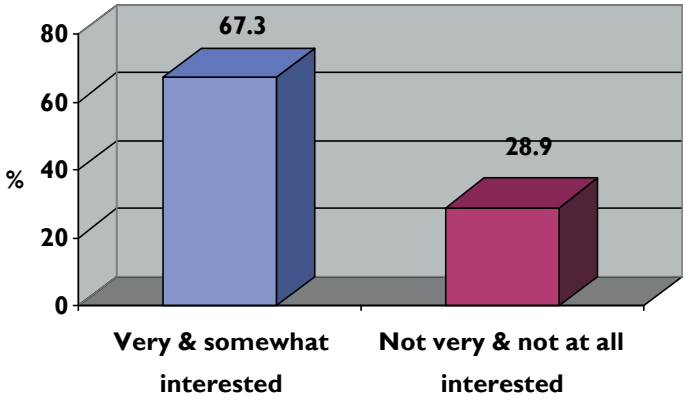


Table 4.20:

Residential willingness to pay to have whole state as local calling area

Among those saying they would pay more

Amount more per month per line willing to pay	Percent	Cumulative
$9	18.3	18.3
$6	2.3	20.6
$5	22.3	42.9
$4	5.1	48.0
$3	4.6	52.6
$2	9.7	62.3
$1	10.3	72.6
$0.50	8.6	81.2
Nothing	5.1	
Don't Know	13.7	

Table 4.21:

Non-residential willingness to pay to have whole state as local calling area

Among those saying they would pay more

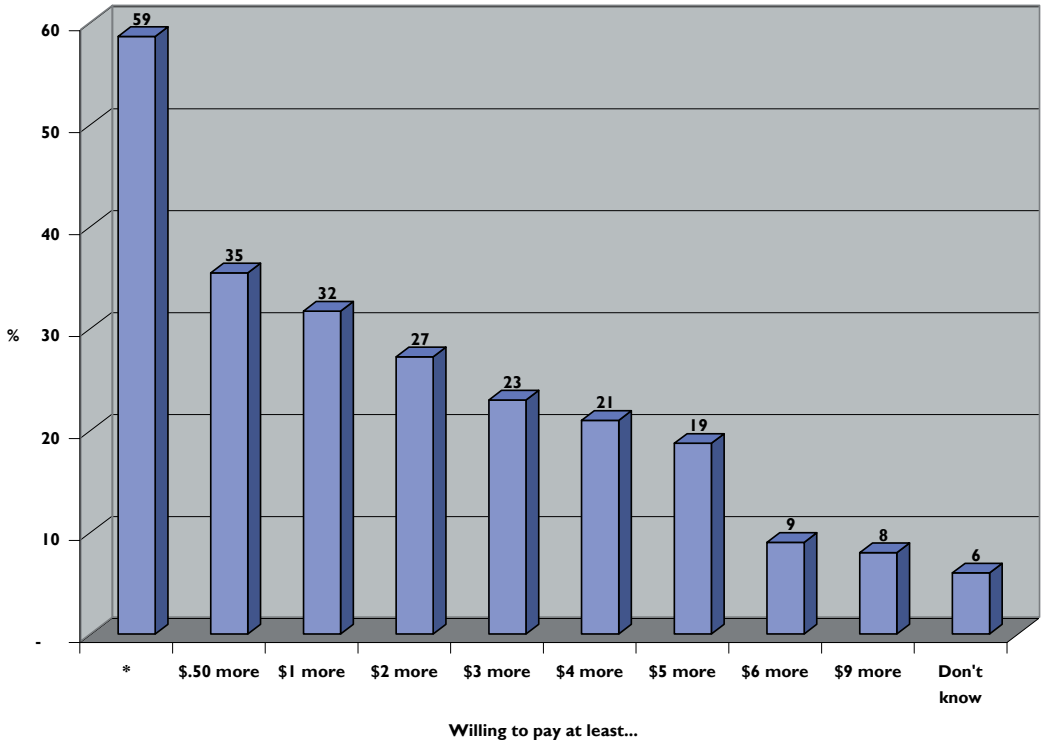
Amount more per month per line willing to pay	Percent	Cumulative
$9	23.2	23.2
$6	10.5	33.7
$5	13.8	47.5
$4	5.5	53.0
$3	2.8	55.8
$2	5.0	60.8
$1	4.4	65.2
$.50	5.0	70.2
Nothing	6.1	
Don't know	23.2	
Refused	0.6	

having the whole state as their local calling area. More than a quarter (28.9%) noted being not very interested (7.0%), or not interested at all (21.9%).

Almost one half (47.9%) of residents interested in having the whole state as their local calling area, said they would be willing to pay more to have it happen. Just over two fifths (42.6%) would not. 9.5% suggested not knowing or being unsure. One half (49.8%) of nonresidential respondents interested in having the whole state as the local calling area would be willing to pay more to have this happen. Just over one third (36.5%) would not, and 13.7% suggested not knowing or

Figure 4.6:

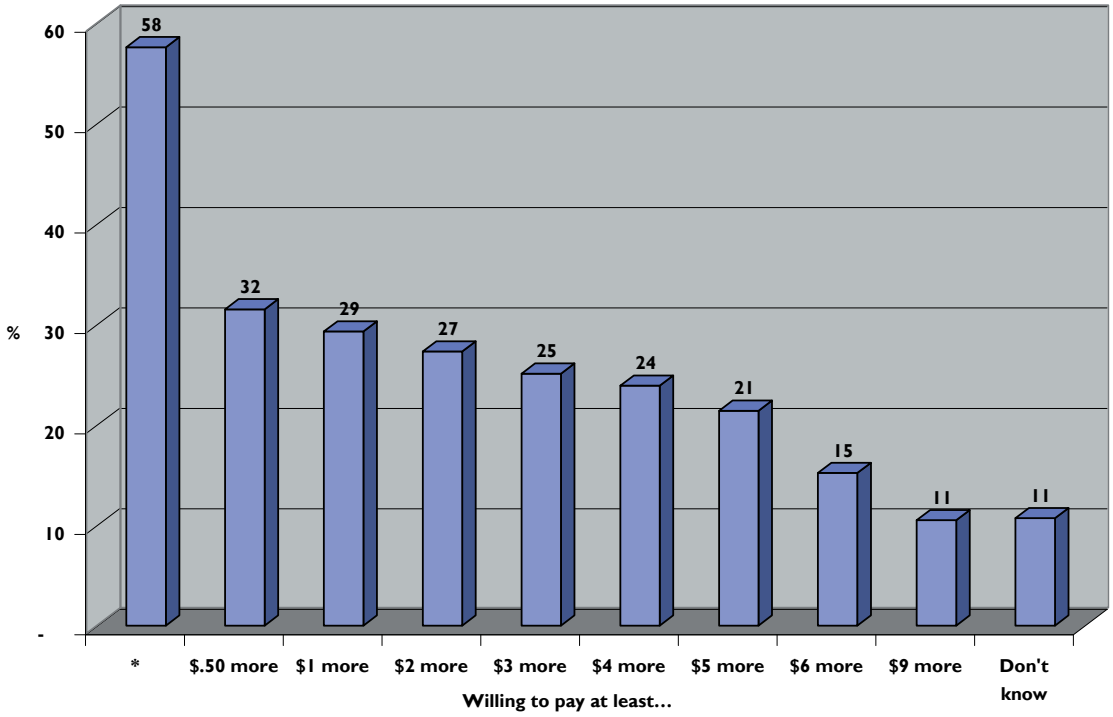
Residential users willing to pay more to have whole state as local calling area



*Not interested, not very interested, or interested but not willing to pay extra

Figure 4.7:

Non-residential users willing to pay more to have whole state as local calling area



*Not interested, not very interested, or interested but not willing to pay extra

being unsure. Researchers asked those respondents willing to pay more how much more per month, per line, they would be willing to pay to have the whole state as their local calling area. Table 4.21 summarizes the nonresidential results and Table 4.20 summarizes the residential results as collected. Figures 4.6 and 4.7 aggregate the responses for all those interviewed, both those who were interested in having the state as their local calling area and those who were not. These tables suggest that solid majorities of Vermonters on both the residential and non-residential sides do not have a great interest in the whole state as their local calling area if it will raise their local rate, although a minority were willing to pay significantly more.

TELEPHONE SERVICE QUALITY EXPECTATIONS

Researchers presented respondents with the following question: "If you need to speak to a telephone company representative, how long are you willing to wait on the telephone to speak to someone, before you think the delay is unacceptable?" Table 4.22 summarizes the residential results, and Table 4.23 summarizes the nonresidential results

Respondents were presented with the following question: "If you report a telephone line in need of repair, how long are you willing to wait to have it repaired, before you think the delay is unacceptable?" Table 4.24 shows the results for this question from the residential survey and Table 4.25 depicts results from the nonresidential survey.

All residents interviewed were presented with the following question: "If you request a new or additional line, how long would the telephone company need to take to install the line, before you thought that the delay was unacceptable?" (See Table 4.26.) All nonresidential respondents were presented the following question: "Suppose that your organization needs an additional line installed as soon as possible. After you call to request the line, how long would the telephone company need to take to install the line, before you thought that the delay was unacceptable?" (See Table 4.27.)

Table 4.22:
Residential call answering expectations

Minutes willing to wait on the phone to speak to a representative	Percent	Cumulative
More than 30 minutes	0.2	0.2
25.1 to 30 minutes	0.2	0.4
20.1 to 25 minutes	0.2	0.6
15.1 to 20 minutes	0.5	1.1
10.1 to 15 minutes	2.0	3.1
5.1 to 10 minutes	8.3	11.4
1.1 to 5 minutes	63.8	75.2
Up to 1 minute	19.5	94.7
Don't Know	5.0	
Refused	0.5	

Table 4.23:
Nonresidential call answering expectations

Minutes willing to wait on the phone to speak to a representative	Percent	Cumulative
More than 10 minutes	0.3	0.3
5.1 to 10 minutes	3.2	3.5
2 to 5 minutes	65.4	68.9
Up to 1 minute	27.9	96.8
Don't know	3.2	

Table 4.24:
Residential repair expectations

How many hours willing to wait for phone repairs	Percent	Cumulative
1 Week	1.5	1.5
4 Days	0.2	1.7
3 Days	4.0	5.7
2 Days	12.2	17.9
1 Day	45.4	63.3
15.1 to 23 hours	0.2	63.5
10.1 to 15 hours	4.8	68.3
5.1 to 10 hours	2.2	70.5
1.1 to 5 hours	10.7	81.2
Up to 1 hour	10.0	91.2
Don't Know	8.5	
Refused	0.2	

Table 4.25:
Nonresidential repair expectations

How many hours willing to wait for phone repairs?	Percent	Cumulative
24 Days	0.2	0.2
7 Days	0.2	0.4
3 Days	2.0	2.4
2 Days	6.2	8.6
1 Day	46.1	54.7
15.1 to 23 hours	0.4	55.1
10.1 to 15 hours	4.5	59.6
5.1 to 10 hours	4.5	64.1
1.1 to 5 hours	20.4	84.5
Up to 1 hour	12.5	97.0
Don't Know	2.7	

Table 4.26:
Residential installation expectations

Days willing to wait for installation	Percent	Cumulative
6 months	0.2	0.2
5 months	0.2	0.4
2 months	0.2	0.6
1 month	0.2	0.8
2 weeks	6.2	7.0
1 week	28.4	35.4
6 days	0.2	35.6
5 days	3.2	38.8
4 days	3.2	42.0
3 days	10.0	52.0
2 days	15.2	67.2
1 day	11.4	78.6
Less than a day	5.7	84.3
Don't Know	12.7	
Refused	2.5	

Table 4.27:
Nonresidential installation expectations

Days willing to wait for installation	Percent	Cumulative
30 days	0.2	0.2
28 days	0.7	0.9
21 days	0.2	1.1
14 days	6.0	7.1
10 days	1.0	8.1
7 days	27.4	35.5
6 days	0.2	35.7
5 days	5.0	40.7
4 days	3.5	44.2
3 days	14.2	58.4
2 days	17.5	75.9
1 day	7.0	82.9
Less than a day	8.7	91.6
Don’t know	8.0	
Refused	0.2	

WIRELESS SERVICE

Wireless subscription rates have grown in Vermont over the past several years, as they have elsewhere in the U.S. and the world. Just over two fifths (44.1%) of nonresidential respondents reported that their organizations are currently subscribed to a wireless phone service, while more than half (55.9%) are not. Wireless phones are also not reserved for business use in Vermont. Household subscribership levels were about the same as nonresidential subscribership levels. Almost half of all residents interviewed (45.6%) reported someone in their household subscribing to a wireless telephone service. Of this group, a majority (85.2%) indicated personally using a wireless telephone, while 14.8% do not. The percentage of households that are subscribed to wireless telephone service has grown over time and soon a majority of households are likely to have at least one wireless phone. Table 4.28 shows how wireless subscribership has grown since 1995, increasing about four percentage points every year on average. Not surprisingly, wireless subscribership is linked to income. While a majority (51.0%) of households with incomes between $35,000 and $75,000 and a large majority (71.7%) of households with incomes above $75,000 subscribed to wireless, only 32.6% of households with incomes below $35,000 subscribe to wireless service.

Respondents whose households did not subscribe to a wireless service (54.1%) were asked a couple of questions regarding wireless telephone service. When asked to provide the reasons their households did not subscribe to wireless telephone service, more than a half (52.8%) noted not needing it, while 20.2% indicated the service was too expensive. Other reasons included either not wanting one (12.4%) or that coverage/reception

Figure 4.8:
Vermont organizations subscribed to a wireless service

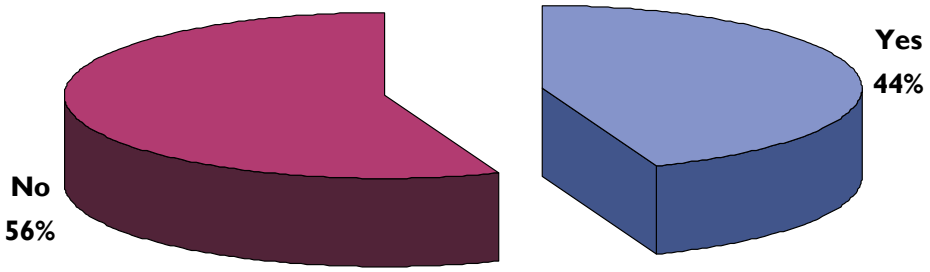


Figure 4.9:
Residential wireless adoption

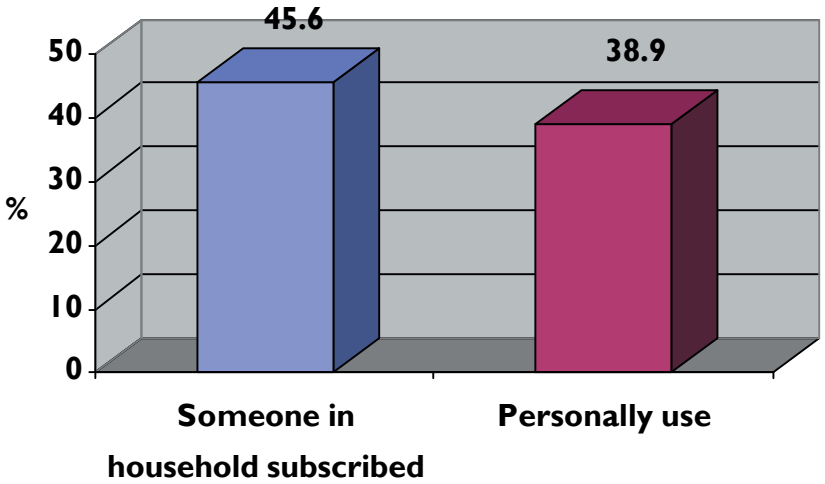


Table 4.28:
Percentage of households subscribing to wireless service 1995-2003

1995	1999	2003
11	27	46

was bad (11.9%). Almost one fifth of residential respondents in a household without a wireless phone (18.3%) suggested being very (5.5%) or somewhat (12.8%) likely to acquire a wireless phone in the next year. More than three quarters (79.3%) indicated being somewhat unlikely (17.4%) or not at all likely (61.9%) to acquire a wireless phone in the next year. A few respondents (2.3%) did not know or were unsure.

Unicel and Verizon remain the wireless companies with the largest blocks of Vermont customers. Respondents having someone in their household who use wireless telephone (45.6%), were asked to name their household's wireless service provider. Respondents whose organizations were subscribed to a wireless service (44.1%) were also asked to name their current wireless service provider. Table 4.29 holds all results as collected.

Few wireless users in Vermont have a good impression about the extent of wireless coverage in Vermont. Respondents with someone in their household using a wireless phone were presented with the following statement: "An area in Vermont is said to have wireless phone coverage if you can make and receive wireless calls in that area. Some areas in Vermont have wireless

Figure 4.10:
Why does your household not subscribe to wireless service?

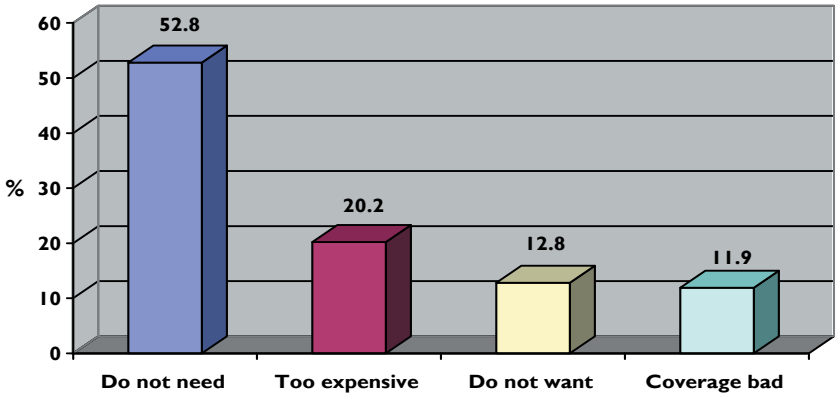


Table 4.29:
What company is your current wireless provider?

	Percent nonresidential	Percent residential
Unicel	49.2	41.0
Verizon	38.4	31.7
US Cellular	2.8	5.5
Nextel	2.8	2.2
AT&T	2.3	2.2
Sprint PCS	0.6	3.3
Trac Phone	--	3.3
Don't Know	2.8	8.2
Other	0.6	1.6
Refused	0.6	1.1

Table 4.30:
Impressions about wireless coverage

	Nonresidential Percent	Residential percent
Excellent	4.0	0.0
Good	18.6	24.0
Fair	40.7	35.5
Poor	35.0	34.4
Don't Know	1.7	6.0

Figure 4.11:
Residents agreeing wireless phones should be as reliable as regular phones

Among households with a wireless user

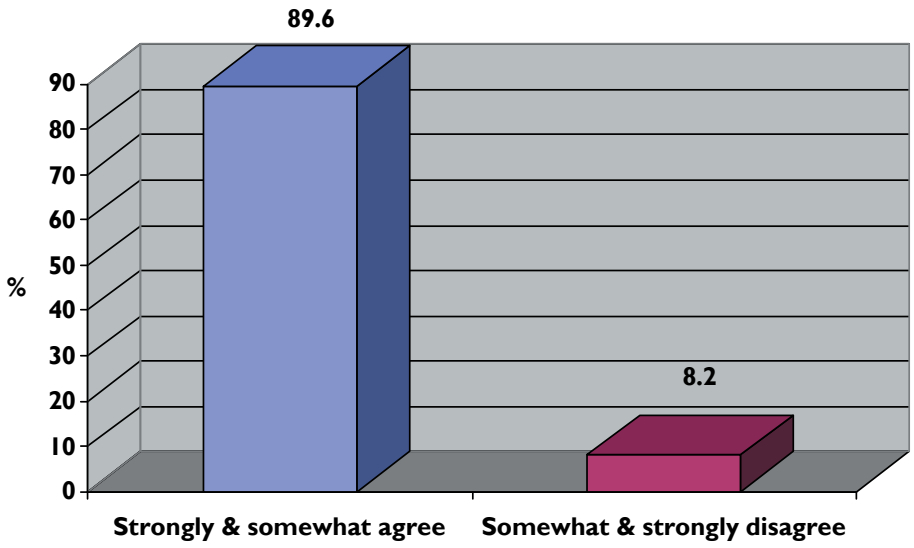
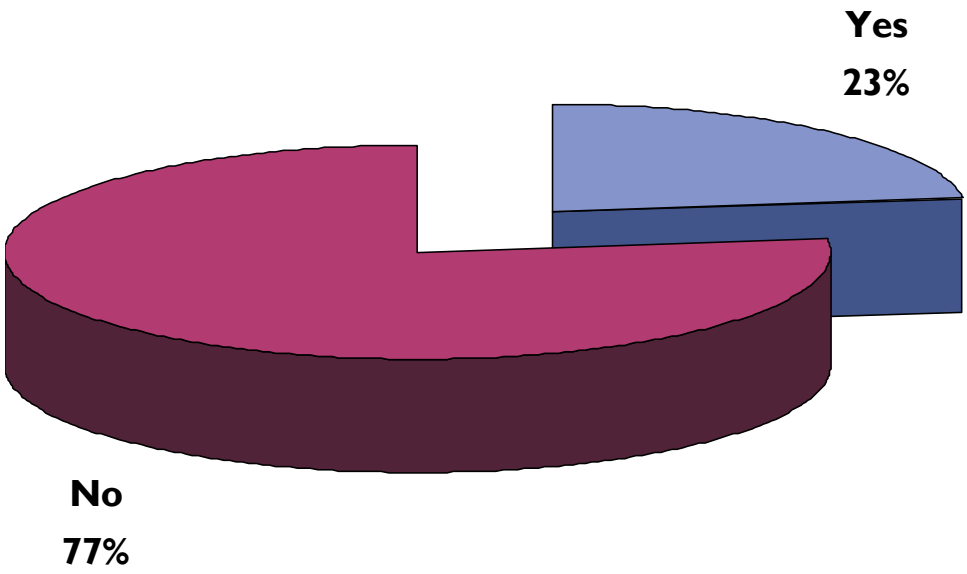


Figure 4.12:
Considered discontinuing regular phone service to use only wireless

Among households with a wireless user



phone coverage and other areas do not." Only one quarter (24.0%) rated the extent of wireless coverage in Vermont as good (24.0%), while almost three quarters (69.9%) gave it a rating of fair (35.5%) or poor (34.4%). None rated it as "excellent." More than one fifth of nonresidential respondents (22.6%) rated the extent of wireless coverage in Vermont as excellent (4.0%) or good (18.6%), while three quarters (75.7%), gave it a rating of fair (40.7%) or poor (35.0%).

While residents as a whole were not impressed with the extent of wireless coverage, they did have expectations about how reliable the service should be. A majority (89.6%) strongly (59.6%) or somewhat (30.1%) agreed with a statement suggesting that in those areas where wireless phones are used frequently, they ought to be as reliable as regular telephone lines. Less than ten percent (8.2%) indicated disagreeing somewhat (6.6%) or strongly (1.6%) with the same statement.

Respondents who had someone in their household that use wireless telephones (45.6%) were presented with the following statement: "Some households who have wireless phone service have discontinued their regular phone service – the service that is connected to the wall in your house." Less than a quarter (23.0%) have considered discontinuing their regular phone service

and using only their wireless phone, while more than three quarters (77.0%) have not. Just under a third (31.1%) reported using their wireless phone much more (18.6%), or somewhat more (12.6%) often than their regular telephone, when making long distance calls from home. More than two thirds (68.9%) indicated using their phones sometimes, but less often than regular (27.9%) or never (41.0%), when making long distance calls from home.

An important consideration when thinking about consumers' potential willingness to substitute a wireless phone or an Internet phone service for conventional telephone service is the value they place on a phone that doesn't depend on batteries or home electric service. The use of cordless phones in the home has grown significantly in recent years. Cordless phones, while typically used with conventional phone service, require electric power and can be impacted by the availability of service in a power outage. Just over one fifth of all respondents (21.7%) suggested all of the phones in their household were cordless. Less than two-thirds (64.1%) noted only some of the phones in their households were cordless. And 14.2% indicated not having any cordless phones.

All households, both those with wireless services and those without, were

Figure 4.13:
Frequency of use of wireless phone for long distance

Among households with a wireless phone user, compared to regular phone use

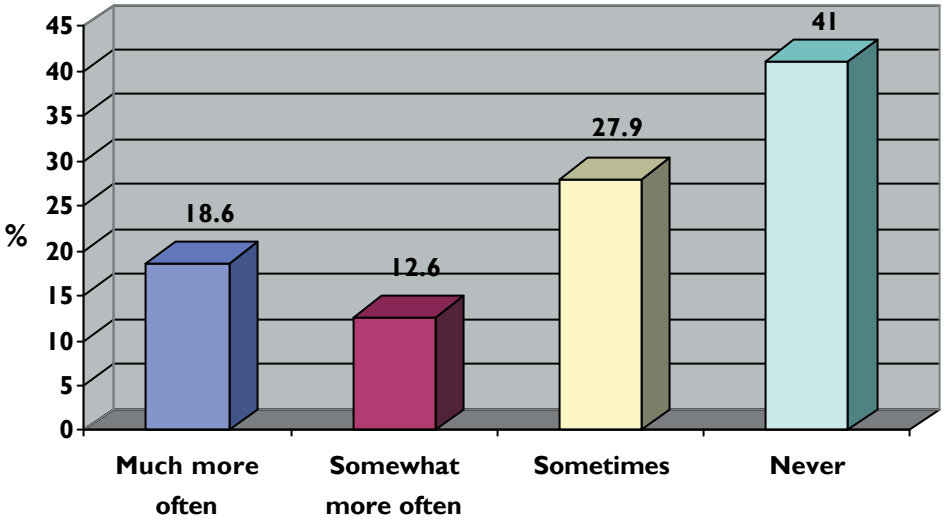


Figure 4.14:
Number of phones in household that are cordless

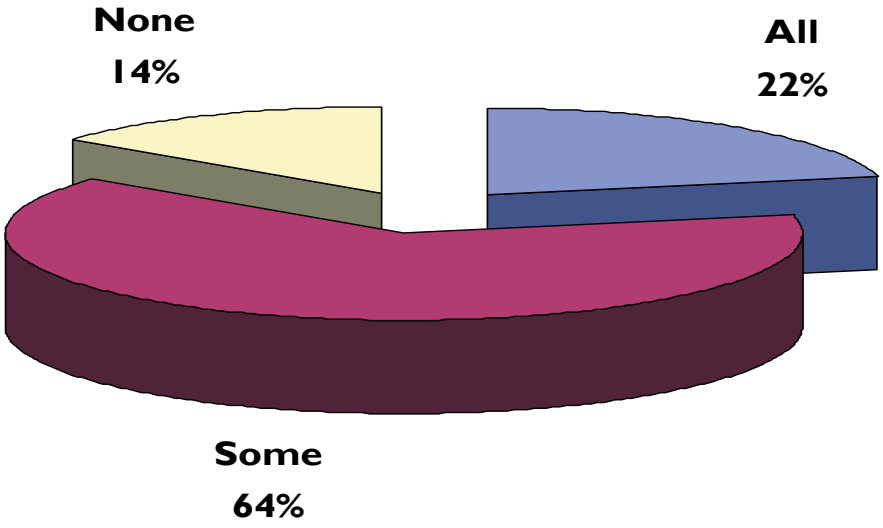


Figure 4.15:
Importance of better wireless service

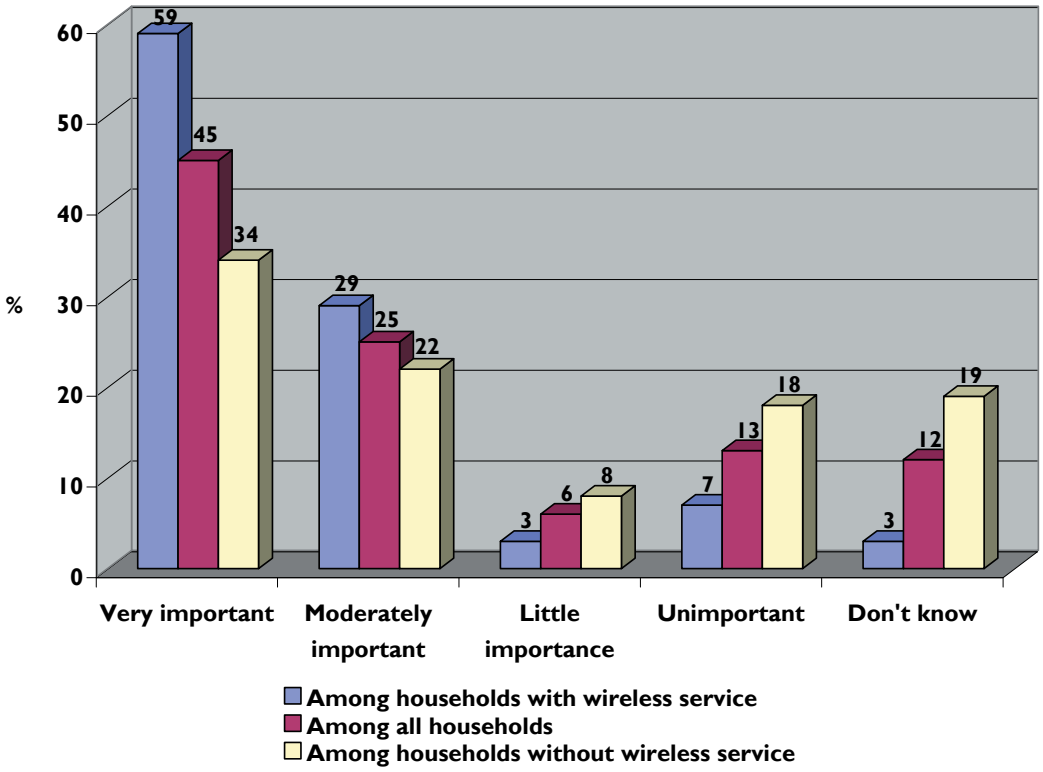
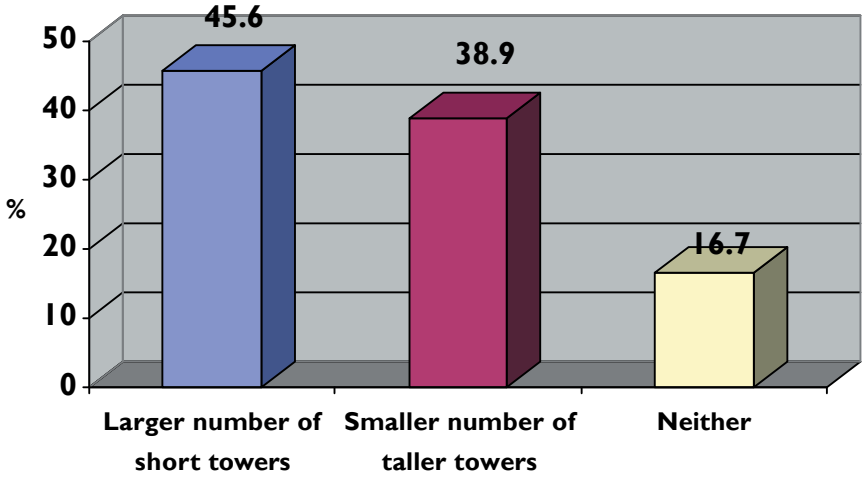
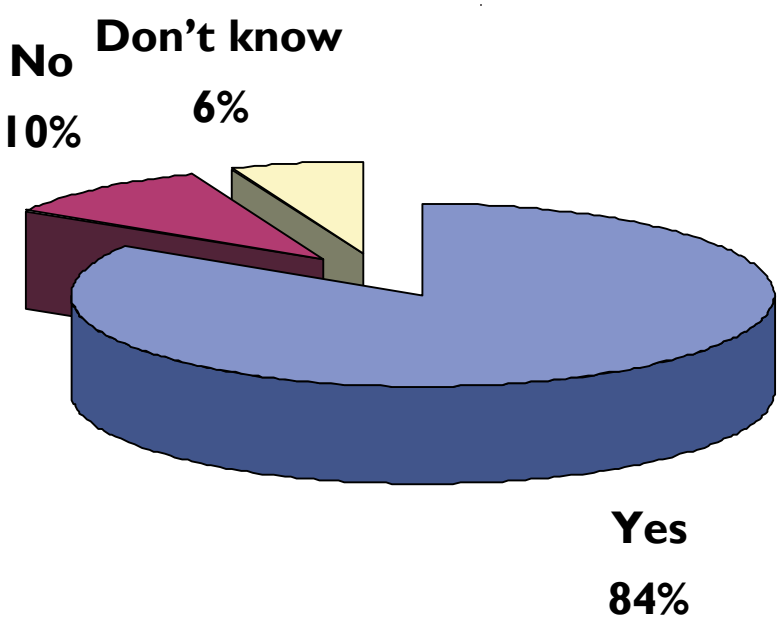


Figure 4.16:
Residents preferring large number of small towers vs. small number of large towers



asked questions about the importance of wireless services and about tower siting issues. More than two thirds of all residents interviewed (69.8%) would describe the need in Vermont for better wireless phone service as very (45.1%) or somewhat (24.7%) important. Less than one fifth (18.4%) would describe it as having little importance (5.7%) or being unimportant (12.7%). Respondents from households that subscribed to wireless service felt even more strongly about the issue—87.4% felt that better wireless service was either very important (59.0%) or moderately important (28.4%). Even a majority of respondents from households that did not subscribe felt that the issue was important, either very important (33.6%) or moderately important (21.7%).

Figure 4.17:
Support more towers in community for better 2-way radio for emergency services?



Tower height and the number of towers for wireless services has been a matter of public controversy in the past. Two strategies to improve wireless coverage are to build taller towers to give signals greater range, or to locate a greater number of towers. A larger number of shorter towers might provide similar coverage to a smaller number of larger towers. The residential survey asked Vermonters to identify which of the two alternatives they found preferable. While 30.2% of respondents would prefer a large number of short towers to improve wireless service, 29.2% would prefer a small number of tall towers. One sixth (16.7%) stated without prompt that they would prefer neither. And 23.9% did not know or were unsure. While a large majority of respondents (84.0%) would support more towers in the community to improve two-way mobile radio communications for police, ambulance, or fire services if they were needed, 10.0% of residents interviewed would not.

THE INTERNET

Both the residential and nonresidential surveys asked a number of questions regarding Internet access and the use of Internet applications. A number of these questions corresponded to questions asked in prior surveys, presenting a picture of changes over time.

Table 4.31:
Residents' frequency of Internet use

Last use of the internet?	Percent
Today	46.4
Last 7 days	20.2
last 30 days	3.7
Last 3 months	1.0
Last 6 months	2.5
last year	0.2
> 1 year	1.7
Never	23.7
Don't know	0.5

Figure 4.18:
Residents who have Internet access at home

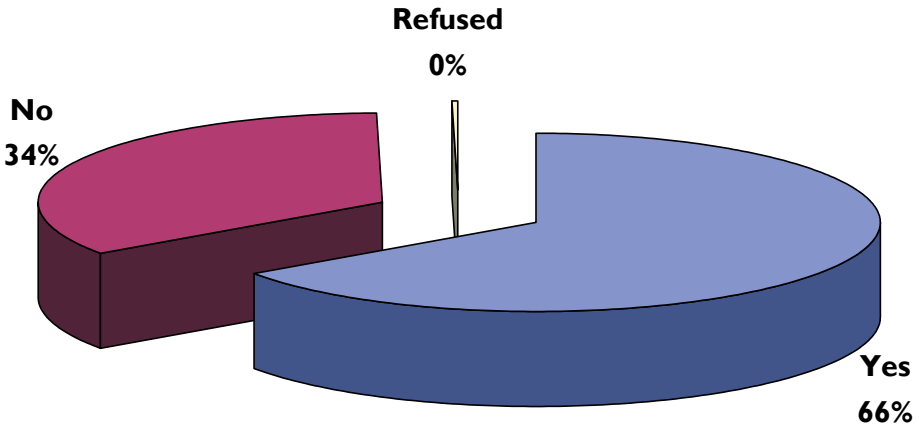


Figure 4.19:
Organizations who have Internet access

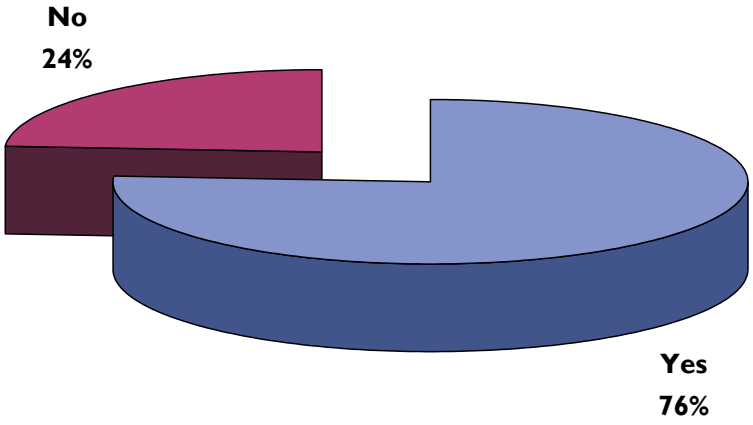
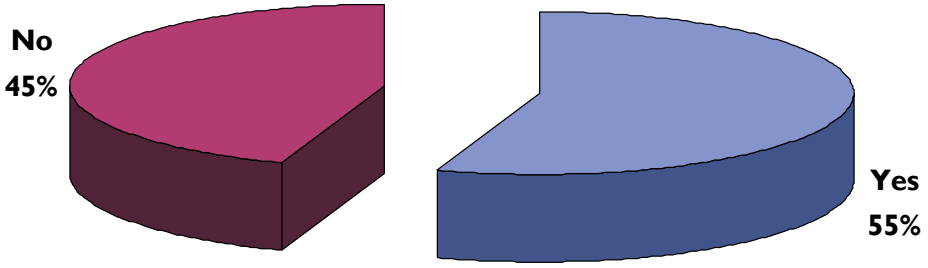


Figure 4.20:
Organizations who currently have an Internet website

Among those with Internet access



INTERNET ACCESS

Not surprisingly, Internet use in Vermont is up among both households and nonresidential users. In the 1999 residential survey, researchers asked respondents if they had ever used e-mail and if they had ever used the Internet for other purposes. Just under two-thirds answered that they had ever done these things (60% and 61%, respectively). In the 2003 survey, higher percentages of respondents answered that they not only had used the Internet at one time, but also were frequent Internet users or had access in their homes. Just under two thirds of all residents interviewed in 2003 (65.3%) had Internet access at home, while 34.4% did not. Regardless of whether or not the respondent had Internet access in the home, researchers asked a series of questions to determine respondents' frequency of use of the Internet. All respondents were asked when, if ever, was the last time they used the Internet. Table 4.31 holds results as collected. Two-thirds had used the Internet at least once in the last week, and nearly half had used it the day of the interview.

A greater number of nonresidential respondents stated that their organizations were connected to the Internet. More than three quarters of respondents (76.1%) indicated their organizations have access to the Internet. Less than a quarter (23.9%) did not. In the 1999 survey, 56% had Internet service. More

Table 4.32:
ISPs' shares of customers

Percent of residential customers			Percent of nonresidential customers	
AOL	22.9		SoVerNet	14.4
SoVerNet	11.8		Adelphia Cable	12.8
Adelphia Cable	11.5		AOL	11.5
Earthlink	8.4		Earthlink	8.8
United Online (Juno/NetZero/ BlueLight)	5.0		Verizon	6.2
Power Shift Online	4.2		VTel Internet	4.6
Vtel Internet	4.2		Green Mountain Access	4.3
Verizon	3.8		Vermont Link.Net	3.3
Green Mountain Access	3.8		Global.net	2.6
AT & T	2.3		Lightship	2.6
Global.net	2.3		Charter Communications	2.3
Innevi	1.9		Power Shift Online	2.3
MSN	1.9		Valley Net	2.3
Kingdom Connection	1.5		Kingdom Connection	1.6
Charter Communications	1.1		ABS / Telcove	1.6
GovNet	0.8		United Online (Juno/NetZero/ BlueLight)	1.6
Trans Video	0.8		GovNet	1.3
Vermont Link.Net	0.8		MSN	1.3
ABS/Telcove	0.4		AT&T	1.0
Shoreham	0.4		TDS Net	1.0
TDS Net	0.4		Stowe Cable	0.7
UU Net	0.4		Shoreham	0.3
Valley Net	0.4		WorldCom	0.3
Other	6.5		Other	6.2
Don't Know	1.5		Don't know	4.6
Refused	1.1		Refused	1.0

than half (55.4%) of the organizations with access to the Internet had a website. This is similar to the proportion in the 1999 survey, when half of the organizations with Internet access had a web site.

The market for providing Internet access in Vermont is split among a large number of companies. Respondents with Internet access were asked to name their Internet service provider. Table 4.32 portrays the results. America On-line clearly had the greatest market share among homeowners in a heavily divided field. Among the nonresidential organizations, SoVerNet and Adelphia Cable were the most frequently cited Internet Service Providers (ISPs) among an even

Figure 4.21:
Residents likely to upgrade to faster Internet connection in the next year

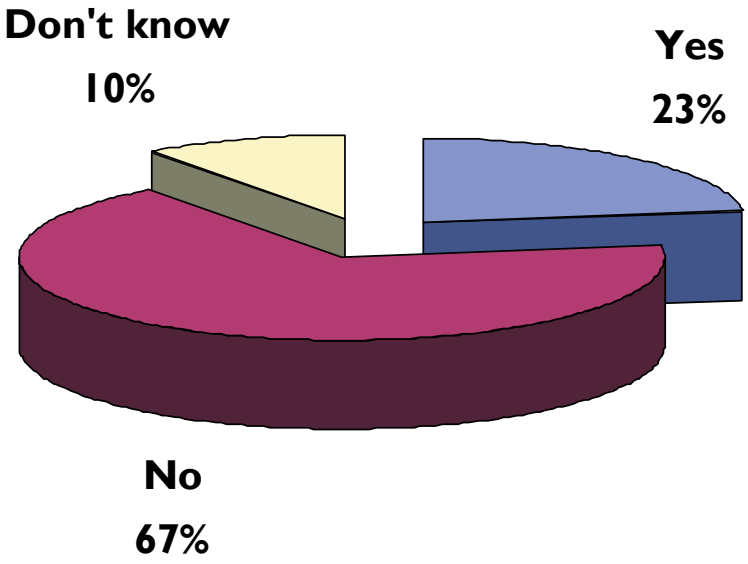
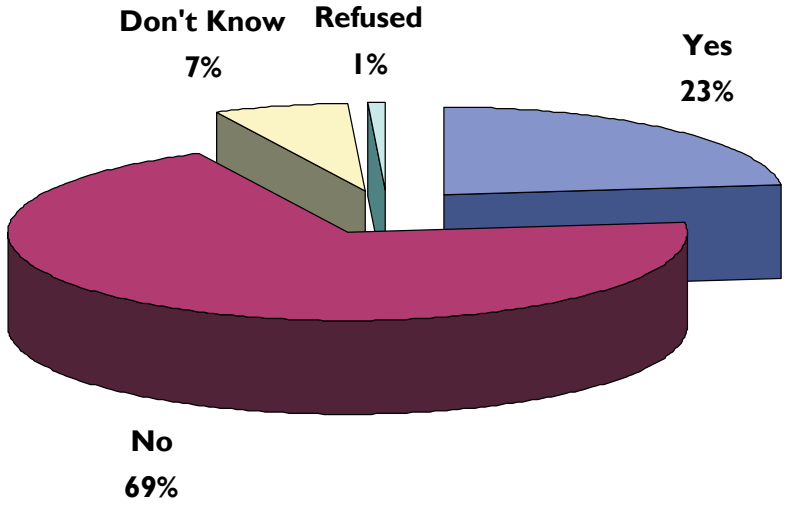


Figure 4.22:
Residents without home Internet access likely to acquire it in the next year



more heavily divided field. The appearance of Adelphia Cable near the top of this list is notable because Adelphia's cable modem service was originally only marketed as a residential offering, although now it is available as a business service as well. The survey results may reflect the extent to which the residential and small business markets are using similar types of broadband Internet services.

While 22.9% of the households said it would be likely they will upgrade to a faster Internet connection at home in the next year, two thirds (66.8%) will not. Ten percent (10.3%) did not know or were unsure. Just under one quarter of households without Internet access at home (23.0%) suggested being likely to acquire Internet access at home in the next year, while 69.8% said they still would not. Respondents from organizations with Internet access, were also asked if they planned to upgrade their Internet access service to a faster service. Table 4.33 portrays the results as collected. Respondents from organizations with no Internet service access (23.9%) were asked if they planned to obtain Internet access service in the future. Table 4.34 shows the results obtained.

The extent to which homes and businesses are adopting broadband Internet connections is an important question. Respondents with Internet access at home (65.3%) were asked for the type of Internet connection they had. Table 4.35 holds the results. About a quarter of Vermont homes that connect to the Internet use broadband connections, and the broadband penetration rate exceeds 15% of all Vermont homes. Cable modem connections are somewhat more common than Digital Subscriber Line (DSL) connections.

A higher proportion of nonresidential Internet users rely on a broadband connection, about half. Respondents from organizations with Internet access (76.1%) were asked for the primary way that their organizations connected to the Internet. Table 4.36 holds the results. The most common broadband means of connecting by far were still DSL and cable modems, in roughly equal proportions.

Respondents from organizations with Internet access were read a list of methods to connect to the Internet and asked if those methods were available in the area they were located. Table 4.37 summarizes the results as collected. It is not reasonable to expect that these perceptions are in fact accurate—most users do not have detailed information about the availability of the full range of telecommunications services in their area. In fact, there are some notable errors in perception. For example, T-1 is a service that is essentially universally available, although at a price that may discourage many users. It is useful to understand what users perceive their choices to be.

Table 4.33:
Nonresidential plans to upgrade Internet access

Plans to upgrade Internet access service to a faster service?	Percent
Next 6 months	9.5
Next year	9.5
Next 2 years	5.6
No plans to upgrade	68.2
Don't know	7.2

Table 4.34:
Nonresidential plans to obtain Internet access service

Do you plan to obtain an Internet access service?	Percent
Next 6 months	12.5
Next year	12.5
Next 5 years	6.3
No plans for service	63.5
Don't know	4.2
Refused	1.0

Table 4.35:
Type of Internet connection--residential

Type of Internet connection	Percent
Dial-up	71.0
Cable modem	15.3
DSL	10.3
Satellite	0.8
Wireless	0.4
Web TV	0.4
Don't know	1.5
Refused	0.4

Table 4.36:
Type of Internet connection--nonresidential

Type of Internet connection	Percent
Dial-up modem	46.6
DSL	20.7
Cable Modem	19.0
T1 or DS1	4.9
Satellite	1.6
Dial-up ISDN	1.6
Other wireless	1.3
Fractional T1 or DS1	0.7
Frame relay	0.3
Other type	0.3
Don't know	3.0

Table 4.37:
Perceived availability of Internet access--nonresidential

Is method available in the area where you are located?	Percent		
	Yes	*No*	*Don't Know*
Cable modem	57.7	22.6	19.7
DSL	53.1	23.3	23.6
Satellite	43.0	14.1	43.0
Wireless	27.5	25.2	47.2
T1 or DS1	23.9	16.1	60.0
ISDN	22.0	23.6	54.4
Frame relay	8.9	13.4	77.7

Table 4.38:
Reasons for not having Internet connection at home

	Percent
Dislike at home	24.5
No computer	19.4
Too expensive	13.7
Do not use	10.8
Use at work	3.6
Use at other place	3.6
Do not know how	2.9
Family concerns	2.9
Not available	2.2
Don't know	5.0
Refused	10.0

Table 4.39:
Reasons for not using the Internet recently

	Percent
No equipment	40.0
No interest	20.0
Do not like computers	15.2
Do not know how	15.2
Equipment too expensive	6.7
Monthly charges	1.9
Never heard of	1.9
No time to learn	1.9
Phone charges	1.0
Don’t know	4.0

Table 4.40:
Home Internet access by household income

All respon-dents	Less than $35,000	$35,00-$75,000	$75,000 or more
65.3	48.1	70.7	94.3

For those homes without Internet access, the surveys inquired as to why they did not have it. Table 4.38 summarizes the results. About a quarter of respondents stated that they disliked having an Internet connection at home or had family concerns about access. About a third stated that they had no equipment for access, or they thought it was too expensive. Residential respondents who had not used the Internet in the last six months were also asked why they had not used the Internet recently. Table 4.39 shows the results. In response to this question, the greatest number of people responded that they either lacked the equipment to do so or a computer, specifically. The survey suggested that this could be linked to income. There were great differences in the level of home Internet access at different income levels. Table 4.40 shows these results. For upper-income households, the level of penetration of Internet access approached that of telephone service.

In an open-end format question, respondents from organizations with Internet access were asked for the most important reason their organizations did not subscribe to a faster Internet access service. Table 4.41 holds the results as collected. Among those who did not say that they didn't need one or were satisfied with their current service, the most frequently cited reasons were that the faster connections were not available or too expensive, or that the organization was too small.

Table 4.41:
Reasons for not subscribing to a faster Internet access service--nonresidential

Most important reason for not subscribing to a faster Internet service?	Percent
Not needed	34.1
Not available	25.9
Too expensive	16.7
Too small	13.1
Satisfied with current service	3.9
Other	2.0
No time to check	2.0
Lack knowledge	1.0
Provider hard to deal with	0.7
Don't know	0.7

Table 4.42:
What Vermonters do on the Internet

Used Internet in the past 4 weeks for…	Percent		
	Yes	*No*	*Don't Know*
E-mail	90.1	8.8	1.1
Shopping	61.8	37.0	1.1
News reports	60.3	38.5	1.1
Health/medical information	47.3	51.5	1.1
Hobbies	45.8	53.1	1.1
Working from home	38.5	60.3	1.1
Pay bills / managing finances	36.6	62.2	1.1
Playing games	33.2	65.6	1.1
Chat or Instant Message	30.5	68.3	1.1
Internet radio	20.2	78.6	1.1
Downloading music	17.6	80.5	1.9
Something else	16.8	80.9	2.3
Watching/downloading videos	9.5	89.3	1.1
Internet phone calls	5.3	93.5	1.1

WAYS VERMONTERS USE THE INTERNET

Respondents with Internet access service at home (65.3%) were read a list of Internet services, and asked if, in the last four weeks,

they had used the Internet at home for each one of these services. Table 4.42 summarizes the results as collected. Respondents who had used the Internet in the past year (73.8%) were asked how often they had visited a Vermont State Government Internet web site. Almost half (44.6%) suggested having never visited a Vermont State Government website, while two fifths (20.9%) having visited occasionally. Under one sixth (14.2%) suggested visiting frequently, and 0.3% said they did not know or were unsure.

Respondents working at organizations with Internet access were also asked a series of detailed questions about the ways their organization used the Internet. Table 4.43 summarizes the results of a question asking the percent of their employees that used e-mail at work.

More than half (57.0%) of organizations interviewed with access to the Internet indicated making business-to-business transactions over the Internet. Figure 4.23 summarizes the results. This figure has changed dramatically since the 1999 survey, when only 17% percent of organizations connected to the Internet responded in a like manner. More than one fifth (22.4%) of organizations doing business-to-business transactions over the Internet stated these transactions used digital signatures. In

Table 4.43:
Percent of employees that use e-mail at work

In organizations with Internet access

Estimated percent of employees that use e-mail at work	Percent
1 – 10 %	22.3
11 – 20	5.6
21 – 30	6.2
31 – 50	7.5
51 – 60	1.6
61 – 70	1.6
71 – 80	4.6
81 – 90	1.0
91 – 100	48.5
Don't know	1.0

Figure 4.23:
Does your organization make business-to-business transactions over the Internet?

Among organizations with Internet access

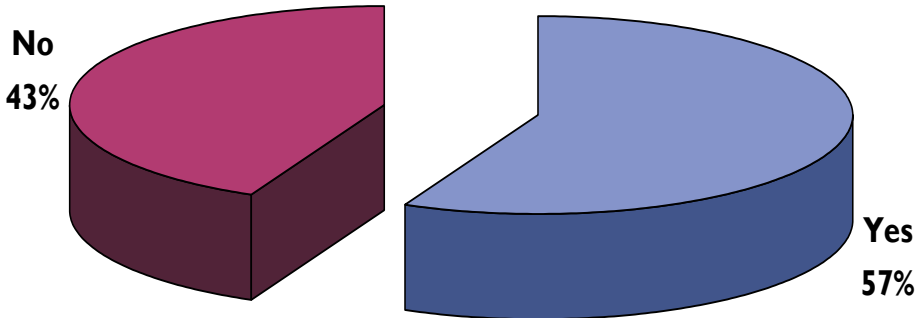
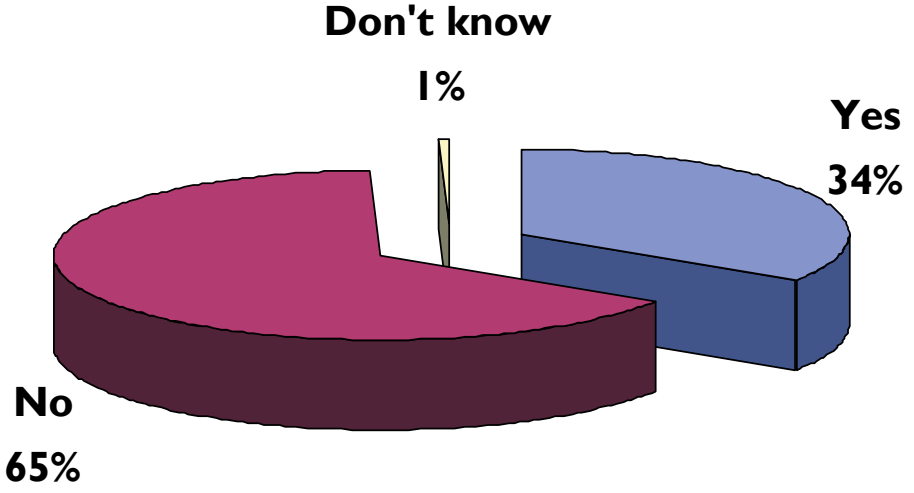


Figure 4.24:
Can customers make purchases using your site?

Among organizations with a website open to the public



contrast, the 1999 survey uncovered virtually no evidence of digital signature use by organizations in Vermont.

Respondents were also interviewed about how their organizations used its website. Almost two thirds (63.9%) of organization websites are used by the public as well as by internal staff members. Just over one third (34.3%) noted their website is only used by the outside public. And a few (1.2%) indicated their website was for internal use only. More Vermont organizations are using websites to drive sales. Of those websites open for public use, just over one third (34.3%) allow customers to make purchases using the website. This is up significantly from 1999, when only 14% of respondents had a similar answer.

Many Internet access services are asymmetrical, providing greater download speeds than upload speeds while others are symmetrical. The survey explored how organizations valued upload and download speeds. Respondents from organizations with Internet access were provided with the following statement: "Internet services may provide different speeds for uploading information to the Internet and downloading information from the Internet." Almost half (48.5%) noted both upload and download speeds were equally important for their organizations. More than

Table 4.44:
Importance of upload vs. download speeds for organizations

Is upload or updown speed more important?	Percent
Upload more important	7.9
Download more inportant	36.7
Equal	48.5
Don't know	6.9

Table 4.45:
Locations used the Internet in the past 12 months

	Percent
Home	83.7
Work	52.0
Friend/neighbor/relative	30.7
School or college	18.9
Library	13.9
Government office	2.0
Senior Center	1.4
Restaurant	1.0
Place of worship	0.7
Other business	3.7
Other	1.4

Table 4.46:
Interest in seeing more public Internet terminals

Does your community need more public use Internet terminals?	Percent
Yes	27.2
No	42.1
Don't Know	30.7

one third (36.7%) suggested download was more important, and 7.9% indicated upload was more important.

One third (33.3%) of respondents who favored upload over download, indicated upload was much more important than download. Two thirds (66.7%), suggested upload was only somewhat more important than download. One half (50.0%) of respondents who favored download over upload, indicated download was much more important than upload. The other half (49.1%) noted it was only somewhat more important.

Table 4.47:
Interest in community Internet assistance programs

If offered for free at a community school, interested in…	Percent		
	Yes	*No*	*Don't Know*
Access to the Internet	30.7	64.3	5.0
Use of e-mail	25.2	69.8	5.0
Training/technical support	38.2	57.1	4.7
Access to online services	37.2	58.6	4.2

USE OF THE INTERNET OUTSIDE THE HOME

Respondents who had used the Internet in the past year (73.8%) were read a list of locations where people might use the Internet, and asked if they had used it at each location in the last twelve months. Table 4.45 depicts the results as collected.

More than a quarter of all respondents (27.2%) agreed their respective communities need more public use Internet terminals. More than two fifths (42.1%) did not. And 30.7% did not know or were unsure. Table 4.46 holds the results collected.

Researchers presented respondents with the following question: "If the computer center at one of your community schools were open to the public in the evening or weekend and offered free services, which, if any, of the following services would interest you?" Table 4.47 holds the results. These results are very similar to the results obtained from similar questions in the 1999 survey.

Table 4.48:
Reliability of nonresidential Internet access service

Frequency of service interruption with primary Internet access service?	Percent	Cumulative
Weekly	23.3	23.3
Monthly	25.6	48.9
Quarterly	17.7	66.6
Yearly	14.1	80.7
<1 per year	4.6	85.3
Never	10.5	
Don't know	4.3	

Table 4.49:
Is reliability or price more important?

Is reliability or price of Internet service more important?	Percent
Reliability more important	39.7
Price more important	12.5
Equally important	46.9
Don't know	1.0

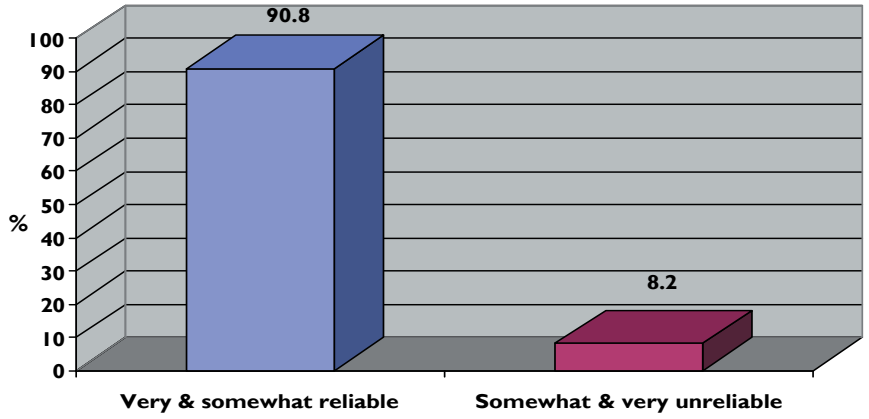
RELIABILITY AND PRICE SENSITIVITY

In an aided open-ended format, researchers asked nonresidential respondents how often they experienced an interruption in their primary Internet access service. Table 4.48 holds the results.

Almost half (46.9%) of respondents from organizations with Internet access suggested reliability and price were equally important for their organization. Two fifths (39.7%) indicated reliability as being more important. And one eighth (12.5%) mentioned price as being more important for their organizations. Table 4.49 holds the results.

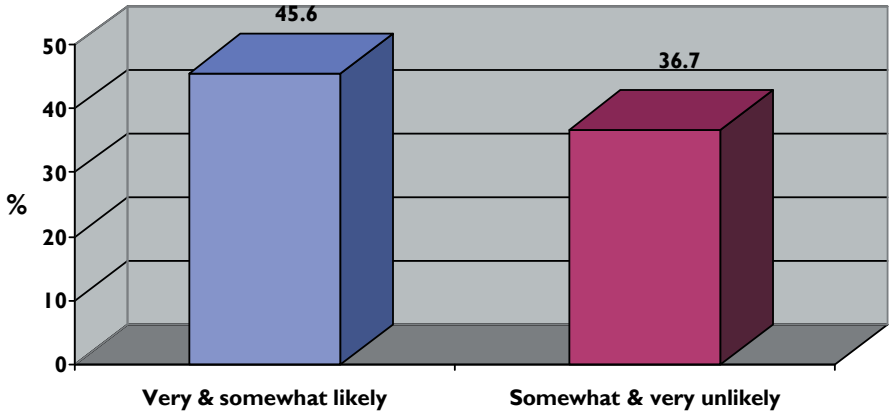
Just under half (48.8%) of respondents who favored reliability over price, indicated reliability was much more important than price. One half (50.4%), suggested reliability was only somewhat more important than price. Just over two fifths (42.1%) of respondents who favored price over reliability, indicated price was much more important than reliability. More than half (55.3%) noted it was only somewhat more important.

Figure 4.25:
How reliable is your organization's Internet service?



A large majority (90.8%) of respondents from organizations with Internet access suggested their service was very (59.7%) or somewhat (31.1%) reliable. Less than ten percent (8.2%) noted their service was somewhat (4.9%), or very (3.3%) unreliable.

Figure 4.26:
Likelihood of joining a telecommunications buyers group



AGGREGATE BUYING

There have been a number of organizations and communities that are or have attempted to organize users into aggregate buying groups in order to obtain better telecommunications service or lower prices. The nonresidential survey asked respondents several questions about this concept. More than two fifths (45.6%) of respondents from organiza-

tions with Internet access noted being very (14.8%) or somewhat (30.8%) likely to join a telecommunications buyers group if such a group was seeking members in their community. More than one third (36.7%) said it would be somewhat (11.1%) or very (25.6%) unlikely they would join. Almost one fifth (17.7%) did not know or were unsure.

Table 4.50:
What benefits would you most want to obtain by joining a buyers group?

	Percent
Lower prices	82.7
Higher speed service	69.8
More reliable service	54.7

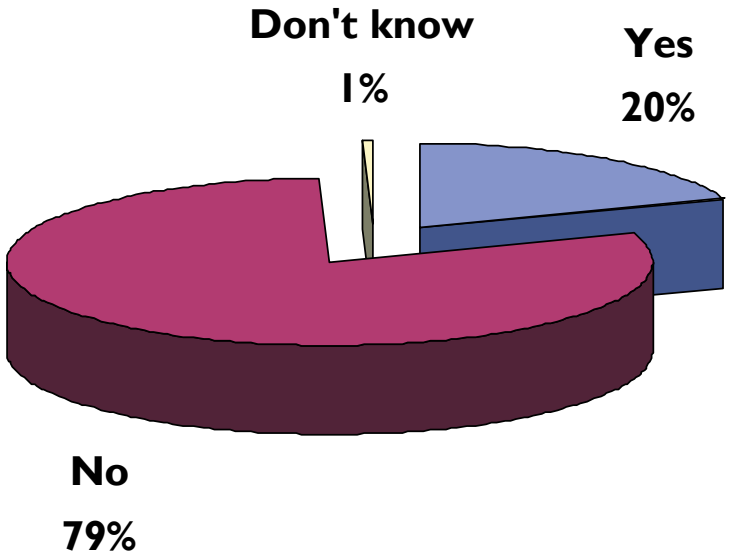
Respondents likely to join such a buying group (45.6%) were asked, in an aided open-ended format question, what benefits they would want most to obtain by joining. Table 4.50 summarizes the results.

TELECOMMUTING

Both surveys examined the practice of telecommuting. All nonresidential respondents were presented with the following statement: "Telecommuting means working at home with the capability to connect to your office's computer network. A person can telecommute part-time or full time." One fifth (19.5%) of all nonresidential respondents suggested someone in their organization (including themselves) have telecommuted in the past year. A large majority (80.0%) indicated no one in their organization had telecommuted in the past year.

One quarter (24.7%) of all nonresidential respondents indicated it was very (13.2%) or somewhat (11.5%) likely themselves or employees in their organizations will be telecommuting in the next year. Almost three quarters (72.8%) indicated it was somewhat (5.7%) or very (67.1%) unlikely anyone in their organizations will telecommute. Ten respondents (2.5%) did not know or were unsure.

Figure 4.27
Has anyone at your company telecommuted in the past year?



The residential survey also asked about telecommuting. The survey first identified those who might be possible telecommuters. The first criterion was that the responder was a member

Figure 4.28:
Likelihood of organization's employees telecommuting full or part-time in the next year

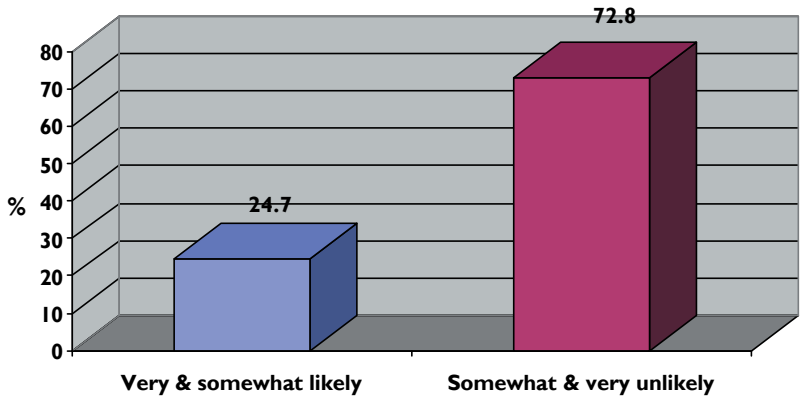


Table 4.51:
Work-at-home frequency

Number of days in the past week spent working from home	Percent	Cumulative
7	9.8	9.8
6	1.0	10.8
5	7.8	18.6
4	1.6	20.2
3	2.6	22.8
2	5.2	28.0
1	6.7	34.7
0	65.3	

Table 4.52:
Telecommuting frequency

How often do you telecommute?	Percent	Cumulative
Every day	6.7	6.7
1+ days/week	4.7	11.4
Occasionally	11.9	23.3
Never	75.6	
Refused	1.0	

of the workforce. Just under one half of all respondents (48.1%) noted having worked for pay or profit in the past week, while 51.6% did not. Respondents who had worked for profit or pay (48.1%) were asked for the number of days, in the past week, they spent working from home. Table 4.51 summarizes the results. It would be unreasonable to expect all workers to be potential telecommuters--not all jobs lend themselves to telecommuting. The survey asked about the amount of time working respondents spent using the phone or computer in their work. This helped to identify the proportion of the working population in Vermont that would likely find it difficult to use telecommunications to allow them to telecommute. More than two fifths of working respondents (45.1%) suggested spending most (29.0%) or about half (16.1%) of the time on the telephone or with a computer, in the course of their business or employment. More than half (53.4%) indicated spending less than half (37.3%) or none of the time (16.1%) on the phone or computer. Almost one quarter of working respondents (23.3%) said they telecommute every day (6.7%), at least one day a week (4.7%), or occasionally (11.9%). Three quarters (75.6%) noted never telecommuting. Table 4.52 holds the results.

Less than ten percent (7.5%) of respondents who never telecommute expect to begin

telecommuting in the next year. A large majority (90.4%) does not. Respondents who never telecommute (36.4%) were asked to provide their reasons. Table 4.53 depicts the reasons cited.

Table 4.53:
Reasons for not telecommuting

	Percent
Job not appropriate	43.8
Not interested	22.6
Employer does not allow	16.4
No equipment at home	12.3
No equipment at office	4.8
Too expensive	3.4
Other	3.4

Telecommuting may be a larger or smaller phenomenon in Vermont, depending how it is looked at. When the researchers asked about "telecommuting," nonresidential respondents indicated about one fifth of the time that someone had recently been telecommuting in the organization. In a similar vein, slightly more than one-fifth of residential respondents in the workforce indicated that they telecommuted at least occasionally. More narrowly, only 11.4% said they telecommuted at least one day or more on average. When the researchers asked about work out of the home, the numbers were larger. Almost one-fifth of residential respondents said that they worked out of their homes in their business or for employment five or more days per week. More than one-third said they did so at least one day per week. And more than two-fifths of organizations surveyed responded that the organization was located in a residence. Home-based work represents a significant part of work and business in Vermont.

PAYPHONE MARKET DEMANDS

Almost two fifths of all respondents (36.9%) believe that more payphones are needed in their community, while 50.9% do not. As shown in Figure 4.30, the perceived need for more payphones in the community has declined since 1995, despite a decline in the number of payphones actually available. In the 2003 survey, just under two fifths (38.4%) believed state or local governments should help finance payphones, if more are needed in Vermont. Under one fifth of respondents in the 2003 survey (18.7%) have, at one time, needed to use a payphone somewhere in Vermont over the past six months, but were unable to find one where they were.

Figure 4.29:
Resident perceptions regarding payphones in Vermont

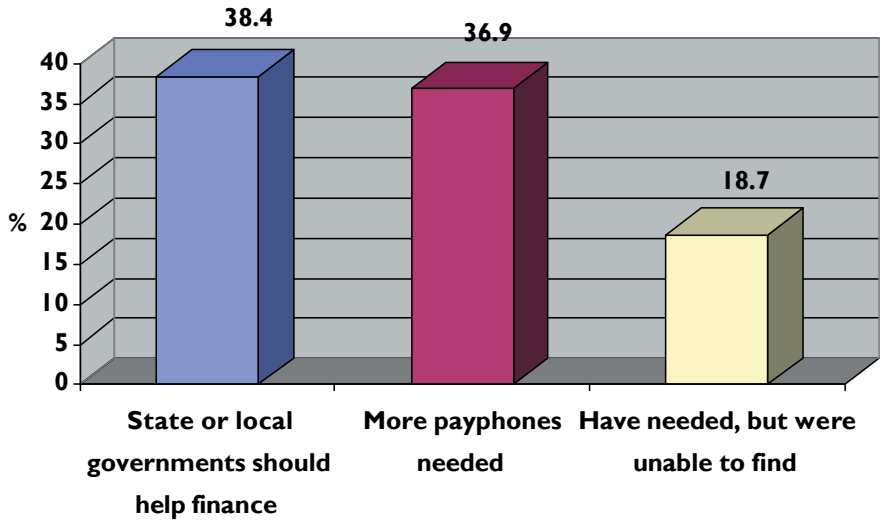
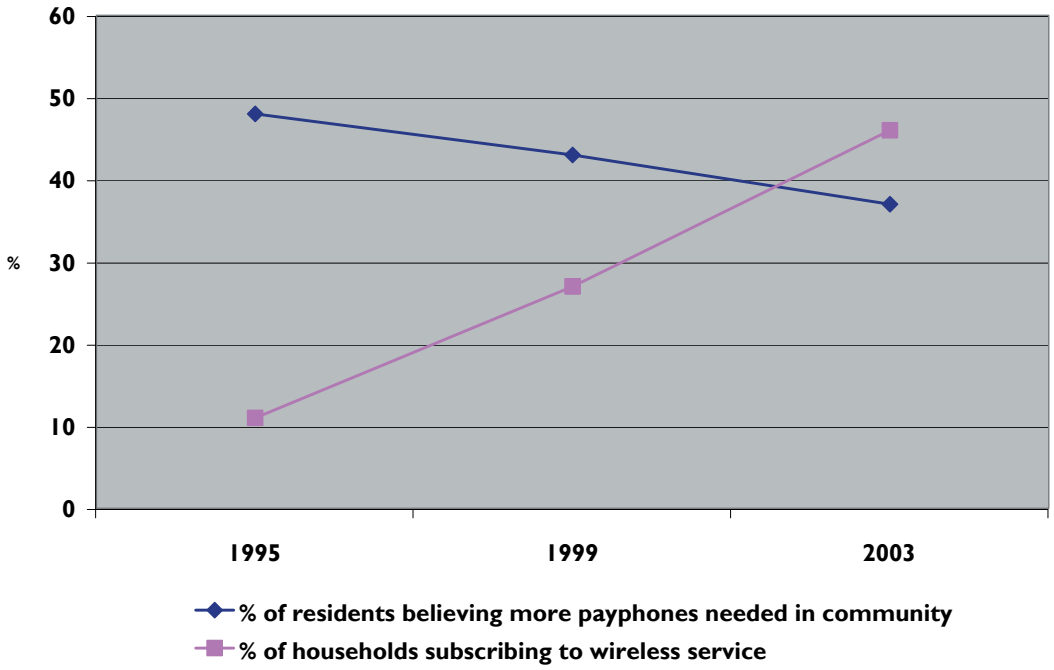


Figure 4.30:
Wireless subscription and perceived need for payphones



CABLE / SATELLITE (DISH) TELEVISION

The residential survey asked respondents a series of questions about television subscribership. Researchers first asked respondents for the number of televisions they have in their household. Table 4.54 holds the results. While only one half (50.5%) of residents with televisions are currently subscribed to cable television, more than a third are currently subscribed to satellite (dish) television. Only ten percent (10.4%) of respondents with televisions have reduced or canceled their cable TV service because they got a satellite dish. As Figure 4.31 shows, there is a degree of overlap in the populations of cable and satellite TV subscribership. Despite the introduction of local channels on satellite TV service, there remains a fraction of the population taking both satellite service and cable TV service. Non-cable television subscribers (48.6%) were asked if cable television wires run past their houses, so that they could subscribe if they wanted to. Less than a third (31.8%) said cables did run past their homes, while 62.6% said they did not.

By crosstabulating the information about satellite subscribership, cable TV subscribership, and cable modem subscribership, it is possible to use the survey results to estimate the "take rates" for various services. Table 4.55 shows the take rates for cable TV service in those areas where it is available and shows the difference in satellite take rates in areas where cable is available and where it is not available. About three quarters of households in Vermont take cable TV service where it is available, and the take rate for satellite service is dramatically lower in areas where cable TV is available. Figure 4.33 shows the percentage of cable customers who have elected to take cable modem service.

Table 4.54:
Number of TVs in household

Number of TVs in household	Percent
None	1.7
1	42.4
2	32.2
3	15.7
4	5.7
5	1.5
6	0.2
9	0.2
Don't Know	0.2

Figure 4.31:
Cable vs. satellite television...

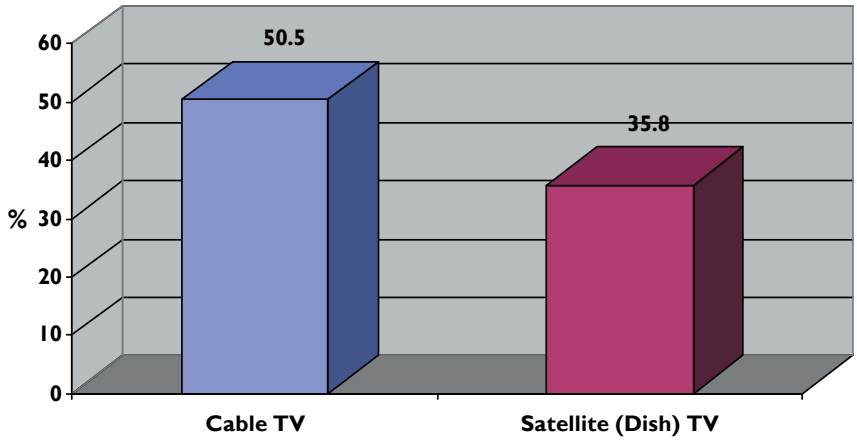


Figure 4.32:
Cable and satellite subscribership

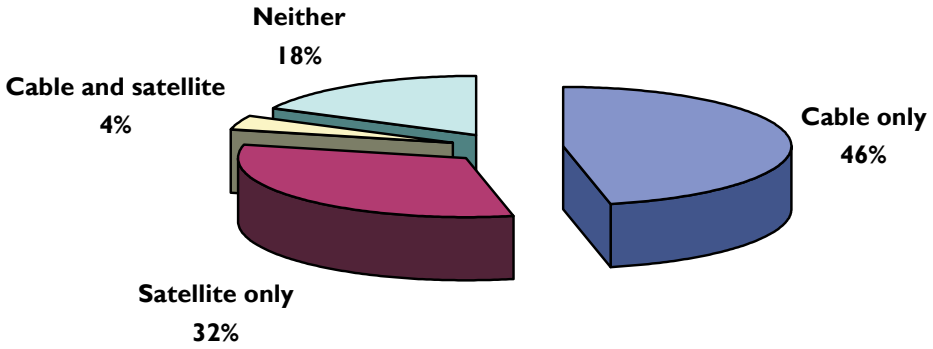
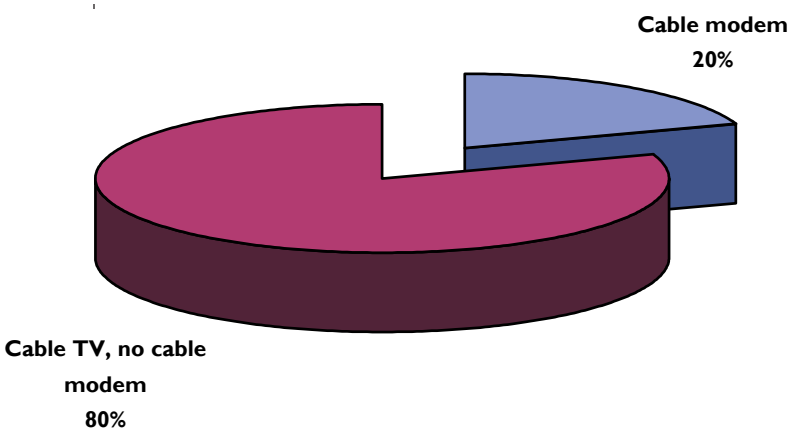


Table 4.55:
Cable and satellite TV take rates

Among households with TVs

	Residents with cable access	Residents without cable access
Percent taking satellite	16.5	64.6
Percent taking cable	76.2	N/A

Figure 4.33:
Cable modem take rates among cable customers



PUBLIC ACCESS TELEVISION

The residential survey asked respondents, both cable subscribers and non-cable subscribers, a series of questions regarding Public, Educational, and Governmental (PEG) access television. The survey asked about viewership, interest in and opinions about PEG access and related issues. Researchers presented respondents with televisions in their households (98.3%) the following statement: "Public access television channels, sometimes called PEG access channels, are designated cable TV channels used exclusively for transmitting television programs produced by the public, educators, and local or other government." Almost two thirds (62.7%) noted having watched a public access channel at some point in their lives, while 36.0% had not.

Respondents were asked for the number of hours per week they watched public access channels in the past year. Table 4.57 depicts the results as collected for all respondents with a TV and for cable TV subscribers. About one-third of cable subscribers reported watching at least an hour of PEG access per week on average.

Respondents were asked for their opinion about the importance of having public access channels at all, and the importance of having enough channels to accommodate all the programs the public might want to place on them. Almost two thirds (61.7%) of respondents with television said it was very (32.0%) or somewhat (29.7%) important to have PEG access channels, while one third (33.0%) said it was of little importance (18.3%) or unimportant. Respondents were also asked, "If the public wants to air more programs than it is possible with the capacity of the current PEG channels, how important would it be for the cable company to provide additional PEG channels?" One half (49.5%) of respondents with television indicated it was very (20.1%) or moderately (29.4%) important for the cable company to provide additional PEG channels. More than one third (39.8%) said it was of little importance

Table 4.56:
Ever watched a public access channel?

	Percent among all respondents with a TV	Percent among households with cable
Yes	62.7	72.9
No	36.0	25.6
Don't Know	1.3	1.5

Table 4.57:
Number of hours per week watched public access channels in the past year

	Among all respondents with a TV		Among households with cable	
	Percent	*Cumulative*	*Percent*	*Cumulative*
10+ hours/week	2.0	2.0	2.5	2.5
5-10 hours/week	3.8	5.8	4.5	7.0
3 - 5 hours/week	6.9	12.7	9.0	16.1
1 - 2 hours/week	15.0	27.7	18.6	34.7
< 1 hour/week	22.8	50.5	28.6	63.3
0 hours	46.4		32.2	
Don't Know	3.0		4.5	

(15.7%) or unimportant (24.1%). Figures 4.34 and 4.35 show that there is very little difference in the way that cable subscribers and non-cable subscribers answered these questions, other than slightly higher support for PEG channels among cable subscribers. More than two-thirds of cable subscribers (67.4%)—who pay for PEG access directly or indirectly through their cable bill—thought PEG channels were very or moderately important. Cable subscribers were more evenly split on the question of whether or not the number of PEG channels should expand to accommodate more PEG programming if needed. About half (50.3%) thought more channels would be very or moderately important. About two-fifths (39.7%) thought it would be unimportant or of only a little importance. About one in ten didn't know or were not sure.

On a related issue, the survey asked respondents about their interest in a Vermont version of "C-SPAN," which broadcasts sessions of the Congress. Almost two thirds (63.2%) of respondents with televisions would watch live television broadcasts from the Statehouse regularly (9.9%) or occasionally (53.3%), while 33.2% said they would never watch it. A few respondents (3.6%) did not know or were unsure. This figure has remained stable over time. A similar question in the 1995 and 1999 surveys indicated that those who would watch regularly or occasionally stood then at 58% and 63%, respectively.

Figure 4.34:
How important is it to have PEG access channels?

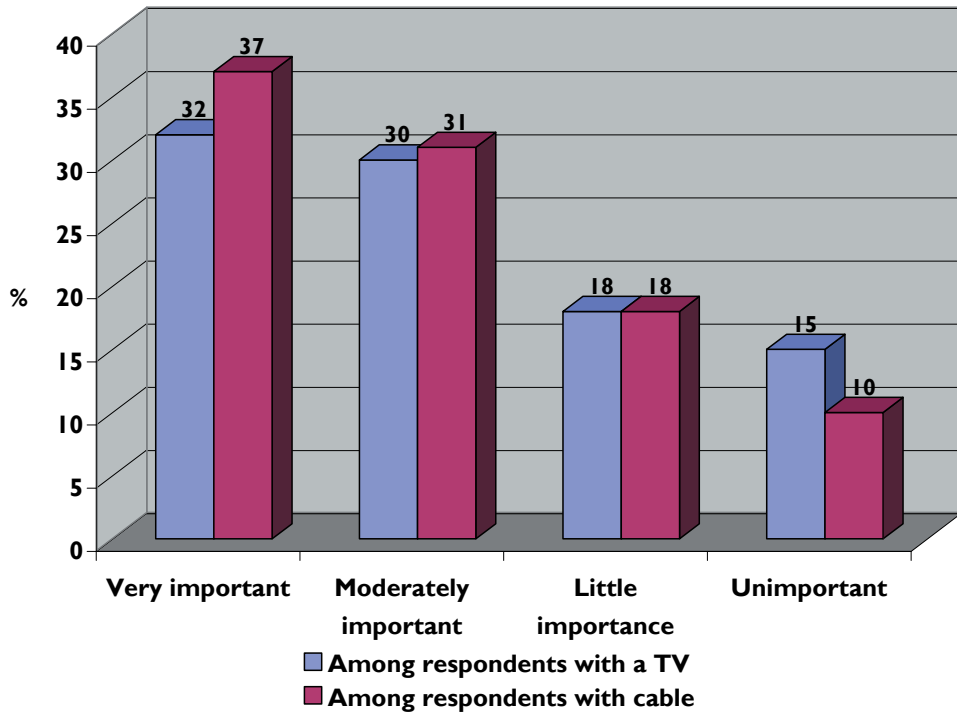
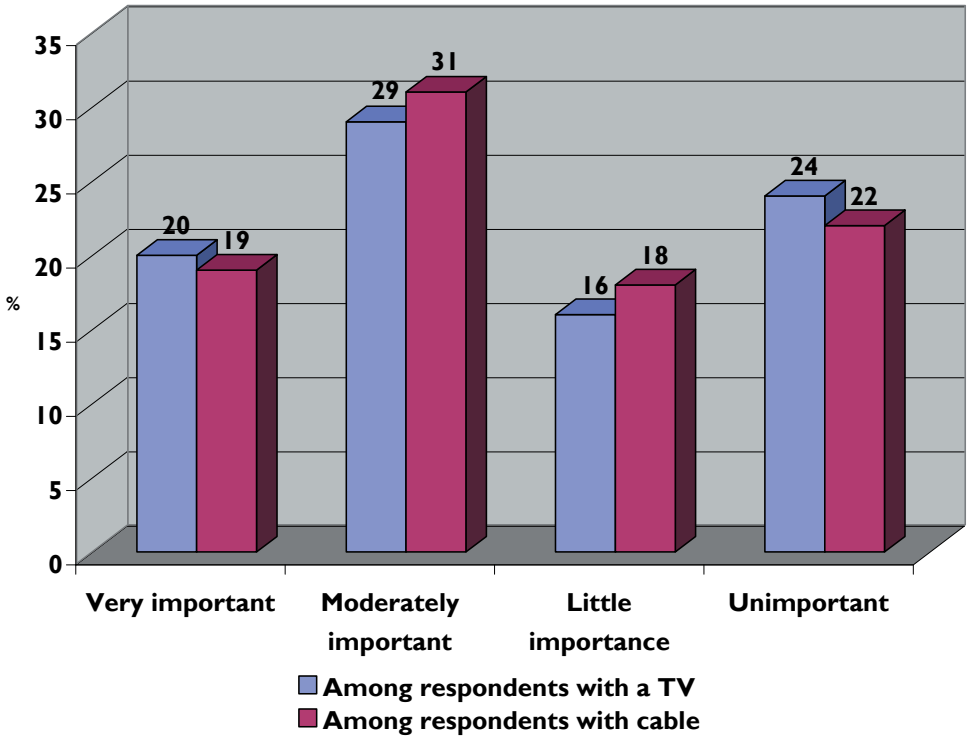


Figure 4.35:
How important is it to provide additional PEG channels for more programming?



Part II: Policies, Strategies, and Action Plans

Universal Service

"Universal service" is a cornerstone of telecommunications policy. It is the idea that telecommunications service is so important to participation in society that everyone ought to have access to it, at least to a certain degree. This also squares well with an important truth of telecommunications networks—the more people who are connected, the more valuable the network. A network of one is useless. A communications network where nearly everyone can be assumed to participate is exponentially more valuable than one that only reaches a half of the population, or a third, or a quarter.

Universal service policy is only theoretical if it does not address serious barriers to its achievement—barriers that include economic hardship, disability, geography and density. Service must not only be available but also within the financial reach of users. Universal service can be a challenge to sustain. Underlying the policy of universal telephone service is a web of support payments, mandates, and judiciously monitored competition.

Universal service is also a term of art with very specific meaning in certain legal and regulatory contexts. That is not the only way it is used in this section of the plan. Instead, this section looks forward to the future and addresses the concept and goals of universal service. Universal service has inherited a legacy of support mechanisms and policies that have produced important results in telephone service, at a cost. The ongoing transition from the system of regulated monopoly service providers to competitive markets presents special challenges to universal service. Responsibility broadens from a single dominant provider to the industry as a whole. Technological advances and the resulting changes in the costs for providing many services are forging a new communications environment. Distinctions between categories of services and providers are disappearing as a result of convergence. As services lose their boundaries, distinctions between services become tenuous, requiring universal service to redefine itself accordingly by adapting its funding mechanisms and target services in an appropriate and effective manner.

"It is the purpose of this section…to…support the universal availability of appropriate infrastructure and affordable services for transmitting voice and high-speed data..."–30 V.S.A. § 202c(b).

TELEPHONE AND BROADBAND

Affordable basic telephone service has been a long-term goal of state telecommunications policy, and this goal has largely been achieved. Vermont has one of the highest levels of telephone penetration in the nation (97.2% of households).[1] Universal service policies have contributed strongly to this objective. In particular, Vermont has funded its Lifeline program to obtain near-maximum federal match. (See Table 5.1.) Federal dollars in support of Lifeline have increased faster than the increase in Lifeline customers (see Table 5.2), but the portion of the monthly local bill set by federal regulators has also increased significantly in recent years. Vermont's universal service fund also supports a successful statewide E 9-1-1 service as well as successful Telecommunications Relay and Telecommunications Equipment programs for the deaf, hard-of-hearing, and speech-impaired. A variety of mechanisms that have supported universal telephone

Table 5.1:
Northeast state federal and state lifeline support

Average monthly support per qualifying phone line as of December 2002

State or Jurisdiction	Basic Federal Support	Additional State Support	Federal Match	Total Federal and State Support
Connecticut	$7.53	$1.16	$0.58	$9.27
Maine	$7.75	$3.48	$1.74	$12.98
Massachusetts	$7.75	$6.00	$1.75	$15.50
New Hampshire	$7.75	$-	$-	$7.75
New York	$7.67	$3.19	$1.60	$12.46
Rhode Island	$7.75	$3.40	$1.70	$12.85
Vermont	$7.75	$3.48	$1.74	$12.97

Source: FCC, Trends in Telephone Service, August 2003.

service in Vermont are in flux. These include the Federal Universal Service Fund, the Vermont Universal Service Fund, and rate-setting policies that tended to lower the price of dial tone, especially in rural and high-cost areas, while increasing the price of other services. (See "Traditional Tools for Keeping Local Dial Tone Rates Low," below.) New technology and business models put pressure on pre-existing notions of how and what to support for universal service.

Traditional Tools for Keeping Local Dial Tone Rates Low

States and the Federal government have traditionally used a variety of tools to keep local telephone service rates low, to promote universal service. Some of these tools are under pressure from competition and technological changes.

- High-cost support: The federal government imposes a charge on telecommunications carriers based on their revenues. (Carriers often pass this on via a charge on customers' bills.) A portion of this money is given to carriers based on their costs (or a model of their costs) to provide service to high-cost areas. This support allows those carriers to reduce local exchange rates.
- Lifeline: This program provides support to carriers for their telephone customers who apply and qualify under income eligibility requirements. Lifeline customers receive a lower monthly telephone rate.
- Access charges: Additional support for the cost of local telephone service is provided through the system of per-minute access charges that long distance companies pay local companies for use of local networks to originate and terminate calls. Traditionally, these charges exceeded the cost of local companies providing access to long distance companies, and the excess revenue allowed local dial tone rates to be lower. Verizon's access charges have declined significantly so that this is much less true than it used to be. However, for independent telephone companies, higher-priced access charges still represent a more significant revenue stream.
- Rate averaging: Regulators traditionally have set rates for urban and rural customers at similar if not identical levels. For customers of large companies that serve both kinds of customers, the effect of rate averaging is that rural rates are kept lower and urban rates higher than they might otherwise have been.
- Other rate design tools: Charging by the minute for local calls and having small local calling areas are techniques that regulators have used to keep down the price of the most basic level of service, especially when that rate would otherwise be a high one.

Table 5.2:
Lifeline subscribers and Federal dollars 1995-2002

	Vermont Subscribers	Federal Dollars to Vermont
1995	25,624	$1,094,178
1996	24,791	$1,039,649
1997	25,356	$1,064,932
1998	26,475	$2,214,987
1999	28,464	$2,403,381
2000	29,740	$2,646,801
2001	30,235	$2,902,466
2002	29,621	$3,193,140

Source: FCC, Trends in Telephone Service, August 2003.

FEDERAL UNIVERSAL SERVICE SUPPORT

The Telecommunications Act of 1996 for the first time in federal statutes codified several important universal service goals as national statutory objectives (see sidebar, "Federal Universal Service Goals") and required the Federal Communications Commission (FCC) to provide sufficient support to achieve those goals. The most important goal for Vermont relates to reasonably comparable rates in rural areas: "access to telecommunications and information services, including…advanced telecommunications… services that are reasonably comparable to those services provided in urban areas and that are available at rates that are reasonably comparable to rates charged for similar services in urban areas."

While the FCC has taken steps to implement this section, the results to date are less than completely satisfactory for Vermont. The FCC addresses the universal service task under two systems. One system applies to what the FCC calls "rural telephone companies." In Vermont there are nine independent telephone companies in this group. The second system applies to so-called "nonrural" companies; in Vermont this means Verizon-Vermont. Funding for larger so-called "nonrural" companies is far less generous, largely because the FCC assumes that each such company has large low-cost urban areas that can contribute to costs in high-cost rural areas in the same state. Unlike many states, Vermont has no large metropolitan area, and it is harder-pressed to support rural areas with internal contributions.

The FCC has used a formula to determine high cost support for large companies. That formula was challenged by Vermont and a number of other rural states. The federal appeals court reversed the FCC and remanded the issue for further consideration. The FCC has revised its formula. Its method still has two flaws for Vermont. One, the formula compares the cost of serving rural areas like Verizon's rural Vermont service areas to national average costs, not to urban average costs, which are lower and which are mentioned in the law. Second, it fails even to provide

Federal Universal Service Goals
Sec. 254 of the 1996 Telecommunications Act

(1) QUALITY AND RATES.--Quality services should be available at just, reasonable, and affordable rates.

(2) ACCESS TO ADVANCED SERVICES.--Access to advanced telecommunications and information services should be provided in all regions of the Nation.

(3) ACCESS IN RURAL AND HIGH COST AREAS.--Consumers in all regions of the Nation, including low-income consumers and those in rural, insular, and high cost areas, should have access to telecommunications and information services, including interexchange services and advanced telecommunications and information services, that are reasonably comparable to those services provided in urban areas and that are available at rates that are reasonably comparable to rates charged for similar services in urban areas.

(4) EQUITABLE AND NONDISCRIMINATORY CONTRIBUTIONS.--All providers of telecommunications services should make an equitable and nondiscriminatory contribution to the preservation and advancement of universal service.

(5) SPECIFIC AND PREDICTABLE SUPPORT MECHANISMS.--There should be specific, predictable and sufficient Federal and State mechanisms to preserve and advance universal service.

(6) ACCESS TO ADVANCED TELECOMMUNICATIONS SERVICES FOR SCHOOLS, HEALTH CARE, AND LIBRARIES.--Elementary and secondary schools and classrooms, health care providers, and libraries should have access to advanced telecommunications services…

(7) ADDITIONAL PRINCIPLES.--Such other principles as…are necessary and appropriate for the protection of the public interest, convenience, and necessity and are consistent with this Act.

support for any rural costs that are less than two standard deviations above the national average cost.

Federal action other than that dealing with the Universal Service Fund could also have an impact on universal service by impacting the affordability of telephone service. The FCC has had a long-pending Notice of Proposed Rulemaking that considers eliminating access charges, the payments that long distance companies make to local companies. (See the subsection on "Federal Preemption" in Section 1, "Telecommunications Trends.") Many conceptual proposals for replacing the lost revenue from access charges involve increases in subscribers' recurring monthly charges. Rural independent telephone companies in particular get a significant proportion of their revenue from access charges, and the necessary increases in subscriber charges could be especially large for the customers of these companies unless there was an increase in some other form of support such as federal universal service support.

In theory, federal action to promote universal service might also extend to broadband services. Section 706 of the Telecommunications Act states that the FCC "shall…regularly…determine whether advanced telecommunications capability is being deployed to all Americans in a reasonable and timely fashion." The section continues, "If the Commission's determination is negative, it shall take immediate action to accelerate deployment of such capability by removing barriers to infrastructure investment and by promoting competition in the telecommunications market." To date, the FCC has not made a negative determination. In summary, while Vermont might have expected greater assistance from federal policy in meeting goals of affordability and deployment of broadband services, that help has been limited and may continue to be so.

Strategies/Action Plans

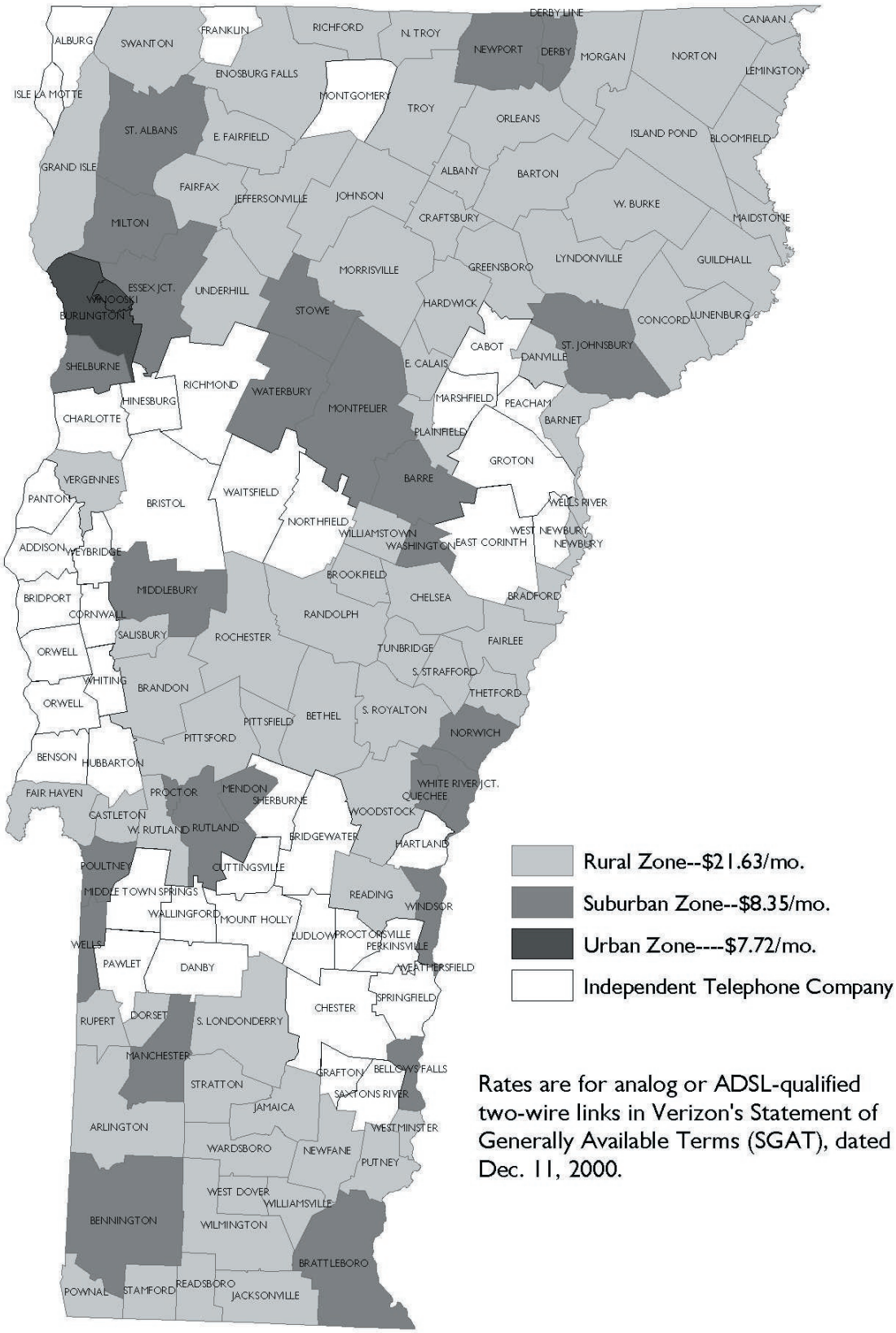
- The Public Service Board (PSB), Public Service Department (PSD), and Vermont's federal lawmakers should all advocate for Federal policies and programs that support universal telephone service in rural Vermont as well as measures that ensure that advanced telecommunications services are universally available to Vermonters.

STATE UNIVERSAL SERVICE SUPPORT FOR HIGH-COST AREAS

In the past, Vermont has helped to offset the higher cost of providing telephone service in sparsely populated areas by setting rates that were similar in rural and more urbanized parts of the state (so-called "rate averaging") and by allowing rates charged to long distance companies by local service providers to bear a disproportionate share of the cost of the network, relative to the rates charged to local customers. These techniques have been important parts of maintaining universal service, and both are under pressure by competition and technology change. Vermont can continue to fund universal service by changing the ways it supports universal service. At the same time, it is a good time to re-examine what are the essential basic telecommunications services. While Vermont should re-tool the way it funds universal service in high-cost areas, it is important to realize that this is an update of longstanding public policy, not brand new policy.

In the past, regulators had greater power to manipulate rates to achieve public

Figure 5.1:
Verizon deaveraged wholesale loop rates



policy goals, and a prime goal was low-priced dial tone. However, competition is now the favored means of restraining prices (as well as meeting a variety of other policy goals), and this requires progressively giving carriers more power to set their own prices without close oversight. Competition for local dial tone service has come to business markets and more recently to residential markets. In a marketplace that increasingly relies on competition over regulation to restrain prices, it is important to reduce barriers to competition in low-density areas. However, a little-understood interaction between federal competition policy and universal service policy limits the spread of competition in rural markets. To provide service to customers Competitive Local Exchange Carriers (CLECs) often rely on Verizon facilities, especially the local loop (the last link between a telephone company central office and the customer's premises). CLECs lease these facilities at wholesale. By FCC order, the wholesale prices for these facilities must be "geographically deaveraged." In other words, the prices for areas that cost less to serve (typically high-density areas) must be priced less than high-cost areas to serve. The PSB has responded by dividing Verizon's exchanges into "urban," "suburban," and "rural" groups. (See Figure 5.1.) Wholesale unbundled loop rates for the rural exchanges are significantly higher than those for urban and suburban exchanges. In the meantime, Verizon's retail rates for local telephone service are averaged across its footprint, containing essentially an internal subsidy that allows rural dial tone to cost less. In fact, Verizon's retail price is less than the price of its wholesale rate for a local loop in a rural exchange. As a result there are few, if any, CLECs providing service in rural exchanges except to businesses that are prepared to spend more on a larger bundle of services provisioned over the loop. This lack of competition for small customers appears unlikely to change except where the competing service is provided over the competitor's own facilities, such as in the case of a cable or wireless company—and these facilities are more expensive to deploy in rural areas as well. One response could be to deaverage Verizon's retail dial tone rate as well. The result could be very high prices for telephone service in rural exchanges, hardly a result supporting universal service. The other alternative is to create a mechanism that mimics in a competitive market that which happens internally in Verizon's averaged retail rate—rural areas receive extra cost support. A state high-cost fund is the mechanism to achieve this. The original legislation creating the Vermont Universal Service Fund in 1993 contemplated a high-cost area component of the fund coming into being upon further legislative action. That action never materialized. Today, a high cost area fund should reflect the developments of technology since 1993.

Present Definitions for Basic Service

The current set of basic services, as defined by the statute establishing eligibility for Vermont Universal Service Fund (USF) support, includes switched voice-grade service, the ability to transmit switching instructions through tones in customer-owned equipment, the ability to transmit and receive computer-generated data, reliably and at common transmission rates using customer-owned equipment, and the ability to reach emergency services and telecom relay services (30 V.S.A. § 7501(b)(1)(A)-(E)).

In its Order in Docket 5713 - Phase I, the Public Service Board concluded:

> Basic service . . . should consist of 1) single party service, 2) continuous emergency access and 3) the availability of extended area service. Bell Atlantic eliminated multi-party service in early 1999. Single party service itself should be made up of several components: switched voice grade communications, access to toll service, and relay service as appropriate. In addition, installation and repair services, white pages (or equivalent) and directory assistance should also be elements of the basic service package. . . basic service must [also] include certain minimum service quality, consumer protection, and privacy assurances. (PSB Order, Docket 5713 Phase I, 5/29/96, 65.)

Universal service policy has concerned itself most prominently with supporting affordable access to basic service. "Basic service" has traditionally meant voice telephone services and a collection of voice service enhancements such as E 9-1-1 and touch tone. We now see that an overwhelming majority of Vermonters are Internet users and every day it is a more indispensable business tool. According to the PSD's periodic surveys in 1999, 5% of all Vermont businesses and other non-residential organizations made business-to-business transactions over the Internet. In 2003, that figure was 43%. It would be wrong, however, to think that Vermont businesses will be able to compete while conducting business on-line over dial-up connections. Packet data services and Internet access have not yet reached the level of importance that voice telephony currently occupies. Therefore, in a present-time sense these do not yet qualify as "basic service." Yet it would be wrong to minimize their importance. The telecommunications network of tomorrow (and to a significant extent, today) is a packet data network. This does not mean voice is going away. The voice service of tomorrow will, in all likelihood, be an application on a packet data network based on Internet Protocol or some successor. It will work as well if not better than the voice service we know today. Tomorrow, the essential service for homes and businesses will not be a voice telephone line on which we sometimes send data via modem. It will be a data telecommunications service over which users send voice, as well as many, many more applications. This is already coming to pass. Internet access has already grown to become fundamentally embedded in business and work, education, government, and social interaction. Therefore, it is time to treat packet data service as the emerging basic service.

In 1999, 5% of Vermont businesses and other non-residential organizations made business-to-business transactions over the Internet. In 2003, that figure was 43%.

State and federal universal service funds do not currently address broadband. Federal universal service policy may eventually do so through the section 706 process, but Vermont cannot afford to wait for possible future FCC action. Moreover, a state high-cost fund can address other issues as well. It can address the lack of rural access to telephone service choice and support the deployment of rural broadband by focusing on the basic element that underlies them both—the last mile link. It can also provide a mechanism for reducing rural independent telephone companies' reliance on above cost access charges to support affordable dial tone rates. (For more on this last issue, see the subsection on "Rates" in Section 8, "Vermont Telecom Regulatory Policy.")

Policies

- By the year 2007, at least 90% of Vermont's homes and businesses should have broadband Internet access at prices comparable to those available in the commercial centers of the state.
- While packet data services may not qualify as "basic service," under pre-existing universal service programs intended to support affordable voice service, they should be regarded as emerging basic services.
- Whenever possible, support for basic voice telephony service should not be structured in such a way as to preclude its use for "dual use" networks—packet data networks that can support carrier-grade voice telephony.
- The benefits of opening the Vermont telecommunications market to more competition should flow to all consumers. Imposing barriers or constraints on competitive services to preserve universal service is likely to provide

only temporary relief, hamper efficiency, and delay services that would benefit the basic service customer.

Strategies/Action Plans

- The legislature should authorize a new fund to support rural telephone and broadband links capable of supporting telephone service in areas with a high cost to provide service.
  - Service providers should receive from the fund a credit for each access line or line equivalent served in rural zones defined from time to time by the PSB.
  - To provide revenue for the fund, the PSB should be authorized to impose a charge on each access line or line equivalent across all service providers. Lines or line equivalents eligible to receive support should be exempt from paying the charge.
  - Charges should be imposed on and credits given to providers offering retail service, not to retail customers, so as not to increase the complexity of customer bills.
  - Charges and credits should apply to both voice and data lines or line equivalents. The PSB should be authorized to establish and adjust a level of data "basic service" for the purposes of calculating cost requirements.

THE EXISTING STATE USF CHARGE

The Vermont Universal Service Fund (USF) has been operating since 1994. How the state will sustain a stable and viable base of contributions to this fund in the face of changes in how communications services are regulated is an emerging issue. The Vermont USF charge today applies to all telecommunications services provided to a Vermont address. Telecommunications services are defined generally as "transmission of any interactive electromagnetic communications that passes through the public switched network."[2] The statute provides examples of services that are included and services that are excluded.

The charge is collected by "telecommunications service providers," defined as any:

> ...company required by law to hold a certificate of public good from the public service board to offer telecommunications service for intrastate service, or is authorized by the Federal Communications Commission to offer interstate telecommunications service.[3]

A telecommunications service provider must impose the charge on its customers' bills for telecommunications services, must collect customer payments, and must remit those payments to the state's fiscal agent. The rate is set annually by the PSB and varies from year to year depending on the expenses of the programs it supports. Under law it cannot exceed 2.0%.

Unfortunately, these definitions differ slightly from the definitions used to establish which companies are subject to the jurisdiction of the PSB, and they are becoming more difficult to interpret in light of new services. Voice and data services are converging with the

Table 5.3:
VT USF fiscal year 2004 budget

E-911	$3,241,031
Lifeline	$1,468,355
Telecommunications Relay	$436,002
Relay "Adaptive Equipment"	$75,000
Administrative	$163,000
Total	**$5,383,388**

growth in Voice over IP (VoIP) services. Broadband services used for Internet access have not been subject to the charge, but now there are "broadband phone companies." The PSB has not formally addressed whether various cable, telephone, and wireless broadband services that combine Internet access with a communications facility should be subject to Vermont USF surcharges. To sustain the programs funded by the Vermont USF, state policy must provide for a stable base on which it can impose the charge. If consumers migrate their spending to services on which the charge is not imposed, then the goals of the program will suffer without some other funding source. At the same time, equitable treatment of similar services is desirable, and the fund should not be applied unnecessarily to new services.

Policies

- Functionally similar services should or should not contribute equally to the Vermont USF regardless of the technology used to deliver the services.
- The universal service charge that funds voice-related programs like E 9-1-1 and relay should be levied on services sold to Vermonters that provide voice capability and that rely at least in part on the Public Switched Telephone Network (PSTN) and that use telephone numbers.
- The question of whether or not a service provider is obligated to collect for the Vermont USF should not necessarily be linked to the question of whether the service provider is regulated by the PSB. In other words, it may be desirable that some voice-related services contribute even if they are not regulated; it may be desirable to have some regulated services that do not contribute; and it should not automatically follow that a contributing service should be regulated.

Strategies/Action Plans

- The legislature should clarify the definition of "telecommunications services" contained in Chapter 88 of Title 30 in line with the policies presented above.

TELECOMMUNICATIONS TAXATION

Unfortunately, over the years, telecommunications and cable services have become the subject of an increasing level of taxation. Act 60 introduced a sales tax of 4.36% on telecommunications services. Act 68 of the 2003 session increased this tax (along with all other sales taxes) to 6%. Sales and use tax also applies to purchases companies make on equipment to be installed in Vermont. As the level of taxation for non-telecommunications purposes on telecommunications rises, not only do Vermonters pay more for an essential service, there is also more resistance to charges that actually contribute to universal telecommunications access.

On the property tax side, differences exist in how the personal property of telephone and cable companies (like their outside plant) are taxed. Cable companies' property is taxed with a conventional property tax while that of telephone companies is the subject of a special, statewide alternative tax. These taxes have different tax rates and different methods of establishing property value. These

differences are discussed in greater detail in a 2000 report by the Departments of Taxes and Public Service entitled, *Broadband Deployment and Taxation in Vermont*. Trends in technology indicate that this differing tax regime will become increasingly unworkable over time. In particular, it is likely that cable companies will sooner or later introduce telephone services in Vermont. These services will use the same infrastructure as cable television, thereby placing the proper classification of this infrastructure in doubt. Furthermore, cable and telephone companies are already both selling functionally similar broadband services (cable modem and DSL services) to Vermonters.

Policies

- Infrastructure used for providing telecommunications over cable, telephone or wireless should receive similar property tax treatment.
- Telecommunications services should not be the subject of new special taxes to fund non-telecommunications purposes.

Strategies/Action Plans

- When opportunities arise to reduce taxes on telecommunications, highest priority should be given to taxes on investment in new infrastructure, especially infrastructure for high-speed data services and mobile services, followed by consumption taxes imposed on telecommunications services.
- The legislature should proactively move property taxation of cable companies and telephone companies to a single system.

DISABLITY ACCESS

The mass migration of communications to data networks is in some ways converging the communications of the hearing- and speech-impaired and the rest of the community. While many disabled Vermonters have relied for years on a long-standing form of "instant messaging"—the TTY or text telephone—it now seems that the rest of the world has discovered instant messaging on the Internet and on mobile phones. Computers can now function as TTY's and any computer with an Internet connection can now provide relay service without long distance charges through Internet Relay. Users type their conversation on a web page and the communications assistant calls the desired party on the telephone. Furthermore, as videoconferencing moves to the desktop the implications for the deaf and hearing impaired can be profound. For many of these individuals, written and spoken English is a second language and using a TTY is the rough equivalent of a hearing English speaker using the telephone—but having to do so in Greek. American Sign Language (ASL) is a language that cannot be typed or heard, but requires a visual medium, a visual that video conferencing provides. Despite these developments, one should not exaggerate the extent to which barriers to access have come down. Neither text messaging nor videoconferencing yet have the universal adoption of the telephone, and therefore cannot yet completely replace services that adapt the telephone to the needs of disabled people. Relay services act as a vital bridge.

About 3,000 Vermonters are deaf, and approximately 20,000 more are hard-of-hearing.

Vermont, as well as all other states, provides access to a relay service (see "What is Relay Service" below) that links conventional telephones and TTYs. A rela-

tively new service, video relay service, allows users with a broadband Internet connection and a connected video camera to communicate in sign language to a communications assistant, who acts as the bridge to a telephone user. While states and the federal government share the costs of relay service along an intrastate/interstate split, the costs of video relay have in the past been paid entirely through the FCC on an interim basis. There is a significant likelihood that the FCC will implement a means of identifying where the video users are "calling" from and revert to splitting these costs with states. This represents potentially very high costs for the state. The rate Vermont has paid in the past for traditional relay service is less than $2.00 per minute, as part of a total relay program cost of less than half a million dollars per year. In 2003, the FCC set its reimbursement rate for video relay service at $7.75/minute. Clearly, the state cannot support video relay under the current funding mechanism and levels for the state universal service fund.

For the visually impaired, the increasing amount of content available on the World Wide Web can produce frustration, if that information is not made accessible. Vermont state government should do its part by assuring that state web sites do not throw up barriers.

Policies

- Vermont should make a priority support of technologies that allow hearing and speech-disabled Vermonters to communicate in familiar modes including ASL. Video Relay is a current example of such a technology.
- Vermont should continue to support the use of broadband services to deliver voice-to-text services. Internet relay is a current example of such a technology.

What is Relay Service?

The Vermont Telecommunications Relay Service (VTRS) is a telephone service that the Americans With Disabilities Act requires every state to provide. Through the service, specially trained communications assistants relay messages between hard-of-hearing, speech disabled, or deaf people who use text telephones and related equipment, and people who communicate via regular telephone. To communicate, a hard-of-hearing, speech disabled or deaf person uses a text telephone (TTY)—a telephone with a keyboard and a small screen—to type his or her part of the conversation. The communications assistant simultaneously receives and reads the messages to the hearing person at the other end of the line. The communications assistant then types back the hearing person's spoken words to the TTY user. The service also includes "speech-to-speech" relay in which a communications assistant, trained to understand people with speech disabilities, repeats the speech-disabled person's conversation to the other party. Speech-to-speech is a new feature and is presently underutilized due to lack of public awareness.

Users reach the relay service by dialing 7-1-1 or one of several toll-free numbers. The service is provided at no cost to the caller or the called party, and long distance charges are billed as if the caller had placed the call directly to the called party without the communications assistant as intermediary. The service has greatly enhanced the ability of deaf, hard-of-hearing and speech disabled persons to communicate with friends, family, business associates, doctors and others with whom contact is essential to full participation in society. For more information, visit http://www.vermontrelay.com.

- State government Web sites should provide appropriately accessible communications for all users.

Strategies/Action Plans

- Assistance programs for the deaf, hard-of-hearing, and speech impaired should continue to provide assistance for devices usable with broadband telecommunications.
- If the FCC ceases to fund video relay, the legislature must review and explicitly decide whether the state will fund the full cost of video relay and designate a new or expanded funding mechanism for it.
- Vermont Emergency Management officials should incorporate new modes of communication such as wireless text messaging into emergency alert systems.
- The E 9-1-1 Board should continue to work with national standard-setting groups to identify standards for the use of text messaging devices for emergency communication.

(Endnotes)

[1] Federal Communications Commission (2002). Trends in Telephone Service, p. 17-4. Telephone penetration rate are as of July 2001.

[2] 30 V.S.A. § 7502(b)(5)

[3] 30 V.S.A. § 7502(b)(6)

Telecom Infrastructure and Service Development

Vermont has achieved universal telephone service and has built an infrastructure to support it. The telecommunications network that will meet the needs of Vermont's society and economy going forward must support a range of telecommunications services—high-speed data services, mobile services, as well as traditional voice and video. It must do so affordably and over a network that is inherently reliable. Vermont must find new ways to accelerate infrastructure development and encourage the introduction of new services. This will include mitigating obstacles that range from low customer density and incomplete customer awareness of services to capital availability and lengthy regulatory review processes. To have robust telecommunications networks that provide an array of telecommunications services requires both a ready supply of service and the demand that will support the providers who serve Vermont. This section deals with policies and actions that will help improve the telecommunications marketplace in Vermont and help Vermonters apply the tools of telecommunications to their lives.

GOALS

Vermont should seek a high standard of quality in its telecommunications infrastructure. To this end, it is important to describe what such an infrastructure would look like. This is especially difficult in the fast-changing realm of telecommunications where today's high speed is tomorrow's slow lane. There are general characteristics of a high-quality infrastructure that change more slowly. In laying out these characteristics, it is useful to divide networks conceptually into several pieces. The "last mile" or "distribution" infrastructure connects end users to local sites (like central offices, cable headends or hubs, cellular sites, wireless and other forms of access points) where service providers focus their local equipment. The "middle mile" or "transport" infrastructure connects these local access points in networks that reach through the state or its immediate region. The "first mile" or "backbone access" infrastructure provides Vermont's connections to the long-haul telecommunications networks of the country and the world. In addition, there are distinct desirable characteristics of those parts of Vermont's telecommunications networks that serve not fixed locations, but mobile services. Each of these conceptual pieces of the network has a set of desirable characteristics that Vermont should seek to achieve and maintain.

"Last mile" (or "distribution") infrastructure should:

- be universally available;
- support widespread use of high-speed packet data services by consumers throughout the state;
- have a clear migration path to support ever higher speeds as needed;

- be designed to readily support a variety of services offered by a variety of service providers, either through one or multiple sets of physical facilities.

These characteristics ensure that Vermonters will have access to new and emerging telecommunications services and will have options for how those services will be used to their benefit.

"Middle-mile" (or "transport") infrastructure should:

- reach all key locations in the state;
- be evolving so as to be moving closer to customers;
- use redundant routes and have physical redundancy from multiple carriers;
- be readily scalable;
- serve a variety of service providers.

These characteristics provide fair access to all regions and locales in the state, promote reliability, and are consistent with a competitive telecommunications market.

"First mile" or "backbone access" infrastructure should:

- provide ways to enter or exit the state over facilities from multiple regions of the state;
- use redundant routes and have physical redundancy from multiple carriers;
- be readily scalable;
- serve a variety of service providers.

These characteristics stress reliability and ready access to the robustly competitive telecommunications marketplace beyond Vermont's borders.

Mobile wireless services should:

- be available continuously along Vermont's principal numbered interstate, U.S. and state highways, and in all significant concentrations of population;
- be available in all regions of the state from at least three service providers;
- support emerging packet-data based services commonly found around the country, as well as voice.

These characteristics are important if users are to perceive Vermont's wireless services as dependable, up-to-date, and competitive.

In addition, it is important that all levels of Vermont's telecommunications infrastructure be in good repair and dependably maintained.

SPECIFIC DESIRED IMPROVEMENTS

When comparing these general goals against technology trends described in Section 1 of the plan, against service availability data found in Section 3 and against proprietary network information provided by telecommunications service providers, a number of desirable improvements come to light in each of the four conceptual pieces of Vermont's telecommunications infrastructure. Each of these specific improvements would represent clear and meaningful progress toward the goals of the plan.

Last mile improvements:

- Consumer-grade and small-business-grade broadband services including Digital Subscriber Line (DSL) or cable modem services and comparable services available to 90% of homes and businesses that have access to a telephone by 2007.
- Access to a packet-based, mass-market broadband infrastructure for all homes and businesses that have access to a telephone by 2010.

These improvements are important milestones on the road that leads to the new universal service, as described in Section 5.

Middle mile improvements:

- Route diversity for voice and data traffic carried between all local exchange company central offices, such that local areas are not isolated by single cable cuts or equipment failures.

This improvement is essential for Vermont to insulate itself from regional network failures that endanger business and economic activity as well as the public's safety. Much of Vermont's telecommunications network already meets this standard but it should be consistently met throughout the entire state.

First mile improvements:

- An additional route-redundant, carrier-neutral, high-capacity fiber optic link via southwest Vermont to Albany.
- An additional route-redundant, carrier-neutral, high-capacity fiber optic link from Vermont to Quebec.

These routes will increase the diversity of the small number of large

What is "broadband?"

The goals of this section purposely do not provide a specific numerical definition for the term "broadband" because the meaning of this term will evolve as data networks nationwide and around the world offer more and more capability to their users. Networks in Vermont must also be capable of evolving to keep up with this progress. Currently, the Federal Communications Commission (FCC) defines "high-speed services" as those having a data transmission capability of at least 200 kbps in one direction, and "advanced services" as those having a data transmission capability of at least 200 kbps in two directions. In Vermont in 2004, broadband services sold to residential users often have maximum download speeds in excess of 1 or even 2 Mbps, while upload speeds are usually lower, around .5 Mbps or even less.

It is important to recognize that Vermont needs not just a single type of broadband service but a family of service tiers capable of meeting the needs of various users affordably. In particular small business users may need services that offer bandwidth that is high in both upstream and downstream directions, and not just asymmetrically high. Small business and some other users may also require that their broadband services support certain features that increase the usefulness of the service, such as the ability to support servers, and the ability to connect the service to a Local Area Network (LAN).

voice and data pipes that connect Vermont to the outside world. They will also provide Vermont companies with greater access to a wider range of national and international backbone providers at the favorable rates in these markets.

Mobile wireless improvements:

- 100% handheld phone coverage along all interstates, plus Routes 2, 4, 7, and 9 on both the GSM/GPRS and CDMA digital standards by 2007.
- 100% handheld phone coverage on all numbered state highway routes on both the GSM/GPRS and CDMA digital standards (or their successors) by 2010.
- Reasonably priced mobile walkabout "Wi-Fi" in all designated downtowns, all highway rest areas, welcome centers, and in significant resort locales.

These improvements represent a minimum level of mobile wireless service that will be required to send the message that Vermont is "open for business" to local businesses, businesses considering locating in Vermont, and the traveling public. They will help send the message that Vermont has a modern, capable telecommunications infrastructure. Anything less will cause users repeated frustration and tar the state with a reputation of technological backwardness.

This list is not intended to be an exhaustive list of desirable improvements to Vermont's telecommunications infrastructure. Nevertheless, these improvements would be tangible benefits for the state. There is no one way to achieve all of these specific improvements—there will be a variety of applicable tools. Initia-

Leadership for Infrastructure Advancement

In 2003, Governor Douglas, by Executive Order 15-03, directed the Agency of Commerce and Community Development to be the Agency responsible for statewide leadership to address expansion of Vermont infrastructure for wired and wireless voice and broadband communications, and created a Telecommunications Advisory Council to assist the Agency in this role. In 2003, the Agency also created the position of Director of Telecommunications Infrastructure Advancement to serve as the point person for its activities in this area.

The Executive Order directed the Agency to perform the following functions:

- Lead the effort to create the vision for Vermont's telecommunications infrastructure, and establish goals and objectives to achieve the vision, in coordination with the Department of Public Service's Telecommunications Plan, and in conjunction with key stakeholders;
- Develop a work plan with activities, milestones and identification of the entity or individual responsible for achieving the goals and objectives and provide strategic planning and annual review of such plan to ensure accountability, including goal setting and ongoing measurement and reporting of milestones and accomplishments;
- Coordinate activities and initiatives among state agencies and departments, non-government groups, regional partners and other key stakeholders to ensure ongoing collaboration of efforts around telecommunications development throughout Vermont (including encouraging the involvement of local communities and regions of the State as appropriate and necessary);
- Research and benchmark best practices in other states and communities and be the central repository of knowledge on telecommunications-related activities and projects for both the demand and supply sides in Vermont;
- Identify activities requiring funding to advance the State's telecommunications objectives, and work to secure available private, state, and federal funding;
- Recommend legislative and administrative policies that will support the development of quality telecommunications infrastructure and services in Vermont, and advise the Governor and cabinet members on matters of telecommunications policy;
- Serve as a primary point of information and guidance for the Administration and the Department of Information and Innovation on telecommunications policy; and
- Work with State communications and public relations resources to develop marketing and outreach materials in order to communicate the need for, and the potential of, a competitive telecommunications infrastructure in Vermont and the State's telecommunications needs, resources, initiatives and accomplishments.

Assignment of this role to the Agency and creation of the Director position are instrumental parts of accomplishing many elements of this plan, especially the elements of this Section.

tives that can achieve these specific ends should receive special consideration in a range of venues including alternative regulation plans, other utility regulatory proceedings, loan and grant programs, land use planning and regulation, state purchasing, capital budgeting, and demand aggregation and stimulation programs.

FINANCING INFRASTRUCTURE AND SERVICES

Financing continued progress in modernizing Vermont's telecommunications networks is a significant investment, one that will continue to be financed primarily with private dollars. Government involvement should complement and leverage this private sector funding. Providing assistance that helps service providers finance capital improvements to deliver better telecommunications infrastructure and services addresses a key challenge that many service providers face.

Providing financial assistance is in some cases a question of using existing resources better. The federal government has a number of programs to provide support for rural telecommunications that are underutilized in Vermont. New state resources are also coming on line. This includes the Vermont Economic Development Authority's (VEDA) Technology Infrastructure Financing Program. Both for-profit and non-profit entities will be eligible to borrow from this fund for a variety of purposes including the purchase of customer premise equipment, the construction (including upgrading) of new communications infrastructure, and the installation of equipment to bring the network online. Other possible sources of funding to assist the development of telecommunications infrastructure are traditional community and economic development sources, such as Community Development Block Grants (CDBG) and the U.S. Department of Commerce Economic Development Administration (EDA) grants. The fact that these programs serve a variety of needs limits the extent to which they can be used for telecommunications. Nevertheless, as the importance of telecommunications grows in the economy and the community of Vermont, it makes sense to treat telecommunications as an infrastructure on par with the other types of infrastructure on which these programs have traditionally focused.

There may be some instances where private sector dollars to build the networks Vermont needs are not forthcoming, or not forthcoming in a timely manner. In those instances, direct public investment may be a necessary tool, but private investment is preferred. If there is direct public ownership of pieces of Vermont's telecommunications network, its most important role should be to facilitate the financing of an open-access telecommunications platform that can still be used by various private sector businesses to provide service to customers.

Policies

- The participation of state, regional, and local economic and community development organizations and programs in providing financing assistance for telecommunications infrastructure is supported.
  - Economic and community development assistance should not be used to displace private investment but should be used to enhance access by private service providers in hard-to-serve areas.

- Private sector investment is preferred as the primary source of funding improvements to telecommunications networks in Vermont. Direct public investment by the state in building common carrier telecommunications networks should be an option where private sector investment has failed to meet state and community needs and is likely to continue to do so.
  - If there is direct public ownership of pieces of Vermont's telecommunications network, it should be structured so as to maximize the opportunities for private sector providers to offer services to users over the network on an open basis.

Strategies/Action Plans

- The Agency of Commerce and Community Development (ACCD) should periodically inventory the variety of state and federal telecommunications funding opportunities that are available. This includes, but is not necessarily limited to, the U.S. Department of Agriculture's Rural Broadband Loan and Grant Program, the Rural Telephone Bank, federal universal service programs, and the VEDA Technology Infrastructure Financing Program.
  - ACCD should benchmark the extent or percentage of available funds awarded to Vermont as an indicator of the state's success.
- ACCD should strive to create financial incentives that will improve the return on investment for service providers in rural areas. This should include at a minimum tax policies in line with those outlined in Section 5.
  - ACCD should periodically monitor the effect of any financial incentive to ensure that the desired outcome is being achieved.
- ACCD should establish or provide support for a process to solicit private sector service to meet needs in unserved or underserved communities in Vermont that can be used prior to concluding direct public investment is needed as a financing tool.
- ACCD should examine efforts that have been implemented in other states and jurisdictions for models of how the public sector can support investment in telecommunications infrastructure.

COMMUNITY AGGREGATION

Simply put, aggregating demand is "building the market." The goal of any aggregation strategy is to create market demand sufficient to attract investment by telecommunications service providers without having to rely on public infrastructure investment. For a telecom provider, organized demand creates access to a customer base that represents real value. One Vermont-based service provider recently placed the value of demand aggregation, through marketing savings, at approximately 15-20% of the total cost of a new telecommunications initiative. In addition, the cost savings are comprised largely of up-front costs. The ability to demonstrate demand means that obtaining financing, especially in a tight capital market, becomes less daunting. An aggregate can serve as a "market-maker" even in a region short on competitive market choices.

While not a panacea, community aggregation can complement actions called for elsewhere in the plan including loan and grant programs, marketing, and

using state purchasing to create incentives or assistance for service providers to bring service to underserved areas. Community aggregation requires significant investments of time by people "on the ground" in local communities, performing the kind of labor-intensive identification of users that can be prohibitively expensive for service providers. Municipalities and other local organizations can take the lead in these efforts, or be part of a coalition of local partners. State-level organizations such as ACCD, the Vermont Broadband Council, and the Vermont Council on Rural Development (VCRD) can add value by coordinating the work that goes on in various communities, providing a road map, professional assistance, and resources about potential users and providers across multiple towns. The state has already provided support for the VCRD's community aggregation effort through the 2003 capital budget. This effort is an excellent foundation on which to build further efforts.

Policy

- The state should support community aggregation projects in underserved communities.
- Municipalities are encouraged to be partners in community aggregation efforts.

Strategies/Action Plans

- As state funding opportunities become available, the state should seek to provide sufficient funds through ACCD or another agency to expand aggregation to at least several community aggregation projects in underserved rural communities in the next year of a program in addition to those already underway.
  - The VCRD or a similarly qualified organization should oversee the program and assist local communities organize efforts. Regional Planning Commissions (RPCs) should provide assistance in their respective regions.
  - The program should verify that the money provides significant successful outcomes in the communities through attracting additional new or lower-cost services to those targeted communities.
  - If the program continues to be successful, the state should fund additional communities in subsequent years until last mile infrastructure goals are met.
- ACCD should help publicize an on-line registry, such as the one maintained by the VCRD, where unserved potential users of broadband and wireless telecommunications services can register their desire to obtain service and their willingness to be contacted.

RIGHT-OF-WAY ACCESS

Access to rights-of-way (ROWs) represents a key element of telecommunications infrastructure development. Continuous rights-of-way are difficult to assemble, therefore once assembled, holders are often in a position either to be catalysts for telecommunications service or alternatively to slow its progress. It is in the public interest that telecommunications and cable TV services face

minimal barriers to use of public rights-of way. Recent efforts by the Public Service Department (PSD) and the Public Service Board (PSB) to improve the rates and other terms and conditions faced by new attachers to utility poles were an important step forward. (See also the subsection, "Pole Attachment Policy" in Section 8, "Regulatory Policy.") Cost-effective access to transportation ROWs is also beneficial.

The price of access to state transportation ROWs by telecommunications service providers varies. Prices for highway ROWs are favorable. State policy has allowed telecommunications infrastructure in highway ROWs and has not required a lease payment to the state for telecommunications utilities to use highway ROWs. On the other hand, there has been a lease payment required on state-owned rail systems. State law directs the Vermont Agency of Transportation (VTrans) to seek fair market value for leases of state-owned railways, although it allows the Agency to bargain for less than fair market value when the proposed use serves a public purpose. Access to state-owned railways may in some cases be complicated by the fact that the state has leased the railway to private railroads, along with the right to bargain for ROW access; the state only receives a share of the lease payment that the private railroad negotiates with a telecommunications company. Nevertheless, the state should seek to do what it can to maximize the opportunity that rail as well as highway ROWs provide to promote the development of telecommunications infrastructure.

Beyond addressing the lease payments collected from telecommunications service providers for access to utility poles, railways and roads, there may be additional opportunities for state and municipal agencies to lower the cost of infrastructure deployment over the long run. Construction and major maintenance of roads or other infrastructures in the roadway (such as water or sewer lines) sometimes represent special opportunities to provide for present or future communications infrastructure through the laying of conduit while other work is being done. When other work is being done may often be the most cost-effective time to install conduit, and it is usually less expensive to install fiber optic facilities into available conduit than it is to dig a fresh trench or replace utility poles to create additional space. Laying conduit along or in roadway may also have additional benefits besides cost. It may facilitate the future development of Intelligent Transportation Systems (see the "Two Agencies with Expanding Needs" subsection of Section 2, "Initiatives and Activities."). Having conduit available also facilitates underground placement of communications utilities, which has aesthetic benefits. It will take time to create a significant amount of useful conduit, and road work schedules may dictate that the opportunities to place conduit inexpensively are significantly in advance of when it is used. This means that placement of conduit should be part of a long-term, incremental program. Placement of conduit may not always be advisable, but identifying the opportunities to place conduit cost-effectively is a prudent step.

Policies:

- Access for telecommunications projects to publicly owned rail and highway ROWs where space and safety requirements permit is in the public interest and encouraged when the facilities provide service to the public in Vermont.

- Such ROW access should not be seen as a net revenue generator, and the state and municipalities should not seek payments, except to defray costs of installation. In lieu of other compensation the state may seek concessions to provide service or facilities to the state or additional service to communities.

Strategies/Action Plans:

- VTrans and municipal highway departments should evaluate, with advice from ACCD and the PSD, the circumstances under which they should install conduit to support fiber optics when construction, excavation or major maintenance of highways or local roads provide the opportunity to do so.

"HOT SPOT" PLANNING AND DEVELOPMENT

While areas that lack service or are underserved are a special concern, there are many well-served locations throughout the state. Nurturing and publicizing the locations in Vermont that have special telecommunications amenities is important to the telecommunications development of the state. Providing high-quality, robust telecommunications service should not be a matter of favoring one area over another. Businesses and other activities that rely on telecommunications are found in all corners of the state. Nevertheless, there are certain locations where a special effort to ensure a high level of telecommunications service is worthwhile. These include business and industrial parks and commercial centers. Now and in the future, the attraction of sites like these to businesses will be limited without ready access to wired and wireless telecommunications services. Downtowns and resort areas are another area of special concern. Many of these areas (especially downtowns) tend to be the centers of local telephone, wireless, and broadband services. The explosion of Wi-Fi and other mobile wireless Internet technology is changing the expectations of tourists and shoppers around the country. High-speed access to the Internet is an amenity that increasingly users will not want to leave at home or the office, making it an emerging "must have" for many spots that seek to attract large numbers of visitors.

Policies

- Planning and economic development organizations that develop or plan for the development of business and industrial parks should coordinate with ACCD, the PSD, and local service providers to better understand present and future telecommunications options available at potential sites.
  - Business and industrial parks should include prudent provisions for future expansion of telecommunications service, such as spare conduit.
- All downtown and resort areas, working through local downtown associations, chambers of commerce, municipalities, or Regional Planning Commissions, should ensure that wireless Internet access amenities are offered by a service provider in areas frequented by visitors.

Strategies/Action Plan

- The state should offer wireless Internet access to travelers at highway rest areas.

WIRELESS SERVICE DEVELOPMENT

WIRELESS PERMITTING

The permitting system that has been in place for wireless infrastructure since the mid-1990s has had both success and failure. It has been very successful at protecting the Vermont landscape from the worst examples of tower development. Wireless carriers have responded creatively by developing wireless service using existing structures or new structures cleverly designed to blend in with the Vermont landscape, for example appearing like farm silos. The slow pace and often uncertain outcome of proposals for new development has contributed to wireless networks in Vermont that are often spotty (or absent in many rural areas) and slow to respond to growth in usage or demand for new services. During the period since the last plan in 2000, Vermont saw an active period of proposals for the deployment of new wireless infrastructure due in part to financing obtained from capital markets at the tail end of the telecom boom and in some cases build-out deadlines for new FCC licenses. Many proposals failed to pass through the process in time for Vermont to realize the full benefit (in terms of new services and expanded service) of this period of heightened interest. The new service providers who entered the market provided competitive pressure to cut rates and introduce new services like wireless e-mail and Internet. Vermont cannot depend on a similar level of investment interest in the near future. Only recently have capital markets regained some of the past optimism on the telecom industry. It is likely that investors will be most attracted to wireless investments that are relatively certain and can earn a return in a relatively short period of time. Therefore it is important that Vermont have a wireless permitting environment that is competitive with that of other states.

At the same time, wireless infrastructure is growing in importance. No longer merely a toy, novelty, or niche product, wireless services are mainstream services and business tools. Wireless services bring Internet access to areas with few alternatives. By the end of 2004 it is likely that the majority of Vermont households will have a wireless phone. Wireless provides a key future competitor to incumbent telephone companies. Wireless technology also provides the opportunity for multiple companies to bring new choices to the wireless telephone and broadband Internet markets. Wireless technology is providing the opportunity for a number of small, Vermont based companies to enter the broadband Internet access market. PCS companies have brought more competition to traditional cellular companies. Wireless services are key to emergency services. About one-third of calls to 9-1-1 in Vermont are made on a wireless phone. As described elsewhere in the plan, public safety agencies are examining upgrades to mobile wireless services. Without wireless services people (especially those familiar with the explosive growth of wireless outside of Vermont) will not perceive Vermont to have a complete and modern telecommunications infrastructure. This will be an economic handicap. The challenge then is to establish clear paths to success for wireless infrastructure development that will also be acceptable to the larger part of the community.

A more wireless-friendly land-use policy need not result in an unattractive landscape. To significantly improve the quality and extent of wireless service in Vermont requires that policy within the state make it easier for service providers to identify and implement successful strategies that are acceptable to the community. Types of installations and site modifications that typically are approved must make it through the siting process in a short timeframe. Low-impact sites should face fewer levels of review. The wireless industry can also help communities better incorporate wireless service into planning by providing timely information about wireless coverage and gaps. In 2003, the Cellular Telecommunications and Internet Association (CTIA), a national wireless industry group, adopted a voluntary industry "Consumer Code." This code includes a provision that companies complying with the code will provide maps showing where service is generally available, using generally accepted standards and methodologies. This mapping provision should improve the quality of information generally available to the public about the extent of coverage.

Vermont must address the length of the process that even good proposals must face in Vermont if wireless providers are to respond well to meet the state's future needs. Many wireless facility developments must currently undergo multiple layers of review before construction. Legislation passed in the latter 1990s placed wireless developments even as short as 20 feet in height under Act 250 review. Since then, all communities have had the opportunity to develop local zoning that includes wireless development or to develop special ordinances on wireless development. Many communities have now exercised that authority. Vermont continues to need oversight of wireless development, but there may be procedural changes in permitting that can enhance service without harming environmental quality.

Policies

- Wireless telecommunications infrastructure is an important part of a complete telecommunications infrastructure in Vermont and is in the public interest.
  - It is desirable to have PCS and wireless broadband services available to Vermont communities, in addition to traditional cellular telephone services.
- All communities should ensure that local land-use regulations permit service providers to identify practical and economic ways to provide continuous mobile service along interstate, U.S. and numbered state highways, and within concentrations of population.
- All communities should ensure that local land-use regulations permit public safety agencies to identify practical and economic ways to provide continuous mobile emergency communications throughout populated areas.
- All communities should ensure that local land-use regulations permit service providers to identify practical ways to provide fixed wireless broadband service, including to sparsely populated areas.
- Vermont should continue to facilitate and encourage the use of existing facilities for siting antennas. Service providers should use pre-existing structures where available for deployment of antennas.

- Permitting authorities should strive to make requirements for use of pre-existing structures less burdensome than construction of new structures.
- Use of electric transmission structures for placement of wireless service antennas is specifically supported and encouraged in instances when such structures can provide coverage and not endanger electric safety and reliability.

▶ Service providers should not take any action that would discourage collocation by another service provider at sites they occupy. Owners of wireless infrastructure (for example, towers or other tall structures) are encouraged to allow collocation of multiple carriers to the extent practical.

▶ Tower developers and users should take reasonable steps to reduce the adverse visual impact of structures and should prefer sites with lower visual impact to high-impact sites.

Strategies/Action Plans

▶ ACCD, in conjunction with the Vermont League of Cities and Towns and the Vermont Association of Planning and Development Agencies, should produce an updated model zoning bylaw that contains examples of low-impact wireless installations that will expedite the permitting process.

▶ Due to the critical need to improve wireless service for public safety and for broadband deployment the state should strive for one permitting process for wireless siting. This may include Act 250 permitting for larger structures and local zoning for the sites with minimal environmental impact.

▶ Regional Planning Commissions should undertake a coordinated process of planning for wireless development in their regions.

- RPCs should maintain maps of existing wireless sites in their respective regions.
- To the best of their ability, utilizing coverage maps available from providers (such as maps produced under the CTIA "Consumer Code"), RPCs should create electronic maps that represent handheld coverage for their region, in the aggregate and by carrier.
- In areas with inadequate coverage, RPCs should identify preferred wireless sites, particularly in communities and along the state highways and the interstate.
- RPCs should assist their communities with the development and updating of zoning related to wireless development.

▶ ACCD should support some technical assistance to municipalities and RPCs who are planning for wireless service development.

STATE PROPERTY LEASING

In 1997, Act 48 was passed and was intended, in part, to improve the process for leasing state property for wireless antennas by making the Secretary of Administration the state's sole agent for leasing state buildings and lands for wireless facilities. The law established a Tower Siting Advisory Committee (TSAC) to advise on applications and create policies and a lease. The state's Chief Information Officer had been the Secretary's designee. The Secretary's authority was statutorily delegated to the Commissioner of Information and Innovation

when the Department of Information and Innovation (DII) was created in 2003. Although well intentioned, wireless carriers have at times viewed the process as a barrier. A significant issue has been the lack of time by experienced staff to work with potential lessees to address issues expeditiously. There are steps that the state could take to make this process work more smoothly and better achieve the legislature's intent.

Strategies/Action Plans

- TSAC should identify specific state sites on which wireless equipment location is encouraged and that will meet service providers' needs.
  - The state should contract with a vendor to market these sites to wireless service providers.
- DII should create a professional position to manage state radio and radio site assets, or contract for this with a professional management company.
- DII and TSAC should revise the standard state lease to be friendlier to lessees and encourage use of state property.

DEMAND STIMULATION

Demand and supply for advanced telecommunications services are linked. The more users who buy services, the lower the cost per user and the more economical it is to provide services. Likewise, the cheaper and more available services are, the easier it is for users to find those uses of the services that drive demand. There can be barriers to using new technology when it is unfamiliar and the advantages are not clear. Therefore, supporting those users who need help in discovering and applying beneficial uses of telecommunications technology helps all users by providing a broader base of support for the development of telecommunications networks and services.

APPLICATIONS EXTENSION

In its May 12, 2003 issue, BusinessWeek reported that U.S. productivity gains from e-business are 1%-3% annually—and may be headed up.

Information technology and communications are essential elements for virtually any business in today's and tomorrow's economies. Relationships with customers, suppliers, and business partners are increasingly accomplished on-line and with less and less regard to distance. Information and education that can help a business thrive is available through communications technology in ways it has not been available before. Information technology is driving productivity gains that sustain growth in the economy. Businesses that fail to use telecommunications and related technology well are at a distinct disadvantage. Yet one quarter of Vermont non-residential organizations surveyed by the PSD in 2003 (predominantly businesses) are not yet connected to the Internet, the basic communications tool of the on-line economy. More and more, this will be the equivalent of a business not having a telephone ten years ago.

Vermont has many very small businesses, and small businesses face special challenges in using technology well, even if they have access to it. While telecommunications technology should be important to nearly all businesses, few businesses are experts in it. Businesses who do not know how to apply technology to their businesses well are less likely to use high-speed telecommunications.

The fewer who use the technology, the less likely it is to be offered, or offered on favorable terms. The less it is offered, the fewer businesses will be exposed to its possibilities.

Vermont has a successful program for assisting manufacturers with manufacturing technology, management, processes, and best practices in the Vermont Manufacturing Extension Program (VMEC) based at Vermont Technical College. The impact of this program is detailed in VMEC's annual "Impact Report."[1] This program includes assistance to manufacturers on the subject of e-business. A similar program could help a wider range of Vermont small businesses.

The benefits of helping businesses with the application of telecommunications technology, both for the businesses and the development of the telecommunications marketplace in Vermont, were recognized in the *Vermont Telecommunications Plan* as early as its 1996 edition. This recognition led to early PSD and PSB support for the Vermont Telecommunications Application Center (later the Vermont Telecommunications Advancement Center, or VTAC). VTAC was never able to scale up to a program capable of reaching out to individual small businesses and over the last several years its activities were largely dictated by federal grant funding opportunities. VTAC closed its doors in June 2004, but it is appropriate to renew the focus on helping small business apply telecommunications and related technology to become more successful.

Strategies/Action Plans

- Through one of the state's institutions of higher learning Vermont should re-establish a program to provide assistance to Vermont businesses, especially small business, in understanding and adopting applications of telecommunications and related information technology that will help them improve productivity, reach new markets, or support jobs in Vermont. The program should involve these steps:
  - Associate the program with an existing program of extension to business at a Vermont higher educational institution.
  - Provide a sustaining level of on-going state funding for at least three years, then evaluate the level of success and need. Supplement with subsidized rates charged to businesses assisted.
  - Focus the program on business sectors or types where it can have the greatest impact with limited funds.
  - Assess the program's success by the number of businesses helped and estimates of new jobs created/existing jobs retained.
- Include in the program a technical support matching program to link Vermont businesses with a need for on-going technical support for telecom-dependent applications with appropriate vendors who can provide that service.
  - Encourage technical support vendors to provide discounted support during an initial period in exchange for referrals.

JOINT MARKETING PROGRAMS

Broadband telecommunications, like nearly every other new service, requires marketing to introduce consumers to the service and build demand. While a significant and growing number of Vermonters have already seen the value of broadband services, many are still holding back. This is neither surprising nor alarming. As discussed in Section 1, consumer products and services follow an adoption curve that starts out slowly and gradually builds as a greater and greater share of the population adopts the new technology. Getting past the initial period of low demand is a challenge for many parts of Vermont. Installing broadband service usually requires a significant up-front capital investment, which is only sustainable once a critical mass of customers is reached. In rural areas that critical mass may represent a much larger portion of the potential customers, meaning that service providers may have to wait longer to earn a return on investment. More quickly progressing along the technology adoption curve in rural areas will help Vermont reduce this obstacle. A more concerted effort to market broadband services will help reduce per-customer costs and develop a self-sustaining level of demand for broadband services.

An additional benefit of a marketing campaign would be to change some people's (inaccurate) perception of Vermont as a technology backwater. Although Vermont has challenges in making broadband telecommunications available everywhere, most Vermonters have access. This is not a reason to be complacent about those who don't, but the problem is not helped when potential customers in Vermont do not seek service because they think they can't get it, or when potential employers and telecommunications users from out-of-state avoid Vermont because of an impression they will not be able to obtain needed services affordably.

Strategies/Action Plans

- ACCD should fund a multi-media marketing campaign to promote the use and benefits of broadband service.
  - ACCD should seek to conduct its campaign with support from, and in cooperation with, providers of broadband service in Vermont including possible jointly sponsored messages.

(Endnotes)

[1] http://www.vmec.org/about/impact.php.

Telecommunications and Public Sector Use

The public sector is an extensive user and purchaser of telecommunications services. It also operates important telecommunications networks and provides telecommunications services to users outside of state government. The quality of telecommunications greatly impacts the activities of the public sector, and the public sector also shapes the telecommunications landscape in its role as user, operator, and purchaser in addition to its roles as regulator and policy-maker.

GOALS

The policies and actions set forth in this section of the plan are guided by four overarching goals for the state as a builder and buyer of telecommunications networks and services. In this role, state government should seek to:

- Obtain low cost, high quality, easily managed telecommunications services to meet the needs of state government;
- Support the ability of state, local, federal agencies, and related public-interest institutions to communicate with each other easily with appropriate technology;
- Apply innovative but proven technology to improve the efficiency of state government and the quality of services offered to the public; and
- Support the development of high-quality, high-value telecommunications networks and services to the residents, businesses, and institutions throughout Vermont.

PUBLIC-INTEREST TELECOM NETWORKS

The state operates and contracts for a variety of telecommunications networks either on an owned or leased basis, including GOVnet/K12net and the Public Safety network. The networks operated by the Department of Public Safety (DPS) and the Department of Information and Innovation (DII) serve the range of state agencies. In addition to state government users, they serve to a certain extent local public sector and other users, such as local schools and local emergency responders. Greater integration of telecommunications networks across the public sector in Vermont is important to realizing the greatest value for the state's communications dollar. Finally, there are categories of users outside of state government to which state government does not traditionally provide telecommunications services but in which the state has an important public interest. For example, important aspects of the Department of Health's public health mission are compromised when small health care providers are not connected and using electronic public health care databases. Examples of users extend from health care providers to underserved rural communities. While the state may not necessarily play the same role in ensuring telecommunications services

to these "public-interest" users, the state must be mindful of the ways that its actions in purchasing or building telecommunications networks can positively or negatively affect them.

The year 2003 saw significant positive movement toward the management of telecommunications and information technology in state government on an enterprise-wide basis with the creation of the new Department of Information and Innovation. As this first stage of reorganization and integration takes hold, it is appropriate to look at ways that the integration of state government telecommunications can be further extended. While the DII has consolidated the purchasing of state voice lines and GOVnet data links, significant pieces of state government telecommunications have not yet been integrated. The most obvious example is the state public safety network, which provides voice, data, and mobile communications capability. The DPS operates it, and the State Police and Emergency Management are its most mission-critical users. Still, only about half of the usage on the network is DPS usage. The DPS provides service to dozens of organizations, among the largest are the Agencies of Natural Resources, Transportation, and Human Services. The upgraded microwave network was designed with capacity to handle traffic beyond that which the DPS is likely to use, at least in the near future. Not only does the DPS share its network with other users, it also relies on payment from those users to offset the costs of operating the network. It is obvious that the state must have a public safety communications system and that in providing that system there is the opportunity to provide for the communications needs of other users. With state government providing two major voice and data communications options, it makes sense that state government should manage use of these options (and funding for them) on the basis of what best meets the needs of the whole enterprise.

Other examples of state telecommunications links include the various short-haul point-to-point wireless links being implemented by various state agencies. This type of high-speed link, often operating in a license-exempt band, can connect locations such as two buildings within town using a pair of small fixed antennas. This can be a relatively inexpensive way to extend the reach of a Local Area Network (LAN) with a multi-megabit connection. This type of link can be a low-cost, quick-setup solution and perfectly appropriate. There are possible downsides as well to state agencies deploying these links if they were to be deployed in a completely ad-hoc manner. One possibility is the potential for interference. Since these devices often operate in unlicensed radio bands (like cordless phones or Wi-Fi transmitters), a large number of devices operating within a small area (such as the capitol complex in Montpelier or the state campus in Waterbury) could result in the devices causing interference with each other. Skilled planning can reduce the likelihood of this happening. The other downside is the possibility of lost opportunities. Use of these devices in an ad-hoc manner can obscure the true level of demand and usage at state facilities. There may be opportunities for different state users to combine usage over links in ways that lower cost or improve performance or reliability. With a level of common oversight and planning these opportunities can be realized. DII has developed an inventory of these links and is working with a wireless planning and engineering firm to better manage the interactions between them.

The presence of a variety of types of telecommunications networks in state government—the DPS-owned and operated microwave network, the ad-hoc point-to-point wireless links, and the GOVnet and Centrex voice system, leased from providers like Telcove and Verizon—illustrate the "buy vs. build" question. Is it better for the state to have control over its own communications facilities or to lease services from commercial carriers? The answer depends heavily on a variety of factors that vary in specific situations including cost, reliability, support, availability of service, level of in-house expertise, and funding constraints. Regardless of whether the state builds or buys, its decision will have greater positive impact beyond state users (and possibly for state users as well) if it is able to share. Sharing communications capacity can take a variety of forms including buying in conjunction with other users, negotiating for better service on behalf of not only the state government, but the public, sharing bandwidth or facilities with other users or carriers who serve the public, and acting as an "anchor customer" to help justify the case for new investment that will serve multiple users. If sharing can be good, sharing widely can be better. Sharing only among a few categories of favored users can make those users who are not privileged less attractive to service providers, especially in rural communities. Sharing is not appropriate or possible all of the time, but it deserves support. The state is likely to continue to serve its needs through a combination of owned and leased facilities and equipment, but if it can share telecommunications service or facilities with a wide spectrum of other users the state will gain an important tool in developing the state's telecommunications future.

Policies

- In budgeting for and funding state communications systems, facilities and services used for law enforcement, emergency response, emergency management, and public health threat response should be especially high priorities.
- When examining its options for providing voice and data services to state government agencies, the DII should examine both state-operated networks and facilities (especially pre-existing ones like the DPS microwave network). The DII should seek to manage the communications services provided and costs incurred across the entire state government enterprise.

Strategies/Action Plans

- State agencies should register new point-to-point wireless links with the DII.
- The DPS should consult with DII on planning and implementation of all major telecommunications projects, initiatives, and interagency service arrangements and ensure that these are consistent with state government enterprise-wide telecommunications policies and objectives.

STATE DATA AND VIDEO COMMUNICATIONS

It has been at least five years since most of the major state telecommunications contracts for data telecommunications services have been put out to bid. Much has changed in the intervening period. Services available have evolved, prevailing prices have changed and the state has completed a major upgrade to the backbone of the Public Safety Network. The renewal of the state contracts for data communications services in the fall of 2004 represents an important

opportunity. It is an opportunity to re-evaluate state needs. It is also an opportunity to leverage the state's power as a customer for the public interest.

The upcoming request for proposals also coincides with upcoming changes in communications for education. Under the five-year Verizon alternative regulation plan, Verizon has provided to high schools in its territory at no charge the high-speed links needed to create the Interactive Learning Network (ILN), the videoconferencing network managed by the Vermont Institutes. Verizon's subsidy for this network is due to expire before the end of the 2004-2005 school year. While the ILN is an Internet Protocol (IP)-based network and is compatible with delivery of Internet traffic as well as video, the terms of the plan did not allow the ILN to be used for purposes other than education-related videoconferencing. While the end of the plan presents a serious funding problem for the ILN, it also removes these restrictions. The Vermont Institutes have announced that one option under serious consideration is conversion of the ILN into a statewide wide area network for schools that would offer videoconferencing and Internet access integrated together. Schools would buy services together from private vendors. At the same time, the DII and the previous state office of the Chief Information Officer (CIO) have for a number of years offered Internet access to schools as K12Net, under the umbrella of GOVnet. K12Net was first conceived when options for Internet access were few and expensive. As time has progressed, schools have had more choices of Internet Service Providers (ISPs) and have tended to drift away from K12net (although many remain). The creation of the DII, as well as the forthcoming state Request for Proposals (RFP) for connectivity including K12Net, provides an ideal opportunity to re-examine the role of the state in providing Internet access to schools and the opportunities for providing videoconferencing to state offices.

Policies

- Except for those instances when there are overriding issues of public safety or security, state government should favor the use or creation of open networks above networks that only state government or elements of the public sector are allowed to use. This may take the form of
  - State use of common-carrier services; or
  - State use of state-owned networks or facilities that are open on reasonable terms for use by common carriers to serve the public.
- The DII should structure RFPs for data communications connectivity to explicitly enable smaller vendors the opportunity to bid for a fraction of the state's data connectivity needs, or the state's needs in a particular region. It should not guarantee that the state will not choose a very small number of vendors to supply its data communications needs or choose a vendor or vendors to serve its needs on a statewide basis.
- The state should try to use its purchasing power and excess capacity on networks it owns to promote improvements in telecommunications infrastructure, services, and prices, especially in unserved or underserved areas of the state.
  - The state should focus on locations, services and infrastructures that have limited choice of providers or services for consumers, and avoid intervening in markets where there is robust competition.

- The DII should seek to engage the telecommunications purchasing managers at other important buyers of telecommunications services on an ongoing basis. This should include entities such as colleges, schools, major businesses, and hospitals and health care networks. With these partners, DII should seek to identify opportunities to coordinate purchases of telecommunications services for mutual benefit or to help improve telecommunications in the wider community.

Strategies/Action Plans

- The DII and the Vermont Institutes should collaborate to produce a combined successor network (the "Educational Communications Network") to both K12Net and ILN by the 2005-2006 school year.
  - The Educational Communications Network should contract for wide area networking and Internet access in conjunction with state government.
  - The Educational Communications Network should offer schools security, filtering, e-mail, hosting, and videoconferencing through the network. The network should solicit and consider bids by outside vendors to provide these services.
  - The Vermont Institutes should offer information, support, and training to schools on the use of technology in education in conjunction with the network.
- The Educational Communications Network should make available ILN-style conference-room based videoconferencing for state office buildings at cost.
- The state should make open space located in strategically located state buildings available to telecommunications service providers when doing so will enable telecommunications vendors serving the state to offer better or less costly data telecommunications services to unserved or underserved communities.
- The DII should issue a Request for Information (RFI), and an RFP (if warranted), for a contract for broadband services to the home for state agencies with telecommuting employees that can also be offered by the vendor to state employees.

STATE VOICE COMMUNICATIONS

In all likelihood, the day is approaching when the state will have the opportunity to use a voice telephone system that rides over a data network. The emergence of voice as just another data application, promises opportunities to increase the flexibility of the state's voice services. For example, it may be easier to provide custom calling features to state employees, re-arrange phone systems, and integrate computer and phone networks. The state may also be poised to save money or improve telecommunications service in the future by operating a single voice and data network instead of separate voice and data services. It is too early to determine the optimum system for the state and whether it is best for the state's voice services to ride over a data and video network operated by the state or that of a service provider offering voice service over a converged network. Nevertheless, there are new opportunities becoming available for state government in the provision of voice services.

Policies

- DII should continue to review new voice technologies as they mature and standards become firm.
- The state should continue to maintain a voice communications system that provides relatively low cost at high value to the enterprise. The state should seek to balance lowest cost with features that enhance the productivity of state workers and improve service to the public, not allowing either one to become a concern to the exclusion of the other. The state should seek to establish a long-term technology migration path, while allowing enough flexibility to adjust to technology developments.

Strategies/Action Plans

- The state should seek out telephone services that, when required, can be integrated with and complement other communications-related applications, including website applications, e-mail, instant messaging, wireless telephone service, electronic contact databases, and remote access.
- The DII should plan for an eventual migration to packet-data voice services, contingent on cost and value factors. It should establish a migration path over the next three to five years. It should take steps now as opportunities present themselves to facilitate a smooth migration, either sooner or later, as appropriate.
- When selecting a voice service supplier, the DII should evaluate the costs of operating separate voice and data services/networks vs. the costs of operating a converged voice, video and data network.
- When selecting a telephone service supplier or suppliers, the DII should evaluate options for both buying services (e.g. Centrex) and operating equipment (e.g. PBXs or softswitches) and include in the evaluation the long-term costs of each option.

STATE MOBILE COMMUNICATIONS

The DPS operates the most far-ranging public-sector mobile communications system in the state. It not only serves the State Police and Vermont Emergency Management but thirty state, federal and local agencies and organizations. Vermont's existing, analog, public safety radio communication system is under the pressures of aging technology, increasing service demands, inadequate coverage, channel congestion, interference, and a dramatically changing wireless communications environment. The first part of the DPS's transition plan, the $8 million upgrade to the microwave backbone, has been successfully completed. A second, larger, upgrade has been deferred for many years. To improve interoperability and to promote efficient communications within consoli-

VoIP and Wireless Internet:
New York's 9/11 Experience

"[New York City's Department of Information Technology and Telecommunications] also relied heavily on Internet telephony to provide voice communications. Internet telephony allowed users of specific phone lines to move from location to location as needed, without changing phone numbers. City Hall's phone service was provided through the Internet for weeks after the attacks; workers simply plugged their phones into any available Internet jack.

"DoITT also used high-speed wireless transmitters to connect various other local government buildings to the City's network. At a cost of approximately $38,000 each, City Hall, the Municipal Building, and the City Council at 250 Broadway, were all reconnected to the Internet by wireless transmitters quickly plunked on top of their respective buildings."—*Homeland Defense Journal* July 2003, p.37.

dated dispatch centers, a new digital radio system is needed. A radio system that allows for mobile data technology and trunking technology is the system of choice. (See sidebar, "The Advantages of Trunking.") Some of the operational requirements for a new radio system include:

- Reliability. Emergency service providers depend on a system that is operational 24 hours per day, 365 days per year. Radio communications provide the only lifeline to dispatcher or back-up assistance in emergencies.
- Interoperability. Increased complexity, size and frequency of emergency incidents are raising the requirements for coordinated multi-agency and multi-state responses. Interoperability is fundamental to a coordinated emergency response. Current solutions to interoperability involve allowing local emergency responders to program State Police frequencies into their radios to use only in special emergency situations. This is only a band-aid and does not offer the interconnection flexibility of a trunked radio system.
- Improved Coverage. The current radio system was not designed to provide full state radio coverage. At the time it was designed it did not include portable (handheld) radio coverage. The current needs of law enforcement require a greater coverage area and portable radio coverage, not merely coverage using vehicle-based systems.
- Mobile Data. Mobile data is needed to afford law enforcement a greater opportunity for real time data in their vehicle. Data in the field can provide officers with needed information in a timely fashion and increase the amount of time an officer can spend in the field. Mobile data could reduce voice traffic and lighten dispatcher workloads as voice systems are often used to relay data that an officer might be able to access directly if a mobile data system were in place. Furthermore, it is possible that during the planning window for this project, it may become feasible and desirable to combine voice and data networks into a single mobile data network that supports digitized voice communication as one application on the data network.

Joint state and federal support have worked together in the past to upgrade the network. Recent federal support included approximately $4 million for the upgrade of the backbone and $1.4 million for mobile data upgrades. While the backbone upgrade has been completed successfully, the funding to date for the mobile data project will only allow the state to achieve a limited trial or partial upgrade. A 1998 preliminary estimate by the DPS of the cost of a statewide digital mobile network upgrade put the cost of the project at $20 million. An exact figure is hard to calculate reliably without a planning and design study.

The Advantages of Trunking

Used for many years by the wireline telephone industry, trunking technology was first applied to wireless communications in the 1970's. Trunking technology was developed specifically to increase communications and spectrum efficiency. A trunked system supports a larger number of users on a group of radio channels, achieving spectrum efficiency through channel sharing. Much like the classic image of a switchboard operator, when a user wishes to make a call, the system automatically selects an available channel from a pool of frequencies. As a result, all users have automatic access to any available channel, reducing the wait time for a channel. Trunked radio systems are ideally suited to meet the needs of wide area or multi-agency systems. Trunking provides autonomy of communications for each agency, but supports direct interoperability when desired.

Furthermore, a project that is designed to cover only the mobile communications needs of the State Police misses a vital opportunity. Local police, fire, rescue and other agencies will also be facing the need to upgrade systems over the next decade. A statewide trunked radio system serving state government users plus local and federal users can accomplish a major goal of homeland security and emergency response—it can provide multiple agencies with their own communications capacity while linking those users as needed. While an expanded system could be up to several times more expensive than a system designed primarily for the State Police, depending on the number of users and extent of local coverage, it is likely to be less expensive and more useful than dozens of separate uncoordinated projects.

Finally, although the needs of public safety users must be given top priority, an upgrade to the public safety network provides opportunities to support the goals found elsewhere in this plan of improving commercial wireless service. There may be benefits for both state government and commercial providers. To the extent that a new network may require new or rebuilt tower structures, there is an opportunity to work with private providers up front to plan for new or enhanced collocation opportunities and cost sharing. Furthermore, there may be opportunities for the state to reduce its need to construct a completely separate mobile communications system, especially for mobile data, by contracting with a private wireless service provider. Such a relationship would put the state in a position to demand quality of service and coverage standards that could improve the service available to the general public in Vermont.

Policies

- As a high priority, the state should seek to include local government and federal users voluntarily in an integrated trunked mobile radio system and discourage the deployment of non-interoperable systems in Vermont.
- The state should evaluate both building vs. buying mobile radio services when considering what path to take for a state mobile network upgrade. It should evaluate both kinds of alternatives on their cost and ability to assure acceptable and desired levels of performance, security, coverage, and reliability.
- In developing a mobile radio system upgrade, the state should communicate with commercial wireless service providers and take advantage of all practicable collocation opportunities.
- The state should not shy away from developing new tower sites if a lack of otherwise available and practical sites prevents meeting goals of improved public safety communications. It should minimize the cumulative aesthetic impact of a new network, especially by minimizing the number of new sites and the number of sites used only by public safety users.

Strategies/Action Plans

- The legislature should make a multi-year capital commitment beginning in fiscal year 2005, if possible, to the upgrade of the public safety mobile communications system to enable proper planning, engineering, and timely implementation of a design. If one-time money becomes available in the

state budget, a major one-time infusion to the communications system should be a high priority.

- The first step should be funding a needs assessment, planning, and engineering study that will identify the potential willing users (including local users) of the system, identify the specific needed services for those users, develop a needs assessment, and a design for the project. The state should be prepared to spend several hundred thousand dollars on this phase of the project.
- Once funding is in place for the study, the state should establish a user group that includes local users to guide and assess the work of the consultant.
- The state should seek completion of a new mobile radio system within 5 years of initial funding.

▶ Vermont's Congressional delegation should make a major earmark in support of the upgrade or similarly available funding a priority.

TELECOMMUTING IN STATE GOVERNMENT

Telecommuting (or "telework") is a mature, mainstream, application of telecommunications that can help state government meet its goals in a variety of ways. The Institute for Distributed Work has forecasted that corporate employees working outside the office at least two days per week will rise to 13.7 million by 2005, a figure that equals 9.2% of the workforce and which is up from 6.3 million in 1995.[1] A 2001 telephone survey by researchers at Old Dominion University found that about 20% of the U.S. workforce age 18 or older do some type of telework, either at home, at a satellite office or telework center, or on the road.[2] Common reasons that employers will institute telecommuting programs are real estate savings, increased employee productivity, and an ability to attract and retain qualified employees.[3] AT&T, which has conducted statistically valid research of its own teleworking employees since 1992, found that teleworking managers have 7.4 productive hours per day, compared to only 6.7 productive hours per day for the general population of managers.[4] Telecommuting works best when it is done as part of a structured program. Fortunately, there are many examples of state and federal programs to promote successful telecommuting, both in the public and private sector workforces. At least fourteen states, the District of Columbia, and the federal government have programs to implement or encourage telecommuting.

"[T]elework is here to stay… its not just a perk or special privilege, its an opportunity to increase employee morale and increase the attractiveness of working for the federal government."—Kay Coles James, Director U.S. Office of Personnel Management on www.telework.gov

Strategies/Action Plans

▶ Vermont state government should develop appropriate support structures for telecommuting by state government employees. Telecommuting should be supported in situations where it offers benefits for employee retention, satisfaction, and productivity. Telecommuting should be encouraged where it offers additional benefits for the state government enterprise.

▶ The Department of Personnel should develop policies, standards, and a training program for managers in identifying appropriate employees for telecommuting, and techniques for successfully managing telecommuting. These should draw upon best practices of successful telecommuting programs of other government and private-sector organizations.

- The Department of Personnel should develop guidelines for use of private office equipment, use of private phone and Internet services, and procedures for employer-requested telecommuting and employee-requested telecommuting arrangements.
- The DII should implement an enterprise instant messaging system for state government that can be used by telecommuting state government employees and employees in the office.

Planning and implementing a telework program

The J.D. Edwards experience

In 1998 a small group of executives decided that J.D. Edwards would benefit from formalizing a telework program. Up to that time this was done on an ad-hoc basis, with each department developing their own guidelines and policies. They wanted to develop a program consistent company-wide, and decided a person to oversee the program was critical to its success. Wanda Brackins was hired in February 1999 to implement and manage the telework program.

First, she put together a project team. Members included representatives from IT Remote Access, IT PC Support, IT Voice Services, IT Help Desk, IT Security, Procurement, and Legal (in addition to Wanda). Their first task was to document what was being done in various departments. By April they had information on existing practices. From that developed company-wide standard criteria and policies. These were submitted for executive review and approval. Having top management pushing for a formal program made this much easier.

Next, they researched potentially sticky issues through site visits and the experience of telework managers. They held a few focus groups with existing teleworkers. They then focused on the identified problem areas. One of the most difficult issues was (and is) connectivity. If an employee's job requires a high-speed connection, then it must be available at their home for them to be eligible for telework. (The CIO noted that providing connectivity is the most problematic ongoing aspect of the telework program. Each home office is unique.) Employees were eager to participate in the telework program, managers less so. They were given training on how to manage remote employees and encouraged to consider telework for their workers.

They put together equipment guidelines so that there is some standard (making support easier) set of equipment and procedures in place to help set up the PC a worker takes home. Early teleworkers sometimes complained of down time in getting a PC set up for use at home. They developed procedures for handling PC problems so that a worker would have minimal time without a PC. Initially, workers had to ship a failed PC and get a loaner, often causing extended downtime. Now they sub-contract with the Whitfield Group, which will go to the worker's home to fix certain classes of problems.

They developed "quick guides" for existing remote workers. (They identified about 200 teleworkers, including sales and pre-sales positions.) The rollout of the new program was done in late August of 1999. During the 4 to 5 months that followed, they attended meetings at the Senior VP (Executive) team and VP/Director levels to present an overview of the program, policies, and guidelines, giving the "why's", goals, and their responsibilities.

Originally there were four parts to the teleworkers' training - given by IT Security, IT Remote Access, PC Support, and Wanda (for HR) on guidelines, etc. Now there are two presenters - Wanda and IT Remote Access (troubleshooting information included).

They developed a handbook, originally hard copy, now on line. They send out notices (included in the twice-a-week corporate newsletter) whenever there are substantive changes. The handbook information was presented in three stages - to the mangers with remote workers (information included a table comparing what was vs. current, with the "why's" to the changes). A week later they sent the information to all remote workers. Finally, they included the information in the company newsletter.

When someone officially starts telework, this is recorded in the company employee records so that Wanda has access to accurate lists of teleworkers (facilitating contact with them) and can gather performance statistics.

The project team still meets on a regular basis. Previously they met monthly, now they meet every two months. The involvement of Legal has waned from their initial involvement, as there is little ongoing need for their input.

(Excerpt from Vermont Telecommunications Advancement Center's report "A Work at Home Project for Rural Vermont," June 2003.)

- The DII should continue to support options for remote access to office networks by virtual private networks or comparable technology. In addition, the DII should establish one or more supported ways for remote access to state voice telephone service, including possibly a voice-over-IP gateway.

TELECONFERENCING SYSTEMS

Teleconferencing encompasses the range of video and voice systems that allow multiparty meetings, classes, hearings, and other forms of interactive communication over distance, and the tools of real-time collaboration over computer networks. Teleconferencing is in the process of moving out more and more on to desktop computers. At the same time, the Internet and IP are becoming more and more capable of handling real-time applications like voice and video. Teleconferencing includes, but is not limited to, "videoconferencing." Increasingly, it also includes the ability to support multimodal collaboration, sharing computer applications, and documents. (See "The Future of IP Teleconferencing" sidebar.) This diversification and diffusion of teleconferencing technology has significant implications for Vermont's established videoconferencing systems—Vermont Interactive Television (VIT), the Vermont Interactive Learning Network and UVM's Distance Learning network, and it opens up new opportunities in state government.

VERMONT INTERACTIVE TELEVISION

VIT's largest group of users is the educational community, although it also serves government and private users, all on a fee-for-service basis that varies by type of user. (Additional support is provided by legislative appropriation.) VIT has the advantage of being a mature, stable system that provides users with a managed videoconferencing environment—staff is on hand at each VIT site to operate equipment and make the system easy to use for even novice or infrequent users. It also has an established system in place for scheduling users at sites and billing. VIT has limits. As currently implemented, it would be very expensive to increase the number of VIT-type sites in Vermont by a significant number. While users may not often travel as far as they might otherwise when they use VIT, they often do travel. VIT's full schedule and billing structure lends itself more to pre-planned events than to ad-hoc meetings between a few individuals.

VIT's value lies partly in its technology and partly in its administrative support structure. The day is likely coming when the need for VIT's technology will be eclipsed as the options for doing desktop and conference-room teleconferencing become less expensive, more robust, and easier to use. In light of this trend, it is not advisable to make a major investment to convert a network like ILN, with more than four times the sites, to the technological and service standards of a VIT site. (Increased interconnection and interoperability is another matter.) In the meantime, VIT can play an important role in its existing form to provide videoconferencing capability to those populations that cannot yet support it on their own. Circumstances may support some limited expansions of the legacy VIT network, but technology is providing other options for many videoconferencing applications. Beyond the technology, the institutional ability of VIT

to manage sites for outside users, schedule events, and interconnect is itself a resource that other public-sector partners should try to leverage and not to duplicate. If VIT can act as a catalyst to link together different users with a range of videoconferencing options, it can continue to add value even without adding sites.

Policies

- Other publicly supported videoconferencing systems, especially the ILN and UVM's Distance Learning Network (DLN), should not seek to duplicate VIT's administrative infrastructure for centrally managing a statewide set of videoconferencing sites for use by the public.
  - VIT should support requests by other Vermont teleconferencing systems to perform, at cost, scheduling, site management, business functions, data management and analysis, marketing and public relations, and long-term facility planning, coordination, and standards as requested.

Strategies/Action Plans

- VIT's system should be maintained for the near future at least. Expansion by means of interoperation with existing videoconferencing systems such as ILN and DLN is supported, as are expansions that could be supported on the basis of additional revenue generated by users of the system.
- Establishment of a Montpelier VIT site as soon as possible should be a VIT and state government priority.
- Although it may be convenient to continue to house VIT in the Vermont State Colleges, VIT should take steps to increase perception of the organization as a more universal teleconferencing resource. The Commissioner of Information and Innovation or his or her designee should be a standing member of the VIT coordinating council and should play an active role in governance.
- VIT should seek to nurture and leverage expertise in the effective deployment and use of teleconferencing technology. State support of VIT should include a responsibility to advise and assist state government through the DII in the selection, deployment, and support of teleconferencing and video streaming technologies.

The future of IP teleconferencing

IP conferencing improves worker productivity. Workers that use conferencing and collaboration will employ an interface that seamlessly extends across IM, voice and videoconferencing for both ad hoc and scheduled conferences. IP conferencing will provide workflow efficiencies for scheduling and joining conferences, and will enable more effective spontaneous communications through multimodal, rich-media, ad hoc conferencing.

Users will be able to initiate and control conference calls in various ways, including the "voice first" or 'text first" paradigm. Using an IP phone or an IM service, workers will establish a connection with a remote colleague, and then using intelligence built into the conferencing infrastructure, decide to add other associates or co-workers and/or expand the conference to include other media types as required.

On a pop-up screen, the user will click on the participants to include in a conference, then select the media types appropriate for the conference— video, audio and/or data collaboration. The network will then seek out and find those users (using presence technology), determine which device the user is on, and which media types the device can support; then it will set up the required conference resources (bridges and connections) automatically—transparent to the worker who initiated the call.

Conferencing will no longer be a "this or that" endeavor—a choice to use one media type or another, or to enable ad hoc calls but with limited functionality. Instead, it will become a dramatic telephony enhancement—an extension of the intelligent network that seamlessly locates, facilitates and enables media-rich conferences.

--Communications News, "The Future of IP Conferencing," October 2003, p. 31.

- VIT should continue to develop and promote gateways for interoperating with Internet-based videoconferencing systems.
- VIT should offer live and archived Internet video streaming of VIT sessions as a service and should seek to make available fee-based Internet video streaming services to Vermont organizations, either directly or through a third party.
- VIT should post real-time or near real-time conference room availability to the web and should work with the DII to develop automated on-line booking of conferences as an e-government application integrated with the state portal.
- Other than the types and examples of expansion discussed here, expansion in the number of VIT sites using its present form of videoconferencing should not be a state funding priority. Furthermore, at such time in the future when a high-quality, user-friendly, IP-based videoconferencing on the desktop or in the conference room/classroom becomes widespread in its availability and use in Vermont, this will signal the end of the need of ongoing state support of the network in its current form.

VERMONT INTERACTIVE LEARNING NETWORK

ILN serves the high schools (and a limited number of other sites), primarily in support of secondary education. Using a different videoconferencing technology than VIT that is IP-based, ILN links dozens of sites on the network via a video bridge in Montpelier. Unlike VIT, where staff actively manages the conference at each site, using ILN is more like making a high-quality videophone call on a private phone network. Although the system is technically capable of transporting Internet traffic, its use has been limited by the terms under which it has been created and supported: the connectivity has been provided at no charge by Verizon under the terms of its 5-year alternative regulation plan, but only for the educational videoconferencing purpose for which it was created. This plan and the support for ILN expire in the first part of 2005.

Strategies/Action Plans

- At the end of the current Verizon alternative regulation plan, ILN should discontinue as a separate videoconferencing network and operate on a fee-for-service basis as part of an IP-based integrated voice/video/data wide area network with Internet access.
- The Vermont Institutes should promote the development and interconnection of high-speed wide area networks linking Vermont schools with bandwidth capable of flexibly supporting reliable collaborative applications between Vermont schools.

STATE GOVERNMENT TELECONFERENCING

Videoconferencing, primarily VIT, has been seen by some in state government as a tool to reduce travel by state employees and promote greater access by the public. The state has had a measure of success in each of these areas using technologies implemented to date. As noted above, teleconferencing is developing in ways that will allow new, more convenient opportunities for collaboration over distance without travel. Over the next 3-5 years it should be the vision of

the state to use emerging teleconferencing tools to enhance and improve on the telephony tools currently available to state employees. The state should use teleconferencing technologies as a tool for breaking down inter-agency barriers and enabling collaborative work across the state government enterprise.

Strategies/Action Plans:

- The DII should identify at least one or more desktop teleconferencing programs it will support on Wide Area Networks and provide information and support to network managers for the successful integration of these programs into state office networks and Virtual Private Network (VPN) access. This should include how to deal with security issues.

PRIVACY OF ELECTRONIC INFORMATION

The push for e-government is important for improving efficiency in government and providing the public with better and more convenient services. E-government also involves increasing amounts of information stored and transmitted in electronic form. This makes it easier to collect, store, manipulate, and transfer information. The use of electronic information in government raises reasonable concerns about privacy and confidentiality of information held by state government about Vermonters. Various state government agencies will also need to cope with federal privacy requirements, such as those of HIPAA (the Health Insurance Portability and Accountability Act of 1996) in health care and the Gramm-Leach-Bliley Act in financial services. The state must also consider the privacy implications of state employee information in electronic form. Issues of privacy of electronic information in state government can be addressed successfully, and the creation of DII provides a new focal point for these efforts.

Policies

- Every electronic information asset in state government should have a set of privacy practices associated with it.

Strategies/Action Plans

- The state's Information Resource Management Advisory Council (IRMAC) should develop a recommended statewide privacy policy in 2004 and report to the Commissioner of Information and Innovation.
  - The Department of Personnel should advise the Commissioner of Information and Innovation on privacy issues related to state employees and the state's union contracts.
  - The Commissioner of Information and Innovation should accept or modify the IRMAC privacy policy as warranted.
- Once a privacy policy is in place, the DII and other state agencies should undertake a privacy audit of state electronic information assets.
- The state should use digital signatures whenever applicable to protect privacy.
  - DII should seek funding sources to support use of digital signatures in state government.

What is a digital signature?

Digital signatures are an application of encryption technology used to scramble a file or message so as to secure it, such as when it is being sent from one party to another. A digital signature uses a "private key" that allows one party to scramble and "sign" an electronic document and a "public key" to allow intended recipients to unscramble the message and verify the sender's identity.

(Endnotes)

[1] Shellenbarger, Sue, Wall Street Journal, "'Telework' is on the Rise, but It Isn't Just Done from Home Anymore." January 23, 2002, p. B1.

[2] Davis, Donald D. and Karen A. Polonko. "Telework America 2001 Summary." http://www.telecommute.org/telework/twa2001.htm.

[3] Vermont Telecom Advancement Center, "Work at Home Project for Rural Vermont," a report to the US Dept. of Agriculture, June 2003, p. 48.

[4] Roitz, Joseph, Brad Allenby, Robert Atkins. "2001/2002 Employee Survey Results: Telework, Business Benefits, and the Decentralized Enterprise." (2002) AT&T.

Vermont Telecom Regulatory Policy

Several trends and pressures are setting the state's regulatory agenda for telecommunications service. Prominent among trends are growing consumer demand for ubiquitous high-speed access to the Internet and mobile voice and data service. Data networks are essential tools for many Vermont companies and institutions, and telecommunications networks are the backbones and access points for these networks. Meanwhile, technological advancement is increasing the overlap of formerly separate telecommunications service platforms or networks, enabling consumers to substitute one telecommunications service for another, and increasing the prospect for significant inter-modal competition. Wireless companies, for instance, are expanding their geographic scope of coverage, improving voice quality, and offering all-distance service at flat or low per-minute rates. Cable television system operators introduced high-speed Internet access service within the past four years and will likely introduce local phone service within the next two years.

Wireline telecommunications companies (both local and inter-exchange), to varying degrees, are experiencing revenue pressures as a result of this inter-modal competition and product substitution, as well as from other wireline companies. Growth in local usage revenue (through local measured service charges) and sales of additional phone lines have flattened or declined as consumers migrate from low-speed Internet access service (which is accessed by making local phone calls) to high-speed Digital Subscriber Line (DSL) or cable-modem access services. Some portion of consumers have migrated much of their long-distance calling to attractive rate plans offered by wireless telephone carriers.

All telecommunications carriers are adapting by introducing service bundles that expand into their competitors' traditional niches.

All telecommunications carriers are adapting to these pressures and to consumer demand by introducing service bundles that expand into their competitors' traditional niches. Local phone companies are offering long-distance and high-speed Internet access. Internet service providers are offering local phone service. Long-distance companies are offering local phone service. Wireless companies are offering long-distance and even high-speed Internet access. With increased competition, companies that offer a variety of services may lose ground in their traditional market segment, but make offsetting gains in other market segments. Carriers are also reducing prices where competition necessitates reductions, and reducing costs and capital expenditures on market segments or geographic areas that are not strategic priorities or where productivity can be improved.

Regulatory policy will continue to have a role in Vermont's telecommunications marketplace, often a critical role. While remaining, that role must evolve. The challenge for regulators is to determine and implement the combination of regulations and forbearance that best accomplishes the state's policy objectives.

NONDOMINANT REGULATION

The number of choices for telecommunications service is increasing. Some markets, like local service, still bear some of the marks of their monopoly past while becoming competitive. Others, like long distance, have essentially made the transition from monopoly service to competition. Still others, like wireless service, have grown up in a competitive environment. As of June 2003, there were more than 500 Competitive Local Exchange Carriers (CLECs) and long distance carriers registered with the Public Service Board (PSB). Some of these carriers have a material customer base in Vermont, while many others do little to no business in Vermont. Only a few companies operating in Vermont still have any significant market power—the rest are "nondominant." Yet, the same certificate of authority (a "Certificate of Public Good" or "CPG"), change-of-control consent, and tariff requirements apply to all, which imposes a substantial administrative burden on regulators and carriers alike. The volume of telecommunications tariffs and tariff revisions reviewed by the Public Service Department (PSD) and the PSB is large—approaching one thousand per year. The PSB has allowed nondominant carriers to file "rate bands," reducing the need for companies to file individual rate changes. Still, there is little residual value to tariffs for nondominant carriers. They impose a burden on the companies filing them and consume PSD and PSB staff resources to review and approve them. Furthermore, tariffs lay out terms and conditions that bind consumers independent of the knowledge that they have of the tariff (which is usually little to none). For most companies, the job of consumer protection could be more effectively accomplished by instituting a set of basic generic consumer protection rules in place of tariffs, and allowing terms and conditions to be set on the basis of contracts or other agreements between service providers and their customers. The PSB gained such authority in 2000 through Act 67 (30 V.S.A. §227c), which allows it to modify, reduce or suspend certain tariff and miscellaneous transaction preapprovals applicable to nondominant carriers if it makes certain determinations. These determinations are that remaining requirements will be sufficient to assure that such carriers' rates and practices are just, reasonable and not unreasonably discriminatory, and that the public will be afforded at least as much protection as the requirements being suspended or reduced. This was in addition to preexisting authority that the PSB has to reduce or suspend regulation in a competitive telecommunications market where no competitor has the power to set prices for the service (30 V.S.A. §227a).

As of 2004, it appears that certain markets, especially the local telecommunications service market, are still composed of both "dominant" and "nondominant" carriers. There are trends afoot, however, that are likely to erode the dominance of incumbent local telephone companies either over a shorter or longer period of time. These trends include increased use of wireless technology, improvements in cable telecommunications, and voice service provided over the Internet. Incumbents may become nondominant in the markets for certain services before they become nondominant across the board. While new competitors entering the telecommunications market in Vermont are obvious candidates for nondominant regulation, it is important to put in place a framework of nondominant regulation that can readily accommodate even incumbents as they lose dominance in various markets. In addition, it may be appropriate to examine whether the markets for certain telecommunications services have no dominant competitor.

In most circumstances, a company may be considered to have lost dominance in a market when it no longer has "market power," the ability to set prices for the relevant geographic and functional market for a particular service. When looking at market power, it is important to consider at least whether any competitor or competitors offers a sufficient quantity of similar or equivalent services, and whether there is reasonable ease of entry into the market for providers of these services. "Nondominant regulation" should not be seen merely as a way of separating one type of company from another, but should be seen as an overall direction for regulation—as competition increases, regulators should look for instances where legacy regulations no longer suit the situation. Those regulations should be eliminated or reformed as the new situation requires.

In 2004, the PSB released informal drafts of new rules that were intended to establish generic consumer protections applicable to telecom service, establish some relaxed regulatory requirements for nondominant telecom carriers, and define which carriers would be considered "nondominant." As of this writing, the PSB is taking comment on its proposal. Establishing a framework for nondominant regulation and simplifying and streamlining regulation for nondominant carriers should be done soon in the interest of providing consumers with a wide array of choices and allowing the state to re-focus its activities.

Policies

- State regulation should only continue where conditions still warrant it.
- With regard to nondominant carriers and telecommunications markets with no dominant competitor, the PSD, PSB, and other state agencies as applicable, should focus on activities such as:
  - Establishing and enforcing "rules of the road" that allow all carriers to efficiently compete yet interact and cooperate as needed to deliver seamless telecommunications services (for example, regarding intercarrier compensation, traffic exchange and interconnection);
  - Establishing generic rules against precipitous or capricious loss of essential services, and enforcing them when problems arise;
  - Establishing generic rules against unfair and deceptive trade practices and consumer fraud and enforcing them when problems arise;
  - Establishing generic rules requiring truth-in-marketing (and billing) and enforcing them when problems arise;
  - Investigating and ordering corrective action when service quality levels threaten public safety or other essential activities;
  - Requiring and enforcing compliance with a very small number of necessary general industry obligations, such as support for E 9-1-1.
  - Collecting a basic level of information about the industry, including the identity and contact information for companies, and basic statistics on the industry.

Strategies/Action Plans

- The PSB should implement rules that reduce traditional regulatory requirements on nondominant carriers and establish generic consumer protections suitable for a competitive marketplace.

- Nondominant carrier rules should contain mechanisms for incumbent carriers to move to "nondominant" status as the level of competitive pressure rises, and state regulators should work with incumbent companies to establish greater clarity about when these companies or certain markets will be considered nondominant.

ALTERNATIVE REGULATION

Alternative regulation forms a bridge that connects the worlds of traditional monopoly utility regulation and nondominant regulation. Alternative regulation allows the state and regulated companies to craft a plan that sets a framework of certain objectives and, within the boundaries of that framework, allows a company subject to the plan to act more like a competitive company would. To date, only Verizon and its predecessors have been under alternative regulation in Vermont. Since April 2000 Verizon has been operating under a five-year alternative regulation plan. The Plan required phased, selective rate reductions at the outset, and streamlined requirements and approvals necessary for Verizon to introduce new services and enter service agreements with individual customers. The Plan also established retail service quality benchmarks and a customer credit mechanism in the event that Verizon did not obtain the benchmarks. Verizon was also exempted from cost-of-service regulation during the period of the Plan. As of 2004, the PSB has begun to investigate whether the present plan has obtained the statutory objectives and will consider what, if any, successor alternative regulation plan should be established. Circumstances have also changed since the last alternative regulation plan was implemented in Vermont. Competition in retail services, while still young, has increased and has spread in some areas of the state to the residential market as well as the business market. In 2004 the need for specific network modernization steps is clearer, as is the need for broadband services.

It may also be time to consider alternative regulation for independent companies that have not been under this form of regulation for reasons that are somewhat different. As independent local phone companies seek to expand the scope of services they offer (some of which are not subject to PSB regulation), setting cost-based rates for services that are subject to PSB regulation has and will become more of a challenge. Flexibility for small incumbent telephone companies may be especially important as competitive choice grows in independent territories. Although independent companies have historically faced fewer competitors than Verizon, competition through alternative facilities such as cable or wireless could increase rapidly over the near term. Introduction of competitive alternatives that were extensively available to a wide range of customers in independent territories would change the level of market power historically enjoyed by these companies. These companies will need to adapt to new circumstances. The chance that increased competition for these companies could come along sooner rather than later makes it a priority to implement an alternative regulatory framework for small incumbent companies for the transition to greater local competition. Alternative regulation plans, which the PSB is permitted to apply to individual companies, may offer the independents the flexibility they seek, while assuring that the rates for traditional services remain reasonable and that reliability, service quality and the ability of other carriers to offer services

in competition with the independents are not compromised. In addition, the legislature in 2004 increased the attractiveness of alternative regulation for companies with fewer than 10% of Vermont's access lines. Amendments to Title 30 provide the authority to the PSB to use an expedited process for establishing alternative regulation plans for small companies, and to refrain from conducting cost-of-service, rate base or rate-of-return analyses as a precondition to alternative regulation.[1]

Over the period of the plan, the PSB and PSD will need to evaluate the effectiveness of alternative regulation plans that have been implemented. At the expiration of an alternative regulation plan it is reasonable to assess how well the plan has worked over its life. Key issues may include:

- Whether the current service quality benchmarks are set at levels consistent with industry norms and reasonable customer expectations,
- The long-run adequacy of network maintenance and capital replacement,
- The extent to which the company used the flexibility accorded it under the legacy plan to the benefit of its customers,
- The extent to which the value offered (rates, service quality, and service availability) to Vermont customers by the company has advanced, lagged or kept apace with corresponding value offered by the company to customers in other states or with other comparable companies, and
- In what other ways the plan functioned or did not function as expected.

It is important that the PSB, PSD, and regulated companies continue to build on the experience that Vermont has gained with alternative regulation.

Policies

- Alternative regulation plans should be consistent with the state of competition in the telecommunications markets in which the subject company operates.
- Network modernization and investment expectations should be an important element of any alternative regulation plan over the next five years. Alternative regulation plans should use milestones for marking and evaluating the company's ongoing progress toward transformation of telecommunications networks consistent with the infrastructure and service goals and specific desired improvements contained in this plan. (See especially Section 6 and the subsection on "Network Infrastructure Standards" below.)
- Service quality plans should remain a feature of alternative regulation plans. Less emphasis should be placed on service quality measures that are subject broadly to competition. Continued or greater emphasis should be placed on measures related to facilities and services the incumbent controls, for which there are few meaningful competitive alternatives; or which are essential for public safety and economic activity.
  - Wholesale service quality measures should be a part of an alternative regulation service quality plan for companies that provide regulated wholesale service. (See also the subsection, "Wholesale Service Quality," below.)

- Alternative regulation plans should ensure that areas of poor service quality performance, when they occur, will be remedied and not only penalized.

- In exchange for commitments that will deliver value to the state, additional pricing flexibility may be extended to local dial tone rates in areas where sufficient competition exists, but with safeguards to prevent excessive price increases, should any price increases occur.
- Alternative regulation plans should be responsive to consumer expectations and interests in purchasing packages that combine regulated and non-regulated services.
- Alternative regulation plans for smaller independent companies need not contain the same level of complexity as a large company alternative regulation plan, but should be tailored to the circumstances of the company.

Strategies/Action Plans

- The PSB should investigate a successor plan to the current Verizon alternative regulation plan, instead of extending the current plan for any great length of time, so as to provide the opportunity to incorporate new objectives, policies and experience.
- Independent telephone companies and state regulators should begin work in the short term to develop an alternative regulatory framework for small incumbents. Such a framework should provide companies with flexibility to react to competition, technological change, and other factors as they arise.

SETTING A FRAMEWORK FOR COMPETITION

Telecommunications competition in Vermont has begun to take hold in many markets, but it still is in a relatively early stage overall. Through Telcove, Vermont has a major alternative fiber network that extends through all regions of the state. Companies like Lightship and SoVerNet have combined wholesale transport and loop facilities with their own voice and packet switching equipment. National companies like MCI have taken advantage of the complete Unbundled Network Element (UNE) platform of wholesale Verizon elements to capture a small but significant segment of the local market. Wireless companies like Unicel have begun to offer wireless voice packages with pricing competitive with landline service for some customers. Cable and telephone companies already compete for mass-market data customers. In the near future, it is highly likely that cable companies will introduce voice services in Vermont as they have done elsewhere. The developing competition from wireless voice services and the coming telephone service over cable are of special interest because they both are delivered to the end user without buying wholesale facilities from Verizon.

Yet it would be a mistake to characterize the current state of affairs as a fully developed competitive market. CLEC and cable facilities lack the ubiquity of the traditional telephone network. Even competitors with their own switching, transport, and local loop facilities (such as Telcove) must rely on Verizon loops to reach certain individual customers. Wireless quality of service often does not yet equal that of landlines and in many locations coverage is lacking. Incumbent telephone company facilities and services are still in many ways the "glue" that

binds together the many new and legacy telecommunications networks that exist side-by-side. This means that incumbents often continue to provide essential services and bottleneck facilities. Competitive alternatives are increasingly available for retail services, but the strength of those alternatives often depends heavily on the ability of competitors to buy at wholesale key elements and services from other carriers.

Competition can pressure companies to increase efficiency, respond creatively to consumer demand, introduce and market new services, price services attractively, and possibly expand the geographic reach of their service in response to other providers coming to their own territory. State regulators have a number of roles to play to support and encourage the benefits competition can bring to consumers. Going forward, wholesale markets warrant a greater proportion of state regulators' energy. Attention to wholesale service quality and wholesale terms and prices, in addition to facilities-based competition, will enable more retail competitive alternatives. Encouraging, and if necessary establishing, simple, fair, flexible, and predictable interconnection will allow competitors greater freedom to innovate. The state will have a role in promoting informed competition and enforcing fair trade practices, buffering the most vulnerable, and acting to preserve public confidence in the telecommunications network and in competition.

CONSUMER PROTECTION

Changes in the telecommunications marketplace have changed the nature of consumer protection in telecommunications. At one time regulators fixed rates, choices were few, and disputes often focused on connection or disconnection of retail service by a single provider. No longer. Competition has substantially increased and changed the nature of complaints lodged by consumers at the PSD. Some complaint themes remain the same as in a monopoly service market—complaints about delays in provisioning service, for example. The most competitive market segment—long distance—now produces the greatest volume of complaints. These complaints largely deal with problems that are most likely to occur as competition develops—billing errors, misrepresentation of rates, and unauthorized changes in service. In addition, the advent of competition in the market for local residential telephone service is producing a new generation of complaints. Those complaints principally involve carriers new to Vermont failing to abide by the most basic consumer protection rules. Most providers of local phone service are operating nationally, and either disregard state-specific requirements or experience difficulties customizing their systems and networks to conform to state-specific requirements. Wholesale transactions can also lead to situations that produce consumer complaints. With increased frequency, complaints about local or long distance service reflect provisioning or communication errors between a consumer's retail provider and the underlying company that provides service on a wholesale basis.

Competition provides consumers with the power of choice when shopping for telecommunications service—if they don't like the terms or the service provided by a company, they may leave for an alternative. Consumers that have true choices do not require the same kinds of protections against high prices, poor customer service, or loss of service from a particular provider. In a competitive

marketplace, consumers must be protected from those practices that erode or impede the consumer's ability to choose in an informed way. Customers must be able to decide and control which carrier will serve them. Consumers must be informed, in ways they can understand, about how much their service will cost, and they must not be misled about the price and terms of service. Services must be billed accurately and at the rates consumers were offered. These consumer protection principles protect not only consumers but also the bulk of companies that are prepared to give consumers a square deal, as well as public confidence in competition itself. Furthermore, telecommunications service remains essential to participation in society and the conduct of business, and for public safety. Consumers must have sufficient protection against unreasonable loss of service from all providers; competition should make it easier for consumers to obtain service, not less so.

Competition does not mean the end of consumer protections, but instead requires a different focus. The PSB's rules on disconnections and deposits for telecommunications service are badly out of date, having last been revised in 1990 for deposits and residential disconnections and in 1983 for non-residential disconnections—before any meaningful competition in telecommunications.[2] These rules provide consumers with extensive protections against loss of service from individual providers, even in those situations when the consumer has many other providers from which to choose. In 1999, the PSB adopted in Docket 5903, a "consumer bill of rights." (See sidebar, "Consumer Bill of Rights.") While many of these principles are very applicable to a competitive marketplace, they remain separate from the PSB's rules. There exists a wealth of transferable experience from the application of state and federal consumer fraud laws as enforced over the years by such agencies as the Federal Trade Commission and the Attorney General's office that could be used in crafting consumer protections with broad but specific and well-understood meaning.

In fact, to the extent that services not regulated by the PSB come to compete with services regulated by the PSB, it will be important to harmonize the consumer protections of the PSB and the consumer protections overseen by the Attorney General. Many (although not all) of the consumer protections that a competitive telecommunications market requires are substantially similar to those protections any competitive market requires. Indeed, the Vermont Attorney General can and has pursued actions and settlements against telecommunications companies for alleged violations of Vermont's fair trade laws. (Although there are some elements of Vermont's

Consumer Bill of Rights

Public Service Board Final Order July 2, 1999, docket 5903

- Consumers shall have the right to know and control what they are buying.
- Consumers shall have the right to know from whom they are buying.
- Consumers shall have the right to know the full price of the goods and services that they are purchasing.
- Consumers shall have the right to reasonable payment terms.
- Consumers shall have the right to fair treatment by all providers.
- Consumers shall have the right to impartial resolution of disputes.
- Consumers shall have the right to reasonable compensation for poor service quality.
- Consumers shall have the right of access to basic local exchange service as long as basic local exchange service charges are paid, regardless of whether they have paid any charges for non-basic local exchange services.
- Consumers shall have the right to be free of improper discrimination in prices, terms, conditions, or offers.
- Consumers shall have the right to privacy by controlling the release of information about themselves and their calling patterns and by controlling unreasonable intrusions upon their privacy.
- Consumers shall have the right to join with other consumers for mutual benefit.

generic consumer protection laws from which companies regulated by the PSB are currently exempt.) The Attorney General has authority to address consumer fraud and related problems and to elaborate on fair trade laws with rules for specific industries, even for otherwise unregulated companies. The Attorney General also has a history of pursuing multi-state settlements in cooperation with other Attorneys General, and these multi-state agreements may often be appropriate in an industry with companies operating in multiple states. For all of these reasons, shifting greater emphasis to the Attorney General for consumer protection in competitive telecommunications markets may be appropriate. Nevertheless, simply removing responsibility for telecommunications consumer protection away from the PSB and the PSD's Consumer Affairs and Public Information Division (CAPI) would risk losing some important benefits. State utility regulators have special expertise and experience in dealing with the telecommunications industry and its technology. CAPI employs a professional staff to receive complaints about essential services like telecommunications and to work with consumers and companies to see those complaints resolved; the Attorney General's Consumer Assistance Program (CAP) relies heavily on part-time college students to take complaints and consumers receive less active assistance with their individual complaints. CAPI also has provided an important link for state regulators to consumers' experiences. It may very well be more efficient and fair to reduce the extent to which state consumer protections overseen by the Attorney General and state utility regulators overlap, but it should be done in such a way that maintains key advantages found in the current system.

Finally, consumer protections are of limited value without effective enforcement. Currently, the Department's Consumer Affairs and Public Information Division (CAPI) handles and resolves the vast majority of consumer complaints informally and without the authority of the PSB. CAPI has no authority to formally enforce PSB rules and orders dealing with harm done to consumers. Consumers who complain are helped while practices that led to the complaint are not necessarily fixed. When necessary, enforcement actions are brought before the PSB. These proceedings are handled much like other cases before the PSB, and involve considerable expenditures of time and other resources. As a result, only a fraction of violations of PSB rules or orders that established consumer protections are ever brought before the PSB for resolution and penalties. While in these cases significant penalties often are sought, selective enforcement, as necessitated by the time-consuming process, may not deter purposeful violations or encourage diligent adherence to established rules and policies. There is a role for a "small claims" type of proceeding where companies who have a less egregious pattern of violations can be brought quickly to account, but where large penalties are not necessarily at stake. Such a forum would allow state authorities to warn and give authoritative guidance on the application of consumer protection rules and regulations while not allowing harmful practices to fester and be perpetuated.

Policies

- Consumer protections for telephone service should be reformed to better reflect the emerging role of competitive markets.

Strategies/Action Plans

- A revision of the disconnection and deposit rules for telephone service should be a high priority for the PSD and the PSB.
  - The PSB's rules should allow companies to use alternative measures of creditworthiness (other than past payment of utility bills) that are commonly used among a wide variety of businesses.
  - The PSB's rules should allow companies to use means of assuring payment for customers with poor credit other than deposits, such as prepaid service.
  - The PSB's rules should allow companies a less demanding disconnection notice and notice period for those services for which there is competitive choice. Consumers should continue to have strong protections against disconnection from companies receiving universal service support.
  - Consistent with current PSB policies, consumers should not lose access to basic local service for failure to pay charges for other services.
- The PSB's rules should be amended to include generic consumer protections providing for rate disclosure, proscribing unfair billing practices, unfair or deceptive marketing practices, and other unfair trade practices.
- The PSD should propose streamlined administrative procedures for the rapid adjudication of consumer protection cases where the possible penalties are relatively small.
- The PSB should bar companies from refusing to port numbers for failure to pay legitimately disputed charges.
- State policymakers should collaboratively examine ways to achieve greater consolidation of consumer protection roles now performed by the PSD, the PSB, and Attorney General in competitive telecommunications markets while still preserving appropriate consumer protections. Any reforms should preserve the following features:
  - A professional staff that receives and works to resolve Vermont consumers' complaints;
  - Staff with expertise in telecommunications technology and markets; and
  - A flow of information about consumer experiences to state telecommunications regulators.

RETAIL SERVICE QUALITY

In Docket 5903, the PSB established a set of generic service quality standards that apply to all local service providers in addition to establishing consumer protection principles.[3] The purpose of these standards was to establish minimum performance levels in areas such as installation and repair, reliability, and companies' handling of customer requests, inquiries, and complaints. These standards, which were reached through a stipulation with the incumbent local exchange companies, are generally weak and in some cases should be updated to reflect intervening and on-going changes in technology and the marketplace.

During the years they have been in place, the standards have proven valuable for several purposes. They keep companies focused on basic aspects of network integrity and customer service, and they enable the public and regulators to

evaluate the performance of companies over time and in relation to one another. These benefits are especially important where companies face incentives to cut costs. As the number of companies operating in the state grows the PSB and the PSD will face an increasing challenge to collect and make good use of service quality data. In addition, where consumers have a true choice of providers the purpose of monitoring and reporting service quality results shifts from being exclusively a regulatory tool, and its role as a customer information tool becomes more important.

Policies

- In a competitive market service quality standards and reporting requirements should apply to companies that have dominant market positions. Such standards and reporting requirements should, likewise, apply to nondominant companies when there is a significant possibility that consumers are receiving poor quality service and cannot readily obtain adequate quality service from another provider. Companies that receive universal service funding should have a special responsibility to meet or exceed service quality standards.

Strategies/Action Plans

- The PSB should modify the existing generic service quality standards to keep pace with changes in reasonable consumer expectations, technology, the marketplace, and service quality benchmarks widely accepted among other jurisdictions.
- The PSB should exempt nondominant carriers from mandatory reporting on service quality metrics except for Eligible Telecommunications Carriers (ETCs)[4] and except when it determines that there is a cause to believe a carrier has a pattern of delivering poor service.
  - The PSD and PSB should encourage voluntary reporting of service quality metrics by nondominant carriers. The PSD should publish comparative ratings on reported service quality measurements for consumers, including a list of companies who choose not to report.

Standards keep companies focused on basic aspects of network integrity and customer service.

WHOLESALE SERVICE QUALITY

Nearly all competitive alternatives to Verizon's local service are provided by CLECs that resell Verizon's service or lease some or all of the necessary facilities from Verizon. The sustainability of local phone service competition in Vermont, for at least the near future, is dependent on the quality of Verizon's wholesale service. CLECs must receive good quality wholesale service from Verizon in order to provide good quality retail service to their customers. Moreover, those CLECs would be placed at an unreasonable competitive disadvantage if Verizon provides better service to itself than to its competitors. Verizon has operated under a wholesale service quality plan to which it consented as part of its approval to enter the interstate long distance market. The "Performance Assurance Plan" is modeled on a similar plan applicable to Verizon in New York. A number of factors recommend this approach, including avoiding the administrative burden of creating and tracking performance according to a framework unique to Vermont, and the fact that many potential competitors operate in multiple states. The PSB recently closed an investigation into whether it should

impose a distinct Vermont wholesale service quality plan on Verizon. In this docket, SoVerNet presented evidence that its ability to provide quality service to customers had been substantially impaired by poor wholesale service quality from Verizon. At the same time, Verizon had not violated its wholesale service quality plan. This points out a key weakness in the plan. The wholesale service quality plan measures the service Verizon gives CLECs against the service it provides itself; that is, for most performance benchmarks, the metrics measure the amount of difference between levels of service quality for Verizon's retail and its wholesale services. At the time, Verizon had failed in a number of key measures for its separate retail service quality plan, which is part of its alternative regulation plan. A service quality plan should promote consistently high quality of service instead of just merely consistent service, good or bad. In closing the wholesale service quality investigation, the PSB reminded parties that closure did not foreclose the opportunity to request the PSB investigate specific instances in which they believe Verizon's wholesale service is inadequate and correctly noted that it may be appropriate to examine wholesale service quality issues in the context of its forthcoming review of a successor to Verizon's Incentive Regulation Plan.

Policies

- For ease of administration, the PSB should look to use the wholesale service quality plans found in other large states or groups of states as models;
- Wholesale service quality standards should have absolute service quality floors, not merely relative ones.

Good quality wholesale service is needed for good quality retail service by a competitor.

Strategies/Action Plans

- Measures of wholesale service quality should be incorporated into future alternative regulation plans where the company offers regulated wholesale services.

OPEN NETWORKS/UNBUNDLING

It is unrealistic to expect multiple ubiquitous, high-quality physical telecommunications networks in the near or even medium term. Yet even if there are a limited number of physical networks in the state, if those networks are open, it is possible for a greater number of service providers to use those networks to innovate and provide Vermonters with a range of telecommunications services. This "openness" is an important value and should remain a part of telecommunications in Vermont. Economical access to portions of the network in a manner that provides flexibility to customers is important not only for competition but to create room for new or innovative applications of telecommunications technology by retail as well as wholesale customers. The biggest questions are how far-reaching the requirements for open networks should be and what prices incumbents should be allowed to charge. Past and present examples of "openness" include: the freedom of consumers to attach their own phones, fax machines, and modems to telephone networks; "equal access" to a choice of long distance companies; and the ability to use broadband data pipes for the whole range of applications supported by TCP/IP, including e-mail, web browsing, and voice and video communication, without restrictions on content; and the freedom of carriers to turn raw transport or "dark fiber" on carrier-neutral networks into

higher-level services. Maintaining "openness" may involve a greater or lesser level of regulatory intervention, but it is essential that Vermonters have substantial choices in how they put their telecommunications services to work for them.

The most basic level of openness is the right of customers to use communications services to engage in communication of their own choosing. In a broadband Internet world, this means the ability to send e-mail, access web sites, send and receive video and audio content, and use voice and other communications applications that can be transported over IP, all at the discretion of the customer, within the technical limits of the service he or she has purchased. Telecommunications service providers are consistently identified under the law as "common carriers," and afford their customers this kind of freedom to use the services they purchase to determine what communication goes over the services they buy. In contrast, companies that are not telecommunications companies under the law, like cable and satellite TV providers also often influence the content communicated or carried by their service by selecting the channels carried by the service.

If companies have access to basic elements and services, a much larger choice of services, applications, and service providers become possible.

Internet service providers have not traditionally been classified as telecommunications service providers, but "information service" providers. Information service providers can limit customer's access to or use of communication. In practice, this is not a significant risk with Internet access services because consumers have been able to use their telecommunications services (such as telephone calls or dedicated data circuits) to access a large selection of Internet service providers. With consumer broadband services, the situation is often different. The communications link to the consumer (such as a DSL copper pair or a the cable modem access) is usually bundled with the Internet service, and there are often only one or a very small number of ISPs the customer can choose from, either as a matter of company policy (such as with most cable companies), or because few ISPs elect to provide Internet service over broadband transport provided by an unaffiliated company (such as is usually the case with DSL). Because these broadband services mix transport with what has traditionally been considered an "information service," the Federal Communications Commission (FCC) and the federal courts have been divided in their opinions about how these services should be classified. The PSD and PSB have opposed FCC efforts to classify cable modem Internet access as exclusively an "information service," with no "telecommunications service" component, and the matter is still in the courts as of this writing. Recognizing the telecommunications service component of broadband Internet access is important for protecting consumers' ability to freely access content and applications over the Internet. Recognizing the telecommunications service component of broadband Internet access need not lead automatically to large amounts of regulation; there is still an important role for forbearance. However, clarity that these services should remain open to users' communication choices will benefit consumers and help sustain competition the in the applications and services that ride on the broadband communications platform.

One way that telecommunications companies gain access to pieces of the telecommunications network today is through the state and federal policy of unbundling. Unbundling is a cornerstone tool in current federal-state oversight of the transition from monopoly to competition in local telecommunications markets. It has meant allowing competitors to buy parts and pieces of an incum-

bent's network (especially those of the Regional Bell Operating Companies, such as Verizon) at wholesale rates in order to offer service. Wholesale pricing is dominated by federal policy. The FCC has directed states to use the Total Element Long-Run Incremental Pricing (TELRIC) method for setting wholesale unbundled prices. This method looks forward at what it should cost to build a network anew instead of backwards at incumbents' embedded costs for building the networks they have in place. By applying this method, state commissions set rates on a state-by-state basis. The range of services available for unbundling is also heavily influenced by federal policy. Unbundling rules have been a source of controversy. The Regional Bell Operating Companies (including Verizon), on whom unbundling requirements primarily fall, have supported a variety of initiatives in Congress and before the FCC to reduce or eliminate unbundling requirements. In its 2003 "Triennial Review" decision, the FCC affirmed unbundling while making several changes to its rules regarding unbundling. (See the "The Unbundling Debate" in Part 1, "Telecommunications Trends.") An appeals court overturned that decision, and the future of the rules is uncertain. While the overturning of the FCC's Triennial Review decision on appeal leaves uncertain exactly what specific decisions Vermont will need to make on UNEs in the future, it is worth considering how technology and the development of facilities competition in Vermont could influence the importance of UNEs over time. For example, the trends in the technology of switching, in which advances in computing are offering cheaper switching options from vendors, suggest that mandatory unbundled switching may not be needed as long as other elements, such as the local loop or transport elements.

As a general matter, the availability of open networks and unbundled services and elements on a wholesale basis is important in Vermont, regardless of whether these are supplied by Verizon or other companies. It is not realistic to expect a large number of facilities-based carriers to build out Vermont. Yet it is possible for Vermonters to have a much larger choice of services, applications, and service providers—if companies have access to a relatively small number of basic elements and services, and those elements and services are available on reasonable terms.

Table 8.1:
Verizon wholesale rates vs. Verizon retail rates

	Residential			Business		
	Zone 1	*Zone 2*	*Zone 3*	*Zone 1*	*Zone 2*	*Zone 3*
Total wholesale price for unbundled loop, port, and switching	$12.75	$13.38	$26.66	$12.75	$13.38	$26.66
Average Verizon retail charges for local service (assumes 500 minutes of peak calling, and 500 minutes of off-peak calling)	$32.10	$32.10	$32.10	$48.39	$48.39	$48.39
Wholesale price as a percentage of retail charges	39.7%	41.7%	83.1%	26.3%	27.7%	55.1%

Sources: National Regulatory Research Institute, "A survey of unbundled network element prices in the United States." July 2003. Supplemented by personal communication August 14, 2003, by author Billy Jack Gregg to Christopher Campbell.

Policies

- To allow Vermonters continued access to a broad range of service offerings and innovations in telecommunications, it is important to have common carriers who provide wholesale and retail customers with an open network, allowing them flexibility to take services and elements and transform them into value-added services.
- The availability of wholesale unbundled services and network elements on reasonable terms and conditions is important to sustaining a robust telecommunications marketplace in Vermont.
  - Unbundled access to loops and many forms of transport are especially important to enable competition over the near to mid term.
  - Unbundled access by competitors to incumbent dark fiber transport is increasingly important.
  - The importance of unbundled access to switching is being eroded by technological trends such as the availability of softswitches. However, any elimination of unbundled switching elements in Vermont must be based on further evidence. Competitors should not plan to rely indefinitely on long-term access to mandated unbundled switching from Verizon.

Strategies/Action Plans

- The PSD and PSB should continue to advocate for federal recognition that services delivering broadband Internet access to customer premises, such as cable modem service and DSL service, contain a "telecommunications service" component, thereby recognizing customers' right to have control of the communication for which they use the service and the content that they access.

BUNDLING

While the term "unbundling" occurs frequently in discussion of wholesale markets, the terms "bundling" or "bundles" are found in discussions of retail marketing strategies. Essentially, companies that offer multiple services to consumers try to get customers to buy groups or "bundles" of services, often by offering a lower price on the whole bundle than the sum of the prices of the individual services. As communications companies enter each others' legacy lines of business, bundles are becoming more common. Examples of bundles include; bundles of telephone, high-speed Internet access, and cable TV or other video programming; bundles of local and long distance service; or bundles of local and wireless telephone service. There are a number of reasons why a company may find it desirable to offer customers packages or bundles. When customers buy more services, companies may often be able to spread out certain kinds of costs to serve each customer, like infrastructure, marketing, and customer service costs, over a larger revenue base. Selling a customer more services at better combined prices is often thought to increase customer "stickiness," the likelihood that a customer will stay with a company and not leave for a competitor's service. Even if the profit margin is lower on each service in a bundle than on individually priced services, bundles may result in higher overall income for the company that offers them.

Regulators have traditionally been wary of bundles that combine regulated and unregulated services. The concern has been that this provided regulated companies a way to offer some customers a lower price on a regulated service as an inducement to those customers to buy an unregulated service. This could result in unfair competition in the unregulated market and a revenue shortfall in the regulated market that would need to be made up by other captive customers. New competitors are now poised to offer bundles of service that include even local telephone service. To compete with these bundles, telephone companies that have been traditionally regulated now need the ability to respond with their own bundles of regulated and non-regulated services. In 2004, the legislature amended Title 30 to allow the PSB to review and approve tariffs that conditioned the purchase of regulated services on unregulated or jurisdictionally interstate services, provided that revenue was reasonably allocated between services.[5] This flexibility opens the door to a more permissive stance by the PSD and PSB on bundling.

Strategies/Action Plans

- The PSB and PSD should recognize that some bundling of services regulated by the state with services not regulated by the state is necessary for incumbent carriers to compete over time with new entrants, many of whom are subject to less state regulation.

TRAFFIC EXCHANGE/INTERCONNECTION

If end users are to communicate with any other user, regardless of who provides their service, telecommunications traffic must be exchanged predictably and reliably among carriers, including carriers that compete with one another. A network of many providers' networks requires that traffic flow among them. When one compares the voice telephone network to other modes of communication that lack interconnection—like instant messaging—a great strength of the telephone network is plain; on the telephone network, users have the ability to call customers of independent telephone companies, Verizon, new competitors, wireless companies and more. We take it so much for granted it is hardly noticed.

While all local exchange carriers are required by the Telecommunications Act of 1996 to exchange traffic with other Local Exchange Carriers (LECs), directly or indirectly, in practice this has taken one predominant form in Vermont: every carrier is interconnected for traffic exchange with Verizon. This indirect traffic exchange can be useful, especially when the volume of traffic between two third parties would otherwise be small. Yet, it would be unreasonable to require Verizon to act as the middleman without compensation, as they have in some cases in the past. Verizon's customers would ultimately bear costs incurred by Verizon to provide this transit service. In the future, a greater diversity of arrangements could be desirable, including a greater amount of direct traffic exchange between carriers.

While interconnection of networks for exchange of voice traffic is commonplace, interconnection of carriers' data communications networks is less common. The inefficiencies that result from this lack of data network interconnection is perhaps most significant in cases where a business or institution has sites located in both the territory served by Verizon and by independent telephone companies.

For instance, a voice telephone business customer with locations in both Verizon and independent telephone company territories may obtain telephone service from both sets of companies without concern that employees will be able to call seamlessly from one site to the other. A business connecting multiple sites with frame relay service may be in a different situation. Such a business probably will not be able to order frame relay from each company and expect them to interconnect. Instead, it will most likely need to obtain frame relay service from one company, which will, in turn, connect the sites in the other company's territory to its own network using more expensive dedicated circuits. Providing direct connections between different company's data systems would allow each to more efficiently and economically serve customers.

Policies

- Traffic exchange between data communications networks (such as frame relay, ATM, or Ethernet networks) of different carriers is supported and encouraged.
- Verizon and other carriers providing transport of local traffic between two third-party LECs should receive compensation, preferably negotiated privately between the parties. Direct interconnection is encouraged as an alternative.
- Independent telephone companies should exchange traffic with competitors offering service to their exchanges.
- Independent telephone companies, wireless companies, and CLECs with larger presences in Vermont should interconnect directly for the purpose of exchanging traffic.

WIRELESS TELEPHONE REGULATION

As the services offered by wireless companies mature and more people use and rely on wireless telephone services, it is reasonable to re-examine how wireless service providers fit into the overall framework for a competitive telecommunications marketplace. Wireless companies that provide telecommunications service are deemed to be telecommunications companies under Vermont law, and therefore fall within the jurisdiction of the PSB. Federal law restricts states' authority to regulate rates and prevent market entry, while leaving other aspects of regulation to each state's discretion. Regardless of authority, wireless service in Vermont has in practice been very lightly regulated (except with regard to siting facilities). For instance, in lieu of the Certificate of Public Good and tariff requirements applicable to other telecommunications companies, the PSB requires wireless companies only to register with it and file standard service contracts for informational purposes only. The service quality standards that the PSB has applied to wireline carriers it has not imposed on wireless carriers, nor do the policies established by the PSB in Docket 5903, the generic investigation into consumer protection for telephone consumers, apply to wireless carriers. The maturation of the wireless service market, and the increasing substitution of wireless service for wireline services argue for a convergence of wireless and wireline telecommunications regulation. This convergence should be accomplished predominantly by moving nondominant wireline companies in the direction of the current regulatory framework established for wireless, i.e. toward lighter regulation, rather than by increasing the regulation on wireless

companies. Somewhat higher levels of regulatory attention should be expected for wireless companies that voluntarily seek universal service funding, to make sure that the use of the funding is consistent with the public policy objectives of universal service programs. (This does not include those subjects that are preempted by federal law, such as rates.)

Policies

- The PSB should forebear from regulations that apply only to wireless companies when allowed to by law.
- Wireless companies should not necessarily be exempt from future generic telecommunications consumer protection rules that have been designed for a competitive marketplace and apply to all nondominant telecommunications carriers (see also subsection on "Nondominant Regulation," above), other than those rules that would be preempted by federal law.

VOICE OVER INTERNET PROTOCOL

Voice over Internet Protocol (VoIP) presents an exciting opportunity to lower the price of voice service, offer new features, and bring new competition. It also presents challenges to legacy regulatory models. There are different types of VoIP. A more complete discussion about these types is found in Section 1, "Telecommunications Trends." The discussion here will deal primarily with two types of voice-over-IP that use telephone numbers and interact with the Public Switched Telephone Network (PSTN). For convenience, these are referred to herein as "type 1" and "type 2" VoIP

- Type 1 voice-over-IP encompasses what is often known as "computer-to-phone" VoIP. In these instances, the service provider provides the voice service to the customer in a data format. The service provider also provides a gateway to the PSTN that will allow the customer to communicate with people who have conventional phones. Because the service provider brings the service to the customer in a packet data format, the customer must either use a computer or IP phone to communicate or use some form of adapter device that will convert the data communication into a form usable by conventional telephone equipment. IP networks used to deliver type 1 services to customers will support not only voice services, but also other data or even video applications.
- Type 2 voice-over-IP encompasses instances where the Internet Protocol is used by a carrier at some point in its network, but which presents itself functionally to the customer as a conventional telephone service requiring only conventional telephone customer premise equipment. Sometimes this is known as "phone-to-phone" VoIP. With type 2 services, it is virtually impossible for the customer to know that the service uses IP, unless he or she is told.

It is in the interest of Vermonters to allow them ready access to the wide variety of voice-over-Internet services.

The regulatory status of nearly all forms of VoIP is in flux, and the FCC released a notice of proposed rulemaking on the subject in March 2004.[6] FCC actions may restrict the PSB's discretion, or outright preempt its jurisdiction in this realm. To the extent that any authority is reserved for the PSB, Vermont should not attempt to regulate voice-over-IP in a significantly different way from most

Telecommunications service under Vermont law

The issue of how to properly classify voice-over-IP under state law contains echoes of a previous issue that is in suspension—the classification of cable modem service. Under Vermont law, "'Telecommunications service' means "the transmission of any interactive two-way electromagnetic communications, including voice, image, data and information. Transmission of electromagnetic communications includes the use of any media such as wires, cables, television cables, microwaves, radio waves, light waves or any combination of those or similar media." In its Order in the Docket 6101 Adelphia refranchising case, the PSB tentatively concluded Internet over cable was a telecommunications service, and under its jurisdiction. Vermont's statutory definition of telecommunications does contain a data exemption, created by Vermont's legislature in 1987, based on the Computer II federal regulation of that era that sought to protect and encourage the growth of electronic services, such as bulletin board and subscription data services. Noting the similarity of ISP services such as email and data transmission to those services protected by the Vermont definition's data exemption, the PSB concluded that "the provision of Internet service by an Internet service provider, when the manipulation of data is joined with the transmission of data, is not "telecommunications service" under 30 V.S.A. § 203(5)." However, it went on to say:

> Adelphia, however, is more than an ISP. Adelphia also provides the physical facilities for two-way transfer of Internet data. In the 1980's, subscription data services and electronic bulletin board services did not also physically transport their customers' data. We conclude, therefore, that the physical transport of Internet data is not protected by the data exemption. Because Power Link is two-way communications electromagnetic communications, and because it is not covered by the data exemption, we tentatively conclude that Power Link, and other cable television systems that provide Internet services, are providing "telecommunications service" under Vermont law.

The fact that Vermont law regarding what kinds of services are considered "telecommunications" is similar to, but slightly different than federal law is sometimes missed in the debate over whether or not to subject a service to the jurisdiction of the PSB. While "telecommunications" is but one word, it can have somewhat different legal meanings in Vermont and a federal context. At the federal level, the classification of cable modem service is in legal limbo. The FCC has ruled it is an "information service," while the Ninth Circuit Court of Appeals has ruled it is a "telecommunications service." The question is on further appeal. After its tentative conclusion in Docket 6101, the PSB had discontinued further investigation into the question of state-law classification, and supported the argument at the federal level that the service was a "telecommunications service." The PSB thus far has not attempted to enforce its tentative conclusion in Docket 6101.

Until this issue is fully resolved, it is nevertheless possible to narrow the controversy. Steps to change and loosen the regulation on nondominant telecommunications carriers will have the effect of bringing the practical regulatory treatment of nondominant telecommunications service providers and information service providers closer together.

of the rest of the country, as this is likely to limit market entry and choice to Vermont consumers. Nevertheless, Vermont policy-makers will need to face this issue and should participate in that national discussion; the analysis and preliminary conclusions in this plan are intended to inform and guide their considerations.

To allow Vermonters ready access to the wide variety of type 1 providers coming on line, it appears best to forbear from subjecting these services to PSB regulation to encourage market entry by providers in Vermont. Type 1 services effectively change the voice service from its position as the primary telecommunications service to a position as an application riding on top of a data telecommunications service. The number of type 1 service providers available on the Internet is growing rapidly, and there appear to be relatively low barriers to entry in this market. Consumers with standard IP telephony equipment have access to many alternatives and can set up a new service relatively rapidly. Pricing for this service is relatively low and is likely to be driven even lower as the market matures. Finally, as mentioned previously, type 1 service requires an underlying broadband connection, which is likely to be more expensive and for which there are likely to be many fewer competitive choices than the type 1 service itself. The loss of that underlying service would present a much greater problem to a home or business trying to maintain its communications capability than would the loss of the type 1 Internet telephony service. Limiting state regulation of this service will encourage the development of the nascent market for this new service.

The PSB has substantial authority under 30 V.S.A. § 227c to modify, reduce or suspend the otherwise

applicable requirements for nondominant providers of telecommunications service relating to regulation of rates and other terms and conditions, as well as various corporate and financial transactions. However, the PSB has less discretion under state law regarding which companies will be subject to its jurisdiction. The section of Title 30 that defines the telecommunications companies subject to the PSB's jurisdiction, 30 V.S.A. § 203(5) includes a data exemption created by Vermont's legislature in 1987, based on the "Computer II" federal regulation of that era that sought to protect and encourage the growth of electronic services, such as bulletin board and subscription data services. The exemption only extends to "nonvoice" services. (See sidebar, "Telecommunications service under Vermont law.") While at one point the use of voice as a trigger was reasonable, today it raises serious questions. Does even voice chat over Internet instant messaging systems constitute service subject to PSB jurisdiction? The "nonvoice" exemption does not appear to depend on whether or not a voice service uses telephone numbers, and seems to imply that even "computer-to-computer" VoIP applications that do not interact with the PSTN could fall under PSB oversight according to state law.

Even if type 1 service is not regulated by the PSB, there will still remain a number of important public-policy issues that type 1 service raises. This is especially true if type 1 service is offered as a mainstream alternative by cable and traditional telephone companies, and it attracts significant numbers of consumers who begin to use the service in place of legacy telephone services. Three types of issues that arise are issues of consumer protection, intercarrier issues, and "social obligations" such as support for universal service and 9-1-1. The paragraphs immediately below discuss the latter two issues, while the subsection on "Consumer Protection," above, discusses this plan's approach to consumer protection in competitive marketplaces.

Intercarrier issues arise because the rights and privileges of telephone companies as they relate to other telephone companies (for example, the right to interconnect with other telephone companies, the ability to obtain blocks of telephone numbers from numbering administrators, the right to reciprocal compensation, etc.) often hinge on the status of the companies as certified telecommunications companies. To address this, it should be clear that the PSB will only enforce those rights and privileges for companies that hold certificates of public good to provide telecommunications service. The use of CPGs is a convenient signal to participants in the telecommunications industry regarding who is entitled to claim those rights and privileges. To this end, it may in fact be desirable for some type 1 providers to voluntarily seek out or maintain at least nondominant regulation by the PSB. Other type 1 companies may simply elect to work with partners who are telephone companies certified in Vermont and who sell the type 1 provider access to the PSTN. Specific discussions of local number portability and virtual number issues as they relate to type 1 services are in the subsection below on numbering.

The current telephone system provides support for a limited number of key public benefits. These include access to E 9-1-1 emergency services and universal service programs that help all members of society obtain essential communications. Erosion of these public benefits due to a migration of users from legacy telephony to VoIP would not be in the public interest. Issues

affecting E 9-1-1 are discussed in the subsection, "E 9-1-1," below. In addition, the discussion of how to apply universal service support on a going forward basis, found in Section 5, is applicable to these companies. In essence, it should be possible to separate the obligation of VoIP providers who interact with the PSTN to support these public benefits from the issue of imposing PSB regulations generally on these providers.

In contrast to type 1 services, the use of IP in a type 2 scenario should not change the regulatory status of a company's telephone service. The use of type 2 VoIP is essentially a technology choice made by a company about its own internal network. This may or may not allow a company to run a better, more efficient network, but otherwise offers little difference in the way that companies hold out service to the public. This does not mean that the state should necessarily seek to impose heavy regulatory requirements; many companies using type 2 VoIP should qualify for nondominant status.

Policies

- The state should forbear from subjecting "type 1" VoIP services to PSB regulation and should attempt to find alternative means to address other important public policy issues.
- (See additional policies that relate to VoIP in the subsections below on "Virtual Numbers," "Local Number Portability," and "E 9-1-1" and in the "Existing State Universal Service Fund" subsection of Section 5, the "Universal Service" section.)

Strategies/Action Plans

- The legislature should provide the PSB with additional authority under state law to forbear in whole or in part from requiring CPGs for nondominant companies to whom the PSB has granted forbearance from all of the Title 30 requirements currently listed in 30 V.S.A. §227c.
- The PSB, by rule or order, should act to forbear from regulation of type 1 VoIP services, as well as computer-to-computer voice services that do not use telephone numbers.

NETWORK INFRASTRUCTURE STANDARDS

The emerging range of retail service choices that Vermonters can access is supported by a limited number of physical telecommunications networks that connect Vermonters to each other and the outside world. The quality and capabilities of these networks are critical to Vermont's future.

HIGH-SPEED SUPPORT

Data transmission was once an ancillary use of telephone networks and was often accomplished through facilities that were segregated from facilities used to transport voice traffic. Data uses have grown and will continue to grow exponentially while voice traffic volumes are relatively stable. Voice service will, in the near future, become an ancillary service of a network that is evolved and designed principally to handle data. In order for Vermonters, Vermont

businesses and Vermont institutions to be competitive, these services cannot be available only in selected areas. High-speed data services must become available to all subscribers throughout the state. The primary obstacles to making this objective a reality are the required upgrades to or replacement of "last mile" facilities (i.e. the telephone distribution plant that connects customers' locations to telephone central offices) that were designed and built to carry voice traffic, not data.

All of the facilities-based local telephone companies have made at least some progress in rebuilding and reconfiguring their networks to support the next generation of telecommunications services. In the case of some independent telephone companies this transformation has been extensive. Typically, it involves pushing fiber deep into the network to numerous remote terminals and shortening the remaining copper loops greatly so that they are capable of high DSL speeds. Other possibilities loom. Fiber optics all the way to the individual premise would provide nearly limitless capacity. The cost of fiber networks is close to an economic tipping point, and it could very well be pushed over the edge of cost-competitiveness if implemented on a wide scale by large national companies. Regardless of the exact strategy used, the bottom line is that "voice grade" is no longer a sufficient standard for the state to hold its local exchange networks to. This has already been recognized by mainstream organizations such as the U.S. Department of Agriculture's Rural Utilities Service (RUS), which insist that borrowers building or upgrading rural telephone plant design their networks in such a way that they can support video to the subscriber and minimum data transmission rates of 1 Mb per second.[7]

The Rural Utilities Service insists that borrowers building or upgrading rural telephone plant design their networks in such that they can support video to the subscriber and minimum data transmission rates of 1 Mb per second.

Policies

- Local exchange carriers should be upgrading their last mile infrastructure to be capable of providing mass-market broadband services to all customers. Any remaining copper loops should be short enough in length to support high-quality video over broadband to customers, either presently or with modest additional upgrades to line electronics.
- Local exchange carriers should evaluate the life-cycle cost of deploying fiber to the premises including maintenance costs. If projected costs and revenues support fiber-to-the-premises projects, LECs should begin to convert their outside plant to fiber.
- Fiber-to-the-premises pilot projects by LECs should be supported even if impacts on regulated revenue requirements are modestly unfavorable if conducted by LECs for the purposes of gaining real-world experience with the technology and evaluating cost and consumer response.

REDUNDANCY AND DIVERSITY

People expect telecommunications service to work reliably, and for some organizations and businesses that reliability is mission-critical. Telecommunications networks tend to concentrate the traffic of a large number of users onto a few high-capacity facilities as it travels over distance. Loss of service on these facilities can cause harm to large numbers of customers. Redundancy is the technique of operating multiple facilities capable of providing a service to guard against failure on one facility. While redundancy alone can protect against equipment

failure, service is still vulnerable to interruptions caused by such threats like a cable cut if redundant facilities (such as dual fiber optic pairs) traverse the same physical route. Redundancy is enhanced when redundant facilities traverse physically diverse paths. Some entire networks, such as Telcove's Vermont fiber optic network, are designed so that all routes are redundant and geographically diverse. While many Vermont phone exchanges are connected to each other by interexchange facilities that are both redundant and diverse, some are not. Depending on which inter-office routes are disrupted, all phone customers in an exchange may be unable to make calls beyond their own exchange during an event such as a cable cut. For example, Verizon and several independent-owned telephone exchanges northwest of Burlington experienced outages in 2002 and 2003 as a result of cable cuts. Such outages have serious implications for public safety, as callers were unable to reach 9-1-1 emergency dispatchers. Such outages also have implications for commerce. Redundancy and diversity issues are not limited to local exchanges; outages can occur on interstate facilities. For example, a June 2003 fiber cut in New York State interrupted Adelphia Cable's Internet access service and MCI's long-distance service in Vermont. These companies had not arranged diverse facilities.

The most telecommunications-dependent customers achieve redundancy by purchasing service over the networks of two or more providers, although providers with separate facilities are available in only limited areas of the state. Redundancy and diversity may be points of competition between carriers that are vying to serve a large business or institution, but that is not presently the case for the vast majority of consumers. To the extent that competitive alternatives exist, the competitors in all probability are leasing or re-selling the incumbent local company's network facilities, and their service will be only as reliable as the incumbent's. Network redundancy and diversity does not, at present, seem ripe for a market solution and should therefore be considered as a subject for minimum standards or an explicit incentive framework.

In addition to dependence of phone service on inter-office and inter-regional facilities, the reliability of phone service is vulnerable to cable disruptions or equipment failures in the distribution plant that connects customers to their service provider's local central office. While providing all customers with complete redundancy in local loop facilities would be costly and possibly excessive, a number of telephone companies in Vermont have linked their remote terminals in the field with SONET rings that provide redundancy in the "feeder" portion of the local loop. This extension of redundancy increases the reliability of the network.

Policies

- All local exchange carriers should build or arrange for redundant, physically diverse interexchange facilities to all exchanges served such that loss of service on one route does not cause an interruption of interexchange service.
  - LECs that choose not to construct their own facilities to achieve these ends should lease circuits or enter transport agreements with other carriers.
  - Interconnected LECs should maintain physically diverse redundant connections, either directly or indirectly through a third-party LEC.

- All interstate interexchange carriers should maintain physically diverse redundant connections in and out of Vermont such that loss of service on one connection does not cause an interruption of interexchange service.
- Facilities-based LECs should look for opportunities to extend redundancy and physical diversity into the feeder portion of the loop when planning and improving their networks.

POWER BACK-UP

Robust battery back-up has long been a feature of central offices that have contributed to the reliability of telephone service so that consumers could call even in the event of a power outage. Although once most customers were connected directly to the central office, today telephone companies provide many consumers' telephone service through remote terminals in the field. These facilities allow companies to use copper loops more efficiently, improve line quality, and help deploy broadband services. They also require an electric power supply to operate. Not all remote terminals have been equipped with sufficient back-up in the past. Consumers served by remote terminals should not have a lower standard of reliability than those served by central offices. Cell sites are another type of remotely located facility that more and more Vermonters are depending on for service. Although evidence has not come to light that these facilities are not properly equipped with power back-up, it bears stating that power back-up at these facilities and on the landline phone facilities that connect cell sites to switches are becoming, if anything, more important.

Policies

- Local exchange carriers with facilities should maintain sufficient battery or generation back-up available to maintain power indefinitely on both central office and remote terminal equipment during an extended commercial power outage.
- Wireless telephone providers should maintain battery or generation back-up available to maintain power at antenna sites during an extended commercial power outage.

POLE ATTACHMENT POLICY

As a rural state, utility poles provide the primary locations for communications companies to place their facilities that deliver services to Vermonters. Fair and nondiscriminatory access to these bottleneck facilities is crucial to the success of cable and telecommunications companies, whether incumbent or non-incumbent. Pole attachers should contribute fairly to the costs of jointly used facilities, but poles should not be a source of extraordinary revenue or a means of slowing market entry. Over the past several years the PSB and PSD have reformed pole attachment policies and rules applicable to pole-owning utilities and the entities that seek attachments to those poles. This progress is important and must be both maintained and sustained.

Policies

- When utility poles are shared, the PSB should assure fair and nondiscriminatory access to these facilities. Costs associated with these facilities should

also be shared in a manner that is fair and nondiscriminatory including, for example, pole rentals and attachment conditions, survey fees, and make ready charges.

RATES

The days of the PSB setting a single set of rates available to each customer for local and long distance calling in Vermont are still here to a certain extent, but they are waning. It is time to review and re-examine the role of the PSB and PSD in this traditional area of regulatory activity.

LOCAL RATES AND ACCESS CHARGES

Competition and technology are providing new options to retail customers for local and long distance calling, often at lower prices. One way that PSB policy very much continues to influence the rates customers pay for local and in-state long distance is by settling disputes and setting rules on rates and other terms for when and how much telephone companies pay each other for originating or terminating calls. These rules and decisions can either accommodate or slow down the rate of change for new calling options.

Given changes in technology, competition, and the types of calling packages that competition is offering consumers, it is time to review policies on wholesale and retail local calling areas, access charges and local usage rates.

Prices for telecommunications services were historically set to approximate the underlying costs to set up and bill for phone calls, switch and transport telecommunications traffic and remunerate inter-connecting carriers for their costs to originate, transport or terminate calls. (The term “cost” as it is used here and typically used in ratemaking includes a margin to allow for reasonable return on investment.) The network configurations, technologies and interconnection arrangements used to accomplish these tasks have changed constantly since the inception of telecommunications networks, and will continue to change. Service providers and regulators have been hard-pressed to modify service rates at the pace with which the costs have changed. In many cases, rate structures that provided carriers sufficient revenue streams in an era of monopolies or limited competition are not sustainable in the face of competition. Yet, in many cases, abrupt re-balancing of rates to align with economic, underlying costs would cause difficult and disruptive rate increases to certain services and classes of customers. Accordingly, in many instances, rates have been adjusted incrementally and opportunistically when cost decreases or periods of cost stability have allowed. This approach offers the benefit of "winners, but not losers" from rate re-balancing, although the advent of competition has forced or may require a more accelerated approach.

The distinction between "local traffic" and "toll traffic" is foremost among the rate structures out-of-synch with underlying costs and under pressure from changes in technology and the industry. Landline competitors and wireless companies have introduced "all distance" local/toll calling packages with either unlimited, flat-rated pricing or a bucket of any-distance minutes. Verizon and several of the incumbent independent LECs have followed suit. Voice over the Internet Protocol has arrived, with niche carriers introducing service in 2003 and 2004, and mainstream carriers such as AT&T and Verizon introducing similar services nationally in 2004. Moreover, mobile phones, e-fax services, and

"virtual number" services (discussed at length with other telephone numbering issues below) have all eroded the concept of a telephone number being associated with a specific geographic location - an assumption around which telephone traffic has historically been classified as "toll" or "local" and upon which intercarrier compensation arrangements have been built. Moreover, current rules sometimes produce counterintuitive results for intercarrier compensation by relying on physical geography. Federal rules permit the PSB to define local calling areas in Vermont, but allow competitive telephone companies to opt for a single point of interconnection in the state with an incumbent telephone company. The PSB has previously ruled that local calling areas for intercarrier compensation are the same in Vermont as those for the incumbents' minimum local calling areas. While this seems natural, exchanges that are nearby geographically can be less so as a call travels the telephone network. When a consumer makes a local call to another telephone company's customer, the company originating the call must transport it to the point of connection with the other company (even if that point is far across the state), and receive no compensation from the other company, or even pay compensation to the terminating company. If the consumer makes a long distance call within Vermont, the originating company will receive toll or access compensation, even if the call is a relatively short distance toll call. Maintaining the current usage charge structure in Vermont without reforms is likely to pull the PSB and PSD into a series of complicated intercarrier disputes about who must pay various costs, and when. Rebalancing and simplifying the rules for intercarrier compensation will make it easier for carriers to focus on creating value for customers through their calling plans.

The PSB substantially reduced Verizon's intrastate access rates (essentially, its wholesale toll rates) over the last three years as well, bringing those rates closer to underlying costs. The access rates of Vermont's other local phone companies, the Independent LECs, remain substantially higher than underlying costs. (For a comparison of incumbent telephone company access rates, see Section 3, "Telecommunications Almanac.") Because revenues from these access services constitute a substantial fraction of those LECs' total revenues, aligning rates to costs is a challenge, whether through reduced access rates or expanded local calling areas. The disparity between rates and costs makes the incumbent LECs all the more vulnerable to revenue losses, and invites other carriers to transport or exchange traffic in ways that minimize those carriers' costs, but that which are inefficient from an overall perspective. In recent years, significant progress has been made in reducing or keeping local dial tone rates low and relatively affordable. Revenue declines, to the extent the local companies are experiencing them, are principally to usage-based categories (access, toll and local usage). Over time, a greater proportion of telecommunications traffic will likely bypass the traditional switched network in favor of wireless or the Internet, yet Vermonters will expect that local companies will continue to maintain an adequate and reliable local phone network. The best way to enable local phone companies to meet this responsibility may be to provide them with a relatively stable revenue stream that relies heavily on fixed rates or rates that are not subject to bypass. The creation of a state fund to support universal telecommunications service in areas with a high cost of service, discussed in Section 5 (see subsection on "State Universal Service Support for High-Cost Areas"), would provide an additional support mechanism to companies who serve the hard-to-serve in the face of

declines in traditional support mechanisms. Overall, stability of dial tone rates is a reasonable objective; opportunities to reduce rates should instead focus on reducing usage-based rates.

The PSD's 2003 telephone survey indicated that Vermonters were satisfied with their current local calling areas, but were interested in other local calling area options. Many were unwilling to add much to their local bill to save on long distance. Allowing competition and innovative marketing by telephone companies to provide consumers with calling options is a good way to address this somewhat diffuse popular opinion. Addressing tensions that are arising as past intercarrier compensation policies and decisions age is a good way to promote innovation and options for consumers.

Previous sections of the plan described the potential for FCC action to restructure intercarrier compensation. (See the subsection on "Federal Preemption" in Section 1, "Telecommunications Trends" and the subsection on "Federal Universal Service Support" in Section 5, "Universal Service.") It is even possible that the FCC will preempt state authority over intrastate intercarrier compensation and eliminate all intercarrier compensation. The Notice of Proposed Rulemaking (NPRM) in which this possibility has been raised has been pending for three years in 2004. Regardless of this possibility, there are good reasons for the PSB to address the intercarrier compensation issues raised here. Similar issues to the ones raised here motivate the FCC NPRM. Should the FCC continue to delay action, these issues will not go away in Vermont. Should the FCC eliminate intercarrier compensation, including intrastrate intercarrier compensation, Vermont may have limited time to consider and deal with the impacts of such an event. Addressing the issue proactively will allow Vermont more time to act thoughtfully.

Within local dial tone rates, Vermont has made significant progress in bringing business and residential rates closer together. (See the "Retail Rates" subsection of the "Telecommunications Almanac," Section 3.) Nevertheless, business rates remain higher, and there is little reason to believe that the amount of difference in the rates accurately reflects differences in the cost of providing residential and business telephone lines. A measure of rate rebalancing between residential and business rates may be necessary.

Policies:

- To the extent that it can be done without causing rate shock, rate-regulated LEC usage rates for measured local usage and access rates should be set at similar, cost-based levels, while accounting for possible differences such as transport distances and least cost methods of traffic routing.
- Until usage rates are set at or near to cost (including a reasonable rate of return on investment), reductions in usage rates should be accorded higher priority than reductions in dial tone rates.
- To the extent that independent telephone companies require above-cost access charge revenue to maintain affordable dial tone rates, it is preferable to assign the non cost-based component to a terminating carrier common line charge instead of spreading the non cost-based component equally over all the access charge elements.

- Requirements for incumbent local telephone companies to have calling plans with local measured service caps should be retained in the near term, but should be re-examined in those service territories that have universal, affordable broadband access or affordably-priced unlimited local calling plans.
- Differences between regulated business and residential dial tone rates, if any, should reflect differences in the cost of the services.
- When rebalancing rates is performed outside the context of a rate investigation rate-regulated companies should be allowed to have revenue neutrality.

Strategies/Action Plans

- The PSB should open a generic investigation into wholesale local calling areas and access charges, with an objective to rebalance and simplify local and intrastate access intercarrier compensation obligations to reflect changes in calling patterns, competitive markets, and costs. During the course of this investigation, the PSB should also consider the challenges and opportunities that could arise if the PSB rebalanced and simplified intercarrier compensation. These include:
  - Would changes to wholesale local calling areas and access charges allow either incumbents or competitors to offer more attractive retail expanded local calling areas or local calling options?
  - If usage rates are lower, is keeping local measured service caps essential, especially in areas where broadband Internet access is available?
  - Would a narrowing in the difference between local and toll charges or an expansion of local calling areas create a more attractive option to consolidate rate centers and conserve telephone numbers? (See subsection on "The 802 Area Code" below.)
  - How could different rules on wholesale local calling areas and lower access charges simplify the PSB's treatment of foreign exchange, foreign exchange-like, and virtual number services? (See subsection on "Virtual Numbers" below.)
  - How might changes in intercarrier compensation affect the affordability of telephone service, and are there sufficient universal service mechanisms available to compensate?
- The PSB should base access charge and local measured service rates on updated cost study results.
- If the conclusion of a rate case provides the PSB with the opportunity to reduce incumbent LEC rates, highest priority should be given to above-cost originating access rates. Parity between originating and terminating rates should not be a priority until originating rates are at or near cost.
- In telephone company rate cases the PSD and PSB should seek to equalize business and residential single line rates unless there can be shown clear cost-based reasons for maintaining higher business rates.

SPECIAL ACCESS

"Special access" is a regulatory class of services that includes the workhorse of data communications, the T-1 circuit. Once used primarily by a small number of large customers, special access services are increasingly going mainstream.

What is "special access?"

Special access circuits were high-capacity lines originally deployed typically for voice services; for example, they would be used to link a large user's PBX to a long distance carrier's network to obtain lower long distance rates. This arrangement avoided the per minute access charges that the local company would otherwise charge the long distance carrier. Instead the local company collected "special access" charges that depended on the distance traveled by the dedicated high-capacity link. While special access circuits are still used in voice applications, for example, linking cell sites back over the landline network to cellular carriers' switches, increasingly they are used as high-capacity links in data communications networks.

One of the latest applications is to deliver a combination of voice lines and high-speed data to small offices over a single facility. Special access circuits also form the backhaul for many of the broadband services offered to the mass market. Therefore, the price of these services can influence the price and availability of other telecommunications services. Despite their growing importance there has been relatively little regulatory focus on these services especially compared to local dial tone rates and the "regular" access charges that affect long distance rates. There is reason to believe that the costs to providers associated with these services may have changed in the period since they were last examined. For example, a form of DSL can now provide an equivalent to the traditional T-1 service, 1.5 Mbps of data transmission in both directions. Yet, a T-1 special access circuit, when purchased through Verizon's intrastate tariff, costs at least $453 per month (and often much more than this), in comparison to roughly $60 per month for a combination voice and DSL line. Increasingly, competition pressures incumbent providers selling special access services over the "middle mile." There is much less often an alternative to the incumbent's facilities for providing special access circuits over the "last mile."

Strategies/Action Plans

▶ The PSD and PSB should examine the extent to which lower prices would increase usage of intrastate special access services and consider undertaking a cost study of special access services, at a minimum for T-1 and T-3 circuits.

NUMBERING POLICY

Telephone numbers are essential pieces of "virtual real estate" in the telecommunications realm. Numbering issues impact a wide variety of other issues discussed in this plan, including competition, consumer protection, and use of the Internet. In addition, the 802 area code is an important piece of Vermont's identity, and extending its useful life as Vermont's sole statewide area code may be in the public interest. This section deals in greater detail with three numbering issues that are to varying degrees related: the 802 area code, local number portability, and virtual numbers.

THE 802 AREA CODE

Vermont has made significant strides in delaying the exhaust of the 802 area code, as detailed in the "Telephone Numbers" subsection of Section 1, "Telecommunications Trends." The credit largely goes to the PSB's implementation of thousands block number pooling, which increased the efficiency with which telephone numbers are assigned and used in Vermont. This measure is made more effective when the PSB continues to actively police the assignment of numbers. While telephone companies are entitled to blocks of numbers that they need, they must abide by rules that require them to make requests for number blocks based on realistic forecasts.

While greatly reduced, the risk of exhaust for the 802 area code has not been completely eliminated. Actions to extend the life of the 802 area code taken

while a crisis is still far off and the remaining pool of numbers is still relatively large will have the greatest effectiveness. One step that remains available is rate center consolidation. Reducing the number of rate centers (rating areas) would reduce the number of blocks of 10,000 numbers assigned to each carrier, thereby slowing the rate of exhaustion of numbers. Vermont has 141 rate centers, which means there are 141 local calling areas. If there were only one local rate center for the entire state, each new entrant would get a single block of 1,000 or 10,000 numbers for the entire state. In addition to conserving numbers, reducing the state to a single rate center would also have the effect of eliminating in-state long distance. Eliminating in-state toll would presumably raise local rates, but perhaps not as much as might be expected. A less drastic step might simply be to reduce the number of rate centers by a factor of 5 or 10. As rate center consolidation has revenue and rate impacts, it should not be examined solely in the context of its impacts on the 802 area code. It may be advantageous to combine rate center consolidation with a program of access charge reform, simplification of wholesale and/or retail local calling areas, and the clarification of policies dealing with virtual numbers and foreign exchange service. Consolidating rate centers would tend to reduce the complexity of disputes involving local and toll distinctions, or at least reduce the scope of such disputes, especially if care was taken to establish rate centers that more closely reflect the configuration of the underlying network. That underlying network has changed in the decades since rate centers were first defined, and the network continues to evolve. Telecommunications networks today are more likely to allow a call to be transported over great distances even if the final destination is close by. (This is not unlike an airline that routes passengers through a hub in Detroit to transport passengers from Burlington to Miami.) The correlation between telephone network distance and distance "as the crow flies" is less than it once was which is an argument for larger rate centers.

Actions to extend the life of the 802 area code that are taken while a crisis is still far off will have the greatest effectiveness.

Strategies/Action Plans

- The PSB should continue to regularly audit carriers' use of assigned numbers and order unused blocks returned to the pool. It should impose penalties on companies who exaggerate use projections to obtain or hoard numbers.
- The PSB should consider rate center consolidation when investigating wholesale local calling areas and access charges. (See subsection, "Rates," above.)
  - The PSB should examine consolidation of groups of rate centers by grouping together the existing rate centers in Verizon host-remote clusters and independent company service territories, although some modifications may be necessary.

LOCAL NUMBER PORTABILITY

The ability for business and residential consumers to keep their telephone numbers is a key to reducing the barriers to customer choice. Consumers are more likely to exercise their right to choose if it will produce fewer disruptions to their use of the service. The market discipline this imposes on competitors means that local number portability (LNP) is almost always desirable in telephone markets, even if there are transition issues for carriers to implement it. The FCC's orders extending LNP to the wireless telephone market and granting

consumers the ability to port numbers between wireless and wireline carriers were important victories for consumers and the telecommunications marketplace.

Internet telephony providers, in particular the "type 1" Internet telephony providers described above, raise some special issues in connection with local number portability. Some VoIP companies offer their customers the option of porting their existing telephone numbers to the service. This is not in itself unreasonable (and is likely to please consumers), but it raises some questions. Number portability has been conceived as something that occurs between telecommunications companies. If a VoIP company is not a telecommunications company, then how does it port numbers? Obviously, this is part of a larger question about the relationship of a type 1 service provider to the public switched network. If such a provider does not become a LEC, then it must buy local telephone services from a LEC in order to create a gateway between the Internet and the PSTN. The type 1 provider's conventional LEC would be capable of porting numbers to the telephone lines the type 1 provider buys from the LEC. There are issues of fairness involved if one LEC ports a number from another LEC that belonged to telephone customer 1 (the end user) and assigns it to telephone customer 2 (the type 1 VoIP provider). If the type 1 provider is now the "customer" on the ported telephone number, what recourse does the end user have if he or she wants to port that number away from the VoIP service to some other telephone service? Local number portability is an important consumer benefit that enhances competition. Clearly, if consumers' numbers may be ported to VoIP services then they should have the clear and unambiguous right to port numbers away from these services.

Policies

- The PSB and PSD should support wireless number portability in Vermont including portability between wireless and wireline numbers.
- VoIP service providers should not receive customers' ported telephone numbers unless they allow customers the unambiguous right to port those numbers away from the service provider.

VIRTUAL NUMBERS

Not long ago telephone numbers were firmly anchored to geography. Most customers only had the option of obtaining a telephone number associated with their local exchange. And in fact the telephone number was generally assigned to a switch physically located in that exchange. For those that wanted to have a telephone number in a distant exchange (along with that exchange's local calling area), foreign exchange services were available but were expensive and not commonly used. (Call forwarding is a more recent "traditional" service for making a call appear to be delivered somewhere it is not.) As with other telecommunications services involving distance, prices have come down significantly due to a combination of reductions in the unit cost of telecommunications transport, mobile technology, the Internet, and competition. Now a variety of service providers are offering their customers the ability to have a telephone number associated with a distant exchange at a low price. The most obvious examples of this phenomenon are wireless telephone providers. A customer with a Rutland, Vermont, wireless number can be traveling (or even have moved

to) California, and callers in the Rutland local area can still reach him or her for the price of a local call. The implementation of wireline-to-wireless number portability will only increase the power of this trend. Also, LECs now offer ISPs distant local numbers in order to offer local dial-up access numbers to the Internet over a wide area without the need to establish many multiple local physical points of presence.

A more recent and striking example is the virtual number options offered by many type 1 VoIP providers (and Internet faxing providers), who offer their customers the ability to choose a telephone number without regard to their location. A customer located in Albany, Vermont could have a Manhattan phone number, or vice versa. For that matter, since the customer connects to the service provider over the Internet, there is nothing to stop someone located in Bangalore, India or Tel Aviv, Israel from obtaining a Vermont number. Furthermore, even if a Vermont number is established at a Vermont location, some type 1 VoIP services share some of the portability characteristics of wireless telephone service. Since these type 1 VoIP services are tied to an IP telephony device, not a location (like a consumer's wireless telephone service is tied to a particular cell phone at a given point in time), users can easily move type 1 services. Take

The use of the term "virtual number" in this plan

The term "virtual" has become a charged word in connection with numbering issues, and its use presents some problems. Therefore, it is worthwhile to explain why and how its use is intended in this plan.

Although the term currently has a pejorative sense in some regulatory contexts, this originally was not so. In the mid to late nineties, the adjective "virtual" came to be used to describe services that appeared to be in a location but in some sense were not. For example, virtual ISDN was a service that made it appear that certain switches offered ISDN service to their exchange, when in fact the service offered was served out of a distant exchange. This virtual service was a benefit to consumers who otherwise would not have had access to the service. A variety of LECs began to offer customers such as ISPs "virtual" numbers that allowed the ISP to appear as if it had a modem bank in a particular local calling area when in fact traffic was delivered to it at a distant location. This helped to sustain the availability of statewide dial-up Internet access at local calling rates. Unfortunately, such services were subject to abuses. In Docket 6742, the PSB examined the way that the CLEC GlobalNAPs had implemented its virtual NXX service (see subsection on "Telephone Numbers" in Section 1, "Telecommunications Trends") and concluded that it had the effect of unfairly shifting transport costs to Verizon and avoiding long distance charges, and stated that virtual NXXs were contrary to public policy. However, the PSB also stated that there could be legitimate services that made it appear to a caller that a user had a number in a rate center in which they were not in fact physically located. It pointed to foreign exchange (FX) services and also stated that there could be permissible "FX-like" services. In Docket 6209, the PSB took testimony on whether or how to apply its ruling in Docket 6742 generally to the whole industry. While there was considerable disagreement between parties about the meaning of the terms "virtual," "FX" and "FX-like," some parties (including the PSD) used "virtual" as a name for the types services the PSB should prohibit and "FX" and "FX-like" as a name for the types of services the PSB should permit.

In the world of marketing, especially the marketing of Internet telephony providers, and among the early adopters of this technology, these semantic distinctions are not yet established. For this reason, and for simplicity's sake, in this plan the term "virtual number" is used generically to refer to any number that appears to be in a particular location but in fact is being used by someone in a geographically distant location. Some applications of "virtual numbers" may be contrary to public policy, and others (as the term is used here) may in fact qualify as "FX" or "FX-like" services (as those terms have been used in Docket 6209). The use of the term "virtual" in the plan in and of itself should not be taken as approval or disapproval of a particular service.

an IP phone or an analog telephone adapter that is registered with Vonage from a home Internet connection, plug it in to an Internet connection at work, or at a hotel room on the road, and it will continue to work with the same telephone number despite the change in location. There is no reason why Wi-Fi enabled wireless IP phones could not simulate a cell phone wherever broadband wireless access is available, making these services truly mobile. If type 1 VoIP services exist at all, it is nearly impossible to prevent the use of virtual numbers.

Vermont will be swimming against the tide if it tries to ban the use of virtual numbers entirely. The ability of business and residential consumers to keep their number when they move, to have a number that comes with them when they travel, or have a "virtual" presence in a community of interest is an example of an innovative response to the high prices of traditional foreign exchange and long distance call forwarding that policymakers should expect from competition. There are, however, legitimate issues regarding the proper compensation for local telephone companies that must deliver or receive traffic from the LECs offering virtual number services and regarding the rate at which telephone numbers are used.

One basic principle should be that carriers who wish to offer customers a telephone number in a local rate center should have a legitimately local presence. Customers or switching facilities physically located in an exchange where a local carrier has a block of numbers are the preeminent examples of such a local presence. This is not to say that a LEC with a block of numbers it has obtained for use by customers or a switch in an exchange should not be able to offer virtual numbers out of that block to other customers who are remotely located, subject to certain conditions. Going further and allowing whole number blocks that are entirely virtual, though, runs too great a risk of interests outside the state consuming numbering resources entirely for non-Vermont customers; this is especially true if Vermont's policies on this issue are more lenient than that of other states. (A national policy could significantly change this consideration.)

A second principle that is related to the first deals with how calls to virtual numbers are treated for intercarrier compensation and exchange of traffic. All virtual number services have the effect of providing retail customers with the ability to avoid toll charges on certain routes. For example, if the owner of a cell phone with a Rutland number is called by a Rutland resident, the call is local, even if the phone is in California. If a call travels between local carriers a virtual number can change the intercarrier compensation. This is true even of traditional foreign exchange service. Although a Middlebury customer buying a traditional Verizon foreign exchange service with a Rutland number pays Verizon a fixed monthly fee to transport such calls from Rutland to Middlebury, the customer does not pay neighboring telephone companies like VTel anything. Nevertheless, when VTel's customer in Killington calls the Rutland number of the Middlebury customer, VTel collects local usage charges (if any) from the caller instead of the higher originating access charges from a long distance company it would have collected if its Killington customer had called the Verizon Middlebury customer at a Middlebury number. As virtual number services become possible at lower and lower cost, this kind of situation will become more common. The PSB should not seek to ban virtual number services to preserve access charge revenues—in any event this is likely

to be extraordinarily difficult to enforce against Internet and especially wireless telephony services. The increasing ease by which telecommunications consumers can bypass high access charges is instead another reason for the PSB to examine access charge rates and the extent to which local and in-state long distance charges should differ. Local telephone companies should not have to transport traffic to other companies who offer virtual numbers beyond a reasonable distance. As a general matter, it is fairer for companies who offer virtual numbers to pick up or drop off traffic at or reasonably close to the exchange in which the number is assigned or for them to pay someone else to do it for them. Federal policy complicates this matter somewhat by decreeing that CLECs are entitled to a single point of interconnection for local traffic with ILECs in Vermont. Nevertheless, if the PSB narrowed the difference between local and toll calling in Vermont, it would reduce the complexity of the virtual number issue.

In Docket 6209, the PSB has been investigating the use of "virtual NXXs." The clearest application of these numbers during the course of the investigation has been their use for dial-up Internet access. While the notion of calling the Internet was clearly contemplated by the PSB when it began this docket, not so was the notion of the Internet calling back. The decision in Docket 6209 may only serve as an interim solution. In Docket 6209 the PSB took as a given its prior policies on wholesale and retail local calling areas established in the mid-1990s and the access charge and local usage rates already in place. Given the changes in technology, competition, and the types of calling packages that competition is offering consumers, it is time to review those policies. (See subsection, "Rates." above.) That is also the opportune time to review and establish complementary policies regarding the use and compensation for virtual numbers.

Policies

- The state should not attempt to block Internet telephony providers from offering virtual numbers to customers unless matched by similar efforts in a critical mass of other states or the FCC.
- The PSB should allow telephone companies to offer some forms of virtual number services.
- When a telephone service provider chooses to offer a customer a number in a rate center at a distance from the customer's geographic location, the carrier offering the service should assume the responsibility for substantial transport between the nominal telephone number location and the customer's actual physical location.

Strategies/Action Plans

- The PSB should prevent carriers from retaining blocks of numbers for extended periods in rate centers in which they have no customers or switching facilities physically located.
- The PSB should re-address fair but flexible rules for the use of "virtual" or "foreign exchange" numbers when addressing issues of local calling, access charge reform, and rate center consolidation.

E 9-1-1

Vermont's statewide E 9-1-1 system is one of the premier E 9-1-1 systems in the nation. An independent E 9-1-1 Board oversees the E 9-1-1 system in Vermont. The Board is charged with designing, installing and overseeing the operation of statewide enhanced 9-1-1. The Board fulfills its responsibilities by maintaining and auditing the database, network, Public Safety Answering Point (PSAP) and call-taker components of the system, by providing an ongoing training and certification program for 9-1-1 call-takers, by maintaining the statewide enhanced 9-1-1 Geographic Information System (GIS) database and by engaging in a variety of other activities designed to ensure the reliability and integrity of the system. The Enhanced 9-1-1 Board oversees nine 9-1-1 PSAPs. They are located at the Springfield Police Department, the Hartford Police Department, the Montpelier Police Department, the Lamoille County Sheriff's Office, the Saint Albans Police Department, the Shelburne Police Department, and the State Police Barracks at Williston, Rutland and Rockingham. A tenth PSAP was activated at the new Derby State Police Barracks in 2004. Further information on the status and challenges of Vermont's E 9-1-1 system can be found in the E 9-1-1 Board's annual report to the Governor.[8]

Competition and technology change pose new challenges to Vermont's E 9-1-1 system even as the initial challenges of establishing the system have been overcome.

Competition poses new challenges to Vermont's E 9-1-1 system even as the initial challenges of establishing the system have been overcome. New entrants to the market frequently are at first not fully aware of their Vermont E 9-1-1 responsibilities or are not always diligent about them. Staffing at Vermont's E 9-1-1 Board needs to change to reflect this reality. Dealing with more companies simply requires more time than dealing with the limited number of telephone companies that used to serve all Vermonters. Ensuring compliance with Vermont's E 9-1-1 requirements must become the work of personnel dedicated to that function.

Technology changes are also presenting emerging challenges to maintaining E 9-1-1 in the future, although those challenges are being addressed. A major weakness of type 1 Internet telephony services (see subsection on "Voice over Internet Protocol," above) as they have been deployed up until the end of 2003 is the lack of support for enhanced 9-1-1 service. Some service providers like Vonage have voluntarily added support for limited 9-1-1 service, but routing traffic to the correct PSAP has been problematic and there has been a lack of support for enhanced features like Automatic Location Identifier and automatic call-back if the caller cannot speak. Other type 1 providers simply have not supported E 9-1-1. While one might argue consumers should be free to choose their level of E 9-1-1 support, in reality consumers may not get to make an informed decision. When services are marketed as a telephone replacement, it may be difficult for consumers to appreciate the nuances in 9-1-1 coverage levels. It also greatly complicates the job of those who need to craft clear and concise public information about how and when to use 9-1-1. Emergency telephone service should be simple and straightforward enough that even children and the impaired will be able to use it in a crisis situation. If

Table 8.2:
E 9-1-1 calls 2002-2003

Year	9-1-1 calls	Cellular Calls		Abandoned Calls	
		Number	*%*	*total abandoned*	*%*
2002	188,840	57,747	31%	19,488	10%
2003	194,042	68,488	35%	17,063	10%

something looks like a telephone, it is likely to be used like a telephone in an emergency and should support enhanced 9-1-1. Moreover, support for E 9-1-1 on VoIP services should not present service providers with insurmountable technological obstacles. Fortunately, Vermont law provides authority for the Enhanced 9-1-1 Board to require E 9-1-1 support even from unregulated private telephone systems. The public education obstacles that this technology will present are more serious. Users will need to know that they must provide up-to-date location information to VoIP providers if E 9-1-1 operators are to find them in an emergency when they cannot speak. They will need to understand that Internet telephony devices, which require electric power, are only as good in an emergency involving loss of power as their battery or other back-up.

Fortunately, a voluntary consensus appears to be emerging between VoIP providers and the emergency services community regarding support for E 9-1-1. In December 2003, the National Emergency Number Association (NENA) and the Voice on the Net (VON) Coalition reached an agreement on action items leading to support for E 9-1-1 service for VoIP systems. (See sidebar, "NENA-VON Coalition Agreement.") Vermont's E 9-1-1 Board was an important participant in this national discussion. The E 9-1-1 system will also need to adapt to a future in which VoIP providers make it easier for consumers in Vermont to have telephone numbers with area codes in other states. While theoretically a "foreign area code" can be matched to a Vermont address, currently the tandems Vermont uses can only recognize up to four area codes.

Wireless technology also imposes new challenges for emergency call-takers. While wireless E 9-1-1 is improving, wireline E 9-1-1 technology still provides the exact location of a caller who cannot speak more consistently than wireless technology. As more people consider dropping their wireline phones and relying on wireless phones for their service at home, more people need to be aware of this and consider it before eliminating a conventional wireline connection to their home. This problem can be mitigated somewhat if consumers use newer handsets that take advantage of Wireless Phase II E 9-1-1.

Policies

- The Vermont Universal Service Fund (USF) rate should be

NENA-VON Coalition Agreement

In December 2003, NENA, the VON Coalition and a number of major companies involved in providing voice-over-IP equipment or services agreed on a set of action items:

- For service to customers using phones that have the functionality and appearance of conventional telephones, 9-1-1 emergency services access will be provided (at least routing to a Public Safety Access Point (PSAP) 10-digit number) within a reasonable time (three to six months), and prior to that time inform customers of the lack of such access.
- When a communications provider begins selling in a particular area, it should discuss with the local PSAPs or their coordinator the approach to providing access. This obligation does not apply to any "roaming" by customers.
- Support for current NENA and industry work towards an interim solution that includes (a) delivery of 9-1-1 call through the existing 9-1-1 network, (b) providing callback number to the PSAP, and (c) in some cases, initial location information.
- Support for current NENA and industry work towards long-term solutions that include (a) delivery of 9-1-1 calls to the proper PSAP, (b) providing callback number/recontact information to the PSAP, (c) providing location of caller; and (d) PSAPs having direct IP connectivity.
- Support for an administrative approach to maintaining funding of 9-1-1 resources at a level equivalent to those generated by current or evolving funding processes.
- Development of consumer education projects involving various industry participants and NENA public education committee members to create suggested materials so that consumers are fully aware of 9-1-1 capabilities and issues.

established annually at a level that assures the legislature's E 9-1-1 appropriations are fully funded.

- USF funding for state E 9-1-1 costs should be limited to those cost elements directly related to providing the E 9-1-1 service.
  - The E 9-1-1 Board should have primary responsibility for verifying state USF funds released for E 9-1-1 are consistent with that purpose. When allocating funds to other agencies for E 9-1-1, the legislature should provide for accountability mechanisms (such as quarterly itemized accounts) that enable verification by the E 9-1-1 Board.
- VoIP providers that allow customers to call telephone numbers should support all the capabilities of enhanced 9-1-1 provided to customers of traditional telephone service.
- Vermont's E 9-1-1 tandem vendor in the future should be prepared to support calls from large numbers of different area codes associated with Vermont locations.

Strategies/Action Plans

- The E 9-1-1 Board and Vermont's wireless carriers should work together to develop standard informational materials about the capabilities and limitations of wireless E 9-1-1 and to distribute them at the time of purchase. The materials should also encourage customers to upgrade old handsets to ones that are Wireless E 9-1-1 Phase II capable.
- The E 9-1-1 Board should create a position dedicated to enforcing compliance with Vermont E 9-1-1 laws and rules.

CABLE AND SATELLITE VIDEO PROGRAMMING

Cable has evolved from a platform for enhancing reception of broadcast TV signals to a multi-function communications platform. Although the portion of the plan that follows deals primarily with cable in its role as a video delivery system, cable infrastructure is also important to Vermont's future because of its ability to deliver high-speed data and voice.

Satellite TV is also a very significant platform for the delivery of video programming to Vermonters, as about one in three Vermonters subscribe to a satellite video programming service. Many Vermonters now have a choice of cable or satellite TV. Unlike cable TV service, satellite TV providers receive their authorization to provide service from the FCC, not the state. Many satellite viewers in Vermont can now receive local broadcast TV stations via their dish, although satellite viewers still receive less local programming than do cable subscribers.

CABLE LINE EXTENSION POLICY

Vermont has a long-standing line extension policy that merits continued support with some modification. Essentially, cable companies are required to extend lines into unserved areas where there is a reasonable expectation they will be able to cover the costs of doing so, based on a formula that includes the costs of construction, penetration levels, and average revenue per customer. Cable companies are also expected to annually count houses in unserved areas and

proactively build areas with qualifying density. This policy has been important to spur the delivery not only of cable TV but broadband Internet services in rural Vermont. Recent changes in the cable marketplace deserve to be reflected in the formula. One increased challenge to cable companies building into new areas is the prevalence of satellite dishes, which reduce the number of likely subscribers. (Recent cable CPGs have included line extension formulas that account for satellite.) On the other hand, while cable once was a predominantly residential service, cable's data services are now more appealing to businesses. Therefore, it is now appropriate to count businesses as potential subscribers as well as households.

Technology is also opening up new possibilities in how house counts are conducted. Electronic maps promise to make the process of counting houses easier and its results more useful. On the one hand, recent electronic filings by Adelphia of house count surveys and areas served by cable, as well as steps taken by the PSD to digitize house count maps, were instrumental in creating the maps of cable TV and cable modem service that appear in this plan and elsewhere. On the other hand, the annual requirement on cable operators to survey unserved areas is time-consuming and expensive. Towns and the E 9-1-1 Board collect most of the information needed for house count surveys—road location and the location of residences and businesses—and make it publicly available in a GIS format. GIS can not only store the results of cable company house counts but it can be used to identify areas of very low density, eliminating the need to frequently ride out and survey these areas.

Strategies/Action Plans

- The PSB should adjust future line extension formulas in rule and CPGs to account for satellite dish subscribership and businesses subscribing to cable video or data services.
- The PSB and PSD should evaluate the effectiveness of using GIS map models to reduce the need for cable companies to physically ride out unserved areas to count houses and businesses.
- The PSB and PSD should require larger cable companies (at least) to report house count surveys and areas served in a GIS-compatible electronic format.

CABLE CPG STANDARDS

Vermont has recently seen a string of cable refranchising proceedings. The next several years will see a number of small company refranchising proceedings and, as shown in Figure 8.1 and Table 8.3, a new round of towns in which Adelphia franchises will expire. (Adelphia has a number of operating companies in Vermont, which hold a number of distinct franchises, but not all of which expire at the same time.) While there are a large number of specific criteria for cable franchise renewal in state and federal law, it is worth stressing here a pair of broad priorities. First, part of the importance of cable infrastructure is its ability to deliver local content to Vermonters. Vermont's geography does not favor local broadcasting. Cable provides a medium that can deliver Vermont-specific commercial and non-commercial content to Vermont households at a time when public discourse and local commercial communication depend on this outlet as much as ever. Furthermore, cable operators have discretion in what program-

Table 8.3:
Cable franchise expirations in the next 5 years

Franchise expires	Company	Towns
2004	Opticable	Readsboro
2005	North Country Cable	Bakersfield, Berkshire, Montgomery
2007	Adelphia	Andover, Arlington, Athens, Baltimore, Barnard, Benson, Bridgewater, Castleton, Cavendish, Chester, Chittenden, Dorset, Fair Haven, Goshen, Grafton, Hubbardton, Ira, Jamaica, Landgrove, Londonderry, Ludlow, Manchester, Middletown Springs, Mount Holly, Peru, Pittsfield, Pittsford, Plymouth, Poultney, Reading, Rupert, Sandgate, Sherburne, Shrewsbury, Springfield, Stratton, Sudbury, Sunderland, Tinmouth, Wardsboro, Weathersfield, West Haven, Weston, Windham, Windsor, Winhall, Woodstock, Addison, Avery's Gore, Barton, Bridport, Brighton (Isl. Pond), Bristol, Brownington, Charleston, Charlotte, Coventry, Derby, Ferdinand, Ferrisburg, Glover, Hinesburg, Holland, Huntington, Irasburg, Jay, Lewis, Lincoln, Lowell, Monkton, Morgan, New Haven, Newark, Newport City, Newport Town, Ripton, Sheffield, Shelburne, Starksboro, Sutton, Troy, Vergennes, Waltham, Warner's Grant, Warren's Gore, Westfield, Westmore, Jericho, Richmond, Underhill
2008	Adelphia	Belvidere, Cambridge, Craftsbury, Eden, Elmore, Fairfax, Fairfield, Greensboro, Hardwick, Hartford (White River Junction), Hartland, Highgate, Johnson, Morristown, Norwich, Pomfret, Sharon, Sheldon, St. Albans City, St. Albans Town, Stannard, Stowe, Strafford, Swanton, Thetford, Walden, Waterville, West Windsor, Wheelock, Wolcott, Brattleboro, Brookline, Dummerston, Guilford, Halifax, Marlboro, Rockingham, Vernon, Westminster

ming appears on their systems; the programming that is available to the greatest number should inform, educate, reflect community voices, and promote important public conversations. In short, it should serve the public interest. Second, the cable network is an important asset to the community and it deserves ongoing investment and periodic upgrades to reflect industry norms. Without this investment Vermont risks losing an important communications conduit. Furthermore, cable infrastructure can now be a means of delivering various forms of communications service, not only cable TV. The ability to deliver voice and data as well as video over cable is desirable. While these other services may not always be appropriate subjects to address directly through a CPG for cable services, the state in its franchising role should consider how the terms of a CPG may affect the delivery of these other services to Vermonters.

Table 8.4:
Cable franchises with no expiration dates

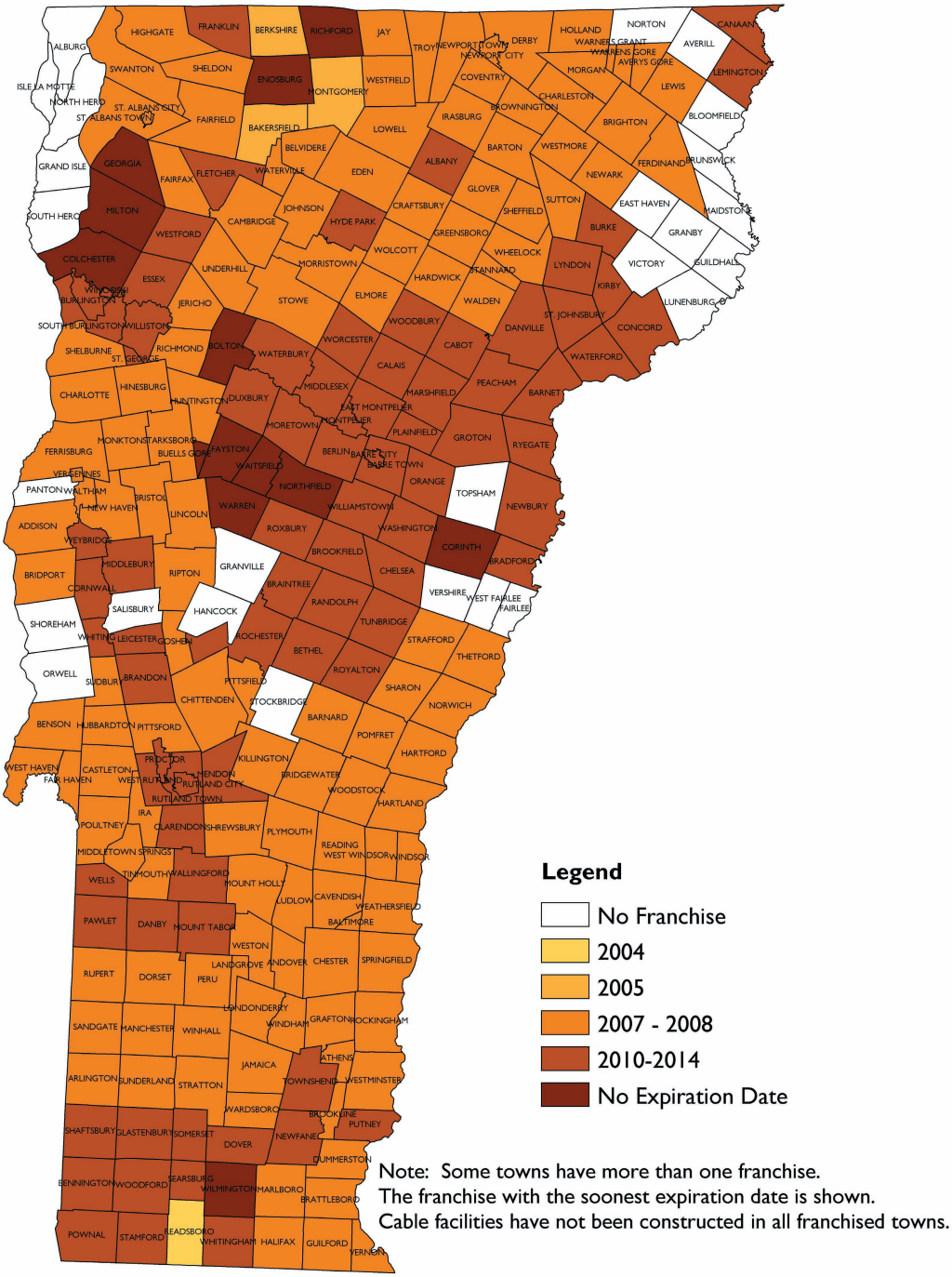
Company	Towns
Adelphia	Colchester, Fairfax, Georgia, Milton, Westford
Duncan Cable	Wilmington
North Valley Cable Systems	Bolton, Williamstown
Olsen's TV and Radio Repair	East Corinth
Smugglers' Notch Cable TV	Cambridge
Stowe Cablevision	Stowe
Trans-video	Berlin, Northfield
Waitsfield Cable	Buel's Gore, Duxbury, Fayston, Moretown, Waitsfield, Warren

Policies

▶ Cable CPG obligations should take into account important public policy objectives, among them encouraging cable operators to make investments in their system and offer new video, voice, and data services.

▶ To meet community needs, cable companies should provide as strong a public interest

Figure 8.1:
Cable franchise expiration dates



Note: Some towns have more than one franchise.
The franchise with the soonest expiration date is shown.
Cable facilities have not been constructed in all franchised towns.

programming base as possible in its basic tier.

- Cable companies should carry a strong component of local content.
  - Cable systems should carry local digital broadcast content as it becomes available.
- All but the smallest cable systems should be made capable of two-way transmission in digital format.

PEG ACCESS

Public, Educational, and Governmental (PEG) access is recognized by Vermont state law as an important component of cable systems. These cable stations provide an outlet for community members and organizations to produce non-commercial programming and present programming of interest to their neighbors. They allow citizens to monitor government meetings and officials even when they cannot attend in person and they give local educators a conduit in the community. Over the course of the last 15 years, the number of locally-organized PEG Access Management Organizations (AMOs) has grown substantially. (See Table 8.5.) The survey conducted for this plan shows that the public continues to support the concept of PEG access by a considerable margin. Furthermore, a significant number of cable subscribers are regular viewers of PEG programming. Although the amount of reported PEG viewership is not overwhelming, very large levels of viewership for any individual cable channel, including commercial channels, are the exception, not the rule, in a digital cable environment of hundreds of channels. The levels of reported PEG viewership are respectable.

That increase in channels and cable system capacity has sparked a debate about the proper level of cable capacity to reserve for PEG access. PEG systems in larger communities are filling multiple channels with programming. The nature of the way cable channels are programmed has evolved. To accommodate the wider selection of channels viewers face and the practice of "channel surfing," cable networks are more likely to repeat programs in multiple time slots, sometimes on multiple channels. Increases in cable system capacity reduce the scarcity of channels as a reason not to expand successful, thriving PEG operations when expansion could better serve the community. At the same time, increases in cable system capacity alone are not sufficient reason to increase the capacity dedicated to PEG. There must be important community needs that increased capacity will meet, and the state in its franchising authority role should consider how capacity allocations will impact other important public policy objectives, among them encouraging cable operators to make investments in their systems and offer new video, voice, and data services.

The capabilities of a PEG access operation are not measured merely by the number of channels it uses. The ability of PEG stations to originate live programming from a variety of locations around the community adds value to the PEG programming experience. Local government meetings and candidate forums are examples of how PEG programming, and especially live PEG programming, contributes to democracy in the community. Furthermore, PEG access can serve the public by being more than just a place to play tapes. When

PEG access includes facilities and training for members of the community to learn video production, it contributes to media literacy in the community.

Changes in video technology affect PEG as well. Video is going digital. To utilize the attributes of digital television, the PEG facilities need upgraded digital tools. To meet future cable-related community needs public access must be able to utilize the attributes of digital video. Analog videotape cassette recorders and editing decks are outdated. Video recording is moving to digital storage media like PC hard drives and DVDs. The recording, editing, and playback equipment of a PEG access station should reflect this digital sea change. Fortunately, this need not necessarily require large new capital expenditures on PEG equipment. The price of digital video quality has followed the same declining cost curve of computers and electronics generally. Furthermore, digital video is more readily transferred back and forth between cable TV and Internet platforms. PEG groups that are able to explore new Internet video platforms and offer access to third party producers who wish to produce video directly for the Web, would provide a valuable side benefit to communities (although cable-based funding sources may not support all such activities if they do not have a tie to PEG access on the cable platform).

Policies

- Community needs and the demand for PEG access services, balanced by cost, should drive considerations of the appropriate number of PEG channels and other PEG capabilities. Indicators of community demand for PEG access services include but are not necessarily limited to:
  - viewership (both the number of people watching and the size and interest level of a "core" viewership),
  - hours of locally sponsored and produced programming,
  - number of PEG access programming hours regularly filled with programming and information of local interest, and
  - levels of expressed community interest in video production training.
- Live origination of local programming from key community sites as well as PEG studio locations is an important public benefit of PEG access.

Table 8.5:
Vermont access management organizations

Started	AMO	Current Number of Channels
1976	Brattleboro	2
1984	Burlington (P)	1
1984	Montpelier	3
1984	Rutland	3
1985	Middlebury	1
1989	Barre	2
1990	Burlington (G)	1
1990	Newport	1
1992	Burlington (E)	1
1992	Shelburne (E)	1
1992	Lyndon/St. Johnsbury	1
1993	Bennington	3
1993	Norwich/Hartford (P)	1
1994	Colchester	2
1994	Richmond	1
1995	Bellows Falls	3
1996	Manchester	3
1999	Springfield	2
1999	St. Albans	1
2000	Windsor	1
2001	Ludlow	1
2001	Waitsfield/Warren	1
2002	Stowe	1
2003	Bristol	1
2003	Shelburne (PG)	2
2003	Woodstock	1
2004	Norwich/Hartford (E)	1
2004	Hardwick	start up
2004	Hyde Park	start up

(P)=Public Access Station, (E)=Educational Access Station, (G)=Government Access Station. All other entries are combined P, E, and G stations.

Source: Vermont Access Network

- Local video production training of community members to produce PEG access programming provides an important public benefit.
- PEG facilities should include the ability to digitally record, edit, and encode video and audio.
- While "cutting edge" video production and cablecasting of PEG access programming should not be required, PEG facilities and channels should be capable of producing and delivering content with high-quality production values in line with changes in technology, viewer expectations, and a reasonable level of PEG funding.
- While increases in channel capacity and system bandwidth should not lead automatically to larger "set asides" for PEG access, cable operators with the ability to deliver more cable content should be prepared to accommodate more PEG access content, if there is a demonstrable community need.
- PEG access entities should not be discouraged from repeating programming at a frequency comparable to that found on commercial cable stations.
- PEG access CPG obligations should bear some relation to the size of the cable system.

Strategies/Action Plans:

- PSB Rule 8.451 is now outdated; terminology specified in the rule should be upgraded to reflect the change from analog video to digital video platforms. The PSB should add the following terms to the definition when next revising Rule 8.400: digital cameras, digital storage media, analog/digital converters, and digital non-linear editing platforms.

STATE-WIDE INTERCONNECT

The PSB's April 2000 order in Docket 6101, the refranchising of many Adelphia systems, breathed life into a concept that PEG access entities and the PSD had supported. This concept, a statewide PEG access network, promises to add value to the existing level of PEG programming. Such a network could improve the Vermont-based programming available to Vermont cable subscribers in a number of ways including:

- Allowing locally-produced PEG programming of special quality or statewide interest to be shown statewide;
- Allowing live access to legislative proceedings, testimony, and other important state government meetings and events, like a Vermont version of C-SPAN;
- Providing a broader audience for educational programming.

The 2003 refranchising of Charter Communications' Vermont system was the first non-Adelphia system to have a franchise condition related to a statewide PEG network. The condition required Charter to interconnect with Adelphia for the purpose of sharing statewide PEG network programming. With Adelphia and Charter participating, the concept would progress further toward being a true statewide network.

Although there have been some discussions and planning, more than one third of the way through the first franchise that called for the statewide network, this important public benefit has not yet been realized. It is time for all parties involved—PEG access groups, cable companies, and the state in its role as franchising authority and facilitator of access to government by the public—to work with renewed effort to make real the vision. One step that would move the development of the network forward would be the designation of an access management organization (AMO) to work with Adelphia, Charter, and other cable companies and to lead in the implementation and management of the network. This AMO may or may not be an entirely new organization. Other possibilities could include adding statewide responsibilities to an existing local AMO or formalizing a consortium of local AMOs.

Policies

- All cable system operators neighboring another cable system operator in the same or an adjacent town are encouraged to interconnect for the purposes of sharing programming and other communication over their network; all new cable franchises should include such interconnection as a CPG condition unless good cause exists not to.

Strategies/Action Plans

- The PSB and PSD should work toward designation of a statewide PEG AMO to manage the statewide interconnected PEG access network.
  - The statewide AMO should be charged with identifying a location for a studio facility if needed, either a new facility or a facility shared with an existing local AMO.
  - The statewide network should provide the ability to (1) receive programming from all Adelphia and Charter local PEG studios and remote origination points, the statewide AMO studio location, and video feeds as available from VIT, UVM, and ILN, as well as state building locations; and (2) deliver live video feeds and stored digital video files to interconnected local PEG access organizations for broadcast.
  - The statewide AMO should be charged with working with Adelphia Cable, Charter Communications, and other cable companies that elect to participate in the network to establish interconnection facilities, video switching between local PEG systems, and digital video storage.

CABLE TARIFFS

Hefty annual cable rate increases exceeding the rate of inflation have become a subject of regular media and congressional attention. While cable companies have accompanied such increases over time with system upgrades, new services, and more channels, consumers are justifiably upset by increases that cost more and more, asking consumers to buy more and more services that they may or may not wish to buy. Nevertheless, state authority in this area is severely constrained. While state law provides the PSB extensive authority to regulate cable rates, federal law pre-empts it and the state currently may not challenge the rates of its cable companies. State law requires cable companies to file tariffs, but the effect of federal law ensures that these are not more than informational tariffs. These filing requirements, while not ultimately determining cable rates,

consume company and state government resources and add a layer of administration and occasional controversy concerning items such as filing deadlines and regulatory notice.

Strategies/Action Plans

- The legislature should grant the PSB the authority to forbear from requiring cable service tariffs as long as federal law preempts state regulation of cable rates or upon a finding that a cable company lacks market power.
- The PSB should ensure basic consumer protections for cable customers through rule in lieu of tariffs.

ELECTRIC UTILITY INVOLVEMENT IN TELECOM

Electric utilities have already played an essential role in the development of Vermont's telecommunications infrastructure. This has come in a variety of forms. As keepers of a major part of Vermont's pole and utility rights-of-way, electric utilities can be an enabler or obstacle to telecommunications development. VELCO's joint agreement with Adelphia more than ten years ago to deploy fiber optic strands around the state was a boon to telecommunications in Vermont and also gave VELCO a private telecommunications network that promotes the reliability of the electric transmission network. Without this kind of partnership, Vermont would have a lower quality and much less robust telecommunications network.

VELCO's joint agreement with Adelphia more than ten years ago to deploy fiber optic strands around the state was a boon to telecommunications in Vermont.

In other states, electric utilities have played a variety of roles with respect to telecommunications development. Some have entered into the retail voice, video, and data market. Others have acted as a wholesale service provider, selling raw transmission capacity or dark fiber to telecommunications companies that provide retail service. In some respects electric utilities are ideal organizations to provide telecommunications service or infrastructure. They have experience with poles and wires, already maintain part of the common infrastructure, have existing customer relationships, have a steady cash flow, and are used to making large capital investments with long payback periods. The idea that electric utilities could provide wholesale infrastructure or raw transmission capacity to a range of retail telecommunications providers is especially intriguing. The telecommunications business has financial risks and low-cost electric power is an important state priority. Therefore, it is important that electric utility investments in telecommunications be able to stand on their own financial merits. There is a balance to be struck by state utility regulators—electric utility ratepayers should not be forced to bear the financial risk of a non-core venture by their utility, but neither should electric utilities receive the impression that efforts by electric utilities to assist in providing another type of essential public service are unwelcome.

Wireless telecommunications and electrical service share a set of siting issues. Although electric transmission and distribution structures differ in many of their specific characteristics, both often require "vertical real estate" in the form of towers or poles. The ubiquity of electric utility structures often begs the question of why wireless facilities are not more often located on these, usually pre-existing structures. In fact, the siting needs of wireless and electric service are

not often the same, but sometimes they are similar. As more and more higher-frequency wireless services, like PCS service and broadband wireless Internet, require more sites in Vermont located closer together, use of utility poles and electric transmission towers may more often be a good solution. If Vermont is to benefit from wireless-electric collocation, there are steps that electric utilities and state regulators can take to make it more feasible. From electric utilities, the wireless service providers require a willingness to work with them to attach antennas to electric utility structures. Since antennas often work best up high, they are often unlike wireline pole attachments. Electric utilities around the country (and to a limited extent in Vermont) have reached agreements with wireless companies to place antennas for them in locations that require trained personnel and special precautions—such as the high points on poles or towers that are near or above electric conductors. From regulators, wireless service providers require clarification on a point of Vermont land-use law. Electric transmission facilities, including transmission towers, are reviewed by the PSB under Section 248 of Title 30, and do not require approval through the local zoning process and Act 250. Through the end of 2003, there had been only one wireless attachment to an electric transmission structure, an antenna providing Sprint PCS service on a VELCO tower in South Burlington. The applicant went through all three permitting processes—local zoning, Act 250, and Section 248. Under state law, Section 248, when it applies, is supposed to substitute for these other two processes, not be an additional layer. Therefore, the state should be clear with wireless service providers who seek to comply with the law about whether the Section 248 process applies when they attach to electric transmission structures.

Policies

- Electric utilities are encouraged to partner with communications companies to leverage electric utility assets and skills in order to create new or improved telecommunications services.
- Collocation of wireless telecommunications facilities on electric utility structures is supported when it can be done safely and without harm to electric service reliability.
  - Electric utilities are encouraged to work with wireless companies to develop economical and safe solutions for co-location of wireless communication antennas on electric distribution and transmission structures, including above electric conductors when necessary.
- Electric utilities are encouraged to evaluate involvement in telecommunications, especially providing or facilitating telecommunications infrastructure in utility rights-of-way when proper financial safeguards are in place for electric ratepayers.
  - Electric ratepayers should not provide cross-subsidies to utility telecommunications activities that are not related to the operation of the utility.
  - Electric utilities should be allowed by regulators to make fair financial contributions to telecommunications projects or ventures out of regulated utility operations when the utility operations receive needed telecommunications services with a benefit proportional to the contribution made.
  - Electric utility operations should receive fair compensation for contributions of time, materials, or other assets to telecommunications ventures. Beyond covering costs, electric utilities should not be required by regula-

tors to maximize the revenue obtained for the regulated utility operation at the expense of telecommunications ventures that provide service to the general public. This is especially true in areas with a marginal economic case for telecommunications service.

Strategies/Action Plans

- The PSB should provide authoritative guidance on the applicability of Section 248 to wireless communication co-locations on electric transmission facilities.

PRIVACY IN COMMUNICATIONS SERVICES

The users of telecommunications networks and services often rely on those networks and services to convey private information. Companies providing communications services often have access to private information about consumers' identity, financial information, and patterns of communications. At the same time, modern computing and telecommunications technologies have brought about a rapid drop in the costs of collecting, storing, manipulating, correlating, and transferring information. New technologies are also opening up new categories of communications, meaning that maintaining the privacy of communications is no longer as simple as enforcing rules regarding the privacy of telephone users. Open disclosure of privacy policies and informed consumers will be important tools for protecting privacy as communications technologies emerge and mature. Consumers will often have expectations of privacy regarding their communications. It is important that companies that provide various types of communications inform their consumers about the level of privacy that their services provide, and keep the promises they make to consumers.

At the same time, the PSD and PSB have taken significant steps to protect telephone consumer privacy in recent years. The PSB's July 1999 order in Docket 5903 created requirements for companies offering intrastate telephone services regarding Customer Proprietary Network Information (CPNI), Automatic Number Identification (ANI), and Calling Party Number (CPN) that reflected corresponding federal rules for interstate services, (CPNI is information available to a telephone company by virtue of its basic service customer relationship. It includes information found on telephone bills, and may detail the types of service used, the amount of service used, and the numbers called and locations called from. ANI and CPN information identifies callers and called parties.) The order also established requirements for telephone companies regarding caller ID blocking and notices of future services with privacy implications. These requirements remain important.

Policies

- Existing PSB privacy requirements on telephone companies providing intrastate telephone service regarding CPNI, AIN, CPN, and Caller ID blocking continue to be supported.
- Companies providing telephone numbers supplied to consumers should protect the privacy of non-published and non-directory telephone numbers.

- Regulated and unregulated providers of communications service to the public are encouraged to provide consumers with their specific privacy policies and inform customers as to the implications for privacy of the services they offer.

Strategies/Action Plans

- The PSD and the Attorney General should monitor developments in technology and in the legal status of communications services and report from time to time to the legislature if changes are needed to update Vermont's law on privacy in communications services.

ELECTRONIC REGULATORY FILINGS

The PSB and the PSD regulate Vermont's telecommunications industry, and while greater availability and use of high-speed electronic services is a goal, ironically the process of regulation before the PSB and PSD depends largely on paper. Tariffs, applications for CPGs, annual reports, docket filings, and various other documents are official when filed with the PSB or PSD in their paper forms. An electronic filing system would provide opportunities for a more efficient workflow and more convenient access to documents held by the PSB and PSD, and it would provide a good example of the use of technology.

Strategies/Action Plans

- The PSB and PSD should make a progressive transition to an electronic filing system for documents required to be filed with either body.

(Endnotes)

[1] 30 V.S.A § 226(b)(h)(1)(I).

[2] The deposit rule, 3.200, saw a revision in 1999, but this was a relatively minor revision, changing the way that interest on deposits is calculated.

[3] Technically, the standards apply to all carriers, not just local exchange carriers. The standards are written in a way that does not fit IXCs, and therefore neither the Department nor the Board have sought to enforce the reporting requirement for service other than local exchange service.

[4] An ETC is a telephone company that has been approved by the PSB to receive federal high-cost universal service support.

[5] 30 V.S.A § 218(a).

[6] In February 2004, the FCC declared that Pulver.com's Free World Dial-up (FWD) service as then configured was an "information service" under federal law and not subject to state commission regulation. The FWD service is a computer-to-computer service that does not provide users with the ability to call people on the PSTN. *Petition for Declaratory Ruling that pulver.com's Free World Dialup is Neither Telecommunications Nor a Telecommunications Service,* WC Docket 03-45, Memorandum Opinion and Order, FCC 04-27 (rel. Feb. 19, 2004).

[7] 7 CFR § 1751.106.

[8] http://www.state.vt.us/E 9-1-1/ReportsToGov/RepToGoven.htm

Appendix

Acronyms and Glossary

LIST OF ACRONYMS

ACCD	Vermont Agency of Commerce and Community Development
AHS	Vermont Agency of Human Services
AMO	Access Management Organizations
ANI	Automatic Number Identification
ASL	American Sign Language
ATM	Asynchronous Transfer Mode
CAPI	Consumer Affairs and Public Information Division, Vermont Department of Public Service
CDBG	Community Development Block Grants
CDPD	Cellular Digital Packet Data
CDMA	Code Division Multiple Access
CIO	Chief Information Officer
CLEC	Competitive Local Exchange Carrier
CPG	Certificates of Public Good
CPN	Calling Party Number
CPNI	Customer Proprietary Network Information
CVPS	Central Vermont Public Service Corporation
DET	Vermont Department of Employment and Training
DII	Vermont Department of Information and Innovation
DOCSIS	Data Over Cable Service Interface Specification
DOL	Vermont Department of Libraries
DPS	Vermont Department of Public Safety
DSL	Digital Subscriber Line
DVR	Digital Video Recorder
EAS	Extended Area Service
EDA	U.S. Department of Commerce Economic Development Administration
ETC	Eligible Telecommunications Carrier
FAHC	Fletcher Allen Health Care
FASTSTAR	Fletcher Allen Specialized Telemedicine for Supporting Transfer and Rescue
FCC	Federal Communications Commission
FTTH	Fiber-To-The-Home
FX	Foreign Exchange
GIS	Geographic Information Systems
GMP	Green Mountain Power
GPRS	General Packet Radio Service
GSM	Global Standard for Mobile Communications
GSP	Gross State Product
HDTV	High-Definition Television

HIPAA	Health Insurance Portability and Accountability Act
ILEC	Incumbent Local Exchange Carrier
ILN	Interactive Learning Network
IM	Instant Messaging
IP	Internet Protocol
IRMAC	Information Resource Management Advisory Council
IRU	Indefeasible Right of Use
ISDN	Integrated Services Digital Network
ISP	Internet Service Provider
IT	Information Technology
ITC	Independent Telephone Company
ITU	International Telecommunications Union
LAN	Local Area Network
LEC	Local Exchange Carriers
LMS	Local Measured Service
LNP	Local Number Portability
MPLS	Multi-Protocol Label Switching
NANPA	North American Numbering Plan Administrator
NECA	National Exchange Carrier Association
NENA	National Emergency Number Association
NPA	Numbering Plan Area
ONU	Optical Network Units
PATH	Vermont Department of Prevention, Assistance, Transition, and Health Access
PBX	Private Branch Exchange
PCS	Personal Communications Service
PEG	Public, Educational, and Governmental
PON	Passive Optical Network
PSAP	Public Safety Answering Point
PSB	Vermont Public Service Board
PSD	Vermont Public Service Department
PSTN	Public Switched Telephone Network
PVR	Personal Video Recorder
RBOC	Regional Bell Operating Company
RETN	Regional Educational Television Network
RFI	Request for Information
RFP	Request for Proposals
ROW	Right-of-Way
RPC	Regional Planning Commission
RPR	Resilient Packet Rings
RRMC	Rutland Regional Medical Center
RUS	Rural Utilities Service
SBDC	Small Business Development Center
SLC	Subscriber Line Charge
TCP/IP	Transmission Control Protocol / Internet Protocol
TDMA	Time Division Multiple Access
TELRIC	Total Element Long-Run Incremental Cost

TSAC	Tower Siting Advisory Committee
TTY	Text Telephone
UNE	Unbundled Network Element
USF	Universal Service Fund
UVM	University of Vermont
VALS	Vermont Automated Libraries System
VAN	Vermont Access Network
VCRD	Vermont Council on Rural Development
VDH	Vermont Department of Health
VEDA	Vermont Economic Development Authority
VI	Vermont Institutes
VIBRS	Vermont Incident Based Reporting System
VIT	Vermont Interactive Television
VITC	Vermont Information Technology Center
VMEC	Vermont Manufacturing Extension Center
VOD	Video on Demand
VoIP	Voice over Internet Protocol
VON	Voice on the Net
VPN	Virtual Private Network
VTAC	Vermont Telecommunications Advancement Center
VTrans	Vermont Agency of Transportation
VTRS	Vermont Telecommunications Relay Service
WAN	Wide Area Network
WISP	Wireless Internet Service Provider

GLOSSARY OF TERMS

Access charge	A charge paid by long distance carriers to local exchange providers for use of local facilities in routing long distance calls.
Access line	A circuit between a subscriber and the central office that serves it.
Bit (Binary digit)	The smallest unit of information a computer can use. A bit is represented as a 0 or a 1 (also “on” or “off”). A group of 8 bits is " called a byte. Bits are often used to measure the speed of digital transmission systems.
Alternative regulation	A family of regulatory techniques that relax traditional rate-of-return regulation in favor of regulation by objectives such as price, service quality, or introduction of services.
Asynchronous Transfer Mode (ATM)	A type of fast packet data service that is specially designed to predictably manage multiple types of data streams, including ones with strict quality-of-service requirements like video and voice.
Broadband	A family of services that provide users with high-speed data communications. In some contexts, broadband is defined as services with an ability to transmit data at greater than specific rates measured in kbps or Mbps.
Byte	Eight bits of information composed of zeros or ones, one of which may include a parity bit. A byte is to a bit what a word is to a character.
Cable modem	A device for transmitting and receiving digital data over a cable television network. Used to deliver broadband (and sometimes telephone) service over cable networks.
Code Division Multiple Access (CDMA)	One of several digital mobile wireless telephone and data standards used in the U.S.

Central office	The telephone company facilities that house switching and related equipment to serve the immediate geographical area. The central office is the most immediate point of interface between the telephone company and customers.
Certificate of public good (CPG)	The permission required from and granted by the State of Vermont to allow a utility or regulated industry, such as a cable company, to do business and serve subscribers in Vermont.
Competitive Local Exchange Carrier (CLEC)	A non-incumbent LEC. See also Local Exchange Carrier, Incumbent Local Exchange Carrier.
Customer proprietary network information (CPNI)	Information about a customer's calling patterns and other personal information that technologies now enable telephone companies to collect.
Dial tone line rate	The basic monthly charge under measured service for access to the telephone network. A charge related to usage is charged as well.
Digital signature	A form of encryption technology that can be used to scramble a message before transmission so as to secure it during transit and prevent anyone but the intended recipient from unscrambling it to retrieve the "information in the message. Additionally, the use of digital signatures enables " the sender's identity to be verified by the recipient.
Digital Subscriber Line (DSL)	A family of technologies that extends the ability of copper telephone lines to carry high-speed data telecommunications over short and medium range distances.
Digital Video Recorder (DVR)	See Personal Video Recorder.

Distance learning	Interactive instruction or training services conducted among remote participants from distributed sites. Audio, visual, data telecommunications devices and related systems are employed. There are many distance learning models; traditional lecture format, remote students with a teacher at a central location, and cooperative learning arrangements involving multiple connections of small groups from various locations.
DS-1	A type of digital service transmitting voice or data at 1.544 Mbps. Sometimes used as a synonym for a T-1 (see also T-1, below). Where distinguished from one another, a DS-1 generally refers to the service, while T-1 refers to the facility carrying the service.
Eligible Telecommunications Carrier (ETC)	A telecommunications carrier that qualifies and has been designated to receive high-cost support from the Federal Universal Service Fund.
Ethernet	The dominant computer networking protocol for Local Area Networks that is often used in the networks of telecommunications carriers.
Exchange	A geographical unit, served by one or more central offices, established for the administration of uniform rates for communications service within that area. Vermont is currently served by 141 exchanges.
Federal Communications Commission (FCC)	A board of five commissioners appointed by the President and confirmed by the Senate in accordance with the 1934 Communications Act. The FCC has the power to regulate interstate and foreign communications originating in the United States by wire and radio.
Fiber optics	Hair-thin glass fibers that transmit light waves capable of carrying enormous amounts of information.

Franchise area	The geographic region in which the PSB or FCC has granted a public service company the authority to offer specific types of service.
Gigabit	One billion bits.
General Packet Radio Service (GPRS)	A mobile wireless communications protocol related to GSM used to provide mobile data services.
Global Standard for Mobile Communications (GSM)	One of several digital mobile wireless telephone standards used in the U.S. and the dominant standard throughout Europe and much of the world.
Head end	The originating point of a signal in cable TV systems.
Incumbent Local Exchange Carrier (ILEC)	A local telephone company that was in operation prior to the advent of competition for telephone service, or a successor to such a company.
Independent phone company	In Vermont, an ILEC other than Verizon.
kbps	Kilobits per second, a unit of data transfer speed.
Kilobit	One thousand binary digits or bits.
Local area network (LAN)	A private communications network linking terminals and computers in a specific area, such as an office or home.
Local exchange carrier (LEC)	A telecommunications company that provides local telephone or data telecommunications service; distinguished from long-distance or interexchange carriers by the fact that they provide the links to consumers at their homes or businesses.
Local loop	The part of the telephone network, i.e., the wires, between a central office and a customer's premise.
Local measured service (LMS)	Local service for which a customer pays a flat dial tone line rate for access to the telephone network, plus a usage charge for each minute of local calling.
Locality	A border area of Vermont that is serviced by a telephone central office in another state.
Mbps	Megabits per second, a unit of data transfer speed.
Megabit	One million binary digits or bits.

Megabyte	A unit of measurement for data storage equal to one million bytes or precisely 1,048,576 bytes; often used as a unit of measurement in describing memory capacity of computer disks and drives.
Microwave	In communications, an atmospheric transmission method using high radio frequencies to transmit analog or digital voice, data, or video signals between antennas or on satellite links.
Personal Communications Service (PCS)	A digital cellular technology providing voice, video, and data services. Uses a higher frequency band than traditional cellular services, limiting the range of signals, but which offers greater bandwidth than the traditional cellular bands.
Personal Video Recorder (PVR)	A device for recording television on a hard drive, integrated with electronic program guides. Allows users to skip forward or reverse instantly, manage and access recorded programs more readily than when using videotapes, and view a recorded program while recording another program.
Plain old telephone service (POTS)	A term used to identify basic voice phone service.
Public Switched Telephone Network (PSTN)	A term used to denote the interconnected networks of many carriers that collectively to provide telephone services to the public. Sometimes used as a term to distinguish these networks from other networks, such as the Internet or private communications networks.
Private branch exchange (PBX)	A private switching system on the customer's premises, which switches calls between phones in the office and to or from the outside phone network.
Public, education, and government (PEG) access channels	The 1984 Cable Act established that access to local cable television franchises are provided to communities who want them. Public, education, and government are three types of “public access” channels.

Public safety answering point (PSAP)	Local, state, or regional center for answering 9-1-1 calls. It may or may not be the dispatch center.
Regional Bell Operating Company (RBOC)	Seven RBOCs were created by the breakup of the Bell System (AT&T) in 1984. These were Bell Atlantic, Bell South, NYNEX, Ameritech, USWest, Pacific Tellsis, and Southwestern Bell. After a series of mergers and acquisitions, four remain: Verizon, SBC, Qwest, and Bell South.
T-1	A type of digital carrier system transmitting voice or data at 1.544 Mbps.
Tariff	The published rates, regulations, and descriptions governing provision of a regulated public service such as telecommunications services.
Telecommuting	Using a computer, modem, and telephone system to connect with a computer system at the workplace and performing tasks that are typically done at the workplace from home or another remote location.
Telework	Sometimes used as a synonym for "telecommuting," and sometimes used as a broader term to encompass telecommuting plus other situations where telecommunications enables work to be done at a distance, whether or not it displaces a traditional commute.
Terrabit	One trillion bits.
Unbundled Network Element (UNE)	A particular piece of an ILEC's network (such as the local loop, switching, or transport facilities between central offices) sold at wholesale rates to a CLEC. Pronounced "yoo-nee."
Unbundling	Separating out for individual sale a particular service or element of a network that is commonly sold together with other elements or services.

Video on Demand (VOD)	A cable TV service that allows a cable subscriber to select a program and have it delivered over the cable network at a time of the subscriber's choosing. Typically the service also allows the subscriber to fast forward, rewind, and pause the program.
Virtual Private Network (VPN)	Emulation of dedicated private data circuits over a shared data network, often over the Internet.
Voice over Internet Protocol (VoIP)	Transporting digitized voice communication over private networks that use Internet Protocol or over the public Internet. Frequently, but not always, the service provides telephone or telephone-like communication, and may enable communication with users on the PSTN.
Wi-Fi	The popular name for an industry standard used for providing wireless local area networks (LANs) over license-free wireless spectrum.