Broadband Deployment in California

California Public Utilities Commission

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Executive Summary

This report is submitted to the California Legislature in fulfillment of Senate Bill (SB) 1563, modifying Public Utilities Code Section 709. SB 1563 requires the California Public Utilities Commission (CPUC) to report to the Legislature about ways to promote the widespread use of advanced communications services throughout the State. The CPUC initiated Rulemaking (R.) 03-04-003 as a forum for gathering information and public input needed to prepare this report.

In order to evaluate ways to promote deployment and use of advanced communications technologies, also referred to as "broadband,"[1] this report surveys the nature, functionality and availability of such technologies in California today. As a result of our investigation, we conclude that broadband access is superior to dial-up service not just because it allows for faster downloads, but because it improves the functionality and uses of the internet. Those who are in a position to compare the two forms of access report that once exposed to broadband, it is very difficult to go back to the limitations of dial up. In addition, some applications such as telemedicine and certain distance learning programs require a broadband connection. Therefore, we view the mandate of SB 1563 within the context that broadband is more than an alternative to dial-up internet access.

In the course of our analysis, we found that California's broadband market is growing and that broadband service is widely available to varying degrees within each zip code in the State. California has far more broadband subscribers than any other state in the nation, almost exceeding the combined broadband subscriber levels of the second and third ranked states. The California broadband market is currently dominated by Digital Subscriber Line (DSL) and cable modem technologies. As a result of this developing broadband market, we have found that there has been increased investment, job growth and lower prices in the communications market.

While there is good news to report on the State's broadband market, there are issues and concerns that exist. Although widely available, we noted that some communities and populations have none or limited access to broadband service, either because the infrastructure is lacking or access is very expensive. Although the number of subscribers to broadband is growing, the overall subscriber rate remains low compared to voice telephone service. The lack of knowledge about benefits of broadband, unfamiliarity with computers, and concerns about the high price and reliability of the service may be factors that contribute to the lower subscriber rate. These factors were noted at public meetings, particularly in rural areas of the state, and through our survey of current and potential broadband users.

[1] This report uses the terms "advanced telecommunications services," "advanced communications technology" and "broadband" interchangeably. The definition of these terms is addressed in the introduction and the glossary of this report.

Our research found that broadband technology costs are declining which means that further deployment should occur, particularly in areas that promise a profitable outcome for investors. Lower investments costs should also translate into lower prices in areas where there are multiple providers competing for a customer's business.

It would cost approximately $5 billion to upgrade all of California's phone lines to allow for broadband access if the State were to embark on a plan to provide a broadband connection to every household in the State. Although we believe there would be economic benefits from improved broadband deployment and use, and despite the power of generalizations such as $5 billion being less than 25% of California's telecommunications market for one year, there is little hard evidence to support a specific amount of benefit.

There are federal subsidy programs and a state program that provide discounts to end users for broadband service as well as federal subsidies for providers' entry into rural underserved markets. California has not taken advantage of some of the federal dollars available, primarily due to definitional problems with the subsidy rules. Despite legislation and a CPUC decision requiring it, California's phone companies currently refuse to provide DSL to the state's schools, libraries, and healthcare facilities via the California Teleconnect Fund, the state's broadband subsidy program. This failure on the part of the carriers to implement a major subsidy for broadband has significantly limited the utilization of existing broadband facilities in California.

Background

SB 1563 added § 709.3 to the Public Utilities Code. § 709.3 requires the CPUC "....to develop a plan for encouraging the widespread availability and use of advanced communications infrastructure."[2]

This report fulfills the requirements of SB 1563, as described in the Commission's order initiating rulemaking, R.03-04-003. SB 1563 articulates California telecommunications policy as including several objectives:

> (a) Continue our universal service commitment by assuring the continued affordability and widespread availability of high-quality telecommunications services to all Californians.

[2] The first step in this inquiry was to define the statute's term, "advanced communications service." For the purpose of this report, we assume that "Advanced Communication Services" is equivalent to "broadband services". Broadband service is further defined as high-speed access to the internet. The FCC defines "advanced telecommunications services" as a service that can transmit data at a minimum speed of 200 kbps in both directions. However, most experts agree that this speed is already yesterday's news. For example, speeds of 200 kbps are inadequate for streaming video, which requires multiple megabits per second, while other applications might require even more bandwidth. Any definition of broadband should consider the applications that consumers want as well as the applications that policy makers want to promote for economic, educational or social reasons. Therefore, a speed of 200 kbps can only be considered a minimum speed to qualify as broadband service. The reality is that some current applications require more bandwidth and certainly, some future applications will as well.

(b) Focus efforts on providing educational institutions, health care institutions, community-based organizations, and governmental institutions with access to advanced telecommunications services in recognition of their economic and societal impact.

(c) Encourage the development and deployment of new technologies and the equitable provision of services in a way that efficiently meets consumer need and encourages the ubiquitous availability of a wide choice of state-of-the-art services.

(d) Assist in bridging the "digital divide" by encouraging expanded access to state-of-the-art technologies for rural, inner-city, low-income, and disabled Californians.

(e) Promote economic growth, job creation, and the substantial social benefits that will result from the rapid implementation of advanced information and communications technologies by adequate long-term investment in the necessary infrastructure.

(f) Promote lower prices, broader consumer choice, and avoidance of anticompetitive conduct.

(g) Remove the barriers to open and competitive markets and promote fair product and price competition in a way that encourages greater efficiency, lower prices, and more consumer choice.

(h) Encourage fair treatment of consumers through provision of sufficient information for making informed choices, establishment of reasonable service quality standards, and establishment of processes for equitable resolution of billing and service problems.

In recognition of these policies, SB 1563 directed the Commission to develop a plan "for encouraging the widespread use of advanced communications infrastructure." The bill finds that "the mission of the plan is to identify factors preventing the ubiquitous availability and use of advanced communications services, assess the consequences of, and develop strategies for, addressing these factors while encouraging the deployment of adequate investment for advanced communications infrastructure that serves the public good," consistent with the policies it specifies.

Based on the legislation, the Commission's rulemaking identified several issues for investigation in fulfillment of SB 1563:

- Existing barriers to the ubiquitous availability and use of advanced telecommunications technology;
- Whether new telecommunications technologies or the cost of existing technologies have changed in ways that would make them more economical to deploy statewide;

- Whether and how telecommunications technologies and their cost are expected to change in the future in ways that would make them more economical to deploy statewide;
- Whether the Commission can or should direct changes in technologies, their deployment or related infrastructure in ways that would promote more ubiquitous availability;
- Whether and how existing programs promote the availability and use of advanced telecommunications technology for inner-city, low-income, and disabled Californians;
- Whether and how open and competitive markets for advanced communications technologies can encourage greater efficiency, low prices and more consumer choice;
- Whether and how identified technologies may promote economic growth, job creation and social benefits;
- The adequacy of current efforts to provide educational institutions, health care institutions, community-based organizations, and governmental institutions with access to advanced telecommunications services; and
- Whether existing law and policy encourage fair treatment of consumers through provision of sufficient information for making informed choices, establishment of reasonable service quality standards, and establishment of processes for equitable resolution of billing and service problems.

Key Issues

This study assumes that the state supports ubiquitous deployment of advanced communications technologies and analyzes related issues in that context. Thus, we begin our inquiry by surveying existing deployment and identifying where services are not yet available. We consider why they may not be available in different cases. We consider barriers and opportunities for deployment by looking at various regulatory, legal and policy issues, technologies and their costs. We review current subsidy programs and address the potential benefits of further broadband use. In pursuit of this inquiry, the Commission solicited written comments from members of the public, conducted workshops, sought ideas and information from affected groups, businesses and policy makers, and reviewed current literature on related issues.

Broadband service is available, at varying levels, theoretically in every zip code in the State. Service levels, prices and customer choices vary by geographic area. Generally, customers have better options and services in urban areas and densely-populated suburbs compared to rural areas.

California leads the nation with the most broadband subscribers of any other state. While the price for broadband service has decreased, the lower prices appear to be limited to areas where there are competitive alternatives. Despite California's leadership in the broadband market, the penetration rate for broadband service remains relatively

low compared to telephone, cable or satellite television service. The percentage of subscribers for broadband service in California ranges from as low as 12% to 33%, depending on the area.[3] According to the input we received in our investigation, this low penetration rate results from high prices, lack of training or knowledge about computers and the internet, and, separately, concerns about reliability in rural areas served by small telephone companies. Some government programs offer subsidies to California schools, libraries and non-profit technology centers which in turn are providing those who need training and advice with a place to learn about the benefits of broadband service. This study identifies some of the possible barriers to increased broadband usage.

Beginning in 1995, the Legislature and the CPUC adopted and implemented policies to open up the communications market to competitive entry. Since the implementation of those policies, the State has benefited from increased investment and innovative technologies including efforts by the communications and cable industries to upgrade their facilities in order to offer broadband service. This inquiry looks at the impact of the State's open market policies on the broadband market.

Broadband service facilitates a high-speed connection to the internet. It does not simply improve the speed of "downloading" graphics, as it originally did. More and more communications applications require broadband connections, including Voice over Internet Protocol (VoIP), streaming video, video-on-demand and video conferencing. We reviewed several potential benefits of increased broadband use, including:

- Providing individuals with increased access to a wide variety of services, such as the ability to conduct business with the government and participate in online educational programs;
- The ability to study for and obtain a college degree;
- Reducing the cost of doing business through improved operational efficiency;
- Improving the quality of life for members of the disabled community; and
- Bringing high quality healthcare to remote communities.

Broadband service is delivered with different technologies, speeds or bandwidth, and prices. We analyzed those technologies with respect to new technologies and whether the State can expect these markets to grow with little to no government intervention. We found that technology is evolving and the cost of deploying many technologies is decreasing.

Report Contents

Chapter 1 tracks the evolution and growth of California's broadband market and compares the experiences in California to the national broadband market as a whole, as

[3] The estimated penetration range is based on proprietary information received from the FCC and various broadband providers in the state.

well as other states' broadband markets. This chapter also includes references to maps that depict the areas in California where broadband service is available, the number of providers in specific areas and the types of technology available.

Chapter 2 details the diversity of broadband technologies available. This chapter provides a technical background for the varieties of broadband currently deployed as well as those that are still emerging technologies.

Chapter 3 covers competitive issues and presents a plan to modify regulatory perspectives on broadband. The purpose of this section is to address the challenges that broadband provides the regulatory infrastructure.

Chapter 4 This chapter reports on the lack of service quality and consumer protection rules for broadband service as well as the CPUC's efforts to address consumer protection in the broadband market.

Chapter 5 summarizes existing subsidy programs and potential subsidy structures. This chapter reports on the effectiveness of these programs to encourage broadband deployment and use and discusses broadband access issues and the "digital divide" in terms of disabled, rural, and low income groups.

Chapter 6 reviews barriers to further deployment of broadband technologies. This chapter addresses current Right of Way (ROW), CEQA and cable law to determine if the application of these laws inhibits broadband investment. In addition, this chapter investigates the factors that limit broadband demand, and also reports on the impact of limited broadband access for underserved communities.

Chapter 7 explores the barriers to broadband utilization. This chapter focuses primarily on the barriers from the cultural to the economic that present limits to broadband utilization by Californians. This section includes both physical limitations and the social factors that may impact broadband adoption.

Chapter 8 addresses who is receiving broadband currently; examining areas such as race, income, and the presence or absence of disabilities.

Chapter 9 explores the costs and benefits of increased broadband deployment and broadband use. This chapter looks at economic benefits including impacts on job creation and the social benefits of broadband use and how the technology can make a difference in people's lives. This chapter also specifically looks at the cost of broadband deployment with regard to the dollars required by broadband infrastructure, but also examines the potential costs of broadband deployment on the already existing traditional telephony infrastructure for traditional phone service users.

Chapter 10 analyzes whether new technologies or the cost of existing technologies have changed in ways that would make them more economical to deploy.

Chapter 11 presents our recommendations for achieving the State's goal of ubiquitous broadband deployment.

A Glossary of key terms is included in Appendix A

Chapter 1. Overview of Broadband Deployment in California

SB 1563 added § 709.3 to the Public Utilities Code. §709.3 requires the CPUC "....to develop a plan for encouraging the widespread availability and use of advanced communications infrastructure." Before we develop a plan for encouraging deployment and use of broadband, we first must know the status of broadband availability in the State today.

The facts show that California leads the nation in the number of broadband subscribers. Furthermore, broadband service is available in every zip code in the State. This is supported by our analysis of broadband availability as contained in the maps in the appendix. Map I shows the type of choices that consumers have throughout California. Map II shows the number of providers available to consumers.[4] These maps show that there are some zip codes in the northeastern part of the state where there is limited broadband availability (satellite only), and thus no choice for consumers. As addressed below, there are significant limitations to the zip code-based deployment maps.

Despite exponential growth in the number of broadband customers, many people choose not to subscribe to broadband service. This chapter tracks the evolution and growth of California's broadband market and compares the experiences in California to the national broadband market as a whole, as well as other states' broadband markets.

1.1 Broadband Is Available Throughout the State

Our geographic analysis found that some type of broadband service is available in every zip code in the State of California. Though this is good news, it does not mean that the California's broadband market is completely developed. For example, because of the insufficiency of the FCC's data, we do not know the exact number of broadband subscribers in each zip code nor do we know the number of potential customers who could actually order and receive broadband service. Additionally, the FCC data provides only zip code based deployment data, which mistakenly implies broadband is widely available in the entirety of a zip code when in fact there may be only one broadband connection including connections for testing purposes only. Furthermore, competitive choice is limited, in most cases, to DSL and cable modem service. There are alternative technologies in the market and soon to be in the market. As we discuss in this report, however, some of these technologies, such as satellite, may not have sufficient bandwidth or reliability to function correctly for specific applications or to meet the needs of subscribers.

1.1.1 Some Areas Have Limited Access or No Choice

Also, in places with little or no choice of provider, prices can be higher than in areas with competitive choice. Most importantly, we were not able to determine how many

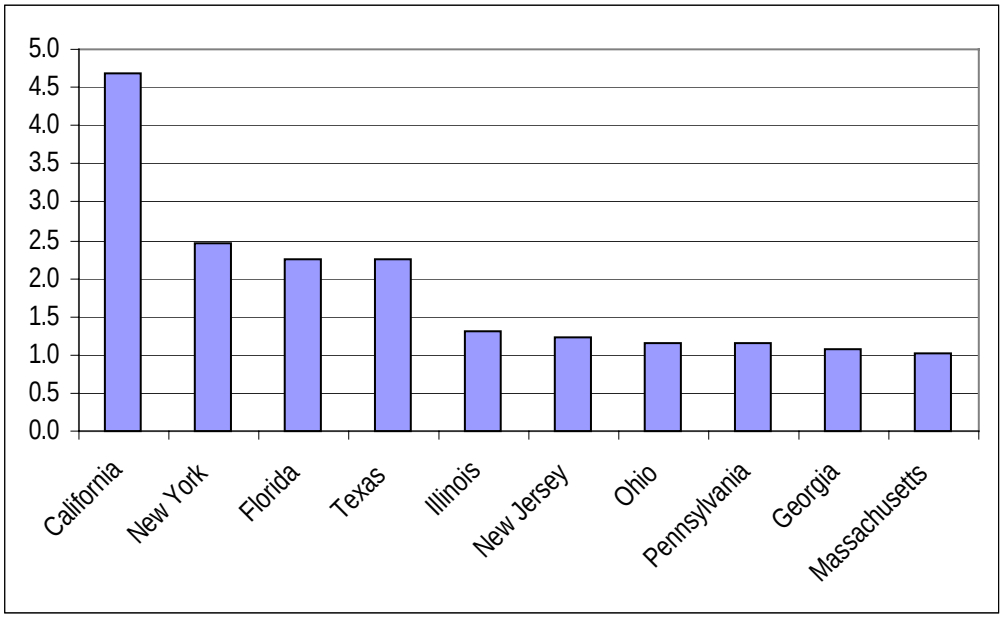
[4] The maps were developed from data that broadband providers supplied to the FCC as part of that agencies oversight of the broadband market. We found, however, that some providers may not be reporting this information to the FCC. This means that the maps may understate the number of providers available.

households in any given zip code actually receive broadband service and if every household in every zip code could in fact receive broadband service if the customer wanted to subscribe. There is pending legislation, referenced in our legislation section, that may address the lack of granular data on broadband deployment in California.

1.1.2 California Leads the Nation in Broadband Deployment

California leads the nation in overall number of broadband lines and overall national broadband market share. Figure 1.1 shows the number of broadband lines for the top ten states in the nation. As of June 2004, California had 4.69 million broadband lines – almost as many as New York and Florida combined.

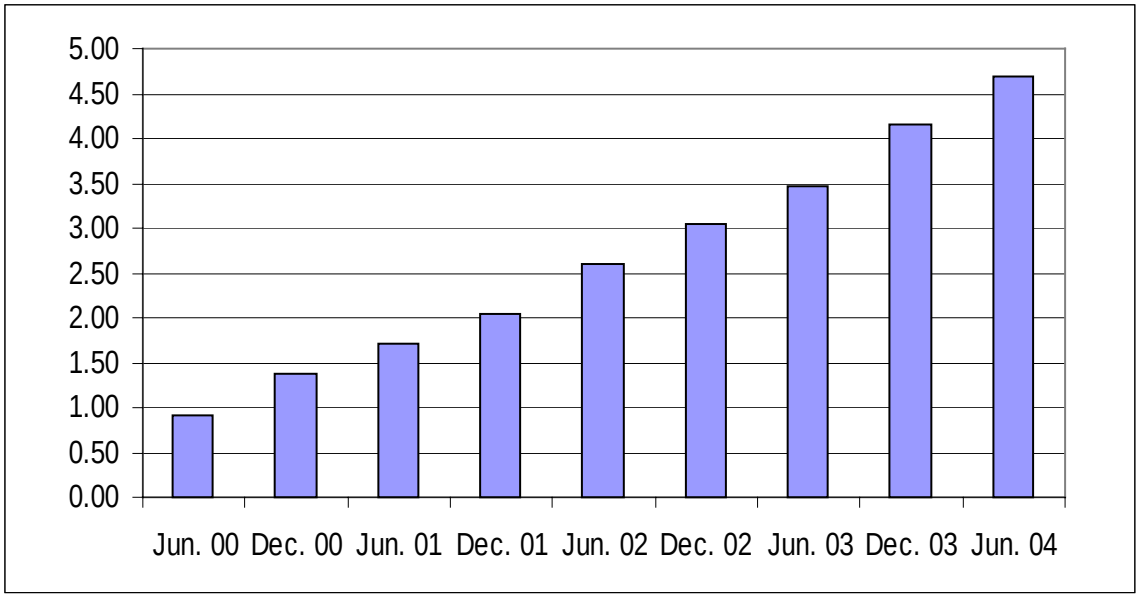
Figure 1.1



1.1.3 Rapid Subscriber Growth in California and Nationwide

From June of 2000 to December of 2004, California's broadband market expanded by 516%, growing from 900,000 broadband lines to just over 4.69 million broadband lines. (Figure 1.2.)

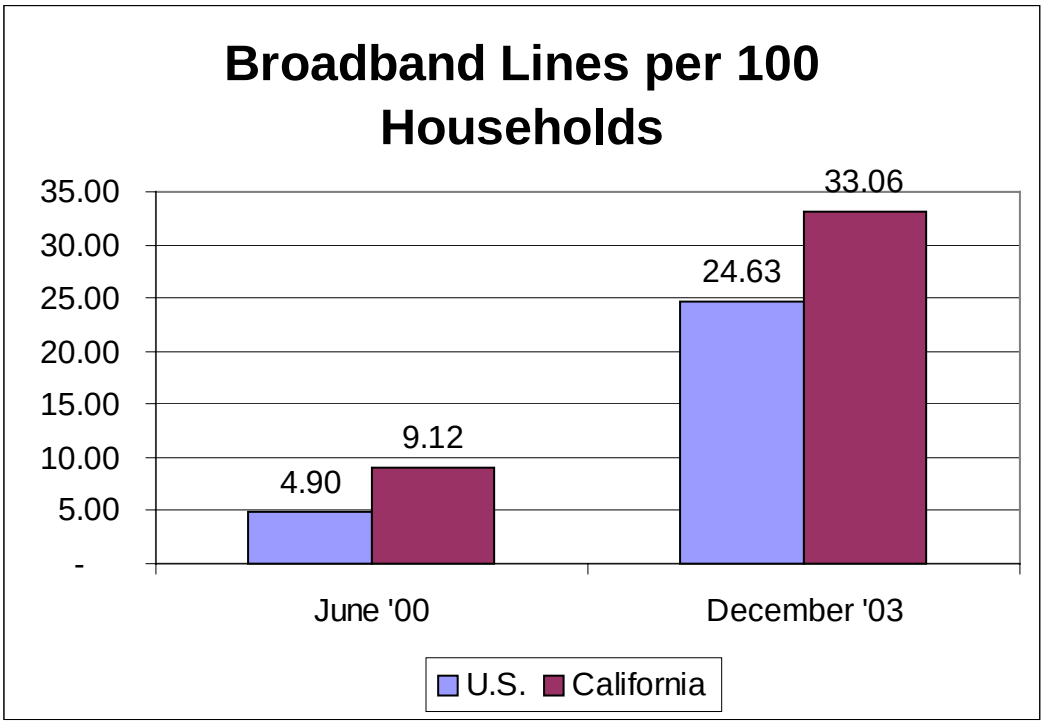
Figure 1.2



1.1.4 California's Broadband Penetration Rate Exceeds the National Average

Figure 1.3 shows the fast rate of growth experienced in the broadband market between 2000 and 2003 as more people sign up for broadband service.[5] California residents and small businesses have a higher broadband penetration rate (33.06 broadband lines per 100 households) than the national rate (24.63 broadband lines per 100 households).

Figure 1.3

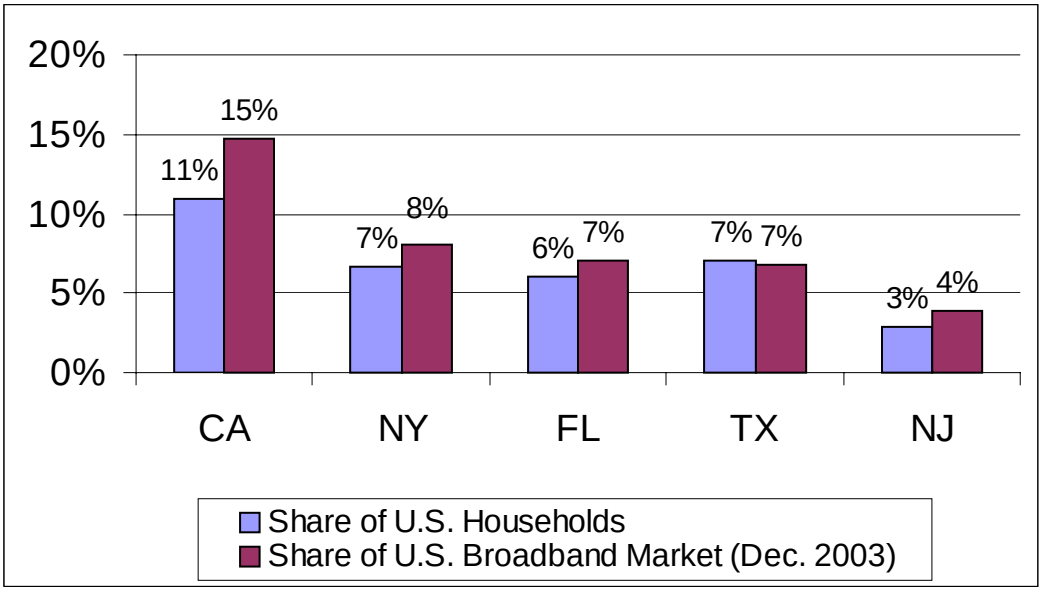


1.1.5 How California Compares to Other States

Figure 1.4 shows that, with 15% of the broadband market and 11% of the nation's population, California's broadband market is 35% higher than its population would otherwise indicate. New York is 27% higher, Florida is 17% higher and New Jersey, a much less populous state than California, is the highest at 42% higher. Texas, on the other hand, has a broadband market share slightly lower than its share of national population. More recent federal data indicates California's share of the national broadband market has slid to 14% from 15%, 2003 is the last full year data available.

[5] The penetration rate is based on the subscriber data collected by the FCC and population data from the United States Census Bureau. The FCC's subscriber data includes small business as well as residential customers. Our independent research found that California providers report a lower penetration rate based on the number of actual subscribers compared to the number of residents that are capable of receiving the service.

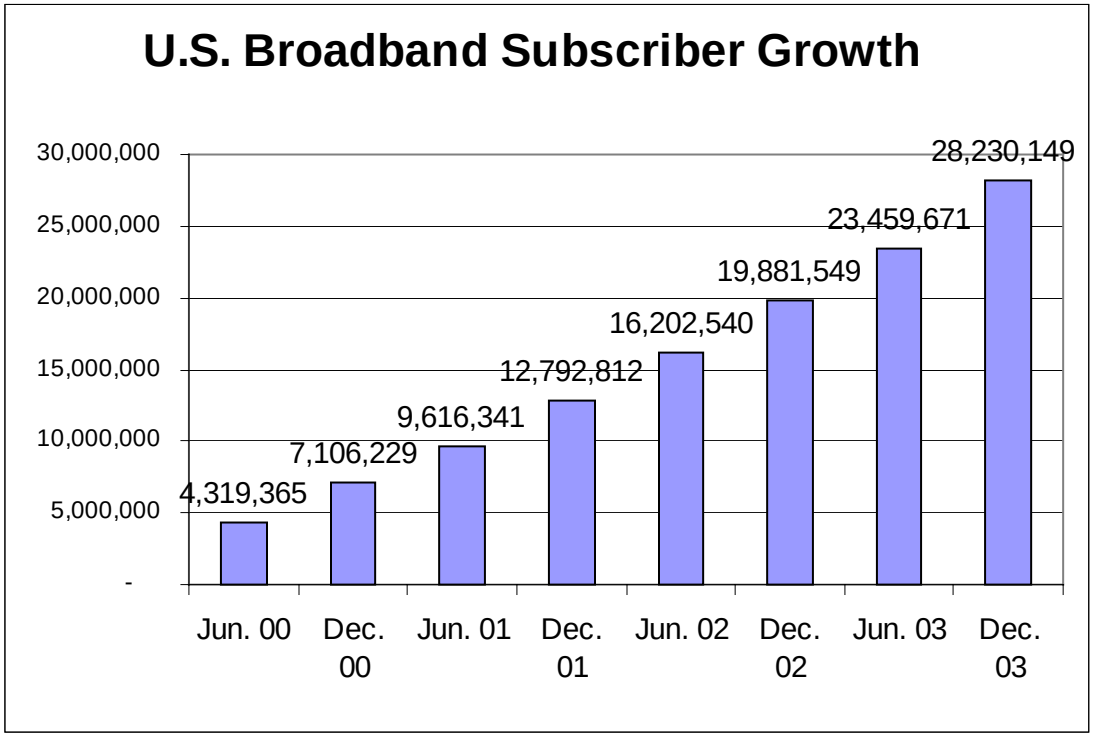
Figure 1.4
Broadband Market Share / Percentage of Households



1.1.6 The National Broadband Market Has Grown Exponentially

During this same 42-month period, the U.S. national broadband market grew by 554%, increasing from 4.3 million broadband lines in June 2000 to 28.2 million broadband lines in December of 2003. (Figure 1.4.) The growth in the national broadband market pushed the national broadband penetration rate from 5 broadband lines per 100 households in June of 2000 to just below 25 lines per 100 households by December of 2003. (Figure 3.4.)

Figure 1.5



1.2 Conclusions

California leads the nation with the largest number of broadband subscribers nationwide. Broadband service is available in every zip code in the State but is not be available to every potential customer in each zip code. Consumers in rural areas may be limited to satellite broadband service which tends to cost more and can be of lower quality. The FCC data that was used to prepare the maps and tables presented here is limited to providers that have 250 or more customers and the data does not show the number of customers in each zip code. Without this detailed information, it is difficult to understand the challenges faced by each underserved region in the state. The CPUC is communicating with the FCC about the need for this more detailed information and pending state legislation may provider greater granularity for California policymakers. Better subscriber information will allow the state to understand whether a lack of broadband service in a particular region is caused by a lack of supply of broadband providers or if potential customers are choosing not to subscribe despite the fact that service is available. We address the reasons why people choose not to subscribe to broadband service in Chapter 7 of this report.

Chapter 2. Broadband Technologies

Similar to the diversity found in the number and type of broadband providers, California is home to a number of different technology platforms that are used to deliver broadband to consumers.

2.1 Digital Subscriber Line (DSL)

Figure 2.1
DSL Characteristics

What is it?	Benefits	Limitations	Price[6]
Broadband service that uses the same phone line used for voice service	Widely available and relatively affordable; the leading platform used for broadband service in California	Limited bandwidth potential and transmission range (<18,000 ft.)	$14.95 | $79.95 per month

DSL runs on the traditional wireline network, utilizing the higher frequency spectrum available in a pair of copper telephone wires which is unused by analog telephone services. Upgrading copper loops for DSL services essentially involves installing a piece of new equipment[7] in the telephone company central office, and removing interference generating devices from the local loop.

Depending on a consumer's distance from the central office, DSL can achieve download speeds of up to 8 Mbps, although DSL service providers usually cap the maximum download speed at about 1.5 Mbps and only guarantee a minimum download speed of 384 Kbps.[8] DSL speeds are sufficient to bring streaming video into customer homes and for customers to send out basic information such as video selections.[9] DSL works well

[6] Prices are for consumer, not wholesale, customers. Broadband pricing can vary greatly depending on a variety of factors: length of contract, speed, equipment (rent or buy), promotional period pricing, existence of market competitors, and bundling with other services (See the discussion of convergence in section 8.2.1 of the report). Generally, costs and prices of all broadband technologies decline as efficiencies due to economies of scale and equipment standardization are realized.

[7] This equipment is called a Digital Subscriber Line Access Multiplexer. The DSLAM allows for the simultaneous transmission of high-speed data and voice services over traditional copper phone lines.

[8] Broadbandreports.com; http://www.dslreports.com/faq/356.

[9] There are other variations of DSL including ADSL, SDSL and VDSL. ADSL, or Asymmetric DSL offers different bandwidth speeds depending upon the direction of the information flow. Data coming from the Internet to the customer's modem will be sent at a higher speed while data coming from the subscriber and going to the Internet is sent at a relatively lower speed or bandwidth. SDSL stands for Symmetric DSL, which offers the same upload and download speed, but would require a pair of dedicated copper loop. VDSL stands for very high data-rate DSL that

as a basic Internet connection, since most residential Internet consumers place greater emphasis on the download speeds needed for surfing the web, downloading files, and sending email messages. Since being introduced in the 1990s, DSL has become the leading broadband technology in California and the second leading broadband technology in the national market.

DSL has certain technical limitations. The most significant limitation is the transmission range. As a digital signal is transmitted through the copper loop, the signal suffers from greater distortion the farther it must travel from a provider's central office to the customer. Debilitating signal degradation generally occurs when the local loop length between customer premises and the central office is between 16,000 and 18,000 feet.

DSL had traditionally suffered from other technical limitations, which are now being addressed through technological advances. For example, DSL had previously been limited in its deployment due to the requirement that it operate only in a pure copper environment. However, telecommunications companies have overcome this technical limitation by installing DSLAMs inside remote terminals.[10]

Also, DSL's bandwidth capacity has traditionally limited the ability of DSL providers to offer the same type of "triple play" package, including video, data and voice services, that can be delivered over cable or fiber facilities. However, new compression technologies are being developed that will allow high definition TV to be delivered over existing copper phone lines.[11] In addition, in order to compete effectively with companies offering bundled services, ILECs such as Verizon, SBC and BellSouth have partnered with satellite companies to add video to their bundled services.[12] For a more detailed discussion of the role of Convergence and Service Bundling, please see section 8.2.1 of the report.

2.2 Cable Modem

Figure 2.2
Cable Modem Characteristics

What is it?	Benefits	Limitations	Price
Broadband service that uses the same coaxial cable used for cable television service	Widely available and relatively affordable; the leading platform used for broadband service in the U.S.	Limited future bandwidth potential; not widely deployed to business customers	$19.95 | $49.95 per month

offer a much higher speed than DSL (52 Mbps) but has a very limited range of less than 4,000 feet.

[10] CPUC Staff interview with SBC representatives, February 1, 2005.

[11] See, e.g., Carol Wilson, "Qbit unveils new compression approach," Telephony Online, January 7, 2005.

[12] "SBC, EchoStar Announce Strategic Marketing Alliance," April 17, 2002. www.sbc.com

Internet service via coaxial cable became available with the cable television industry's migration from analog to digital TV.[13] In the early 1990s, most of the cable television infrastructure in the United States was incapable of carrying digital TV signals. Upgrades were needed to make coaxial networks capable of delivering digital TV, including a high capacity fiber-optic backbone to carry the increase in data, as well as the capability for two-way data transmission. The cable industry spent more than $65 billion dollars between 1996 and 2002 to upgrade its infrastructure.[14] This new cable TV network architecture, called a hybrid fiber-coaxial (HFC) network, allows high-capacity, digitized, two-way data transmission that is used for broadband Internet services today.

Because of the industry's head start in upgrading its network,[15] cable modem has been the dominant national broadband technology since 2000.[16] At the end of 2002, there were more than 65 million cable television customers in the United States, with more than 10 million of those customers subscribing to cable modem service. By September 2004, the number of cable modem subscribers had grown to more than 19.4 million.[17]

The HFC network architecture consists of a fiber backbone linking the cable company headend to a local distribution node.[18] The local distribution node is where cable TV and cable modem data are converted from optical signals to radio frequency (RF) signals to be retransmitted through coaxial cable to a nearby customer's premise. While the fiber backbone has a capacity of 5 Gbps, only 6 MHz bandwidth is allocated for cable modem service from the node to the customer. A theoretical 40 Mbps bandwidth is possible over the 6 MHz bandwidth for each individual cable modem user.[19] This 40 Mbps is shared by all of the cable modem customers serviced by the distribution node, with the possible maximum of 30 Mbps of the 40 Mbps available to each cable modem user

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[13] Digital TV programming is digitized and compressed before being transmitted over the coaxial cable, enabling much more programming to be carried over a single coaxial cable.

[14] National Cable & Telecommunications Association (NCTA), http://www.ncta.com/Docs/pagecontent.cfm?pageID=96.

[15] MediaOne, since acquired by AT&T and then Comcast, began to offer cable modem service in 1994 in West Los Angeles.

[16] This is not the case for California. DSL service is currently the dominant technology in California.

[17] National Cable & Telecommunications Association (NCTA); http://www.ncta.com/Docs/pagecontent.cfm?pageID=96

[18] A "headend" is a master facility for receiving TV signals for processing and distribution over a cable TV system; http://en.wikipedia.org/wiki/Cable_TV_headend. Headend is also where cable modem data is received and retransmitted to the Internet or the customer's computer. A headend serves a region that can be one city, several cities or part(s) of a city depending on the number of households subscribing to the cable data service.

[19] Working through an industry association CableLab, the cable industry agreed on a common cable modem technical standard DOCSIS 2.0 (Data Over Cable Service Interface Specification), which allocated a cable channel of spectrum for cable modem with 40 Mbps of bandwidth.

under the new cable modem standard.[20] A single node may serve hundreds of customers, so service degradation can occur if many users are connected to the internet simultaneously.[21] Today, most cable modem services promise customers a download speeds of between 1.5 Mbps and 3 Mbps.

2.3 Satellite

Figure 2.3
Satellite Broadband Characteristics

What is it?	Benefits	Limitations	Price
Broadband service delivered through geostationary satellites	Covers all areas with a direct view of the southern sky	Limited bandwidth; providers often limit amount of data downloaded per month; difficult and expensive to add capacity	$49.59 | $99.99 per month

Satellite broadband services utilize geo-synchronized satellites that stay in a fixed point in the southern sky to receive and transmit data to and from satellite broadband customers who must install a satellite dish. The primary advantage of satellite broadband technology is that it is available to customers located anywhere in the U.S. with a direct view of the southern sky. The availability of satellite broadband services makes it technically possible, albeit generally at higher cost ($60 - $80 per month) and lower speed (400 Kbps),[22] for virtually anyone living in the United States to obtain broadband service.

There are one-way and two-way satellite broadband services. One-way satellite broadband service requires a telephone line to send data upstream, while data is downloaded directly from the satellite. Initially, for satellite broadband service, only one-way service was available because satellites at that time were not designed to receive data from customers. Those satellites were designed to transmit TV signals back to earth rather than provide two-way communications required for broadband service. Two-way satellite broadband became possible when a new generation of satellites, designed with broadband service in mind, was placed into orbit in the mid-1990s.

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[20] Under the previous cable modem standard DOCSIS 1.1, each cable modem customer can achieve maximum download speed of 10 Mbps, DOCSIS 2.0 increases the maximum download speed to 30 Mbps.

[21] Institute of Electrical and Electronics Engineers (IEEE); http://www.spectrum.ieee.org/WEBONLY/publicfeature/jun01/cmode.html. DSL Reports; http://www.dslreports.com/faq/7135.

[22] As compared to typical DSL and cable modem price ($29.95 to $49.95) and bandwidth (1.5 Mbps to 3 Mbps).

The limitation of satellite broadband services is that its capacity, both in terms of total bandwidth and number of customers, cannot be readily or easily upgraded since it involves launching new satellites into orbit. The architecture of satellite broadband is similar to the architecture of the cable modem HFC network, except satellite uses radio waves instead of fiber and coaxial cable to connect to the node. As a result, satellite broadband service providers limit the amount of data their customers can download and upload each month, and charge additional fees to customers exceeding the monthly cap. Another limitation for satellite broadband service is that it is more susceptible to service interruptions from severe weather conditions.[23]

2.4 Wireless

Figure 2.4
Wireless Broadband Characteristics

	What is it?	Benefits	Limitations	Price
Wireless LAN (Wi-Fi /UWB) Wireless MAN (WiMax) 2.5/3G Cellular	Broadband technology using licensed and/or unlicensed radio frequency spectrum for transmission	Low deployment costs and widespread access	Availability of spectrum; technical standards for higher bandwidth and longer range technologies still being developed; licensed spectrum for dedicated services is expensive	Free | $99.99 per month

Wireless communications are revolutionizing peoples' lives, enabling consumers to access a high-speed connection to the Internet using virtually any device, at any time, from any location. Wireless technologies being deployed today are as diverse as the ideas for how to use them, from Bluetooth, to hot spots, to wireless Internet backbones stretching hundreds of miles over mountain ranges.

There are four major categories of wireless technologies today that enable high speed connections to the Internet:

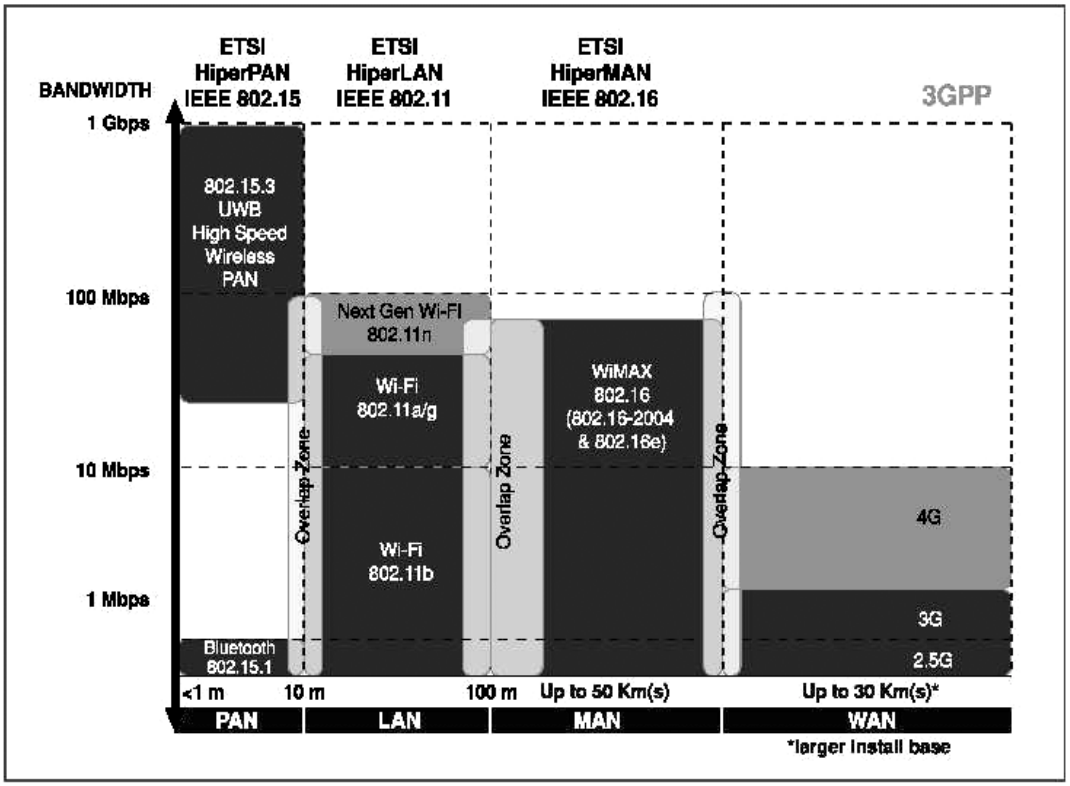
- Personal Area Networks (PANs) including Ultra-Wide Band (UWB);
- Local Area Networks (LANs) including Wireless Fidelity (WiFi);
- Metropolitan Area Networks (WANs) including the Worldwide Interoperability for Microwave Access standard known as "WiMAX;" and
- Next-generation cellular technologies also known as "3G" and "4G" such as Verizon Wireless's EvDO and Cingular Wireless's OFDM services.

Each provides a solution to access broadband Internet that varies based on distance, bandwidth and quality of service that can be tailored to meet the specific needs of

[23] Lonestar Broadband, http://www.lonestarbroadband.org/technology/satellite.htm.

consumers based on the price, quality and type of usage they need. Each technology is discussed below.

Figure 2.5
Types of Wireless Broadband Technologies



Source: Intel, Understanding Wi-Fi and Wi-MAX as Metro-Access Solutions

2.4.1 Wireless Personal Area Networks (WPAN) and Ultra-Wide Band

Wireless Personal Area Networks (WPANs) use two types of standards: 802.15.1 (also known as Bluetooth) and 802.15.3 (Ultra-Wide Band). Both are designed for very small networks within a confined space, such as a home office, desk, or car. Bluetooth is used primarily for communications and computing peripherals, such as computer to printer or handset to headset. Ultra-wide band provides higher bandwidth (over 400 Mbps) for small networks, which allow multimedia services such as DVD-quality video to be shared wirelessly throughout a home.

2.4.2 Wireless Local Area Networks (WLAN) and WiFi / Mesh-Networks

Wireless Local Area Networks (WLANs) have a broader range than WPANs (up to 100 meters) and are typically found in “hot spots,” such as cafes, hotels, airports, offices and

home networks. The wireless standard associated with WLANs is IEEE[24] 802.11. Three versions of the 802.11 standard are commonly used and built into most laptops and mobile devices today:

- 802.11a supports bandwidth speeds up to 54 Mbps
- 802.11b supports bandwidth speeds up to 11 Mbps
- 802.11g supports bandwidth speeds up to 54 Mbps[25]

Wireless Internet Service Providers (WISPs) using directional antennas or implementing "mesh" network technologies have been able to increase WLAN performance beyond 54 Mbps and to cover wider areas (over 10 km) using the 802.11 standard. To extend wireless access nodes, providers still mostly rely on wires or fiber for long distance backhaul to the provider, and from the provider to the core network.

Directional Antennas

WiFi LANs (such as those at Starbuck's "hotspots") use omni-directional antennas that transmit radio frequency (RF) signals in all directions equally. Alternatively, high gain directional antennas can concentrate RF signals primarily in one direction like the beam of a spotlight. By extending the signal across longer distances, these directional antennas can serve as point-to-point links between buildings and access points. These line-of-sight links using directional antennas can be used to bridge last mile gaps, but are sensitive to interference from buildings, mountains and other obstacles.

Mesh Networking

Mesh-network technology extends the range of traditional WLANs by allowing a collection of 802.11 standard "nodes" (an individual laptop or fixed access point such as a hot spot) to interconnect and move data between nodes acting as one "shared" network. In a mesh network (sometimes referred to as "multi-hop" network) small nodes are installed throughout a large area, such as a neighborhood or school, and each acts as a router, transmitting data from one node to the next. One advantage of mesh networks is the use of dynamic path configuration that allows RF signals to navigate around large obstacles, such as mountains or buildings. If one path to the base station is blocked, a transmission using a mesh network will automatically find another path through another node. Another advantage is reliability. In a "single-hop" network, if one node goes down, the entire WiFi LAN network goes down. In a mesh-network architecture, if one node goes down, the network continues to operate by routing data through other nodes.

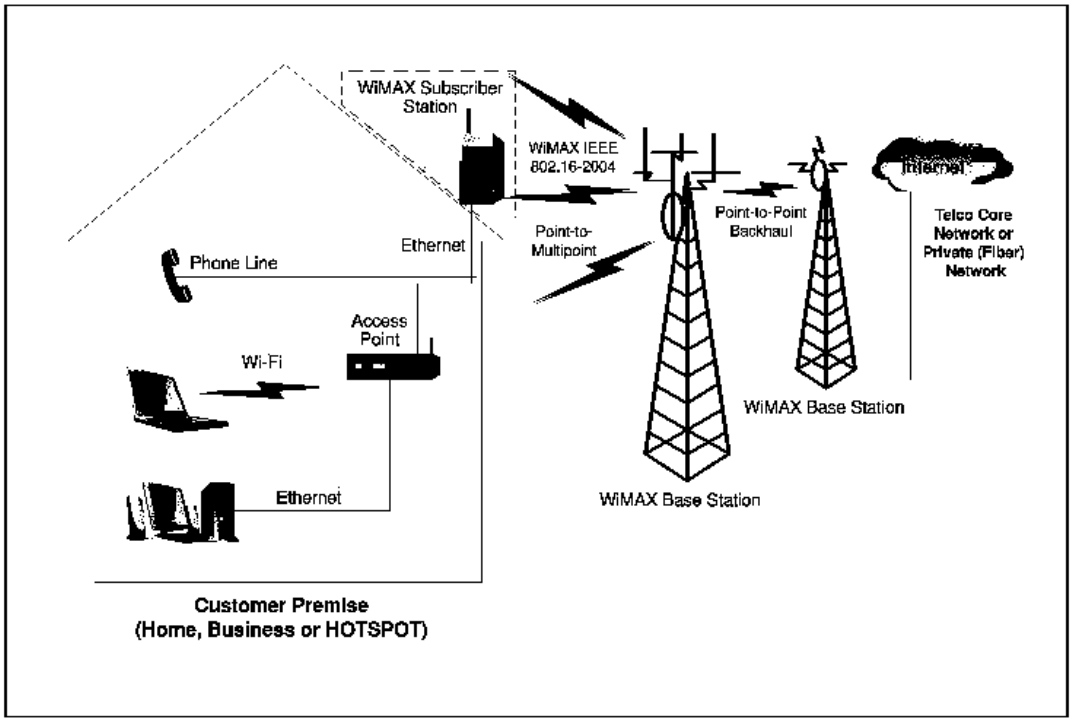
[24] Institute of Electrical and Electronics Engineers, www.ieee.org.

[25] Both 802.11a and 802.11g standards offer up to 54 Mbps in bandwidth but use different radio spectrums and technologies.

2.5 WMANs, WiMAX and WWANs

Wireless Metropolitan Area Networks (WMANs), also known as WiMAX, use the 802.16 standard and cover a much greater distance than WLANs - up to 50 km. This standard is also referred to as "fixed wireless" because it uses a mounted antenna at the subscriber's site to transmit the RF signal from point to point (or point to multi-point) over long distances. WiMAX uses more sophisticated transmission protocols than the 802.11 standards, which result in improved connectivity, network reliability and quality of service. WiMAX therefore serves as a carrier-class solution for the last mile problem - a wireless alternative to cable, DSL or fiber optics. For example, the 802.16 standard enables wireless Internet service providers to guarantee high bandwidth to business customers, and low latency for voice and video applications.

Figure 2.6
WiMAX Network Topology



Source: Intel, Understanding Wi-Fi and Wi-MAX as Metro-Access Solutions

WiMAX can also be used to aggregate WiFi networks (such as mesh-networks and hot spots) and provide long distance backhaul to a core network.

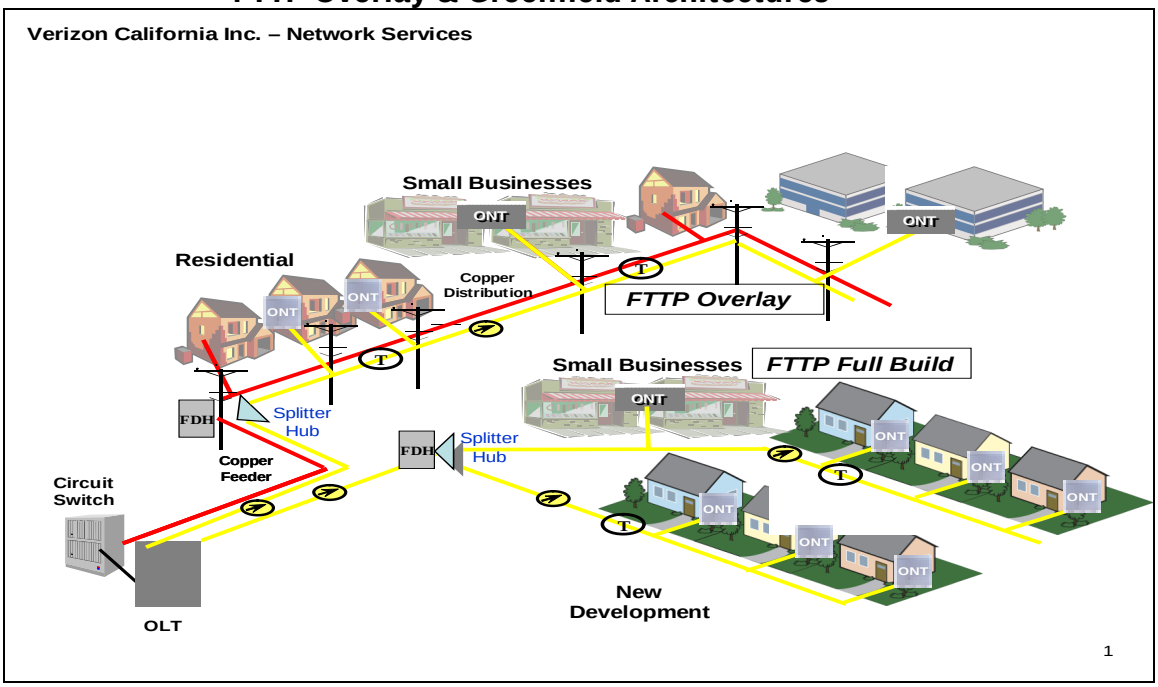
Wireless Wide-Area Networks (WWANs) aggregate WMANs over a large geographic area (over 50 km) using fiber optic or other wired links to connect to the core network, either using WiMAX point-to-point transmission for long distance backhaul or connecting directly to a fiber node.

2.6 Fiber-to-the-Premises

Figure 2.7 FTTP Characteristics			
What is it?	**Benefits**	**Limitations**	**Price**
Broadband service delivered through fiber optic cable	Great bandwidth potential	Expensive to deploy, especially for laying underground lines	$34.95 | $49.95

Fiber-to-the-Premises (FTTP) is a telecommunications network architecture currently being developed by the ILECs and others (including Broadband Overbuilders), to be the next generation of broadband technology. FTTP takes advantage of the extensive fiber backbone network that ILECs have built out over the years and further extends it into customers' homes and businesses. Under the current FTTP architecture, B-PON (Broadband Passive Optical Network), up to 32 customers can be served by a single optical node with a minimum bandwidth of 19.4 Mbps per customer. However, depending on the number of others online at the time, each subscriber could access the entire fiber node's bandwidth of 622 Mbps.[26]

Figure 2.8
FTTP Overlay & Greenfield Architectures



[26] Renee Estes, SBC Laboratories Inc., "Fiber-to-the-Premise – Broadband Optical Passive Network," presented at CENIC conference on March 17, 2004.

The present FTTP standard can be upgraded to 1.2 Gbps, and a new standard offering speeds 2.4 Gbps, called GPON (Gigabyte-Capable Passive Optical Network) is near adoption by the industry. One of the great advantages of fiber is that bandwidth upgrades are achieved simply by installing new equipment at the ends of the fiber facilities.

The primary barrier to deploying FTTP is cost. The per-unit cost of deploying FTTP has dropped from $7,500 per home in the mid-1990s to $1,600 in 2002, and to $1,350 in 2004. This is the main reason that SBC, Verizon, and BellSouth chose a set of common FTTP technical standards, hoping equipment standardization and the combined economy of scales would drive the deployment cost down even further. Verizon estimates that deploying FTTP to its customers in all of its 29-state territory will cost between $20 and $40 billion.[27] There is a significant cost difference between overhead and underground fiber deployment because of the additional costs associated with trenching and digging up streets to bury fiber underground.

Despite the costs, fiber deployments are being made throughout the country. A recent survey indicated a significant increase in FTTP deployments in the United States, almost doubling in number in a six month period - from 78,000 homes in March 2004 to 146,500 homes in September 2004.[28] In California, Verizon has already begun FTTP deployment in the cities of Huntington Beach and Murrieta.[29] SBC developed one of the nation's first FTTP deployments in 2001 for the San Francisco Mission Bay community.[30] SureWest, recognized as one of the nation's leading independent providers of fiber, is deploying FTTP service in Sacramento in direct competition with SBC and the local cable company, and is estimated to be terminating fiber at approximately 30,000 homes.[31]

2.7 Broadband over Powerline

Figure 2.9
BPL Characteristics

What is it?	Benefits	Limitations	Price
Broadband service delivered through the electric distribution system.	Should have relatively low deployment cost and time since BPL utilizes the existing electric grid	Still in development/trial stage. Interferences to and generated from BPL is a potential hurdle	$27.00 | $49.95

[27] Steve Rosenbush, "Verizon's Gutsy Bet," BusinessWeek, August 4, 2003.

[28] Vince Vittore, "IOCs," Telephony, February 28, 2005.

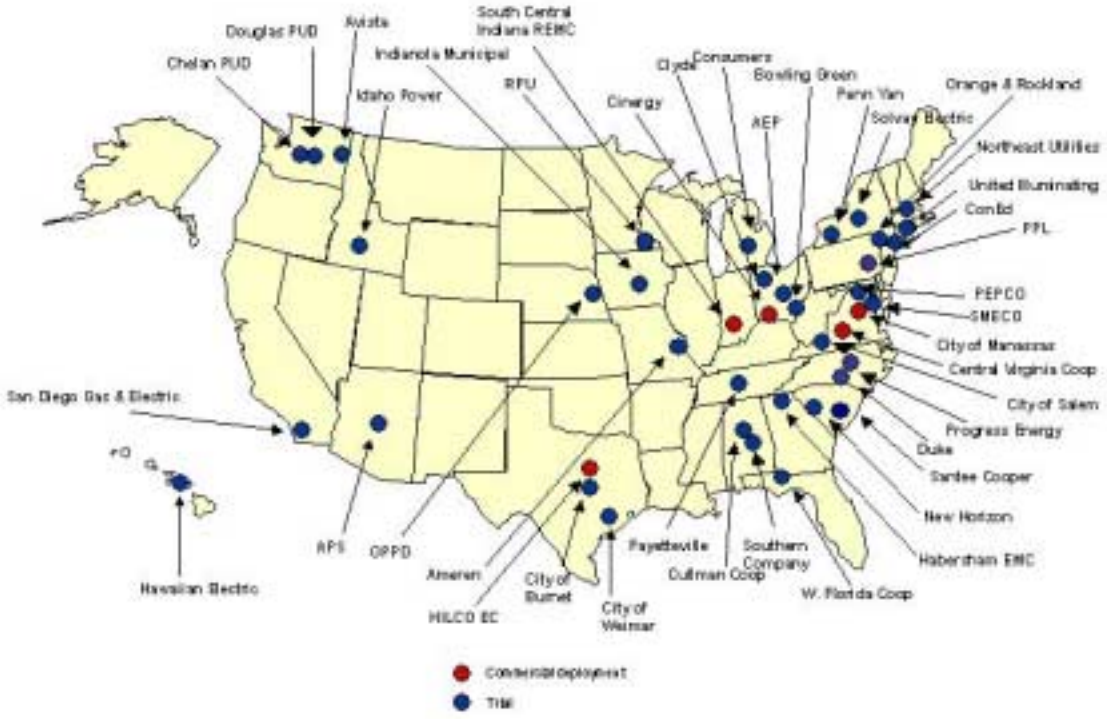
[29] Verizon News Release, July 19, 2004. http://newscenter.verizon.com/proactive/newsroom/release.vtml?id=86053

[30] SBC News Release, June 22, 2004; http://www.sbc.com/gen/press-room?pid=4800&cdvn=news&newsarticleid=21207.

[31] Vince Vittore, supra.

Broadband over Powerline (BPL) is the provision of broadband service over existing electricity distribution wires using the higher frequency bandwidth of those wires. The BPL signal is separated from the electric transmission before it reaches the transformer located on the pole outside the customer premise. It is then sent directly through the customer's wall sockets to equipment located at the premise, allowing a customer to access the Internet by plugging a computer into any electrical socket. Alternatively, BPL can be used to transmit broadband through the power distribution poles, with a wireless connection between a transmitter on the pole and the customer's computer used to achieve the final connection. This is feasible since electric poles are usually no more than 100 feet from people's homes, which is suitable for present Wi-Fi technologies. BPL offers similar bandwidth as DSL and at comparable prices, based on information from the few communities where BPL is in operation. The full bandwidth potential of BPL is not known, however, since it is still early in its development and deployment when compared to other broadband platforms. It is reported that new technologies will permit BPL to provide broadband at bandwidths of up to 200 Mbps by the summer of 2005.[32]

Figure 2.10[33]



[32] Ed Gubbins, "New Reports Suggest 2005 as Critical to Growth of BPL," Telephony, February 28, 2005, p. 9.

[33] United Telecom Council, www.utc.org.

The country's first city-wide commercial BPL deployment will be finished in April 2005 in the city of Manassas, Virginia. ComTek, the company offering the service received a license from the city and is providing BPL over power lines owned by the city Utilities Department.[34] ComTek has stated that more than 10% of the homes passed by its network have decided to take the 500 Kpbs symmetrical service, which ComTek is offering for $29 per month. ComTek expects to achieve 20% to 30% penetration among the city's 12,500 homes and 2,500 businesses in the very near future.[35] Cincinnati, Ohio is another city with an active BPL deployment. That project is a joint venture between Cinergy, the local electric utility, and Current Communications, a BPL service provider.[36] Current Communications is also actively looking to commence a BPL project in California in the near future, although no specific plans have been announced.

About 100 residents of Menlo Park, California were to get 3Mbps BPL broadband and VoIP service as part of a trial co-sponsored by Pacific Gas and Electric Company (PG&E) and AT&T. AT&T dissolved the project in October 2004, four months after it was announced in July 2004.[37] PG&E has advised CPUC staff that it is still interested in exploring deployment of BPL technology but currently has no partner or active BPL project. At the Commission's Full Panel Hearing on this Report on February 8, 2005, San Diego Gas & Electric Company (SDG&E) publicly stated that it was moving forward with a BPL pilot project in its service territory in the near future.[38] The exact scope and nature of this pilot project is still being considered by SDG&E, but the service could potentially reach all 1.3 million customers in its service territory.[39]

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[34] http://www.powerline-plc.com/newsreleases/City_Of_Manassas_Utility_Connection_11_03.pdf

[35] Gubbins, supra.

[36] http://www.cinergy.com/News/default_corporate_news.asp?news_id=420.

[37] http://www.dslreports.com/shownews/48889;
http://www.arrl.org/news/stories/2004/10/21/100/?nc=1.

[38] Transcript of California Public Utilities Commission Full Panel Hearing on Broadband Deployment, February 8, 2005.

[39] Craig Rose, "SDG&E Explores Offering Web Access," San Diego Union-Tribune, February 10, 2005.

Chapter 3: A Plan to Facilitate Proper Functioning of the Market

This chapter addresses, in part, three policy areas set forth by the Legislature in PU Code § 709:

- To promote lower prices, broader consumer choice, and avoidance of anticompetitive conduct.
- To remove the barriers to open and competitive markets and promote fair product and price competition in a way that encourages greater efficiency, lower prices, and more consumer choice.
- To encourage fair treatment of consumers through provision of sufficient information for making informed choices, establishment of reasonable service quality standards, and establishment of processes to resolve billing and service problems.

The primary purpose of this chapter is not to propose a plan that should be implemented in its entirety but is instead to discuss alternative methods for addressing the regulation of broadband. We find the proposal of blanket deregulation of broadband services naïve and misguided, likewise we recognize that broadband technologies are more complicated and dynamic than traditional voice telephone service. Regardless of the eventual outcome we believe that when governments pick winners in volatile technologies the market suffers. It may well be that five years from the issuance of this report broadband technologies emerge that we could not have foreseen. In all likelihood regulation of broadband will evolve into something that resembles a "light regulatory touch." In this chapter we specifically explore the impact of open market policies on broadband use and deployment, including customer choice and prices for broadband service. We also look at the lack of clear and enforceable service quality and consumer protection rules and discuss how competitive pressures may be able to address this area of concern.

3.1 Competition in the Broadband Communications Market

SB 1563 posits that fair price and product competition will result in lower prices, broaden consumer choice, increase efficiency, and avoid anti-competitive firm behavior. In response to SB 1563, the CPUC's rulemaking identifies the issue of "whether and how open and competitive markets for advanced communications technologies can encourage greater efficiency, low prices and more consumer choice" as an element of inquiry in the proceeding. To answer this question, we look at the broadband market during the time when legislators and regulators were implementing open market policies. We will describe the current status of competition in California markets and identify the benefits of competition.

The broadband market is fairly new and is evolving out of different types of legal and regulatory backgrounds. This report describes it as all one market, but the providers are approaching it from all different directions. Some providers have been heavily regulated in the past; others have only had limited obligations under the FCC and state commissions' rules.

In the past, policy makers encouraged all types of competition in the communications market. Facilities-based competition occurs when a company enters a market by investing in its own facilities and competes directly with the existing service provider. The cable industry entered the telecommunications market by providing the service over its own facilities and interconnecting with the incumbent provider. This is called inter-modal competition. Other competitors entered the market by purchasing services and network functions from the incumbent provider. These companies competed with the incumbent by using the incumbents' facilities or by combining the incumbents' facilities with facilities of their own. We refer to this scenario as intra-modal competition.

3.1.1 The Role of Government in the Broadband Market

Federal and state government actions have influenced the structure of the broadband market. It appears that the FCC has changed course and instead of pursuing policies that provide for broad access to existing legacy networks, they are now restricting that access. At the same time, the FCC is focused on enabling new technologies to develop and compete in the broadband market.

3.2 A Plan for Regulation of Broadband Deployment

Over time, the development of markets and resulting regulations often lead to a point in which the resulting system is complex, weak and ineffective. The last 70 years of telecommunications history has seen remarkable shifts in information technologies and associated regulations and has resulted in such a system. It is past time for a "re-creation" of the information and telecommunications framework. The current market contains elements which were unheard of when the first Telecommunications Act was passed in 1934, when the Cable Act was passed in 1964, and even when the second Telecommunications Act was passed in 1996. The complexity and unsuitability of the regulatory environment has led some analysts and providers to call for the elimination of most broadband regulation, a task that the FCC has assisted with its regulatory actions in 2002 and 2003 regarding DSL and cable-modem technology.

The claims of inefficiency being introduced by regulation are partially correct, but the conclusion that an unregulated system would function better is wishful thinking at best. A better solution is to end the trend of cramming new technologies and services into old regulatory frameworks and replace the frameworks with a system that makes sense. A logical first step for these efforts begins with an abstracted description of the technology and services that will be regulated. While a generalized description will ignore some technology-specific details, the most crucial and shared elements of various technologies can be identified and receive focused attention.

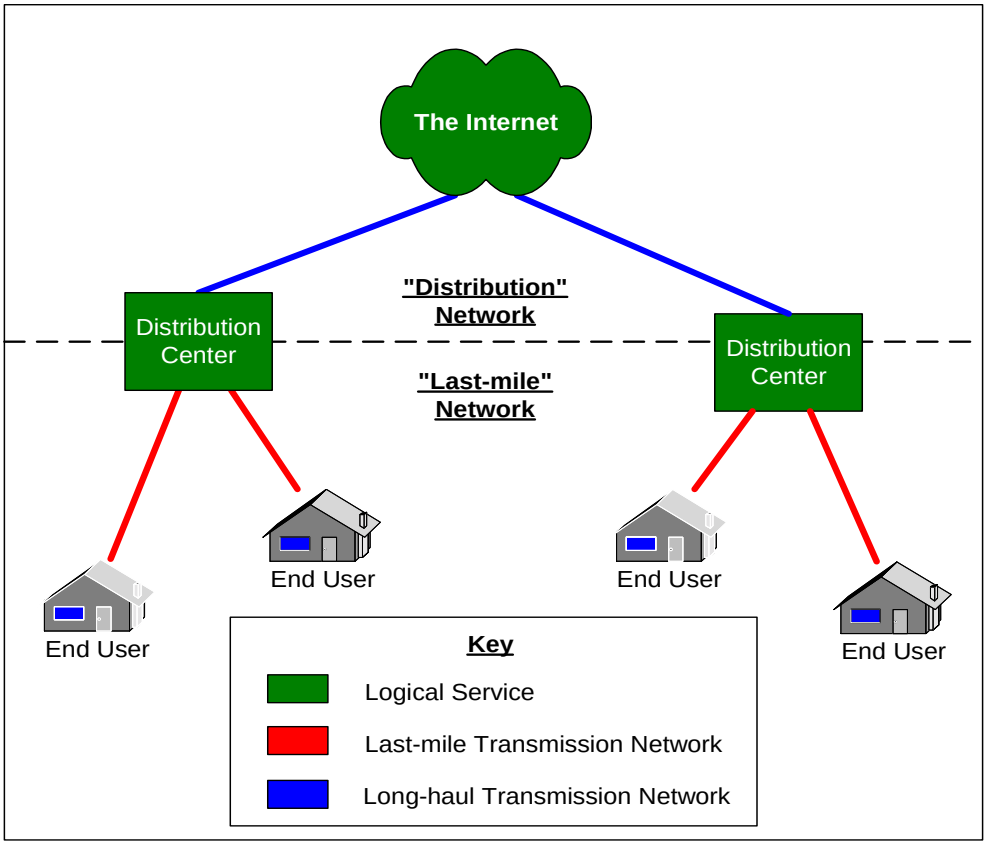
For instance, all consumer internet services are composed of three different technical components, as indicated in Figure 3.1. The first component involves the services necessary to allow computers to communicate with other computers on the Internet. These services are offered through the use of equipment running services related to the Internet Protocol, a system of computer addressing and routing of data among computers. While the "Internet" component involves the use of physical equipment, it provides only the *logical* layer of connectivity to the end user. The physical connections, or transport services, compose the other two components of internet data services.

Transport services can be distinguished between *long-haul* or *inter-network connections* and *last-mile* networks. Long-haul networks exist to inter-connect local aggregation points[40] together and typically consist of fiber-optic connections at very high data rates, while last-mile networks connect consumers or businesses to the aggregation point at a lower data rate. Last-mile networks also consist of a wider variety of communications technologies, including DSL, cable-modem, wireless or satellite connections.

The distinction between these components is critical to understanding the competitive environment in the broadband market. Each component has developed in a different regulatory environment, particularly with regard to competition. While competition has been firmly established in the long-haul networks for almost 20 years, competition in the other components has been widely disputed and the topic of significant legislative and regulatory action. The current regulatory environment essentially bundles the last-mile connectivity with logical data services, despite the different characteristics of each service. The result is the existence of complex and non-market oriented regulations that are criticized on all sides and hinder the development of the market. The key to future development of the market is to develop new regulations based on the abstract technological framework, without relying on the precedent of development and history of different technologies.

[40] Phone companies call their aggregation points “central offices”. For wireless services the aggregation point is the base station or antenna. For cable services the aggregation point is the cable head-end facility.

Figure 3.1: Abstract Broadband Network Architecture



3.2.1 Step 1: Shift Policy and Regulatory Focus to "Last-Mile" Transport

The most significant change in the "network" economy has been the adoption and development of digital technology. Prior to the Telecommunications Act of 1996, a distinction among services using separate analog signals was appropriate given the technological differences of transmission and associated equipment. However, almost any consumer information product is now available in digital form. Mobile phones have almost entirely ceased to be based on analog cell service and have been replaced with digital systems. Cable TV service now offers greater capacity and bi-directional communications using digital signals for transmission. Even traditional local and long-distance phone service are being made available using digital signals either natively or, by using IP telephony, through internet services.

The shift to digital information exchange has occurred over time and will continue into the future because it is typically cheaper, easier to manage, and provides better quality than its analog counterparts. Part of the reason for the shift is that the technology used to transmit and manipulate digital information typically depends very little on the type of information being transmitted, only that the signals are of a compatible digital form. In short, the differences among digital services are becoming smaller and less important. In a world where a copper wire loop can carry internet and phone services and fiber-

optic or cable loops can carry internet, TV, and phone services, it becomes clear that these infrastructure technologies are becoming close substitutes in economic terms. There remain some distinctions among the technologies, but where comparable services can be provided over different technologies it is important to look at them as existing within the same market and regulate them accordingly. While this may indicate that inter-modal competition may be sufficient to achieve policy goals, it is important to consider standard measures of competition and the technical framework before making any conclusions.

Competition among Last-Mile Technologies

Federal guidelines developed jointly by the Federal Trade Commission (FTC) and Department of Justice (DoJ) have published measures of market definition and competition in a market under the auspices of guidelines for horizontal mergers.[41] Competition in the marketplace is defined by using the Herfindahl-Hirschmann Index (HHI), which is calculated by summing the squares of individual market shares of all participants. Concentrated markets are defined as those with an HHI above 1800, while unconcentrated markets are those with HHI values less than 1000. For reference, a market with 10 competitors with equal market share will have an HHI value of 1000, while a market with 5 equal competitors will have an HHI value of 2000.

While the FCC has instantiated policy depending solely on inter-modal competition, it is unclear whether their decision was informed by the DoJ and FTC rules outlined above, since a competitive market would have to have at least six strong competitors according to their rules. Given the fixed costs of infrastructure, this level of purely facilities-based competition is not likely to be achieved, nor is it economically desirable. The reason is that last-mile networks function as natural monopolies, like other utilities, and the development of excessive parallel infrastructure is wasteful. Unfortunately, by definition the result of strictly facilities-based competition is the existence of a market in which a handful of players can exert market power over all internet services.

Isolating the Natural Monopoly

A different regulatory paradigm exists that will allow for better government control over the market. Recall that internet services are composed of three distinct technical components. Only one of the three, the last-mile transmission network, is a natural monopoly. However, today the last-mile network and internet services are sold and regulated as a bundle, allowing owners of the physical network to exert market power over the non-monopolistic internet services market just as AT&T was accused of doing to the long-distance market prior to the Consent Decree.

As Larry Spiwak of the Phoenix Center concludes, “the concept of broadband is rapidly becoming a shibboleth to mask the fundamental structural monopoly problem of the last

[41] See DoJ (1997), see http://www.usdoj.gov/atr/public/guidelines/hmg.htm.

mile."[42] What is required now is to shift from a regulatory paradigm of focusing on services, knowing that a physical service underlies the information or communications service being regulated, to a focus only on the physical medium itself. The physical medium would be designated as a "telecommunications service" with all other services being "information" and regulated accordingly. [43]

Benefits of this Change

By shifting the focus of regulation onto only the monopolistic physical connection, governments would fulfill their mission to minimize the impact of their regulations on the marketplace. Government regulation is not needed in the broadband services market in the way it is required in the physical connection market. Furthermore, by separating physical from logical service, it is possible to accrue benefits of both inter-modal and intra-modal competition. In addition, the change is consistent with the policy goals laid out in the previous chapter:

- This change will allow governments to prevent the use of market power in the last-mile to manipulate the internet service market,
- The change will clarify the regulatory environment by creating a simple bright line,
- The change will treat all technologies and providers the same, and
- It may develop into a framework in which California can regain regulatory authority from the FCC.

3.2.2 Step 2: Promote New Market Definitions

The shift from a focus on data services to a focus on transport services should also involve a re-evaluation of appropriate market definition, since the distinctions among technologies will gain increased attention and may require different policy or regulatory attention by federal, state, or local governments. The evaluation of market definitions should consist of two steps: identifying the factors useful in delineating markets and the application of those factors against known technology.

Factors Defining Market Delineation

There are many differences among technologies that will affect their mutual substitutability. The only one currently used is the bandwidth or speed distinction, a reflection of the service-focused regulatory paradigm. Current policy fails to take into account other differences in last-mile technologies that affect their suitability for various applications. In fact, SBC ASI[44] highlighted this point in their Opening Comments to the PUC OIR by claiming that "Each technology has its technical limitations. It is absolutely essential that the Commission address this fundamental fact of multiple technologies in

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[42] See L. Spiwak (2002a) and (2004),see http://www.phoenix-center.org/commentaries/CWIHorsemen.doc.

[43] This point will depend on the outcome of the BrandX legal case in which a 9th Circuit District Court and the Court of Appeals ruled that cable-modem service consists of a telecommunications component, the physical service, and an information component, the logical service.

[44] SBC ASI is the SBC subsidiary providing DSL services to customers.

forming its Report." Some of the most important variations inherent in technologies are the security, mobility, latency, symmetry of bandwidth, and reliability of the connection.

The failure of policy to take these additional issues into account is partially understandable due to the difficulty in defining them in a useful way. However, it should be equally clear that it is desirable to recognize that there are differences among technologies along these lines. While some consumers may not be interested in the distinctions among the technologies, other consumers may be extremely concerned about them. For example:

- Some businesses may be concerned about the threat to their corporate networks from insecure wireless networks,
- Some customers may choose to utilize certain applications, particularly real-time streaming, that may not function correctly on a high-latency technology, or
- Some consumers may wish to use their introductory broadband connection to provide content to other Internet users, but are stifled by asymmetrical connections.

Without some recognition of these other factors in policy definitions, short-sighted policy may ignore the true monopoly markets that these more discerning customers may face.

Finding: Distinguish between Wireless and Wireline Markets

Since no two technologies are identical, considering too many factors would lead to the separation of each technology into its own market. Obviously, this result is no better than considering all last-mile technologies to be in the same market, so some grouping must be allowed to exist. The most natural division is to separate terrestrial, wire-based services from various wireless services as has been done in the telephone market.[45] In fact, the distinction between local and wireless phones provides a perfect example on which to base a market distinction in last-mile technologies.

Generally, wireless technologies[46] share similar characteristics in terms of mobility, security, reliability, and latency that are not shared with wireline services. The wireless nature of the communications signal subjects information exchange to reliability concerns involving weather or RF interference, and potentially involve security concerns as well. In addition, most wireless technologies[47] share a mobility characteristic. Finally, two-way satellite service involves a substantial latency component, although other wireless connections can sometimes exhibit similar latency behaviors due to interference or congestion.

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[45] In Reply Comments to the PUC OIR, MCI and Covad argue that wireless technologies are not "current or even likely substitutes" for the dominant cable and phone networks.

[46] Including Wi-Fi (802.11 a/b/g), fixed wireless, two-way satellite, and soon to include 3G and WiMax.

[47] Excluding fixed wireless connections, which share characteristics with both wireless and wireline services.

While there may be room for further delineation of wireline services,[48] the symmetry concern is insufficient to make a distinction at this point, especially since some technologies are capable of providing both symmetrical and asymmetrical services upon request.

Finding: Define Innovation Goals for the Next-Generation Market

The notable exception to the criteria used to distinguish markets in the previous section was the bandwidth characteristic of connections. There are two reasons for its exclusion. The first is that issues of speed should be handled through the proper functioning of the market. The second is that bandwidth innovations within the network will quickly outdate any definition based on bandwidth distinctions, as has occurred with the current FCC definitions.

The issue of bandwidth improvements is synonymous with innovation in the marketplace and remains an important consideration of policy planning actions by industry and government. As Gartner Consulting concluded in a report for CENIC, one important step is "the development of a specific definition of next generation broadband."[49] Going a step further, policy-makers should formalize the evolution among mass market service, state-of-the-art service, and next generation service. In 2004, dial-up internet service remains the mass market service, with current broadband offerings being the state-of-the art service.[50]

At this point, a clear vision of next generation service has not appeared. Gartner Consulting wrote a paper to the CENIC group indicating that a goal of universal gigabit connections be the focus of policy.[51] Reed Hundt, a former FCC Chairman during the Clinton Administration, sees a goal of between 10 Mbps and 100 Mbps being the goal for the next generation.[52] In general, either definition provides a good goal for future policy. The point is that some definition should be identified.

However, due to the impending transition of current broadband services to the mass market, a more near-term state-of-the-art technology should enter the policy picture. Given that the distinction between dial-up and broadband services is about an order of magnitude improvement, a similar difference between technology generations seems appropriate. Given the prior definition of advanced services as providing 200 kbps bandwidth in both directions, bi-directional bandwidth of 2 Mbps should become the new state-of-the-art technology. This definition has the advantage of being attainable

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[48] Including cable-modem, DSL, fiber-to-the-home (FTTH) and eventually broadband over power lines (BPL).

[49] See "One Gigabit or Bust Initiative", Gartner Consulting (2003).

[50] Broadband service is on the cusp of transitioning to mass market status from its state-of-the art status, although the switch has not been completed.

[51] See Gartner Consulting (2003).

[52] See R. Hundt (2004) see http://www.newamerica.net/Download_Docs/pdfs/Pub_File_1431_1.pdf.

using current technologies, and it corresponds roughly to the bandwidth of T1 (1.5 Mbps) and E1 (2Mbps) data circuits that are available.

3.2.3 Step 3: Require Separation of Last-Mile and Internet Service Providers

The two previous policy steps comprise an outline that may enhance competition, consumer benefits, and policy planning in information and communications industries. Unfortunately, the outline has not addressed the inherent incentives that incumbent carriers have to protect their retail services from wholesale competition – the true threat to competition in the broadband market. Therefore, the final step in the regulatory reorganization is to require that companies who own and operate last-mile networks are disallowed from providing broadband internet service to customers, although this step is optional if the monopoly firms embrace competition without having to take this draconian measure. The resulting last-mile transmission providers will then be regulated by the PUC just like any other utility and synonymous to how phone companies were regulated while retaining their monopoly status.

Benefits of this Approach

There are two important benefits that will result from taking this step. The first is that it will maximize competition by capturing the effects of both inter-modal and intra-modal competition. The second benefit of this step is that the resulting system will establish the right incentives for all players in the market:

- **Physical providers** will gain profit only through increasing the utilization of their network and ensuring that they have service agreements with the best service providers,
- **Service providers** will have to innovate and compete on efficiency and service offerings in order to attract consumers in their virulently competitive market,
- **State and local governments** can link regulation with their policy goals on the bottleneck last-mile connections independently of the FCC or other state public utilities commissions.

Furthermore, the resulting system achieves all of the goals previously outlined – it avoids firm abuse of market power, it clarifies the regulatory environment further, it is technology neutral, and it maintains a role for California in the regulation of the industry.

Risks of this Approach

There are some risks involved in taking this step. While all parties would need to invest in new technology in order to remain competitive in their markets, there is the risk that huge infrastructure enhancements and innovation will not be accomplished due to the capital risks that the resulting last-mile monopoly may face. It is not clear whether the

risks would be sufficiently higher in the proposed system than in the current system,[53] and in fact the risk may be considerably lower if sufficient inter-modal competition exists. In addition, the resulting market system may take care of the problem through pressure by consumers and service providers. If not, there would still be ample opportunity for government to become involved in assisting infrastructure development through tax incentives or further regulation.

The other major concern with this approach involves the political environment and effects of the transition away from the current integrated structure. This sort of structural separation has been discussed in many states and countries in regard to their telephone networks for several years. Some analyses[54] conclude that this approach would cause great economic damage through the loss of efficiencies of vertical integration. It was attempted in Pennsylvania and has been generally concluded to be a failure as implemented. As a result, most analysts have concluded that structural separation proposals are politically infeasible.[55]

However, the common element of these analyses and trials was the attempted separation of local phone service rather than broadband data services. By limiting separation to data services, some of the major technical questions can be avoided. It also leaves the last-mile provider with a greater income stream that can reduce the effects of the Internet service divestiture. Furthermore, there is an example of a similar effort being successful in California; the spin-off of SBC ASI from its parent company SBC.

Though economic losses and a temporary freeze in service improvement or expansion remain risks to a separation approach, isolating the separation to data services would allow government to manage the risk appropriately. In addition, the resulting system is far superior, making the risks likely worth taking.

3.3 Address Universal and Equal Access Issues

Given the clarity of state policy with regard to universal and ubiquitous access to advanced data technologies, the state needs to take further action to ensure that all residents, businesses, and organizations have access to high-quality, competitive data services. The first step in this process is to gather more accurate data than what the FCC provided about household access to various broadband services in order to get a better understanding of the problem that needs be addressed.

Even without accurate data, the prior analysis provides minimum information on individuals and areas that require state attention in order to obtain competitive access to

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[53] Reed Hundt argues, in R. Hundt (2004), that incentives currently exist for telecom and cable providers to maintain their current networks and avoid major infrastructure enhancements.

[54] See OECD (2003b) http://www.oecd.org/dataoecd/39/63/18518340.pdf and T.R. Bears, G. Ford, and L. Spiwak (2001) http://www.phoenix-center.org/pcpp/PCPP12%20Final.doc for discussions of the problems with structural separation.

[55] See L. Spiwak (2004).

broadband. One option that governments often take, and providers often encourage,[56] is to entice existing providers into developing capabilities through the use of subsidies or tax incentives – policy instruments whose impacts are well understood. A further analysis of these options is outside the scope of this paper, but using these types of financial instruments are typically the base option for addressing access concerns.

However, there are two significant problems with this approach that could indicate a need to consider other options. The first is that under current regulatory rules, a subsidy program is unlikely to provide competitive access without exorbitant and wasteful spending on subsidies for parallel infrastructure development. The second is that the subsidy program may be seen as improper funding of an essentially monopolistic industry. The result is that other, less often used, policy options may be required to address the access concerns. One in particular, the entrance of governmental entities into the telecommunications industry, is a burgeoning national trend and may be superior to the base options.

3.3.1 Policy Option: Build Networks Using Public/Private Partnerships

Governments have a long history of providing services, typically the basic utilities (water, electricity, trash services, sewage, natural gas), to its constituents, in part due to the classification of these services as natural monopolies. However, publicly provided services have typically excluded phone and television services due to the development of those markets in private industry. Over the last twenty years there have been increasing occurrences of local governments violating this custom and offering communications services to its constituents, often at a price lower than what private competitors typically charge.[57] In the past eight years, one of the more popular services being introduced by municipalities in California and across the country is broadband internet, typically leveraging other utility networks to provide service.

A debate exists about whether this trend should be encouraged or ended, and in fact there are many states that prohibit local governments or utility companies from providing broadband services. The standard explanation for these prohibitions is that government should not compete with private interests given the superior legal and monetary advantages of the public entity. Among the most vocal opponents of this trend is the Progress and Freedom Foundation, which has released several reports[58] highlighting the costs of government entry into the telecommunication business. However, there are significant problems with their analyses. The first is that they base their comparisons on networks that are either too recent to show good results, or were created primarily to provide cable rather than broadband services. Second, when discussing the costs associated with building the network, they seem to ignore the significant gains that subscribers see from substantially lower service prices.[59] Finally,

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[56] Verizon's Opening Comments and Reply comments are examples of this support.

[57] See J. Glasner (2003), K. Lassman and R. May (2003).

[58] See K. Lassman and R. May (2003) and T. Lenard (2004).

[59] In fact, in several examples the result of government entry was to force the monopolist provider to significantly drop their prices.

the analyses assume that the network is designed to break even and repay their capital expenses over time. While this assumption is true for the networks examined, this is not the case in the policy proposal in this section, making the application of their conclusions to this proposal irrelevant.

The essential goal of this proposal is to isolate government involvement to the development of last-mile infrastructure while allowing the other aspects of service to be managed by private industry. Once the network is built, state and local governments should contract out its maintenance and operations to a state-wide non-profit firm, and allow any service provider[60] to serve customers on the network. The result is the avoidance of parallel systems for billing or operations as well as the promotion of private-sector solutions in a competitive environment.

Build Networks with Subsidized State Funds and Private Partnerships

There are three major costs involved in providing data services to a community. The first is the capital cost of building the network and procuring the equipment necessary to connect customers to the Internet. The second major cost category is the recurring costs of operations and maintenance. The third cost category is the customer service and billing systems, including both recurring and initial procurement costs. Given sufficient scale, both the operations and customer service cost categories are easily reimbursable through subscription fees.[61] The difficult part for government is getting sufficient scale in a small locality to reach the break-even point. However, under a state plan, particularly one in which government attempts to partner with industry; the ability to reach these scales of efficiency may be within reach. By contracting the operations of all such networks in California to a given company, multiple networks will provide the scale necessary to reimburse these costs. Furthermore, by contracting the service offerings, customer service and billing to existing carriers, these carriers can leverage their other customers to provide sufficient scale to these systems.

The more difficult issue to address is related to the initial capital costs. It is primarily this issue that prevents industry from providing service in these areas since the population is often insufficient to repay the capital costs. However, the government objective is to provide service to everyone, including citizens living in these areas. Therefore, government, at the state and local levels, has little choice but to build the systems and subsidize the capital loss with other funds. It is recommended that some, but not all, of the capital burden should be supported by local taxes.

Benefits and Analysis

While there may be a certain degree of opposition to this plan, if the state is serious about fulfilling its universal service policy then it should be willing to utilize state funds to achieve that goal. In any case, the other option for acquiring universal service

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[60] Providers may include either incumbents or competitors like Covad, MCI, AT&T, Earthlink, etc.

[61] Evidence from other governmental service offerings in the T. Lenard (2004) report shows that there are examples of breaking even on these costs, provided that capital costs are withheld.

subsidies or tax incentives will also cost the state ratepayers money, which may turn out to cost more in the long-run. Through this program, the state can ensure the deployment of new technology and competitive service and may even be able to utilize this program as a testbed[62] for new technologies or innovative practices in the broadband field. In short, while the cost may appear to be high at the outset, this option provides a great degree of flexibility for the state while simultaneously providing a greater degree of control over the market in remote areas.

3.4 Competition in the Broadband Communications Market

Additionally, SB 1563 calls for fair price and product competition to lower prices, broaden consumer choice, increase efficiency, and avoid anti-competitive firm behavior. In response to SB 1563, the R.93-04-003 identified the issue of "whether and how open and competitive markets for advanced communications technologies can encourage greater efficiency, low prices and more consumer choice"[63] as an element of inquiry in the proceeding.

The purpose of this section is to examine the behavior of competitive markets in broadband communications. It will identify theoretical effects of competitive markets, describe the current status of competition in California markets, and identify policy proposals that can be used to strengthen the forces of competition in California markets.

3.4.1 Theoretical Framework of Economic Competition

The broadband market is fairly new and is evolving out of different types of legal and regulatory backgrounds. This report describes it as all one market, but the providers are approaching it from all different directions. Some providers have been heavily regulated in the past others have only had limited obligations under the FCC and state commissions' rules. One of the reasons for this disparity is that policy makers have recognized that even with an open market, certain providers retain market power due to their former monopoly position in the telecommunication industries of the past. The view has been that left unchecked, and without a transition plan that addresses the dominance of these providers, competition would not take hold.

Four critical axioms outline the basic behavior of the standard model of markets in economics. These axioms frame the way we look at markets and allow us to determine if a market is functioning in an efficient manner:

1. Firms attempt to maximize their profits,
2. Firms compete to provide service to consumers,
3. Consumers indicate their preferences through their purchases, and are free to switch providers at any time, and
4. Consumers will choose the provider whose price is lowest.

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[62] The Gartner Consulting (2003) report highlights the need for a testbed of this type.

[63] See CPUC (2003a).

The result of these interactions is that a service price is eventually set in the market such that firms are able to provide service and consumers are willing to pay that price. However, some firms may be able to offer the service for a cheaper cost, so they will gain some profit by charging the market price. Likewise, some customers would be willing to pay significantly more than the market price for the service, so they gain benefits by paying only the market price. Thus, in this standard model, the market is used to generate societal benefits that are shared among consumers and providers as either profits or savings. Furthermore, the resulting price will also be "efficient" in economic terms, since there is no action that any consumer or provider can take that will increase benefits further. For these reasons, the natural competitive market has become the preferred mechanism for distribution of private goods and services.

However, each axiom is critical in reaching this outcome. The first and last axioms reflect that the market actors will act in their own interests, and the third is a technical necessity to ensure that consumers can choose the lowest-cost provider. Unfortunately, the interests of firms and customers are opposed, since firms will always want to charge their customers more for the service to increase profits and customers will always want to pay less money for the same service. Thus, the second axiom is necessary to allow the firms and consumers to reach a mutually agreeable outcome. It is primarily through competition that innovation occurs, and services are offered at the lowest reasonable price that allows firms to retain some profits.

Characteristics of Non-Competitive Markets

Without sufficient firm competition to regulate the interactions in the market, there are no inherent market mechanisms to prevent firms from operating in a manner that will maximize their profits at the expense of the consumer. Usually this means that the service provider will increase the price of the service they charge, since most of the customers will choose to continue receiving the service at the higher cost due to lack of alternatives, even if some consumers choose to cease their subscription to the service. The result is that fewer people receive the service at a higher cost, so there is excess demand that is not being met by supply and some societal benefits remain uncaptured.[64]

This result often occurs in a developing market, so additional providers have an incentive to enter the market to capture some of these benefits. By offering service at a lower price, the axioms in the previous section indicate that the new firm will begin to erode the profits of the incumbent firms since they will often react by reducing service price in order to retain customers. Since the end result is a reduction in their profits, incumbent firms have every incentive to attempt to keep other firms out of the market.

However, in a service market, a new provider faces significantly higher costs than large incumbent providers. The reason is that they must invest significant capital to develop a distribution system or infrastructure for their service before the first subscriber can obtain it. Even after a new entrant gains subscriber, the average costs of providing service to a small number of subscribers are high, since in markets for technical

[64] These uncaptured benefits are referred to as "deadweight loss" in economic terms.

services, the overwhelming share of costs often are fixed rather than incremental. Therefore, a smart incumbent can leverage its *market power* to temporarily lower its prices to a level below the costs the new firm faces. By doing so[65], the new firm will never be able to obtain sufficient customers to make a profit and will eventually leave the market to the incumbent. In the long run, prices will return to a higher level and investors will learn that funding competitors is a poor use of capital resources.

The investment risk often means that entering service providers must expect to quickly achieve and maintain a significant market share, a difficult proposition to achieve in a short timeframe.[66] Other times it indicates that the service is a natural monopoly, like water or sewage services, that should be allowed to run without competition, since the result would likely be to force consumers to pay high fixed costs for parallel infrastructures. The general point is that service industries stretch the basis of competitive markets with their unbalanced cost structure.

Market Failures

Market failures can occur in one of two primary situations. The first is when a market intended to be competitive cannot achieve sufficient levels of competition because of the nature of the market or the actions of existing market actors. Often incumbent providers will take steps similar to those outlined above, or investors will choose not to invest in competitors given the risk that incumbents will force the competitor out of the market. In effect, this is a breakdown of the natural regulating mechanisms within the market model. Government has a responsibility to detect when this occurs so that other regulating mechanisms can be artificially instituted into the market to force a more balanced outcome.

The second type of market failure occurs when the market behaves correctly[67], but government actors or regulators determine that the natural market outcome does not align with government policy or societal desired outcomes. There are severe disagreements about whether this type of outcome is truly a failure, but it is typically one of a number of market behaviors that indicate the need for regulatory intervention.

3.4.2 The Role of Government in the Broadband Market

As mentioned previously, markets are the preferred method of distributing goods and services among the population. In many cases, the result will be a relatively efficient distribution of goods and services, and the market will aggressively bring innovation to society. In such environments, government involvement through regulation would serve only to hamper the efficient outcomes the market produces on its own. Therefore, in evaluating the development of broadband communications services and the need for

[65] This action is, of course, technically illegal, but it may be difficult to win a case in a reasonable timeframe.

[66] Especially when there may be other entrants into the market who will actively attempt to ensure that your firm may not achieve the necessary market share in a timely fashion.

[67] Although it is also possible for both types of failures to occur – they are not mutually exclusive.

new policy adjustments, it is important to leverage the benefits that the market will provide without government efforts.

The PUC and state legislature should instead focus on using their resources to focus on areas in which market-driven behavior has failed; whether the failure is a technical problem in the market that requires intervention or merely that the market outcomes do not match state policy. Government must be especially active when competitive market behaviors are thwarted by firms exerting market power, which occurs most often in situations where providers exist either in a monopoly or oligopoly as has recently existed in the broadband market.

However, government action, especially state action, occurs within a timeline of market changing events and decisions that are made primarily at the federal level. Often, the nature of competition and its desirability are altered by events occurring at that level, significantly altering the response of other agencies. Figure 3.2 presents an outline of important competition-related events in the telecom and broadband markets, focusing on recent decisions. The first three events outline the principle of using regulation to correct market failures. Each of those three decisions reduced the ability of incumbent providers to monopolize a market through the use of their market power. Unfortunately, the more recent actions by the FCC have not maintained the use of the principle.

Figure 3.2
Significant Legal and Regulatory Decisions for the Broadband Market

	Event	Description
1984	AT&T Consent Decree	The monopoly market prevailed until 1984 when AT&T and the Department of Justice signed the "AT&T Consent Decree," divesting AT&T of its local "Bell" system which was split into seven regional Bell operating companies (RBOCs). The underlying philosophy was that while the phone market contained local exchange (phone) and inter-exchange (long distance) components, only the local exchange market was a natural monopoly that should be protected. At the same time, the long distance market could, and should, be open to competition, and protected from manipulation by the market power local carriers could exert.
1996	1996 Telecommunications Act	The TCA is responsible primarily for bringing competition to local exchange markets. However, due to the design of DSL technology, it also affected competition in the broadband communications market as well though the interpretation of a prior FCC on UNE requirements. However, the more important regulatory actions for broadband occurred years later.
1999	FCC Ruling on Line-sharing	In November 1999 the FCC passed an order requiring incumbents to provide competitors access to the high-frequency portion of phone lines. This "line-sharing" requirement allowed competitors to provide DSL services directly to customers without having to provide local phone service at the same time.

2002	FCC ruling on Cable-modem services	In 2002, the FCC made the determination that cable-modem services were properly classified as "information services"[68] rather than telecommunications services. The result of this determination is that the competition provisions of the TCA cannot be applied to cable-modem services as they can to DSL and other telecommunications services. The result was an environment of asymmetric regulation between cable-modem and DSL services.
2003	Triennial Review Order (TRO)	In August 2003, the FCC released their long-awaited rulings on several matters including the TRO. While much of the ruling addressed UNE rules, it affected the broadband market by phasing out the line-sharing requirement for RBOCs and incumbent DSL providers. The effect is a significant strengthening of incumbents' position in the DSL markets.

3.4.3 Competition in the Broadband Market from 1996 to 2003

The 1996 TCA was a landmark legislative action bringing competition to the last-mile of telecommunications networks. As outlined in Section 3, the legal environment of competition was uncertain and varying between 1996 and 2003, making a structured analysis of the effects of competition difficult. However, taking the major shifts in policy and effects of the 2001-2002 recession into account, there remain noticeable trends that hint at the success of competition in the broadband marketplace.

1. **Firm investment increased**[69] – Firm investment can be used as a proxy for information about competition and innovation in a market when more specific information is not available. In the telecommunications market, the introduction of competition to the "last-mile" in 1996 resulted in a dramatic increase in investment, as shown in Figure 3.3. Furthermore, cable companies alone have invested over $84 billion in upgraded infrastructure since 1996 to provide advanced services.[70]

[68] See FCC (2002) see http://www.fcc.gov/Bureaus/Cable/News_Releases/2002/nrcb0201.html.

[69] For further discussion of the effects of competition on investment, see K. Hassett, Z. Ivanova, and L. Kotlikoff (2003), K. Hassett and L. Kotlikoff (2002) and Phoenix Center (2003a)(2003c).

[70] From the National Cable and Telecommunications Association, http://www.ncta.com.

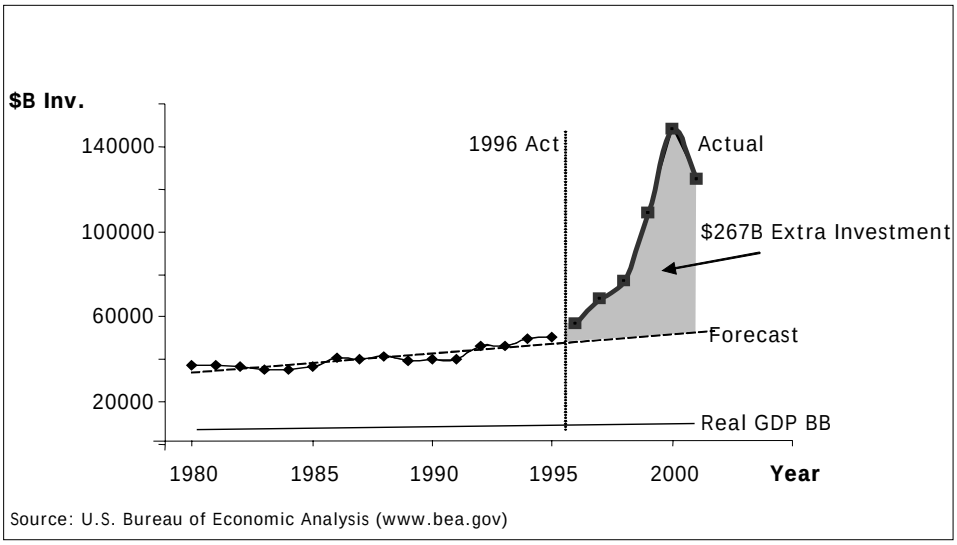

Figure 3.3: Investment by Telecommunications Firms Before and After the 1996 Telecommunications Act[71]

2. **Line-sharing resulted in huge increase in DSL subscriptions –** At the time of the 1996 TCA, DSL technology was known to exist and was ready for deployment on US telecommunications networks. However, by December 1999 only 369,000 DSL lines were deployed nationwide, compared to 1.4 million cable-modem connections. Although there may be many reasons for this development, MCI, Covad[72] and others assert that a significant reason is that the DSL market threatened the more lucrative phone and line leasing markets over which the RBOC's held a virtual monopoly, so the RBOC's deployed DSL only when forced to by competitive DSL providers and cable companies. This view is supported by the data following the November 1999 FCC decision requiring line-sharing. Deployed DSL lines grew by 157% in June 2003, and another 107% by December 2000, compared to modest 60% growth in the cable-modem market. Furthermore, in 2000 the FCC concluded that "the availability of ... line sharing has spurred tremendous investment in DSL deployment."[73] Regulatory action to strengthen competition seems to have had a significant positive effect in this case.

3. **Competition led to 150,000 telecom jobs –** Examining job figures resulting between 1996 and 2000 show that the result of increased competition in the telecom sector resulted in 150,000 direct jobs, and numerous other jobs in other sectors.

4. **Price of service responsive to competitive environment** – A longitudinal analysis of broadband prices is made difficult due to the changing economic and

[71] Taken from Phoenix Center (2003c).

[72] See Reply Comments of MCI and Covad Communications Company to PUC Proceeding 03-04-003

[73] See FCC (2000).

regulatory environment between 1999 and 2003. However, ARS and Current Analysis have compiled average broadband prices between 2001 and 2003, shown in Figure 3.4, which show promising results. In 2001 the prices of both cable-modem and DSL services rose approximately 10%, a result that analysts concluded "provide hard evidence that… consolidation has left broadband customers with fewer choices and, ultimately, higher monthly prices."[74] The symmetry of movement indicates that coordination among providers exists in the market, a behavior often associated with oligopoly markets.

Figure 3.4: Average Price of Dominant Broadband Technologies[75]

	Jan. 2001	Oct. 2001	Mar. 2002	June 2002	Mar. 2003[15]	Jun. 2003[76]	2004
Cable-modem	40.09	44.17	44.95	45.31	43.26	42.87	X[77]
DSL	47.18	51.68	51.82	51.36	43.34	42.24	Y[78]

While these effects lack sufficient data and analysis to provide conclusive proof of the effects of competition, they provide a significant characterization of the positive effects that continued competition might bring to the broadband market.

3.4.4 Limitations of Current Competitive Framework

The previous sections of this report have laid out the evolution of broadband regulations, described the development of the market, and provided a more detailed analysis of the competitive environment in California. One part of this history allows inferences to be drawn between the regulatory environment, level of competition, and spread of broadband technology that indicate that the health of the broadband market relies in part on competition. This conclusion, in addition to explicit calls for competition from Congress and the California legislature, demand that competition be encouraged in the market. Unfortunately, the current competitive framework is insufficient to produce the desired levels of competition.

Challenges to Competition From the FCC

In 2003, the FCC released new rules governing the competitive marketplace for broadband technologies as part of their Triennial Review Order (TRO) process. After an

[74] See ARS (2001).

[75] See ARS (2001), ARS (2002), Current Analysis (2003).

[76] The reported prices take into account discounted introductory offers.

[77] Kolko (2004) reports that cable-modem prices have remained roughly the same. Cable-modem providers seem to have decided to compete on its speed advantage compared to DSL.

[78] Kolko (2004) reports that incumbent DSL providers have dramatically slashed their introductory prices under $30, although these prices are typically dependent on consumers choosing a service bundle and expire after a year.

extended legal battle has wound down the primary effect of the ruling for broadband is that the "line-sharing" provisions, established in 1999 and responsible for much of the current competition in the market, would be reversed. Instead, the RBOCs are being encouraged to develop market agreements with competitors in order for them to continue offering service. The result is that incumbent DSL providers are now in a position to freely assert their market power to retain, or even gain, market share by controlling the minimum price of all DSL service using their lines and pricing their own service accordingly. If the RBOC's choose to assert this power, the result will be a significant decrease in the levels of competition in the market over the next decade.

Thus, critics charge that the FCC has essentially anointed the RBOCs and cable companies as operators of choice of broadband networks.[79] The justification of this policy relies on two arguments. The first is the argument advanced by the RBOCs that they faced regulatory disadvantages compared to cable-modem providers, and that the regulatory burden should be normalized. The second argument advanced by the RBOCs is the notion that once they were confirmed in their monopolies that they would compete more strongly with cable-modem providers and begin building the next generation of broadband networks.[80] The problem is that these newer networks were also discussed in the TRO, and were specifically excluded from competitive requirements in the future.

It has been noted that many critics question whether either the cable companies or RBOCs will deploy new networks once they are comfortable with their renewed monopoly status.[81] In fact, once oligopolistic behavior is possible, the incentives for the incumbents will be to avoid innovation. This brings into question the definition of "competition" as it relates to the broadband market.[82] Some people argue that intra-modal, or competition on the same physical connection, is necessary to attain the desired levels of competition, in addition to avoiding the wasteful development of parallel broadband infrastructures. However, the FCC has adopted in their ruling the notion that facilities-based, or inter-modal, competition is superior to intra-modal competition and is sufficient alone to capture the benefits of competition in the marketplace.

Inter-modal and Intra-modal Competition

From a consumer perspective, both inter-modal and intra-modal competition play valuable roles in the broadband market. Inter-modal competition gives customers the choice of different technologies so that they can choose the most appropriate one for the applications they use. However, intra-modal competition is also important because it allows customers a choice of firms from whom to acquire services. The choice of firms is important because service offerings and customer support capabilities may vary among

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[79] See A. Goldman (2003b) (2003c), R Hundt (2004).

[80] See Opening and Reply Comments from Verizon, Opening and Reply Comments from SBC, FCC (2003b), and S. Pociask (2002).

[81] See Reply Comments of MCI and Covad Communications Company, and R. Hundt (2004).

[82] See A. Goldman (2003b).

firms, so it is in the customer's best interests to have competitors working to provide the best service possible to their customers. When intra-modal competition exists, customers can choose a new provider using the same technology if customer or technical service quality deteriorates, while the ability of customers to switch providers is limited by the technological differences when only inter-modal competition exists.

From a firm perspective, competition should be avoided wherever possible, so there is no desire on the part of the providers to see intra-modal competition continued. Furthermore, it is too easy for customers to switch providers, so firms must constantly compete with their intra-modal competitors on price, rapidly diminishing their profits. Finally, incumbent providers argue that intra-modal competition creates a disincentive for them to invest in major infrastructure upgrades since other firms will be able to leverage that investment to provide better service to its customers. In the case of phone companies, the RBOCs have essentially promised that they will invest in new infrastructure if they can maintain a monopoly presence on the network. However, there is ample evidence[83] that the RBOCs have invested heavily in new technology while faced with intra-modal competition and have previously made such promises and later broken them.

We note that the desires of powerful industries are diametrically opposed to the interests of small market players and the people. The FCC has chosen to side with the incumbent LECs and cable providers and virtually eliminate intra-modal competition. While it is impossible to gauge the full impact of this decision in the future, one obvious element is that significant levels of competition will be eliminated from the broadband market in the near future. In fact, within a few years there may not be any ZIP codes left in California with more than five or six providers.

Market Shifts Threaten Existing Regulatory Mechanisms

The other trend that justifies adjustment of the regulatory paradigm is reflected in recent shifts in information and communications markets. The first shift is the accelerating phenomenon of provisioning service as a part of a service bundle from a given provider. The second shift is a fundamental change in telephone technology, allowing phone service to be provided over broadband connections.

Broadband Increasingly Offered as Part of Service Bundles

There is currently a significant spike in price pressure of DSL service due to the increased offerings of bundles by phone companies. SBC, for example, is offering DSL service for under $30 per month, a $20 discount off published rates. However, that price is only available if the consumer is also subscribed to SBC local and long-distance services. In addition, cable companies have been offering such discounts for a significant period of time. Most cable companies provide a discount of between $10-20 per month when customers subscribe to both cable TV and cable-modem services. The result is that these companies are able to use revenues from other services to partially

[83] See the Reply Comments of MCI and Covad Communications Company for a discussion of this point.

subsidize their broadband offerings. In addition, they are using their entrenched monopoly position in one market to undercut their competitors on price in the other market.

Voice-Over-IP (VoIP) Technology

The other concerning trend is the development and deployment of VoIP technology, allowing consumers to subscribe to local phone service using only a data circuit. The regulatory response to this service is being handled in another proceeding at the PUC at the moment. However, attempting to adapt the existing regulatory framework to properly include VoIP services will prove to be a difficult and contentious process.

In addition, the development of this technology highlights the eventually transition to a networked world with all communications services being provided over the Internet. VoIP technology is advantageous since it is a lower cost technology than traditional switched local voice service, and it provides additional features. As a result, this development threatens the RBOCs core service and creates an incentive for them to attempt to squash or delay the deployment of VoIP technology.

Chapter 4. Regulations and Policies That Promote Consumer Protection and Service Quality in the Current Broadband Environment

4.1 Consumer Protection and Service Quality

This section examines current law and policy related to consumer protection and service quality. Although the FCC has chosen not to closely regulate in these areas, the agency is currently considering how to classify broadband service (information or telecommunication) and has sought input regarding network reliability and consumer protection issues as part of its inquiry[84]. However, the FCC has not issued a decision or established any rules at this time. There are also examples of local jurisdictions that have established rules for cable modem service providers.[85]

4.1.1 Broadband Providers Are Generally Not Subject to Regulatory Requirements with Respect to Service Quality and Consumer Protections

The CPUC does regulate both the service quality and the billing policies of telecommunications service providers who have Certificates of Public Convenience and Necessity (CPCN) to offer service in the state of California. As a result, the CPUC's Consumer Affairs Department assists customers who experience problems with their DSL service. However, the CPUC can only perform this function with companies that also offer telecommunications service. The CPUC does not currently have the authority to assist customers who are purchasing DSL directly from an Internet Service Provider (ISP), cable modem service from a cable provider or wireless broadband service from a wireless provider. There is also a state law requiring customer notice for service changes that applies to all internet service providers.[86]

The FCC is the agency with the authority to regulate broadband service but has opted not to because a majority of the Commissioners believe that the broadband industry in its fledgling stage should be free of government interference. The FCC is supported by most of the industry who argue that there are sufficient options for consumers to allow market forces to enforce both service quality and fair and equitable treatment of the consumer. Given this backdrop, we will examine the state of regulation in the broadband market, and offer an opinion as to what the State of California could do if it was determined that there is a need to establish rules to protect broadband consumers.

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[84] FCC 02-42: Appropriate Framework for Broadband Access to the Internet over Wireline Facilities" http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-02-42A1.doc

[85] At least one local jurisdiction regulates service quality and establishes customer service standards. Maryland's Montgomery County recently enacted new regulations that establish service intervals for installations, repairs and maintenance, and set service call answer times. Amit R. Paley, "Montgomery Sets Rules for Cable Modem", Washington Post, July 28, 2004.

[86] Business and Professions Code, Chapter 783, Section 17538.35.

4.1.2 The Customer Experience

When initially applying for broadband service, a customer is presented with an array of options. Depending on the customer's location, the customer may have a choice in technology type: DSL, cable, wireless or satellite. Customers may also have the option of choosing between different levels of service that will vary in price, usually dependent upon the bandwidth offered.

Based on the range of choices available to most consumers, it is easy to see why policy makers might believe that there is no need to regulate broadband service. While some consumers may have a number of choices in broadband providers, the availability of multiple service providers is limited and is dependent upon the area that the customer resides.[87] Therefore, a number of potential broadband subscribers may have little to no choice if they want to purchase broadband service. Service reliability is a concern for many and some people claim that they do not subscribe to broadband service because it is unreliable.[88]

4.1.3 What Makes Broadband Service Different

We agree that in markets where there are multiple broadband providers that are able and willing to offer service, the market itself will provide some discipline. This means that a provider who faces competition will make every effort to keep service quality high and will be more inclined to treat customers in a fair and reasonable manner. However, there are some characteristics of broadband service that may adversely impact the competitive model. One of the axioms of a competitive market is the freedom that consumers have to switch service providers at any time. However, switching broadband service providers can be difficult. For example, there can be additional fees for signing up for new service, including replacing the computer modem. Some providers require advance written notification of termination. If a customer has a business that relies on broadband service, there is the additional cost of changing service. If a company is web-hosted through their broadband provider, the company would incur switching costs including purchasing a new website address. In addition the customer would have to change their email address and website address.

4.1.3 The CPUC Has Assisted Customers with Complaints

As stated previously, the CPUC has assisted, and continues to assist consumers with DSL service complaints. For example, the CPUC Consumer Affairs Branch logged in 1,894 DSL complaints in 2001. The complaints handled by the CPUC ranged from equipment problems to over-billing to phone service being terminated for non-payment of an incorrect broadband charge.

According to the CPUC's Consumer Affairs Branch, the CPUC only takes complaints concerning DSL providers and those complaints are further limited to DSL providers who have a Certificate of Public Convenience and Necessity, more commonly referred to as a CPCN. Providers who offer telephone service in California are required to acquire a

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[87] See Map II.

[88] Second Broadband Survey, responses to Question #5.

CPCN. This means that the CPUC cannot help customers who purchase service from an ISP because the CPUC does not regulate ISPs. To date, the DSL providers that the CPUC has worked with have accepted our efforts to resolve these disputes and have worked with customers to resolve issues with their broadband service. However, it is conceivable that these providers could argue that because the CPUC does not regulate ISPs, the providers are not under any legal obligation to work with the CPUC.

4.1.4 Other Options

With the exception of the complaints that the CPUC does handle, a consumer could pursue complaints with the Federal Trade Commission (FTC), the Justice Department or small claims court. Staff found that consumers have contacted the Consumer Affairs branch of the California government, the Better Business Bureau, the Federal Communications Commission (FCC), the FTC, and local government and state attorney general's offices. There is no clear path for a consumer to follow.

Both the FCC's and the FTC's websites have standard complaint submission forms (FCC Form 475 and FTC Form OMD #3084-0047), neither of which specifically address broadband issues. The federal Justice Department's website addresses only criminal acts such as fraud and community dispute resolution and does not deal with other issues such as billing problems. In addition, Staff found a number of examples of lawsuits taken against broadband providers. These include suits for "untrue, deceptive or misleading" advertising and negligent misrepresentation[89], and lying about customer service data[90] in response to inquiries made by the state attorney general.
There is also a section of the California Business and Professions Code that requires internet service providers to provide 30 days notice before terminating a customer's email address.[91]

4.2 Conclusions

If policy makers believe that market forces are a sufficient mechanism to insure that consumers receive high quality broadband service and protections from unscrupulous business practices, it is our responsibility as public servants to do all we can to create a marketplace that will in fact provide that discipline. If consumers are expected to solve their own problems by "voting with their checkbooks", we need to ensure that consumers have a choice. As it stands now, consumers seem to lack the information necessary to make informed decisions. We found evidence of broadband providers being deceptive about promotional pricing and charges for changing to a new service.[92] Although the CPUC does assist some customers with their complaints, those efforts are limited because of jurisdictional uncertainty. As detailed above, we found examples of complaints and lawsuits against broadband providers. It is not possible to determine from our inquiry the extent to which service quality and a lack of information are

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[89] Class Action – Verizon, Sprint Consumer Suits the Tip of the Iceberg, www.broadbandweek.com, February 5, 2001 Features.

[90] Ex-Employee: AT&T Lied About Customer Service, www.news4jax.com, January 28, 2002.

[91] Business and Professions Code, Chapter 783, Section 17538.35.

[92] http://search.complaints.com/search?q=CPUC

causing problems for broadband consumers. The State should keep this in mind as it considers a plan for encouraging broadband deployment in California.

Chapter 5. Programs to Promote Broadband Use and Deployment

In this chapter, we respond to three of the policy areas detailed in PU Code §709:

- To continue our universal service commitment by assuring the continued affordability and widespread availability of high-quality telecommunications services to all Californians.
- To focus efforts on providing educational institutions, health care institutions, community-based organizations, and governmental institutions with access to advanced telecommunications services in recognition of their economic and societal impact.
- To assist in bridging the "technologies for rural, inner-city, low-income, and disabled Californians.

We review current subsidy programs, including other states' programs and federal programs that are designed to provide discounts on broadband service to end users and to encourage providers to invest in unserved or underserved communities.

5.1 End User Subsidy Programs

End user subsidy programs are designed to benefit consumers of broadband service by reducing the monthly price, thus making the service more affordable. Tax credits and grant programs are designed to both encourage further deployment of broadband infrastructure and provide education and training about broadband technology to promote use of advanced telecommunications technology.

5.1.1 End User Subsidies Provide Discounts for Broadband Service

There are two subsidy programs available to Californians that provide benefits directly to the end user.[93] The California Teleconnect Fund (CTF) program, administered by the CPUC, provides a discount of 50% on selected telecommunications services to qualified schools and libraries, municipal, county government or hospital district owned and operated hospitals or health clinics, and community based-organizations offering health care, job training, job placement, and/or educational instruction. The covered services range from basic telephone service up to high-speed transmission lines for data services.

The FCC's E-Rate program offers eligible K-12 schools and libraries a discount of 20% to 90%. Figure 5.1. compares the CTF and E-Rate Programs.

[93] While the end user is the direct beneficiary of the CTF and E-Rate programs, the telecommunications carriers actually receive the funds from the program. The qualified participants receive discounted service from the telecommunications carriers. The telecommunications carriers then receive the portion of the service cost not paid by the end user from the CTF and/or E-Rate programs.

Figure 5.1
Comparison of CTF and E-Rate

	CTF	E-Rate
Eligible Entities	Schools, libraries, hospitals, health clinics and community based organizations	Schools and Libraries
Amount of Discount	50%	20% to 90%
Services Covered	Regular phone service and high speed data lines	Data lines, Internet Service Providers and internal building equipment
Funds Committed 1999 through 2003	$290 million	$1,641 million[94]

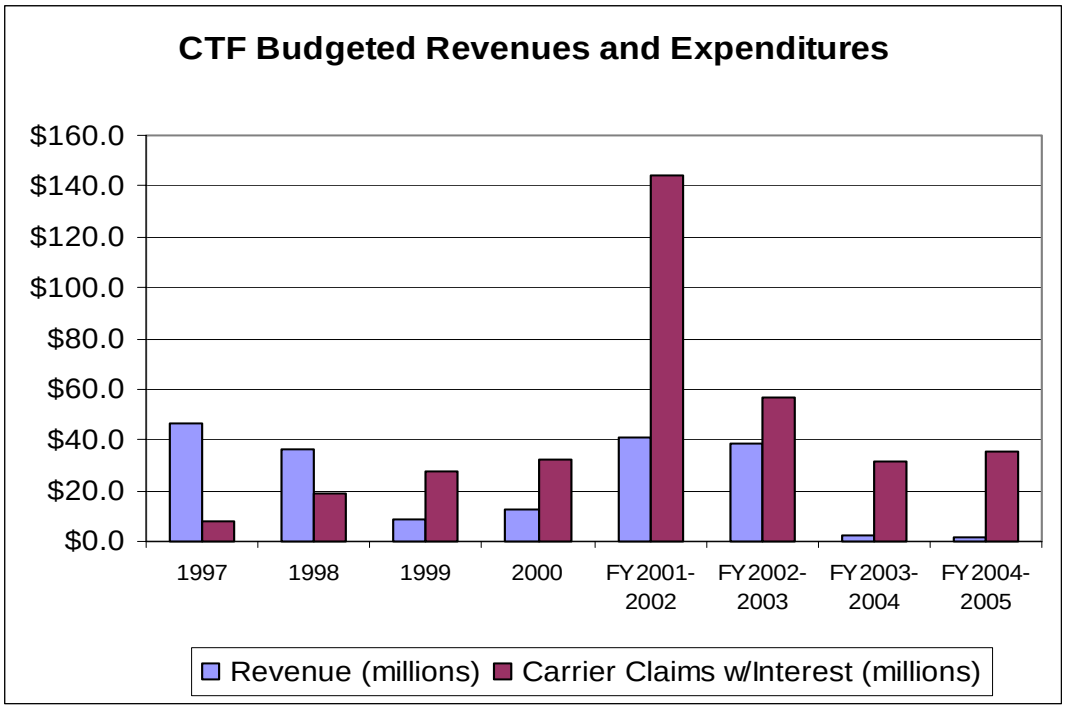
Eligible schools and libraries can participate in both the E-Rate program and the CTF program. Currently, CTF participants are not required to participate in the E-Rate program. The CPUC is currently researching how to adjust the CTF discounts to encourage E-Rate participation.

5.1.2 The CTF Program

The CTF program was established in 1996 as a result of Assembly Bill 3643. The goal of the CTF is to afford schools, libraries, community groups, health care facilities and government institutions the benefits of advanced communications services. The CPUC implemented the program in 1997. The CTF program receives its funds from an end-user surcharge applied to customers' monthly telephone bills. From the program's inception in 1997 through 2002, the surcharge rate has ranged from 0.05% to 0.41%. From January 2003 through July 2004, the surcharge rate was set at 0%. The current surcharge is 0.16%. Figure 5.2 shows the CTF program's budgeted revenues and expenditures from 1997 through the current fiscal year.

[94] This is the amount of funding received by California schools and libraries.

Figure 5.2[95]



Services Covered

The CTF discount applies to both regular telephone service as well as advanced services. Claims paid to providers show that the percentage of funds dedicated to advanced services versus regular telephone service is about an even split. We note, however, that there may have been more funds dedicated to advanced services if providers offered DSL under the CTF program. While DSL is an eligible service under CTF program rules, very few, if any, telephone companies are providing DSL under the program. The telephone providers claim that since DSL is an FCC regulated interstate service, not a CPUC regulated intrastate service, they are not required to offer DSL under the CTF program.

Input Regarding the CTF Program

We received comments, survey responses and direct input from community based organizations (CBOs) who participated in meetings regarding this proceeding that provided ideas and experiences with the CTF program. We discuss those proposals below.

[95] The surge in claims in 2001 is due to deferred carrier claims filings and represents claims from service provided in 2000 as well as 2001.

Expansion of the CTF Program

There is some support for expanding the CTF program to allow other organizations to receive discounted services. Specifically, we heard suggestions that churches, local boys and girls clubs and tribal governments should be eligible for the CTF discount. Others do not believe that expansion of the CTF program is needed.

Problems with the CTF Program

Recipients of CTF subsidies report that while the program has helped underserved communities, the subsidies are not sufficient because they do not cover broadband access to the home. While many organizations rely on the CTF to pay for broadband service, there are even more that are unaware of the programs' existence.[96] Even more alarming are the number of organizations who do not receive any type of support for broadband service and are not familiar with the CTF Program.[97] Some eligible entities complained that delays in the application process were preventing them from subscribing to broadband services.

Providers who participate in the CTF program complain that there are delays in processing claims and uncertainty about the availability of funds given the State's practice of borrowing money for the General Fund.[98] Because of the uncertainty created by the budgetary battles over CTF funding, providers may be hesitant to further promote the CTF program because providers apply the discount to end user's bills with no guarantee that the State will actually reimburse them for the discount.

5.1.3 The Federal E-Rate Program

The E-Rate program provides eligible K-12 schools and libraries a discount of 20% to 90%. Discounts depend on the level of poverty and the urban/rural status of the population served. The table below shows how the discount is determined.

[96] 47% of respondents received support from the CTF while 35% received support from E-Rate and another 18% from Rural Utilities Service (RUS). RUS is discussed later in this chapter. Of the 82 respondents to our second survey, only 8 reported receiving the CTF subsidy. Thirty-nine respondents reported that they were not aware of the CTF at all.

[97] Of the respondents who did not identify the CTF program as a support mechanism they used, 58% stated that they did not know about the program.

[98] Funding for the CTF Program was not included in the 2004-2005 California budget. However, Senate Bill 1276, which was passed by the Assembly on August 19, 2004, authorizes funding for the CTF Program.

Figure 5.3
Determination of Discount Percentage

INCOME	URBAN LOCATION	RURAL LOCATION
Measured by % of students eligible for the National School Lunch Program	Discount Percentage	Discount Percentage
If the % of students in your school that qualifies for the National School Lunch Program is...	...and you are in an URBAN area, your discount will be...	...and you are in a RURAL area, your discount will be...
Less than 1%	20%	25%
1% to 19%	40%	50%
20% to 34%	50%	60%
35% to 49%	60%	70%
50% to 74%	80%	80%
75% to 100%	90%	90%

The average percentage discount received from the E-Rate Program by California schools and libraries for the past five years is shown below.

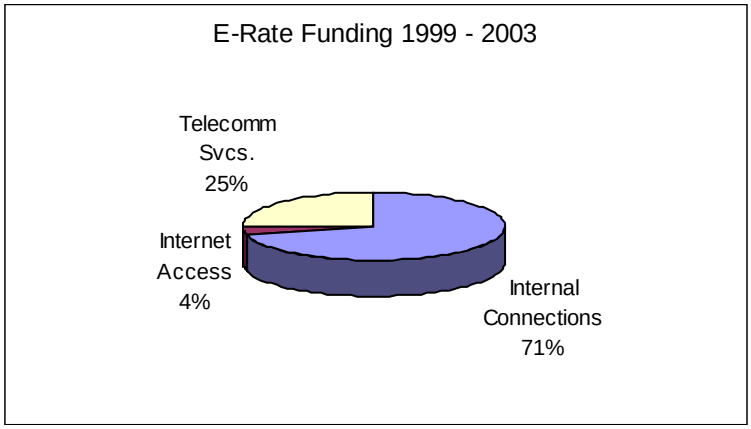
Figure 5.4
Average E-Rate Discount

1999	75.57%
2000	82.75%
2001	82.65%
2002	78.14%
2003	79.84%

The E-Rate program provides discounts for telephone services, internet access as well as the costs associated with connecting users to common equipment. Telecommunications services are phone lines and data lines such as basic telephone service, T-1 and ISDN.

California schools and libraries have received $1.6 billion from the E-Rate program for the last five years. The following pie chart shows the funds distributed to California over the last five years and the types of services that were subsidized:

Figure 5.5
Funds (Percentage) Appropriated to California by Category



5.1.4 The Universal Lifeline Telephone Service (ULTS) Program

Currently, the ULTS program provides discounted basic residential telephone services to low-income households. It is funded by a surcharge on all end-user telephone bills. Some providers suggest that it may be possible to modify the ULTS to expand access to broadband services. Others suggest that the CPUC provide "ULTS subscribers with immediate dial-up Internet access and reserve broadband subsidies for schools, libraries, non-profits and community centers."[99]
However, of those who submitted comments to the CPUC, most expressed the opinion that the ULTS program should not be expanded because of the high cost of subsidizing this service. Other reasons given for this opinion were that, in certain areas, there are multiple providers of broadband service, the service is provided through different types of technology and the regulatory status remains unclear. Finally, as discussed in the Introduction and in Chapter 1, the penetration rate for broadband service remains low, and as such, does not meet the CPUC's universal service standards. This standard is based on the principle that a tax should not be applied to fund a service for which a substantial majority of households do not subscribe.

5.1.5 Deaf and Disabled Telephone Program (DDTP)

The DDTP, administered by the CPUC, provides telecommunications equipment for California residents who are deaf, hearing impaired and/or disabled. The deaf and hearing impaired community urges the CPUC to investigate the feasibility of having the DDTP distribute computers with broadband service at no charge to those deaf subscribers who depend on American Sign Language, sign language translation, and/or speech reading to communicate fully.

[99] "Opening Comments by Latino Issues Forum and the Greenling Institute on the Order Instituting Rulemaking," filed in R.03-04-003, June 10, 2003.

5.1.6 Conclusions

The CTF and E-Rate programs assist in bridging the digital divide by providing subsidies to organizations that share their technology with the larger community. The CTF program could benefit from better marketing, streamlining the application process, reducing the time it takes to process claims and stabilizing the funding source. Some CTF recipients, who are also eligible for E-Rate funding, choose not to apply for E-Rate benefits because of the complexities and delays in the application process. The CPUC is considering how to adjust the CTF discount to encourage E-Rate participation.

We have heard from community groups and some broadband providers who support expanding the ULTS program to include subsidies for broadband access. Others argue against expanding ULTS primarily because of the cost. Consistent with our findings in the SB 1712 Report, the penetration rate for broadband service does not meet the guidelines of the Legislature and the CPUC for including this service in the definition of basic or universal service.

The deaf community urges the CPUC to investigate the feasibility of having the DDTP distribute computers with broadband service at no charge to those deaf subscribers who depend on American Sign Language to communicate fully.

5.2 Incentive Programs

California's success in increasing broadband usage has occurred without government programs to support infrastructure deployment. Other states, however, have implemented funding programs to address the lack of broadband service availability, particularly in rural communities. This section examines the use of tax credits and other incentives to encourage broadband providers to invest in broadband infrastructure in rural areas and other communities that are lacking broadband service. We also review initiatives to encourage training and education in broadband technology. Our inquiry includes an examination of other states that have as their purpose, similar goals as those set forth in SB 1563. We examine the process that was undertaken to initiate the programs, including the criteria by which providers qualified for funding. We also examine the types of benefits offered, including grants, matching funds, tax breaks and loans. We review the results of some of these programs, including specific examples of monies paid to providers and the degree of success they have achieved.[100] We also examine federal programs that offer grants and loans to address the lack of broadband service in rural areas, support investment in telemedicine and provide education to bridge the digital divide.

[100] Including increases in high-speed lines and total dollars invested in infrastructure projects.

5.2.1 State Initiatives

Currently, there are approximately fifteen states that provide some form of incentive to broadband investment, primarily to companies that provide the service to underserved areas. Our analysis attempts to cover a cross-section of programs to provide the clearest and most complete picture of the status of tax incentives in other states. Figure 5.6 contains a summary of the eight states we examined, the programs they offer, the dollars provided to eligible entities and the change in the number of broadband providers that occurred after the implementation of these programs.

Figure 5.6
State Incentive Programs to Encourage Broadband Deployment

State	**Program Name**	**Type of Incentive**	**Funds Provided/Proposed**
Alaska	Rural Alaska Broadband Access Program	Grants	$15 million
Idaho	Broadband Tax Credit	3% Tax Credit	$3 million
Maine	High Technology Investment Tax Credit	Tax Credit	N/A
Michigan	Michigan Broadband Development Authority	Grants & Low Interest Loans	$250 million proposed
Mississippi	Mississippi Broadband Technology Development Act	Variable Tax Credit (location dependent)	$10 million
Montana	Advanced Telecommunications Infrastructure Tax Credit	20% Tax Credit	$1.2 million
Ohio	Community Technology Fund	Grants	$754,000
Oregon	Advanced Telecommunications Facility Credit (AFTC); Telecommunications Infrastructure Act (TIA)	AFTC: 20% Tax Credit; TIA: grants	AFTC: $70 million

N/A is defined in this table as “Not Available”

Comparison of Tax Credits, Grants and Loan Programs

The choice of offering tax credits, grants or loans is dependent upon the funding options available to states. As shown in Figure 5.6, tax credits are the most common incentive offered. Tax credits are popular because they do not require cash outlays by the state. However, tax credits do cause a decrease in state revenue as a result of lower taxes paid by recipients for the year in which the investment was made.[101] The amount of tax credits vary from state to state. However, one state, Mississippi, has different funding levels depending on whether the area is rural or urban. Tax credits only offer the potential to reduce tax liability and this may not provide sufficient incentives for broadband providers to invest millions. With a lower average income and uncertain interest in high speed internet access in rural areas, it is not assured that a fully realized tax credit would equally offset the amount expended. Moreover, if there is no tax liability in the year of investment, and carry-forward is not allowed, the company gets nothing. Grant programs, by comparison, are expensive and require upfront cash outlays by the state.
Some states impose pricing restrictions on the broadband providers who receive tax credits or grants. These restrictions typically require that broadband rates for rural communities be roughly comparable to urban rates.

State Legislation

A number of bills have been introduced by California legislators in the current legislative session, including:

SB 631, enacting the "Real Investment in California's Economy Program," would provide qualified taxpayers, beginning on or after January 1, 2006, with an exemption from those taxes on personal property capable of providing broadband services at speeds greater than 128 Kbps.

SB 850 would declare the Legislature's intent that California's universal service policy includes the concept of universal availability of broadband to all areas of the state. This bill would require the Secretary of the Business, Transportation and Housing Agency to develop a strategy for making broadband telecommunications service accessible to all areas in California. This bill would also require the CPUC to determine which areas in California lack broadband service and which areas are lacking competition in the provision of broadband service, and report the findings to the Legislature by July 2006.

AB 903 would ensure that the same requirements for providing public, educational, and governmental access requirements are applied to all cable television providers, including telephone corporations or their affiliates for an area within the telephone corporation's service territory.

AB 1388, titled the "Digital Opportunity Act of 2005," would express the intent of the Legislature to promote the accelerated deployment of next-generation broadband

[101] Unless the state has a carry-forward rule that allows recipients to take the tax credit in the tax year in which the company earns a profit.

networks in California. This bill would require the Department of General Services (DGS) to submit an annual status report to the fiscal and policy committees of the Legislature, the Department of Finance (DOF), and the CPUC on implementation of this bill. This bill would also require DGS, in consultation with the Director of Transportation and the CPUC, to report to the fiscal and policy committees of the Legislature, the DOF and the CPUC on the extent to which the residents in each census tract in the state will have or are likely to have access to advanced communications services networks by 2011.

AB 1458 would amend current law relative to leases of state-owned property to wireless telecommunication providers. Currently, 15% of revenues from fees collected pursuant to a lease agreement must be available, upon appropriation by the Legislature, for the purpose of addressing the state's digital divide. Current law excludes revenues from fees collected from lease agreements signed before January 1, 2004 from this requirement and AB 1458 repeals this exclusion.

5.2.2 Federal Initiatives

Existing federal programs provide funding for broadband deployment, education and telemedicine services. The United States Department of Agriculture (USDA) is by far the lead federal agency and has the most amount of funding. However, the United States Department of Commerce and the Department of Health and Human Services also provide funding for broadband related projects. Finally, there are Congressional initiatives that would provide funding to rural and underserved areas.

Rural Utilities Service (RUS)

The RUS provides grants, incentives, and low-interest financing to electric, communications, water, sewer, telecommunications, and environmental projects. The RUS has been in existence for over 50 years with the purpose of providing essential assistance to rural communities.

In October 2003, the RUS program issued $44 million in grants for broadband programs to improve access to broadband for educational institutions, for medical agencies for telemedicine services, as well as to increase penetration of broadband usage in rural communities. Of the $44 million, $23.5 million was for distance-education projects, $11.3 million for rural community projects, and $8.9 million for telemedicine projects.[102] According to RUS's 2003 annual report, the program has an excess funding level of $1.8 billion specifically earmarked for telecommunications[103].

The agency provides broadband loans to states. On May 4, 2004, the USDA announced that they would provide $190 million in broadband loans to 19 states.[104] States qualified

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[102] *Federal Computer Week,* October 1, 2003 issue.

[103] http://www.usda.gov/rus/index2/RUSannualreport.pdf

[104] http://www.usda.gov/Newsroom/0180.04.html. The 19 states are AL, AR, MS, GA, KS, TX, LA, MI, ND, OH, OK, PA, SC, SD, TN, CO, IL, VA, and WI. To fund the loans, $150 million came from the 2002 Farm Bill, and $40 million from the traditional RUS program.

for the loans by agreeing to arrange for matching funds and using the loans to improve broadband access in low income communities with less than 2500 people.

California has not been a beneficiary of the RUS program, mainly because many of California's rural communities do not qualify for the program because of RUS's definition of rural. There are several identified definitional problems that restrict the public monies that flow to rural areas. RUS defines rural as "any incorporated or unincorporated place that: (1) has no more than 20,000 inhabitants; and (2) is not located in an area designated as a standard metropolitan statistical area or MSA.[105] Because many of California's rural areas get counted with large urban populations in the same county, these counties do not meet the definition of rural and therefore are not eligible for RUS. There is a proceeding before the FCC (which works with the USDA to implement the RUS program) to consider changes to the program's definition of "rural". One proposal is to allow state's to adopt their own definition of rural. This proposal would give California the flexibility it needs to adopt a definition that does not exclude communities that are rural, despite the fact that they may share the same county with an urban area.

Distance Learning and Telemedicine Grant Program (DLT)

The DLT Grant Program, also administered by the RUS, helps fund capital costs for broadband infrastructure and equipment for eligible institutions (schools, hospitals, etc.), and requires a 15% matching of costs. The DLT program has spent $173 million funding broadband projects since 1993.[106] California has received over $8 million from this program up to and including 2003.

Technology Opportunities Program

Administered by the United States Department of Commerce, the Technology Opportunities Program (TOP) has as its goal bridging the digital divide, with matching grants aimed at model projects to increase training and advanced telecommunication technology in rural and urban communities. TOP's purpose is to support lifetime learning, assist public safety officials, encourage telemedicine applications and promote economic development. In 2003, 28 matching grants were awarded for a total of $13.95 million.[107] For 2004, approximately $12.9 million of grant money is available.

Telemedicine Programs

There are also a number of programs in place specifically designed to promote telemedicine in rural areas. For communities that lack a medical infrastructure, these programs can provide real-time care in such areas as consultations, drug abuse therapy, and counseling. For example, the Department of Health and Human Services awarded

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[105] The Farm Security and Rural Investment Act of 2002 P>L> 107-171: § 601 (b) (2).

[106] Application information can be found at http://www.usda.gov/rus/dlt/dlml.htm, and DLT regulation at http://www.usda.gov/rus/dlt/dltregs.htm.

[107] http://www.ntia.doc.gov/top

$3.74 million dollar in grants to improve rural telemedicine outreach in 2003.[108] The Health Resources and Services Administration Office for the Advancement of Telehealth announced a $3.86 million grant program on October 21, 2003.

Broadband infrastructure deployment has the potential to increase access to healthcare services where patient density would not otherwise support a full array of healthcare services. This area of subsidized broadband deployment has been increasing in rural areas nationwide and in California, including California's American Indian lands.

Federal Legislation

In December 2004, President Bush signed the Internet Tax Nondiscrimination Act (SB 150), which put a new four-year ban on state and federal taxation of certain kinds of Internet transactions. SB 150 expands the definition of Internet access to include dial-up as well as DSL, cable modem and wireless Internet connections. It is expected to promote broadband deployment by prohibiting the taxation of Internet access, double taxation of a product or service bought over the Internet, and discriminatory taxes that treat Internet purchases differently from other types of sales. The new law does not apply to sales taxes on Web transactions nor Internet telecommunication services.[109]

In January 2005, H.R. 3 was introduced. Titled the "Transportation Equity Act: A Legacy for Users," this bill would require the Secretary of Transportation in cooperation with the Secretary of Commerce, state departments of transportation, and other appropriate state, regional, and local officials, to conduct a feasibility study on whether installing fiber optic cable and wireless infrastructure along multistate Interstate System route corridors would improve communications services to rural communities along those corridors. The report would specifically identify rural broadband access points for such infrastructure.

H.R. 144 was also introduced in January 2005. This bill, titled the "Rural America Digital Accessibility Act," would authorize the Secretary of Commerce to make grants and guarantee loans to facilitate private sector deployment of broadband capabilities to underserved rural areas. In aggregate, the grants/loans would not exceed $100 million annually for years 2005 through 2009. The bill states that particular attention shall be given to providing Internet service to underserved rural areas, new models or technologies for broadband service, and the use of broadband service to stimulate economic development. In addition, tax credits may be granted to holders of qualified technology bonds, and $25 million will be appropriated for the National Science Foundation to research the facilitation or enhancement of access to broadband services, particularly for rural areas.

H.R. 146 would amend the Public Works and Development Act of 1965 and would provide grants for broadband-based economic development. Eligible applicants include state or local governments, institutions of higher learning, and nonprofit economic development organizations, while the affected regions shall contain populations of less than 1,000,000 individuals. $50 million will be appropriated for these grants, which

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[108] http://tie.telemed.org/funding/news.asp

[109] http://internetnews.com/xSP/article.php/3443631.

individually shall not exceed $1 million; the federal share of the cost of each project will be set at 50%.

S. 14, titled the "Fair Wage, Competition and Investment Act of 2005", would establish a broadband access tax credit, permitting electing taxpayers to treat any qualified broadband purchase, lease, installation or connection expenditure as a deductible expense to any taxable year.

S. 497, titled the "Broadband Rural Revitalization Act of 2005," would establish a Rural Broadband Office within the Department of Commerce to coordinate all Federal resources relating to the expansion of broadband technology into rural areas. The Rural Broadband Office would be required to annually submit a report to Congress that assesses the availability of broadband technology, estimates the number of individuals using broadband technology and establishes a plan to meet unmet demand for broadband technology in rural areas. This bill would also permit electing taxpayers to expense qualified broadband Internet access expenditures in any taxable year.

5.2.3 Conclusion

There are already a number of federal programs available to encourage broadband providers to invest in under-served areas. As detailed above, the RUS has a grant program that could potentially address the concerns of some of California's rural communities and would not require a specific California tax credit program. A threshold question for California is whether a separate tax credit or grant program is even necessary given the extent of deployment in California and the opportunities from RUS and other programs that are already in place.

RUS is a vibrant program with millions of dollars to assist states with communities without broadband service. Even though every zip code in California has access to broadband service, some have no choice of providers and others are limited to satellite service, which, as we discuss in Chapter 2 of this report, is a more expensive option and has limited bandwidth. The residents of California's rural communities may not realize the benefits of choice amongst broadband providers unless there are incentives for providers to offer service to those communities.

If California chooses to move forward with the idea of financially encouraging broadband deployment into rural, unserved, and underserved areas, the State should consider the factors described above as well as the experiences of other states.

Chapter 6. Barriers to Further Deployment

PU Code §709 adopts, as a policy of the State, "(t)o remove the barriers to open and competitive markets and promote fair product and price competition in a way that encourages greater efficiency, lower prices, and more consumer choice." This chapter identifies the barriers to broadband deployment and use.

Public policies should encourage, rather than obstruct, the providers' attempts to expand their serving areas to new unserved or underserved communities. There are laws and rules that govern the process companies must engage in before deploying facilities. California has public rights-of-way (ROW) laws, the California Environmental Quality Act (CEQA), and cable franchise agreements. All of which govern what a provider must do, and pay, in order to deploy facilities. All of these laws were designed to facilitate California's high quality of life; however, they were not designed with broadband deployment in mind. We will review these complicated areas of law to determine if any, or all of them, may pose a barrier to further deployment because of the way they are implemented or because of problems with the laws themselves. Then we will examine the factors that limit broadband demand, and also report on the impact of limited broadband access for underserved communities.

6.1 Rights of Way

There are four areas in ROW regulation that affect the deployment of broadband. These areas are (1) fees for access to the ROW, (2) the period allowed for processing of ROW applications, (3) the application form, and (4) the ROW dispute resolution process. We conclude that changes to the ROW laws would assist California's goal for broadband deployment. This report's assessment of ROW issues comes in great part from comments we received and a workshop CPUC staff held on the issue in February of 2004. (See Appendix B for a summary of the workshop and Appendix C for examples of other states' actions on ROW issues)

6.1.1 All Levels of Government Share Responsibilities for ROW Requirements

Telecommunications providers are granted authority within the State of California to gain access to the ROW by California Public Utility Code Section 7901.[110] California defines the rights of the municipality, with respect to ROW, as the "right to exercise reasonable control as to the time, place, and manner in which roads, highways, and waterways are accessed."[111] Another state law addresses the right of local governments to charge permit fees to companies that access the ROW.[112] The Federal government, through the 1996 Telecommunications Act, does not assert jurisdiction over public

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[110] "Telephone corporations may construct lines...along and upon any...lands within this State...and other necessary fixtures of their lines, in such manner and at such points as not to incommode the public"

[111] California Public Utilities Code Section 7901.1(a)

[112] California Government Code Section 50030.

rights-of-way but does define the role of state and local governments in their administration.[113]

6.1.2 ROW Fees Should Be Limited to Local Government Costs

The 1996 Telecommunications Act states that local municipalities may, "require fair and reasonable compensation from telecommunications providers, on a competitively neutral and nondiscriminatory basis."[114] In addition, California Government Code Section 50030, states that, "(a)ny permit fee imposed by a city, including a chartered city, a county, or a city and county..., shall not exceed the reasonable costs of providing the service for which the fee is charged and shall not be levied for general revenue purposes." As a result, local governments have the right to collect fees from telecommunications providers for access to the ROW to cover the costs associated with administration of the ROW by the city. The Legislature and the courts have upheld the requirements that fees be limited to the local government's cost of providing access.[115]
ROW fees have been an area of contention between municipalities and telecommunications providers for years. Local governments have argued that "reasonable", a term used in both the state and federal law, does not necessarily infer that fees are to only cover costs. Providers have argued that to be reasonable, fees must be directly related to the city's costs. Providers also view the city as using the ROW process as an opportunity to increase local revenue rather than cover costs which in turn, "raise[s] the cost of deploying broadband,"[116] and may deter deployment.

6.1.3 California Lacks an Efficient Method for Resolving ROW Disputes

A dispute over ROW can also delay a provider from deploying facilities for months or even years. In some cases, a provider may be forced to completely withdraw its investment plan. The state of Michigan addressed this problem by recently enacting ROW laws that include provisions for a dispute resolution process to expedite and simplify the process for municipalities and providers alike. The law established a separate entity to implement the new law and assigns to the Michigan Public Utilities Commission the authority to resolve disputes. [117]

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[113] Section 253(c) of the 1996 Telecommunications Act.

[114] Ibid.

[115] In response to concerns that local agencies were charging developers unfair or unrelated fees that were hindering development California passed the Mitigation Fee Act (MFA) in 1987. The act requires public agencies to meet specific requirements when imposing a fee as a condition of new development. Most importantly, the MFA states that there must be a relationship between fees and the local agencies cost of administering the development. The law was first applied to a communications case in Williams Communications vs. City of Riverside. On December 19, 2003, the Fourth District Court of California found that the fee must be limited to the local government's cost to administer permits. The court also ruled that there can be no separate fee or distinction for providers of advanced data services.

[116] Verizon California Inc.'s Opening Comments filed in R.03-04-003, June 10, 2003.

[117] Michigan: Metropolitan Extension Telecommunications Rights-Of-Way Oversight Act, section 6, subsection 2.

The CPUC adopted a ROW dispute resolution process for carriers and municipalities in Decision 98-10-058. However, the CPUC's process is limited to the provider because the CPUC does not have authority over local governments.[118] For this reason, providers report that it makes more sense for them to file directly with a court of law with their disputes.[119]

6.1.4 It Is Difficult to Predict when ROW Application Will Be Processed

The time to process a ROW application varies from city to city and providers are unable to predict how long it will take for them to obtain permission to build out their facilities. This uncertainty is a barrier to deployment because financing of these projects is based on estimated completion dates that are impossible to predict under the current process.

The National Association of Regulatory Utility Commissioners (NARUC) recognized the benefit of standardizing the time period to process ROW permits. NARUC adopted a resolution that states that ROW reform is necessary and that deployment of advanced services would benefit from requiring local government to, "act on applications for access to public rights-of-way in a reasonable and fixed period of time."[120]

The California State Assembly recently passed and submitted to the Senate for consideration, AB 1874, Telecommunications: Information and Advanced Communications Deployment Act of 2004. The intention of the bill is to "promote accelerated deployment…ensure prompt access to public lands by expediting and streamlining rights-of-way access". The bill requires the California Department of Transportation to either approve or deny a ROW application within 45 days of receipt of a completed application. As of the writing of this report, the bill was vetoed by the Governor on the grounds that it was too costly.

6.1.5 There Is No Standard ROW Application Form

Each city and county in California has its own ROW application. Providers who intend to offer services within multiple cities and counties are faced with a different form for each government entity in its prospective service territory.

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[118] CPUC Decision 98-10-058, Conclusion of Law 17.

[119] A CPUC order granting access to the ROW can be ignored by local governments. Should that occur, the telecommunications carrier's only recourse is to file a lawsuit in the appropriate court of civil jurisdiction for resolution. The Commission's order authorizing access may be used in support of its case in civil court. D.98-10-058, Conclusion of Law 18.

[120] *Broadband Facilities and ROW* written on 7/13/02, NARUC.

6.2 CEQA

In this section, we address the CPUC's approach to enforcing the California Environmental Quality Act. CEQA[121] was enacted in 1970 in response to growing public concern about environmental issues. Initially, the law required government agencies to consider, disclose, and where feasible, mitigate the environmental impact of public construction projects. Its scope was later expanded to also include construction by private entities. In 1977, CEQA was amended to reduce regulatory delays associated with the processing of applications for development projects. The amendment set specific time limits and mandated that all state agencies specify in advance the information that will be required in a CEQA project application.

6.2.1 The CPUC Performs CEQA Reviews for Broadband Service Applications

The CPUC is the lead agency responsible for the review of telecommunications service area expansion and construction of new telecommunication facilities within the state of California. As the lead agency the CPUC has the responsibility to perform CEQA reviews for these projects. California mandates that the CPUC must process applications in a specified period of time and specify in advance the information required in an application. The State however delegates the responsibility to determine which projects are subject to CEQA to the CPUC.

6.2.2 The CPUC Has Not Consistently Applied CEQA to Construction Projects

The CPUC's current implementation of CEQA is problematic as it includes significant uncertainty and risk regarding regulatory compliance. In seeking authorization for the deployment of new facilities, providers report that the CPUC process is not processing CEQA filings in a consistent manner. The CPUC administers the program differently depending on the regulatory classification of the provider and when the provider received its certificate to operate in California (Certificate of Public Convenience and Necessity or CPCN).

Providers report that the uncertainty associated with CEQA review is a barrier to deployment because providers are hesitant to invest time and resources into a project if they can not predict if the project will be approved. Although CEQA was amended to reduce the regulatory delays associated with the processing of applications, delays still remain within the CPUC administration of CEQA. In some cases, providers are forced to wait years for CEQA approval to deploy facilities.[122]

The wide variation in the manner in which CEQA is applied to providers by the CPUC is evident when one considers the following example. An Incumbent Local Exchange

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[121] California Public Resource Code Sections 21,000-21.177, CEQA Chapters 1-6.

[122] The CPUC identified the need to revisit its CEQA rules and started the process to do so by issuing Rulemaking 00-02-003 (R.00-02-003) in February of 2000. As of the writing of this report, the CPUC has not come to any decision nor acted on this rulemaking.

Carrier (ILEC) would not be required to seek CEQA review for a project to build out infrastructure for broadband service. A Competitive Local Exchange Carrier (CLEC) who received authority to operate in California in 1996 might need CEQA approval depending on whether or not the project will be built in the existing ROW.[123] A CLEC who just recently entered the California market falls under a different process and would be required to file an application with the CPUC before it could build.[124] It is evident that there is not a level playing field with respect to CEQA enforcement and that the process itself may be precluding some companies from investing in California.

Complicating the CPUC's handling of CEQA matters is the Attorney General's criticism of CEQA review for telecommunication carriers prior to 1999. These concerns were recorded in comments in R.95-04-043, D.99-10-025, D.00-12-048, D.00-12-050 and R.00-02-003 regarding the batch review process for CEQA. R.00-02-003 has recently been reassigned offices and is now before the Commission.

6.3 Cable Franchising Rules

This section examines how cable franchising rules impact the further deployment of broadband facilities.

6.3.1 There Is Little Competition among Cable Companies

Cable modem service provided over cable lines accounts for the second largest percentage of broadband lines in California after DSL. Although cable modem service is available to many consumers, there is very little competition among cable companies for customers.

6.3.2 State Regulation of Cable Franchises Discourages Competitive Entry

The lack of competition among cable providers is due in part to the current regulatory framework in California. California Code allows cities and counties to authorize (by franchise) the construction of a cable television system.[125] This is a monopoly franchise arrangement that does not facilitate competition from another cable provider. California law does not allow competition between cable providers unless an additional franchise is granted by the local government. This additional franchise is referred to as a Competitive Franchise[126] and would be granted to a cable provider interested in entering a market already served by a franchised incumbent provider. The local government may

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[123] CPUC Decision 96-12-120.

[124] CPUC Decision 99-12-050.

[125] 53066. (a) Any city or county or city and county in the State of California may, pursuant to such provisions as may...authorize by franchise or license the construction of a community antenna television system.

[126] California Code Section 53066.3 (a) allows "...a city, county, or city and county elects to grant an additional cable television franchise in an area where a franchise has already been granted to a cable television operator..."

grant or deny an additional franchise based on the presence of "significant positive or negative impacts on the community being served."[127] If an additional franchise is approved, state code mandates that the competitive franchise be required "to wire and serve the same geographic area within a reasonable time,"[128] as the incumbent provider.

The obligation to wire and serve the same area as the incumbent is cost prohibitive to almost any potential entrant as it requires a massive infrastructure investment that is in most cases not economically viable. Along with this investment, the competitive franchise also assumes greater risk when entering the market because it does not have the captive customer base the incumbent had when it began to offer service, and must compete with a provider already entrenched in the target market.

6.3.3 The Federal Government's Open Video System Designation Encourages Competitive Entry

To encourage competition in the cable video market, the Federal government, through the 1996 Telecommunications Act, created a new designation called Open Video System (OVS) as an alternative to traditional cable television regulation.[129] The OVS designation was created to encourage competition by lessening the regulatory burdens on OVS providers. Most importantly, the OVS designation does not include the same build out requirements that incumbent cable providers have. This allows a competitive provider to enter the market without the requirement to extend its network throughout the entire incumbents franchise territory.

California code does not currently recognize the OVS designation, and the state requirements for a competitive franchise are in direct contradiction to the Federal scheme. The California State Attorney General recognized this problem and opened Opinion No. 02-1013[130] requesting comments. As of the writing of this report, the proceeding was closed and no opinion was issued. This review should ensure that the economic or other forms of redlining to not occur as a result of the OVS designation. Broadband competition cannot exist only for those whose zip codes reflect desirable economic conditions. The OVS designation should not function as a mechanism that limits the geography of the competitive broadband market.

6.4 Conclusion

Both Federal and California laws address ROW and its implication in the deployment of telecommunications services. Despite this fact, providers face uncertainty and the possibility of local governments' charging exorbitant fees for access to the ROW.

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[127] California Code Section 53066.3.(1)

[128] California Code Section 53066.3 (d)

[129] 1996 Telecommunications Act, Section 653. FCC Rules, Section 76.1500-76.1505.

[130] Do the provisions of California Government Code section 53066.3 apply where a competitive franchise, license or agreement is proposed to be granted by a local franchising authority to an open video system operator that has been certified as such by the Federal Communications Commission under federal statutes and regulations?

The fees imposed for rights-of-way access must be directly attributed to the costs incurred by the municipality to administer the ROW. ROW fees are not a barrier to deployment as long as local governments only charge cost based fees for which they are authorized. However, if cities and counties use ROW fees as an opportunity to increase local revenue, these fees will quickly become a barrier to deployment.

The problems with CEQA arise not out of the law itself but from the manner in which the CPUC applies CEQA requirements to providers. The applicability of CEQA to telecommunications carriers by the CPUC is burdened with uncertainty. Current CPUC rules are a barrier to deployment and may be effectively preventing ubiquitous broadband deployment. The CPUC's CEQA rules require standardization and must be applied to all carriers in a consistent manner. If correctly implemented, CEQA would not be a barrier to deployment.

Current California cable regulation concerning competitive franchises is a barrier to competition and the deployment of broadband services. The requirements of a competitive franchise seem to prevent competition more than encourage new providers to enter the market. The OVS designation removes barriers to infrastructure investment by allowing providers to enter a franchised area in an economically viable manner.

Chapter 7. Barriers to Broadband Use

7.1 Barriers to Use of Broadband Services

This section reviews the barriers to broadband use identified by participants at our community meetings and responses to our two surveys.[131] The input from these sources is reflective of the view of users of technology rather than providers of technology. The opinions of users are significant and help us understand why consumers choose not to use broadband service. Though we acknowledge that deployment concerns remain, our focus is this chapter is on the barriers to use, even when broadband service is supposedly available.[132] High prices, lack of training and knowledge on the Internet and broadband service as well as customers' experiences with unreliable broadband service appear to be the main barriers to further broadband use. We also found evidence that many are not aware of the CTF program which means that there may be organizations that are eligible for discounts on broadband services who are currently not receiving them.

7.1.1 The Price of Broadband May Keep Many from Subscribing to the Service

Based on our inquiry, the most overwhelming barrier to broadband use is the price.[133] Though we have seen evidence of prices falling as a result of competition, it is also the case that prices remain high especially where there are few or no competitive choices. This is supported by evidence provided by broadband providers' experiences with relatively low penetration rates in areas where broadband service is offered.[134] Besides the cost of the service itself, the price barrier also includes the cost of purchasing and maintaining a computer and associated software necessary to use advanced services. Together, price and computer ownership were the two largest barriers reported by the CPUC survey conducted in support of this report. That survey demonstrates that many organizations are not aware of the CTF discounts for broadband service.

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[131] Staff conducted two surveys. The first survey was directed towards CBOs and nonprofit groups who provide services, including technology services, to various communities. The second survey was sent to a wider group of users including CBOs , healthcare associations and local governments. The second survey focused on the respondent as a user or potential user of broadband service.

[132] The underserved groups we heard from, both through the public meetings as well as our surveys, expressed doubt that the market alone would improve their groups' access to and use of broadband services.

[133] Price is a barrier to not just the broadband connection but to the required accompaniments: a computer (or other interface), training, and ongoing support and maintenance. However, the main focus of participants in this proceeding was the price of broadband access.

[134] Proprietary information provided by broadband providers indicates an average subscription or penetration rate of approximately 17% per service accessible households. See also the Opening Comments of Roseville Telephone Company at 1-2 and Opening Comments of AT&T Communications of California at 4-5.

7.1.2 Training and Lack of Internet Knowledge May Prevent Some Communities from Subscribing to Broadband

A lack of training may also be the reason that more consumers do not subscribe to broadband service. Cultural issues or other biases are perceived as barriers to broadband use. Our research found that biases and fear of technology disappear once people are exposed to computers and the Internet. Experts that work with underserved groups believe that broadband use is low within the communities they serve because people are not aware of the benefits available to those who have access to a sufficient connection to the Internet.

7.1.3 Potential Customers in Rural Areas Refrain from Purchasing Broadband Service Because of Reliability Concerns

As discussed in Chapter 3, there is little regulatory oversight of the service quality of broadband service. The lack of regulatory rules means that consumers must look to the market to provide incentives to keep service quality high because of the risk providers face of losing customers to a competitor. However, as evidenced by Map II in this report, California still has areas with little competitive alternatives for broadband service. Rural health care providers note that redundancy is a chief concern of theirs and that there are insufficient choices of broadband providers to supply that redundancy.[135] Our second broadband survey also found that some people in rural areas, who are served by small telephone companies, do not subscribe to broadband service because of concerns about reliability.[136]

7.1.4 Consumers Lack Sufficient Information Regarding Availability of Broadband Service

Those that attended our community meetings reported on their frustration with the lack of information about broadband availability.[137] Decisions about where to locate offices are unavailable because there is no source of information about where broadband is and is not offered. In rural areas, broadband access is an important criterion for relocation decisions both for residence and business. The chief complaint we heard was the inability to determine whether broadband is available at a specific residence or office until after the entity has relocated.

7.1.5 Lack of Relevant Content Hinders Demand

Some communities do not access the Internet because of a lack of relevant content. We heard concerns about the lack of information in different languages and the inability for

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[135] Participants at the Redding meeting explained that no redundancy is available in or near Redding for rural health care clinics.

[136] Second Broadband Survey Results, April 27, 2004, Question 5.

[137] The lack of data on broadband deployment was echoed in the formal comments in this proceeding as well.

the disabled population to access information. A barrier to access for the disabled population is the lack of adequate adaptations to equipment and software that would allow them to make use of the technology.

7.2 Conclusions

We found that price, insufficient training and knowledge, the perception of or experience with unreliable service and insufficient information about broadband availability are barriers to further use. Though price has come down in some areas, it still remains high for some consumers, even in areas with multiple competitors. In areas with only one provider, prices remain high. The population of the state is receiving training and knowledge from schools, libraries, and the Community Technology Centers that are funded by the CTF. However, these efforts may not be sufficient to achieve high growth in broadband subscription rates in the near term.

Chapter 8. Is Broadband Reaching Everyone?

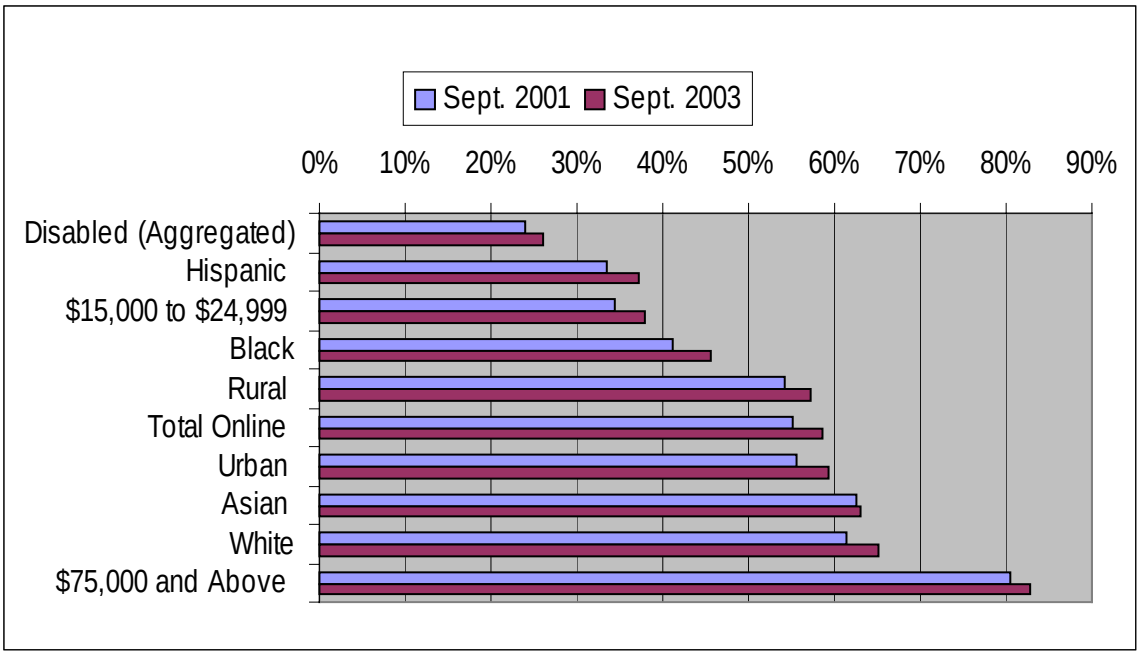
Despite California's success and national leadership on broadband penetration, not all of the state's residents have access to, or are using, broadband. Certain communities are lagging behind: low-income consumers, residents of rural areas, and persons with disabilities.

Disparity in the access to, and use of, broadband among certain communities is now commonly referred to as the "digital divide," much as that term was used in the past to describe the gap between those who owned computers and those who did not, and later to describe the gap between those who used the Internet and those who did not. Much of the information available on the digital divide still examines that issue in terms of access to the Internet or access to a personal computer. Although these studies and statistics do not directly address broadband deployment and use, we include examples of them here because we believe them to be of probative value in addressing the problem of unequal access to, and use of, broadband.

Much of the data found addresses the "digital divide" in the United States, not in California specifically, regardless of one's definition of that term.

As recently as September 2004, the United States Department of Commerce released data on the disparate rates of Internet usage among certain communities, shown in Figure 8.1 below.

Figure 8.1
Internet Usage: Percent of U.S. Population Online



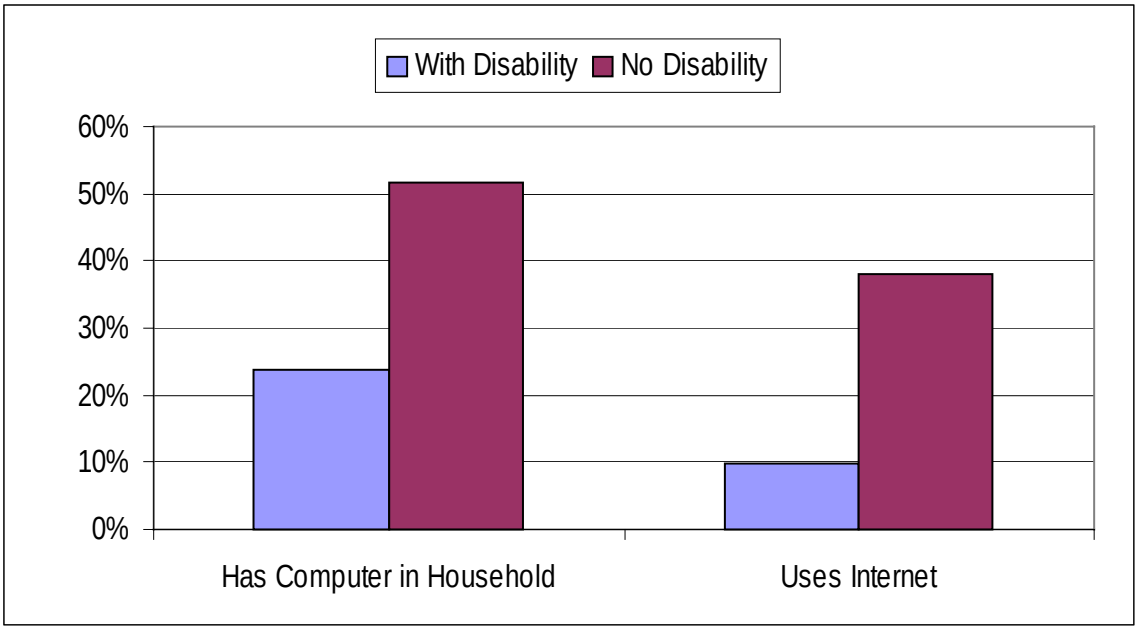
U.S. Department of Commerce, "*A Nation Online*: Entering the Broadband Age," September 2004.

The data shows disabled populations being the least connected to the Internet (24% in 2001 and 26% in 2003), with the most connected being households with a family income of $75,000 and over (80% in 2001 and 83% in 2003). Other lower use groups include Hispanics of any race (33% in 2001 and 37% in 2003), low income persons (34% in 2001 and 38% in 2003), and Blacks (41% in 2001 and 46% in 2003).[138] The statistics revealed almost no difference among the total United States population online and the rural and urban populations online – all three were approximately 57% in 2003.[139]

8.1 Disabled Community

Access to broadband, and the wealth of information and resources it provides, presents a critical opportunity for people living with disabilities to live fuller, more "connected" lives. Yet, a study entitled "Disability Watch: The Status of People with Disabilities in the United States," found in 2001 that 24% of disabled individuals had access to a personal computer (compared with 52% for non-disabled), and only 10% of disabled individuals had access to the Internet, either through a dial-up or broadband connection (compared with 38% for non-disabled).[140] This data appears to conflict with the U.S. Department of Commerce data showing disabled community Internet usage at over twice that level.

Figure 8.2
Computer Access and Internet Use



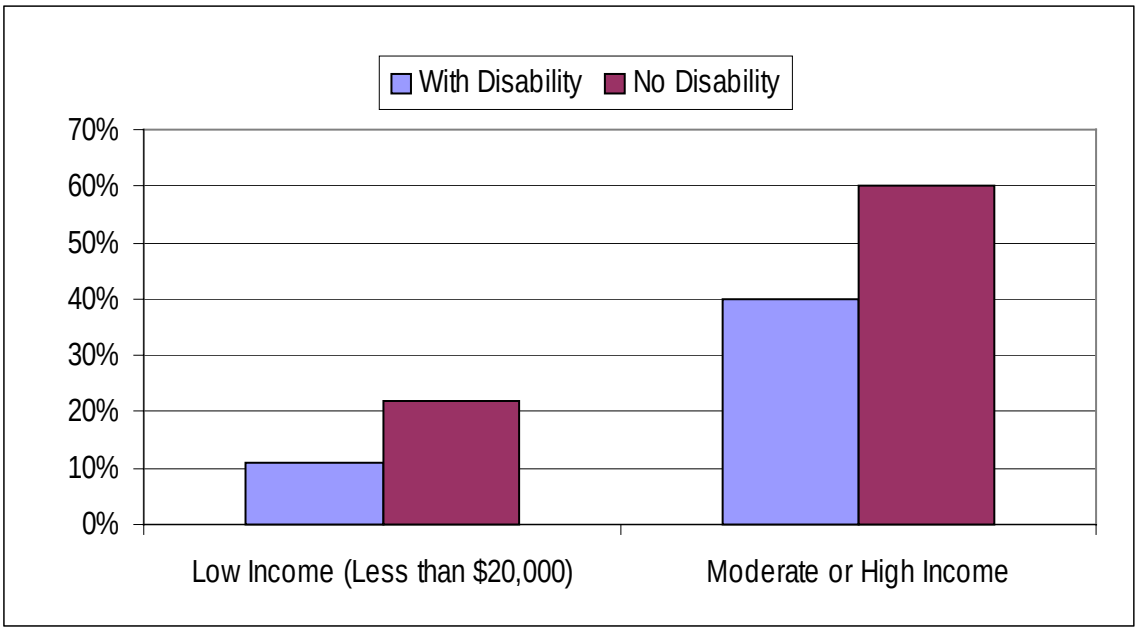
[138] U.S. Department of Commerce, "A Nation Online: Entering the Broadband Age," September 2004, Appendix Figure 1.

[139] Ibid.

[140] Disability Watch: The Status of People with Disabilities in the United States, Volume 2, 2001, p. 87.

As the following chart illustrates, cost appears to be the primary barrier to bridging the technology gap between the disabled and non-disabled communities. With lower average incomes, 11% of low-income people with disabilities use computers, compared to 22% of other low-income persons .[141] Computer use increases at higher income levels for persons with and without disabilities.[142]

Figure 8.3
Computer Use by Household Income



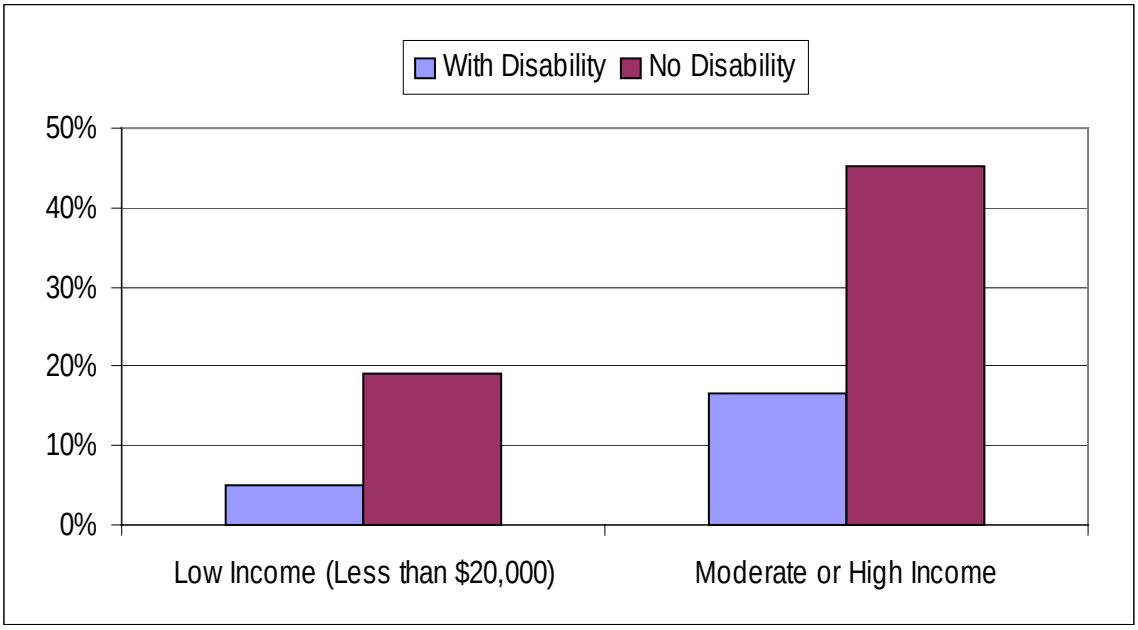
The rate of Internet use among low-income people with disabilities is only 5%, while the rate for those with higher incomes is more than three times higher, at 17%. Persons with no disability use the Internet at 19% and 45%, respectively, for low income and moderate or high income households.[143]

[141] In California, the median household income for people without disabilities is $29,339 while the median income for people with disabilities is $16,534. Andrew J. Houtenville, Adam F. Adler, Cornell University, "Economics of Disability Research Report No. 4," Figure No. 8, April 2001.

[142] Ibid.

[143] Disability Watch, p. 90.

Figure 8.4
Internet Use by Household Income



8.2 Rural Areas

Although the U.S. Commerce Department data cited in Figure 8.4 above fails to illustrate a significant difference in Internet use between rural and urban residents, other studies such as the Pew Internet & American Life Project's "Rural Areas and the Internet"[144] do cite a significant difference, as shown in Figure 8.5 below.

Figure 8.5
Internet Penetration by Community Type[145]

	2000	2003
Rural	41%	52%
Urban	51%	67%

While Internet access has grown in rural areas between 2000 and 2003, urban access has grown as well, with the disparity between the two increasing from 10% to 15% in those three years.

8.3 Lower Income Individuals

Despite the trend toward lower prices, computers and Internet access remain more expensive than many low-income individuals can afford. The following table shows Internet access by urban households with incomes of less than $30,000 to range

[144] Pew Internet & American Life Project, "Rural Areas and the Internet," February 2004.
[145] Ibid., p. 8.

between 38% and 54%, while urban households with incomes above $30,000 range from 70% to 93% Internet access. Internet access is lower for rural populations than urban populations at almost all income levels, with the difference being generally greater at lower income levels and fairly low at higher income levels.[146]

Figure 8.6
Percentage Urban/Rural Internet Penetration by Household Income[147]

	Under $10K	$10K – $20K	$20K – $30K	$30K – $40K	$40K – $50K	$50K – $75K	$75K – $100K	$100K and Greater
Urban	38%	52%	54%	70%	79%	83%	93%	90%
Rural	19%	35%	39%	66%	73%	76%	85%	89%
Difference: Urban vs. Rural	19%	17%	16%	4%	6%	7%	8%	1%

8.3.1 A California-Specific Study

The Center for Justice, Tolerance and Community at the University of California Santa Cruz has worked to quantify and analyze the "digital divide" in California, and recently published its work in a report entitled "A Nation Offline? Research on the Digital Divide."[148]

The report found that an increasing number of California households have computers, are accessing the internet, and are using broadband to access the internet. By 2003, over 66% of California households had computers, almost all households with computers had access to the internet, and close to half of all households with computers had access to broadband.[149]

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[146] Ibid., p. 34.

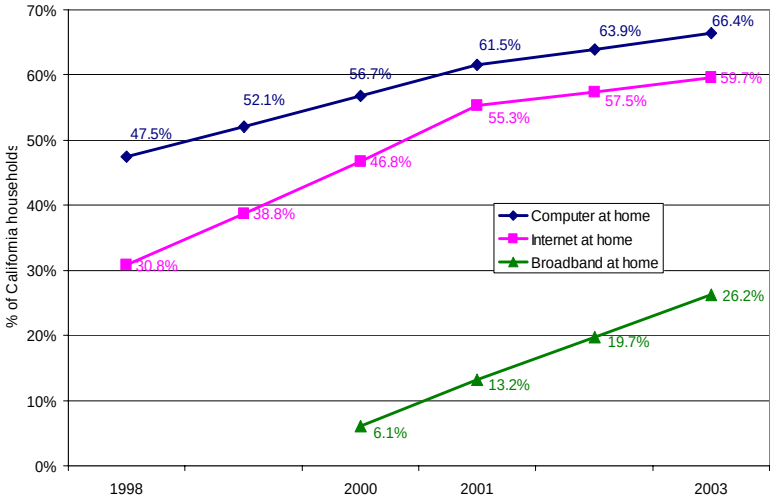
[147] Ibid.

[148] Rob Fairlie, Rebecca London, Manuel Pastor, Rachel Rosner, "A Nation Offline? Research on the Digital Divide," Center for Justice, Tolerance & Community, University of California Santa Cruz, 2003; www.cjtc.ucsc.edu;digitaldivide.html.

[149] Ibid.

Figure 8.7

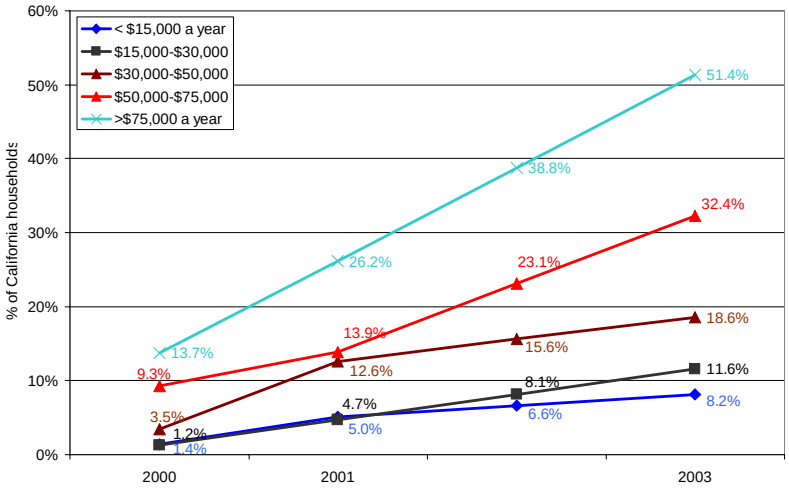
Percent of California Households with Computers and Internet Connections, 1998-2003



The report found a strong correlation between household income and broadband. In 2003, California households with annual income of over $75,000 were more than six times as likely to have broadband connectivity than households with annual income of less than $15,000.[150]

Figure 8.8

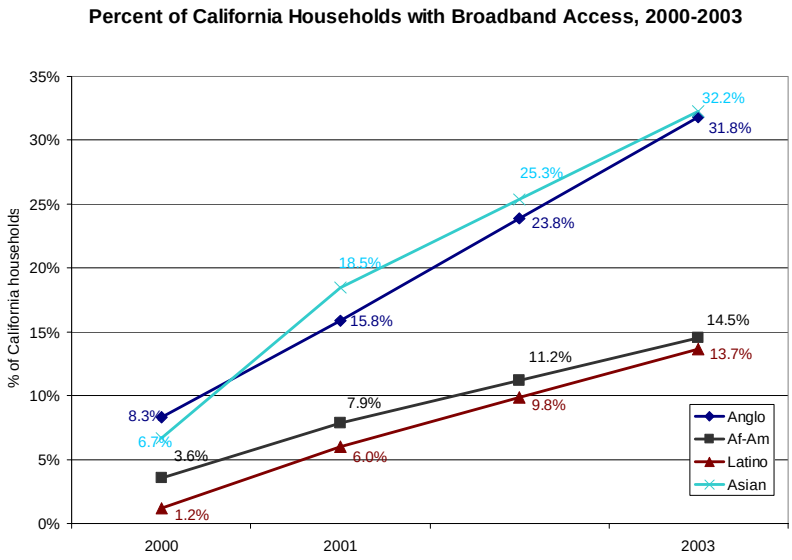
Percent of California Households with Broadband, 2000-2003



[150] Ibid.

The report also examined broadband penetration rates based on ethnicity, and found that Anglo and Asian households in California were more than twice as likely to have broadband than African-American and Latino households (as shown in Figure 8.9 below).[151]

Figure 8.9

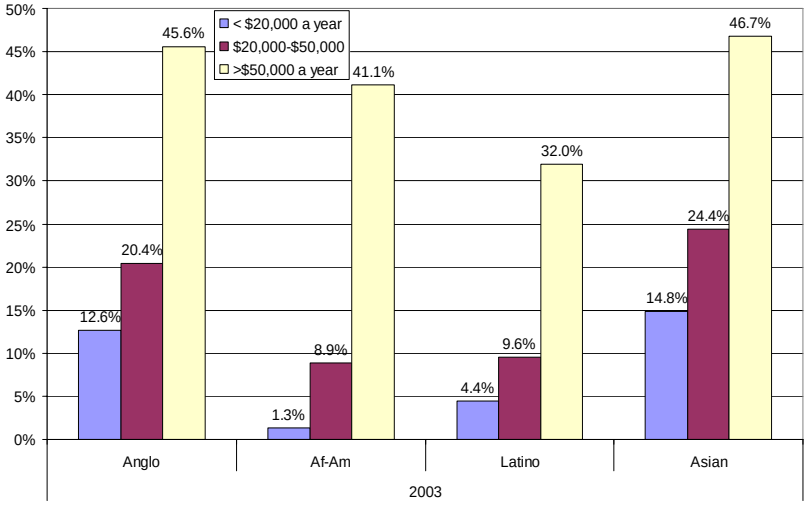


[151] Ibid.

The report then examined the existence of broadband in California households in 2003 by both annual income and ethnicity. It found that households with annual incomes of over $50,000 were the most likely to have broadband connectivity, and households with annual incomes of less than $20,000 were the least likely to have broadband, regardless of ethnicity. The report did find, however, that disparities existed within the three household income groups based on ethnicity.[152]

Figure 8.10

California Home Broadband by Ethnicity and Income



[152] Ibid.

Chapter 9. Opportunities and Costs Associated with More Broadband Use

SB 1563 reinforced the Legislature's commitment to universal service and adopted a policy based on the belief that the State will benefit from increased deployment of and use of broadband services. PU Code §709 identifies these two policies:

- To continue our universal service commitment by assuring the continued affordability and widespread availability of high-quality telecommunications services to all Californians.
- To promote economic growth, job creation, and the substantial social benefits that will result from the rapid implementation of advanced information and communications technologies by adequate long-term investment in the necessary infrastructure.

In response to that policy, we first estimate the cost of achieving ubiquitous broadband deployment. The CPUC submitted a report to the Legislature in August 2002 that included an analysis of the costs associated with subsidizing broadband internet access service.[153] The CPUC stands by the analysis contained in the 2002 report and summarized below.[154] However, we provide an update to the 2002 analysis to compare against the 2002 report's findings. Next, we identify the issue as "(w)hether and how identified technologies may promote economic growth, job creation and social benefits."[155] This chapter explores the benefits of increased broadband deployment and broadband use. Specifically, we address the question set forth in the rulemaking. First, we look at economic benefits including impacts on job creation. We then separately look at the social benefits of broadband use and how the technology can make a difference in people's lives.

9.1 The Cost of Ubiquitous Broadband Deployment

9.1.1 The Cost of Investing In Broadband Infrastructure

Significant economic gains from broadband deployment will occur as a result of capital investment resources, including the support of telecom firms and the job growth necessary to support the goals of the investment effort. However, measuring the true effect depends on projections of the total investment necessary to develop a statewide or nation-wide ubiquitous broadband network. Our research found estimates stating that the required investment for DSL or cable modem ranged from $700 to $1,300 per line.[156] Similarly we found that the costs for Fiber to the Home (FTTH) range from $1,500 to $2,200 per line or home passed.[157]

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[153] "Broadband Services as a Component of Basic Telephone Service", CPUC report in response to SB 1712, August 2002.

[154] Administrative Law Judge's Ruling Scheduling Prehearing Conference and Summarizing Issues, August 8, 2003.

[155] Rulemaking at 6.

[156] G. Kim "No Demise for DSL" Fat Pipe Online, http://www.fatpipeonline.com/archives/aug2001dsl.asp. Aug 2001. From NCTA website,

We can expect the cost of connections to decrease due to the declining costs for telecommunication equipment as well as the economies of scale that will be achieved as more customers subscribe to broadband service.

9.1.2 The 2002 Report Concluded That a Broadband Subsidy Program Would Be Costly to Ratepayers

Listed below are the major findings of the CPUC's 2002 Broadband Report:

1. The cost of upgrading all of California's phone lines to provide ubiquitous DSL broadband access would be $5.3 billion over a 5-year period.

2. If basic service was redefined to include DSL, for purposes of universal service subsidies, monthly rates for a voice and DSL bundle would increase 276% to 552% depending on the number of years over which the fixed cost of plant upgrades are spread.

3. The2002 Report estimated the cost of adding DSL broadband subsidies to the ULTS program would be an increase of 249% from $282 million to $983 million a year.[158]

We recognized that the costs to upgrade existing phone lines today could be less than in 2002 because there are fewer lines to upgrade and the costs to upgrade have decreased. To update the analysis presented in our 2002 Report, we performed an analysis to estimate the total cost to achieve ubiquitous broadband use. Our updated analysis is based on the current number of households who do not subscribe to broadband service and the cost is based on updated cost data for DSL costs per line. From this analysis, we estimate that it would cost the state between $4.8 and $8.5 billion to achieve ubiquitous DSL broadband deployment.[159] The 2002 Report's estimate of $5.3 billion falls within this range.

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http://www.ncta.com/Docs/PageContent.cfm?pageID=37 The cable costs were based on self-reports from the industry and reflect past investment through 2003. The DSL figures reflect costs necessary to retrofit all United States copper plant. [156] R. Crandall, C. Jackson, H. Singer (2003). "The Effects of Ubiquitous Broadband Adoption On Investment, Jobs and the US Economy" http://www.newmillenniumresearch.org/archive/bbstudyreport_091703.pdf Criterion Economics, LLC. Sept. 2003. Per line figures calculated by author using data from http://quickfacts.census.gov/qfd/states/00000.html

[157] R. Crandall, C. Jackson, H. Singer (2003). "The Effects of Ubiquitous Broadband Adoption On Investment, Jobs and the US Economy" http://www.newmillenniumresearch.org/archive/bbstudyreport_091703.pdf Criterion Economics, LLC. Sept. 2003. Larry Magid, "Companies Look to Juice up Internet", Palo Alto Daily News, July 15, 2004. Staff found some variation in these amounts. See Chapter 2 of this report

[158] "Appendix F to Broadband Services as a Component of Basic Telephone Service," CPUC Report in response to SB 1712, August 2002.

[159] Though we did not update the analysis from the 2002 report, we conclude that including DSL service as part of basic service would still result in a significant rate increase for the average ratepayer.

9.1.3 The Widespread Availability of Broadband and VoIP May Increase the Costs of Basic Telephone Service

An infrequently mentioned aspect of widespread broadband and VoIP use is the potential for increases in the costs of basic telephone service, even for those who do not or cannot use broadband. As a result of recent FCC decisions, states are pre-empted from the regulation of IP telephony. The use of VoIP services, which are dependant on broadband connections, may someday replace significant portions of the traditional telephony base. The fact that VoIP use has been declared an interstate telecommunications service means that state programs such as the California Teleconnect Fund, the Deaf and Disabled Telecommunications Program, and the high cost funds are increasingly becoming under-funded. The Telecommunications Division reported the costs of VoIP to the state's public programs may be as high as $407 million per year as soon as 2008.

9.2 Economic Benefits of Broadband Networks

There are significant potential benefits to a build-out of broadband infrastructure, particularly development of robust next-generation networks. The initial development and deployment of the network leads to the infusion of capital into the economy in addition to adding the jobs necessary to build the network and associated devices. After the network has been built, additional job growth may occur in service companies that will utilize that network.[160] Some people suggest that the development and use of new networks can allow for increased productivity gains and general development of the economy. However, we were unable to find evidence to support this claim.

9.2.1 Effect on Employment

A strong impetus for a focus on direct infrastructure investment is the effect that investment will have on jobs in a localized area. Infrastructure investment is a catalyst for economic development since it transforms upstream products into a form that can be used by downstream providers to fuel the economy. In the case of broadband infrastructure, a wide deployment of systems will have the direct effect of employing thousands of people to build and support the infrastructure, as well as purchasing the communications equipment and lines. The result is an effectual up-flow of money from the infrastructure to fiber and equipment manufacturers, who in turn must increase production and employment in order to provide the necessary volume of materials for the infrastructure development project.

One of the more popular claims regarding the development of infrastructure is that it will lead to significant new jobs for the California and American economies. Figure 9.1 outlines the categories of firms who will see benefits from investment as well as the types of jobs that will be created by large infrastructure investments.

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[160] In addition to the development jobs which will be mostly retained for maintenance purposes.

Figure 9.1
Jobs and Infrastructure Investment

Firm Type	Money Source	Jobs Created	Relationship
Infrastructure Developer	Investors and prior profits	Construction and telecom – to build and maintain networks	Direct
Equipment and Parts Suppliers	Infrastructure Developer	Design and manufacturing – to supply orders[161]	Indirect
Providers of Goods and Services	Employees of other firms	Mostly service – to help other employees spend their money[162]	Indirect
Firms utilizing Infrastructure	Other Investors	Unknown – Any type	New Products/Services[163]

9.2.2 A Summary of Job Development Studies

Only a few studies have examined the issue of job development resulting from greater broadband investments, although there are numerous reports and press releases that refer to them. Each assumes that some jobs in each of the four Firm Types will be created. It is important to note that all of the numbers in these studies are projections. These projections are more susceptible to error the further the relation of the job to the activity of actually deployment broadband infrastructure. Thus the estimates of construction and telecom jobs are the most accurate. Figure 9.2 provides a summary of the claims made in three relevant reports.

Figure 9.2
Studies of Job Growth Due to Broadband Deployment
(Sources listed, figures may be adjusted)[164]

Author	Jobs in US	Jobs in CA	Direct	Indirect
TeleNomic Research, 2002[165]	820,000 (1.2 million)	100,000[166]	200,000 (238,000)	620,000 (974,000)

[161] Assuming that excess capacity for manufacturing does not already exist in these companies. It is hard to judge, but following the 2001 recession, it is likely that some excess capacity exists, but cannot be quantified.

[162] Again assuming that excess capacity to provide goods and services does not already exist.

[163] There is no direct effect between the influx of infrastructure investment and jobs created in these types of firms. While the jobs created in other firms rely on the infrastructure, the number of jobs created is closely tied to the fortunes and investors in these other firms.

[164] The numbers in parenthesis represent the studies' findings. The amounts that are underlined are our estimates which take into account the flaws in the studies.

[165] S. Pociask (2002) "Building a Nationwide Broadband Network: Speeding Job Growth." TeleNomic Research, LLC. http://www.newmillenniumresearch.org/event-02-25-2002/jobspaper.pdf. 25 February 2002. The published report cites a figure of 1.2 million jobs.

Critereon Economics, 2003[167]	(824,000)[168]	103,000[169]	(140,000-180,000)	(664,000)
Gartner Consulting, 2003	(2 million)[170]	500,000 – 750,000[171] (2 million)	N/A	N/A

9.2.3 Increased Broadband Deployment May Result in a Job Increase

We found flaws in all three of the studies presented in Figure 9.2. The following bullet points summarize our concerns with the three studies.

- From 1996 to 2001, 588,000 telecommunications jobs were created, nationwide. This timeframe represents years with high growth in the telecommunications market.
- From 1996 to 2004, only 194,000 jobs were created, nationwide, representing a net loss of 394,000 jobs. [172]
- The TeleNomic Research Study did not properly use an "employment multiplier effect" to come up with job creation estimates.
- The TeleNomic Research Study assumes that jobs in the equipment market will all be filled in the United States.
- The Criterion study assumes rapid adoption of broadband technology to support is job creation estimates.[173]
- The Gartner report does not document the methodology used to calculate its job creation estimates.

However, as discussed later in the paper, the calculations used were incorrect, and a revised figure is presented.

[166] California's portions of the 820,000 jobs based on California's share of population and GDP.

[167] R. Crandall, C. Jackson, H. Singer (2003). "The Effects of Ubiquitous Broadband Adoption On Investment, Jobs and the US Economy" The authors present a under which full deployment and adaption of broadband technologies would occur by 2013 instead of the original assumption of 2021, resulting in the creation of 1.2 million jobs. http://www.newmillenniumresearch.org/archive/bbstudyreport_091703.pdf Criterion Economics, LLC. Sept. 2003.

[168] 664,000 + (140,000 +180,000)/2=824,000.

[169] This amount is calculated by taking the average of 10% of 824,000 and 15% of 824,000.

[170] A graphFigure published in the report claims that by 2010, "20 Million Jobs [will be] added". Gartner Report , Figure 7 "Total Jobs Added" on page 23.

[171]Based on the Gartner's prediction that significant broadband adoption will result in $376 billion in additional GSP, Staff calculated this range of job growth by dividing the GSP by average wages for telecommunication workers.

[172] Bureau of Labor Statistics, http://www.bls.gov

[173] The study assumes full deployment and adoption of broadband technologies would occur by 2013 instead of the original assumption of 2021.

Staff's estimates, which are the underlined numbers in Figure 9.2, were calculated by adjusting the job numbers to account for errors or lack of support for an individual estimate. Our results present a conservative estimate of job creation if California were to embark on a campaign to deploy or upgrade existing broadband infrastructure.

9.3 The Benefits of Broadband Access

Access to and use of broadband Internet access enriches people's lives and simplifies both government and business transactions. SB 1563 assumes that a "digital divide" exists between those who have access to advanced communications services and those who do not. While our findings suggest that the divide is decreasing, reliance on market forces alone may result in some communities not realizing the benefits of this technology. In this section, we describe the difference between dial up and broadband access and explain why we conclude that broadband is not just for fast downloads. We then present the benefits of broadband access by describing the functions and activities that are possible.

9.3.1 Broadband Provides More Than Faster Downloads

Broadband internet connections provide the user with faster downloads of information. A broadband connection greatly impacts the functionality and type of use of the Internet. More and more applications require a broadband connection to the Internet. Broadband allows uses to be creators and managers of online content as well as satisfy a wide range of queries for information.[174]

9.3.2 Community Technology Centers Benefit from Broadband Access, but Lack Access to DSL via the CTF

There are hundreds of Community Technology Centers in California run by non-profit organizations. Some of these organizations offered their views about the benefits and success of those centers. All of these organizations claim that without broadband access, the centers are not as effective. Cost was listed as a major factor in broadband deployment for respondents of the broadband surveys, which supports a need to provide DSL via the CTF in compliance with statute. It was reported that public computer center use is significantly lower in centers that only offer dial-up access.[175] Dial up connections result in long waits for access to a computer and frustrate users because of the time it takes to access information. A detailed summary of the surveys conducted in support of this report is available at http://www.cpuc.ca.gov/bbsurvey/ for public review.

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[174] "The Broadband Difference" *How online Americans' behavior changes with high-speed Internet connections at home,* John B. Horrigan and Lee Rainie, Pew Internet & American Life Project.

[175] CPUC Public Meeting, February 10, 2004.

9.3.3 Most Telemedicine Applications Require a Broadband Connection[176]

Telemedicine is the use of communication networks to transmit medical information and data to enable the medical industry to diagnosis and treat various medical conditions. Though there may be some telemedicine applications that work over a dial up connection such as email, most applications require a broadband connection. These applications include access to medical images and other test results, connecting remote medical clinics to each other and to larger medical facilities and videoconferencing for remote consultations. The efficient functioning of telemedicine applications is of particular concern to rural healthcare organizations because it can provide high quality care in places where none is available.

9.3.4 Home Broadband Access Is Preferred over Public Access

Our inquiry found that while public access centers play an important role of providing exposure and training regarding computers and the internet, they are not enough to bridge the gap between occasional and regular users. Those that attended our community meetings suggested that home access provides a greater potential for increasing use of broadband service as users become more familiar with the technology and can be spontaneous with their use of the service to do research or arrange a transaction. This is an important observation given the fact that demand for broadband access remains fairly low. Exposure to the technology is necessary in order for people to value the service.

9.3.5 Many in Our Disabled Population Would Benefit from Broadband Access

Internet access provides significant benefits to the disabled community as many are home bound or have increased challenges to transportation. Disabled people can use the Internet to do research that would otherwise require a trip to the library, order groceries, look for work or make social connections. Though these activities do not require a broadband connection, there are services for the disabled that do. Through broadband, it is possible for the user to have computer speech recognition, speech synthesis and other applications that require a high speed connection to allow for the interactivity requirements of these communications.

9.4 Conclusions

The cost of providing broadband service to every household in California would cost the State at least $5 billion to achieve. There is no definitive evidence of job creation as a result of further broadband deployment. However, we would expect some jobs to be created. We caution against some of the higher estimates presented in recent studies.

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[176] Many of the respondents to our Second Survey were rural healthcare providers. These respondents offered examples of telemedicine applications that cannot be run over a dial-up internet connection.

However, it would be reasonable to expect 100,000 to 200,000 new jobs if a program to deploy broadband were adopted or if private industry increased their investment in California. Finally, broadband is more than just fast downloads. Public Access Centers, medical clinics and the disabled communities benefit from access to broadband service.

Chapter 10. Costs and Opportunities of Broadband Technologies

This chapter addresses PU Code §709's policy, to encourage the development and deployment of new technologies and the equitable provision of services in a way that efficiently meets consumer need and encourages the ubiquitous availability of a wide choice of state-of-the-art services. Understanding what is happening with broadband technology is critical information for the State to have before it embarks on a program to address ubiquitous broadband availability. We discuss whether new technologies or the cost of existing technologies have changed in ways that would make them more economical to deploy. Figure 10.1 summarizes the major findings from that analysis.

In general, we found that there are intensive industry efforts underway to improve existing technologies (such as DSL and satellite) and to develop new technologies like Broadband over Power Lines (BPL) and Fiber to the Premise (FTTP). We observed differences in the technologies with respect to cost and price, but also to the suitability of a particular technology to an area, such as rural or urban, or to an application or consumer preference, such as mobility or bandwidth.

Figure 10.1
Broadband Technologies

	What is it?	Strength	Weakness	Cost	Price [177]
DSL	Broadband service that uses the same phone line for voice service.	Widely available and inexpensive. The leading broadband service in California.	Limited future bandwidth potential and service distance (<18,000 ft.)	Overall, costs have gone down due to economy of scale associated with widespread deployment and equipment standardization.	$14.95 | $79.95
Cable Modem	Broadband service that uses the same coaxial cable for cable TV service.	Widely available and inexpensive. The leading broadband service in the nation.	Limited future bandwidth potential. Not deployed to business customers	Overall, costs have gone down due to economy of scale associated with widespread deployment and equipment standardization.	$19.95 | $49.95
Wireless LAN (Wi-Fi)	Wireless broadband technology.	Low deployment cost from using free radio spectrum and standardized equipments. Backing from heavyweight such as Intel.	Limited bandwidth (usually under 1 Mbps), and range (300-ft outdoor, much less indoor.)	Costs are declining through economy of scale as more and more people deploy Wi-Fi for both broadband access and wireless networking.	$19.59 | $99.99
Wireless	A new generation of wireless	Range (up to 30 miles from antennae)	Standards still to be finalized.	Still unclear. However, as deployment	N/A

[177] * Broadband pricing can vary greatly dependant on a variety of factors: length of contract, speed, equipments (rent or buy), promotional period and bundling with other services (phone and cable TV.)

Figure 10.1 Broadband Technologies					
	What is it?	**Strength**	**Weakness**	**Cost**	**Price** [177]
MAN (WiMax)	broadband, offering greater bandwidth and range.	and bandwidth (up to 70 Mbps). Also uses free spectrum and has backing from Intel.	Lack of adequate free radio spectrum.	becomes more widespread, cost should come down through standardization and economy of scale.	
Fiber-to-the-Premises (FTTP)	Broadband service delivered through fiber optic cable. FTTP is viewed by ILECs as the successor to DSL.	Great bandwidth potential (up to 2 Gbps.) Can offer a "triple play" bundle of voice, data and TV services.	Expensive to deploy, especially for upgrading underground line in existing neighborhoods (high trenching and excavation costs.)	Current deployment cost of $1,600 per home is expected to decline significantly from wider FTTP deployment.	$34.95 | $49.95
Satellite	Broadband service delivered through geostationary satellites.	Covers virtually every corner of the nation that has a direct view of the southern sky.	Limited bandwidth. Providers often limit total amount of data download per month. Difficult and expensive to add capacity (launching new satellite.)	Cost has come down due to higher bandwidth capacity of new satellites.	$49.59 | $99.99
Broadband over Powerline (BPL)	Broadband service delivered through the electric grid.	Low deployment cost since it uses the existing electric grid, which has higher penetration rate than telephone and cable TV.	Still in development/trial stage. Interferences to and generated from BPL is a large potential hurdle to widespread deployment.	Unclear at this time. Widespread deployment should bring down deployment cost.	$27.00 | $49.95

10.1 Technology Costs Are Declining

The costs of all of the technologies presented in Figure 10.1 are already decreasing or will decrease soon as the technology becomes more widely deployed. With wider deployment, companies can achieve economies of scale that result in reduced equipment costs. In addition, members of the industry have been working together to develop standards for the newer technologies which should eventually result in lower equipment costs. FTTP is the most expensive technology but is also the most promising in terms of bandwidth capabilities. We expect FTTP costs to come down as the

technology is more widely deployed. Satellite costs have come down due to technology improvements. BPL, though very new and just being deployed, is less costly than FTTP, in part because it piggy-backs over existing infrastructure. Though many uncertainties remain, we expect BPL, if technically capable, to be a fairly low cost method of providing broadband access.

10.1.1 Developing Technologies Could Result in Increased Deployment and Customer Choice

Broadband providers will deploy facilities where it makes economic sense to do so. The factors that enter that decision are the investment costs, including the legal costs associated with permitting and CEQA review, and the expected revenue from services provided over those facilities. Regulatory rules may also impact investment. The ILECs claim that they will not invest in advanced service facilities if they are required to provide access to those facilities under the terms of the 1996 Telecommunications Act. The cable industry alludes to the same argument. Competitors to the ILECs and the cable industry argue that requiring access to next generation facilities will result in more choice for consumers, lower prices, and increased investment from the incumbent providers as well as competitors. There is evidence to support the competitor's claims, as we discuss in Chapter 4.

10.1.2 Conclusion

Our research found that costs are declining as economies of scale are reached with the resultant savings in equipment costs. The industries efforts to standardize technologies should also result in cost reductions. Further deployment should occur, beginning in areas that are the most lucrative in terms of potential profit. Lower costs should translate into lower prices as long as consumers have a choice amongst providers. As outlined in Map II, many Californians do live in areas with multiple broadband providers. The amount of choice and the number of consumers who have a choice should increase if technologies continue to develop as they have done thus far.

Chapter 11. Recommendations

California leads the nation with the largest number of broadband subscribers nationwide. The cost to invest in broadband infrastructure remains high, particularly for certain technologies, but progress is being made that should result in lower deployment costs. Nonetheless, there is evidence of a "digital divide" and the State could engage in efforts to address the barriers to broadband deployment and use.

We recommend that the State adopt a plan that encourages investment and offers opportunities for people to become oriented to the benefits of broadband access so that more California citizens are connected to this important information network. The CPUC should continue its efforts to implement PU Code §709 and the Telecommunications Act of 1996 and to encourage both inter-modal and intra-modal competition. The more alternatives available to subscribers, the more likely consumers will experience lower prices and good service quality. Finally, California needs to do a better job of informing its citizens, including corporate entities, about the subsidies available through the CTF and the various Federal programs, as well as do a better job of coordinating California's programs with Federal programs.

11.1 Changes to ROW Laws

We recommend that the Legislature, in consultation with local governments and broadband providers, consider changes to California Government Code Section 50030 to establish:

- Standardized time frames for municipalities to process applications for access to the ROW.
- Consider changes to the statute to insure that local governments are only seeking cost based ROW fees.
- A standardized ROW permit application form for all municipalities.

The CPUC will consult with cities and providers to determine if there may be a role for this agency with respect to resolving ROW disputes. Regardless of the outcome of these consultations, the CPUC will amend its orders to clarify the CPUC's role over ROW disputes.

11.2 CEQA Reform

We will conclude our rulemaking R.00-02-003 to accomplish the following:

- Establish standardized and consistent rules as to whom, where, and when CEQA reviews are required.
- Develop requirements for CEQA review that are dependent on the type of project being undertaken not the type of carrier undertaking the project.
- Standardize the rules that determine the type of project subject to CEQA review.
- Application of CEQA rules to all carriers in an consistent manner

11.3 CTF Implementation

The CPUC must enforce legislative mandate and its own decisions to make DSL available to California's schools, libraries, healthcare facilities and community based organizations via the

California Teleconnect Fund. Carrier's unwillingness to provide this needed subsidy should not be tolerated.

11.4 Encourage Inter-modal and Intra-modal Competition

The Legislature should modify California Code Section 53066.3(d) to:

- Recognize Open Video System (OVS) for competitive cable franchises and remove the requirement that OVS competitors to the incumbent cable provider must build out to serve the same geographic area as the incumbent;
- Require similar but not the same public educational and governmental access requirements; and
- Retain requirements that the competitive franchisee deploy its services within a reasonable time and in a sequence that does not discriminate against lower income or minority residents.

The CPUC should continue its efforts to facilitate competition as follows:

- Continue its proceedings to implement PU Code §709 and §251 and §252 of the 1996 Telecommunications Act;
- Advocate before the courts and the FCC for a continuation of competitive polices such as line sharing and access to the incumbents' network for all common carrier providers;
- Support efforts by the FCC to address spectrum issues that will enable wireless broadband to become a competitive alternative to DSL and cable modem; and
- Support efforts by the FCC to promote Broadband Over Power Lines so that this technology can become a viable alternative to DSL, cable modem and wireless broadband services.

11.5 The CPUC Should Modify the CTF Program to:

- Require those schools and libraries, who are CTF beneficiaries, to participate in the E-Rate Program or adjust the CTF discount by a fixed percentage (E-Rate proxy) to ensure the CTF program is not unduly burdened because federal subsidies are not being fully utilized by eligible entities; and
- Move forward with plans to publicize the CTF.
- The CPUC should immediately act to enforce prior CPUC decision and legislative mandate that DSL be provided via the CTF.

The CPUC should lead efforts before the FCC and the United States Department of Agriculture to ensure that eligible entities receive federal funding. Specifically, California may not be receiving all the federal monies that it should because of these agencies definitions of rural. We will work with other interested parties to urge the FCC and the USDA to change their definitions of "rural" so that California's rural communities can take advantage of the considerable amount of funding available under the Rural Utilities Service program.

Appendix A: Glossary

Bandwidth	The amount of data that can be transmitted in a fixed amount of time. For digital devices, the bandwidth is usually expressed in bits per second (bps) or bytes per second. [www.webopedia.com]
Broadband	In general, broadband refers to telecommunication in which a wide band of frequencies is available to transmit information [www.whatis.com]
Broadband over Power Line	Broadband service delivered through the electric grid.
Cable Modem	Broadband service that uses the same coaxial cable for cable TV service.
CEQA	The California Environmental Quality Act: A 1970 California state law that required government agencies to consider, disclose, and where feasible, mitigate the environmental impact of public construction projects. Its scope was later expanded to also include construction by private entities.
CTF	The California Teleconnect Fund: Administered by the CPUC, the CTF program provides a discount of 50% on selected telecommunications services to qualified schools and libraries, municipal, county government or hospital district owned and operated hospitals or health clinics, and community based-organizations offering health care, job training, job placement, and/or educational instruction
CLEC	A CLEC (competitive local exchange carrier) is a company that competes with the already established local telephone business by providing its own network and switching. The term distinguishes new or potential competitors from established LEC and arises from the Telecommunications Act of 1996, which was intended to promote competition among both long-distance and local phone service providers. [www.whatis.com]
Competitive (Cable) Franchise	California law does not allow competition between cable providers unless an additional franchise is granted by the local government. This additional franchise is referred to as a Competitive Franchise.
CPCN	Certificates of Public Convenience and Necessity: Certification from the CPUC required by all telecommunications carriers in order to provide service in the state of California.

CPUC	The California Public Utilities Commission
DDTP	Deaf and Disabled Telephone Program: Administered by the CPUC, the DDTP provides telecommunications equipment for California residents who are deaf, hearing impaired and/or disabled.
Dial-up	Establishing an Internet connection via traditional telephone lines.
DSL	Digital Subscriber Line: Broadband service that uses the same phone line for voice service.
E-Rate	The FCC's E-Rate program offers eligible K-12 schools and libraries a discount of 20% to 90% on select telecommunications services.
FTTP	Fiber to the Premise: Broadband service delivered through fiber optic cable. FTTP is viewed by ILECs as the successor to DSL.
ILEC	An ILEC (Incumbent Local Exchange Carrier) is a telephone company in the U.S. that was providing local service when the Telecommunications Act of 1996 was enacted. ILECs include the former Bell operating companies (BOCs) which were grouped into holding companies known collectively as the RBOCs when the Bell System was broken up by a 1983 consent decree. ILECs are in contradistinction to CLEC. [www.whatis.com]
Inter-modal Competition	Facilities-based competition that relies on competition between different physical networks
Intra-modal Competition	Facilities-based competition on the same type of physical connection
ISP	An ISP (Internet service provider) is a company that provides individuals and other companies access to the Internet and other related services such as Web site building and virtual hosting. [www.whatis.com]
Last-mile	The portion of the cable or telephone company that is wired directly into the customer's home. [www.webopedia.com]
OVS	Open Video System: A new designation called OVS is an alternative to traditional cable television regulation and was created to encourage competition by lessening the regulatory burdens on OVS providers. Most importantly, the OVS designation does not include the same build out requirements that incumbent cable providers have.
RBOC	Regional Bell Operating Companies; comprised of SBC, Verizon, BellSouth and Qwest.

ROW	Rights-of-Way: Defined by California as the "right to exercise reasonable control as to the time, place, and manner in which roads, highways, and waterways are accessed."
RUS	The Rural Utilities Service (RUS) provides grants, incentives, and low-interest financing to electric, communications, water, sewer, telecommunications, and environmental projects.
Satellite Internet	Broadband service delivered through geostationary satellites.
Telecommunications Act of 1996	The Telecommunications Act of 1996, enacted by the U.S. Congress on February 1, 1996, and signed into law by President Bill Clinton on February 8, 1996, provided major changes in laws affecting cable TV, telecommunications, and the Internet. The law's main purpose was to stimulate competition in telecommunication services. The law amends the original Telecommunications Act of 1934. [www.whatis.com]
Telemedicine	Providing medical services to remote locations via telecommunications services, such as video conferencing and broadband.
TRO	Triennial Review Order: In 2003, the FCC released new rules governing the competitive marketplace for broadband technologies as part of their TRO process. The TRO reversed the FCC's "line-sharing" provisions by phasing it out over time and allowing the prices for line sharing access to increase.
ULTS	The Universal Lifeline Telephone Service: The ULTS program provides discounted basic residential telephone services to low-income households, and is funded by a surcharge on all end-user telephone bills.
VoIP	Voice Over Internet Protocol: A category of hardware and software that enables people to use the Internet as the transmission medium for telephone calls by sending voice data in packets using IP rather than by traditional circuit transmissions of the PSTN. One advantage of VoIP is that the telephone calls over the Internet do not incur a surcharge beyond what the user is paying for Internet access, much in the same way that the user doesn't pay for sending individual e-mails over the Internet. [www.webopedia.com]

Appendix B

Right-of-Way Information Session with the CCPUC Telecommunication Division

On February 13, 2004, the Telecommunications Division held a meeting seeking input from municipalities and broadband providers that are affected by ROW issues.

The following are highlight of the comments and recommendations made by attendees at the meeting:

Comments

- No uniformity in process among local government when applying for access to the ROW.
- The CPUC's ROW complaint resolution process needs authority to enforce not only make decision.
- ROW is not a primary concern at this time for most telecommunications carriers.
- The time and effort required by a carrier to enter the market may be positive as it assists to eliminate unnecessary construction.
- Deployment has been successful in CA with current rules.
- No new ROW rules or legislation is needed.
- The interaction between providers and local governments has been positive for the most part.
- Regardless of all other factors revenue remains the primary barrier to deployment.

Recommendations

- The state should Institute a time schedule for the processing of ROW permits.
- City should be allowed to require the coordination of deployment by multiple carriers when possible.
- Local government should be allowed to offer expedited permits for an additional charge.
- State should allow local government to assess a penalty for abandoned fiber/facilities, or include the cost in ROW permitting.
- Cities should be consulted by the CPUC prior to CEQA approval.
- Pole attachment agreements should be limited to 45 days to process.

Appendix C

Florida and Michigan have undertaken efforts to standardize and streamline the ROW process in an effort to encourage broadband deployment within their respective states. Offering greater opportunities for providers to enter the market, Florida and Michigan have realized the necessity to protect the jurisdiction of local government and assure the revenue stream from ROW users to municipalities continues in a fair and efficient manner.

Below are highlights of Michigan and Florida's recent legislation on ROW:

Florida: Simplified Communications Services Tax

- Creates a common base for the assessment of all local taxes and fees on all communications services.
- All communications providers are required to pay the same fees.
- Local government can wave their right to franchise fees in exchange for an increase in local taxes.
- Local governments will set general ordinances for the use of ROW, therefore communications provider will not have to enter into individual use agreements with each local jurisdiction.

Michigan: Metropolitan Extension Telecommunications Rights-Of-Way Oversight Act

- Creates a telecommunications right-of-way oversight authority.
- Coordinates with local governments to collect ROW fees.
- Standardizes ROW permitting and fees.
- Creates a common ROW maintenance fee for all local governments.
- Offers a waiver of the ROW fee to providers in "underserved areas".
- Requires local government to make a decision on ROW application within 45 days.
- Michigan Public Utilities Commission offers an expedited dispute resolution process.