D R A F T
REPORT

Broadband Deployment in California

California Public Utilities Commission
February 1, 2005

Chapter 1. Introduction

Telecommunications is in the midst of a revolution. Technology advances in recent years have changed the way we live, learn, communicate, and do business. Telecommunications has become central to the needs of families, the health of our economy and the vitality of our communities. Today, much of the information in the world is no more than a click away for those in even the most remote areas. Doctors can review medical test results in real time and diagnose patients from 100 miles away, bringing critically needed healthcare to rural communities. Students can take classes and earn degrees from universities on the other side of the continent. Whether you need the latest news or a business license, whether you are hiring a plumber or buying a car, sending family photos, text-messaging a friend or closing a business deal with a company on the other side of the world – advances in telecommunications technologies have brought limitless opportunities and benefits to our lives.

There is one catch. You need sufficient bandwidth to take advantage of these opportunities.

California leads the nation in broadband use, both in terms of total number of broadband lines and U.S. market share, and our growth rate continues to exceed the national average.

California's success to date is based on a wealth of early adopters and tech-savvy businesses. As the broadband market moves beyond its infancy, however, California is falling behind other states in developing policies to continue broadband growth and facilitate deployment of next generation technologies.

In a state-by-state analysis, Silicon Valley's respected coalition of technology company executives, known as TechNet, ranked California 14th in the nation in developing policies that encourage broadband deployment.[1] For the state of California, home of Silicon Valley, to rank only 14th in broadband policies is a serious concern.

If California is to maintain its lead in broadband usage, reach into lower-use communities and lead the way in next-generation technologies, we must adopt next-generation policies that match our quest for progress. Progress will come from relentless innovation not only in technology, but also in policymaking.

This report is the product of a continuing mandate by the California Legislature to identify and eliminate barriers to the ubiquitous availability of advanced telecommunications services in California.

[1] "The State Broadband Index," TechNet (July 17, 2003).

1.1 Legislative Context: Senate Bill 1563

In Senate Bill (SB) 1563, the California Legislature directed the CPUC to develop a plan "for encouraging the widespread use of advanced communications infrastructure." SB 1563 states:

> …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.[2]

SB 1563 advances California's long-standing view that the state will benefit from increased deployment, access and usage of broadband services. California Public Utilities Code Section 709 was subsequently modified to express the SB 1563 policy objectives:

- 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.[3]

1.2 Public Comment Process: OIR 03-04-003

The California Public Utilities Commission (CPUC) opened an Order Initiating Rulemaking (OIR) identifying issues for study and examination consistent with the requirements of SB 1563. In pursuit of this inquiry, the CPUC has solicited written comments from parties and members of the public, conducted public participation workshops, prepared and analyzed results from two surveys on broadband use and related issues, conducted independent research, reviewed current literature and information, and met with affected individuals, community based organizations, businesses and policymakers.

1.3 Definition of Broadband

The first issue identified by the PUC in its investigation is that there is no clear definition of the term "broadband." Many people associate the term "broadband" with a particular speed of transmission or a certain set of services, such as Digital Subscriber Line (DSL) or wireless local area networks (wLANs). However, the term broadband does not refer to a specific speed or service.

Broadband combines connection capacity (bandwidth) and speed. Twenty years ago, anything faster than primary rate Integrated Services Digital Network (ISDN) service, which

[2] SB 1563, codified in Public Utilities Code Section 709.
[3] Public Utilities Code Section 709.

offered speeds of up to 144 kilobits per second (kbps), might have been considered broadband. Over the last six years, as broadband networks based on either DSL or cable modem technologies have been deployed, speeds of 200 kbps and upward are generally regarded as broadband.

Today's "broadband" may be considered narrowband when tomorrow's technologies are deployed and consumer demand for higher bandwidth appears on a large scale.

However, since broadband technologies are advancing rapidly and Internet access speeds are increasing all the time, the definition of broadband also continues to evolve. In the rapidly changing technology environment of the Internet, the definition of broadband is a moving target that is likely to mean different things next year and the year after that. For purposes of this Report, therefore, we identify the "current" state of broadband. Today, the term broadband typically describes Internet connections that range from 384 kbps to 10 megabits per second (Mbps) and higher.

1.3.1 Broadband As Initially Defined by the FCC

In response to congressional mandate,[4] the Federal Communications Commission (FCC) initiated its first inquiry on the state of advanced telecommunications services in 1999 and filed the first Section 706 Report with Congress.[5] In that first Section 706 Report, the FCC defined "broadband" as:

> the capability of supporting, in both the provider-to-consumer (downstream) and the consumer-to-provider (upstream) directions, a speed (in technical terms, "bandwidth") in excess of 200 kbps in the last mile. This rate is approximately four times faster than the Internet access received through a standard phone line at 56 kbps.[6]

The FCC chose 200 kbps because "it is enough to provide the most popular forms of broadband -- to change web pages as fast as one can flip through the pages of a book and to transmit full-motion video."[7] However, a 200 kbps threshold will not support full-frame video and many other imaging and multi-media applications, regardless of the platform.

1.3.2 Other Definitions of Broadband

There are perhaps as many definitions of broadband as there are organizations and countries that have attempted to define it. The Committee on Broadband Last Mile Technology, an expert group assembled by the National Academy of Sciences, called 200 kbps "at best, a lowest common denominator" and added that setting any minimum speed threshold is

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[4] Federal Communications Commission, "Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996," FCC Docket No. 98-146, Second Report, FCC 0-290 (August 21, 2000). Available online at http://www.fcc.gov/Bureaus/Common_Carrier/Orders/2000/fcc00290.pdf

[5] Section 706 reports are the FCC's primary national reporting mechanism on the state of advanced telecommunications services.

[6] Ibid.

[7] Ibid.

"unwise over the long run."[8] The International Telecommunications Union, a global standards-setting body, defined broadband as a "transmission capacity that is faster than primary rate Integrated Services Digital Network (ISDN) at 1.5 or 2.0 mbps.[9] The Organisation for Economic Cooperation and Development, on the other hand, considers downstream access of 256 kbps (with 128 kbps upstream) as broadband.[10]

The Canadian National Broadband Task Force (CNBTF) in formulating its definition of the term "broadband," noted that among the 14 countries that were surveyed, national definitions of the term ranged from as low as 2 mbps to high as 30 mbps. Taking a more functional approach to definition, the CNBTF decided not to define broadband in terms of information transmission rates, but instead defined it as "a high capacity, two-way link between end users and access network suppliers capable of supporting full-motion interactive video applications to all Canadians on terms comparable to those available in urban markets."[11] Based on the technology existing at the time, it concluded that a minimum two-way or symmetrical transmission speed of 1.5 Mbps per individual user was required to meet this standard. In the future, the CNBTF predicted, speeds of up to 4 to 6 Mbps would be required to handle emerging applications such as peer-to-peer video file sharing and video conferencing.[12]

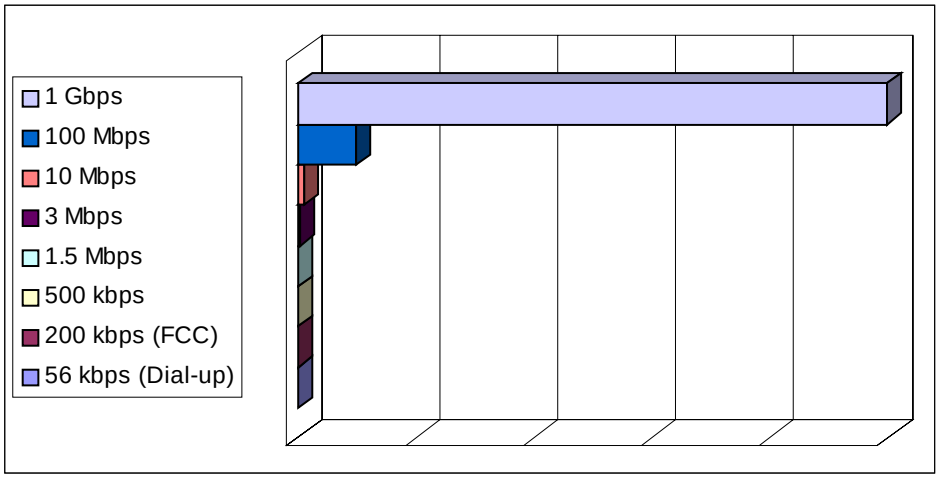
1.3.3 Why the Definition of Broadband Matters

The proliferation of bandwidth-intensive applications is the key driver of broadband adoption. Access to a "pipe" is merely a means of obtaining products and applications such as the Internet, video on demand, news services, interactive gaming, chatting, telephony and countless other services. Policies designed to promote broadband deployment and access to advanced services, therefore, must rely on a definition of broadband facilities that is robust enough to support emerging technologies and applications not yet developed. Policies that promote a limited definition of broadband facilities ultimately discourage broadband adoption by limiting the applications consumers can access.

The following graph provides a comparison of various Internet access speeds, from dial-up modem to high-speed broadband achieved by fiber optic cable.

[8] http://books.nap.edu/html/broadband/ch5.html
[9] http://www.itu.int/home/
[10] http://www.oecd.org/home/
[11] Report of the National Broadband Task Force available at http://www.broadband.gc.ca/Broadbanddocument/report_e.asp.
[12] Ibid.

Figure 1.1
Comparison of Internet Access Speeds



The following table illustrates the capabilities of Internet Access speeds, as well as various other communications delivery systems, to transmit a DVD[13] from New York to California.

Figure 1.2
Speed and Bandwidth[14]

Delivery	Minutes	Hours	Days
UTOPIA Fiber (1 Gbps)	1 min		
UTOPIA Fiber (100 Mbps)	10.4 min		
PON (OC-12/32) (19.4 Mbps)	53.6 min		
VDSL (8.5 Mbps)		2 h 12m	
PON (OC-3/32) (4.84 Mbps)		3 h 36m	
Cable Modem (3 Mbps)		5 h 18m	
FedEx		10 h[15]	
T-1 (1.54 Mbps)		11 h 12m	
DSL (1 Mbps)		16 h 48m	
ISDN (128 kbps)			5 1/2 days
Pony Express			11 days[16]
Dial-up Modem (56 kbps)			13 days

[13] Electronic transmission figures assume a typical 2 hour-long movie.
[14] http://www.utopianet.org/technology/speed.htm
[15] FedEx package delivery from New York, NY 10005 to Beverly Hills, CA 90210.
[16] Extrapolated from record Pony Express delivery time: Lincoln's Inaugural Address, March 4, 1861 carried approximately 2,000 miles from St. Joseph, Missouri to Sacramento, CA in 7 days 17 hours.

Chapter 2. The California Broadband Market

2.1 Broadband is Widely Deployed in California

The analysis that follows is based largely on data reported by carriers to the FCC's semiannual Form 477 survey for June 2004.[17] The FCC data is augmented by independent CPUC research.[18] This data has been compiled into a set of maps (see separate files for Maps 1 through 8).

Map 1 illustrates that broadband is available in every California zip code. All four broadband technologies surveyed in the FCC 477 report (Wireless, DSL, Cable and Satellite) are available in 26% of California zip codes, and 39% of California zip codes have DSL, Cable and Satellite broadband technologies available.

Figure 2.1
Broadband Availability in California Zip Codes

Services	Percentage of Zip Codes
DSL, Cable Modem and Satellite	39
DSL, Cable Modem, Wireless and Satellite	26
DSL and Satellite	19
Satellite only	13
Cable Modem and Satellite	3
Total	100

Map 2 illustrates the wide choice of broadband service providers in California. Areas of the map that are shaded red, which are primarily located in major metropolitan areas, have access to at least 11 (and up to 23) broadband service providers. As shown in Figure 2.2

[17] The FCC Local Competition and Broadband Form 477 data (collected semiannually in December and June) used to prepare the maps and tables presented here is derived from responses from providers having 250 or more customers. The data is provided to state commissions after the FCC publishes its analysis of the data in its Section 706 Report on the Availability of Advanced Telecommunications Capability, generally with a six-month lag. The June 2004 data was the most current available at time this report was prepared. December 2004 data will be available in June 2005. All data was collected by zip code, but does not include the number of customers in each zip code. Consequently, all indications of broadband availability and of the number of providers are understated. On November 12, 2004 in FCC Docket 04-266, the FCC adopted a new Form 477 that, among other things, will require reporting of five speed broadband services categories, ten broadband technology types and will eliminate any minimum customer reporting threshold. This more detailed information should help identify supply and subscribership patterns with greater accuracy and specificity.

[18] Staff researched the availability of cable broadband in California zip codes through a variety of sources, including interviews with providers, public participation meetings, and research. Staff found that cable broadband is available in 313 more California zip codes than FCC data indicates. Staff's coverage calculations also assume that all areas in California with exposure to the Southern sky have access to satellite broadband. See Section 4.3 of the report.

below, two or more broadband providers serve almost every California zip code (93%). A majority of California zip codes are served by four or more broadband providers.

Figure 2.2
Broadband Service Providers in California Zip Codes

Number of Providers	Percentage of Zip Codes
1	7
2-3	35
4-5	10
6-10	17
11-23	31
Total	100

Map 3 illustrates population density in California, with the red areas being those with the most population (100,001 to 3,912,200 people) and green representing those with less than 5,000 people. Viewing this map in conjunction with the two other maps illustrates that multiple broadband providers service the major population areas in California, and that consumers within those zip code areas have multiple broadband providers available to them.

The last map, Map 4, depicts the most current information on WiFi hotspots in California. "WiFi" is the abbreviated term for wireless fidelity, and "WiFi hotspots" are physical locations such as cafes, hotels, and airports where wireless connections to the Internet are offered. Most public WiFi hotspots require paid subscriptions -- hourly, daily or monthly -- for access, although there are a growing number of free hotspots.

There are now more than 50,000 WiFi hotspots around the globe. The number of hotspots around the globe is believed to have increased more than 40% since July 2004 alone - from 35,000 locations just seven months ago[19] - and new hotspots are being developed at a furious pace. The United States leads the world in hotspot availability, having more than 21,000 cities where WiFi hotspots can be found. California leads the country with 3,848 -- more than double New York's 1,546 hotspots. San Francisco ranked ninth among the top ten cities, with 382 hotspots. Other California areas with significant WiFi hotspots are Oakland, Los Angeles, San Jose, Orange County, and San Diego.

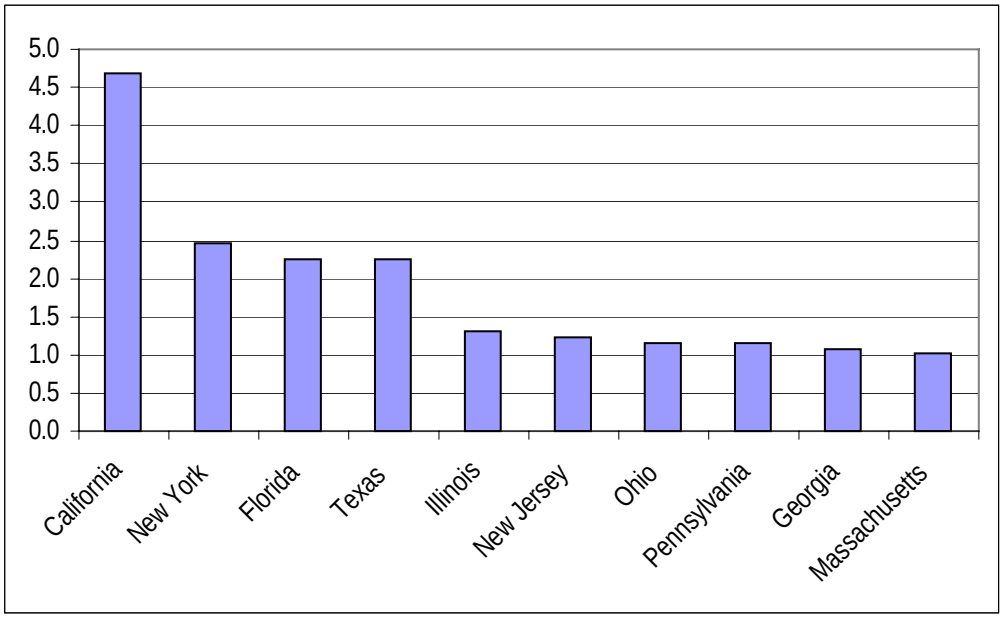
2.2 Broadband Access in California Leads the Nation

California leads the nation in the total number of broadband lines as well as overall national broadband market share. Figure 2.3 below shows the number of broadband lines for the

[19] www.jiwire.com; Sam Diaz, "World is going WiFi – Fast", San Jose Mercury News, January 17, 2005, p. 3E. See Section 4.4 of this report for a detailed discussion of wireless broadband technologies.

ten most populous states in the nation. As of June 2004, California had 4.69 million broadband lines, almost as many as New York and Florida combined.[20]

Figure 2.3
California Leads the Nation in Broadband Lines (in millions)

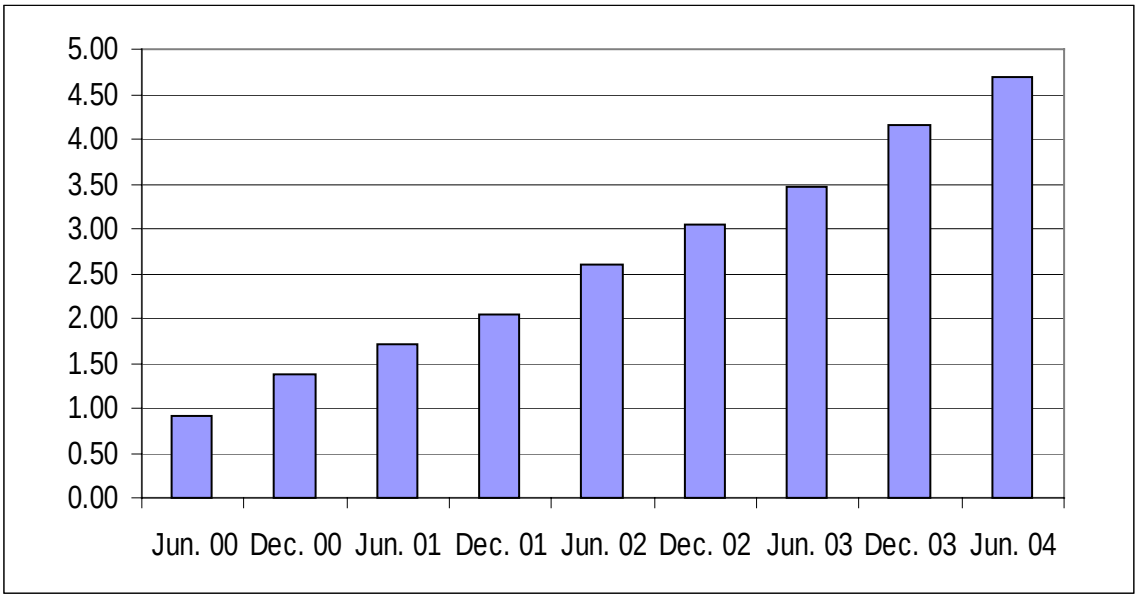


2.3 Rapid Growth In California Broadband Market

From June of 2000 to June of 2004, California's broadband market expanded by 516%, growing from 900,000 to just over 4.69 million broadband lines (See Figure 2.4).

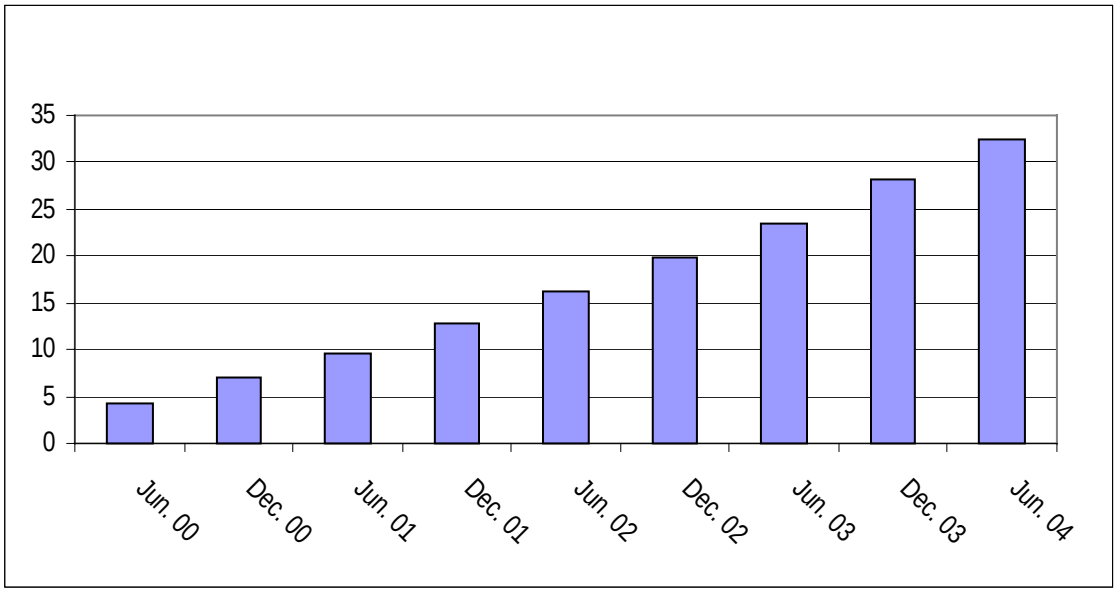
[20] FCC Form 477, December 2004.

Figure 2.4
Growth in Broadband Lines in California (in millions)



During the same 48-month period, the national broadband market grew by 751%, increasing from 4.3 million broadband lines in June 2000 to 32.4 million broadband lines in June 2004.

Figure 2.5
Growth in Broadband Lines Nationwide (in millions)

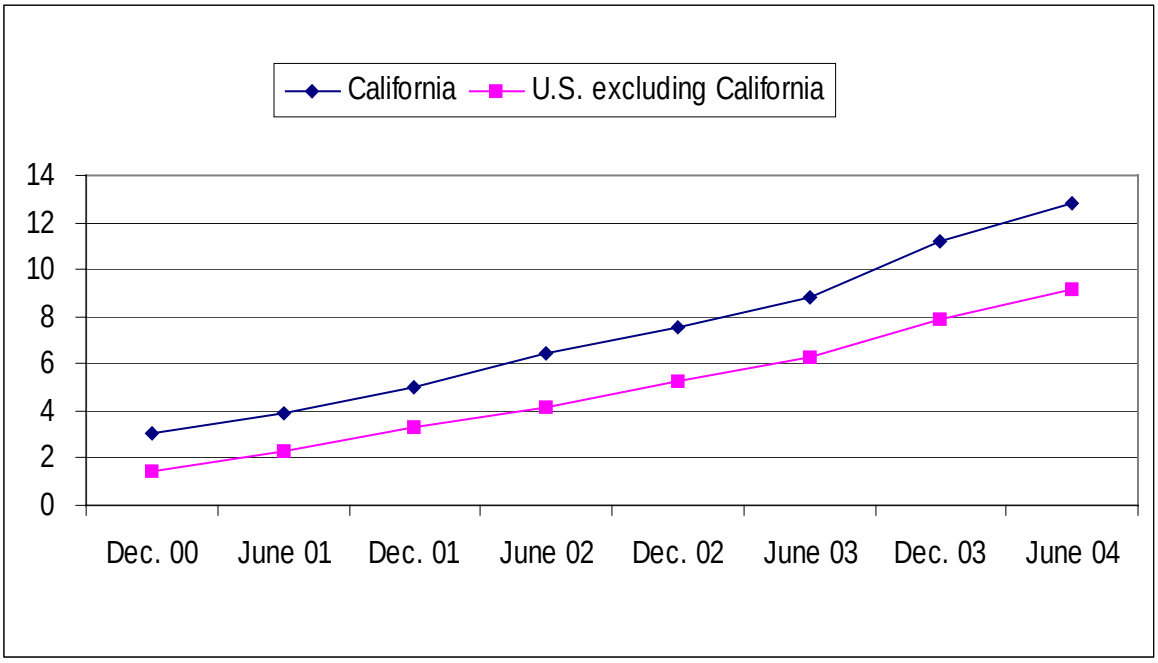


2.4 California Broadband Penetration Lead Continues to Grow

While the rate of growth of the U.S. broadband market exceeded that of the California market (751% vs. 516%), it is important to remember that California was well ahead of the

rest of nation in its broadband penetration rate (3.1 vs. 1.46 broadband lines per 100 persons) in June 2000. California's early market maturation has resulted in a slightly lower rate of growth compared to other states. However, California's lead in broadband penetration compared to other states has continued to grow. In December 2000, California had 1.64 more broadband lines per 100 persons than the average of other states. By June 2004, California's lead had grown to 3.57 more broadband lines per 100 persons than the average of other states.

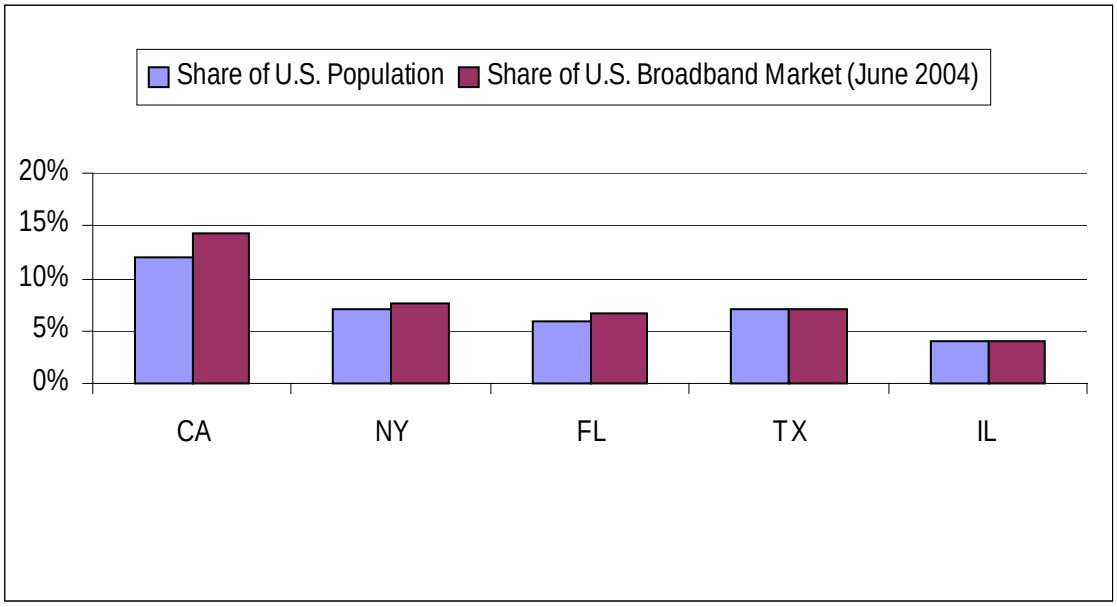
Figure 2.6
Broadband Lines Per 100 Persons



2.5 California's Share of National Broadband Market

California leads all other states in its share of the national broadband market as a percentage of population. The following figure illustrates that California's broadband market is 19% larger than its population would otherwise indicate, with 14% of the national broadband market and 12% of the nation's population. New York's broadband market share is 13% higher than its population share, while Florida's is 19% higher. On the other hand, the Texas and Illinois broadband markets are 5% and 10% smaller, respectively, than their shares of the U.S. population.

Figure 2.7
Share of Population vs. Share of Broadband Market



2.6 Is Broadband Reaching Everyone?

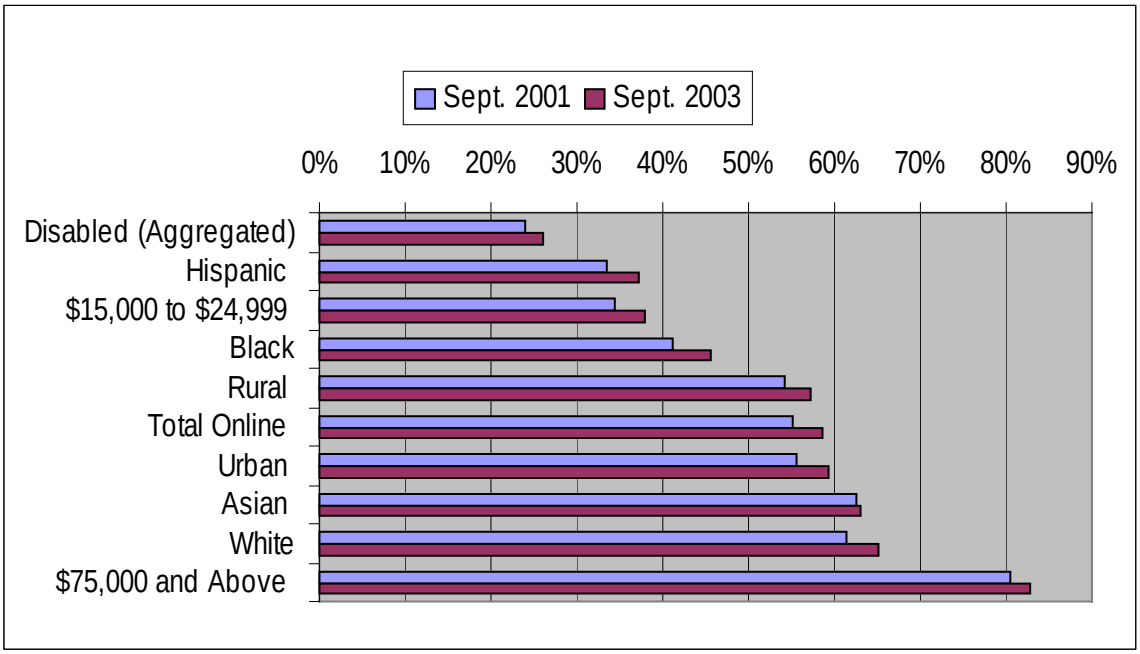
Despite California's success and national leadership on broadband penetration, not all of the state's residents have access to, or are using, broadband. Certain communities are lagging behind: low-income consumers, residents of rural areas, and persons with disabilities.

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.

In addition, 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 2.8 below.

Figure 2.8
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).[21] 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.[22]

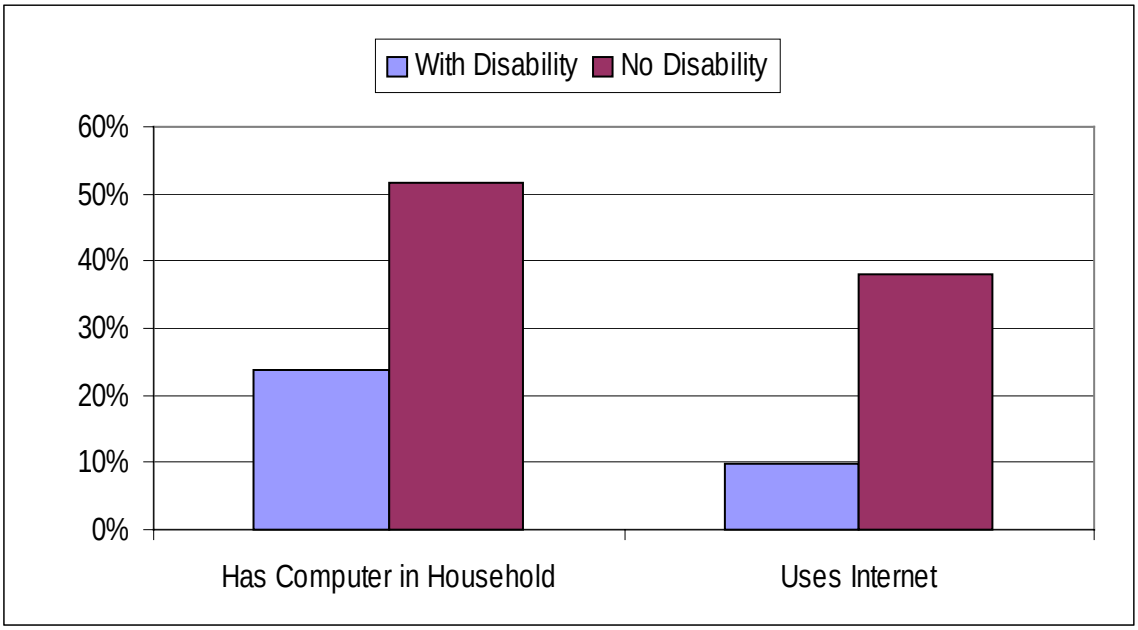
2.6.1. Disabled Community

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

[21] U.S. Department of Commerce, "A Nation Online: Entering the Broadband Age," September 2004, Appendix Table 1.
[22] Ibid.

non-disabled).[23] This data appears to conflict with the U.S. Department of Commerce data showing disabled community Internet usage at over twice that level.

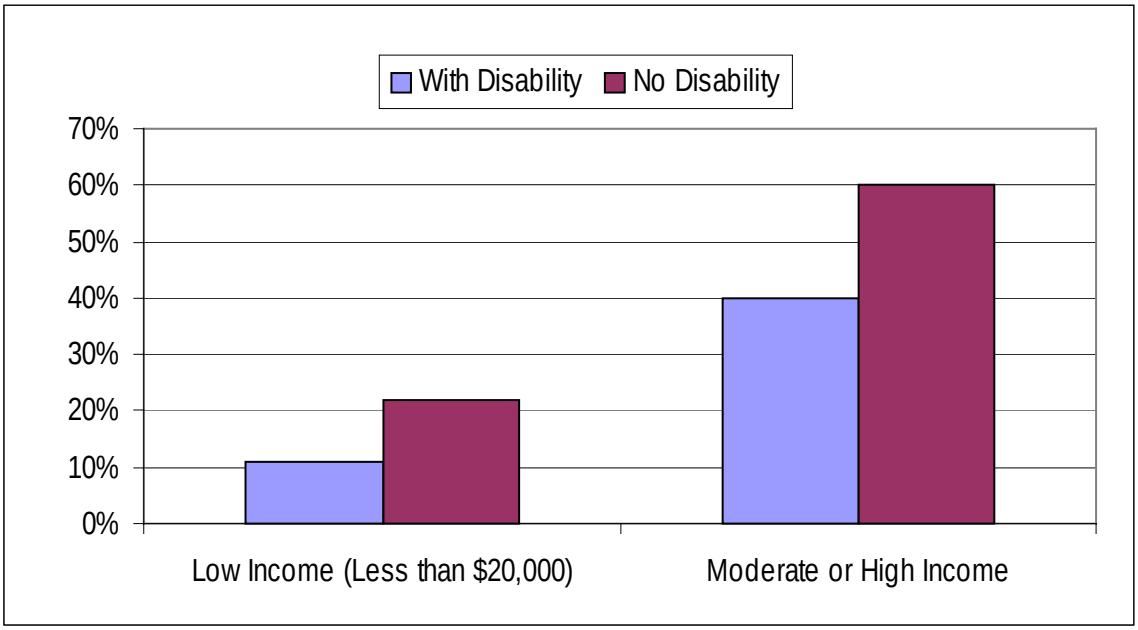
Figure 2.9
Computer Access and Internet Use



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,[24] 11% of low-income people with disabilities use computers, compared to 22% of other low-income persons. Computer use increases at higher income levels for persons with and without disabilities.[25]

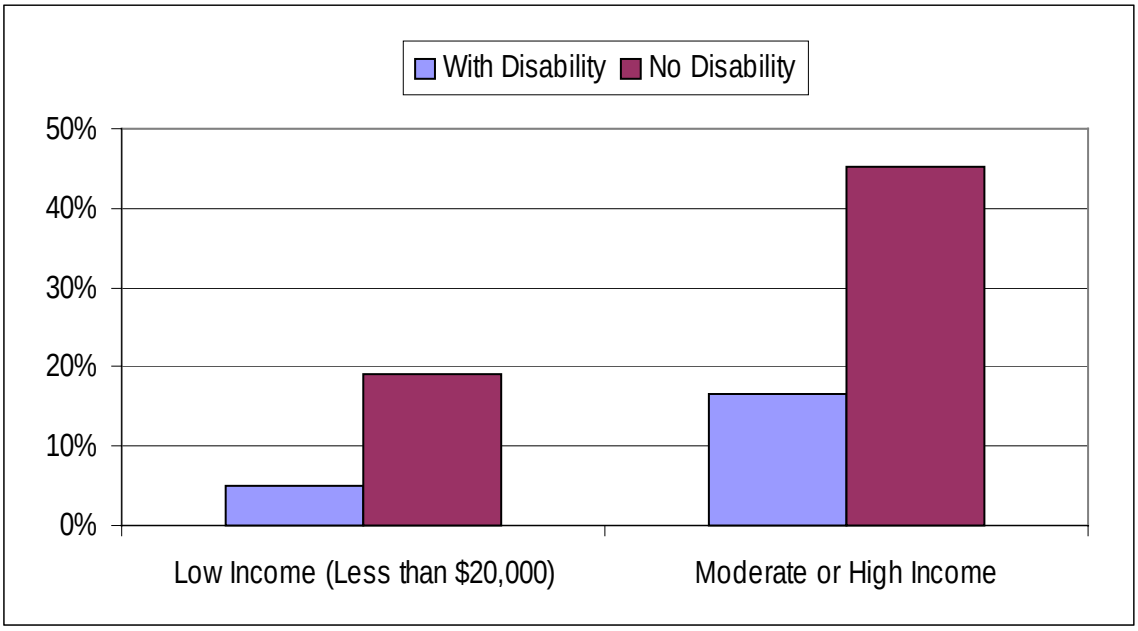
[23] Disability Watch: The Status of People with Disabilities in the United States, Volume 2, 2001, p. 87.
[24] In California, the median household income for people without disabilities is $29,339 while the median income for people with disabilities is $16,534. Andrew J. Houtenville, Adam F. Adler, Cornell University, "Economics of Disability Research Report No. 4," Table No. 8 (April 2001).
[25] Ibid.

Figure 2.10
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.[26]

Figure 2.11
Internet Use by Household Income



[26] Disability Watch, p. 90.

2.6.2 Rural Areas

Although the U.S. Commerce Department data cited in Figure 2.8 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"[27] do cite a significant difference, as shown in Figure 2.12 below.

Figure 2.12
Internet Penetration by Community Type[28]

	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.

2.6.3 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 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.[29]

Figure 2.13
Percentage Urban/Rural Internet Penetration by Household Income[30]

	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%

[27] Pew Internet & American Life Project, "Rural Areas and the Internet," February 2004.
[28] Ibid., p. 8.
[29] Ibid., p. 34.
[30] Ibid.

Chapter 3. Broadband Market Competitors

Broadband providers in California consist of traditional telecommunications companies - incumbent local exchange carriers (ILECs), competitive local exchange carriers (CLECs), wireless companies and cable operators - as well as relative newcomers to the market, such as satellite companies, developers of new wireline broadband technologies, and fiber deployment companies. As noted in Chapter 2, many parts of California benefit from a broadband market marked by competition among multiple providers and technology platforms. Additionally, some communities have built their own broadband networks.

3.1 Incumbent Local Exchange Carriers (ILECs)

ILECs are wireline telecommunications carriers that own the legacy telephone network within a geographic area. They offer local telephone service, local toll, long distance, international, Internet access and are now offering video services through co-marketing agreements with satellite television companies such as DISH Networks. Currently, two large ILECs (SBC and Verizon), two mid-sized ILECs (Citizens and SureWest), and eighteen small ILECs operate in California. Some of the ILECs serving California have established corporate affiliates to offer long distance, wireless and/or broadband services.

3.2 Competitive Local Exchange Carriers (CLECs)

CLECs are wireline carriers that are authorized under CPUC and FCC rules to compete with ILECs to provide local telephone services. They often package their local service offerings with local toll, long distance, international, Internet access, cable and/or video services. Under policies adopted by the CPUC, the FCC and the Telecommunications Act of 1996 (1996 Act),[31] CLECs are not required to duplicate ILEC local service offerings. They can choose which customers to serve (business, residential or both) and what services to offer. CLECs provide telephone services in one of three ways, or a combination thereof:

(a) Building network facilities needed to connect themselves to their customers' premises;
(b) Purchasing telecommunications services from another carrier (typically an ILEC) at wholesale rates and reselling those services to their own customers at retail rates; and
(c) Leasing parts of the ILEC network, referred to as "unbundled network elements" (UNEs).

Some of the larger CLECs operating in California are AT&T, WorldCom, Inc., Pac-West Telecommunications Inc., and Cox California Telecom, LLC.

Some ILECs also operate as CLECs outside their original service territories. In California, for example, SBC and Verizon each have authority to operate as CLECs in the other's service areas.

[31] 47 U.S.C. Sections 151 et seq.

Data Local Exchange Carriers (DLECs) are an ILEC and CLEC subset. DLECs deliver broadband services generally by purchasing unbundled local loops and providing their own electronics at each end to provide DSL service to customers. DLECs traditionally have not provided voice services, although some are now offering Voice over Internet Protocol (VoIP) telephony.[32] Most ILECs offer DLEC functions through corporate subsidiaries or affiliates. DLECs operating in California include Covad Communications Company and SBC-Advanced Solutions Inc.

3.3 Satellite Broadband Providers

Satellite providers can deploy broadband service to customers in almost any part of the United States. Customers must install a satellite dish with a clear line-of-sight view of the southern sky. It is a popular choice for customers in rural and other areas that lack an existing broadband infrastructure, where deployment costs are often too high for other broadband providers to enter the market. Deployment costs are substantial, as they involve placing a new satellite into orbit. Satellite providers often set limits on data downloads, with overage charges applied if a customer goes over his or her quota. Three prominent satellite broadband service providers serving residential customers in the U.S. are DirecWay, Echostar and StarBand. DirecWay and StarBand currently offer service in California.

Other providers are entering the market. Wild Blue's plans to provide satellite broadband service literally got off the ground in mid-2004 with the successful launch of the Anik F2 satellite. Wild Blue plans to begin offering service in the second quarter of 2005, focusing on rural areas yet unreached by DSL and cable providers. Wild Blue plans on offering 1.5 Mbps download and 256 kbps upstream speeds for under $50 per month.

3.4 Wireless Broadband Providers

Wireless carriers provide broadband service using fixed or mobile wireless technology. Fixed wireless technology can offer services to large geographic areas with a modest investment. It is a particularly attractive form of broadband in rural areas, smaller towns, and suburbs. Sprint Broadband Direct and WorldCom are examples of fixed wireless providers serving customers in certain areas in California. Companies offering mobile broadband services, such as Verizon Wireless and its EVDO service, are expected to play an increasingly prominent role as technologies like 3G and WiMAX continue to develop.[33]

3.5 Cable Providers

Cable companies provide broadband services over their coaxial cable networks. Cable providers are generally granted exclusive franchises by the jurisdictions in which they operate. Cable broadband providers serve primarily residential customers, since many

[32] See Section 5.3 of the report for a discussion of VoIP.
[33] See Chapter 4 of the report for a discussion of Wireless broadband providers.

homes across the nation already subscribe to cable video. There are five major cable providers in California – Comcast, Cox, Time Warner, Adelphia, and Charter, which operate in exclusive franchise territories. In addition, there are a number of smaller cable providers operating in the state, including Brighthouse Networks, Mediacom California and NPG Cable.

3.6 Broadband Overbuilders

Broadband Overbuilders are a new type of telecommunications provider. Unlike local telephone and cable television companies, which have adapted their existing networks to provide broadband, these providers focus on a core business strategy of building new fiber-optic networks which they use to provide local telephone, cable television, and high-speed Internet services. Companies must first obtain a local franchise authorizing them to begin construction and must obtain the rights-of-ways to build the network.

For example, Grande Communications has announced plans to deploy an FTTP network to over a million homes and businesses in Texas over the next seven to ten years.[34] Although Broadband Overbuilders have a limited presence in California, there are several currently offering service, including SureWest, RCN, Seren Innovations (doing business as Astound!), and Champion Broadband.

According to the General Accounting Office, once the Broadband Overbuilder begins building its network, construction usually takes between two to four years if the company has steady access to capital and has no difficulties in obtaining the necessary local government permits.[35] This same study compared six markets with a Broadband Overbuilder and six without, and found that those markets with a Broadband Overbuilder had lower local telephone, cable and high-speed Internet rates.[36]

3.7 Publicly Owned Broadband Networks

Some communities without commercial broadband providers have opted to build their own networks using public funds, or by establishing public-private partnerships. Examples of this form of broadband deployment include the Truckee-Donner project in Northern California and the City of Cerritos's project in Southern California, both of which are discussed in section 8.3.2 of this report.

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[34] "Grande To Deploy Fiber to the Home Targets One Million Texas Homes, Businesses," Grande Communications Press Release, January 14, 2005.
http://www.grandecom.com/About/pressroom_release.jsp?PR_ID=_PR284

[35] General Accounting Office, "Wire-Based Competition Benefited Consumers in Selected Markets," GAO-04-241, February 2004. www.gao.gov/cgi-bin/getrpt?GAO-04-241.

[36] Ibid.

Chapter 4. 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.

4.1 Digital Subscriber Line (DSL)

Figure 4.1
DSL Characteristics

What is it?	Benefits	Limitations	Price[37]
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[38] 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.[39] DSL speeds are sufficient to bring streaming video into customer homes and for customers to send out basic information such as video selections.[40] DSL works well 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

[37] 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.
[38] 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.
[39] Broadbandreports.com. http://www.dslreports.com/faq/356.
[40] 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 offer a much higher speed than DSL (52 Mbps) but has a very limited range of less than 4,000 feet.

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, that 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.[41]

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.[42] 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.[43] For a more detailed discussion of the role of Convergence and Service Bundling, please see section 8.2.1 of the report.

4.2 Cable Modem

Figure 4.2
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

Internet service via coaxial cable became available with the cable television industry's migration from analog to digital TV.[44] 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-

[41] CPUC Staff interview with SBC representatives, February 1, 2005.
[42] See, e.g., Carol Wilson, "Qbit unveils new compression approach," Telephony Online, January 7, 2005.
[43] "SBC, EchoStar Announce Strategic Marketing Alliance," April 17, 2002. www.sbc.com
[44] 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.

way data transmission. The cable industry spent more than $65 billion dollars between 1996 and 2002 to upgrade its infrastructure.[45] This new cable TV network architecture, called a hybrid fiber-coaxial (HFC) network, also 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,[46] cable modem has been the dominant national broadband technology since 2000.[47] 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.[48]

The HFC network architecture consists of a fiber backbone linking the cable company headend[49] to a local distribution node. 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. A capacity bottleneck is created for cable modem users at the distribution node. While a theoretical 40 Mbps bandwidth is made available with cable modem service,[50] the current industry standard results in only 10 Mbps being available to be shared by all of the cable customers serviced by a single distribution node. Often, a single node services hundreds of customers. Today, most cable modem services promise 1.5 Mbps transmission speed and have a cap of 3 Mbps as the maximum download speed. The actual download speed experienced by subscribers depends on how many other cable modem users on the same distribution node are online at the same time.[51]

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

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

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

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

[49] 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.

[50] Working through an industry association CableLab, the cable industry agreed on a common cable modem technical standard DOCSIS 1.1 (Data Over Cable Service Interface Specification), which allocated a cable channel of spectrum for cable modem with 40 Mbps of bandwidth.

[51] 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.

4.3 Satellite

Figure 4.3 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),[52] 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.

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.[53]

[52] As compared to typical DSL and cable modem price ($29.95 to $49.95) and bandwidth (1.5 Mbps to 3 Mbps).
[53] Lonestar Broadband, http://www.lonestarbroadband.org/technology/satellite.htm

4.4 Wireless

Figure 4.4 Wireless Broadband Characteristics				
	What is it?	**Benefits**	**Limitations**	**Price**
WirelessLAN (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

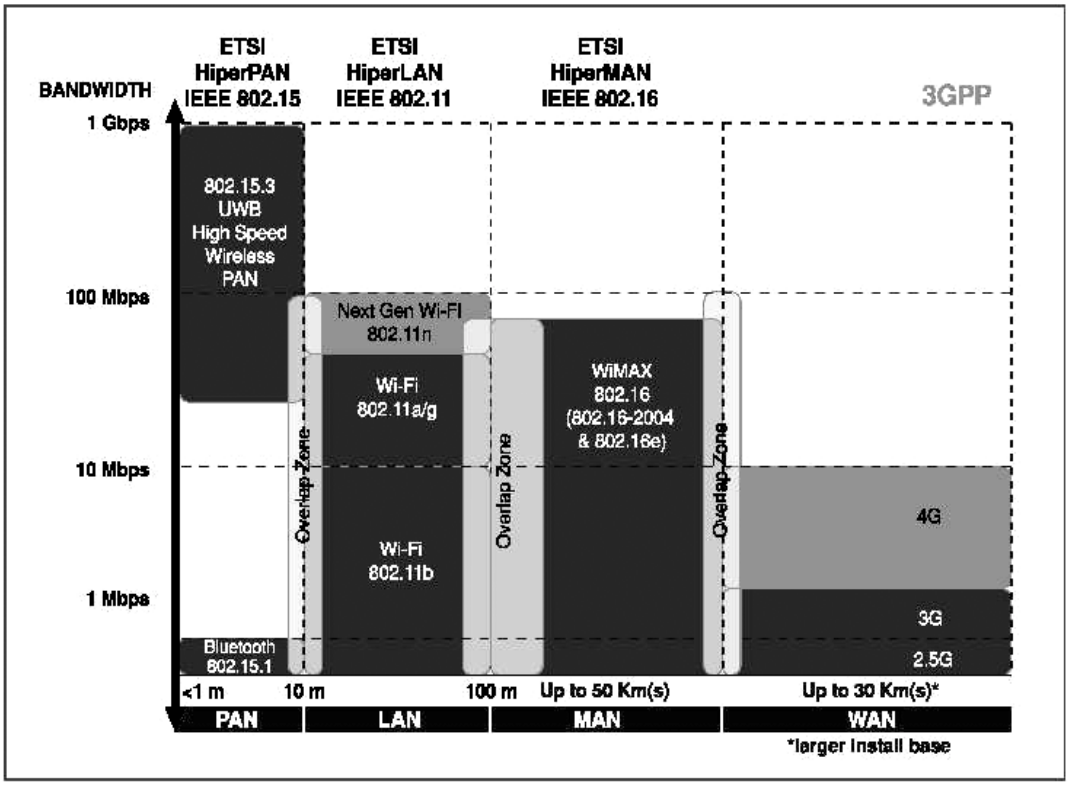
Wireless communications are revolutionizing peoples' lives, enabling consumers to access a high-speed connection to the Internet using virtually any device, at any time, from any location. Wireless technologies being deployed today are as diverse as the ideas for how to use them, from Bluetooth, to hot 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."

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

Figure 4.5
Types of Wireless Broadband Technologies



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

4.4.1 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.

4.4.2 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[54] 802.11. Three

[54] Institute of Electrical and Electronics Engineers.

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[55]

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.

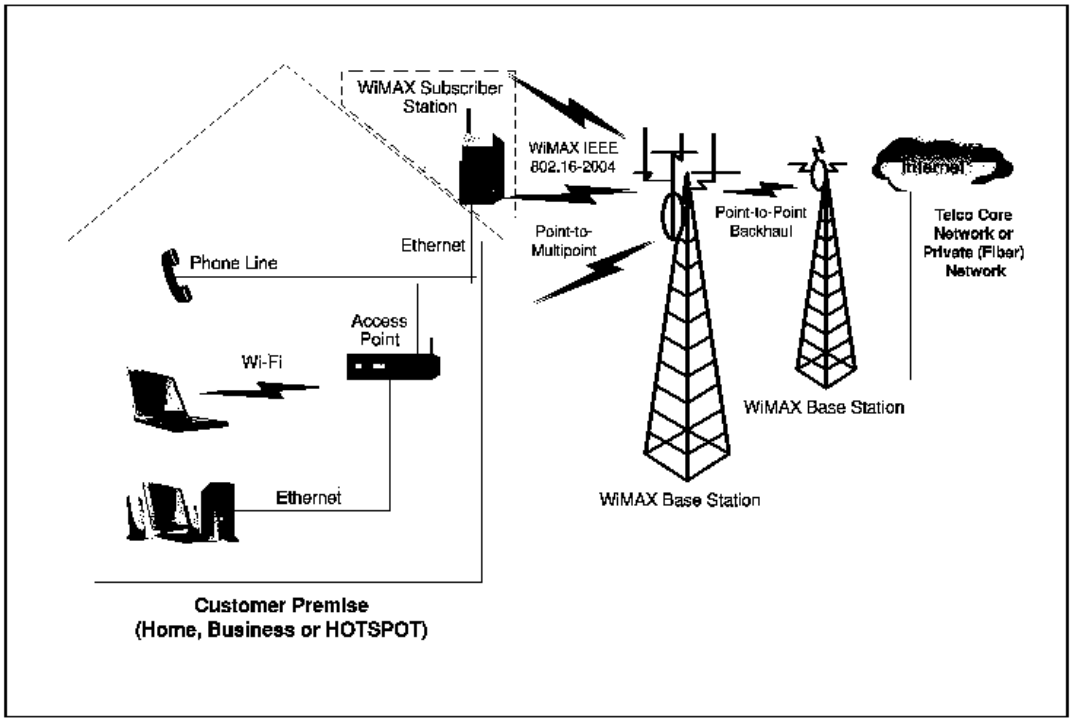
4.4.3 WMANs, WiMAX and WWANs

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

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

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 4.6
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.

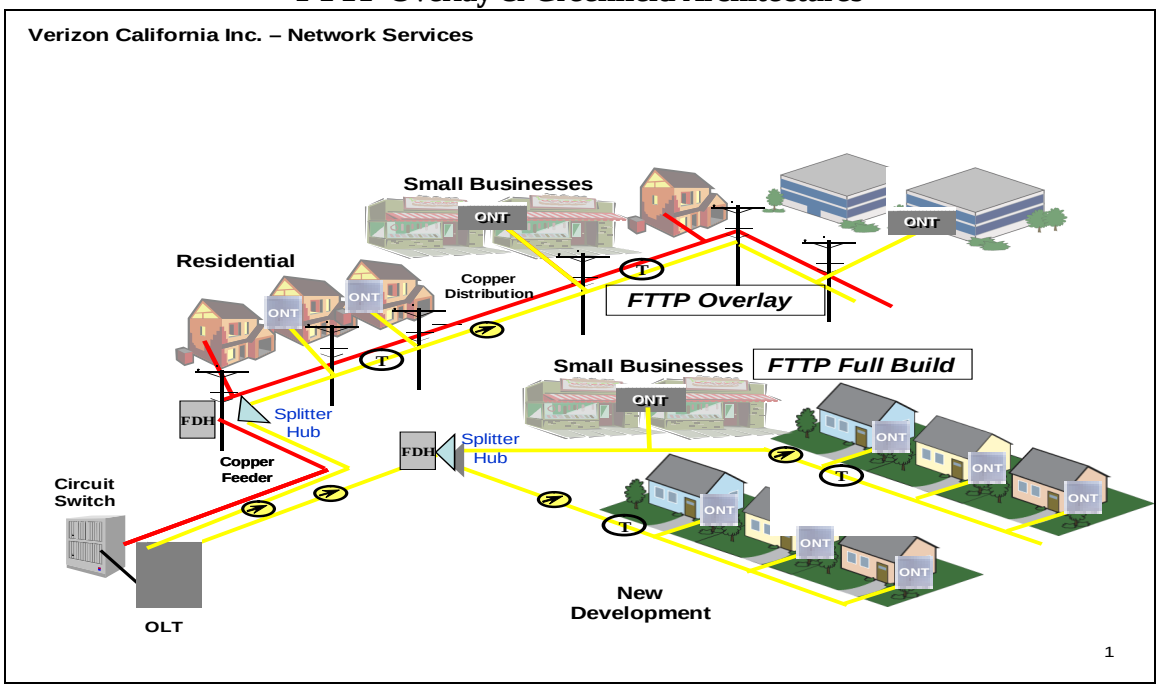
Wireless Wide-Area Networks (WWANs) aggregate WMANs over a large geographic area (over 50 km) using fiber optic or other wired links to connect to the core network, either using WiMAX point-to-point transmission for long distance backhaul or connecting directly to a fiber node.

4.5 Fiber-to-the-Premises

Figure 4.7 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.[56]

Figure 4.8
FTTP Overlay & Greenfield Architectures



[56] 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.[57] 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. In California, Verizon has already begun FTTP deployment in the cities of Huntington Beach and Murrieta.[58] SBC developed one of the nation's first FTTP deployments in 2001 for the San Francisco Mission Bay community.[59] SureWest is deploying FTTP service in Sacramento in direct competition with SBC and the local cable company that passed over 62,000 homes, and 14,700 subscribers.

4.6 Broadband Over Powerline

Figure 4.9
BPL Characteristics

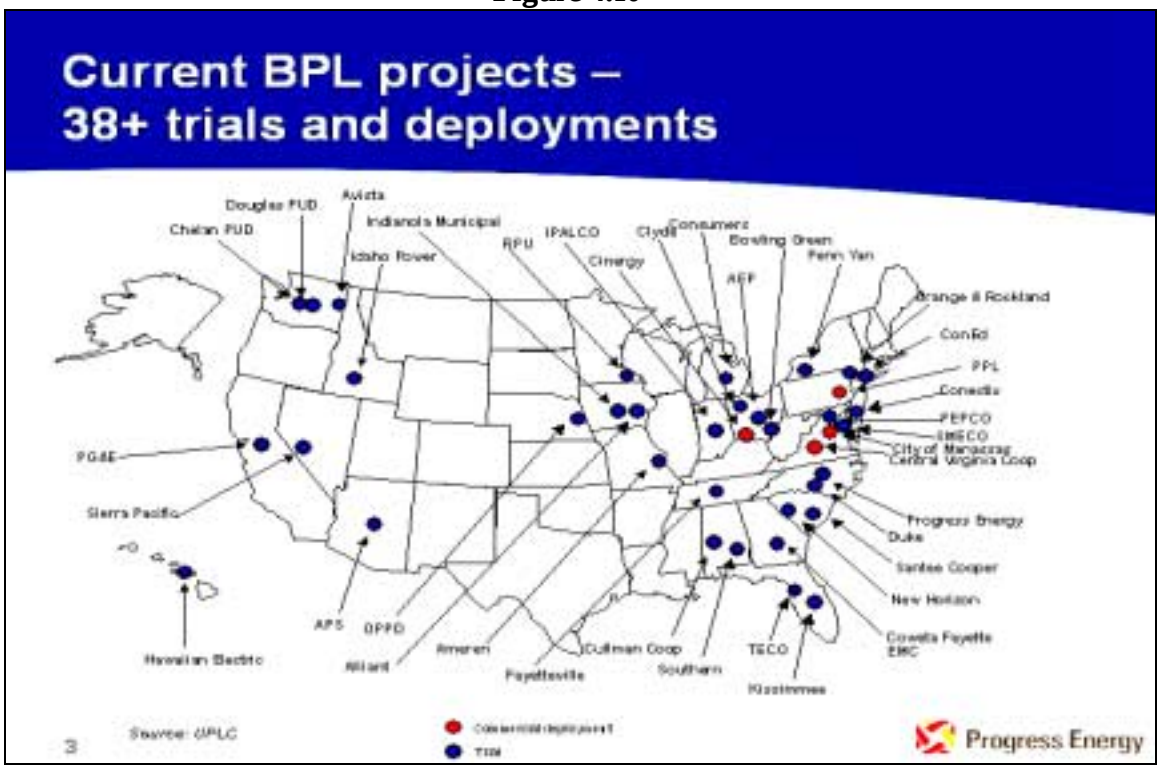
What is it?	Benefits	Limitations	Price
Broadband service delivered through the electric distribution system.	Should have relatively low deployment cost and time since BPL utilizes the existing electric grid	Still in development/trial stage. Interferences to and generated from BPL is a potential hurdle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

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,

[57] Steve Rosenbush, "Verizon's Gutsy Bet" BusinessWeek, August 4, 2003.
[58] Verizon News Release, July 19, 2004.
http://newscenter.verizon.com/proactive/newsroom/release.vtml?id=86053
[59] SBC, News Release. June 22, 2004: http://www.sbc.com/gen/press-room?pid=4800&cdvn=news&newsarticleid=21207

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.

Figure 4.10[60]



An example of BPL in commercial deployment is in the City of Manassas, Virginia, where a franchise license has been granted to provide BPL to the city's residents through power lines owned by the city Utilities Department.[61] Another BPL deployment is in Cincinnati, Ohio, which has undertaken a similar joint venture between Cinergy, the local electric utility, and Current Communications, a BPL service provider.[62] 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.[63] 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.

[60] Graphic provided by SBC-California.
[61] http://www.powerline-plc.com/newsreleases/City_Of_Manassas_Utility_Connection_11_03.pdf
[62] http://www.cinergy.com/News/default_corporate_news.asp?news_id=420
[63] http://www.dslreports.com/shownews/48889;
http://www.arrl.org/news/stories/2004/10/21/100/?nc=1

Chapter 5. Benefits

5.1 Economic Development

Advanced telecommunications is the key infrastructure for today's digital economy. The economies of California, the nation and the world are increasingly powered by the creation, use and transmission of information and entertainment content in digital format. Just as the telegraph transformed management of the far-ranging railroad networks of the 19th century, and the telephone enabled coordination of businesses with widespread operations in the 20th century, the digital communications infrastructure is transforming business activities on a global scale and in real-time in this century. The widespread deployment and use of broadband will spur the creation of entire new industries, transform existing ones and, like the automobile industry's impact on horse-drawn carriage manufacturers, displace others.

The deployment of broadband infrastructure impacts the economy both directly and indirectly. The cable industry alone has invested over $65 billion since 1996 upgrading its systems to provide digital content. Verizon is poised to spend up to $40 billion in the coming years to deploy a FTTP network.

Yet, the effects of broadband technology on the economy are much more far-reaching than the direct benefit created by capital investment in deployment and the manufacturing of the components such a network requires. The most significant economic benefits do not come from the deployment of broadband technology, but in its use. As broadband penetration increases, there will be resulting demand for computer and home network equipment, software applications, wireless devices and other equipment that utilize broadband. Like all infrastructure investment, the economic impacts of broadband will also include the increased productivity and innovation that it fosters. The full economic impact of widespread broadband deployment and adoption cannot be captured in even the most sophisticated econometric modeling.

5.2 Quantifying the Economic Benefits of Broadband Deployment

Several studies have attempted to quantify the economic impacts, particularly increases in employment and economic activity, that can either be directly or indirectly liked to increased deployment of broadband technologies. For example, one study sponsored by Cisco Systems, written by Hal Varian of the University of California and Robert Litan of the Brookings Institute, found that full implementation of currently underway or planned Internet business solutions could result in over $528 billion in cost savings to U.S. businesses though 2010.[64] Additionally, this study finds that these solutions could result in a cumulative increase of over $1.5 trillion in revenue to businesses resulting from implementation of Internet business solutions. While this study looked broadly at Internet based business solutions, and not just those enabled by broadband, this information is nevertheless

[64] Varian Litan, Elder, and Shutter, "The Net Impact Study: The Projected Economic Benefits of the Internet in the United States, United Kingdom and Germany," January 2002.

illustrative of the significant benefits advanced telecommunications can have on business and on economic growth.

Figure 5.1
Broadband Investment Projections

Required Investment	Description
About $1300 per line, $270 billion total	Figures for DSL.; Reflects costs necessary to retrofit all US copper plant
About $1200 per line, $65 billion total	Figures for Cable-modem; Reflects past investment through 2002
More than $1250 per line, total investment would vary based on platforms used	Figures for "Ultraband" fiber connections; $1250 reflects customer expenses, not upstream capital and communication costs
About $700 per line, $63 billion total[65]	Figures for wiring additional 75% of US households with current technologies (cable or DSL)
About $900 per home passed and $2200 per home served by the technology, $93 billion total[66]	Weighted average calculated from 2003 to 2021, for investment in FTTP technology

The wide-ranging deployment of broadband infrastructure will have the direct effect of employing thousands of people: to manufacture, sell, purchase, install, manage, and maintain the equipment and facilities, as well as the resulting services.

Only a few studies have examined the issue of job development resulting from greater broadband investments, although many other publications and documents reference them.

[65] Per line figures calculated by author using data from http://quickfacts.census.gov/qfd/states/00000.html
[66] Staff found some variation in these projections.

Figure 5.2
Job Growth Due to Broadband Deployment

SOURCE	U.S. JOBS	CA JOBS
TeleNomic Research, 2002[67]	1.2 million	100,000
Critereon Economics, 2003[68]	1.2 million	N/A
CENIC/Gartner Consulting, 2003[69]	N/A	2 million

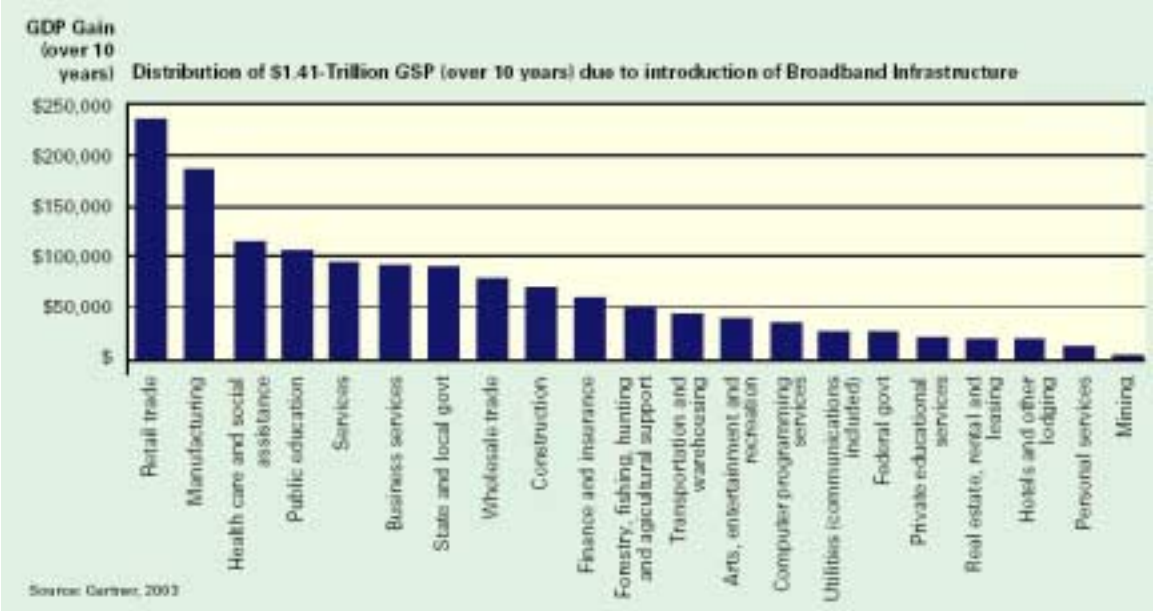
5.2.1 The CENIC/Gartner Study

The Gartner Group, a technology and market research and consulting firm, was engaged by the Corporation for Education and Network Initiatives in California (CENIC) to evaluate the economic potential of accelerating next generation broadband deployment in California.

Gartner studied the impact that a 50% penetration by 2010, i.e. one broadband line for every two people in California, would have on economic activity and employment. [70] Gartner's modeling shows an increase of $376 Billion in incremental Gross State Product (GSP) over a ten-year period. This increase would result in a $5,500 increase in annual per capital GSP. Gartner then sought to quantify theses economic impacts by sector of the economy. The following chart illustrates the study's results.

[67] S. Pociask, "Building a Nationwide Broadband Network: Speeding Job Growth." TeleNomic Research, LLC, February 2002. http://www.newmillenniumresearch.org/event-02-25-2002/jobspaper.pdf.
[68] R. Crandall, C. Jackson, H. Singer, "The Effects of Ubiquitous Broadband Adoption On Investment, Jobs and the US Economy," Criterion Economics, LLC, September 2003. http://www.newmillenniumresearch.org/archive/bbstudyreport_091703.pdf
[69] Gartner Consulting. "One Gigabit or Bust Initiative: A Broadband Vision for California," May 2003. http://www.cenic.org.
[70] The equivalent penetration of basic telephony in California is approximately 73% on a per capita basis.

Figure 5.3
Distribution of Gain in Gross State Product by Industry



Source:
CENIC's One Gigabit or Bust Initiative: A Broadband Vision for California Summary Report
http://www.cenic.org/gb/pubs/gartner/Gartner_Short.pdf

Retail trade, manufacturing, health and social assistance, and public education see the largest positive economic impacts of accelerated broadband deployment.

Gartner also studied the impacts such accelerated deployment would have on employment and found the potential to create two million additional jobs in California over the ten-year study period.

5.2.2 The TeleNomic Research Study[71]

A study conducted by TeleNomic Research found substantial employment gains from increased broadband deployment. The major finding of this study is that building and using a robust, nationwide network will expand U.S. employment by an estimated 1.2 million new and permanent jobs. Specifically, TeleNomics found:

- 166,000 jobs would be created directly in the telecommunications sector;
- 72,000 manufacturing jobs would be generated by the direct purchase of network plant and equipment and customer premise equipment; and
- 974,000 indirect jobs would be created if a next generation network were built.[72]

TeleNomic Research estimated that about 237,000 jobs nationwide would be created directly from broadband deployment. To this, the study adds jobs created indirectly from the

[71] S. Pociask "Building a Nationwide Broadband Network: Speeding Job Growth," TeleNomic Research, LLC, February 25, 2002. http://www.newmillenniumresearch.org/event-02-25-2002/jobspaper.pdf.
[72] Ibid., p. 2.

deployment and use of broadband, such as content providers and software developers, who create new products that utilize the broadband networks. This indirect effect also includes jobs created by the increased spending of those whose jobs were directly linked to broadband deployment. The study finds that the effects of greater broadband deployment will ripple though the economy, increasing employment even more. TeleNomic estimates that over 4 indirect jobs will be created for every 1 new job directly resulting from the deployment of broadband.[73]

5.2.3 The Criterion Economics Study[74]

Robert Crandall and his associates at Criterion Economics completed a study in 2003 looking at the effects of ubiquitous broadband adoption on the U.S. economy. The study considers 95% penetration to be ubiquitous broadband adoption and assumes that this level of penetration is reached in 2021.[75] This study estimated that for every $1 million in capital investment in telecommunications networks, there are 18 jobs created. This leads the study to project that an average of 140,000 direct jobs would be created by the increase in capital investment engendered by widespread deployment of broadband. The indirect jobs created are estimated to be approximately 664,000, leading to a total of 804,000 new jobs. The study also concluded that widespread deployment of broadband technologies could result in increased economic activity of $414 billion in additional economic output for the nation.

This study also examined the impacts of an even more rapid deployment of broadband and finds that under a scenario where 95% penetration is reached in 2013 (rather than 2021) as many as 546,000 additional new jobs would be added.[76] This results in a total addition of 1.2 million jobs to the U.S. economy.

The Criterion Study also attempted to measure the additional benefits to consumers of broadband deployment by measuring consumer surplus. Consumer surplus is defined as the measure of the net benefit that new or improved goods and services bring to consumers. Given the tremendous value that broadband can provide to consumers, the study found significant gains in consumer benefit and found that the more ubiquitous the deployment the greater the consumer gains.

At 50% broadband penetration, the Criterion Economics study finds that additional value to consumers would rise to between $64.4 billion and $96.6 billion per year depending on price elasticity. If broadband service were to become truly ubiquitous, similar to ordinary telephone service at 95% penetration, this study concludes that the additional value to consumers - over and above their expenditures on the service - would be between $234 billion and $351 billion per year.

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[73] Ibid., p. 7.
[74] R. Crandall, C. Jackson, H. Singer, "The Effects of Ubiquitous Broadband Adoption On Investment, Jobs and the US Economy," Criterion Economics, LLC, September 2003. http://www.newmillenniumresearch.org/archive/bbstudyreport_091703.pdf
[75] To achieve this level of penetration broadband subscribership must increase by about 9.4% per year from 2004 through 2021.
[76] The study shows that employment peaks in 2010 at 546,000 and averages approximately 271,000 though 2021.

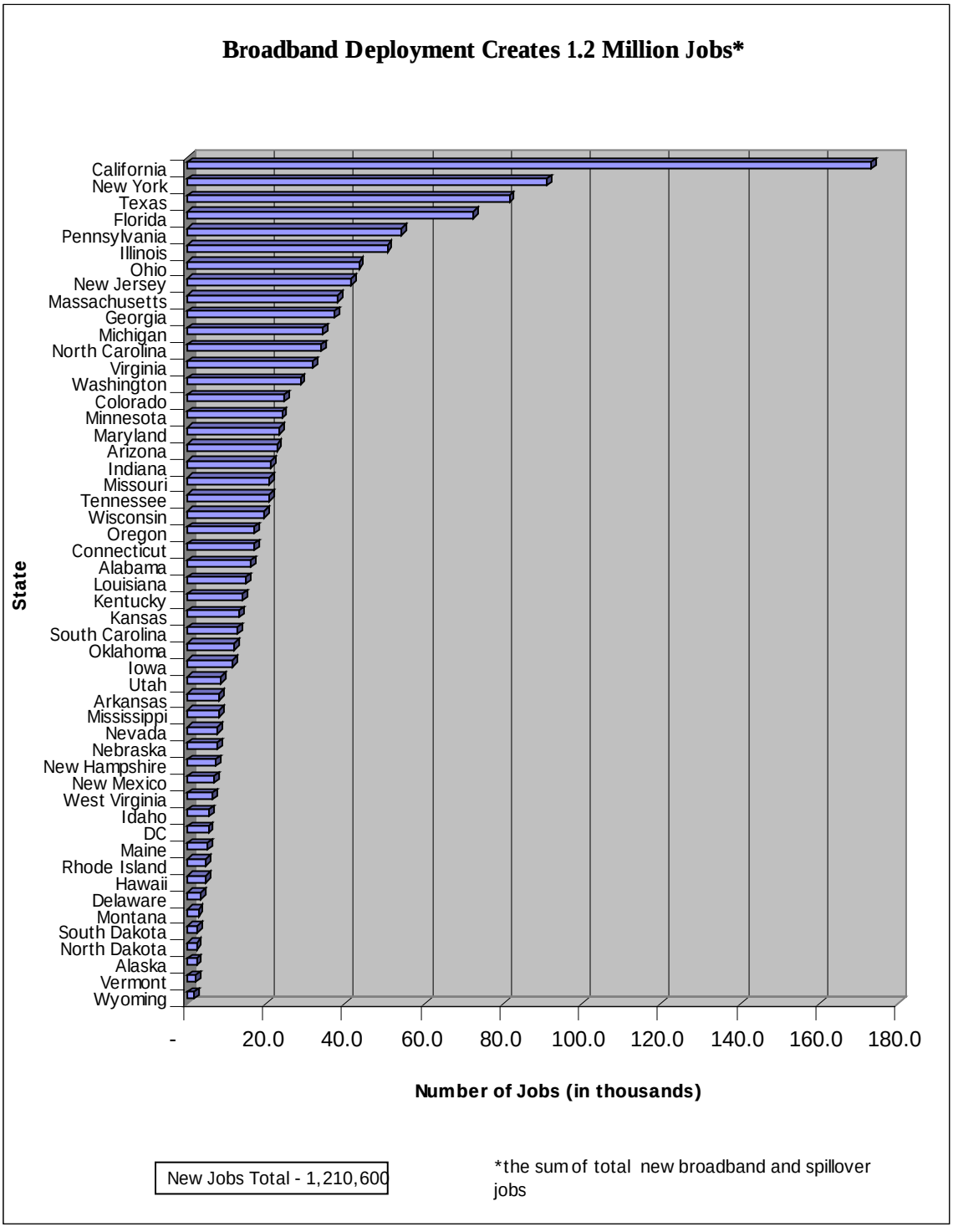
5.2.4 The Citizens for a Sound Economy Study

Citizens for a Sound Economy (CSE) published a study by Wayne T. Brough, Ph.D., which took the results of the Criterion study and sought to estimate the employment impact by state.[77] This study estimated that California would see an increase in employment of over 170,000 new jobs. The CSE study found that California would gain over 96,000 direct jobs. This would be expected given California's large information technology sector. For comparison, CSE estimates that Florida and New York would see gains of over 40,000 jobs as a direct result of broadband deployment. California would also see over 76,000 new jobs through the indirect impacts of broadband deployment, according to the study.

The findings of the study are illustrated in Figure 5.4 below.

[77] Wayne T. Brough, "State Economies Can Benefit from Broadband Deployment," Center for a Sound Economy, December 1, 2003.

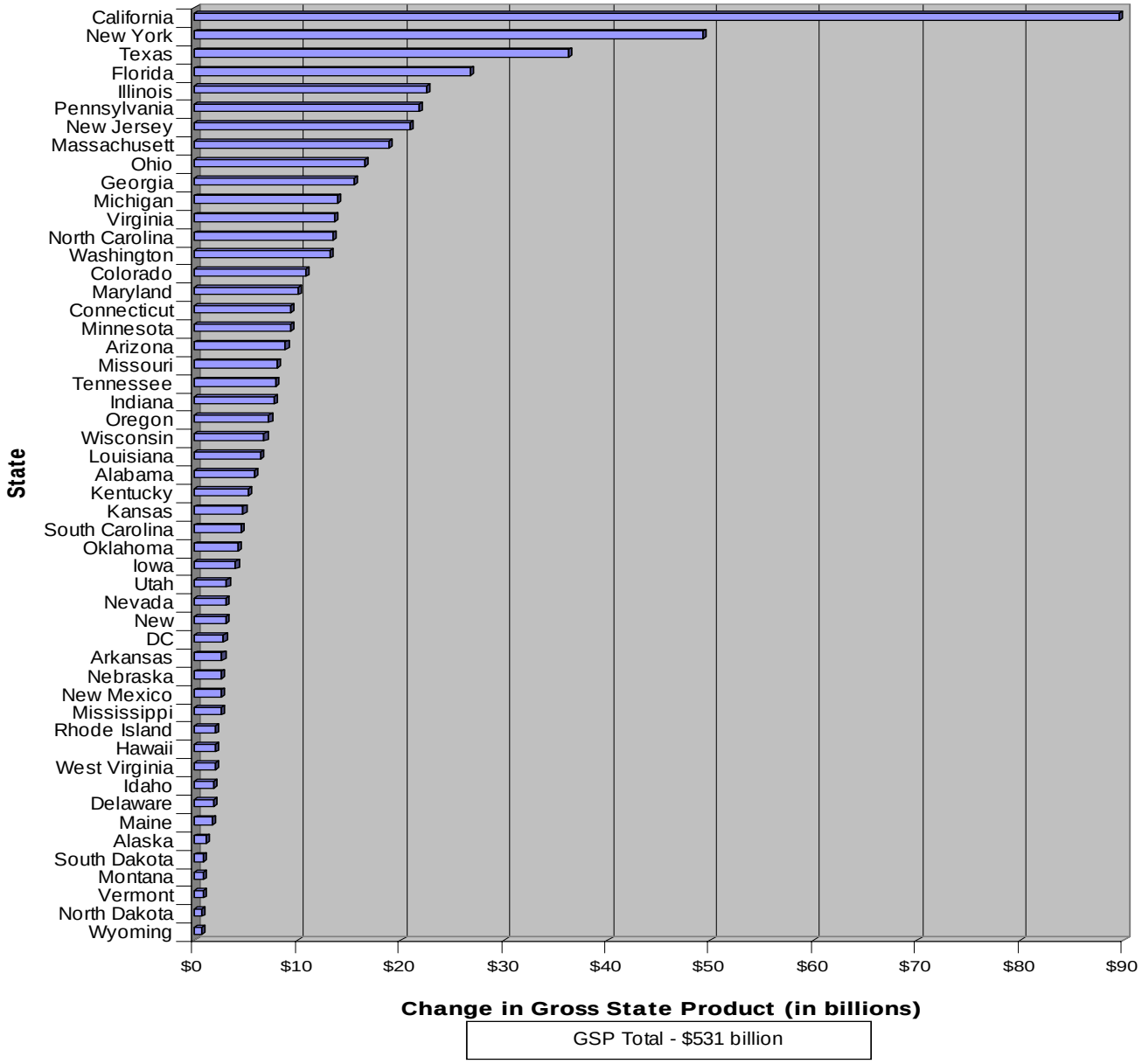
Figure 5.4



The CSE study also calculates that widespread broadband deployment could add over $500 billion to the U.S. economy and calculates that California would add over $90 billion to its economic output due to increased broadband deployment. Given California's large information technology and entertainment industries, California gains from increased

broadband deployment in other states, as well as the benefits it derives from deployment within California.

Figure 5.5
Economic Output Increases by State



5.3 New Products and Services

Broadband will provide consumers with significant bandwidth, that will in turn encourage the development of new services, applications and hardware for consumers. The range of new products and services will only be limited by the imagination of innovators and the interests and demands of consumers.

5.3.1 Telemedicine

Telemedicine is the use of broadband networks to transmit medical information to enable health care personnel to diagnosis and treat medical conditions over long distances. It is a dramatic example of the benefits of broadband applications. Telemedicine applications use broadband to transmit detailed medical images, as well as for videoconferencing to connect health-care clinics in remote rural locations with experts and specialists located elsewhere. In this way, smaller rural clinics and hospitals can have access to the same medical expertise that is available in the most sophisticated urban hospitals. Telemedicine applications also allow health care professionals to monitor a patient's health remotely and, using video-conferencing technologies and medical telemetry devices, to have virtual house calls.

Over the past five years, California has become known as a telemedicine and eHealth leader. In 1997 the California Telemedicine and eHealth Center (CTEC)[78] was created with funding from private foundations and in conjunction with the California Healthcare Association. CTEC works collaboratively with hospitals, clinics, community-based organizations and government agencies to facilitate the growth of telemedicine and eHealth, particularly in rural areas. California was one of the first states in the nation to allow Medicaid reimbursement for telemedicine and eHealth services.[79]

Case Study: Shasta Community Health Center

Shasta Community Health Center (SCHC) received an $84,000 grant from CTEC to provide same-day quality medical care for developmentally disabled adults in five rural Intermediate Care Facilities (ICF). The focus of this project is to provide access to health care services in a more cost effective and timely manner. By providing medical care via telemedicine, SCHC can offer timely medical care with less disruption and emotional stress and disruption in the lives of its patients. The project aims to reduce the number of emergency room visits per year for ICF patients and eliminate wait time at SCHC for appointments.

5.3.2 VoIP

The most prominent example of how broadband has resulted in innovative new services is the development of VoIP (Voice over Internet Protocol). VoIP allows high quality two-way voice transmission over broadband connections, and is already revolutionizing the

[78] See California Telemedicine and eHealth Center http://www.cttconline.org
[79] Ibid.

telecommunications industry.[80] While the commercial deployment of VoIP is relatively new and there are still important public policy issues raised by its emergence such as e911 and support for Universal Service programs, analysts predict that between 2004 and 2008, the number of VoIP connections will increase from about 800,000 to 17 million.[81]

Calls made using IP technology or over the public Internet provide significant cost savings to consumers by eliminating most per minute long distance and local toll charges. Many VoIP providers are offering unlimited local and long distance calling plans for as low as $19.95 per month.[82] In addition to significant cost savings, VoIP facilitates advanced applications and capabilities including mobility, location independence including choice of zip code, integrated messaging applications, voice access to e-mail and a common mailbox for voice, e-mail and Instant Messaging.

5.3.3 Video on Demand

Cable companies and Broadband Overbuilders already offer television and video over their broadband networks. Telephone companies are seeking to offer similar services, delivering their own "triple play" to consumers. SBC and set-top box vendor 2Wire this year will offer TV, video on demand, digital video recording and Internet content over DSL and satellite service.[83] The increased capacity of these broadband networks combined with advances in data storage technology will spur increased Video on Demand applications.

5.3.4 Smart Homes

Homeowners can utilize broadband technologies to control the electronic devices in the home remotely. Lighting, heating and air conditioning, appliances, and home security and other systems can now be remotely monitored and controlled. In addition, advanced energy metering technology in the home will allow consumers to control their energy demand and respond to market signals.

5.3.5 Gaming

Online interactive video and computer gaming is increasingly a leading driver of broadband deployment and use. It is forecast that the worldwide market for online games will reach $9.8 billion in 2009, a 410% increase over 2003 revenue of $1.9 billion.[84] Broadband applications can provide gamers with the ability to connect directly with interactive, multi person, high-resolution, fast action, and complex online games. Broadband gaming technologies that create virtual-reality environments could be a precursor to sophisticated

[80] http://www.businessweek.com/technology/content/sep2004/tc20040921_7486_tc024.htm
[81] "No Nerds Needed': VOIP Is No Longer Just for Techies", November 3, 2004, By Suzanne Vranica, Staff Reporter Of The Wall Street Journal
http://online.wsj.com/article/0,,SB109943061445662597,00.html
[82] See http://www.packet8.net "Freedom Unlimited"
[83] "SBC, 2Wire Inc. to Launch Home Entertainment Services," Sacramento Business Journal, January 4, 2005.
[84] DFC Intelligence Forecasts Significant Growth for Online Games, August 3, 2004.
http://www.dfcint.com/news/praug32004.html

training and simulation applications with a myriad of uses in industrial, entertainment, military, and commercial settings.

5.4 Teleworking and Telecommuting

In 2004, a report sponsored by the International Telework Association and Council found that the number of Americans who worked at least part time from home increased 7.5% from 2003, to a total of 44.4 million workers. The report also found that during that same one year period, the number of teleworkers using broadband soared 84%, from 4.4 million to 8.1 million employees.[85] Companies can use broadband to enable employees scattered around the globe to communicate and share information in real-time. Employees working from home or in branch offices are able to work with colleagues in other offices as easily as if they sitting in adjacent cubicles. Broadband allows telecommuting to serve as a practical alternative to office-based employment. In addition to the efficiencies realized by employers from lower overhead costs, telecommuting results in significant benefits to the environment,[86] results in greater worker productivity and job satisfaction, as well as the expansion of employment opportunities to those with disabilities.[87]

California was a pioneer in exploration and adoption of telecommuting by state employees. In 2003, the state published a guide to assist agencies plan and implement teleworking/telecommuting programs.[88]

5.5 Benefits to Public Agencies and E-Government

Government can increase the number and level of public services available to citizens by putting new and existing services online.[89] Union City, California has announced that it is replacing the telephone crime reporting system now in use with a system that will allow residents to file certain crime reports from their homes through the Internet. The new system will be less stressful for victims, eliminating games of "phone tag," while it eases the workload on community service aides and police officers. The $20,000 cost is projected to save the city $85,000 in salary and benefits annually.[90]

As broadband becomes more widespread, public safety authorities will be able to develop systems for providing public safety alerts via the Internet. For example, the town of

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[85] "Work at Home Grows in Past Year by 7.5% in U.S.; Use of Broadband for Work at Home Grows by 84%," Press Release of International Telework Association and Council, September 2, 2004. http://www.telecommute.org/news/pr090204.htm

[86] See AT&T's Telecommuting Calculator at www.att.com/telework/calculator.html, which permits workers to calculate carbon dioxide emissions saving by telecommuting.

[87] Burt Helm, "Paving the Road for Telecommuters," BusinessWeek, September 29, 2004; Ben Macklin, "The Benefits of Broadband: Telecommuting," Entrepreneur, May 6, 2002.

[88] http://www.dpa.ca.gov/telework

[89] Herndon, Virginia Helps Locate Missing Children with PhoneTop AMBER Alerts and Cisco IPC System, February 9, 2004. http://newsroom.cisco.com/dlls/2004/hd_020904b.html

[90] www.ci.union-city.ca.us/default.htm

Herndon, Virginia is using its VOIP-based network to broadcast Amber Alerts to the IP based phones in local government offices.

Broadband allows local government jurisdictions to host Internet community forums and provide multimedia communication services on websites. Additional benefits of such e-government include eliminating the time and transportation costs involved with visiting local government offices.

Similar to the benefits realized by private companies, broadband is also helping to reduce paperwork and cut costs for government. California State Controller Steve Westly has advanced a wide-ranging set of e-government proposals designed to save as much as $37.5 million annually by making the state more efficient at handling everything from tax returns to travel vouchers. Electronic filing of tax returns and refunds alone are expected to save up to $7.5 million each year. On-line processing of travel claims, payroll and benefits for state workers will bring additional savings of up to $29 million each year.[91]

Increased deployment of advanced telecommunications services including broadband will also have a positive impact on revenues to state and local government. Increased employment will generate higher income tax revenues, and increased economic activity will create additional sales tax revenues. Furthermore, the capital expenditures to deploy broadband networks will increase the property tax base.

5.6 Benefits for the Disabled Community

Broadband services are particularly beneficial to the disabled community. For example, video phones with closed caption technology can greatly increase the ability to communicate for those within the deaf community. High-resolution computer screens and voice-activated programs can aid the visually impaired, and with software such as eBooks, everything from novels to textbooks can be downloaded. For the physically disabled and the elderly, the Internet, especially with a broadband connection, provides a means for them to connect and communicate with the world.

Wireless broadband offers another opportunity for the disabled. Rather than using a desktop computer, a wheelchair bound consumer with a mounted notebook computer can access the Internet from anywhere in his/her home. With voice-activated dialing, a physically disabled or visually impaired consumer can communicate more effectively and easily using VoIP over a wireless broadband connection.

[91] "Westly Outlines E-Government Agenda," May 12, 2004, http://www.controller.ca.gov/eo/pressbox/index.shtml.

5.7 Benefits for Rural Areas

Broadband infrastructure can be a critical element in assisting a rural community to compete economically within the overall global business climate.[92] Broadband infrastructure assists rural communities in attracting businesses, providing health care to residents and accessing government services. Broadband can serve as a critical link to information and news for communities that have limited newspaper, radio and television station choices. Access to broadband infrastructure can also improve the quality of education available to small population communities. For, example the California Mother Lode region - including Amador, Mariposa, Tuolumne, Calaveras, Inyo and Mono counties - has no state college or university and only one community college within the area's 18,546 square miles. High-speed Internet connections allow Mother Lode residents to access technology training and educational opportunities provided through the Golden Gate University's Cyber Campus. Students can remain in their communities, receive Bachelors and Master degrees online and with their advanced education, contribute to the economic vitality of the region.[93]

5.8 Benefits for Low Income Consumers

Increasingly, access to computers and the Internet are necessary for academic success and better-paying jobs . Broadband offers access to training, services and educational advancement that allows low-income consumers to improve their skills, access critical services such as health care, and actively participate in the new digital economy

There are surprisingly few studies measuring the benefits of broadband to lower income consumers.[94]

> **Case Studies: Reaching out to Low Income Consumers**
> The Eastmont Computing Center (ECC) in Oakland, California. provides broadband Internet access, computer courses and job placement services to approximately 500 people per week.[95] The Latino Issues Forum conducts computer technology and Internet literacy projects in low-income urban and rural schools.[96] The Signature Learning Project (SLP) and the Rural Technology and Information Project (R-TIP) are model public, private and nonprofit partnerships created to develop comprehensive technology learning environments for low income and minority communities. [97]

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[92] "Public Policy Roadmap for Improving Broadband Access," New Valley Connexions, December 2003, p. 16.
[93] Amador-Tuolumne Community Action Agency, Opening Comment in R. 03-04-003.
[94] One study found that children of school age increased their use of a personal computer for education-related purposes by 19%, while decreasing their use for gaming and entertainment by 21%, when those computers were equipped with broadband connections. 2004 British Telecom Study, www.unreasonableman.net/2004/09/broadband_has_p.html
[95] Latino Issues Forum and Greenlining Institute, Opening Comments in R. 03-04-003.
[96] Ibid.
[97] Latino Issues Forum and Greenlining Institute, Opening Comments in R. 03-04-003, Appendix A: Model for closing Technological and Educational Disparities in Underserved Communities.

Chapter 6. Barriers

Many of the barriers to greater broadband deployment relate to the "last mile" problem. The "last mile" refers to the connection between the broadband infrastructure and the consumer at the neighborhood level. For many communities, connecting the last mile represents the single greatest challenge to delivering broadband to consumers. Last mile hurdles include such issues as difficult topography, problems with government permitting and licensing, as well as the economic and technical challenges caused by low population density and distance from major population centers.

6.1 Access to Non-Telecommunications Utility Property and Facilities

Public Utilities Code Section 851 requires a utility to obtain prior CPUC approval before selling or leasing property that is necessary or useful in the utility's performance of its duties to the public. This arises as a barrier to broadband deployment because it can prevent a utility from leasing access to existing utility property, such as electricity distribution poles, to a company seeking to use those poles to carry broadband infrastructure such as wires or antennae. Even when the CPUC approves a Section 851 application, the delay in receiving CPUC approval is often so long as to effectively deter broadband projects. In recent years, the average time for the CPUC to act on a Section 851 application has decreased from more than a year to approximately six months. However, the CPUC has been sharply divided on interpretation of the standards necessary for Section 851 approval (whether the proposed transaction must provide a public "benefit" or must simply have no negative impact). Many routine applications can remain pending at the CPUC for nine months or longer with no indication that approval is assured. The result is significant regulatory uncertainty, which can disrupt financing and planning of broadband projects.[98]

6.1.1 California Environmental Quality Act (CEQA)

In the case of broadband deployment over existing utility rights-of-way, the application of Section 851 also triggers CPUC review under the California Environmental Quality Act (CEQA)[99] for any such proposed build-out. For example, if Southern California Edison were to lease power lines for broadband deployment, CPUC approval including a favorable CEQA review would be required even though the physical changes to existing power lines would be minimal and would result in no discernable environmental effects. The CPUC has the power to grant categorical exemptions from Section 851 requirements to certain types of projects[100], however inconsistent interpretation of the relevant exemption standard has limited the use of that mechanism.

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[98] In addition to Section 851, wireless broadband projects face special problems related to the placement of antennas on utility poles because they are subject to additional state and federal statutory constraints on exposure of the public and utility workers to RF emissions and other hazards associated with the use of powered antennas, such as the danger of shock hazards from powered antennas.

[99] California Public Resources Code Sections 21000 – 21177 (1970).

[100] California Public Resources Code Section 853(b)

Case Study: San Mateo Bridge
In March2000, PG&E sought CPUC approval under Section 851 for authority to lease space on its electric transmission towers crossing San Francisco Bay to a company seeking to install fiber optic cable. PG&E obtained authority to install the wires from the Bay Conservation and Development Commission (BCDC), which, consistent with CEQA, found that the installation of wires on existing utility poles is categorically exempt from CEQA. PG&E began installation, while continuing its efforts to obtain CPUC authority for the lease transaction.

On October 8, 2002, the CPUC issued a draft decision that denied PG&E approval of the lease, effectively shutting down work on the project. On May 22, 2003, the CPUC granted the Section 851 application, but found that the installation of fiber optic cable on the towers was not categorically exempt from CEQA. On June 20, 2003, PG&E filed a petition to modify the decision, noting that the BCDC had found that the installation of utility transmission facilities on utility towers was categorically exempt from CEQA. On April 1, 2004, over four years after PG&E's first request for approval of the transaction, the CPUC reversed its position and found the installation to be exempt from CEQA. By that point, however, the fiber optic company had filed for bankruptcy protection.[101]

6.2 Rights of Way

The process for obtaining Right of Way (ROW) permits for construction of broadband infrastructure in California is lengthy, expensive, inconsistent and is cited as one of the most significant barrier to broadband deployment. ROW permits are issued by various agencies - federal, state and local agencies, as well as tribal governments - to build broadband infrastructure on property controlled by those agencies. There is no consistency in the application form or process, or in the permitting criteria or fees.

California Public Utilities Code Section 7901 authorizes telecommunications providers Rights of Way (ROW) access within the state of California. The Code further defines the rights of municipalities 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."[102] The California Government Code reserves the right of local governments to charge permit fees to companies that access ROW.[103] The federal government, through the 1996 Telecommunications Act, does not assert jurisdiction over public rights-of-way but does define the role of state and local governments in their administration.[104]

6.2.1 ROW Fees are Inconsistent and Often Above Cost

The 1996 Act stipulates that local municipalities may "require fair and reasonable compensation from telecommunications providers, on a competitively neutral and

[101] CPUC Decision 04-04-068 (2004).
[102] California Public Utilities Code Section 7901.1(a)
[103] California Government Code Section 50030.
[104] Section 253(c) of the 1996 Telecommunications Act.

nondiscriminatory basis."[105] In addition, California Government Code Section 50030 states that "any 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 ROW to cover the costs associated with administration of the ROW.

The Legislature and the courts have upheld the requirement that fees be limited to the local government's cost of providing access. In response to concerns that local governments were charging developers unfair or unrelated fees that were hindering development, California adopted the Mitigation Fee Act (MFA) in 1987.[106] 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 government's cost of administering the development.

The law was first applied to a communications case in *Williams Communications vs. City of Riverside.*[107] On December 19, 2003, the *Williams* court found that ROW fees must be limited to the local government's cost to administer permits and ordered that the city refund $750,000 that it had required as a condition for granting a license to Williams for installing and maintaining fiber optic facilities in the city streets. The court also ruled that there could be no separate fee or distinction for providers of advanced data services.[108]

Despite statute and case law, ROW fees remain an area of contention between municipalities and telecommunications providers. 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 believe that local governments often use the ROW process as an opportunity to increase local revenue which in turn, "raise[s] the cost of deploying broadband."[109]

There is no consistency in how cities and counties calculate ROW costs and often apply different fee requirements for similar infrastructure projects. Verizon reports, for example, that the fee schedule for its FTTP Project from the City of Banning is based on the amount Verizon has traditionally been charged as an ILEC. The County of Riverside and City of Beaumont, by contrast, have charged additional fees based on footage of aerial facilities. Turlock, Sunnyvale, and Palo Alto, for example, charge fees based on the provider's cost of construction, not the cities' respective costs.

6.2.2 ROW Application Processing is Inconsistent, Costly and Time-Consuming

The time to process a ROW application varies depending on the local government, and providers are unable to predict how long it will take to obtain permission to build out

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[105] Ibid.
[106] Government Code Section 66000 et seq. (1987).
[107] 114 Cal. App 4th 642 (2003).
[108] Ibid.
[109] Verizon California Inc.'s Opening Comments in R. 03-04-003.

facilities. Obtaining permits can take anywhere from weeks to months in each jurisdiction. When setback requirements and in-depth reviews by municipal planning departments are imposed, turnaround times approach the upper limits of this range. Reviews for compliance with zoning regulations also add to processing delay. The City and County of Los Angeles on average has a turnaround time of six weeks to obtain permits, although each project varies greatly. For example, placing utility cabinets above ground may lengthen the permit process due to local design-review codes. In some jurisdictions providers complain that cities sometimes do not reply to permit requests at all. Other cities, like Sunnyvale, Santa Clara, and Corona, require providers to enter into right of way agreements that can take many months to negotiate before the city will issue permits. SBC reports that it took two years to obtain permits for recent projects in Orange, Riverside and San Bernardino counties, although they indicate that the majority of permits are issued within the lower range of the time frame.[110]

Uncertainty caused by the ROW application process is a barrier to deployment. Financing of projects is often based on estimated completion dates that are impossible to predict under the current process. The National Association of Regulatory Utility Commissioners (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."[111]

6.2.3 ROW Application Forms and Assessment Criteria Are Inconsistent

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 jurisdiction. Providers also face different criteria upon which cities and counties assess their ROW applications. These criteria can even differ within the same jurisdiction, depending on the type of technology deployed or the type of project sponsor. For example, some permitting agencies, cities, counties request higher fees for fiber installations than they have traditionally charged for other materials for no discernible reason, and they impose additional engineering requirements, such as engineering stamps.[112] In contrast, ILEC engineers are exempted from this requirement pursuant to Business and Professional Code Section 6747. This results in different rules being applied to projects depending upon the status of the project sponsor.

6.2.4 California Lacks Efficient ROW Dispute Resolution Method

A dispute over ROW can delay the deployment of facilities for months or even years. In some cases, a provider may be forced to completely withdraw its plan.

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[110] Email transmittals between CPUC Staff and representatives of Verizon and SBC on January 14, 2005; January 26, 2005; January 27, 2005.

[111] "Broadband Facilities and ROW," July 13, 2002, NARUC, http://www.naruc.org/associations/1773/files/broadband_access.pdf

[112] The stamp certifies the plans were developed by a registered professional engineer. Communications companies contract with outside engineering firms to have their plans reviewed and then stamped. However most engineering firms only stamp plans they develop, requiring communications companies to contract the outside firm to draw the plans as opposed to being able to use their own employees, which is usually cost prohibitive.

In 1998, the CPUC adopted a ROW dispute resolution process for carriers and municipalities in Decision 98-10-058. However, local governments can ignore a CPUC order granting access to a ROW because they are not subject to CPUC jurisdiction. With no other recourse available to them, providers often proceed directly to expensive court battles to resolve disputes.

6.2.5 No Standards for State Agencies in ROW Permitting

State law currently provides little certainty as to the process and criteria used by state agencies in imposing and collecting ROW fees. California Government Code Section 50030 does not apply to state agencies, which led to a recent dispute between the California Department of Transportation (CalTrans) and SBC in Humboldt County. In that case, CalTrans imposed millions of dollars in ROW fees for deployment of fiber optic lines along a freeway, as a means of raising General Fund revenue to close a budget gap in 2001 . In the past, CalTrans had used an "incremental cost recovery" model in pricing ROW. To generate additional revenues, however, CalTrans charged SBC $6.40 per linear foot per one-inch conduit for right of way access, adding up to $2 million to the project cost. The CPUC ruled the dispute out of its jurisdiction, and SBC sued in federal court maintaining that the fees were illegal. Deployment of high-speed Internet access to the region was halted while the fees were disputed in court. A two-year impasse ended in June 2003 when SBC agreed to place $1.4 million in disputed fees in an escrow account. Although the long-awaited construction project was able to proceed, the core issue as to the extent to which a state agency can charge above-cost ROW fees remains unresolved and continues to be litigated.[113]

6.3 Carrier Certification Process Inconsistent and Unclear

The CPUC has traditionally required that telephone companies constructing facilities outside their traditional service territories seek authority to do so under Public Utilities Code Section 1001. With the advent of competition in the telecommunication market in California, new market entrants began to offer services in the state. Since these carriers did not have "service territories," the CPUC began requiring new entrants to obtain a Certificate of Public Convenience and Necessity (CPCN) to construct facilities and begin offering service.

Thus, the CPUC has required new entrants to obtain CPUC approval prior to entering the market and prior to construction of any facilities. For those firms that utilize existing facilities owned by other carriers, the granting of a CPCN focuses simply on the fitness of the provider to offer service in California, such as the company's record of compliance with consumer protection laws, as well as the records of the company's owners and management team. However, for those carriers seeking to construct new facilities to provide service, obtaining a CPCN requires the filing of a formal application and final approval by the CPUC, which can take many months longer to process and approve.

[113] North Coast Times, June 5,2003. See also, http://www.cenic.org/gb/pubs/gartner/report/broadbandObstacles.htm

In 1996 the CPUC developed a process to streamline the application and environmental review process for new carriers. However, in 1999 the CPUC changed the process to require that new entrants file a formal application for a CPCN. This was intended to be a temporary measure to remain in place while the CPUC addressed concerns with the process established in 1996, such as inequitable treatment of carriers based on a carrier's status. In February of 2000, the CPUC opened R.00-02-003 to address these underlying issues. However, this proceeding has been dormant since the summer of 2000. No new rules have been established, and the stop-gap measures remain in place, leaving the industry without a workable process for entry and build-out of networks.

The CPUC's current implementation of its CPCN approval process is problematic because it does not treat carriers seeking to construct new facilities in a uniform manner. The primary area where this disparate treatment occurs is in the review of the environmental impacts of the new entrants' proposed networks. The CPUC administers its review differently depending on the regulatory classification of the provider, and depending on when the provider received its certificate to operate in California - instead of the environmental impacts of the specific project.

The lack of uniformity in the CPUC approval process is illustrated by the following example: an ILEC is not required to seek review for either a CPCN or under CEQA for a project to build out infrastructure, as long as it is within its existing service territory. A CLEC that received authority to operate in California in 1996 might need approval depending on whether or not the project will be built in an existing ROW.[114] A CLEC that just recently applied to enter the California market would be required to file a CPCN application with the CPUC before it could do anything. Energy utilities are permitted under CPUC rules to construct certain facilities without CPUC approval or environmental review. However, such exemptions have not been made available to many telecommunications providers. Additionally, many of the CPUC staff conducting the reviews have experience reviewing large electric and natural gas projects, but relatively little experience reviewing telecommunications projects. Providers are hesitant to invest time and resources in a project if they cannot predict if, when, or under what conditions the project will be approved.

6.4 Cable Franchising

California Government Code Section 53066 allows cities and counties to authorize exclusive franchises for the construction of a cable TV system.[115] Under this arrangement, there is minimal competition among cable companies for customers. Other cable providers are not permitted to compete in the area unless the local government grants an additional franchise, which is referred to as a competitive franchise.[116] The local government evaluates requests

[114] CPUC Decision 96-12-120.

[115] California Government Code Section 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 TV system.

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

for competitive franchises based on "significant positive or negative impacts on the community being served."[117] 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," as the incumbent provider.[118] This obligation to wire and serve the same area as the incumbent is cost prohibitive to most potential entrants, as it requires a massive infrastructure investment that is in most cases not economically viable.

To facilitate deployment and encourage competition in the cable video market, the 1996 Act created a new designation for competitive cable providers called Open Video System (OVS) as an alternative to traditional cable TV regulation.[119] 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 build out requirements. This allows a competitive provider to enter the market without the requirement to extend its network throughout the entire franchise territory.

California code does not currently recognize the OVS designation, however, and state requirements for a competitive franchise are in direct contradiction to the federal scheme. The California Attorney General recognized this problem and opened Opinion No. 02-1013 in 2002, requesting comments. An opinion was never issued.

6.5 Broadband Access Challenges to the Disabled Community

Broadband access for those with disabilities lags behind the non-disabled. One reason for this is the fact that many technical adaptations for consumer premises equipment and assistive services for the disabled are not widely available and are often expensive. Public access points, such as community centers and libraries, often can not accommodate disabled individuals, despite requirements under California law and the Americans with Disabilities Act.[120] A variety of computer-based assistive technology devices and software tools are available to help people with disabilities. However, access to a computer and appropriate software is often prohibitively expensive.[121] Disability Rights Advocates quotes prices for JAWS® screen-reading software for blind and visually-impaired consumers at up to $1,095.00, and voice recognition software at $179.99.

Assistive technologies available to the disabled community through the Deaf & Disabled Telecommunications Program (DDTP) are focused on traditional voice communications services over the Public Switched Telephone Network, not high-speed Internet access, services, consumer premises equipment or software such as those mentioned above.

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117 California Government Code Section 53066.3.(1)
118 California Government Code Section 53066.3 (d)
119 1996 Telecommunications Act, Section 653. FCC Rules, Section 76.1500-76.1505.
120 Comments of Disability Rights Advocates and the Center for Independent Living, San Francisco meeting on February 10, 2004.
121 Disability Watch, p. 93.

6.6 Challenges to Access in Rural Communities

In rural California, low population density makes investment in certain types of broadband infrastructure, such as DSL and cable, less economically feasible than in urban and suburban areas. In Tuolumne County, for example, local officials indicate that more than 90% of the population does not have access to high-speed Internet service other than satellite.[122] Dial-up Internet service over analog phone lines remains the predominant form of Internet connection in many rural areas for reasons of economics, demographics and lack of infrastructure.

The demographics of rural areas play a large role in broadband subscription rates, making cost-effective investments in infrastructure even more difficult. Research data from 2002 indicate that nearly two-thirds of rural residents believe that they will not go online at all in the future. Rural areas also have large elderly populations, who are the least likely of all consumers to go online, as well as the smaller numbers of high school and college students relative to the rest of the population. High school and college students are the most likely to use the Internet. A significantly higher percentage of rural residents earn less than $30,000 per year (47% compared with 39% of urban and 29% of suburban residents). The $30,000 per year earning level is a significant break point in terms of usage rates.[123]

Figure 6.1
Internet Use by Population by Community Type[124]
May 2002

	Will go online	Will not go online
Urban	47%	50%
Rural	33%	62%

Population demographics are significant criteria in infrastructure investment decisions. Less densely populated areas are at a disadvantage in attracting private capital for broadband infrastructure because there are fewer willing consumers to provide a return on any investment over a reasonable period.

Local officials and community based organizations have provided subsidies and grants to build broadband infrastructure in rural areas. Construction loans for broadband deployment are available from the Rural Utilities Service (RUS). The definition of "rural" that certain federal agencies use, however, unduly restricts the flow of subsidies to many areas.[125] The U.S. Department of Agriculture (USDA), which oversees the RUS, defines rural as "any incorporated or unincorporated place that (A) has not more than 20,000 inhabitants based on the most recent available population statistics of the Bureau of the Census; and (B) is not located in an area designated as a standard metropolitan statistical area." This definition disadvantages many rural California communities because some large, rural counties also

[122] Amador-Tuolumne Community Action Agency, Opening Comments in R. 03-04-003.
[123] Pew Internet & American Life Project, "The Ever-Shifting Internet Population," April 2003.
[124] Ibid., p. 16.
[125] New Valley Connexions' Public Policy Roadmap for Improving Broadband Access, December 2003, pp. 18-20.

include a large urban population, resulting in the entire county not obtaining RUS grants because it does not meet requirement (B).

For example, California's San Joaquin Valley is approximately 80% rural with low population densities.[126] But by federal definitions, it is not eligible for federal funding.

[126] New Valley Connexions, p. 3.

Chapter 7. Existing Programs to Promote Broadband

7.1 Subsidy Programs

Subsidy programs are designed to benefit consumers of broadband service by reducing the monthly price, making the service more affordable. Incentive programs are designed to both encourage further deployment of broadband infrastructure and provide education and training about broadband technology to promote the use of advanced telecommunications technology.

Two subsidy programs, the California Teleconnect Fund (CTF) and the Federal E-Rate program, provide benefits directly to consumer end users and are available to Californians. Under both the CTF and E-Rate programs, qualified participants receive discounted service from telecommunications carriers, which are then compensated with program funds for the discount provided. The subsidies are provided to organizations that share their technology with the larger community. The FCC's E-Rate program offers eligible K-12 schools and libraries a discount of 20% to 90%.[127] The CTF program provides a 50% discount for eligible schools, libraries, hospitals, health clinics and community based organizations. The table below compares the CTF and E-Rate Programs.

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

[127] On August 3, 2004, the FCC suspended any new grants from the E-rate program. On November 29, 2004, funding for the program resumed.

Figure 7.1
Comparisons 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 – 2003	$290 million	$1,641 million This is the amount of funding received by California schools and libraries.
Funding Source	(A)[128]	Universal Service fee charged to companies providing interstate and/or international telecommunications services

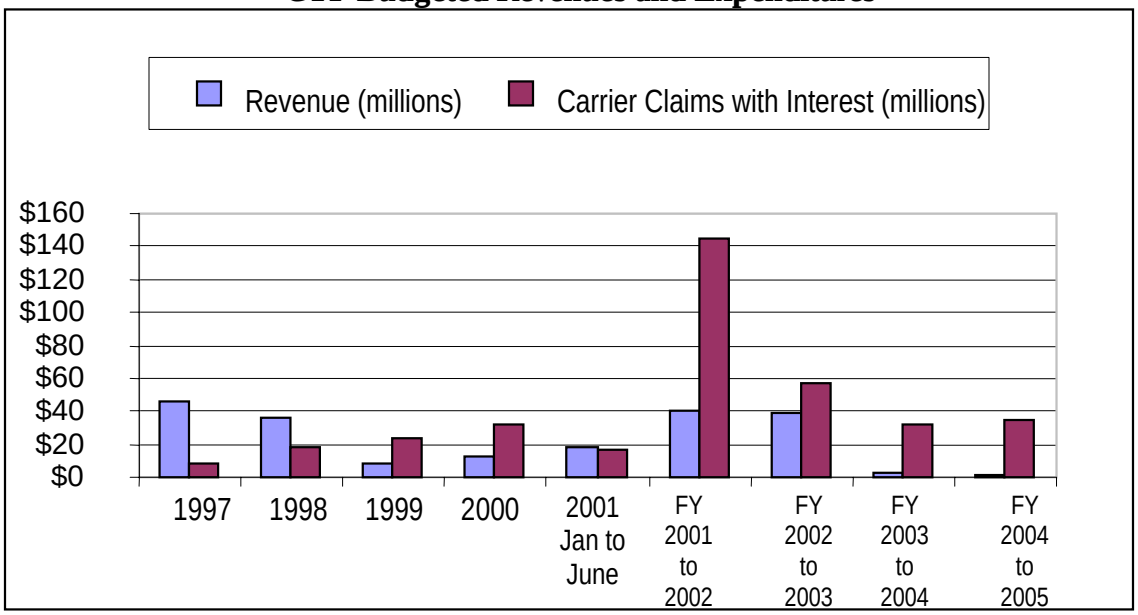
7.1.1 California Teleconnect Fund

The California Teleconnect Fund program, administered by the CPUC, provides a discount of 50% on selected telecommunication services to qualified schools and libraries, municipal-, county-, 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 to high-speed transmission lines for data services.

The table below shows the CTF program's budgeted revenues and expenditures from 1997 through the current fiscal year. The table below shows the CTF program's budget revenues and expenditures from 1997 through the current fiscal year. A review of the table indicates that there has historically been a disconnect between the program's budgeted revenues and budgeted claims. In some years, program revenues far exceeded claims, and in other years, claims far exceeded revenues. Such discrepancies, along with operational problems discussed below, have been a cause of concern. An appropriation of $17,974,000 for Fiscal Year 2004/2005 was adopted by the Legislature.

[128] The all-end-user surcharges are assessed on consumers' bills for intrastate telecommunications services except for the following: Universal Lifeline Telephone Service (ULTS) billings, charges to other certificated carriers for services that are to be resold, coin sent paid telephone calls (coin in box) and debit card calls, customer-specific contracts effective before September 15, 1994, usage charges for coin-operated pay telephones, directory advertising, and one-way radio paging.

Figure 7.2
CTF Budgeted Revenues and Expenditures



The CTF program receives funds from an end-user surcharge applied to the intrastate portion of all customers' monthly telephone bills. The current surcharge is 0.16%. From the program's implementation in 1997 through 2002, the surcharge rate has ranged from 0.05% to 0.41%. From January 2003 through July 2004, the surcharge was set at 0%, when the surcharge was suspended because more than sufficient funds had been collected for the subsequent fiscal year.

7.1.2 Services Covered

The CTF discount applies to both regular telephone service as well as advanced services. At present, claims paid to providers show that the percentage of funds dedicated to advanced services versus regular telephone service is about evenly split. However, although DSL is an eligible service under CTF program rules, few telephone companies are providing DSL under the program. More funds could be dedicated to advanced services if providers elected to offer DSL under the CTF program.[129]

7.1.3 CTF Program Issues

Recipients of CTF subsidies report that while the program has helped lower-use 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

[129] The CPUC has determined that CTF discounts apply to all services deemed CTF eligible irrespective of the inter- or intra- state nature of the service. SBC filed an intrastate tariff with the CPUC for DSL service and is the only broadband provider to have done so.

are even more that are unaware of the program's existence.[130] The survey revealed that there are a number of organizations that do not receive any type of support for broadband service and are not familiar with the CTF Program.[131]

Providers who participate in the CTF program have stated that there are delays in claim processing and uncertainty about the availability of funds given the state's ability to borrow money for the General Fund.[132] Claim processing delays occur when there is a significant influx of claims filed at the same time. Claim processing procedures have been significantly streamlined with CPUC adoption of Resolution T-16763 in May 2004, reducing the potential for future backlogs.

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 reimburse them for the discount.

The CPUC staff currently conducts outreach to community-based organizations in order to expand awareness of the CTF fund, in an effort to increase subsidies to these groups.

7.1.4 E-rate Program

The E-rate program provides eligible K-12 schools and libraries a discount of 20% to 90% off telephone service, internet access and other services. The level of discounts depends on the poverty level and the urban/rural status of the population served. The table below shows how the discount is determined.

[130] 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 the second survey, only eight reported receiving the CTF subsidy. 39 respondents reported that they were not aware of the CTF at all.

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

[132] Funding for the CTF Program was not included in the 2004-2005 State budget. However, Senate Bill 1276, signed by Governor Schwarzenegger on September 28, 2004, authorizes funding for the CTF Program.

Figure 7.3
Determination of Discount Percentage

INCOME	URBAN DISCOUNT	RURAL DISCOUNT
If the % of students in THE school that qualify 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 7.4
Average E-Rate Discount[133]

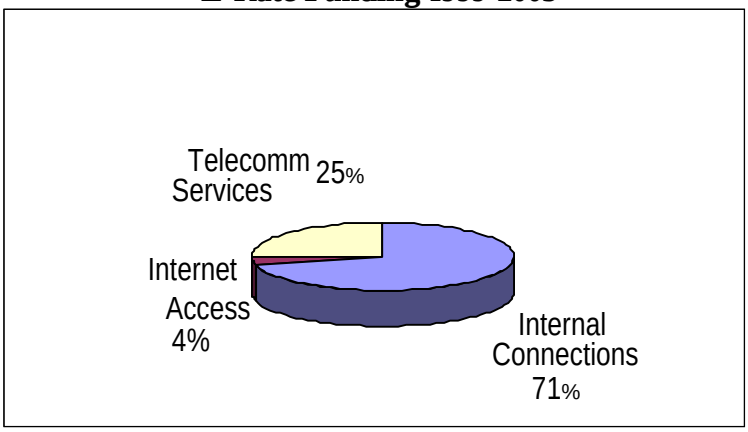
1999	75.57%
2000	82.75%
2001	82.65%
2002	78.14%
2003	79.84%

The E-Rate program provides discounts for telephone services, Internet access as well as the costs associated with connecting users to common equipment. The program also covers usage, cell phones and long distance, which the CTF does not. Internet access includes "basic conduit access" to the Internet. The E-Rate program defines "basic conduit access" as all standard features typically provided by Internet Service Providers. Internal connections are infrastructure items serving multiple users, such as cabling and file servers.

California schools and libraries have received $1.6 billion from the E-Rate program during the last five years. $63.5 million (4%) of the $1.6 billion has been appropriated for Internet access. The following figure illustrates the funds distributed to California over the last five years and the types of services that were subsidized:

[133] Percentages calculated from data downloaded from www.sl.universalservice.org.

Figure 7.5
E-Rate Funding 1999-2003



7.2 Federal Incentive Programs

In addition to the E-Rate program, which offers direct subsidies to the users, there are a number of existing federal programs that provide funding for broadband deployment, education and telemedicine services. The USDA is the lead federal agency on these initiatives, as well as the agency with the greatest amount of funding available. The United States Department of Commerce and the Department of Health and Human Services also provide funding for broadband related projects. Additionally, there are Congressional initiatives that provide funding to rural and lower-use communities.

7.2.1 The Rural Utilities Service

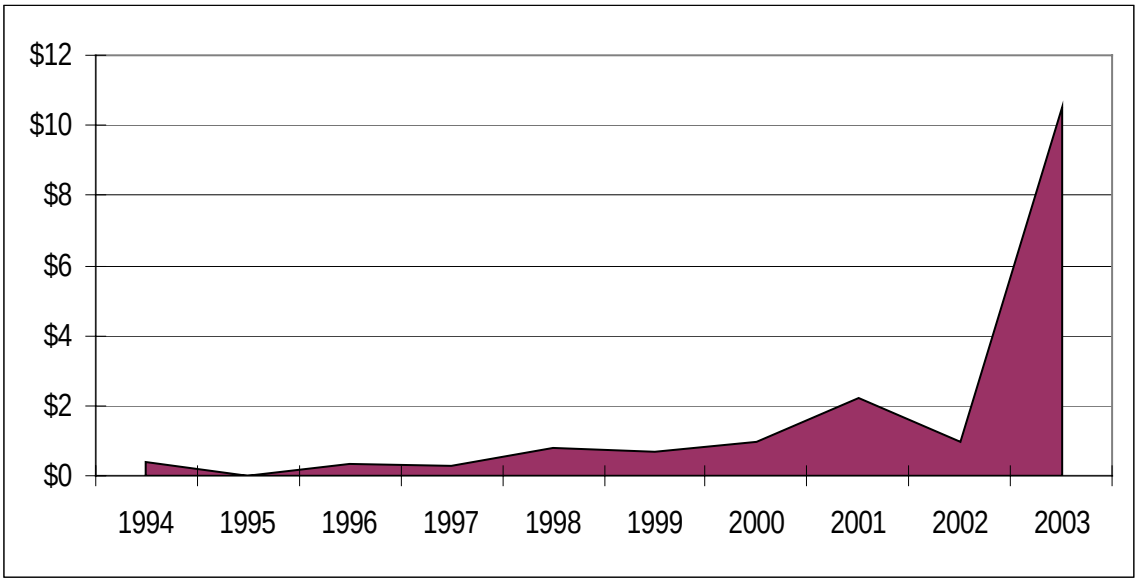
The Rural Utilities Service (RUS) program provides grants, incentives, and low-interest financing to electric, communications, water, sewer, telecommunications, and environmental projects. The RUS has been in existence for over 50 years, always with the purpose of providing essential services to rural communities. In October 2003, the RUS program issued $44 million in grants for programs to improve access to broadband for educational institutions, medical agencies for telemedicine services, as well as to generally increase penetration of broadband usage in rural communities. Of the $44 million, $23.5 million was provided for distance-education projects, $11.3 million for rural community projects, and $8.9 million for telemedicine projects.[134] According to the RUS's 2003 annual report, the program has an excess funding level of $1.8 billion specifically earmarked for telecommunications.[135] Over $2.2 billion was made available for loans to promote broadband access in 2004/2005.[136]

The following graph illustrates the $17.2 million cumulative funding provided to California beneficiaries of the RUS program for the years 1994 to 2003. Three awards are in the 2003

[134] Federal Computer Week, October 1, 2003.
[135] http://www.usda.gov/rus/index2/RUSannualreport.pdf
[136] Federal Register, Vol. 69, No. 60, March 29, 2004.

amount, including one award for $9.7 million to Doctors Telehealth Network in Newport Beach, California.

Figure 7.6
RUS Grants to California Recipients
(Dollars in millions)



On May 4, 2004, the USDA announced that it would provide $190 million in broadband loans to 19 states.[137] States qualified 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 2,500 people. As of November 2004, the RUS had announced that two California providers had received Broadband Loan Awards: $7.7 million to Calaveras Telephone Company in Copperopolis and $38.3 million to Sierra Telephone Company in Oakhurst.[138]

7.2.2 Distance Learning and Telemedicine Grant Program

The Distance Learning and Telemedicine Grant Program (DLT), also administered by the RUS, helps fund capital costs for broadband infrastructure and equipment for eligible institutions such as schools and hospitals, and requires a 15% matching of costs. The DLT program has spent $173 million funding broadband projects since 1993.[139] California has received over $8 million from this program, up to and including 2003. In 2004, the DLT program issued $24,604,673 in grants, with California receiving a $447,752 award for West Hills Community College.[140]

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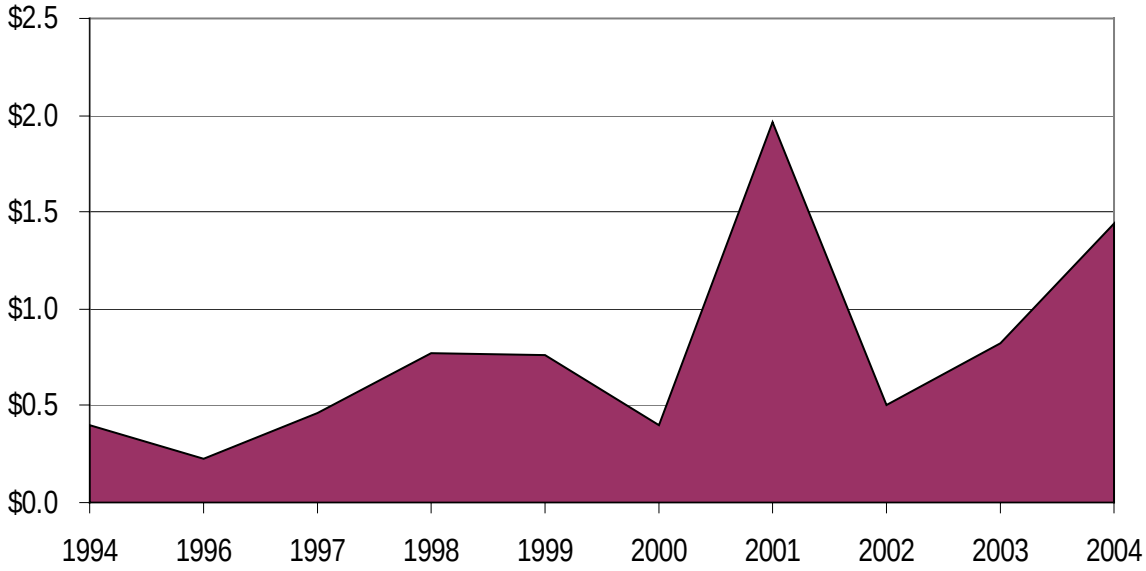
[137] http://www.usda.gov/Newsroom/0180.04.html. The 19 states are AL, AR, MS, GA, KS, TX, LA, MI, ND, OH, OK, PA, SC, SD, TN, CO, IL, VA, and WI. To fund the loans, $150 million came from the 2002 Farm Bill, and $40 million from the traditional RUS program.
[138] http://www.ruralbroadbandcoalition.net/RUSLoans.pdf
[139] 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.
[140] http://rurdev.usda.gov/rd/newsroom/2004/2004DLTGrants.html

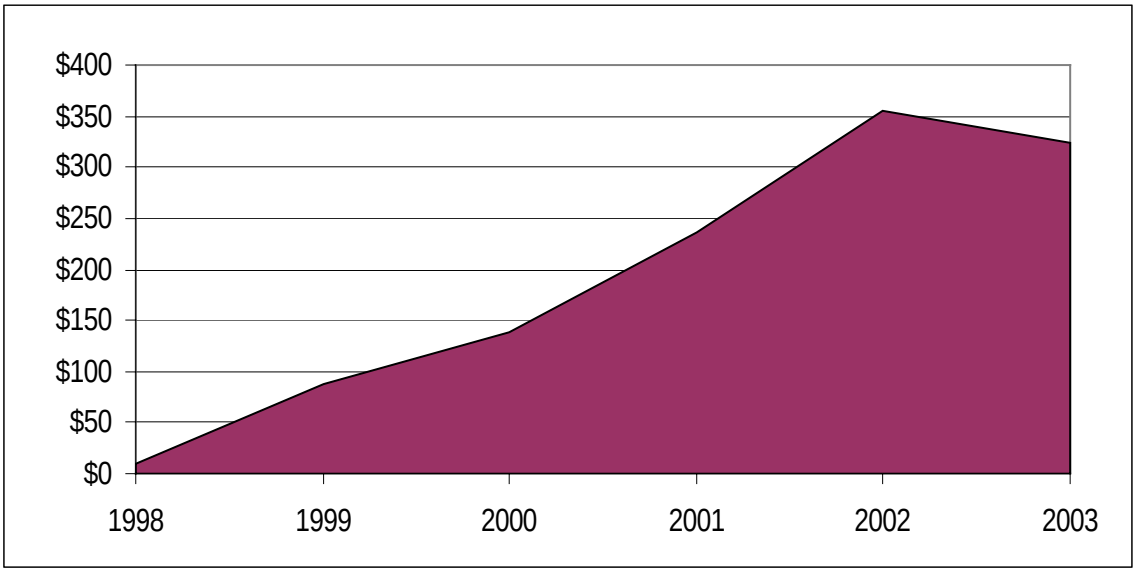
Figure 7.7
Distance Learning Grants to California Recipients
(Dollars in millions)



A number of programs specifically 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. In 2003 the Department of Health and Human Services awarded $3.74 million in grants to improve rural telemedicine outreach.[141] The Health Resources and Services Administration Office for the Advancement of Telehealth announced a $3.86 million grant program on October 21, 2003. The following graph illustrates that California recipients have received a cumulative $1,151,254 in Telemedicine grants for the years 1998 - 2003.

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

Figure 7.8
Telemedicine Grants to California Recipients
(Dollars in thousands)



7.2.3 Technology Opportunities Program

The United States Department of Commerce funds the Technology Opportunities Program (TOP). TOP provides matching grants for projects to increase training in advanced telecommunication technology. TOP's purpose is to support lifetime learning, assist public safety officials, encourage telemedicine applications and promote economic development. In 2004, 27 TOP grants were awarded for a total of $14.4 million, including grants to San Diego State University Foundation and San Joaquin General Hospital.[142]

7.3 What Other States Are Doing

Many states have taken steps to facilitate broadband deployment. States have generally avoided direct intervention in the broadband market, however. The extent to which state governments are engaged in deployment of broadband infrastructures varies according to policymakers, strategies, budgetary situations, and other factors.

A matrix identifying a variety of government initiatives for deployment of broadband infrastructure is attached to this report as Appendix B. The types of policies examined in the matrix largely address state government actions taken outside of the regulatory context that are aimed at directly or indirectly assisting the build-out of broadband network infrastructure.

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

The following are eight examples of approaches taken by other states to encourage broadband deployment.

7.3.1 Alaska

The Regulatory Commission of Alaska (RCA), the equivalent of the CPUC, developed a program called the "Rural Alaska Broadband Internet Access Program" in 2002 to provide grants funding 75% of costs to bring high-speed Internet to isolated communities. The funds for the program were obtained from the federal government's Rural Utilities Services (RUS). The recipients of the grants are required to charge a rate comparable with the price in urban areas, such as Fairbanks or Anchorage (currently around $50 per month) through the maintenance phase of the project. As of May 5, 2004, $15 million has been allocated to the program, with $4 million already committed to various projects.[143] The FCC's 477 report states that between December 2002 and December 2003, there were almost 16,000 broadband lines installed in the state of Alaska,[144] representing approximately a 28% increase in broadband penetration.

7.3.2 Idaho

Idaho provides a Broadband Tax Credit of 3% for Idaho taxpayers. The credit allows corporations and individuals to install qualifying broadband equipment that has a capacity of transmitting signals at a rate of at least 200 kbps to a subscriber and at least 125 kbps from a subscriber.[145] According to the Idaho Public Utilities Commission (IPUC), in the first three years, the program has funded almost $3 million in broadband projects, with another $500,000 to $750,000 currently pending. Qwest, Verizon and CableOne submit the majority of the applications. The tax credit not only has a carry-forward option, but also is transferable, in that a company can sell its tax credit. In the most recent legislative session, the governor signed a bill to extend the program. According to the FCC's Form 477, from 2000, until the most current information available, an additional 72,000 broadband lines have been added in the state, an increase of over 897%.

7.3.3 Maine

Maine offers a number of research and development and technology tax credit incentive programs, including the "High Technology Investment Tax Credit."[146] Eligibility criteria are designed for businesses primarily engaged in high tech activities, such as design, creation and production of computer software, equipment, supporting communications components and other accessories that are associated with computer software equipment. The credit amount is equal to the adjusted basis of eligible equipment placed in service in Maine, less any lease payments received during the taxable year. The credit cannot reduce the tax liability to less than the preceding tax year's liability after the allowance of any credits, and it cannot reduce the tax liability in the current year below zero. Any unused portions of the credit may be carried forward five years but the credit cannot exceed $100,000 in any one year and income

[143] http://www.state.ak.us/rca/Headlines/040506_1.pdf
[144] http://www.fcc.gov/Bureaus/Common_Carrier/Reports/FCC-State_Link/IAD/hspd0604.pdf
[145] Before the Idaho Public Utilities Commission, Case No PRJ-T-03-1, Order No. 29318
[146] http://www.maineco.org/advantages/I_tax_credits.html

must be increased by any credit base amount claimed as a business expense. The High Technology Investment Tax Credit is part of an ongoing effort by Maine to increase investment in the state. Since inception, this tax credit has funded an estimated $2 million in broadband projects. Maine is also has a BETR program (Business Equipment Tax Reimbursement) that reimburses businesses for locally imposed business equipment taxes, but the High Tech tax credit cannot be used in tandem with BETR. The program has facilitated high end operations such as MBNA, LL Bean and BankNorth and has led to a significant growth of call centers in Maine (aided by their Governor's Training Initiative grant program), which now has more call centers per capita than any other state. According to the FCC's Form 477, from 2000, until the most current information available, an additional 73,000 broadband lines have been added, an increase of over 278%.

7.3.4 Michigan

The Michigan Broadband Development Authority (MBDA) was established in August 2002 to spearhead a state initiative to encourage broadband deployment. Michigan has also raised capital through bond issues to increase financing opportunities for providers, and to provide community grants and low interest loans for the planning of infrastructure projects. Interested companies must submit a business plan that includes financing needs and expected results. According to the September 2002 report by the MDBA, 32 project proposals had been submitted for requests totaling over $250 million. These projects (ranging from $500,000 to $50 million) include DSL, cable, medical applications, E-commerce, data centers, and others. Michigan's programs to increase broadband subscription are ongoing, with the most recent balance sheet of the Michigan Broadband Development Authority showing Total Assets of $45 million. Forecasted 2004 financial statements show a loan portfolio of $11 million, that is estimated to be $150 million by 2009. According to the FCC's Form 477, since the date of the MDBA's inception in 2002, an additional 208,000 broadband lines have been added in the state, an increase of about 32%.

7.3.5 Mississippi

In 2003, the Mississippi Broadband Technology Development Act was enacted in the state legislature. The Technology Act seeks to bring broadband and similar services to "Tier 2" and "Tier 3" areas, not just "Tier 1" by means of infrastructure investment.[147] The Act became effective on June 30, 2003 and remains in effect until July 1, 2013. Recipients are awarded tax credits based on the areas in which they plan to invest. Equipment costs for providing broadband service are reimbursed at a rate of 5%, 10%, and 15% (urban to rural), with a credit cap of 50% of the provider's tax liability. But unlike Oregon or Montana, the provider can carry forward the benefit for a maximum of 10 consecutive years. To qualify as broadband technology, a minimum of 384 kbps transmission speed is required in at least one direction. The state Science & Technology Institute quotes BellSouth as praising Mississippi's initiative in providing tax credits for broadband investment, and states that prior to the legislation, costs to expand broadband technology into rural areas was too cost-

[147] The tiers each represent one third of the counties in Mississippi ranked by average per capita income and unemployment rates. The 27 counties with the highest income and lowest unemployment are designated Tier 1. The next lowest income and highest unemployment is Tier 2, etc.

prohibitive.[148] In the same report issued by TechNet, BellSouth estimated that it has spent over $10 million dollars in Mississippi by the end of 2003, and now believes that it has 100% DSL coverage in the state. According to the FCC's Form 477, in 2003 an additional 35,000 broadband lines have been added, an increase of almost 44% from 2002.

7.3.6 Montana

Montana offers a 20% tax credit to telecommunication providers who invest in advanced telecommunications infrastructure improvements in the state. The tax credit (called the Advanced Telecommunications Infrastructure Tax Credit) may not exceed a total of $2 million for all qualified telecommunication services in any consecutive 12-month period. There are further tax implications, forbidding the use of carry-back or carry-forward of any losses resulting from the credit, and no refund is allowed on a tax return if the company has a zero or negative tax liability as a result of the credit. A provider is required to submit an application proving that the investment would improve access to a majority of customers in an unserved or lower-use community. In 2000, the program accounted for $204,221 in tax credits, which was included in an estimated $1,777,237 in total infrastructure expenditures that year. The following year, $1,006,476 in tax credits was awarded, for a total infrastructure investment of almost $11,000,000.[149] By the end of 2001, it is estimated that over 120 formerly lower-use rural areas of Montana now have complete access to broadband, DSL, or comparable services. Funding for these projects was eliminated after 2002 due to budget concerns. The director of the program noted that while a number of useful projects were started, there were fewer than expected applications from providers. According to the FCC's Form 477, since 2000 (the first year data is available for Montana) until the most current information available, an additional 32,000 broadband lines have been added, an increase of over 432%.

7.3.7 Ohio

The Public Utilities Commission of Ohio created the Community Technology Fund. This fund was created to help ensure that rural communities would have access to advanced telecommunications technology. As of June 2001, the Fund had awarded $754,000 to various not-for-profit organizations in their efforts to bridge the digital divide. According to the FCC's Form 477, since 2001 until the most current information available, an additional 541,000 broadband lines have been added, an increase of over 124%.

7.3.8 Oregon

Oregon has two broadband investment programs with different incentives. The Advanced Telecommunications Facility Credit (ATFC) provides a tax credit to broadband providers investing in broadband infrastructure and equipment in lesser-use communities. The ATFC offers a tax credit based on total expenditures. The tax credit is capped at $10 million, or 10% of the total expenditure. Other stipulations include a limit on customer price to 125% of average cost in a comparable urban area, and access must be made available to at least 51% of persons in the lesser-use community to be served. "Advanced telecommunications"

[148] http://www.matr.net/print-7475.html
[149] http://www.techpolicybank.org/mtprogram.html

is defined as equipment receiving and sending at a minimum transmission speed of 200 kbps.

The Oregon Telecommunications Infrastructure Act (TIA), the other broadband program, offers grants based on an identified need in lesser-use communities, usually rural areas. Funded by U.S. West funds as a condition of the deregulation of its intrastate operations, over $70 million dollars has been invested in TIA infrastructure projects. Grant amounts are not limited and recipients are not subject any requirements. However, tax credits received under the ATFC program are deducted from TIA grant awards. According to the FCC's Form 477, since the inception of ATFC and TIA in 2001, 287,000 broadband lines have been added in Oregon, an increase of 308%.

Chapter 8. Emerging Solutions

There have been many significant developments that hold promise for addressing the current barriers to greater broadband deployment in California. This chapter identifies a number of these emerging solutions and categorizes them into three key areas: (a) technology improvements, (b) market developments, and (c) policy issues.

8.1 Technology and Infrastructure

Improved technology holds the promise of overcoming many of the barriers currently preventing more widespread deployment and use of broadband. The history of broadband technology has been one of ever-greater innovation, increasing capabilities, and decreasing costs.

8.1.1 DSL

Telecommunications companies have overcome the technical limitation of DSL requiring all-copper facilities by installing DSLAMs inside remote terminals. Because the price and capability of DSL equipment have been greatly improved in recent years, ILECs have been able to deploy more DSLAMs in remote terminals, making it feasible to provide broadband in more areas with low population density. As the ILECs continue to extend the reach of DSL farther out into more rural areas, broadband services will continue to become more widely available.

The maximum bandwidth that can be delivered via DSL remains distance-dependant, but technical advancements are also increasing the bandwidth available through DSL. By locating DSLAMs farther into neighborhoods and closer to customers, and combining 2-wire pairs in a process called "copper pair bonding," telephone companies are also able to offer higher speed DSL services with existing facilities.[150]

New technologies that compress digital signals also allow images to be transferred at a much higher rate over DSL.[151] Using compression technology, a high definition television signal which requires about 20 Mbps could be reduced to approximately 2 Mbps, allowing a standard 6 Mbps ASDL line to transmit HDTV into homes. This could facilitate an ILEC's ability to deliver any data, including real-time video, over any medium including a twisted copper pair.

8.1.2 Fiber to the Premises (FTTP)

Fiber to the Premises systems involve the installation of optical fiber directly into homes. The technology promises speeds of up to 100 Mbps and can reach greater distances, 6.2 to 49.6 miles, than DSL. In an effort to remain competitive with cable companies, ILECs have

[150] Loring Wirbel, "SBC Shifts Focus from DSL to Passive Optical Nets," EE Times, November 27, 2001. See also, SBC "Fiber-to-the-Node" announcement;
[151] "Carriers Get Technical Help in Bringing HDTV to Market," Telephony Online, January 17, 2005.

begun to deploy fiber in select areas, providing a single connection that can carry telephone service, high-speed Internet and video on demand. Verizon has announced plans to deploy FTTP over the next 10 to 15 years throughout its nationwide operating system. SBC has also recently announced plans to invest $4 billion dollars over the next three years to build a fiber network using both Fiber to the Node (FTTN),[152] and FTTP technologies. SBC expects to reach 17 million homes with FTTN and 1 million homes with FTTP by 2007, including a residential neighborhood in Irvine, California[153] and a new development in San Francisco's Mission Bay.[154]

Case Study: SureWest's Broadband All-Fiber Network

SureWest Broadband, a subsidiary of ILEC Roseville Telephone serving the Sacramento area was among the first in the nation to offer the "triple-play" package of integrated data, voice and video on demand over a fiber-to-the-home network in California. With over 9,000 subscribers constituting a 20 percent market penetration rate, SureWest's all-fiber broadband Internet offers speeds up to 10Mps symmetrical. SureWest has committed to pass 150,000 homes with fiber by 2006.[155]

Case Study: Verizon's FTTP Deployment

Verizon is now offering FTTP services in Riverside, Orange, and San Bernardino counties[156] with plans to offer the service to about 100,000 homes and businesses in California.[157] Prices range from $39.95 per month - $199.95 per month, based on the level of service. Maximum connection speeds range from 5Mbps download and 2Mbps upload for the entry-level service to 30Mbps download and 5Mbps upload for the fastest service.[158] Verizon announced plans to pass 1 million homes and businesses in nine states by the end of 2004.

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[152] Fiber-to-the-Node, which is similar to cable modem's HFC network architecture, but SBC will use copper loop instead of coaxial cable to connect to individual customers.

[153] Financial Times, June 22, 2004.

[154] June 22, 2004, http://www.sbc.com/gen/press-room?pid=5097&cdvn=news&newsarticleid=21207

[155] SureWest, http://www.surewest.com, July 9, 2003 and "Cisco Helps SureWest Deploy Integrated Data, Voice and Video," http://www.cisco.com, 2004.

[156] Verizon, "Verizon Deploying Fiber Optics to Homes and Businesses in 6 More States in Northeast and Mid-Atlantic," www.verizon.com, October 21, 2004. http:///newscenter.verizon.com

[157] Jim Duffy, "Verizon details FTTP plans," Network World, July 26, 2004. http://www.nwfusion.com

[158] Verizon, http://www.verizon.com

Case Study: SBC's Project Lightspeed
SBC's Project Lightspeed will use both FTTP and FTTN technologies. In existing neighborhoods, SBC plans to use an FTTN architecture, which takes fiber to within 3,000 feet of homes being served and makes use of advanced compression technologies along with IP switching to deliver high-quality TV, Internet access and voice services. FTTN is capable of delivering 20 to 25 Mbps downstream, sufficient to simultaneously deliver four streams of TV programming, including HDTV and Internet access with robust speeds, and IP voice —all on a common IP network platform.[159]

8.1.3 Cable

Currently, the 40 Mbps bandwidth available to a cable node comes from the dedication of a single cable channel for cable modem service. To satisfy demands for greater bandwidth, there are efforts underway in the cable industry to increase available bandwidth by 10 Mbps to 20 Mbps through adoption of a new cable modem technical standard called DOCSIS 2.0. On December 16, 2003, Comcast doubled its downstream speeds from 1.5 Mbps to 3 Mbps for customers in the San Francisco Bay Area.[160] The new cable standard increases bandwidth by dedicating more TV channels to cable modem service.

In August 2004, RCN launched cable broadband service with a download speed of 7 Mbps, making it the fastest residential Internet service available in the country.[161] The 7 Mbps also comes with an upstream speed of 800 kbps and is offered in the San Francisco Bay Area and Southern California markets. RCN is an OVS provider and with its 7 Mbps service, is currently offering broadband services at double the speed of the incumbent cable providers with which they compete.

8.1.4 Wireless Technologies

With a range of up to 30 miles and bandwidth of 70 Mbps, WirelessMAN technologies have the potential to become a viable last mile broadband connection, allowing prospective broadband customers to bypass the physical broadband pipes owned by the phone companies, cable companies and electric utilities. Of the two wireless broadband technologies, WiFi and WiMax, WiMax is farthest along in development. Further enhancing WiMax's prospect to become a true last mile alternative, industry heavyweight Intel plans to introduce WiMax chipsets for service providers and for integration onto desktop and laptop computers. Intel played a critical role in helping to popularize Wi-Fi by integrating Wi-Fi chipset into its Centrino chipset for laptop computers. Commercial distribution of WiMax & WiFi chips from companies like Intel is crucial, as it dramatically lowers the cost of

[159] SBC, www.sbc.com, November 11, 2004.
[160] Comcast, www.comcast.com
[161] Sam Kennedy, "RCN offers fastest access to Internet", The Morning Call, August 31, 2004. http://www.mcall.com

integrating the technology onto a computer since it is included as a function of a computer chipset, rather than a separate component.[162]

There are increasing calls for the FCC to reallocate and/or dedicate additional unlicensed spectrum for wireless broadband technologies. One promising source of new spectrum is that currently occupied by local television station analog signals. This spectrum will become available once television stations complete their migration from spectrum to broadcast high-definition television programming. The FCC has opened a proceeding to look into this issue.[163] The FCC also currently is undertaking efforts to better manage and allocate spectrum to meet the demands for wireless broadband, including allocating additional unlicensed spectrum for WiFi.[164] Another federal agency, the Office of Spectrum Management is charged with coordinating the development of a comprehensive national spectrum management policy.[165]

Case Study: WiFi Hot Zones in Los Gatos

Several businesses and a local wireless networking company, called Firetide, have teamed up to develop a two-block WiFi network in Los Gatos, California, complete with free broadband. Previously, organizations such as the Los Gatos Opera House and the Tollhouse Hotel were unable to offer broadband to clients due to the difficulty with wiring fragile century-old building walls. The Los Gatos project provides a glimpse at the potential for widespread use of hot zones. WiFi zones can meet the needs of multi-block neighborhoods and school campuses, and could someday replace the wired broadband networks that require miles of expensive and cumbersome underground cables to reach homes and businesses.

Case Study: NextWeb

NextWeb is a wireless Internet service provider based in Fremont, California. NextWeb offers fixed-wireless broadband services of up to 10 Mbps to small and medium business customers utilizing unlicensed radio spectrum and proprietary technologies. It has more than 2,000 customers in more than 175 cities in California. The NextWeb wireless link is connected over carrier-class fixed broadband wireless facilities that never touch the incumbent phone company's access network, and then route through NextWeb's redundant transit providers. By combining a NextWeb wireless link with the customer's existing wireline connection - DSL, T1, Cable or a NextWeb-supplied wireline service, the customer has multiple distinct, path-diverse connections to the Internet, increasing reliability of the network.[166]

[162] Wi-Fi Planet, http://www.wi-fiplanet.com/news/article.php/3302591; Intel, http://www.intel.com/netcomms/technologies/wimax/

[163] FCC Notice of Proposed Rulemaking (FCC 04-113), May 13, 2004.

[164] For a more detailed discussion, visit the FCC website, "Spectrum Policy Task Force Proceedings and Initiatives," at http://wireless.fcc.gov/spectrum/proceeding.htm?pagenum=1.

[165] An office of the NTIA, U.S. Department of Commerce.

[166] http://www.nextweb.net/network-technology.htm

Case Study: MetroFi
A company based in Mountain View, California, MetroFi, intends to offer a residential WiFi Internet service to Santa Clara in early 2005, and to Cupertino homes later in the year. At $19.95 a month, the MetroFi price will be considerably less expensive than current cable modem or DSL service.[167]

8.1.5 Satellite

Satellite broadband providers are continuing to improve their services by adding bandwidth and capacities. Satellite service providers can now offer services to nearly every Californian at speeds that exceed DSL. For example, Ground Control located in San Luis Obispo, California offers fixed location services with upload speeds now reaching between 450 and 500 kbps and download speeds near 1.5 Mbps. Ground Control states that since July 2003, it has had over 99.9% uptime for satellite broadband service and that its services are available to over 99% of those requesting service in California. Ground Control also offers the option of a mobile broadband service. Although the mobile service does not equal the speeds of its fixed services, it is capable of reaching speeds of 1.5 Mbps download and 128 kbps upload.[168] Ground Control expects to offer mobile services that match its fixed service speeds in the near future.[169]

Case Study: NASA Uses Satellite Technology to Recover *Columbia*
As an example of how advanced commercial provider technology has become, NASA used satellite broadband to recover debris in the aftermath of the *Columbia* shuttle tragedy in February 2003. Since the debris was spread over remote areas stretching from California to Texas, Hughes Corp. made available its two-way satellite broadband service (DirecWay) to NASA. By dedicating more than 180 Mbps in bandwidth to the recovery efforts, searchers were able to take high-resolution digital photographs as large as 30 MBs and send them to NASA for review and confirmation that photographed artifacts were part of the *Columbia*.[170]

8.1.6 Broadband Over Powerline (BPL)

Because of the ubiquity of electric power systems, BPL may be the broadband technology that proves most effective in bringing affordable broadband to lower-use communities. As such, BPL technology has the potential to become a significant player in the broadband market.

[167] MetroFi, www.metrofi.com
[168] Ground Control, www.groundcontrol.com
[169] CPUC Staff interview with Ground Control, December 8, 2004.
[170] CPUC Staff interview with DirecWay representative during April 2003 Broadband Summit in Washington, D.C.

In November 2004, the NARUC BPL Task Force reported BPL trials or commercial deployments taking place in fifteen states.[171] California's only BPL trial, a joint project of AT&T and Pacific Gas & Electric, was ended last year when AT&T decided to leave the residential telephony market. PG&E and other California electric utilities are in discussions to launch new BPL trials.

On October 14, 2004, the FCC adopted rules to encourage BPL development**.**[172] The Order establishes technical and administrative requirements for BPL equipment and operators to ensure that interference with licensed radio operators does not occur. The Order also sets forth procedures to measure the radio frequency (RF) energy emitted by BPL equipment.[173]

8.2 Market Solutions

To date, competition in the broadband industry - and consumers themselves - have been the greatest drivers of broadband deployment.

8.2.1 Convergence

A torrent of innovation including Voice over Internet Protocol (VoIP) and advanced wireless technologies is causing great upheaval in the telecommunications industry, shattering traditional business models based on separate offerings of voice, video and data services over separate networks owned by distinct types of companies. Cable companies now offer phone service; telephone companies offer video programming; Internet providers offer anytime, anywhere calling plans; and wireless carriers offer email, Internet access and even video news delivered to consumers through their cell phones. The traditional models are gone. This market development, referred to as "technology convergence," is the future of the telecommunications industry. The choices, lower prices and benefits available to consumers from convergence is driving the need for broadband.

Price is the key to broadband use.

Convergence is the key to lower prices.

Many experts agree that deployment of advanced services networks, while not yet ubiquitous, is less of an obstacle to broadband penetration rates today than the price of service and the perceived value of those services to consumers. In fact, in most areas including rural California, supply still outstrips demand for broadband services.[174] Many industry surveys show that at a price point of $30 per month, broadband subscribership would significantly increase. One consumer survey in 2004, for example, showed that at $29.99 per month, 46% of dial-up users would be likely to upgrade to broadband.[175]

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[171] The 15 states are: Arizona, Florida, Hawaii, Indiana, Maryland, Massachusetts, Michigan, Missouri, New York, North Carolina, Ohio, Pennsylvania, Tennessee, Texas and Washington.
[172] The CPUC filed comments in this docket, expressing support for the FCC's efforts. http://gullfoss2.fcc.gov/prod/ecfs/retrieve.cgi?native_or_pdf=pdf&id_document=6516209118
[173] News Release, FCC 04-245 *Report and Order* , ET Docket No. 04-37
[174] Pew Internet and American Life Project, Rural Areas and the Internet, (February 17, 2004)
[175] Jupiter Research, The DSL Market Opportunity (January 2004)

Technology convergence is driving competition among broadband service providers, and competition is the single, most effective way to lower prices and bring greater value to consumers. The average household in California spends $160 per month for telecommunications services today.[176] As technology convergence continues, providers are competing with each other to offer multiple services bundled together as a package, which is driving down the price of all services in the bundled package. As illustrated below, virtually every major telecommunications provider today offers a 10%-30% discount to customers who buy multiple services from them:

- Verizon's "Freedom" plan currently offers unlimited local and long distance calling plus DSL for $89.95 per month or DirectTV for $97.95 per month. For packages that include all three (unlimited calling, DSL and DirectTV) customers would pay approximately $127 per month.[177]

- East Coast cable giant Cablevision, in a battle for customers with Verizon, offered a promotion in 2004 called the "Triple Play" that included telephone, high-speed Internet and TV services for $29.95 each with a one-year contract.[178]

- Cox Communications in San Diego offers combination packages including standard cable, digital telephone, high-speed Internet and digital cable programming for $99.99 (unlimited local calling) and $124.99 (unlimited nationwide calling).[179]

- Time Warner Cable offers digital cable, high-speed Internet and nationwide digital phone service for approximately $127 per month plus equipment installation charges.[180]

- SBC Communications Chairman and Chief Executive Officer Ed Whitacre recently said in an interview with the *Wall Street Journal* that he expects SBC to offer a full slate of video services, Internet access, wireless calling and all-distance phone service with the cost of the combined package (including wireless) to decline to approximately $100 per month.[181]

- By the end of 2006, more than half of the households in the U.S. (an estimated 110 million) will have the option of getting phone service from their cable company.[182] The nation's largest cable providers, including Comcast, Time Warner and Cox Communications, are also discussing the formation of a joint venture to add cell phone service to their bundled packages.[183]

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[176] TNS Telecom Report, October 2004. www.TNStelecoms.com
[177] www.verizon.com
[178] "Here Comes Cable…," Wall Street Journal, September 13, 2004.
[179] http://www.cox.com/sandiego/coxcombo
[180] www.timewarnercable.com
[181] "Meet the New TV Guy," Wall Street Journal, November 24, 2004.
[182] "Here Comes Cable…," Wall Street Journal, September 13, 2004.
[183] "Cable Titans Discuss Offering Cellular Services…," Wall Street Journal, November 8, 2004.

The price of broadband service as part of these bundled packages drops as low as $19.95 to $26 per month[184] plus the cost of customer premises equipment.

8.3 Policy Issues

8.3.1 Universal Service

The Universal Service Fund (USF) was designed to promote ubiquitous deployment of basic phone services by subsidizing deployment costs in rural and low-population density areas. California expanded Universal Service to provide subsidies to low-income individuals for the cost of basic telephone service. Nationally, the USF collects and distributes approximately $6 billion in funding. Some states, including California, have added a separate surcharge to customers' bills to fund a higher level of subsidies. California collects and distributes approximately $1 billion per year in additional subsidies through two High Cost Funds (HCF-A and HCF-B for different types of carriers). The federal USF surcharge is imposed on interstate and long-distance calls.

With technology convergence, all-distance calling plans and IP-telephony, interstate and long distance revenues are falling rapidly - reducing the funding source for Universal Service programs. The FCC is engaged in several proceedings dedicated to reforming intercarrier compensation (a significant source of revenue for USF), Universal Service Funding and IP-enabled services. As an integral part of these proceedings, the FCC and states will address future funding for USF and whether Universal Service should be expanded to include subsidization of broadband, wireless technologies and other types of telecommunications services. As Congress begins amending the 1996 Telecommunications Act, these policy issues will be central to the debate.

8.3.2 Public Ownership of Advanced Service Facilities

Governmental organizations have a long history of providing basic services such as water, electricity, trash removal; sewage, and natural gas to constituents, in part due to the classification of these services as essential. A number of local governments have deemed high-speed Internet access to be essential and have opted to use government resources to build, as well as own and/or operate public broadband networks.[185] Others have opted to provide wholesale access only with the end-user services being provided by a private sector companies.[186] Some states prohibit local governments and municipal utilities from providing broadband services based on the view that government entities engaging in commercial broadband ventures displace private investment, stifle competition, and operate with an unfair competitive advantage due to superior access to capital and a captive ratepayer base.

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[184] See Verizon online, Comcast, SBC Yahoo

[185] For additional information on this subject: Nancy Bedard, "Progress on Point -Periodic Commentaries on the Policy Debate: A Survey of Government-Provided Telecommunications"; Kent Lassman and Randolph J. May, "Disturbing Growth Trend Continues Unabated," October 2003; "Community Broadband, Separating Fact from Fiction," Yankee Group, January 2004; "Wholesale Communications Strategies Reports, Municipalities Make their Own Broadband Opportunities," January 2004.

[186] Ibid.

The alternative view is that high capacity telecommunications infrastructure is as essential to a community's economic well being in today's world as its airport, freeways, and reliable water supply, and with deployment costs rapidly declining, chosen to provide low-cost or free broadband access as a public benefit.[187] This debate was most recently and publicly played out in Philadelphia, Pennsylvania.[188]

Case Study: City of Cerritos

The City of Cerritos is a southern Los Angeles county community of 51,000 residents with a median household income of $73,000. Seeking to provide broadband to more residents in the area, Cerritos entered into an agreement with Aiirnet Wireless, LCC, allowing Aiirnet's antennas to be attached to city owned buildings and other properties. In exchange, Aiirnet is able to provide wireless broadband service for the entire city. WiFi is available without cost near the civic center area during certain hours of the day. Elsewhere, a variety of payment and service plans are available.[189]

Case Study: San Diego's Tribal Digital Village

The Tribal Digital Village, in a remote part of San Diego County, is a project of the Hewlett-Packard Development Company and the Southern California Tribal Chairmen's Association. Launched in March 2001, the Tribal Digital Village's goals are focused in five key areas: (1) linking the tribes to a community network infrastructure; (2) preserving traditions and culture for future generations; (3) improving education opportunities through distance learning; (4) enabling community interaction using online tools; and (5) launching a community-led economic development project. With a $5 million grant from Hewlett Packard, TDV uses a series of radio towers to wirelessly connect a high-speed landline facility in a central data center with various locations in a 200 square mile area. Using point-to-point broadband transmission towers, a number of different tribal buildings including community centers, offices and various other sites are connected with 24 Mbps of bandwidth.[190]

[187] "The UTOPIA Story: Wholesale Telecommunication Services and Regional Development", Roger Black, Deputy Director and Chief Operating Officer, Utah Telecommunications Open Infrastructure Agency, August 2004.
[188] See, e.g., Stephen Lawson, "Law May Snag Philadelphia Wi-Fi Rollout," and "Philadelphia Wi-Fi Plans Move Forward," IDG News Service, December 2, 2004.
[189] CPUC Staff interview with Cerritos representative, January 31, 2005.
[190] Visit of Assigned Commissioner to TDV, September 2004; see also www.sctca.net

Case Study: Truckee Public/Private Partnership
In Truckee, a mountain community near Lake Tahoe in California, consumers complained about the service quality of the available cable modem and satellite broadband dish services. The Truckee Donner Public Utility District researched the feasibility of creating a fiber optic network, and spent four years obtaining the permits, funding and partners needed to launch an integrated service that will combine digital cable television, voice over IP telephony, and high-speed Internet access. The utility consequently formed a partnership with Eagle Broadband, a private company, to deliver the services. The proposed fiber-optic network will cost $24 million and will provide Internet access at 1.5 Mbps, faster than the typically 256 to 768 kbps speeds available from DSL or cable modems. Construction was scheduled to begin in October 2004. The holder of the local cable franchise, Cebridge Connections, objected however, stating that the business plan is financially unviable and arguing that the arrangement is unfair competition. In September, the permit authority agreed to reconsider the city's permit.[191]

8.3.3 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.[192]

In January 2005, new federal legislation was introduced to facilitate the deployment of broadband services. H.R. 144, titled the "Rural America Digital Accessibility Act," would allow 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 shall 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

[191] John Gartner, "Public Fiber Tough to Swallow," Wired, September 13, 2004. http://www.wired.com/news/technology/0,1282,64902,00.html
[192] http://internetnews.com/xSP/article.php/3443631

organizations, while the affected regions shall contain populations of less than 1,000,000 individuals. $50 million will be appropriated for these grants, which individually shall not exceed $1 million; the federal share of the cost of each project will be set at 50%.

Chapter 9. Conclusions and Recommendations

9.1 Make Broadband Deployment and Access a Priority

California should establish a statewide policy identifying broadband deployment and accessibility as a priority. Such a policy could take the form of an Executive Order or a statute. The purpose of an explicitly stated policy objective is to direct state agencies, boards and commissions to weigh the impact of all existing and proposed regulations on the accessibility and deployment of broadband infrastructure and advanced telecommunications services and to eliminate barriers to deployment wherever possible.

9.2 Develop a California Broadband Task Force

California should develop a statewide Broadband Task Force charged with the ongoing task of identifying barriers to deployment of broadband infrastructure and access to advanced telecommunications services, and making recommendations to eliminate such barriers. The Broadband Task Force should be comprised of senior representatives from state agencies, boards and commissions having a role in infrastructure development, information technology and economic development, representatives of California's private sector technology and investment industries, and lower-use communities.

9.3 State Government Should Lead by Example

California state government should be the undisputed leader in the use and availability of broadband and advanced telecommunications services for both government operations and public access. California's Web portal, "MyCalifornia.com" has been recognized nationally as a model of accessibility. By using and offering advanced telecommunications services and digital content, state government will in turn promote greater deployment of broadband networks. In addition to promoting the use and deployment of broadband, these initiatives have the benefit of making state government more efficient, more effective, and more accessible.

State agencies, departments, boards and commissions should be required to:

- Maintain a website by a date certain that enables Californians to obtain basic information, apply for permits, schedule appointments and file comments and applications electronically. State government Web sites should be accessible to persons with disabilities and those not proficient in English.

- Provide Webcasting of all public meetings.[193]

[193] The CPUC currently offers webcasting of its Commission meetings.

- Utilize videoconferencing as a means of increasing public access to agencies. For example, the CPUC sets aside time at each public Commission meeting for public comment.[194] Members of the public often must travel hundreds of miles and sometimes stay overnight in order to participate in Commission meetings. The public should be able to speak from the Los Angeles or Sacramento CPUC offices via videoconferencing instead of having to appear in person.

- Examine the cost-effectiveness of using VoIP telephony as part of the CalNet system.

9.4 Reform Rights-of-Way

Legislation should be enacted to reform the process for obtaining Rights-of-Way (ROW) permits for construction of broadband infrastructure in California. The ROW permit process is cited as one of the most significant barriers to deployment.

There are three recommendations on ROW:

- Standardize the ROW Process. California should enact legislation requiring local governments to use a standard ROW application, to make decisions concerning the grant of a ROW using standard criteria, and to make that decision within an established period of time. The state should require all state agencies granting ROW to adhere to the same process requirements imposed on local jurisdictions.[195]

- Limit ROW Fees. California should aggressively pursue enforcement of the limitation on ROW fees assessed by local governments that has been established by the Mitigation Fee Act and the *Williams* case. The state should impose the same restriction on all state agencies granting ROW. As a means of encouraging compliance, legislation and CPUC regulations should condition eligibility for state and federal programs to encourage broadband access to adoption of "best practices" for ROW permitting, including limitations on the fees and charges assessed. Programs that should be linked to ROW compliance include: the California Rural Infrastructure Grant Program, the federal Rural Utilities Service (RUS) programs, the California Teleconnect Fund, the Digital Divide Account, Universal Service Fund programs, the CA High Cost Fund A and B, and any other program designed to promote broadband and Internet access.

- Provide Effective Dispute Resolution. California should establish a ROW dispute resolution process that is either binding upon local governments, state agencies, and providers, or part of a "best practices" guide that must be adopted and implemented by local and state agencies in order for them to be eligible for state and federal grant programs.

[194] Only members of the public who are not parties to any proceeding can use the time set aside for comments from the public.
[195] AB 1874 would have required state agencies to act within 45 days of the application.

What Other States Are Doing

Florida and Michigan have undertaken efforts to standardize and streamline the ROW process in an effort to encourage broadband deployment within their respective states. Below are highlights of their recent ROW legislation:

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 governments can wave their rights 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 ROW 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 "lower-use communities."
- Requires local government to make a decision on ROW application within 45 days

To promote the build-out of broadband networks, the National Telecommunications and Information Administration (NTIA) a branch of the U.S. Department of Commerce, has been working with a variety of agencies and associations to streamline and simplify rights-of-way processes and procedures at the state and local level. As part of its work, NTIA has assembled a matrix of state ROW laws, which is attached as Appendix A to this report. [196]

[196] In addition to compensation statutes, the NTIA matrix also includes citations to relevant state statutes and provides a brief description of key statutory provisions relating to jurisdiction, timelines, nondiscrimination, mediation, remediation and maintenance concerning access to public rights-of-way. The information was compiled through original research by NTIA, with reliance on existing research by NARUC and NATOA. http://www.ntia.doc.gov/ntiahome/staterow/rowtableexcel.htm

9.5 Streamline CEQA Process for Broadband

Legislation and/or regulations should be enacted that streamline and eliminate inconsistencies in the CEQA review process for broadband projects. Specifically:

- Provide a categorical exemption from CEQA for certain broadband projects. Broadband projects that do not require a change in the functionality of existing infrastructure, such as stringing fiber optic cable on existing utility poles, should be granted a categorical exemption from CEQA.

- Change CPUC policy to ensure that the CEQA requirements are consistent for all providers. Providers applying for CEQA review for broadband projects should not be subject to different application processes or regulations based on whether they are an Incumbent or Competitive carrier, or whether they are a common carrier or non-regulated entity.

9.6 Streamline Certification Process for New Carriers Deploying Broadband Facilities

The CPUC should enact regulations to streamline the certification process for new carriers deploying broadband facilities. These regulations should allow new carriers deploying their own facilities to obtain a CPCN before applying for environmental review, consistent with carriers who lease facilities.

Specifically:

- Change CPCN Process: The CPUC must develop a process for timely granting of those CPCNs that require CPUC approval and hence require a review of the environmental impacts, if any, of the deployment of the network. The CPUC should return to the process it utilized prior to 1999 to approve such requests until such time as it develops a better means of addressing the issue.

9.7 Reform Public Utilities Code Section 851

Legislation should be enacted to amend Public Utilities Code Section 851 to categorically exempt broadband deployment projects from CPUC approval. [197]

[197] Section 851 states:
No public utility other than a common carrier by railroad subject to Part I of the Interstate Commerce Act (Title 49, U.S.C.) shall sell, lease, assign, mortgage, or otherwise dispose of or encumber the whole or any part of its railroad, street railroad, line plant, system or other property necessary or useful in the performance of its duties to the public, or any franchise or permit or any right thereunder, nor by any means whatsoever, directly or indirectly, merge or consolidate its railroad, street railroad, line, plant, system or other property, or franchises or permits or any part thereof, with any other public utility, without first having secured from the commission an order authorizing it so to do. Every such sale, lease, assignment, mortgage, disposition, encumbrance,

Specifically, legislation and regulations should be enacted to:

- Exempt Broadband Projects from Section 851. California should amend Section 851 to categorically exempt broadband deployment projects from CPUC approval. This can be done through legislation, or by the CPUC adopting a categorical exemption for such projects under Section 853(b). [198]

- Reform Section 851 Policies to Encourage Utility Investment in Broadband. The CPUC should adopt a policy regarding Section 851 and the ratemaking treatment of revenues that accrue to utilities for leasing their facilities for broadband deployment projects in such a way that incentives are created for utilities to allow use of their structures and Rights of Way.

9.8 Change Cable Franchise Law

Legislation should be enacted to make California Cable Franchise Law consistent with the federal OVS designation, and require local governments to permit competitive entry into a franchise area without requirements to serve the entire franchise area.

9.9 Encourage Broadband Over Powerlines

California should encourage deployment of BPL by its electric utilities by providing regulatory certainty in the areas of its affiliate transaction rules, in the treatment of BPL program expenses and revenues, and exemption from Section 851 requirements for the use of utility assets. The CPUC should adopt this policy framework proactively without waiting for an application to be filed by an electric utility for a BPL project.

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merger, or consolidation made other than in accordance with the order of the commission authorizing it is void. The permission and approval of the commission to the exercise of a franchise or permit under Article 1 (commencing with Section 1001) of Chapter 5 of this part, or the sale, lease assignment, mortgage, or other disposition or encumbrance of a franchise or permit under this article shall not revive or validate any lapsed or invalid franchise or permit, or enlarge or add to the powers or privileges contained in the grant of any franchise or permit, or waive any forfeiture.
Nothing in this section shall prevent the sale, lease, encumbrance or other disposition by any public utility of property which is not necessary or useful in the performance of its duties to the public, and any disposition of property by a public utility shall be conclusively presumed to be of property which is not useful or necessary in the performance of its duties to the public, as to any purchaser, lessee or encumbrance dealing with such property in good faith for value; provided, however, that nothing in this section shall apply to the interchange of equipment in the regular course of transportation between connecting common carriers.

[198] P.U. Section 853(b) authorizes the CPUC to exempt a public utility from Section 851 review when it finds that such review "is not necessary in the public interest."

9.10 Keep VoIP and Other New Technologies Free from Unnecessary Regulation

Regulatory certainty and forbearance from unnecessary regulation are key to the development of VoIP and other new technologies. The FCC's recent decision that VoIP is inherently interstate and thus subject to exclusive federal jurisdiction attempts to provide clarity and regulatory certainty to VoIP providers. California should adopt a statutory and regulatory framework of forbearance that protects VoIP and other new technologies from unnecessary regulation and taxation.

There are two recommendations for embracing VoIP.

- Recognize that VoIP is Interstate. California should support the FCC's determination that VoIP is inherently interstate and therefore subject to federal regulation except as designated by the FCC or Congress.

- Reform Universal Service. California should reform its methods of funding Universal Service, both to high cost areas and to low income consumers, to ensure continued funding as VoIP gains market share. In addition to ensuring that California develops new ways to ensure continued funding of Universal Service programs, state legislation should make providers of IP-based voice services eligible to draw from Universal Service funds when they are serving a low-income customer or customer in a high-cost area.

9.11 Remove Barriers to Bundling of Services

Laws and regulations that discourage bundling of services impede the competitive pressures that result in lower prices for consumers. The CPUC should reform its affiliate transaction and Implementation Rate Design rules to eliminate barriers that make pricing and marketing of products and services in a bundled package by regulated and non-regulated entities difficult.

Specifically, the CPUC should modify or eliminate regulations that require carriers to file individual tariffs for products such as call waiting, caller ID, call forwarding, voice mail, three-way dialing, and call return to allow telecommunications carriers to offer any product the customer chooses as part of a bundled package. CPUC rules should allow carriers to include those products as part of a single-priced package along with high-speed Internet, video and other services, without maintaining a price floor or manipulating the tariffed price of each product, in order to allow carriers to lower the package price in response to competition.

9.12 Aggressively Seek Federal Funds

Billions of dollars in federal grants, loans and other incentives are available every year for state broadband deployment and development projects. Many of these funding programs

are focused on facilitating broadband deployment in lower-use communities. The Broadband Task Force should be charged with coordinating efforts among state agencies, community based organizations and local governments for obtaining and maximizing such grants, and providing assistance to local governments and community-based organizations in applying for assistance.

9.12 Assist Lower Use Communities

The Broadband Task Force or CPUC should develop a baseline and metrics for measuring broadband usage in specific geographic areas and among demographic groups in the state. Each year penetration rates should be measured using those metrics, and efforts should focus on increasing broadband deployment and/or usage in communities with use rates 10% or more below specific geographic or demographic averages. All programs aimed at encouraging broadband in lower use areas should be measured by their contribution to improvements in the use rate above the baseline.

Specific Programs to Encourage Broadband in Lower Use Areas and Communities.

- Provide time-limited tax incentives to providers deploying broadband facilities in geographic areas and communities with lower use rates.[199]
- Provide infrastructure grants and low-interest loan guarantees for construction of broadband facilities to serve low penetration areas and communities.
- Expand the CPUC Deaf and Disabled Telecommunications Program to provide subsidized customer premises equipment for VoIP, broadband and assisted services for people with disabilities, including JAWS screen-reading and voice recognition software.
- Provide state funds (general fund, Public Goods Charge or Universal Service Fund) for a matching grant program to encourage public/private partnerships for the deployment of broadband in lower use areas and communities (one-third state, one-third local government or CBO, one-third private funds or in-kind contribution). For example, Microsoft awarded grants to San Francisco low-income housing agencies to develop community-based technology learning centers.[200] Hewlett Packard donated computers and equipment to build a wireless broadband Internet backbone for the Tribal Digital Village project near San Diego.
- Establish a special tax deduction for donation of used laptop and desktop computers to CBO projects that facilitate broadband access in lower use areas and communities.

[199] The term "lower use" should be defined as suggested above (e.g. at least 10% below baseline) and not left open to interpretation and endless subsidies.
[200] http://www.microsoft.com Citizens Housing Corporation project