

BROADBAND SERVICES IN THE UNITED STATES: AN ANALYSIS OF DEMAND

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Introduction

Broadband access to the internet has captured the attention of Americans since consumer availability arose half a decade ago. Broadband service provides some fundamental improvements in how we interact with information and with each other.¹ The increase in bandwidth provided by broadband service (in contrast to dial-up service) allows a leap forward in two-way interactivity. Broadband users tend to create and share online content more than dial-up users, rather than just downloading web pages. Broadband, in its wireless form, also allows for greater flexibility in where and how we work and communicate. The critical productivity and knowledge enhancement potential

of broadband makes it clear that access to this technology can enhance the lives of all Americans.

In the last couple of years, broadband has been widely deployed, leading to high levels of availability in many parts of the United States. But “take rates,” or actual subscriptions to broadband, have lagged. How strong is the demand for broadband services in the United States? How can assistance be provided without hindering natural expansion through the workings of the marketplace?

We will examine broadband subscriber growth from a historical perspective, followed by estimates for future growth. The analysis of demand for broadband also includes the gap between current high availability and low penetration. More specifically, demand for broadband services is scrutinized in terms of current limitations.

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¹ In this paper, service is considered broadband when the end-user connection is greater than 200 Kbps in at least one direction. This is not a binding constraint since market offerings typically have a floor of 256 Kbps.

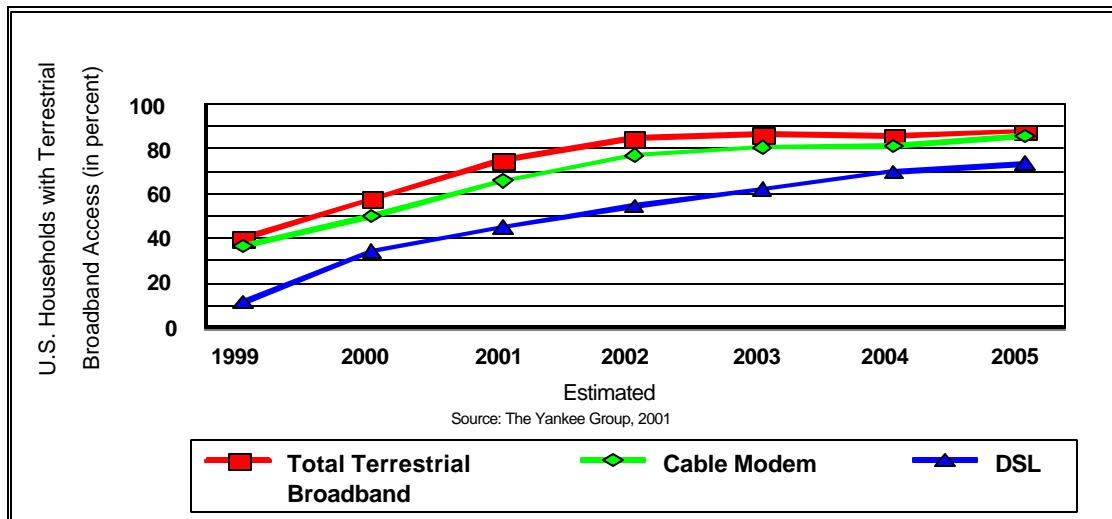


Fig. 1. Terrestrial broadband availability

In the last section of the paper we develop guidelines for further refining government’s role in supporting competitive broadband service and adding assistance where possible. The report from which this paper is excerpted has considerable information on broadband availability and includes several case studies. The reader is referred to that study for more information.² In this paper the emphasis is on the demand side of broadband.

² This report is excerpted from the Florida PSC, *Broadband Services in the United States: An Analysis of Availability and Demand* (Tallahassee, FL: Florida PSC, 2002). The complete study may be published on behalf of The Federal-State Joint Conference on Advanced Services at, <http://www.psc.state.fl.us/general/publications/reports/TakeRateStudyFinal.PDF>. Valuable contribution and editorial input provided by members of the Federal-State Joint Conference on Advanced Services.

Broadband Availability

Estimating broadband availability in the United States is a difficult task in this dynamic market. Numerous sources provide varying estimates on the availability of broadband service. In identifying the most accurate estimate possible, we examined several available sources and analyzed the limitations of these data. Rural deployment rates are of special concern to policy makers and were examined separately.

Overall Deployment Rates

As Figure 1 demonstrates, broadband is already widely available and is expected to continue its expansion for the next few years.

Broadband deployment and subscriber growth have recently experienced slower expansion rates. In light of the recent economic downturn, however, many consumer products with strong historical growth patterns have seen unprecedented declines. In comparison, broadband growth still appears rather vibrant.

- The Yankee Group reports that terrestrial broadband availability stood at 75% of U.S. households in 2001 and is estimated to rise to 85% coverage by year-end 2002. Cable modem coverage is estimated to rise from 66% to 77% by 2002, and DSL is shown to rise from 45% to 54%.³ In a more recent report, Morgan Stanley Dean Witter estimates cable broadband availability alone will be 86% of U.S. households by the end of 2002.⁴
- The Federal Communications Commission (FCC) reported that high-speed service was available in 79% of the nation's zip codes at the end of 2001. This

³ The Yankee Group, *Broadband Access Technology: Whose Number is Up?* September 2001.

⁴ Morgan Stanley Dean Witter, *Broadband Update: Raising Long-Term Modem Forecast*, Apr. 8, 2002.

compares with 78% availability six months earlier and 73% at the end of 2000.⁵ High-speed service subscribers were reported in 98% of the most densely populated zip codes at the end of 2001, the same percentage as a year earlier, and in 43% of the least densely populated, compared with 28% a year earlier.

Broadband Deployment in Rural Areas

While overall U.S. availability stands at approximately 80%, rural availability is somewhat less. Precise availability figures are difficult to obtain on a nationwide scale. Separating rural areas from urban and determining true rural availability is an even more difficult task. However, there are various studies which together paint a relatively clear picture of rural deployment.

FCC data as of year-end 2001 showed the presence of at least one high-speed subscriber in 43.3% of zip codes in the least densely populated

⁵ Federal Communications Commission, *High Speed Services for Internet Access*, released Jul. 23, 2002. Data current as of Dec. 31, 2001. These figures do not indicate full coverage within each zip code but, rather, the presence of at least one high-speed customer and, therefore, at least one supplier.

decile.⁶ This compares with a high-speed presence of 79% for the nation overall. However, high-speed presence in the least populated decile grew more quickly than any other, rising from a 27.5% presence one year earlier.

Looking at another proxy for rural deployment, among National Exchange Carrier Association (NECA) companies it was estimated that 65% of rural lines would be broadband capable in 2002.⁷ In 2001, more than half of rural local telephone companies had deployed broadband to some extent within their service territory, up from only 14% in 1999.⁸

A National Telecommunications Cooperative Association (NTCA) survey estimated 60% of its members' rural customers were able to order broadband service as of summer 2001.⁹ That number was expected to increase to 69% by the end of 2002. Of the survey respondents, one third listed a major goal of reaching all of their customers with broadband service by the end of 2001. 62% wanted to offer broadband to all customers within

⁶ Ibid.

⁷ NECA, *2001 Access Market Survey and Rural Broadband Cost Study*.

⁸ The Universal Service Fund, High Cost Fund played a large role in funding these upgrades.

⁹ NTCA, *2001 Internet/Broadband Availability Survey Report*, December 2001.

18,000 feet of a central office by year-end 2001. Of the survey participants who did provide broadband, 89% offered DSL and 8% offered wireless.

Both the NECA and NTCA studies provide an idea of the unique problems faced by rural areas. The study results were based on DSL carriers, but some of the barriers are applicable to all landline-based networks.

Major barriers to expanding broadband service identified in the literature were loop length, deployment cost, lack of cost-effective smaller scale equipment, and lower revenue opportunities, as well as low demand.

It is apparent that rural America faces several problems in obtaining broadband deployment. Wireless technology has shown advantages in some rural areas and various entities are making use of the technology to make broadband available. Where sufficient demand exists for the service, there are examples of businesses, municipalities or a combination of the two making the investment to fill the void for broadband. The extent to which these successes can be replicated is a crucial matter.

Analysis of Demand for High Speed Services

The major concern for proponents of broadband until recently was the lack of availability. The consensus opinion seemed to be, "If you build it, they will come." Because current data on broadband subscriber growth shows a significant gap between broadband supply and demand, the consensus now seems to be, "It has been built, so where are they?" Concerns have shifted to what many perceive to be low demand for broadband services. This has raised new questions. Is there really a lack of demand? If demand is low, what are the reasons for it? How can demand be stimulated? What can government do to help? These are questions that this section will attempt to address.

Current Status

A clarification of terms used in this analysis will be helpful. Broadband deployment is usually measured in terms of the percentage of U.S. households to which the service has been made available. The terms "penetration" and "take rate" are often used interchangeably as a gauge of broadband subscribership.

While estimates for penetration and take rate are routinely quoted from a variety of sources, they are difficult, if not impossible, to measure. One source estimates that of the 105 million total households in the U. S., 13.8 million were using broadband at year-end 2001, resulting in a 13% penetration rate.¹⁰ By contrast, the FCC reports 12.8 million high-speed lines in service at the end of 2001, with 11 million of these serving residential and small business subscribers.

Present broadband penetration can also be approximated by calculating the percentage of broadband households out of all online households. The majority of internet users connect through a personal computer (PC) and a narrowband (dial-up) connection. According to a National Telecommunications and Information Administration (NTIA) study, as of September 2001, 56.5% of U.S. households had a PC at home and 88% of these PC owners had an internet connection.¹¹ From these figures, one can calculate that 50.5% of

¹⁰ Statistics from GartnerGS, as reported in the *Broadband Bob Report* (<http://www.catv.org/bbb/2002/arch-020502.html>).

¹¹ *A Nation On Line—How Americans Are Expanding Their Use of the Internet*, National Telecommunications and Information Administration, U.S. Department of Commerce, February 2002.

U.S. households presently have an internet connection. The NTIA used the current population survey data and found that 20% of online households were broadband users as of August 2001, compared to 10% a year earlier. In a survey on internet service quality by the National Regulatory Research Institute, as of November 2001, 30% of the respondents, who were self-selected, reported using a broadband connection.¹² These two sets of estimates may reasonably represent lower and upper estimates of broadband penetration, thus indicating that between 10% and 15% of total U.S. households subscribe to broadband services.

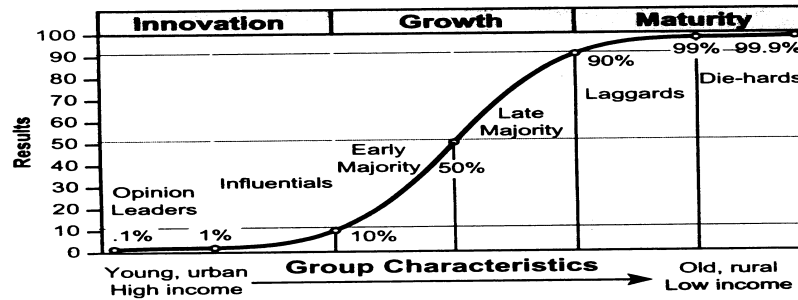
When comparing the high availability of around 80% of U.S. households to the current number of subscribers, the level of subscribership may be considered low. This has caused many stakeholders great distress, resulted in misguided conclusions regarding the state of the broadband market in the United States and prompted calls for government cures for what is believed to be ailing broadband deployment and acceptance.

¹² <http://www.nrri.ohio-state.edu/programs/broadband.html>.

Consumer Adoption Patterns for New Technologies

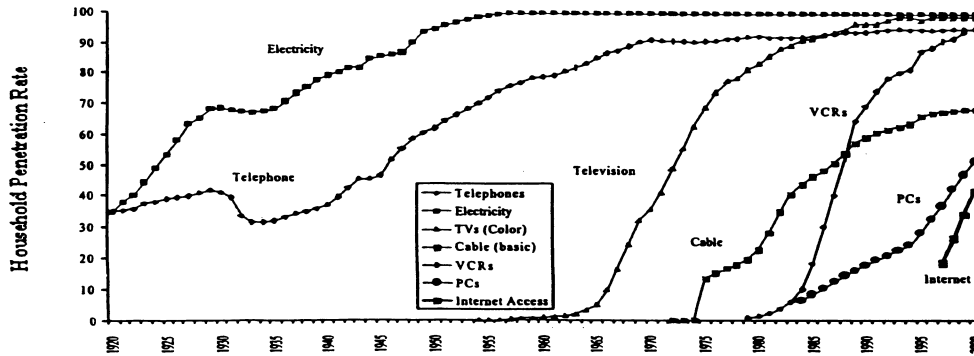
In order to properly diagnose the apparent low broadband take rate, it should be viewed in a broader time horizon. Initial expectations about consumer acceptance of broadband may have been unrealistic. Studies show that consumer adoption of new technologies tends to follow an established S-curve pattern over time as depicted in Figure 2. In the beginning of the diffusion process, the number of users and the penetration rate is low. From this small base, the increase in the rate of growth accelerates. Then, beyond the middle of the S-curve, total number of users and penetration rate will continue to grow, but less rapidly in terms of percentage. Finally, the penetration rate approaches a level that saturates the market for that technology.

For many new technologies, this process often takes a few decades before diffusion reaches its mature level. For example, Figure 3 shows that it took electricity 35-40 years before reaching the current penetration level and about six decades before telephone reached its current penetration level of 94%. Other technologies have also taken many years to reach their current



Source: H.S. Dent Foundation

Fig. 2. Consumer adoption patterns



Source: Wayne A Leighton, "Broadband Deployment and the Digital Divide A Primer," *Policy Analysis*, Washington, DC: Cato Institute, No. 410, Aug. 7, 2001.

Fig. 3. S-Curve for adoption of various technologies

penetration levels, though some technologies, such as computers and internet, have been adopted by consumers faster than others.¹³

Figure 4 compares the early stages of diffusion across five different technologies. Broadband technology appears to be following a fast track

acceptance of consumer products comparable to personal computers and CD players. Although it is hard to predict exactly how many years it will take for the broadband market to reach maturity, the current low penetration rate can be explained to some extent by the diffusion process described in the S curve.

¹³ It took 30 years for radio (not depicted in Figure 3) to reach a 90% level and 50 years to reach 99%.

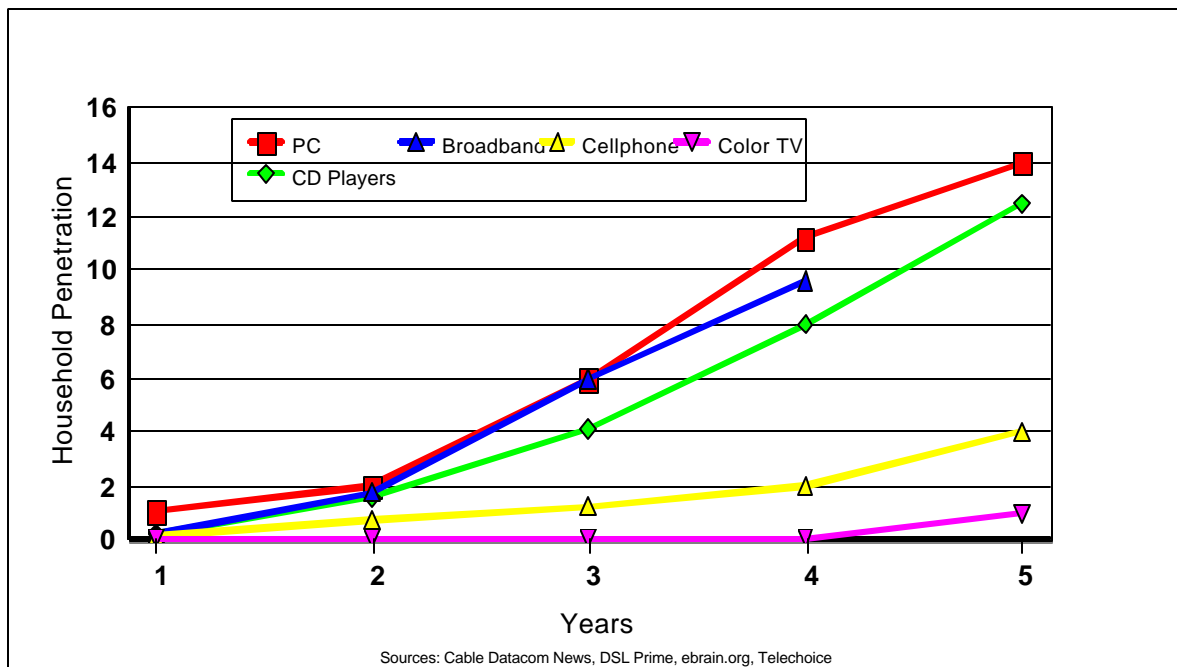


Fig. 4. Consumer technology adoption

Growth of Broadband Demand

Looking further at broadband demand from a historical perspective, although some of the broadband technologies may have been developed decades ago, the actual deployment of facilities and the rollout of services did not take place until recent years. Since passage of the 1996 Telecommunications Act, both availability and take rate have been growing quickly. This is verified by Table 1, which shows the growing percentage of users choosing

broadband among online households from 1998 (the first year the FCC collected data on broadband services) to 2001.

Table 2 presents this trend in terms of absolute numbers of broadband users. While demand appears to be low when it is viewed in relation to availability, consumers are nonetheless subscribing to broadband in record numbers. The growth rate, whether measured by percentage or by absolute number of subscribers, has been impressive and has led to optimistic projections of future growth.

**TABLE 1
HISTORICAL TREND OF BROADBAND USERS
AMONG ONLINE HOUSEHOLDS**

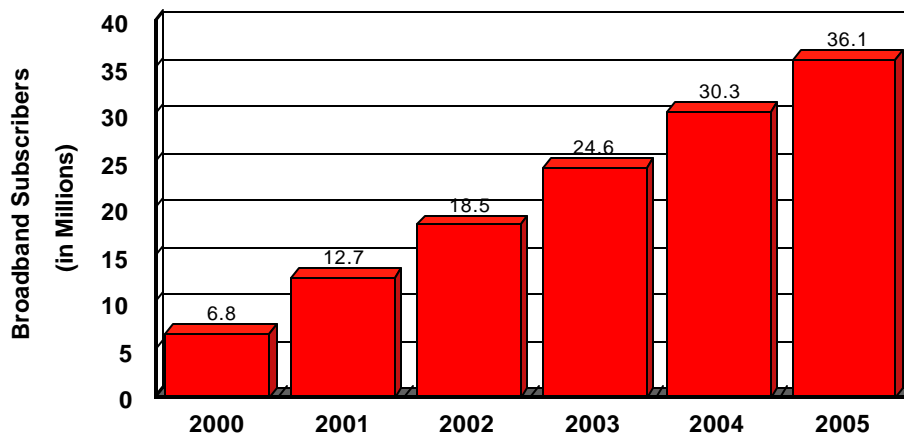
Types	Spring 1998	Spring 1999	Spring 2000	Fall 2000	Fall 2001	Fall 2002
Broadband	1%	1%	5%	11%	15 %	20%
Dial-up	98%	98%	94%	89%	85 %	80%

Source: Data from 1998 to 2000 is from www.digitrends.net. Fall 2001 and fall 2002 data are from "Total Online Census by Category," TR's Online Census, Telecommunications Reports, Third Quarter, 2002.

**TABLE 2
GROWTH OF BROADBAND USERS (1999 – 2001)**

Broadband Types	Dec 1999	June 2000		Dec 2000		June 2001		Dec 2001	
	Subscribers	Subscribers	Growth	Subscribers	Growth	Subscribers	Growth	Subscribers	Growth
Cable Modem	1,411,977	2,284,491	62%	3,582,874	57%	5,184,141	45%	7,059,598	36%
DSL	369,792	951,583	157%	1,977,101	108%	2,693,834	36%	3,947,808	47%
Other Wireline	609,909	758,594	24%	1,021,291	35%	1,088,066	7%	1,078,597	-1%
Fiber	312,204	307,151	-1.6%	376,203	23%	455,593	21%	494,199	8%
Sat./Fx Wless	50,404	65,615	30%	112,405	71%	194,707	73%	212,610	9%
Total	2,754,286	4,367,434	59%	7,069,874	62%	9,616,341	36%	12,792,812	33%

Source: FCC report: *High Speed Services for Internet Access: Subscribership as of Dec. 31, 2001.*



Source: Davis, Matthew, "Broadband Access Technology: Whose Number is Up?"
The Yankee Group

Fig. 5. U.S. broadband subscriber forecast

Figure 5 provides an estimate from the Yankee Group of U.S. broadband subscriber growth from 2000 to 2005.

Factors Limiting Broadband Demand

Economically speaking, take rate reflects the market interaction between demand for and supply of a service. When the current demand for broadband is examined, two critical points, previously discussed, should be emphasized. First, the growth of broadband subscribers in the past five years has been extremely strong. Second, demand appears to be weak when compared to the level of supply, or availability. While broadband is available to about 80% of households, less than 15% of those households have

chosen to subscribe. Thus, other than in rural areas, availability is no longer a critical issue. Rather, this gap indicates that the industry suffers more from overcapacity.

A number of factors help explain this gap and what must be addressed in order to accelerate broadband demand. Major ones included in the following discussions are high broadband prices, lack of compelling applications, low penetration of PCs and internet connections, low consumer awareness, and other non-price supply-side factors.

Current Prices

Demand for broadband service can be described by consumers' willingness to pay at various prices.

Thus far, relatively little research has been done regarding issues of pricing and consumer willingness to pay for broadband services. However, a group led by Hal R. Varian at the University of California, Berkeley, has conducted research that has produced some important results on consumers' behavior when they purchase broadband service.¹⁴ By focusing on the behavior of early adopters, the researchers found that consumers in general are not willing to pay much for higher bandwidth for today's applications. However, administrative and technical users have a significantly higher willingness to pay than other users.

Compared to a dial-up connection, Varian says that, ordinary users need a good reason to pay a premium of roughly \$25 a month to get broadband access. The price of broadband service in South Korea provides some insight about the impact of price on demand. South Korea has achieved a 50% penetration level due, in part, to the low price for broadband compared to most other nations. Korean consumers pay much less for

broadband than U.S. consumers. The incremental cost of broadband services in South Korea is less than \$23 per month—about the cost of dial-up service in the United States.¹⁵ As a result, the number of broadband subscribers in Korea has surged from a few hundred thousand to 8.5 million, and Korea's broadband penetration rate is now approaching its total online penetration.

As do U.S. consumers, Europeans exhibit resistance to paying a substantial premium for broadband. In European markets the average broadband price is about \$40, but consumer-perceived value of broadband is only \$30.¹⁶ This price point appears to be confirmed by the high take rates in the United States when broadband is priced under \$30.

One explanation for high prices in the United States may be relatively higher costs of providing broadband services. The United States certainly does not have the geographical advantages of Korea's high population density, which makes deployment and marketing more difficult and costly in the

¹⁴ Hal R. Varian, *The Demand for Broadband: Evidence from the INDEX Project*, (Berkeley, CA: University of California, 2002).

¹⁵ Ibid.

¹⁶ Scott Robinson, *Broadband Access Technologies in Europe: Are We Answering the Right Question?*, Alcatel, 2002.

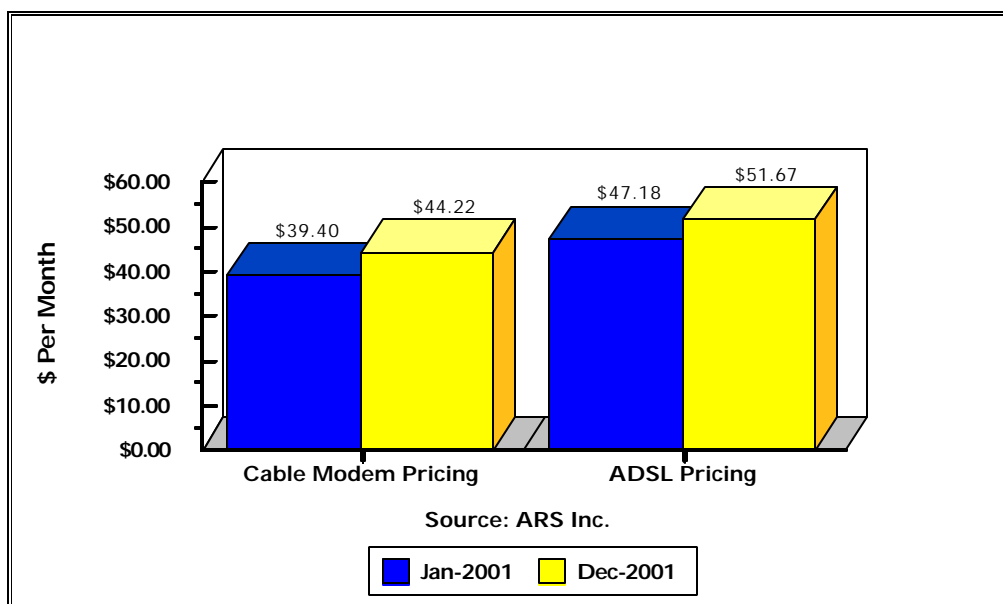


Fig. 6. Residential broadband pricing, 2001

United States. However, studies show that broadband costs have declined significantly, yet U.S. providers have been slow to reduce market prices in any similar proportions. Prices have even gone up in some markets, hurting broadband growth.¹⁷

In 2001, prices for DSL and cable broadband services rose 10% and 12%, respectively.¹⁸ Figure 6 shows the average increase in price for both cable modem and ADSL services in 2001. These price increases coincided with many bankrupt competitors exiting the market, thereby increasing the market share and ability of the remaining

¹⁷ Robert E. Hall and William H. Lehr, "Rescuing Competition to Stimulate Telecom Growth," Sand Hill Econometrics, <http://www.sandhillecon.com/hlpaper/>, Sept. 28, 2001.

¹⁸ See footnote 14.

carriers to raise rates. In 2000, the ILECs' DSL market share increased from 75% to 83%, while the CLECs' share declined from 24% to 16%. ILEC market share further increased to 89% in 2001, while CLEC share declined to 11%. This pricing behavior bears close watching as more competitors are facing financial difficulties.

As shown in Figure 6, cable modem service, on average, is priced 10% below DSL. This price differential partly explains why cable holds 62% of the market compared to 35% for DSL and only 3% for nascent satellite and wireless services.

On the heels of the price increases, broadband subscriber growth

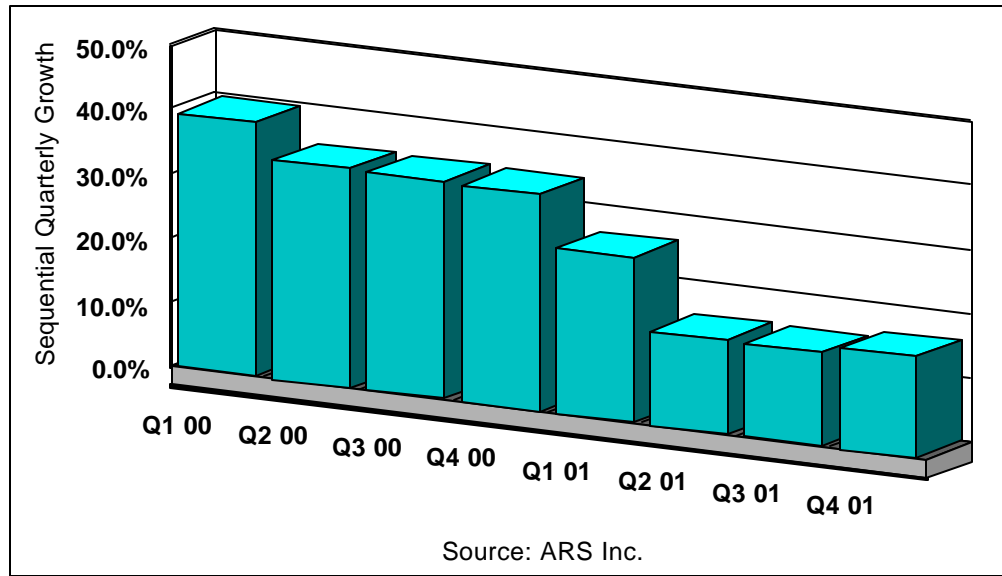


Fig. 7. Broadband subscriber growth on a quarterly basis

has started to slow. Using the FCC's figures, the number of subscribers grew 81% in 2001, compared to 157% in 2000. Another depiction of this trend is presented in Figure 7 which shows the declining growth rate on a quarterly basis.

More Competitive Pricing on the Horizon

High prices are common with the introduction of new products and services; however, as costs decline and new competitors enter the market, thereby increasing supply, prices fall. While the current broadband market appears to be competitive given its intermodal structure consisting of competing cable modem, DSL, wireless and satellite platforms, the outcome of

more competition should be lower prices or increased service value. The previously mentioned price increases may indicate there is insufficient competition, as price increases certainly do not appear to be rational moves in a competitive market, especially one that is experiencing an overcapacity problem. Therefore, any conclusion that this market is already competitive appears contradictory and premature.

Nonetheless, there is growing evidence that the broadband market may be entering a more competitive phase. Carriers are not blind to slowing growth rates and are turning their attention from deployment to gaining subscribers through lower prices. Low introductory rates and free installation

are routinely offered to attract more customers. Basic service rates have also been lowered:

- Qwest Communications offers DSL for \$39.95 per month, or customers can obtain a basic connection for just \$21.95 and choose their own Internet service provider.
- Charter Communications, a leading cable provider, charges a very competitive price of between \$30 to \$35 throughout its service areas for most of its broadband products.¹⁹

Many carriers are test marketing tiered pricing, charging different rates for different bandwidths. This is a growing trend that should increase subscriber-ship, because it gives customers more choice to satisfy their particular bandwidth needs:

- SBC announced an alliance with Yahoo under which it will offer tiered rates and added value, or content, by bundling \$30 worth of premium services at no extra charge.

¹⁹ See Kirk Laughlin, "Tiered Broadband Adds a Penthouse Floor," *America's Network Weekly*, Sept. 6, 2002.

- Cox Communications, another leading cable provider, was test marketing tiered pricing beginning at \$24 per month for 128kbps. This rate is designed as a direct challenge to the \$24 rate charged by the leading dial-up provider.

Many of the evolving rate structures are being designed to entice customers away from dial-up. Carriers appear to believe that once users experience broadband's superior performance and convenience, they will be unwilling to return to dial-up and can be moved more easily to higher priced tiers as their need for bandwidth increases. Another business strategy is to sell bundled service packages. These offerings have reportedly been highly successful in increasing take rates and reducing customer churn:

- Cox reports that nine months after it began selling voice, video and data services as an overbuilder²⁰ in Barrington, Rhode Island, 51% of its customers had signed up for all three services, and 70% had

²⁰ Overbuilders create new networks to rival those of the incumbents.

taken at least two products. Cox has also found that customers subscribing to more than one service are 33% more likely than single product homes to remain Cox customers.²¹

- AT&T's experience with packaged services has produced similar success in increasing customer penetration levels and reducing churn.²²
- Verizon has also begun bundling broadband with other services at a lower price. Its customers can get DSL for \$35 per month if they also sign up for Verizon long distance and local services.

It remains to be seen whether there is sufficient competition to prevent carriers from raising prices after customers are lured to broadband through low price offerings. However, a number of factors are at play that not only will help curb increases, but should exert downward pressure on prices:

- Equipment and provisioning costs are falling.

²¹ See "Bundle O' Subs," *Cable World*, Sept. 9, 2002.

²² "Cable's Vision Voice Clear Money Maker in Cablecos' Field of View," *EXCHANGE*, July 2002.

- Deployment is widespread (overcapacity).
- Demand is slowing.
- Carriers are reducing rates and testing various pricing strategies to attract more customers.
- Fixed wireless, once thought dead, is now making rural deployment more feasible and promising an additional platform from which consumers can choose.

These are encouraging signs, especially as many price reductions are taking place in markets where multiple competitors operate. Lower prices can be expected to produce a surge in subscriptions as has been evidenced in other countries such as South Korea, Japan and Canada.²³ If demand further stalls in coming months, expect to see more price competition.

Lack of Compelling Applications

Presently, the major advantages of broadband over dial-up are that it is "always on" and is fast. In terms of applications, most of what can be obtained via broadband can also be

²³ Glenn Bischoff: "Finding DSL's Sweet Spot," *Telephony on Line*, Jul. 22, 2002.

obtained via narrowband. Thus, compared to the low price of dial-up, broadband subscribers pay as much as a \$25 monthly premium mainly to acquire these two features.

While the rapid growth in subscribers would seem to indicate that consumers have thus far placed sufficient value on the convenience and speed of broadband connections, Varian (2002) revealed some limits to demand at current prices for these features. When Charter Communications introduced tiered cable modem prices of \$23 and \$39.95 per month, for 256 Kbps and 512 Kbps, respectively, the take rate was split 60% to 40% in favor of the \$23 service. This example demonstrates that a high degree of price sensitivity exists given the set of applications available today. Before the present growth rate of demand can be increased with prices fixed at current levels, broadband's value will need to be enhanced through increasing content or bandwidth-intensive applications.

Although broadband services can potentially provide consumers various applications such as high-quality streaming audio and video-on-demand (VOD), video-conferencing, peer-to-peer applications and others, such

applications are not yet widely available due to low subscribership, technical constraints (for example, VOD and certain other applications require higher bandwidth than is generally available) or concerns regarding intellectual property rights.

The Chicken and Egg Problem

New and compelling applications should increase consumers' perceived value of broadband and hence their willingness to pay, thus boosting demand. However, the question is when and how will these applications be made available? It may well be the case that some "must-have" applications will not arise until there is a mass market for them. This suggests the proverbial chicken and egg problem, whereby must-have applications will not be introduced until the number of subscribers is widespread, but subscribership is constrained by the dearth of those applications. In a market with such a network effect, Varian (2002) believes that it makes sense to set low "penetration" prices to increase broadband penetration, which will, in turn, increase the rollout of new applications.

Low Household Penetration of Personal Computers and Internet Connections

The potential market for broadband services is limited by the substantial number of households that are without internet ready devices, primarily PCs with available internet connections.²⁴ As discussed above, as of September 2001, only 50% of U.S. households overall are connected to the internet through either dial-up or broadband, far short of the 80% of U.S. households that have broadband available. This indicates that almost half of America's households are unaware or unconvinced of the internet's value, cannot afford to take advantage of it, or have adequate access through some other means (such as work or school-related access.)

Broadband providers face a difficult and ongoing task to find ways to get this untapped internet market connected. Many of these households cannot afford PCs or lack members who have necessary computer skills. Although TV set-top boxes and interactive TV are being marketed as less expensive and more user-friendly

²⁴ In economic terms, for internet purposes, PCs and internet connections are complements, that is, use of one is dependent on the use of the other.

options than traditional computer access, these options are not yet widely available. Wide availability of user-friendly devices at reasonable prices will entice more households to become internet and broadband connected. However, there are significant issues of education and affordability that will have to be addressed to reach the majority of this group.

Low Consumer Awareness of Broadband

There is a positive relationship between consumers' awareness of and demand for a good or service; obviously, consumers need information about goods and services before they purchase them. Low awareness of broadband also limits demand and helps explain the present low take rate.

A recent Arbitron study based on a national survey found that less than 60% of Americans have heard of broadband.²⁵ As Table 3 shows, such low awareness is relatively consistent across all ages, with the lowest among the elderly. Those between the ages of 18 and 54 have the highest and almost equal awareness. Awareness declines

²⁵ Bill Rose and Warren Kurtzman, Arbitron and Coleman, "Broadband Revolutions 2—The Media World of Speedies."

significantly for those 55 years of age and over. This means that older consumers, who may not be Internet or computer savvy, will first need to be educated on the internet's value, then on use of PCs for accessing it. A marketplace solution—in the form of a simple, user-friendly, inexpensive internet access device, perhaps—offers hope to accelerate acceptance by the elderly.

Among the online population, the level of broadband awareness may be expected to be higher. The Arbitron survey supports this point, with 70% of current internet users saying that they have heard of the term "broadband." However, this number includes those who are actually broadband subscribers. Only 50% of those consumers using dial-up access are aware of broadband. The level of awareness drops to only 20% for the remaining population that do not use the internet (see Figure 8).

The dial-up and non-internet population represent an important potential source of future broadband growth. However, broadband providers have a tough and ongoing task to educate and successfully market broadband services to this group.²⁶

²⁶ Ibid.

Government entities at all levels are addressing these issues.²⁷

Non-Price Supply-Side Factors

Non-price factors have also affected consumers' willingness to pay and subscribe to broadband services. In a recent study by former FCC Chief Economist Gerald R. Faulhaber, four broadband quality issues were identified: addressability of DSL and cable modem service, provisioning, customer self-installation, and customer service.²⁸ Faulhaber believes that these four broadband supply-side problems have hampered the increase in broadband penetration in the following ways.

Addressability

DSL can be provided only over certain telephone lines and has a distance limitation from a customer's premise to a central office (optimally,

²⁷ For example, see the case studies in Florida PSC, *Broadband Services in the United States*. See weblink in footnote 2.

²⁸ Gerald R. Faulhaber, "Broadband Deployment: Is Policy in the Way?" Chapter 10 in Robert W. Crandall and James H. Alleman, Editors, *Broadband, Should We Regulate High-Speed Internet Access?* (Washington, D.C.: AEI-Brookings Joint Center for Regulatory Studies, 2002): 229-244. Available at <http://aei.brookings.org/admin/pdffiles/phpWG.pdf>.

TABLE 3
SIX IN TEN AMERICANS ARE AWARE OF BROADBAND

Age	All	12-17	18-24	25-34	35-44	45-54	55-64	65+
Awareness	59%	61%	66%	64%	68%	64%	54%	39%

Source: Rose, Kurtzman, Arbitron and Coleman, "Broadband Revolutions 2".

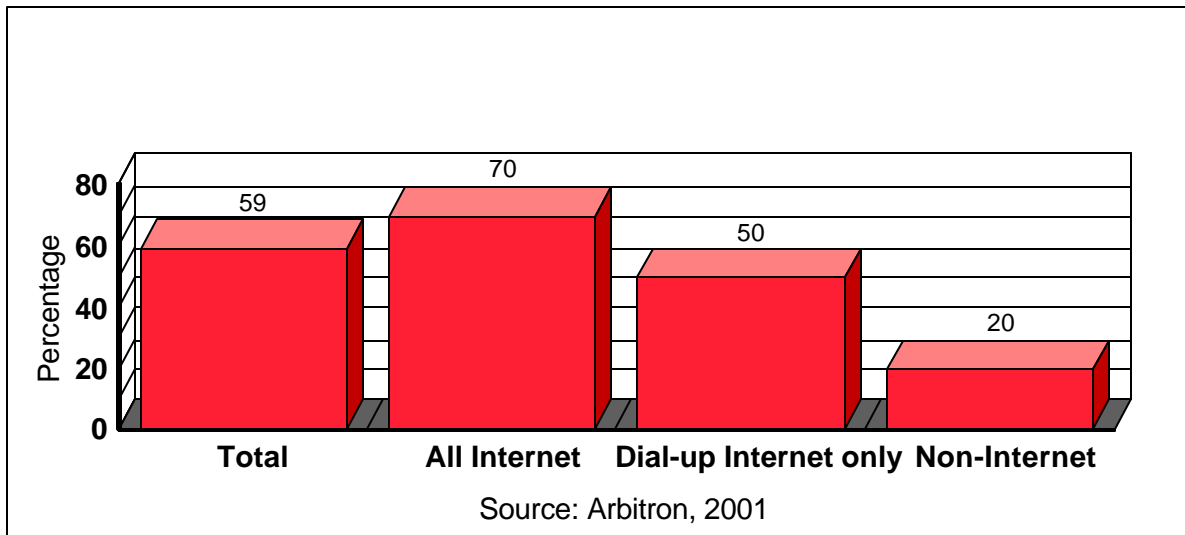


Fig. 8. Broadband awareness among all consumers

12,000 feet). According to the Faulhaber study, in 1999, only 44% of local loops could be reached by DSL, and by 2000, this percentage increased to 64%, due to RBOC efforts to improve DSL addressability. The other major broadband technology, cable modem, also has the addressability problem, albeit to a lesser degree than DSL. Cable modem service can be provided only to homes passed by two-way digital cable. However, the cable industry is at the tail end of a massive infrastructure

upgrade to digital systems using hybrid fiber/coaxial cable.

Provisioning

Timely provisioning of broadband connections has been a serious problem. The customer premises installations have been costly in terms of time and money to both customers and providers. In the beginning of the broadband rollout, an installation took at least one truck roll and cost several hundred dollars. This largely accounts

for the inability of both DSL and cable modem providers to keep up with demand in past years. According to Faulhaber, in 1999, RBOCs were provisioning about 25,000 customers per week while cable companies were provisioning around 30,000 per week. However, requests for DSL and cable modem services were around 39,000 and 47,000 per week, respectively. Providers have addressed this issue by promoting self-installation of DSL and cable modem equipment, usually a digital modem and an ethernet card. Providers routinely offer significant discounts on the installation kits to reduce delay and avoid having to dispatch a truck. While this has greatly reduced costs and installation delays, self-installation does require some level of technical ability, somewhat limiting the program's effectiveness in stimulating demand.

Customer Service

Complaints have often been heard regarding constant service outages and inexperienced, inadequately trained technical support personnel. Some customers reported connections being down for months without repair. Although recent reports

suggest significant improvement in these areas, all the technical support bugs have not yet been worked out.²⁹

The impressive growth rate in broadband subscribers can be attributed, in part, to the significant progress that DSL and cable modem providers have made in addressing the above described issues. These issues have not been solved completely, however, and further improvements can be expected to further increase consumer demand for broadband services.

Government's Role in Encouraging Broadband Demand

Government entities at the federal, state and local levels play a key role in ensuring that creative forces at work to foster adoption of broadband are not stifled. The most important

²⁹ Robert M. Rubin, "Industry Comment: The Home Office: Broadband's Best Hope," *Information Week*, Feb. 25, 2002. <http://www.informationweek.com>.

According to the NRRI internet service quality survey, as of November 2001, 21% of respondents won't be able to use internet service within two weeks after placing the order, 24% reported that connection is interrupted frequently and 47% reported that they have complained about the service quality. Although broadband service quality is part of the internet quality problem, dial-up service quality may be more of a problem. <http://www.nrri.ohio-state.edu>.

recommendations for governments are the following:

Avoid regulations that determine market outcomes

Focus should be maintained on ensuring that there are no market abuses or barriers to entry. Government, itself, can erect barriers through policies that favor particular providers or solutions. For example, wireless is becoming the technology of choice in underserved areas. Regulatory policies or financial incentives that favor wireline services could end up embedding an expensive and inappropriate technology. The proper regulatory approach is one of technological and competitive neutrality. In today's market, more than ever, sound economics should dictate future investment decisions.

Provide regulatory certainty through a consistent regulatory scheme.

The rate of broadband deployment has slowed over the last two years. Capital spending by carriers has dropped by two-thirds since 2000 due to overcapacity in many networks and the deteriorating financial condition

of many service providers.³⁰ Capital spending is no doubt further inhibited by regulatory uncertainty. Regulators should create an environment that promotes new, unfettered investment and innovation.

Avoid "one-size-fits-all" approaches

One-size-fits-all approaches are inappropriate and possibly discriminatory due to the underlying diversity of the participants. This is important in the area of rural deployment because local factors can vary so greatly. Local infrastructures also vary greatly. One small town may have a major fiber access line running past its borders. Others may have no fiber available and particularly poor quality copper lines to boot. In many rural settings the most cost effective broadband solution is wireless. In others, it is satellite. In many cases it is a combination of two or more technologies. Local demographics can vary just as widely. Age, education and income levels are all key factors driving demand and must influence deployment decisions. Appropriate solutions that meet the unique challenges of rural

³⁰ "Consumer Market Called Optical Networking's Next Frontier," *Mercury News*, Aug. 23, 2002.

areas are not a rush-to-judgment government “fix.”³¹

Expand e-government.

Government can enhance the value of internet access and increase demand by enabling more businesses and individuals to access information and do business online. Florida provides an example of how e-government initiatives can draw more people to internet use. Florida launched the MyFlorida.com website, where citizens, public and private organizations, and visitors can access information and do government business online. The Florida PSC also created a user-friendly website, where parties can listen to agenda conferences, access documents, and file complaints online. These initiatives have helped position Florida as a leader in broadband access. According to the FCC’s 2001 year-end report *High-Speed Services for Internet Access*, Florida ranks third nationwide in total number of high-speed access lines and third in

³¹ For an example of a marketplace response in bringing broadband to underserved areas, see article on Usurf America at: www.ursf.com/images/techbiz-7-8-02-reprint.pdf

residential and small business penetration.³²

Be Proactive

Governments can be proactive in fostering and facilitating local “grass roots” solutions that eliminate roadblocks, align interests and implement best practices. A coordinated, interactive relationship can exist between federal, state and local governments. Gaining broadband access is fundamentally a local issue. Uncovering the appropriate solutions requires community input and a concerted effort from local government, community leaders and local businesses. Case studies have shown that a focused local assessment of broadband demand and a roadmap for deployment presents a much stronger case to broadband providers and ISPs. It increases leverage and presents them with a more attractive business proposition. Service providers would more eagerly deal with a community presenting aggregated demand and a streamlined permitting and rights-of-way process. Local efforts to aggregate, organize and direct local demand can

³² Data is for the second half of 2001 and is current as of Dec. 31, 2001.

also accelerate the migration towards broadband adoption. Broadband efforts of regional municipalities can be combined in order to increase the scale of the operation. This provides more leverage in obtaining access to internet backbone capacity and allows costs to be allocated more broadly.

State governments, in particular, can initiate outreach programs to assist local communities in assessing their needs and bringing the appropriate broadband solution to their area. In addition to the case studies in the complete “take rate” study on which this article is based, a compilation of best practices is currently being prepared by the NRRRI on behalf of the Federal/State Joint Conference on Advanced Services. This should aid states in tailoring solutions for their unique characteristics and challenges.

Facilitate Participation in the Digital Revolution

Government can facilitate efforts to equip those who are not online with the knowledge and resources to participate in the digital revolution. A number of federal, state and local initiatives are presently addressing ways to close the digital divide. One federal initiative, the Universal Service Fund

Schools and Libraries Program, has enabled schools and libraries across the nation to become internet connected. A growing number of students and teachers alike are therefore able to experience the internet’s value as a vast educational resource and communications medium. The schools and libraries are providing internet access venues to those who, for whatever reason, cannot gain access at home or the workplace. As the number of these venues expand, the gap should close between those who are connected and those who might otherwise be left behind. Over time, this program will enable more students and “have-nots” to see the value of being connected. This will have the long-term benefit of increasing demand for both internet connections and the devices those connections require.

State Outreach Initiatives

Experience has shown that state governments can be very effective facilitating broadband growth by reaching down to the local communities that may lack or have inadequate service coverage. Broadband is fundamentally a local issue due to its importance to the local economy and to

the health and welfare of the citizenry. The state benefits, as well, from a connected, informed and productive citizenry and business community. One important point gleaned from an examination of rural deployment is that it is important to examine every community individually. The levels of demand, competition and existing infrastructure are just a start. Various levels of government can interact. A key state role may be advising local communities on what options are available. Taken a step further, states can reach out to local communities in some of the following key areas in order to eliminate redundant errors and replicate successes experienced in other communities:

- Create and maintain a central knowledge base for best practices.
- Provide a structured guideline to detail the process (voluntary guidelines).
- Create regional/state workshops for promoting organization and streamlining methods.
- Eliminate regulations restricting broadband expansion or competition.

The North Carolina Program

The state of North Carolina provides one of the best examples of developing a broadband strategy and following through to positive results. In 2000, the North Carolina General Assembly created the Rural Internet Access Authority to study and report on the state's telecommunications infrastructure and to increase internet use.

As shown in Table 4, there are four milestones the authority was charged with meeting.

How well is North Carolina doing on the last milestone? The FCC's 2001 year-end report, *High-Speed Services for Internet Access*, provides some positive results.³³

North Carolina ranks twelfth in the number of high-speed lines with 358,000. However, the state's line count was growing at a 74% rate in the second half of 2001, making it the fifth fastest growing state. No other state with such a high number of lines was growing so quickly. These achievements are even more striking when it is noted that 85% of North Carolina's counties have been classified as rural.

³³ Data is for the second half of 2001 and is current as of Dec. 31, 2001.

**TABLE 4
NORTH CAROLINA’S ROADMAP TO BROADBAND**

August 2001	Local dial-up Internet access available statewide	Achieved
November 2001	Inventory of state’s telecommunications infrastructure completed	Achieved
January 2002	Model telecenters established	Achieved
December 2003	High-speed Internet access available statewide	Pending

Source: Florida PSC, Broadband Services in the United States: Analysis of Availability And Demand, 2002.

North Carolina’s keys to success seem to be related to:

- Early assessment of needs. They classified each of their 100 counties into five tiers based on unemployment, per capita income, population growth, and population size. The lower three tiers were classified as “distressed.”
- Successful interaction between different entities. Various levels of government, businesses (including the three largest communications companies), public and private organizations were involved.
- An organizational structure covering all the necessary aspects of such a project. A 21-

member commission was chosen representing communities from across North Carolina. These members were chosen for expertise in the various fields of technology, education, and economic and community development.

- Successful initial and ongoing funding. MCNC³⁴ pledged \$30 million to jumpstart the program. The four model telecenters were funded through an ongoing grants program.

Another success from the North Carolina experience was the announcement that BellSouth completed the rollout of high-speed data

³⁴ Formerly the Microelectronics Center of North Carolina, but currently titled MCNC.

technology in the state and did so seven months ahead of schedule.³⁵ The system is installed in 136 of 140 central offices statewide, and BellSouth claims to have spent \$100 million on DSL technology in North Carolina. Also, 1,500 remote DSL terminals have been deployed and 2,100 are expected by the end of 2002.

Conclusion

The supply and demand dynamics of the broadband services market in the United States are evolving quickly. Like most developing markets, this is one characterized by contrasts. National service providers have directed sufficient capital investment into cable modem and DSL network upgrades to provide over three-quarters of the nation's households with access to broadband services in roughly half a decade. Likewise, smaller regional carriers, overbuilders, municipalities, satellite and wireless providers are deploying in urban gaps and portions of the rural areas missed by the national carriers. These carriers, large and small, are reacting to continuing consumer demand for broadband

³⁵ "BellSouth DSL Service Ready in N.C.," *The Business Journal of the Greater Triad Area*, Apr. 3, 2002.

services. Broadband remains one of the most robust consumer markets in the United States and matches adoption rates of historical product rollouts which are today considered mainstays of everyday life.

Conversely, many rural areas remain without broadband service, and broadband providers have slowed the pace of deployment. Subscriber growth has declined relative to the growth rates of earlier years. Current monthly pricing for broadband, in connection with a lack of compelling applications and other factors, has resulted in disappointing take rate levels.

It seems a new phase of the broadband market has taken over from the initial, perhaps undisciplined euphoria. Recent bankruptcies in the telecommunications sector and the decreasing capital budgets are forcing much stricter business models for broadband deployment. In many cases, expansion is funded only by returns on existing customer bases, rather than by venture capital or other external sources. The search for profitable business models has replaced the chase for market share.

Consumers also are more focused on the value proposition of

broadband. Now that early adopters have weighed in, the remaining consumer base will have more stringent cost-benefit criteria. While over 13 million American households currently justify the benefits of broadband service, a large percentage of consumers will be persuaded only by higher personal utility gains from broadband service or by lower prices.

Lessons learned from these early shifts in the broadband market may serve to improve longer term market vitality. Successful solutions are being modeled by entrepreneurs, public-private partnerships and local government initiatives. Cooperation is necessary between various levels of government in order to promote and replicate the most productive methods. This continually evolving market emphasizes the importance of sound policies and practices which are supportive of future market progression.