

ConnectingALABAMA

CostQuest Associates

For The Alabama Broadband Initiative and The State of Alabama



[BROADBAND INITIATIVES: A CRITICAL ASSESSMENT]

In this paper, we research and assess broadband initiatives, mostly rural, across the U.S. and abroad, in an effort to identify programs that are likely to succeed in Alabama. This paper is not an exhaustive inventory, but an economic evaluation of programs relevant to Alabama's current broadband initiative.

Broadband Initiatives: A Critical Assessment

Table of Contents

Executive Summary	3
Introduction.....	5
The Economics of Market Intervention	5
Abuse of Market Power.....	7
Limited Capital Funds, Risk and Unemployment.....	7
Public Goods	8
Economies of Scale and External Benefits of “Advertising”.....	9
Network Effects.....	9
Economic Stimulation and Tax Effects.....	10
Related Economic Principles and Private Enterprise	12
Avoid “Binary”Rules	12
Conclusions and Policy Implications	13
Analysis of Exiting Broadband Initiatives.....	14
A. Initial Steps and General Strategies	15
B. Regulatory Roadblocks	17
C. Other Supply-Side Issues	19
D. Demand-Side Issues	22
F. Lessons from Broadband Experiences Outside the U.S.	31
Conclusion	36
Appendix: The Economics of Market Intervention in Detail	37
A. Public Goods and Economies of Scale	37
B. Network Effects	38

Executive Summary

This report does two things that have generally not been done in past reports on broadband initiatives. First, it provides a description of the possible economic rationales for when and why to intervene in markets. This is critical since, by definition, a broadband initiative is an intervention in the market with the goal to produce a different result than would occur with the market on its own. Second, using this economic backdrop, the report provides a critical evaluation of existing initiatives; we provide examples of programs that appear to be successful, or particularly innovative, as well as some examples of programs and mechanisms to avoid.

Our most important findings are:

- There are various rationales for intervening in the broadband market, some are stronger than others – they represent a critical conceptual foundation for any program;
- Collecting and disseminating information on demand, existing supply, and costs of expansion is easily justified and likely critical to a successful program;
- It may be important to eliminate regulatory hurdles, such as rights-of-way policies or tower permit issues;
- To the extent possible, rely on private enterprise;
- Demand-side programs (including programs to expand computer literacy and internet subscription rates) are likely more cost-effective than supply-side initiatives at increasing broadband penetration;
- Relevant content is important moving demand upward improving economic situations and quality of life;
- To the extent that supply-side incentives/subsidies are provided, they should be targeted to those marginal investments that would not have been made – this will require more detailed analysis of demand and costs;
- Avoid “binary” rules for speeds, definitions of “rural” areas, and other “binary” rules; and
- While there are guiding principles, and some actions are likely to be more effective than others, there is no magic formula, and no simple solution – expanding

broadband penetration likely requires multiple approaches, and significant effort and coordination.

Introduction

Broadband internet access coverage, and adoption, has grown rapidly over time. Despite this growth, some areas continue to be unserved, underserved, or undersubscribed. This has prompted government authorities around the world to establish, plan, or contemplate initiatives designed to expand broadband coverage and subscribership. In Section III, we discuss the possible economic rationales for intervening in markets; this considers both general economic rationales, as well as focusing on those rationales that may be specific to broadband deployment and adoption. This discussion is critical to forming the foundation for assessing specific broadband initiatives. Section IV describes the kinds of broadband deployment and subscription strategies that have been deployed, with a particular focus on those that we find are illustrative as best practices, as well as some that we find lacking.¹ It is particularly difficult to measure the success of broadband initiatives, since some jurisdictions may have inherent advantages in attracting suppliers and subscribers. However, we provide what we believe to be the lessons to be learned from initiatives in the U.S. as well as those in other countries. In Section V we discuss our conclusions.

The Economics of Market Intervention

Section Summary

This section describes:

- The economic principles for when/why government intervention in a market (the broadband market in this case) may be appropriate;
- Why abuse of market power is not generally important in this market;
- How periods of high unemployment make limited capital funds an issue for broadband investment;
- How collecting and disseminating information (a public good), especially with economies of scale in “advertising,” provides a sound rationale for intervention in the broadband market;

¹ While the strategies may be considered examples of best practices today, many are newly enacted, and their full impact on broadband penetration and demand will not be immediate; it is difficult to evaluate some initiatives because of the potentially long lag between policy plan and implemented policy results.

- How so-called network effects can provide a theoretical rationale for intervention, but there is not data to quantify the effects;
- How broadband deployment can stimulate employment and the economy, and subsequent tax revenues can act as an offset to monies for a broadband initiative, but quantification of the effects are beyond the scope of this report; and
- That it is best to rely on private enterprise, to the extent possible.

Introduction

A Government initiative with the goal of expanding broadband deployment (on the supply side) or to increase broadband subscription (on the demand side) represents a form of market intervention. That is, the initiative is designed to produce a result that is different from that which would occur with the market simply functioning on its own. As such, it is critical to carefully consider the possible economic rationales for market intervention, and the method by which market intervention might best be achieved.

Economics provides a conceptual framework by which to evaluate market performance and the potential need for market intervention. Economics suggests that under certain circumstances, free market processes will lead to an optimal result, which cannot be improved via any form of government market intervention.² In the context of broadband initiatives, this leads to the following two-part-question: 1) is market-based broadband subscription below the optimal level; and if yes, 2) why have freely functioning potential broadband providers and potential broadband subscribers not achieved this higher optimal level of subscription? In other words, if broadband is below optimal levels, and if broadband has sufficient value to potential subscribers, why have they not subscribed/attracted broadband providers to fulfill their demand?

Economics also describes the circumstances in which freely functioning markets fail to achieve optimal results. These circumstances, also known as “market failures,” provide market results that are inferior to those that can be achieved with government intervention. Subparts A through D discuss potential reasons for the failure in the broadband market and their corresponding rationales for government intervention, while subparts E and F discuss other potential economic rationales for intervention.

² See virtually any economics text on intermediate microeconomics, or managerial economics, e.g. _____. The primary requirements are a large number of buyers and sellers and “perfect information”.

Abuse of Market Power

At the extreme, a single provider in a market could exercise market power, raising price above the efficient level, leading to lower than efficient levels of subscription. Generally, the potential for abuse of market power is the economic rationale for intervention in the form of antitrust law and competition policy designed to preclude anticompetitive behavior.³ This is also the primary rationale for economic regulation of public utilities, where the most important effect is government oversight of utility pricing. However, the abuse of market power is not an important rationale for intervention in the broadband market.⁴ The supply-side issue in the broadband market is the absence of broadband investment, rather than the abuse of market power by those owning existing network facilities.⁵ Indeed, if there is an opportunity to obtain some market power in a geographic market, even if temporarily, it should act as a magnet for investment for the first market provider.

Limited Capital Funds, Risk and Unemployment

One of the authors of this report was told that deploying fiber to the curb/node would require one company at least twenty years to complete, due to limitations in availability of capital.⁶ Every company has a limited capital budget per year. Rational companies choose those investment projects with the highest internal rate of return (IRR), with adjustments for risk.⁷ Therefore, a rational company, with any new technology investment program, will deploy the technology to the most profitable markets first, constrained by their capital budgets. At first glance, it may appear that there could be significant benefits to society to intervene in the markets to somehow encourage more rapid investment. The potential downside of such a

³ See, e.g., antitrust law & econ text ... e.g. Bork

⁴ With respect to the question of dominance in the broadband market, the FCC has found that “the rapidly changing market does not lend itself to the conclusions about market dominance the Commission typically makes to determine the degree of regulation to be applied to well-established, relatively stable telecommunications service markets” and doing so would “lead to a result that would be misleading and could be self-fulfilling.” *Appropriate Framework for Broadband Access to the Internet Over Wireline Facilities*, CC Docket No. 02-33, Report and Order, 20 FCC Rcd 14853, 14898 at ¶ 84, 85 (2005).

⁵ Indeed, as we discuss in section III.D below, national or regional advertising that includes price promotion is likely to dampen the abuse of any market power in small geographic areas, such as rural areas.

⁶ Conversation with a telecommunications cost analyst.

⁷ Cite Allen et. Al. Note, if two or more projects are mutually exclusive, net present value (NPV), rather than internal rate of return is the relevant

strategy is that it may crowd out other investment (perhaps in some completely unrelated technology in a different sector) that also has value to society. However, in circumstances in which unemployment is high, this crowding out effect is less likely. Therefore, in current economic conditions, it is somewhat easier to justify market intervention to encourage investment, with less fear of crowding out.

However, any mechanism designed to encourage investment should be designed to attempt to encourage the marginal investments that would not otherwise have been made, or to significantly advance the timing of investments. To the extent possible, any investment incentives should not be provided to those broadband projects that would have occurred, in the same time frame, in the absence of incentives. Unfortunately, achieving this objective may require more complex evaluation and oversight to achieve.

Public Goods

A public good is one in which the marginal cost of producing and consuming an additional unit of the good is zero (\$0.00). A good with public good-like characteristics is one in which the marginal cost of producing and consuming an additional unit is relatively low (if not literally zero). For ease of discussion, we will use the term “public good” to refer to those goods with a strong public good-like nature. Public goods are most efficiently produced by a single provider and that provider may have difficulty in identifying a pricing strategy by which to recover costs. Therefore, public goods are more likely (than other types of goods) to warrant some form of government intervention; otherwise they may be provided below the optimal level or not provided at all.

For a broadband initiative there are likely to be several public good-like activities, generally related to the collection and dissemination of information. One important dimension is the collection of virtually any information relevant to broadband and a broadband initiative. The relevant information collection could include: 1) the status of existing broadband supply; 2) existing demand for broadband; 3) potential demand (and aspects of potential demand that would require coordination and/or education to create actual demand); and 4) any constraints (e.g., transmission rights of way constraints); and 5) the costs of deploying broadband, by technology type.⁸

⁸ As a related matter, there may be significant risk to the agent collecting/creating the information (i.e., risk that they may not be able to recoup the costs of collection).

Public goods, and economies of scale, are discussed in more detail in the attached appendix.

Economies of Scale and External Benefits of “Advertising”

For any demand-side initiative “advertising” the availability, characteristics, and benefits of broadband service will be important. There are two characteristics of such “advertising” germane to the justification of market intervention by a government agency. First, there are increasing economies of scale in advertising. That is, a single organization purchasing advertising will be able to achieve advertising purchasing economies. These economies will likely exist across geography, time, frequency, and duration of messages. It will be cheaper (and more efficient) for coordinated advertising of broadband characteristics and benefits vis-à-vis advertising by multiple providers.⁹

Second, generalized advertising by a particular provider would have external benefits. As an analogy, consider a specific milk producer advertising the benefits of drinking milk; this would provide a benefit to that company, but would provide an external (external to the company paying for the advertising) benefit to other milk producers. This is the primary reason why such generalized advertising is often performed by a single coordinated agency, such as a trade association.¹⁰ For a broadband initiative, there is a strong economic rationale for market intervention to engage in generalized “advertising” of the characteristics and benefits to potential subscribers of broadband.

Network Effects

The value one receives from subscribing to a network depends in large part on the number of subscribers on the network. For example, a potential subscriber would place no value on an internet connection solely for the purpose of sending and receiving e-mail if no one else has e-mail. As a new subscriber is added to the network, there is value not only to that new subscriber, but also value to existing subscribers (who can now contact the new subscriber). The new subscriber will not consider the value to others when deciding whether to subscribe; that is, the value that others (already on the network) will obtain from their subscription is “external” to

⁹ This will certainly not completely replace advertising by individual providers, which will focus more on provider-specific details (including pricing).

¹⁰ The second reason is the existence of economies of scale in advertising.

the marginal subscriber's decision to pay the network subscription fee. This is called a direct network effect or a positive network access externality.¹¹ Access externalities or network effects provide a potential economic rationale for the historic cross-subsidization of land-line voice telephone service.¹²

As a theoretical matter, network effects can provide a rationale for subsidizing network subscription. However, consider the following three issues regarding network effects as a potential rationale for subsidizing broadband deployment or subscription. First, there is no study of which we are aware that attempts to quantify the network effect for broadband; therefore there is no study by which to determine an optimal level of subsidy.¹³ Second, such network effects will tend to be national/world-wide. This means the smaller the geographic area (e.g., a county or a state), the more difficult it is to justify network subsidization since the benefits largely accrue outside the jurisdiction. Third, to the extent that some customers consider dial-up a substitute for broadband, this weakens the network effect; for example, with some applications the network effect can be achieved with internet connection via dial up. See the attached appendix for more detail.

Economic Stimulation and Tax Effects

Businesses (including broadband providers) pay a variety of taxes. This has two implications for the rationalization of market intervention, especially at the state level. First, some activities can stimulate business to expand or locate within a jurisdiction. Broadband deployment certainly has the potential to stimulate economic activity via primary (e.g., jobs to place broadband infrastructure) and secondary (e.g., marginal attraction of additional jobs due to broadband availability in an area) effects. We will not attempt to comment in any meaningful way regarding the quantification of the economic effects of broadband deployment; such an effort is far beyond the scope of this report. However, there is evidence that broadband deployment certainly can stimulate employment and the economy.¹⁴ To the

¹¹ See, e.g., Steve G. Parsons & James Bixby, *Universal Service in the U.S.: A Focus on Mobile Communications*, 62 FED. COMM. L. J. (forthcoming 2010); and Jeffrey Rohlf, *Bandwagon Effects in Telecommunications*, in HANDBOOK OF TELECOMMUNICATIONS ECONOMICS: TECHNOLOGY EVOLUTION AND THE INTERNET 81 (S.K. Majumdar et al. ed., 2005).

¹² That is, the historical practice of keeping monthly subscription prices low (especially for residential customers), and keeping usage prices, particularly long-distance prices, high. Cite ____.

¹³ Indeed, we know of no study done in the last 20 years quantify the network effect for telephone service.

¹⁴ See, e.g., ROBERT CRANDALL & CHARLES JACKSON, CRITERION ECONOMICS, INC., *THE \$500 BILLION OPPORTUNITY: THE POTENTIAL ECONOMIC BENEFIT OF WIDESPREAD DIFFUSION OF BROADBAND INTERNET ACCESS* (2001); ROBERT CRANDALL, ROBERT HAHN, ET AL., HOOPER

extent that broadband deployment stimulates economic activity within a state, not only will the citizens of the state be better off, this will also lead to additional taxes for the state. This tax effect should be considered an offset, from the financial perspective of the state, for monies spent on a successful broadband initiative. It is likely that secondary effects of the economic stimulus from broadband deployment will come in the form of making one jurisdiction marginally superior to another jurisdiction (e.g., a company decides to build a new facility in Alabama, rather than another state, due to the availability of broadband). Unlike the network effect described in subpart E above, for this effect, the smaller the geographic area, the stronger the potential rationale for a broadband initiative.¹⁵

Second, the existence of taxes, especially high taxes, can make marginal business investments unacceptable. It is possible that some broadband deployment would have been made in the absence of taxes (or with lower tax rates). Alabama ranks near the middle in the 2009 State Business Tax Climate Index (21st with 20 states with better tax climates for business investment).¹⁶ Fortunately, from Alabama's perspective, the three "worst" ranking states on the tax index are high population states, providing a comparative advantage for future business relocations (California, New York, New Jersey). The higher the state tax rate, the stronger the potential rationale for intervening in a particular market to save marginal investment. Since Alabama is 21st on the index rankings, its potential rationale in this dimension is slightly weaker than that of a national average state. To the extent that potential employers are making a regional choice, Alabama's position is something of a mixed bag. Florida has one of the

INSTITUTION, BANDWIDTH FOR THE PEOPLE, POLICY REVIEW 68 (2004) (suggesting that broadband adoption could yield annual consumer benefits of \$300 billion); Robert W. Crandall, Robert E. Litan & William Lehr, *The Effects of Broadband Deployment on Output and Employment: A Cross-Sectional Analysis Of U.S. Data*, ISSUES IN ECON. POL'Y: THE BROOKINGS INSTITUTION, July 2007; U.S. DEPT OF COMMERCE, DEVELOPMENT ADMINISTRATION, MEASURING BROADBANDS' ECONOMIC IMPACT: FINAL REPORT (2006), available at <http://www.eda.gov/PDF/MITCMUBBImpactReport.pdf> ("... broadband access does enhance economic growth and performance, and that the assumed economic impacts of broadband are real and measurable" and with respect to job growth "Broadband added about 1-1.4% to growth rate, 1998-200"; and ROBERT D. ATKINSON, DANIEL CASTRO & STEPHEN J. EZELL, THE INFORMATION TECHNOLOGY & INNOVATION FOUNDATION, THE DIGITAL ROAD TO RECOVERY: A STIMULUS PLAN TO CREATE JOBS, BOOST PRODUCTIVITY AND REVITALIZE AMERICA 1 (2009), available at <http://www.itif.org/files/roadtorecovery.pdf> ("Broadband networks: A stimulus package that spurs or supports \$10 billion of investment in 1 year in broadband networks will support an estimated 498,000 new or retained U.S. jobs for a year.").

¹⁵ Consider two extremes: A national broadband initiative has a small chance of attracting some marginal international investment, due to broadband availability. In contrast, a local municipality is more likely to garner a larger marginal effect from a broadband initiative, by appealing to a larger (vis-à-vis the existing employment base in the community) proportion of potential businesses; there is a larger proportion of businesses that could make the location decision, including one in the adjacent community (or that would have located in the adjacent community).

¹⁶ JOSHUA BARRO, THE TAX FOUNDATION, 2009 BUSINESS TAX CLIMATE INDEX (2008), available at <http://www.taxfoundation.org/files/bp58.pdf>. The index incorporates personal and business income tax rates as well as sales tax rates.

lowest tax rates (ranking 5th) while Georgia is somewhat higher (ranking 27th), and Mississippi and Tennessee are slightly lower (ranking 21st and 17th respectively).

Related Economic Principles and Private Enterprise

If there appears to be a paucity of broadband facilities, why not employ a broadband initiative in which broadband facilities are owned, operated, and sold to consumers by a government agency?¹⁷ There is a significant body of economics literature that suggests that in most circumstances, unregulated (or lightly regulated) private enterprise is more efficient than heavily regulated entities or public enterprises.¹⁸ One implication from this body of literature is that government agencies should, to the extent possible, rely upon private enterprise to perform as many functions as practical. Even if public ownership were to occur, it is likely more efficient to have the facilities privately managed. Similarly, it is likely to be more efficient for the government to only offer wholesale services over the facilities, rather than provide retail facilities. To the extent that supply-side approaches are employed, less onerous still would be subsidies, loan guarantees, or other mechanisms to encourage private ownership and investment.

Avoid “Binary” Rules

With any program, there is a tendency to create “binary” rules; that is rules with a hard line for program qualification or funding calculation. Such binary rules can include: speed to qualify as “broadband” or “high-speed broadband”; definitions of “rural”; dates required for deployment of facilities; size for required subsidy; or prices considered “affordable”. Part of the appeal of such binary rules is that they are simple. However, potential broadband consumers and potential broadband suppliers will not see the world through binary-colored glasses. For example, for most customers, the higher the speed the connection, the greater the value; there is no magic speed at which the service suddenly has appeal because it is “broadband”. Similarly, for producers, higher speed connections will generally be more expensive to provide.

Consider the example of Vermont, where Act 79 (passed in June, 2007) created the standard of 1.5 mb/s down to qualify as High Speed Internet Access (HSIA). Vermont’s 2008 report (released in January 2009) states: “Anticipate providing some of the coverage required using mobile data. The

¹⁷ In addition to the reasons discussed here, there may be other practical issues, such as legal constraints, or insufficient budget for a government agency to engage in such activities.

¹⁸ See, e.g., Weisman re incentive regulation v traditional RoR regulation.

capacity of mobile data is rapidly advancing and, in some cases, now meets the Act 79 criteria of 1.5Mb/s in download speeds. By year-end 2010, available mobile data capability will clearly exceed the 1.5Mb/s standard, which is being driven by the tremendous forecasted increase in video traffic.”¹⁹ In Vermont wireless provision of services is likely to be a critical part of any successful supply-side broadband initiative. Unfortunately, the binary criteria of 1.5 Mb/s down appears to have stalled deployment as the state waits for cost effective rural technology to catch up with the binary rule.

Another example is the recent proposal to require broadband providers who serve more than 50% of an area deemed rural to offer service in the entire area (fill in cite _____). This can have the unintended consequence of causing providers to avoid providing service to more than 50% of such areas.

Conclusions and Policy Implications

The following conclusions and policy implications for broadband initiatives can be derived from the economics of market intervention:

- Abuse of market power, while important for antitrust and regulatory policy, is not important for broadband initiatives;
- The concept of a network effect provides some rationale for subsidizing broadband; however the rationale is somewhat weak (vis-à-vis traditional network examples) and there are no current studies to quantify the importance of the effects;
- It is possible that the economic stimulation (and increased tax revenues) from a broadband initiative could offset part, or all, of the expenditures for a program.
- Collecting and distributing information is likely to be the most easily justified specific activity for any broadband initiative because of its public good nature;
- There is a strong economic rationale to include “advertising” of broadband characteristics and benefits in any demand-side initiative;
- To the extent possible, supply-side initiatives should avoid subsidizing investments that would otherwise have occurred in the same time frame. Unfortunately, achieving this objective requires more complex analysis and monitoring; and
- To the extent possible, continue to rely on private enterprise.

¹⁹ VERMONT TELECOMMUNICATIONS AUTHORITY, ANNUAL REPORT 3 (2008), available at <http://www.telecomvt.org/documents/VTA-annual-2008.pdf>.

Analysis of Exiting Broadband Initiatives

Section Summary

This section:

- Describes basic strategies and initial steps;
- Describes how a consolidated authority has advantages;
- Explains the importance of gathering information;
- Explains that it is critical to reduce regulatory roadblocks to investment such as rights-of-way charges and diverse tower permit rules;
- Discusses the pros and cons of government ownership and operation of facilities;
- Describes how demand-side initiatives are like more effective than supply-side measures;
- Describes issues/problems and possible solutions;
- Provides examples of supply and demand-side initiatives in the U.S.; and
- Provides examples of supply and demand-side initiatives in other countries

Introduction

With the backdrop of economic rationales for market intervention, we now consider the types of strategies that have been employed in existing broadband initiatives. Our intent here is not to create an exhaustive matrix of program characteristics for all fifty states; indeed, a checklist matrix already exists with useful information. A report produced in May 2008 provides lists of enabling statutes, summary information, and contact information by state.²⁰ Rather, our intent is to describe the characteristics and strategic approaches of different initiatives, paying particular attention to those programs that are most noteworthy, and most reflective of what could, or perhaps should, become best practices. In many instances, there has not been sufficient time to empirically evaluate the effects of initiatives; therefore our critical analysis reflects the effects that can be tracked, as well as how closely initiatives appear to reflect the economic principles for market intervention.

²⁰ NGA CENTER FOR BEST PRACTICES, STATE EFFORTS TO EXPAND BROADBAND ACCESS: ISSUE BRIEF (2008), available at <http://www.nga.org/Files/pdf/0805BROADBANDACCESS.PDF>.

A. Initial Steps and General Strategies

Aside from the specific strategies detailed below, which focus on removing regulation or stimulating supply or demand, the following are more generalized strategies that have been widely adopted in broadband initiatives.

Information Gathering

Before creating and implementing a plan for broadband deployment, states should assess the current status of broadband deployment and penetration in order to identify where there are shortfalls and to ensure that policies will be both effective and efficient. Regrettably, the current state of broadband data collection is grim. The FCC, while attacked for years for its data collection methods, has finally adopted a new high-speed Internet data collection plan focused on subscription information at the census tract level.²¹ Unfortunately key information, such as pricing data, is not collected or the FCC is still trying to determine how to collect it.²² Pew Internet has noted that there is no systematically collected and publicly available data on adoption and deployment at the local level, which is valuable not only to underserved communities, but a variety of providers who want to know more about user experiences in order to design services more effectively.²³ Furthermore, there is no baseline against which to measure the progress and success of state policies.

In this vacuum of data collection, only a handful of states, through legislation or executive order, have conducted a thorough assessment thus far, making it extremely difficult for policymakers to determine where broadband deployment is most needed.²⁴ In Texas, for instance, there is a shortage of public data that would allow policymakers to better measure how much demand exists in Texas for expanded broadband services, due in large part to the fact that the Public Utilities Commission lacks the regulatory authority to collect information on the

²¹ *Development of Nationwide Broadband Data to Evaluate Reasonable and Timely Deployment of Advanced Services to All Americans*, WC Docket No. 07-38, Report and Order, 23 FCC Rcd 9691 (2008).

²² PROGRESSIVE STATES, BROADBAND AND TECHNOLOGY INVESTMENTS: POLICY OPTIONS FOR 2009 5-6 (2008), available at <http://www.progressivestates.org/files/reports/BroadBand09.pdf>.

²³ JOHN B. HARRIGAN, PEW INTERNET, WHY WE DON'T KNOW ENOUGH ABOUT BROADBAND IN THE U.S. 2 (2007), available at <http://www.pewinternet.org/~media/Files/Reports/2007/Background.MasuringBroadband.pdf.pdf>.

²⁴ *Id.* See also CONNECTED NATION, INC., THE ECONOMIC IMPACT OF STIMULATING BROADBAND NATIONALLY (2008), available at http://www.connectednation.com/_documents/Connected_Nation_EIS_Study_Full_Report_02212008.pdf; NGA *supra* note 20, at 6.

extent of telecommunications infrastructure and service.²⁵ The most publicized state assessment is ConnectKentucky, which created what was arguably the first comprehensive county-by-county map of broadband infrastructure and service availability, and which many states have, or plan to, replicate. Despite the model's popularity, some criticism has been levied against the information used to create the map. These include the lack of standards for submitting data, incomplete information on type of service, and assumptions of coverage based on proximity to telephone facilities and wireless signals. One of the larger problems, which many other states are facing as well, was the reluctance of carriers to provide information due to security and competitive concerns.²⁶ Other states have improved upon the Kentucky model in an effort to provide more local, granular and reliable data. For example, California collects household broadband information, including data on speeds, and Massachusetts will begin collecting data on a block-by-block basis in areas where a lack of coverage is most serious.²⁷ Moreover, while California chose to allay confidentiality concerns by allowing providers to turn data over to neutral third parties, other communities are choosing to simply survey themselves.²⁸

Formal Plan and Broadband Authority

The first step to successful broadband expansion is for states to create a formalized, coherent plan under a single authority.²⁹ This ensures a common statewide understanding of broadband goals and provides a roadmap for meeting these goals. It also provides a forum for public-private collaboration and "big picture" policy direction. Whether the body takes the form of an advisory council or an agency, they frequently consist of diverse stakeholders with strong representation from a range of community members, and not simply industry representatives.

²⁵ TEXAS HOUSE RESEARCH ORGANIZATION, EXPANDING BROADBAND ACCESS IN UNDERSERVED AREAS 3 (2004), available at <http://www.hro.house.state.tx.us/interim/int78-6.pdf>.

²⁶ For a critical assessment of ConnectKentucky, see Art Brodsky, *Connect Kentucky Provides Uncertain Model for Federal Legislation*, PUBLIC KNOWLEDGE, Jan. 9, 2008, <http://www.publicknowledge.org/node/1334>.

²⁷ Press Release, Massachusetts Executive Office of Housing and Economic Development, State to Identify High-Priority Broadband Investment Targets Through Advanced Mapping Technologies (May 6, 2009), available at <http://www.masstech.org/broadband/docs/MBIGISRelease050609L.pdf>.

²⁸ See Julie Schwartz, *Mapping and Deploying High-Speed Broadband*, PROGRESSIVE STATES, Feb. 11 2008, <http://www.progressivestates.org/blog/772/mapping-and-deploying-high-speed-broadband>; Art Brodsky, *Connected Nation Takes Aim at Stimulus Broadband Mapping; Rural Areas Could Be Hurt*, PUBLIC KNOWLEDGE, Feb. 17, 2009, <http://www.publicknowledge.org/node/1998>.

²⁹ See PROGRESSIVE STATES *supra* note 22, at 6-7

These bodies provide not only leadership, but they can reduce overlapping and inefficient use of scarce state resources.

For example, the California Broadband Task Force (CBTF) provides not only recommendations for achieving ubiquitous access, but also created regional broadband maps that detailed broadband deployment.³⁰ Similarly, Maryland's Rural Broadband Task Force (MRBTF) was charged with examining broadband expansion initiatives in other states; determining what resource and infrastructure investments would work best for the state; and developing proposals, legislation, and procurement policies that would further broadband proliferation.³¹ And more recently in 2007, Hawaii's Broadband Task Force (HBTF) focuses on both broadband availability and adoption, identifying current gaps in coverage and surveying other state efforts in broadband expansion.³²

B. Regulatory Roadblocks

Overview

While next generation fiber networks and wireless systems exist in some locations today, expanding deployment typically requires that network providers access public rights-of-way for backhaul and end-user access. Moreover, the placement of facilities by new providers will generally require rights-of-way. Similarly, permits for towers for wireless expansion can hinder expansion of wireless broadband services. The process of securing such access and permits, however, is often costly and time-consuming. In many states, municipalities are solely responsible for setting rights-of-way policies and some types of tower permits. This frequently results in high access fees, either directly, as municipalities view their authority as an opportunity to generate revenue, or indirectly, due to bureaucratic processes or even neglect.³³ These burdens are easily magnified as municipalities may each have their own policies, imposing separate timetables or fees for granting permits. Naturally, this means firms find it difficult to plan a coherent network rollout. At best, such disjointed regulation has prolonged deployment

³⁰ NGA *supra* note 20, at 4.

³¹ *Id.*

³² *Id.*

³³ See, e.g., TECHNET & ANALSYS CONSULTING, THE STATE BROADBAND INDEX: AN ASSESSMENT OF STATE BROADBAND INITIATIVES IMPACTING BROADBAND DEPLOYMENT AND DEMAND (2003), available at http://www.technet.org/resources/State_Broadband_Index.pdf.

efforts; at worst, firms have redirected efforts and scarce resources to more conducive jurisdictions.³⁴

The National Association of Regulatory and Utility Commissioners (NARUC) has developed a detailed report on these policies and a guide for communities to streamline regulations. Some of the suggestions, coupled with examples of application, are outlined below.³⁵

Solutions

Because municipalities have traditionally been responsible for rights-of-way access and many tower permits – leading to dampened investment incentives and inconsistencies across jurisdictions – a number of states have passed legislation that place limits on municipal actions.

A leading example is Michigan’s Metropolitan Telecommunications Rights-of-Way Oversight Act (“METRO Act”).³⁶ The METRO Act includes several of the most effective approaches to limiting rights-of-way fees and delays. As to policies that expedite access to rights-of-way, the METRO Act (1) limits delay in processing permit requests; (2) streamlines dispute resolution; (3) creates a central authority to coordinate rights-of-way issues with municipalities; (4) standardizes permit applications; and (5) limits local regulation by prohibiting municipalities from imposing conditions on providers beyond their usage of rights-of-way.³⁷

As to policies that limit the costs for rights-of-way usage, the METRO Act (1) limits access fees that municipalities can charge; (2) offers rebates for coordinated construction; and (3) provides rebates for broadband deployment.³⁸ “As a result of this initiative, service providers can

³⁴ This is particularly problematic for those seeking to boost access in rural and scarcely populated areas. Wireless solutions are generally the most cost-effective way to fill the broadband gap and also tend to rely heavily on cost-friendly access to rights-of-way, such as street lights, traffic lights and public buildings to erect antennas. See **Cost Quest Associates, QBits**, <http://www.costquest.com/costquest/qbits.aspx> (last visited May 13, 2008); FED. TRADE COMM’N STAFF, MUNICIPAL PROVISION OF WIRELESS INTERNET 3 (2006), available at [http:// www.ftc.gov/os/2006/10/V060021municipalprovwirelessInternet.pdf](http://www.ftc.gov/os/2006/10/V060021municipalprovwirelessInternet.pdf).

³⁵ TECHNET *supra* note 33, at 12.

³⁶ *Id.* at 31.

³⁷ *Id.* at 32-33.

³⁸ *Id.* at 12-13, 33.

be assured that they will be able to deploy broadband in a timely and cost-effective manner across the entire state of Michigan.”³⁹

Another example is the plan by Vermont to deal with tower permits. The Governor’s office proposed several changes to the wireless permitting process to:

- Create a minor permit process for municipalities to use that will result in a streamlined local permitting review of small wireless communications facilities.
- Exempt homeowners from the need for wireless permits to attach small antennas to their homes for distributing wireless broadband services.
- Reduce the Act 250 jurisdiction over structures used for wireless communications facilities if they are not taller than the height of a common utility pole.
- Create a single, state-level permit process at the PSB for coordinated proposals to build five or more towers located in more than one Act 250 district, in place of local zoning and Act 250.
- Direct the PSB to create a streamlined process for permitting wireless communications attachments to electric transmission and generation towers via the sec. 248 process.⁴⁰

The state also offers a website for assistance with those who believe they have a potential tower location.⁴¹

Another possible solution that might be relevant is to encourage municipalities to become anchor broadband tenants and/or otherwise become vested in a broadband initiative.

C. Other Supply-Side Issues

Overview

Even assuming that regulatory roadblocks do not discourage deployment, current investment plans by network providers may be inadequate to meet the targets of a state initiative. In such cases, there may be a need for states to provide incentives to spur deployment to underserved communities. Consider the following possible solutions.

³⁹ *Id.* at 33.

⁴⁰ STATE OF VERMONT, OFFICE OF THE GOVERNOR, THE VERMONT WAY FORWARD: CREATING THE FIRST E-STATE 7 (2007), available at http://governor.vermont.gov/priorities/e-state_Initiative_VTA_Briefing_2007.pdf.

⁴¹ See <http://www.telecomvt.org/>.

Government Ownership?

While most states have favored market-oriented approaches to broadband deployment, there may be environments where no private sector firm is willing or able to invest in a given community.⁴² In such instances, municipalities may serve a role in providing wholesale services with their own broadband networks. Critics insist that municipal networks should not be permitted to leverage their inherent advantages—from financing at low interest rates to the ability to raise taxes—over their private counterparts through direct competition. Advocates, on the other hand, point out that municipal *wholesale* networks focus competition on content and services rather than on control over the end user through ownership of infrastructure. Thus, with wholesale networks, consumers benefit from open competition in services among those using the municipal network, while service providers benefit from having the network built by a municipality on advantageous terms.

In order to achieve the scale necessary to make such municipal networks a success, many states have permitted “joint powers” agreements or “interlocal entities,” allowing cities to join together in a wholesale network. One ambitious example is the Utah Telecommunications Infrastructure Agency (UTOPIA). Aside from wholesale services, however, UTOPIA has significant restrictions on the ability of municipal networks to offer *retail* services in order to maximize competition for the benefit of consumers and to minimize any negative impacts of municipal deployment on private carriers. And, in many other states, service providers are pushing bills that would prohibit communities from setting up their own networks. This may not be problematic depending on the ultimate broadband deployment model adopted. But states such as Vermont and Minnesota have resisted such efforts, instead granting towns and cities the right (and funds) to deploy their own infrastructure.⁴³

In Vermont, public sector funds (up to \$40 million in state-backed bonds) were have been made available for the purchase and construction of broadband and cellular coverage infrastructure in gap areas. The revenues of the resulting infrastructure, to be owned by the state and leased to service providers, will go towards repayment of the funds borrowed to finance the

⁴² This traditionally happens in scarcely populated areas where cost of entry (infrastructure build-out) is too high in relation to potential revenue.

⁴³ PROGRESSIVE STATES *supra* note 22, at 8-9. For a more in-depth discussion about the benefits and disadvantages of municipal networks, see FED. TRADE COMM’N STAFF *supra* note 34.

initial project. Out of such efforts, “the initial target is to leverage more than \$200 million in private sector investment with the state’s backing.”⁴⁴ The focus of this part of the Vermont plan is for the state to build towers and backhaul facilities in infrastructure gap areas in the state.⁴⁵

Grants and Incentives

Alternatively, some states have chosen a less active role on the supply side, instead offering more traditional financial and non-financial incentives to private firms. Frequently, such incentives have taken more traditional forms, such as financial grants, loans, or tax incentives. In Michigan, for instance, the Broadband Development Authority has offered low-cost financing to both the supply side (service providers) and demand side (broadband users) through a variety of loan programs.⁴⁶ Similarly, Maine assesses every communications service provider an annual fee not to exceed 0.25 percent of revenue received or collected for all communications services provided in the state. Annually, in at least the first two years, the fund received up to \$500,000 in “seed money” to accelerate private investment.⁴⁷ And in California, \$100 million of the California Advanced Service Fund (CASF), which is funded by a 0.25 percent surcharge on end-users’ intrastate telecommunication bills, will provide matching funds to qualified applicant carriers in amounts up to 40 percent of the total project cost.⁴⁸

Tax Incentives

In terms of tax incentives, a number of states have augmented their tax codes to encourage investment in broadband infrastructure and alter firm and consumer behavior. Mississippi provides tax credits and sales tax exemptions for broadband deployment equipment. The incentives are structured such that the percentages increase as investments are made in more rural areas of the state.⁴⁹ Similarly, Missouri provides a tax credit of 40 percent per year per entity for a period of three years for broadband equipment costs incurred while opening or

⁴⁴ STATE OF VERMONT *supra* note 40, at 5.

⁴⁵ *See Id.*; VERMONT TELECOM *supra* note 19; PROGRESSIVE STATES *supra* note 22, at 7-8; and NGA *supra* note 20, at 5.

⁴⁶ TECHNET *supra* note 33, at 34.

⁴⁷ PROGRESSIVE STATES *supra* note 22, at 8

⁴⁸ *Id.* *See also* NGA *supra* note 20, at 5.

⁴⁹ *Id.*

relocating a business facility in an “economically distressed community.”⁵⁰ Alternatively, states might redirect portions of their universal service funds (if a state fund exists) towards supporting broadband, or help subsidize households who cannot afford a broadband subscription (a demand-side adjunct).

Other states and governments have experimented with more long-term strategies designed to encourage the growth of high-technology industries that can compete on the international playing field. Rather than offering state tax subsidies to businesses that will relocate, some states are using their scarce funds to reinvest in new broadband infrastructure. Such investment, combined with the use of state venture capital funds to lure and grow technology startups, can be instrumental in redefining a municipality or state’s economy.⁵¹ If these businesses are successful, they will return equity to the taxpayers that can be reinvested in additional firms. Such investments can also cement those firms in a web of local relationships that encourage broader spin-off effects for the local economy. The Maryland Venture Fund, for example, is one of the largest venture funds; it has invested over \$48 million in more than 175 companies over the last ten years, recouping every dime invested.⁵² Such endeavors have also met considerable success outside the US, ranging from the business innovation districts such as Dubai Internet City (which Oulu, Finland is attempting to replicate) to more modest efforts to stimulate broadband use by small and medium-sized firms, as in the Netherlands.⁵³

Ultimately, all of these approaches can be tailored along a number of dimensions and may be targeted where broadband resources are needed most, such as rural, underserved areas.

D. Demand-Side Issues

Overview

Perhaps the most significant barrier for broadband penetration of rural areas is consumer demand. While the deployment gap (supply side) is closing, the gap in adoption rates is closing at a much slower rate. Pew Internet data, as recently as 2008, indicates that the adoption of

⁵⁰ *Id.*

⁵¹ PROGRESSIVE STATES *supra* note 22, at 21-22.

⁵² *Id.* at 22.

⁵³ ANDREAS HEIMGARTNER, ET. AL., CISCO SYSTEMS, 2010 BROADBAND CITY: A ROADMAP FOR LOCAL GOVERNMENT EXECUTIVES 12-13 (2006), available at <http://www.cisco.com/web/about/ac79/docs/wp/2010/broadband/Broadband-City.pdf>.

broadband stands at only 38 percent in rural America, as opposed to nearly double that rate in urban and suburban areas.⁵⁴ More is at work than the absence of multiple competitors in every market, or even the higher cost of infrastructure deployment in rural areas. If these were the only variables, then we would expect that the urban/rural internet usage gap to have been smaller prior to broadband's expansion, and to have only grown significantly since the evolution from dial-up to broadband in urban areas.

A growing body of data indicates that other factors—education, computer literacy rates, and household income—play a significant role in the adoption of broadband. As one recent survey notes, the largest barriers to adoption are a lack of awareness of broadband's benefits and the up-front cost (of both the connection *and* equipment).⁵⁵

Although private sector creativity and innovation is ultimately responsible for creating broadband applications and services that stoke demand, states can help by driving consumer acceptance and adoption of broadband. While some internet applications are more bandwidth intensive than others, it is likely that the higher the rate of computer literacy, the higher the rate of adoption rate of internet usage and the higher the intensity of internet usage by adopters, the higher the demand for broadband.

Finally, several analysts have suggested that demand-side initiatives are likely to be more cost-efficient at increasing broadband penetration than supply-side efforts. For example, an econometric evaluation of broadband demand concluded, "Significantly, we find that 91% of the variation is explained by demographic and economic conditions, such as household income, education and, most significantly, income inequality. Our research therefore indicates that policies that focus on these demand-side factors perhaps offer more 'bang for the buck' in terms of increasing broadband penetration than supply-side policies, including subsidies for networks or regulation of providers."⁵⁶

Solutions

⁵⁴ HERRIGAN *supra* note 23.

⁵⁵ CONNECTED NATION, INC., CONSUMER INSIGHTS TO AMERICA'S BROADBAND CHALLENGE (2008), *available at* http://connectednation.com/research/publications/Consumer%20Insights%20Broadband%20Challenge_2008%2010%2013.pdf.

⁵⁶ GEORGE S. FORD, ET AL., PHOENIX CTR. FOR ADV. LEGAL & ECON. PUB. POL'Y. STUD., THE DEMOGRAPHIC AND ECONOMIC DRIVERS OF BROADBAND ADOPTION IN THE UNITED STATES (2007), *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1093005.

Beyond the typical financial incentives used to induce private and public sector users to adopt broadband (through discounts, grants, loans, tax incentives, etc.), states have experimented with a wide array of innovative strategies to stoke demand.

Many states have directly targeted the “hardcore nonadopters” that persist in the “digital divide,” engaging with communities to increase grassroots demand. Kentucky’s broadband initiative, ConnectKentucky, has been cited as the model approach to broadband expansion. The first step in the ConnectKentucky model was the creation of a comprehensive map of broadband availability. Representatives then worked with local volunteers to develop community plans that serve as the strategy for bringing broadband to unserved areas. ConnectKentucky formed “eCommunity Leadership Teams,” comprised of some 4,000 volunteers from across Kentucky that came from diverse backgrounds such as agriculture, education, tourism, and local government. Together, they formulated a strategy for bringing broadband access to their unique community, thereby demonstrating to service providers a community-wide demand. ConnectKentucky also conducted household and individual surveys to understand computer and Internet use in the state, identifying barriers to adoption.

According to its own numbers, ConnectKentucky has enjoyed considerable success, with a 58 percent growth rate in broadband deployment and \$860 million invested in state telecommunications networks since operations began.⁵⁷ ConnectKentucky reports that 95 percent of state residents now enjoy broadband access, compared to 60 percent in 2004. Between 2005 and 2007, Kentucky saw an 83 percent growth rate in broadband adoption, compared to a national growth rate of 57 percent.⁵⁸ Other states, such as Ohio and Tennessee, have adopted the ConnectKentucky model, and many more are likely to do so if its success continues.

Of course, the digital divide is not simply a matter of availability of Internet access. Households need devices and the knowledge that will enable them to connect to the Internet, requirements that are themselves significant barriers for many rural areas. As a result, several states have endeavored to reduce entry-level costs of getting online. For example, Kentucky’s “No Child Left Offline” program refurbishes retired state government computers and distributes

⁵⁷ See CONNECTED NATION, INC. *supra* note 24.

⁵⁸ As discussed above, the accuracy of these numbers may be in dispute to do problems with methodology and data collection.

them to offline households with eighth grade children.⁵⁹ Similarly, Philadelphia has reinvested revenue from its widely publicized municipal wireless project in low-cost broadband services and home PCs and training for low-income users.⁶⁰ In terms of increasing technology literacy, states have looked beyond simply investing in physical infrastructure to funding community technology centers where residents can gain essential digital skills and training.⁶¹ A May 2009 article dealing with broadband issues concluded that experts believe that “‘Best Practices’ for increasing broadband ‘take rates’ should include better data collection and a focus on placing more computers in homes and schools”⁶²

States have also pursued more immediate efforts to aggregate demand to spur deployment and adoption in rural areas. For instance, one of the most effective ways to stimulate deployment is for the state to act as an “anchor tenant” in a particular geographic area by procuring a state network to serve state agencies, schools, hospitals, etc. In addition to the benefits of the network, the state provides a core subscriber base that enables a private provider to further expand infrastructure to serve customers and businesses in the proximate geographic area. Alternatively, states may aggregate broadband demand of either public or private sector users, creating a base to enable suppliers to justify extending infrastructure. In Ohio, for example, business demands are aggregated in order to earn buyers group discounts from the multiple vendors participating in its Broadband Link program. These discounts should provide for a greater quantity demanded, but states will only incur organizational costs and administrative fees as the discounts are provided by vendors.⁶³

Some states have employed a wide variety of e-government initiatives to actively encourage internet use (including broadband applications) by citizens and government employees alike. As to citizens, states may provide online content and applications that require,

⁵⁹ NASCIO, *BOWLING FOR BROADBAND 2: TOWARD CITIZEN-CENTRIC, BROADBAND-BASED E-GOVERNMENT 3* (2006) available at http://www.nascio.org/publications/documents/NASCIO-Bowling_for_Broadband2.pdf.

⁶⁰ *Id.*

⁶¹ PROGRESSIVE STATES *supra* note 22, at 11-13.

⁶² Alex Tcherkassky, *Better Data, More Home Computers Could be “Best Practices” on Demand Side, Experts Say*, BROADBANDCENSUS, May 11, 2009, <http://broadbandcensus.com/2009/05/better-data-more-home-computers-could-be-best-practices-on-demand-side-experts-say/>.

⁶³ TECHNET *supra* note 33, at 35.

or are enhanced by, broadband. Such content might allow citizens to access information, conduct transactions or access government services, or interact with elected representatives and government officials. For example, many states provide video streaming of legislative proceedings, and interactive town hall-style meetings that allow citizens to participate remotely are becoming more popular.

In some instances, more state-based on-line services, even if they are not bandwidth intensive, may marginally contribute to broadband usage. In California, for example, residents can make appointments with the Department of Motor Vehicles online, which should save citizens time and the state millions of dollars (by using the common MyCalifornia portal).⁶⁴ While there are few state-based broadband-specific applications today, as more citizens rely upon these internet services, the more technological knowledge and demand will increase.

The importance of healthcare costs, for an aging U.S. population, may be an important driver of that demand, as electronic health records promise to provide customers with a unified view of their healthcare account over time and across multiple service providers.⁶⁵ Taking the idea one step further, citizens may well come to expect an electronic public record detailing their interactions with the government.⁶⁶

Just as states may encourage private use of broadband, so too may they encourage government use of broadband. One example is creating the “mobile civil servant,” giving those employees that are frequently out in the field (such as Texas Child Protective Services) the means to perform their duties remotely.⁶⁷ In a similar vein, the use of telecommuting permits many citizens to work from home, resulting in the reduction of fuel use and increased worker productivity.⁶⁸ These applications are becoming increasingly important as a method of carbon reduction.

Other important government applications are the use of telemedicine and distance learning. Telemedicine allows patients and providers to consult with other providers remotely,

⁶⁴ *Id.* at 19.

⁶⁵ NASCIO *supra* note 49, at 5.

⁶⁶ *Id.*

⁶⁷ *Id.* at 4.

⁶⁸ PROGRESSIVE STATES *supra* note 22, at 17-18.

allowing state hospitals and clinics to share valuable medical expertise. A prime example would be California, where the state has developed 10 rural telemedicine networks that will eventually connect over 300 healthcare providers to a state and nation-wide broadband network dedicated to healthcare. Moreover, the University of California supports the drive for demand with its two Telemedicine Learning Centers where experts provide educational programs that teach practitioners the skills needed to utilize telemedicine and also provide instruction to administrators seeking to bring telemedicine to their communities.

Distance learning and educational programs allow students and teachers at different locations to interact, providing educational opportunities that would otherwise be unaffordable or unattainable, particularly in remote areas. Typical students include high school students seeking out college-level courses and adults who work full time seeking an advanced degree or certificate/credential. Other uses include providing secondary and primary schools with streaming video lessons, conducting community workshops and training, and enabling law enforcement and security personnel to receive crucial training.⁶⁹

Of course, these latter initiatives are advanced examples that may well be inappropriate to regions still struggling merely to connect its citizenry to broadband. Yet, as deployment and adoption continues to permeate throughout underserved areas, they remain as an example of the potential that broadband has to shape the lives of citizens, and the potential of the government to help make that a reality.

E. Relevant Content

In the summer of 2008 Washington's Utility and Transportation Commission published a report on internet usage⁷⁰ in five of the state's least populated and underserved counties. The terrain in these counties runs the gambit from rolling agricultural lands to mountains over 7000' in elevation. This and many other studies found that broadband usage in rural areas is well below that of more urban centers. 28% of the population in these counties do not have access to high speed internet. Half of those individuals said that cost is the main barrier to access while the other half said they didn't see a need to connect to the internet. According to the WUTC study, "research suggests that this is because the

⁶⁹ TECHNET *supra* note 33, at 20.

⁷⁰ See <http://www.wutc.wa.gov/webimage.nsf/0/0C107F2AECCEC013A8825733800684FCF>

perceived value of high speed internet access is not always readily seen by rural residents.” A term often used to express this void is “relevant content.” If an individual fails to see how access to the internet will make a difference in his or her life, that person is unlikely to subscribe to any type of internet service.

Studies by groups such as Pew Internet⁷¹ and The California Emerging Technology Fund⁷² also report that an average of 30% of the people involved in their research do not have access to the Internet at home. Slightly more than half of all Americans have access to *high-speed* Internet at home. That number goes down significantly for non-English speaking individuals and low-income individuals. Ethnicity also seems to play a role as people of color are less likely to have access to the Internet at home. What’s more, people living in rural parts of our country have even lower rates of Internet access. Overall these studies point out that low-income, rural African-American are the demographic group least likely to have access to the Internet at home.

Since these areas may offer the greatest opportunity for increasing penetration, attention must be paid to identifying relevant content based on the specific needs of the target population.

For example, the Navajo Nation has been struggling to provide health care services to the people who live on their 27,000 square mile reservation. 15% of those people have diabetes, making it their single highest driver of health care costs. Earlier this year the Tribe literally launched the Navajo Nation Special Diabetes Project which utilizes equipment similar to weather balloons to collect data from hand-held devices that have been distributed to a small test group of tribal members. The balloons travel 85,000 miles above the earth and can cover over 7,000 square miles of territory. This IT solution was originally designed to track workers or army personnel in remote locations. While the project is too new and too small to report outcomes, Navajo Nation staff responsible for the project anticipate a significant reduction in the number of emergency room visits by diabetics.

Because these individuals fit the profile of non-adopters it can be assumed that this is an example of the demand for an Internet service increasing penetration to an otherwise unserved community.

⁷¹ See http://www.pewinternet.org/~media/Files/Reports/2008/PIP_Broadband_2008.pdf

⁷² See http://cetfund.org/files/cetf_bb_summary.pdf

Non-adopters need to see applications that bridge the divide between the cost of high-speed Internet and the direct benefit of that cost. Anecdotally we know that this list of applications includes eBay, Amazon, and Facebook.

In the tiny town of Springdale, WA the mayor worked to bring high-speed Internet access to his community. Ecliptixnet, a small but dynamic company, received a grant from the USDA to build towers that would bring low-cost Internet forty miles across the mountains from Spokane, WA. At a starting rate of \$20/month the system has a 91% take rate and is expanding to other small rural communities in the area. A recent survey of local senior citizens cited “Facebook” as the highest training priority at the new computer center which was also built with the USDA dollars. The majority of those interested in learning about Facebook mentioned that they have no interest in learning about computers, with this one exception. Again, it’s about finding “relevant content.”

Moving individuals from non-adopters to using even one relevant application can increase the number of subscribers, which is essential to driving infrastructure build-out in areas with low take-rates. This is especially important in underserved areas as it creates a business model for carriers who otherwise cannot justify upgrading systems, much less building systems, in areas where the on-going maintenance cannot be supported by subscribers.

Libraries play an integral role in introducing non-adopters to relevant content. In a 2007-2008 study by the American Library Association, “Libraries Connect Communities,” over two-thirds of all library patrons reported that the library provided their sole access to high-speed Internet. The two main reasons people use computers at libraries are 1) K-12 related activities such as research and 2) job search.

There are a number of other reports on the importance of relevant content and demand side programming including:

- Nearly half of high school graduates who had computers and Internet access at home went on to college. Among students who didn’t have computers and Internet access, the college enrollment rate fell to one in four.⁷³

⁷³ See Bringing Broadband to the Urban Poor," CIO Today, January 5, 2009

- The REACH program, initially established by the Medical College of Georgia, puts stroke specialists in touch with rural hospitals and physicians statewide for consultation on key treatment options during the critical three hours after a stroke.⁷⁴
- The 82-site Missouri Telehealth Network provides services in more than 15 different medical specialties, with a majority of the work coming from radiology, mental health, dermatology and cardiology. To date, more than 11,000 interactive video encounters and 57,500 Teleradiology exams have been conducted. The Missouri Telehealth Network uses T1 (Frame Relay) connections to each site to provide dynamic bandwidth allocation for voice, video and data.⁷⁵
- And a study by economist Robert Litan projected that broadband-based monitoring could cut medical costs for senior citizens by about 30 percent.⁷⁶

Concluding Thoughts

To a large extent, governments have extensively explored various public and private arrangements to expand the deployment of broadband infrastructure, ensuring that broadband service is available to rural, underserved communities. But demand-side initiatives have received far less attention, and it is only through such projects that people in rural communities will perceive broadband as useful enough to warrant diverting their (for the most part) scarce resources. Naturally, tailoring such demand-side programs will depend on a spectrum of considerations unique to a region or locale. But it is in this area that most of the innovative and creative broadband initiatives are arising, and warrant far greater attention from governments and regulators. Furthermore, relative content plays a key role in broadband adoption and promotion of uses that improve economic situations and quality of life. Not only is it integral to increasing the number of broadband subscribers but it could be integral to your future plans. Too many conversations go like this, “28% of anyone surveyed say they don’t have broadband, and half of those say they don’t want it.” And the conversation ends there. That would appear to be a problem for many rural communities where every potential subscriber is needed to make a long term plan for infrastructure build-out.

⁷⁴ See Neuberger, Neal. *Advancing Healthcare Through Broadband: Opening Up a World of Possibilities* (White Paper,2007)

⁷⁵ See Neuberger, Neal. *Advancing Healthcare Through Broadband: Opening Up a World of Possibilities* (White Paper,2007)

⁷⁶ See Neuberger, Neal. *Advancing Healthcare Through Broadband: Opening Up a World of Possibilities* (White Paper,2007)

F. Lessons from Broadband Experiences Outside the U.S.

Lessons from the EU

Perhaps more than in the US, the EU has placed broadband development as a high priority for the Union. And yet, just as in the US, broadband access and adoption has been patchy, with the EU encompassing some of the world's leading broadband countries but also some significant laggards, such as Ireland and Greece. Across Member States, there has been significant variation in investment and availability of broadband infrastructure, quality of service, promotion of market competition, and nature of national regulation. Unsurprisingly, the older ("EU-15") states tend to have higher levels of broadband availability and adoption, as well as higher-speed options. Yet the same sorts of divides exist *within* the EU-15, just as they exist between and within American states.

More specifically in terms of the urban-rural divide, two EU-15 countries that rank among the world's broadband leaders—the Netherlands and Belgium—have particularly small rural populations. These Members share an advantage that facilitated high broadband penetration in leading East Asian countries like Japan, Singapore, and South Korea: high population densities in large urban centers. Yet most of the EU-15 has lower levels of urban density and populations dispersed over large landmasses.

The issue remains how such Members have grappled with expanding broadband access and adoption. To a large extent, and at least partially due to regulations that constrain the ability of governments to take on a more active role, EU Member States have sought to encourage broadband deployment within a liberalized and competitive telecommunications market framework. Generally, these national broadband strategies are marked by a heavy emphasis on supply-side, access-led policies without due attention to demand-side factors that would make broadband use relevant and compelling to rural communities.

Much of this policy seems to have been predicated on the assumption that, once adequate infrastructure is in place, socially useful applications and services will follow. The criticism, which has been similarly leveled at the US, is that while the supply of broadband infrastructure is clearly a necessary step, the process of social adoption of a new network technology is far more complex, multi-layered, and time-consuming. However, there are increasingly signals from both sides of the Atlantic that governments are trying to achieve a greater balance between supply-side and demand-side policies.

One notable example is a UK initiative in North Yorkshire, NYnet, which has been praised as one of the most successful public-sector-led, open access, broadband infrastructure initiatives, using aggregated public sector demand to attract broadband access. NYnet will also serve as a model in the B3 Regions project, which involves eight Member States collaborating to bring broadband to their rural economies.⁷⁷ It is important to note that while NYnet can offer services to the public sector, it cannot supply businesses and households with broadband due to European State Aid and Competition regulations.

Another leading focus has been digital content and other information services as key drivers of adoption and consumption. Austria is among those Member States with lower levels of urban density and populations dispersed over large landmasses, with Lower Austria having some of the lowest rates of broadband penetration in the Union. In Carinthia, however, the “Kaernten Klick” initiative has been receiving praise from the European Commission for its projects aimed at incentivizing broadband use. In addition to traditional public-private supply-side endeavors, Kaernten Klick offers an array of exclusive content that is designed to appeal to residents of the region. This content includes live broadcasts of two Carinthian ice hockey derbies (showing the match, interviews, and replays); “Click & Cook,” an Internet cooking program; and a health program, led by a team of professionals, designed to help people quit smoking.

Another interesting incentive that Kaernten Klick offers is “FreeCall Carinthia,” a Voice over IP (VoIP) system that offers unmatched telephone fees, both within Austria and abroad. Telephoning among participants (of which a directory exists) is free, while users also benefit from the choice of prepaying and receiving invoices in seconds, unlike most landline and mobile networks. And, while many VoIP services require a PC and headphones, the goal for FreeCall is simplicity; customers need only a broadband connection and a phone and, upon registering, customers keep their landline number and can telephone in the same, traditional way. As such, FreeCall stands as one unique example of how broadband services can be tailored to incentivize broadband adoption while easing the transitioning costs of doing so.

Connect Australia

⁷⁷ NYnet: UK Broadband Initiative Heralded As Model for Stimulating Rural Economies Across Europe, TMCNET (Dec. 3, 2008), <http://voipservices.tmcnet.com/news/2008/12/03/3829412.htm>

The “digital divide” facing Australia seems, in many ways, far more problematic than the difficulties facing most European and American states. As a result, the Australian government has earmarked billions of dollars for “Connect Australia,” a broadband initiative designed to improve access and adoption by people living in regional, rural and remote areas; extend mobile phone coverage; build new regional communications networks; and set up vital telecommunications services for remote indigenous communities. Before turning to the demand-side programs, one notable supply-side effort is the Australian Broadband Guarantee: any Australian resident or small business that is unable to get a metro-comparable broadband service at their principal address is eligible to receive a subsidized service—either a registered terrestrial service or a satellite service, depending on availability.

Some of the most interesting work being done under Connect Australia, however, is through its various demand-side initiatives or quasi-demand-side/supply side interactions. The Clever Networks program provides broadband networks in regional areas to improve the delivery of health, education and other essential services. Broadband is being used to improve networking between health service facilities; allowing transmission of electronic health records and images; enabling remote diagnosis and treatment; and providing professional support and development for health workers. For example, a telehealth program in Western Australia will deliver improved picture and sound quality to existing telehealth services and will also be interoperable with other broadband modes of communication including electronic medical records, pathology results and radiology images. The project will enable Aboriginal medical services to be provided remotely to facilitate Aboriginal health workers support of their patients; remote assessment of patients on remand and in prison via telehealth virtual clinics; mental health interviews carried out via videoconferencing; Royal Flying Doctor Service and other emergency services remotely linking with metropolitan emergency departments; and general practitioners remotely linking with education programs and participating in case conferencing and discharge planning.

In the education sector, Clever Networks projects are enabling students to more easily access online learning tools through primary, secondary and tertiary learning institutions, at home and within their communities. For example, the Clever Training project will use advanced broadband technology to break down the barrier of distance that limits access to technical education for students in rural and remote South Australia. Through videoconferencing classes,

the project will increase participation in courses by farmers and small business operators, and, ideally, encourage retention of young people in regional areas of the state. Similarly, the KnowledgeBank project will deliver new internet tools and online content within a secure education network. Within this network, students will be also able to interact with each other using interactive tools such as blogs, wikis, and podcasts, which are currently banned by most educational institutions due to a high risk of inappropriate use. SkyConnect involves construction of a new satellite network to provide increased bandwidth for delivery of education and e-health services to remote communities and homesteads in rural and remote North Australia. The project will establish a new dedicated Interactive Distance Learning studio in Alice Springs to enable Charles Darwin University to deliver vocational education to 54 schools, 160 School of the Air sites, 16 vocational education centers, and 24 health clinics covering 62 communities.

In April, 2009, the Australian government announced a plan to create a company, jointly owned by the Government and the private sector to “invest up to \$43 billion over 8 years to build the national broadband network.”⁷⁸ Specifically, “the new superfast network will:

- connect homes, schools and workplaces with optical fibre (fibre to the premises or 'FTTP'), providing broadband services to Australians in urban and regional towns with speeds of 100 megabits per second - 100 times faster than those currently used by most people extending to towns with a population of around 1,000 or more people
- use next generation wireless and satellite technologies that will be able to deliver 12 megabits per second or more to people living in more remote parts of rural Australia
- provide fibre optic transmission links connecting cities, major regional centres and rural towns
- be Australia's first national wholesale-only, open access broadband network
- be built and operated on a commercial basis by a company established at arm's length from Government and involve private sector investment
- be expected to be rolled-out, simultaneously, in metropolitan, regional, and rural areas.⁷⁹

There are analysts who clearly believe that the Australian approach leans too heavily on government intervention and too little on private enterprise. Scott Cleland describes in detail what he believes are

⁷⁸ Press Release, 7 April, 2009, Minister for Broadband, Communications and the Digital Economy, *available at* http://www.minister.dbcde.gov.au/media/media_releases/2009/022.

⁷⁹ *Id.*

the distinctions between broadband policy in the U.S. and Australia (e.g., much lower infrastructure deployment and reliance on a single regulated provider) as well the shortcomings of the Australian proposal.⁸⁰ Cleland also notes that in areas in which two or more providers can provide facilities, the EU has found:

2.3.2.2. "Black areas": no need for State intervention (37) When in a given geographical zone at least two broadband network providers are present and broadband services are provided under competitive conditions (facilities-based competition), there is no market failure. Accordingly, there is very little scope for State intervention to bring further benefits. On the contrary, state support for the funding of the construction of an additional broadband network will, in principle, lead to an unacceptable distortion of competition, and the crowding out of private investors. Accordingly, in the absence of a clearly demonstrated market failure, the Commission will view negatively measures funding the roll-out of an additional broadband infrastructure in a "black zone".⁸¹

Lessons from Asia

Japan and South Korea have arguably the highest broadband, especially high-speed broadband, adoption rates in the world. Like much of Europe, they have higher rates of population density than the U.S. (particularly Japan). However, these countries also have another advantage – high rates of computer literacy, and internet usage. This is not purely a coincidence. In Korea, computer literacy is expanded through cloud/distributed computing architectures with centralized storage and processing connected with very high-speed networks. This allows less expensive devices to be deployed in the home. “Computing without a computer is not just a dream; it is a reality in South Korea today through the widespread deployment of next generation broadband and IPTV. Because IPTV is interactive, South Korean citizens can already bank online and view video on demand directly from their television set. Coupled with an inexpensive wireless keyboard that costs less than \$20, HDTV can bring the Internet to citizens without computers.”⁸²

Even if cloud computing architectures connected with very high-speed networks are not deployed in the U.S. in the near future, a more fundamental lesson is to be learned. That is,

⁸⁰ Scott Cleland, *Why the Australian “Fiber Mae” Broadband Model Doesn’t Work for the U.S.*, THE PRECURSOR BLOG, May 13, 2009, <http://precursorblog.com/content/why-australian-%E2%80%9Cfiber-mae%E2%80%9D-broadband-model-doesn%E2%80%99t-work-us>.

⁸¹ *European Commission, Draft Community Guidelines for the application of State aid rules in relation to rapid deployment of broadband networks* (2009), available at http://ec.europa.eu/competition/consultations/2009_broadband_guidelines/guidelines_en.pdf.

⁸² STEPHEN EZELL, ET AL., THE INFORMATION TECHNOLOGY & INNOVATION FOUNDATION, *THE NEED FOR SPEED: THE IMPORTANCE OF NEXT-GENERATION BROADBAND NETWORKS* (2009), available at <http://www.itif.org/files/2009-needforspeed.pdf>.

expanded computer literacy, and the availability of less expensive computers in homes, schools, libraries, and civic centers will increase internet adoption, pulling broadband demand with it.

Conclusion

Any conclusion one draws from this research and related report must begin (and end) with the recognition that filling broadband (supply and demand) gaps in a sustainable way is a long term proposition. To paraphrase a well known truism: we didn't get here overnight and working thru a solution is going to take some time. This is the reason this research and report is grounded in the economic rationale for when and why one would intervene in a market. Sustainable solutions (on both the supply side and the demand side) must endure - and anything that endures must be economically rational (and good public policy) in the long run.

Consistent with this view, a key conclusion is that to the extent possible one should rely on private enterprise. Short of turning broadband into a public utility – very expensive proposition indeed – private enterprise is the key to sustainable success in extending the benefits of broadband to all citizens of Alabama.

Demand-side solutions (including expanded computer literacy and subscription rates) are likely more cost-effective than supply side initiatives at increasing broadband penetration. In this same vein, relevant content is important to improve economic opportunity and quality of life.

Supply-side subsidies should be well targeted to those marginal investments in high priority areas (e.g., unserved rural) where investments would not have otherwise been made.

And, as one would expect, there is no magic formula for filling broadband gaps. Some solutions will be more effective and cost efficient than others. Alabama's broadband future will be most bright and most robust if we learn well from the lessons available to us through the adventures (and misadventures) of others across the country and around the world.

Appendix: The Economics of Market Intervention in Detail

A. Public Goods and Economies of Scale

A public good is one in which the marginal cost of producing and consuming an additional unit of the good is zero (\$0.00). A good with public good-like characteristics is one in which the marginal cost of producing and consuming an additional unit is relatively low (if not literally zero). For ease of discussion, we will use the term “public good” to refer to those goods with a strong public good-like nature.

Many modern high-tech products are public goods. Consider the creation of a software product; once the programming is complete the costs of transmitting the software via the internet is virtually zero. Often, information goods have a strong public good tendency; once the information is collected, organized, and analyzed, the dissemination of the information likely occurs with very low cost.

Closely related to the concept of public goods is the economic concept of economies of scale. Economies of scale simply means bigger is cheaper (using average cost as the measure) per time period.⁸³ A pure public good is an extreme example of increasing economies of scale; since marginal costs are zero, the fixed costs of creating the good can be spread over larger and larger quantities, causing the average cost to fall.

The existence of economies of scale implies that a single provider, or a single coordinated method of provision, will be more efficient than having multiple providers all incurring fixed costs. With public goods, or goods with strong economies of scale (with a public good-like characteristic), there are three types of rationales for government regulation, or public provision of the good. First, the very existence of increasing economies of scale (or a public good in the extreme) means that having a single provider is the efficient mechanism; in order to avoid abuse of market power, governments around the world often utilize price regulation, government control, or public ownership in such circumstances. Moreover, even an unregulated private provider may face issues in efficiently creating and providing public goods.

Second, even for an unregulated private provider, it may be difficult to protect the property rights related to public good. For example, protecting intellectual property rights (intellectual property often has a public good-like characteristic) is far more complex than protecting real property. If the investment in intellectual property can't easily (at low cost) be protected, private investment is less likely to occur.

⁸³ Diseconomies of scale means that average costs rise as output increases. Some firm's cost curves may first exhibit economies of scale, then diseconomies of scale beyond some point. Economies of scale is related to the concept increasing returns to scale (which is a strict input-output concept). Economies of scale can result from increasing returns to scale or volume discounts in purchasing inputs. See, e.g., W. BRUCE ALLEN ET. AL., *MANAGERIAL ECONOMICS: THEORY, APPLICATION, AND CASES* ch. 7, 9(6th ed. 2005).

Third, it may be difficult for a private provider to identify and enforce an efficient pricing mechanism with a public good. Consider a company contemplating collecting information on the costs of deploying broadband infrastructure by small geographic area and by technology in Alabama. Once the information is collected, the costs of disseminating the information are likely to be close to zero. Several potential providers should be interested in obtaining the information in deciding in which geographic areas they may have a comparative advantage in entering, and for building a business case for specific geographic area. However, the firm collecting the information may have a difficult time in identifying the value each potential market participant receives and in creating a pricing plan to capture enough of that value to cover the costs of information collection/creation. Moreover, potential broadband providers may have a difficult time in assessing, before the fact, the value of the information. Similar issues arise if information is collected regarding demand for broadband subscription. As a related matter, there may be significant risk to the agent collecting/creating the information (i.e., risk that they may be unable to recoup the costs of collection).

For a broadband initiative there are likely to be several public good-like activities. One important dimension is the collection of virtually any information relevant to broadband and a broadband initiative. The relevant information collection could include: 1) the status of existing broadband supply; 2) existing demand for broadband; 3) potential demand (and aspects of potential demand that would require coordination and/or education to create actual demand); and 4) any constraints (e.g., transmission rights of way constraints); and 5) the costs of deploying broadband, by technology type.

B. Network Effects

The value one receives from subscribing to a network depends in large part on the number of subscribers on the network. For example, a potential subscriber would place no value on an internet connection solely for the purpose sending and receiving e-mail if no one else has e-mail. With networks, the value to the last marginal subscriber on a network will be less than the total value to all subscribers (including the marginal subscriber) of adding the marginal subscriber. This is because the value that others already on the network have of adding a subscriber is “external” to the marginal subscriber’s decision to pay the network subscription fee. This is called a direct network effect or a positive network access externality.⁸⁴ Access externalities or network

⁸⁴ See, e.g., Parsons *supra* note 11; Rohlfs *supra* note 11, at 81.

effects provide a potential economic rationale for this historic cross-subsidization of land-line voice telephone service.⁸⁵

Consider the following points regarding network effects as a potential rationale for subsidizing broadband deployment or subscription. First, there is no study of which we are aware that attempts to quantify the network effect for broadband.⁸⁶ This means that there is no study by which to quantify any network effect. Second, any network effect will tend to be national/world-wide. It is true that potential subscribers almost certainly place higher value on being connected to a network in which those they know are connected; value is increased if neighbors, friends, family, and business associates can be reached via this network. And while many valued connections are likely within the same region (city, state, or other defined smaller area), a large number of valued connections are likely outside this smaller area. This means that rationales to subsidize network connection to garner the network subscription externality are stronger at the national/international level vis-à-vis state levels or smaller geographic areas. When an additional subscriber is added to the network, three groups of parties benefit: 1) the subscriber themselves;⁸⁷ 2) those within the state that derive value by having the subscriber on the network (e.g., friends, family, and business associates within the state); and 3) others on the network outside the state. That said, the stronger the intra-state (or other smaller geographic unit) network relations, the stronger the potential rationale for achieving network effects at the state level. This means, for example, that state-funded programs that stimulate demand for intrastate communications/data transfer/network connection can be more readily supported on the grounds of network externality.

Direct Network Effects? And Dial-Up Substitution?

Original network (and network effect) examples include voice telephony, fax machines, and e-mail.⁸⁸ In each example, existing subscribers receive value from adding new subscribers to the network, and interaction (calling, e-mailing, faxing) to others cannot occur without their subscription. Broadband internet access is potentially different in at least two ways. First, some applications are not strong examples of direct network effects. For example, someone who downloads large data files from

⁸⁵ That is, the historical practice of keeping monthly subscription prices low (especially for residential customers), and keeping usage prices, particularly long-distance prices high. Cite _____.

⁸⁶ Indeed, we know of no study done in the last 20 years quantify the network effect for telephone service.

⁸⁷ If this were the only party to benefit, there would be no network effect.

⁸⁸ Cite to Varian _____.

government sources (e.g., bureau of the census) places value on the sources of data, and their own data connection, but does not per se place value on others having a high-speed connection.⁸⁹ Some broadband applications, e.g., massive multiplayer on-line games, appear to be more consistent with traditional direct network effect applications.⁹⁰ Second, some internet applications are more bandwidth intensive than others: streaming video (e.g. for education); large file transfers (e.g., for remote mammography and other radiological services); multi-user general internet connectivity; and massive multi-player on-line gaming. For relatively less bandwidth-intensive applications (e.g., e-mail and general internet searches with medium-sized file downloads), dial-up internet connection will be a valid substitute for some customers. Such customers will likely have lower demand for broadband service, and will likely be more price-sensitive. Moreover, a significant proportion of such potential customers (for which dial-up is a valid substitute) will make a rationale for broadband subsidization more difficult⁹¹ in that these customers don't contribute to the value of the broadband network. As a related matter, understanding the various drivers of potential broadband demand, and which categories of demand and demanders are, or are not, potentially substitutable with dial-up service will be critical to designing demand-side broadband initiatives.

Comparisons to universal subsidies

Voice telecommunications penetration levels are exceptionally high.⁹² Despite the relatively high levels of penetration, explicit federal universal service subsidies in the U.S. amount to approximately \$7 billion annually and there are also significant residual implicit cross-subsidies to residential telephone service, as well as state-funded universal service funds. The most important time for which to subsidize a network is before the network technology reaches critical mass (cite Varian & Parsons). And, beyond critical mass, the rationale for subsidization of subscription is weaker.

⁸⁹ In such cases there may be so-called indirect network effects, in which having more high-speed subscribers can create more sources with relevant large data files, in this example.

⁹⁰ Without other players with high-speed internet connections, no one would value the multi-player game.

⁹¹ Alternatively, it is important to note that as broadband coverage grows, network effects may cause those without broadband to be increasingly disadvantaged. Web-content providers will presume the presence of a high-speed connection and will thus be less inclined to offer both low and high-bandwidth versions of their sites, rendering dial-up less valuable. See Jon M. Peha, *Bringing Broadband to Unserved Communities*, Brookings Institution Press (2008).

⁹² The most recent data shows that 94.6% of households nationwide subscribe to voice services. See FEDERAL-STATE JOINT BOARD ON UNIVERSAL SERVICE, UNIVERSAL MONITORING REPORT 6-4 (2007), available at http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-279226A1.pdf.

Broadband subscription levels are much lower than for voice telephony, yet broadband service subsidies are not universal, nor nearly as significant as those for voice telephony.⁹³

⁹³ However, voice telephony more clearly exhibits pure direct network effects than does broadband.