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Rural Broadband

A RUPRI Policy Brief

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RURAL POLICY RESEARCH INSTITUTE

POLICY BRIEF

RURAL BROADBAND

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Context

On November 4, 2008, the Federal Communications Commission (FCC) adopted rules that would allow unused airwaves abutting broadcast television spectrum to be available for wireless broadband[1]. Opening these airwaves, which are commonly called television "white spaces," is expected to lead to improved wireless connectivity and considerable innovation in Internet-based products and services. Advocates say that the new rules could significantly upgrade the range and quality of broadband services across rural America. This change is just one of many decisions, policies, reports, and pieces of legislation concerning improved broadband deployment that have appeared in recent months.

This brief has been prepared to give policymakers and practitioners with interests in rural development some background on the issues and opportunities associated with rural broadband, as a basis for wiser public choice on investment in rural places.

What is broadband?

The term "broadband" refers to any technology that transmits data across the Internet at high speeds and is "always on" – as compared with a dial-up system that must be connected each time a user wishes to access the Internet. Broadband systems have a two-way stream of data: upstream for sending data and downstream for receiving data.

Broadband services in the United States are most often delivered by telephone companies on digital subscriber line (DSL) systems using conventional phone lines and by cable television providers over coaxial cable lines. In some locations, alternative "wired" systems such as fiber-optic cable and broadband over power line services are offered. There is increasing competition from "wireless" providers who deliver services either from towers or through satellite systems to a receiver at end-user locations. Wireless systems can be terrestrial or "fixed", which provide broadband to a fixed location such as a home or a business, or mobile for use with handheld devices.

The FCC, which is the regulatory agency for all forms of telecommunications, defines "basic broadband" as the ability to carry data downstream at a minimum of 768 kilobits per second (kbps)[2]. The Commission continues to apply its old minimum speed of 200 kbps in either direction to "first generation services", and also defines faster broadband tiers that increase from 768 kbps to over 100 megabytes per second (mbps)[ii].

Upstream and downstream speeds are important to the definition and consumer experience of broadband. The two-way speeds determine the amount and quality of data than can be transmitted. Complex and data-rich applications such as video-sharing (YouTube being one of the fastest growing segments of the Internet) require high speeds to both upload and download streaming images. Videoconferencing, an increasingly important tool for business and rural health care, requires high speeds that are equivalent in both directions to avoid lagging video images. For more common applications such as e-mail and general web browsing, a speed of 768 kbps is usually adequate.

Why is broadband important to rural America?

In a very short period of time, the Internet has evolved from being a luxury or entertainment item to an essential type of infrastructure for business, health care, education, and government. Access to the Internet at broadband speeds and capabilities has become a necessary tool for engagement in the modern American economy and culture.

Robert Atkinson of the Information Technology and Innovation Foundation and Jon Peha of Carnegie Mellon University have both argued that high speed Internet is more than a consumer good, and that broadband provides benefits to society as a whole. Atkinson calls broadband a "prosumer" technology that stimulates economic growth because users can also become producers[3]. Atkinson and Peha both note the "network effects" of increasing Internet access[4], where the more people who have high speed Internet, the more useful it becomes. The private market has done an effective job of deploying competitive broadband services to well-populated and high-income areas, but where broadband is still not available, households and businesses cannot readily access the resources and benefits that the Internet provides. Both Atkinson and Peha believe that in order to ensure that the benefits are widely shared, government intervention is warranted to expand the broadband market areas not adequately served by the private market — most notably rural America.

The positive economic impacts of broadband deployment on rural businesses, consumers, and the wider economy have been noted by Gillet, Lehr, and Sirbu in their report to the US Economic Development Administration[5]. Benefits include innovations in transactions between businesses, lower costs, telecommuting, and online access to customers and potential employees. Rural consumers, in particular, benefit from online access to goods and services that are not readily available in their communities. At the state and local level, studies have shown that employment growth in non-farm industries, especially in the service sector, is greater in communities that have adopted broadband systems. "For every one percentage point increase in broadband penetration rate, employment is projected to increase by 0.2 to 0.3 percent per year" (2), according to Crandall, Lehr and Litan[6].

[ii] 1 MB or megabyte equals 1,000 KB

Conversely, according to Atkinson, areas that lack broadband have trouble attracting new businesses than communities that have access broadband capability[7]. Overall, broadband availability is becoming an essential prerequisite for business development and growth.

In rural health care, broadband technologies are proving to be cost-saving and opportunity-expanding tools for delivering services. At least 25 states are using telemedicine (also known as telehealth) networks to supplement rural and long-distance health services[8]. Telemedicine provides virtual access to better staffed and equipped urban health centers, and can reduce costs for rural patients (by reducing driving time or time lost from work) and hospitals (by lessening the need for full-time on-site specialists, for example). Emily Sato's review of research on cost savings associated with telemedicine for the treatment of heart failure[9] found savings in all ten studies, including, in one case, savings of up to 68 percent. The importance of adequate broadband infrastructure will continue to be highlighted as telemedicine continues to expand. The FCC recently provided $417 million to the Rural Health Care Pilot Program to build 69 statewide and regional telemedicine networks across the United States[10].

In the United States, computers and the Internet are almost universally available to students wherever they may live. According to Wells and Lewis[11] in a study for the US Department of Education, in 2005, of the 94 percent of public schools with Internet access, 97 percent used broadband connections. The same study found that rural schools were more likely to provide access for students to online distance learning than schools in cities and urban fringe areas. Rural residents can also access college-level distance learning courses and degrees that may not be offered at local institutions.

Another rapidly growing area of broadband use is for government services and public safety. Advocates[12] for "e-government" say that it has the potential to increase transparency, improve customer service, update and streamline bureaucratic management practices, and cut costs. William Eggers says "from license renewals to parking ticket payments, to business compliance reporting, nearly all government transactions with citizens and businesses can be done more cheaply over the Net"[13] (29). These online activities cut costs, and they also reduce citizens' time spent in bureaucratic offices and potentially increase citizens' opinion of government efficiency. In addition, the federal government has recognized the usefulness of broadband communications for public safety. The SAFECOM program of the Department of Homeland Security applies broadband to help first responders by instantly connecting police and firefighters to resources such as pictures of abducted children and blueprints of burning buildings, for example[14]. Wireless broadband systems are especially useful here.

How much does broadband availability differ between urban and rural areas?

Over 70 percent of Americans access and use the Internet at work, home, or by a mobile hand-held device, and consumers are increasingly replacing dial-up services with broadband wherever it is available because of its advantages in speed and capacity[15]. Broadband is nearly ubiquitous in American cities and consumers have many choices among technologies and providers in suburban and urban communities[16]. Unfortunately, while telecommunications providers expanded the national broadband market five-fold between 2001 and 2006[17], they have been less eager to tackle broadband deployment

in rural communities and inner cities. Peha[18] estimates that "roughly one-third of households in rural America cannot subscribe to broadband Internet services at any price"(2).

A key challenge for policy in this area is obtaining meaningful data on broadband access. As Renkow[19] notes, current FCC data suffers from overly broad measurement systems and a heavy reliance on data from broadband providers. According to the FCC, over 99 percent of US zip codes have at least one broadband provider that serves at least one end user.[20] This measurement allows a single business subscription to count for broadband "availability" across a zip code of any size; there is no way of knowing from FCC data how many households and businesses actually have broadband available to them[21].

The Pew Internet and American Life project provides an alternative source of national-level data. In a 2008 telephone survey, 24 percent of rural Americans reported that they do not buy broadband because the service is not available where they live[22]. This data may be subject to some distortion as some consumers may not have been aware of newer forms of available broadband service such as satellite systems.

There have been more detailed data collected at the state level, particularly in California and Kentucky. California's Broadband Task Force[23] found that while the Bay Area had a 99 percent rate of broadband availability, only 57 percent of households in the rural Northern Sierra region had the option to purchase basic broadband services. Overall, the Task Force found that throughout the state, approximately 500,000 households – almost 1.4 million Californians – were unable to subscribe to broadband, and that nearly 2,000 communities did not have any options for broadband access.

ConnectKentucky, a public-private partnership, has become a model for measuring and improving broadband deployment across rural counties. Since 2004, ConnectKentucky has surveyed the state's 81 broadband service providers to analyze availability and to prioritize areas for expanding broadband access. According to Renkow's analysis of ConnectKentucky's data[24], more than 85 percent of households in nearly all areas of the state had broadband access, although there were seven counties in which less than half of all residents had access.

Renkow looked at factors that seem to determine the availability of broadband in North Carolina and Kentucky and concluded that "per capita income had no statistically significant influence on availability. Rather, the key determinants appear to have to do with the size and concentration of the population"[25] (4). Geographic characteristics such as mountainous terrain, long distances, and low population densities have been found to be deterrents to broadband infrastructure investment.

How well is broadband used in rural areas?

Although there is inadequate information on broadband availability to rural consumers, there is data on adoption and use. The National Telecommunication and Information Administration (NTIA), in its recent *Networked Nation* report[26] estimated that 38.3 percent of rural households subscribe to broadband services, compared to 58.3 percent of urban households. Part of the disparity can be explained by the

broadband availability challenge discussed above, but there are also issues of demography, perception, and affordability.

Studies[27] have shown that the elderly, people with less education, and lower income groups, all over-represented in rural areas, tend to subscribe less often to broadband services at home. This in turn creates a "perceived lack of demand"[28] that deters potential investors in broadband infrastructure. In Horrigan's 2008 Pew survey[29], price was the main reason cited as to why Internet users opted to keep dial-up services rather than switch to broadband, although it has been noted that prices do come down when there is competition among broadband providers[30].

In spite of these issues, Horrigan found that once rural consumers had a broadband subscription, the breadth of their online activities was similar to those of urban and suburban users, suggesting that where broadband technologies become familiar to rural consumers through access at school, home, and work, they benefit equally from participation in online services.

Which broadband technology is best for rural areas?

Different broadband technologies have varying speeds and qualities that may affect their usefulness in different rural contexts. The following table shows the speeds, household shares, and quality issues for each of five broadband technology types.

Table 1: Characteristics of Broadband Technologies

Broadband Technology	Speed Capability	Share of Household Subscribers	Quality Issues
DSL	Up to 6 mbps	46%	Quality depends on age of phone lines and distance of end user from central telephone office.
Cable	Up to 8 mbps	39%	High quality, but speeds lower when many users are sharing lines and/or using data-heavy applications.
Wireless	Up to 1.5 mbps	12%	High quality and relatively cheap to deploy. Fixed wireless systems may be most appropriate in many rural areas.
Satellite	Up to 1.5 mbps	Not reported	Suffers 'latency' in data transfer; poor quality for video applications. Relatively expensive for consumers. The only option for some extremely remote places.
Fiber-optic cable	Up to 50 mbps	2%	Very high quality but very expensive to deploy.

Sources: Broadband Fact Book[31], Horrigan (2008), Verizon FiOS Internet[32], NTIA report[33]

Each of these technologies has its benefits and drawbacks, so no single technology will be suited to every location. Some experts[34] believe that fixed wireless may be the most useful and affordable technology to meet rural broadband needs, particularly for rural mountain communities, as there is a potential for lower shared costs and less physical infrastructure. In rural Ohio, satellite is being adopted, and in others where there are cooperative, public-private, or municipal broadband systems, combinations of technologies have been tried. The lack of a "one size fits all" approach has prompted calls in policy circles for "technology neutrality" so that local communities and regions can determine which technology works best for their circumstances and not have a particular type imposed upon them.

What is the Federal government doing to promote rural broadband?

Federal policies on broadband originate in Section 706 of the 1996 Telecommunications Act, which requires the FCC to "encourage the deployment on a reasonable and timely basis of advanced telecommunications capability to all Americans." The Act also stated that consumers in "rural, insular, and high-cost areas" should have access to services and rates that are "reasonably comparable" to those in urban areas. This explicit support for a universal policy was reinforced by not only a focus on low-income consumers and consumers in rural and high-cost areas, but also by the inclusion of schools, libraries, and rural health care providers. A Universal Service Fund was created, which mandated contributions from subscribers through interstate telecommunications carriers from which disbursements for various universal service programs would flow. The Fund supports four different programs, which amounted to nearly $7 billion in 2007[35]:

- ✧ **High-Cost Program**: intended to assist customers in high-cost, rural, or insular areas through financial support to telephone carriers, thereby lowering rates for local and long-distance service. This is the largest program and accounts for over 60 percent of the disbursements made under the Fund.

- ✧ **Schools and Libraries Program**, commonly called the **E-Rate Program**: assists schools and libraries through discounted telecommunications services, specifically for local and long-distance telephone services, Internet access, and internal connection projects. About a quarter of Fund disbursements go to E-Rate.

- ✧ **Low-Income Program**: assists qualifying low-income customers through discounted installation and monthly telephone serves and free toll limitation service. Less than 12 percent of the Fund is used for these purposes.

- ✧ **Rural Health Care Program**: at $37 million, this is smallest of the four programs. Assists health care providers located in rural areas through discounts for telecommunications and Internet access services. The discounts are intended to make rural rates comparable to those in urban areas.

Although these programs have been clearly beneficial to rural regions, there is growing concern that it is time for a comprehensive review of universal service policy. A recent Government Accountability Office report[36] was critical of the High-Cost Program for having led to inconsistent distribution of support and

availability of services across rural America. The report faulted the FCC for lack of appropriate performance goals and measures. Strover observed that "even though E-rate programs are highly valued, many rural and especially minority populations do not feel able to use or comfortable with computers and Internet access in institutions such as a public library or a school."[37] Also, in November 2007, the Federal-State Joint Board on Universal Service, established under the 1996 Act to advise the FCC on the implementation of universal service, called for reform of the service and a comprehensive policy to address problems of broadband in rural regions[38]. Aspects of the Universal Service Fund are currently under review by the FCC.

The recent FCC ruling on the use of "white space" to provide enhanced broadband services, as mentioned earlier, is a significant development with considerable potential for rural America. This additional spectrum will become available in February 2009 when analog television makes the switch to digital service. Supporters of the new rule say that it will increase the competitiveness of fixed and mobile wireless systems against DSL and cable modem broadband, and will lower prices for all consumers[39]. Some even predict "wi-fi on steroids" that "could become a ubiquitous national broadband network"[40]. Rural advocates believe that the extended reach of this wireless spectrum will bring broadband to more remote rural consumers[41]. Opponents to the ruling fear the increased spectrum use will interfere with existing broadcasts or wireless microphones, or that equipment certifications required by the FCC to operate on the unlicensed spectrum will increase costs overall for users[42]. There are a number of operational issues still to be resolved and it is not expected that the additional spectrum will be put to use until at least 2010.

The US Department of Agriculture, Rural Development has been providing loan finance for broadband since 2000, beginning with a pilot program that provided 28 loans of $180 million in 20 states. The current Rural Development Broadband Loan & Loan Guarantee program was established by the 2002 Farm Bill. Since its inception, 70 loans were approved in 40 states to the value of $1.22 billion for the provision of a variety of technologies including wireless, fiber, hybrid fiber and coaxial, DSL, and broadband over power lines. These loans served 1,263 communities with a total of 582,000 household subscribers. In March 2008, the USDA announced a loan of $267 million under this program to Open Range Communications to provide broadband service to 518 rural communities in 17 states. It is estimated that more than six million people will have access to the service over the next five years. The project will provide Wi-Max technology that transmits wireless data in areas not served by cable or DSL technologies, with an aim to offer affordable, wireless high-speed broadband service to under-served and unserved areas. The loan is also intended to leverage $100 million from the private sector[43].

In October 2008, Congress approved the Broadband Data Improvement Act to address the FCC's lack of detailed information on broadband availability, speed, and adoption. The FCC will be required to gather more detailed information from telecommunications providers, and the Census Bureau and the Small Business Administration will include broadband-related questions in their surveys. In addition, grants will be available to fund statewide initiatives to track the availability and adoption of broadband services[44].

What are states doing to promote rural broadband?

The National Governors Association's Center for Best Practices[45] and the Alliance for Public Technology & the Communications Workers of America[46] have both recently compiled reports on current state policies and practices for broadband expansion. A synthesis of these reports identifies four main types of initiatives being pursued through state government:

- ✧ **Task Force, Commission, or Authority** comprising public and private stakeholders to evaluate the current rates of broadband availability and adoption, map broadband deployment, and identify and debate potential state policies. Examples include the California Broadband Authority and the Ohio Broadband Council.

- ✧ **Targeted Tax Incentives** for broadband equipment investment and to encourage consumers to change behaviors. Wisconsin has a tax credit for equipment that carries data transmission speeds higher than 200 kbps to promote economic development in disadvantaged communities. Missouri provides a tax credit for broadband equipment costs incurred while opening or relocating a business facility. Georgia offers a telecommuting tax credit.

- ✧ **Infrastructure Investment** intended to leverage private sector funds to expand broadband availability. Examples include the California Advanced Services Fund, ConnectME Authority, the Illinois Technology Revolving Loan Program, and the Louisiana Delta Development Initiative.

- ✧ **Local Demand Aggregation** by which local communities are engaged to stimulate and aggregate demand and thus lower the costs of broadband services in rural areas. Activities include forming public-private partnerships (such as ConnectKentucky and the e-NC Authority); promoting state networks to connect schools, universities, libraries, and state and local government agencies; initiating telemedicine networks to link rural clinics with larger hospitals and universities (for example, Kansas University Center for Telemedicine and Telehealth); encouraging demand through programs to promote computer ownership, computer literacy, and the development of community-based assistance services; and integrating broadband expansion activities into state health, job training, housing, and education programs.

What principles should underlay future rural broadband policy?

The usefulness and potential of telecommunications and broadband connectivity continue to evolve at a rapid rate. Public policies, regulations, and programs are hard-pressed to match the pace of change. In densely populated metropolitan regions, intense competition and innovation have made possible major advances in speed, quality, and content variety for the benefit of the consumer. Looking forward, broadband policy must be framed to allow these advances to continue, while at the same time ensuring that all parts of the population benefit from those advances.

We recommend that the following set of principles should underlay future rural broadband policy.

1. **Broadband connectivity should be central to universal telecommunications service**.

The intent of the 1996 Telecommunications Act was to ensure that all Americans had access to advanced telecommunications. The FCC data appear to indicate that this goal has already been achieved, with 99 percent of all zip codes having at least one broadband provider and one end user. However, it is clear from recent studies that these data are misleading, and that even in states such as California, there are areas where over 40 percent of the population do not have the option to purchase any broadband service. The recently approved Broadband Data Improvement Act of 2008 should provide the necessary impetus to collect more detailed information on the availability and adoption of broadband across the country and help focus attention on areas where the goal of universal service is not being met.

2. **Broadband is a critical part of rural development infrastructure.**

Investments made through the Universal Service Fund, by the US Department of Agriculture, and by certain states to stimulate broadband infrastructure in rural America have undoubtedly had substantial and positive impact. But this investment has to continue as demand increases and new technologies evolve. For rural America, this investment is not an optional luxury after other infrastructure investments such as roads, electricity, or water. Broadband is an essential prerequisite for any community that hopes to be a contributing force in the national economy. High-speed Internet access offers very real alternatives to deal with the current and destructive consolidation of schools, health facilities, and government services in rural places. The ability to promote distance learning, to transfer medical records and provide remote medical treatment, and to participate in civic affairs online all enable small communities to remain viable and sustainable for the long-term. To ensure rural access to these benefits, experts have called for direct federal investments as part of a National Broadband Policy, including proposals for novel market-based mechanisms to increase private sector investment such as reverse auctions and tradable obligations linked to government subsidies.

3. **Speed really does matter.**

Differences among data transfer speeds and latency issues have the potential to mask another disparity in broadband service across the country. The latest video-conferencing and video-sharing products require much higher two-way speeds than the FCC currently requires under its 768 kbps "high-speed" definition. While the market in metropolitan areas continues to ramp up speeds and quality, less densely populated areas are struggling to obtain basic services, and the divide between urban and rural services continues to widen on this second front. Rural investment programs need to focus not on current minimum requirements, but on building for the next generation of technologies and capacities.

4. **Outcomes, not specific technologies, should drive broadband deployment.**

Outcomes based on measures of availability, speed, and quality should be the drivers of broadband infrastructure investment. Recognizing that rural America comprises a diverse array of geographic, demographic, and economic structures, no single technology or business model will serve all rural needs. In addition, the relative merits of different technologies change over time with innovation.

Individually and in combination, the various technologies of fixed and mobile wireless, satellite, coaxial and fiber-optic cable, and DSL all have a place in rural America. It is important that public policy does not inadvertently give an advantage to one over the others, but remains "technology neutral."

5. **Enhanced supply must be accompanied by strategies to increase demand.**

Studies have shown that there is little difference in the range and depth of online activities of rural Internet users and their urban counterparts once they take the step to be subscribers. The challenge is to overcome the barriers of inadequate supply, cost, and unfamiliarity with the technologies to encourage more rural residents to take that step. Training and support programs offered by community colleges and community-based organizations –- some targeted at businesses and entrepreneurs, others at households and young people – provide many examples of how local communities are aggregating demand for broadband and its benefits among their citizens. Getting more computers into homes and businesses is a necessary prerequisite to increasing comfort levels for potential users. One suggestion has been to extend the E-Rate program to include residential properties; another is to integrate the program into economic development activities in rural areas.

6. **States, regions, and communities should be encouraged to integrate broadband connectivity and use into their strategic planning.**

As discussed earlier, different broadband technologies will work better in some places than others. Similarly, programs to encourage investments and demands will vary from community to community. Many states have already been very active in promoting broadband deployment strategies, but others have not made this a priority. Some local communities, tired of waiting for telecommunications companies or states to make broadband available, have gone ahead with projects to aggregate demand and to forge partnerships with companies, utilities, colleges, hospitals, and other institutions. Federal policies should encourage both statewide and local innovation and remove regulatory and other barriers to such projects by passing bills such as the Community Broadband Act[47], which promises to remove such barriers and has yet to be voted on in the Senate. Another opportunity is presented by the proposed Rural Collaborative Investment Program authorized, but not yet appropriated, in the 2008 Farm Bill. This program will foster multi-county strategic planning and investment across urban and rural geographies, and may be an ideal vehicle for broadband deployment investment planning.

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