FirstMile.US comments to NTIA and RUS

Docket Number 090309298-9299-01

Executive Summary

FirstMile.US believes the most intelligent use of the NTIA and RUS ARRA funding is to utilize it as a pilot program for deployment of ubiquitous, much higher-speed broadband services throughout the United States. As the United States struggles to catch up to other industrialized nations, we believe a holistic view of broadband and the associated deployment outcomes, which our nation deserves, are the appropriate underpinnings for NTIA and RUS funds—providing the philosophical and practical vision necessary for the most intelligent spending of the money.

We believe there are three desired overarching outcomes for the funds. They are:

1. Increased broadband adoption in every community, every household, and every business.
2. Enablement of affordable, ubiquitous broadband solutions, which meet the country's 'grand challenges': healthcare, public safety, education, civic participation, energy independence/efficiency, and economic growth.
3. Facilitating local, state, and federal understanding of the importance of broadband, particularly,
    - Identification of areas where public resources are needed to provide universal service
    - Understanding federal, state, and local policies required to build sustainable self-sufficient, broadband-enabled communities.

During the last 25 years, the main tenets of Internet development included building and sustaining an open, interoperable, scalable network of networks, which robustly supports a variety of applications and devices. As we look forward to a ubiquitous big broadband environment, these basic philosophies still hold true. In order to ensure these sustaining principles, FirstMile.US espouses a new ideology moving from "last mile" supplier-centric networks to "first mile" user-centric networks.

We believe that open networks/infrastructure are the solution to enable user innovation on the widest possible scale. We believe that the recent Australian government broadband program is what the United States should be moving towards. NTIA and RUS should not be funding "last century" broadband installations amidst the opportunities that could be enabled with ARRA funds. We should work together to delve into new solutions, new technologies, and new social engagements that enable user-centric broadband deployment and unrivaled opportunities for innovation, jobs, and economic development.

Our specific recommendations for the NTIA and RUS grant/loan programs are focused on a vision of a ubiquitous, user-centric broadband system—one that enables innovation from all sectors. We are confident that these recommendations can produce a set of pilot projects throughout the country that can be studied and replicated. The recommendations are:

1. Clarification of the nationwide definitions for unserved and underserved is urgent.
2. A definition for unserved and underserved communities with no/low access to broadband is needed.
3. A definition for unserved and underserved high-population urban communities with low adoption of broadband is needed.
4. Definition and characterization of public-good "grand challenge" applications are required.
5. Strong interagency coordination to support the nation's grand challenges is required.
6. NTIA and RUS should maximize the opportunity to create new broadband access through middle-mile and community-connection points
7. Replicable programs, which create new adoption, workforce development, and new applications, are necessary.
8. Mapping
    - Verifiable, reliable data sources must be utilized.
    - Grand challenge institutions should be mapped.
    - Standardized GIS schema must be created at a national level.
    - The mapping must include more data than the combined upload/download speeds.
    - Broadband services should be mapped.
    - The factors that affect adoption should be mapped.
    - The federal government, state institutions, tribal governments, and local leaders should work together to determine the variety of geographical areas needed to understand the true nature of broadband deployment.
    - All federally owned, state-owned, and tribal-owned lands and buildings should be mapped.

Introduction

FirstMile.US believes the most intelligent use of the NTIA and RUS ARRA funding is to utilize it as a pilot program for deployment of ubiquitous, much higher-speed broadband services throughout the United States. As the United States struggles to catch up to other industrialized nations, we believe a holistic view of broadband and the associated deployment outcomes, which our nation deserves, are the appropriate underpinnings for NTIA and RUS funds—providing the philosophical and practical vision necessary for the most intelligent spending of the money.

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During the last 25 years, the main tenets of Internet development included building and sustaining an open, interoperable, scalable network of networks, which robustly supports a variety of applications and devices. As we look forward to a ubiquitous big broadband environment, these basic philosophies still hold true. In order to ensure these sustaining principles, FirstMile.US espouses a new ideology moving from "last mile" supplier-centric networks to "first mile" user-centric networks.

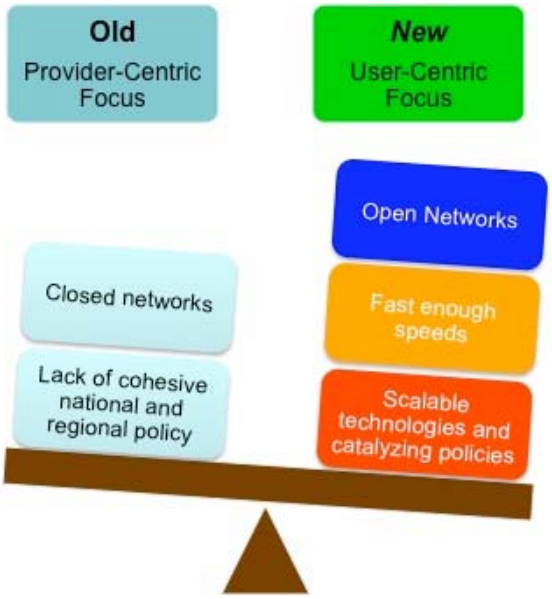

Figure 1. The FirstMile.US broadband vision shifts the priority from "last mile" provider-centric networks to "first mile" user-centric networks.

To understand how broadband should evolve, it is essential to understand the three distinct portions of a broadband connection.

1. The first is the pipe—essentially the path, street, or highway connecting you to the rest of the broadband network. These can be wireless or wired, or a combination of the two.
2. The second level involves applications—what you can do over the broadband pipe. These are sometimes software-based, but may be built in to certain devices.
3. Finally, there are devices and computers that you need to attach to your pipe that provide specific functions to help you more readily access applications.

The California Emerging Technology Fund as created an equation called the five A's of adoption. FirstMile.US believes the five A's are a realistic way to address the issues surrounding broadband adoption. They are:

ADOPTION = Access + Applications + Affordability + Accessibility + Assistance

FirstMile.US encourages the NTIA and RUS to think about similar definitions that help characterize the problem we are trying to solve. We have provided a listing of specific concepts that should be considered when 1) defining broadband and unserved/ underserved communities, 2) creating grant evaluation criteria and 3) when tracking the who-what-how-where-when of the grants and their success/failure. We believe these are the crucial areas for NTIA and RUS to consider:

- **Access**. Providing proven measurement methodology to have an apples-to-apples means of evaluating proposals when building new broadband supplies.
- **Applications**. Focusing specifically on sectors where socio-economic equity needs to be achieved and broadband adoption is less than the national norm, develop current and new applications to make residential broadband a necessary, useful purchase.
- **Affordability**. Devise programs to make residential broadband purchases cost-effective and structured for maximum adoption potential including subsidizing middle mile infrastructure.
- **Accessibility**. Ensuring that all potential users are considered and utilizing universal design thinking in our processes.
- **Assistance**. Working with community-based organizations and others that have close existing ties with the targeted communities to catalyze additional broadband collaborations and programs.

Figure 2. Broadband adoption can be characterized using the five A's of Adoption model.

We believe that open networks/infrastructure are the solution that enables user innovation on the widest possible scale. We believe that the recent Australian government broadband program is what the Unites States should be moving towards. NTIA and RUS should not be funding "last century" broadband installations amidst the opportunities that could be enabled with ARRA funds. We should work together to delve into new solutions, new technologies, and new social engagements that enable user-centric broadband deployment and unrivaled opportunities for innovation, jobs, and economic development.

Specific Recommendations

1. Clarification of the Nationwide Definition for Unserved and Underserved Is Urgent.

The NTIA and RUS are interested in what constitutes unserved and underserved "communities" in terms of "access" and "adoption," where they are located, and the issues creating roadblocks to adoption. During many Roundtable sessions, there was significant confusion about the definitions of unserved and underserved; markedly so, when comparing and contrasting urban underserved communities with low adoption rates with rural underserved communities with no access to broadband services. It is imperative that the NTIA/RUS create a set of definitions that encompass the various aspects of the five A's of adoption and that are unique to individual underserved communities so that no confusion remains and the path forward is clear to all.

2. A Definition for Unserved and Underserved Communities with No/Low Access to Broadband Is Needed.

FirstMile.US has developed documented criteria for expensive-to-serve underserved areas called *A Comprehensive Determination of Broadband Deployment to Designate Unserved and Underserved Communities Using Fact-based Measurement Criteria.* We believe that the NTIA/RUS should, at a minimum, incorporate these five criteria into their evaluation criteria for grant/loan awards. We believe these criteria can help the NTIA and RUS on two levels: 1) in determining the need for federal funds and 2) in helping determine how to develop regional solutions to maximize federal investments (i.e., middle-mile, open-infrastructure construction.)

These five criteria are discussed in detail below and include:

- Number of providers, especially the availability of *Open Infrastructure*
- Price
- Coverage
- Highest upload and download speeds
- Backhaul/middle-mile availability

Our methodology was developed with the goal of becoming a training document for local broadband advocates, who are trying to realistically assess their community or region. A community applying for a grant might use this as a first step towards understanding exactly where their problems lie in order to obtain the monies to solve them. It is imperative that people understand what they are entitled to have—no matter where they live—and to think regionally. Our process and data structure helps people utilize a strategic methodology to think about how to implement bigger and better broadband services. The process helps develop deep regional understanding of what is right and what is necessary. You might call it self-help for the broadband deprived.

The methodology espoused in the criteria was developed in 2007 and 2008, while assessing deployment in rural California regions. We developed the methodology to create a viable regional understanding of the broadband deployment situation. The criteria are tested and provide a comprehensive a review of why broadband is not deployed and a comprehensive understanding of regional issues through a scaling system.

Our methodology enables one to focus on how to measure existing broadband penetration in a predetermined area. We suggest a measurement ranking system that allows communities to compare their services with other communities through assessment of their current service levels.

A Note about Open Networks Versus Vendor-Controlled Networks

Typical U.S. broadband deployments are based on the concept of vendor-controlled networks. Vendor-controlled networks usually restrict the use of the network connection to their own provided services (voice, Internet, TV, etc.) and, thereby, control the applications and content available to subscribers.

The world is moving towards a much more consumer-robust concept of open networks. A recent report from a group of international broadband experts describes the open network idea. [1]

> "The big picture idea about communications is an open network. At a high level, everyone understands what it means for a network to be open: (1) whatever else is might do, the network offers a pure "transmission" service, so that users can freely communicate with each other; (2) users can connect any devices they want, as long as they don't harm the network; (3) the network connects to other networks; and (2) the network doesn't discriminate among users or among the services, information, and applications users want to provide to each other.
>
> In this regard, we should carefully distinguish between the basic infrastructure on which communication depends, and the notion of a "service" provided using that infrastructure. Newspaper delivery is a "service" provided using roads – a physical transportation infrastructure. We do not normally think of roads themselves as a "service" being provided to anyone – even though it obviously costs money to provide and maintain roads, and even though there must be rules regarding the use of and access to roads…The point of the [communications] infrastructure is not be a market-driven service itself. The point of the infrastructure is to enable and facilitate the provision of services that will be subject to the normal operation of market forces."

[1] Big Think Strategies - Open Access
http://www.budde.com.au/presentations/content/2009_Big_Think_-_OAP_-_Public_Copy.pdf

A Note about Satellite Broadband

We do not advocate recognizing satellite broadband as part of the deployed service base in our measurement criteria. The General Accounting Office said it best in its 2006 report.[2]

> "Currently, three providers of satellite service can offer nearly ubiquitous broadband service in the United States. These providers use geosynchronous satellites that orbit in a fixed position above the equator and transmit and receive data directly to and from subscribers. Signals from satellites providing broadband service can be accessed as long as the user's reception dish has a clear view of the southern sky. Therefore, while the footprint of the providers' transmission covers most of the country, a person living in an apartment with windows only facing north, or a person living in house in a heavily wooded area might not be able to receive Internet access via satellite. Earlier Internet services via satellite could only receive Internet traffic downstream—that is, from the satellite to the subscriber—and upstream Internet traffic was transmitted through a standard telephone line connection. Currently, however, satellite companies provide both upstream and downstream connections via satellite, eliminating the need for a telephone line connection and speeding the overall rate of service. Transmission of data via satellite typically adds one-half to three-fourths of a second, causing a slight lag in transmission and rendering this service less well-suited for certain applications over the Internet. While satellite broadband service may be available throughout the country, the price for this service is generally higher than most other broadband modes; both the equipment necessary for service and recurring monthly fees are generally higher for satellite broadband service, compared with most other broadband transmission modes."

Factors that Should Be Considered when Determining the Nature of the Broadband Supply

After studying rural areas, we determined five unique criteria for measuring broadband supply. Each criterion may play an important, possibly limiting role in the availability of broadband supply and the motivation for service providers to choose or ignore a community as a viable business opportunity.

Criterion 1: Number of Service Providers Especially with Open Infrastructure

To accurately establish the availability of a competitive environment in an area, it is critical to understand the role of the service provider, open versus closed networks, and the number of competitors with closed networks. With market-driven vendor-centric services, the number of providers indicates the desirability of the area in terms of profitability. With open networks deployed, only one pipe is needed to avail access from many communications service providers to homes and businesses via an installed fiber or wireless network.

[2] http://www.gao.gov/new.items/d06426.pdf

In a vendor-controlled network, each unique pipe to the home should be counted. In an open network, one pipe is adequate. In closed, vendor-controlled networks, three or more service providers constitute a robust competitive environment in a rural area. Currently, the European Union is has determined that it takes at least three to five carriers to provide a true competitive environment in urban settings. Because it is unrealistic to envision this depth in the more remote or sparsely populated rural areas, we lowered the number to reflect what might be reasonable in rural areas. In vendor-controlled networks, the number of providers should include wired services, fixed wireless services, and mobile wireless that provide at least a basic broadband service.

How to Measure

Survey the providers in your area and determine if they provide vendor-controlled networks or open networks. Make a list comprising their name, website address, service levels (upload and download speeds), and prices. Look for providers in all categories: telephone companies, cable TV companies, mobile wireless companies like cell phone carriers, fixed wireless companies, and other smaller Internet Service Providers (ISPs) that might serve your area. Ensure that you fully understand where their service is available and where it is not available.

Ranking

- If you have an open network with scalable capacity, award five points.
- If you have three or more vendor-controlled providers that provide broadband service at speeds faster than 768 Kb/s in either direction, award five points.
- If you have at least two vendor-controlled providers that provide broadband service at speeds faster than 768 Kb/s in either direction, award three points.
- If you have at least one vendor-controlled provider that provide broadband service at speeds faster than 768 Kb/s in either direction, award one point.
- If you have no providers that provide broadband service at speeds faster than 768 Kb/s in either direction, award zero points.

Criterion 2: Price

The pricing of broadband services is important to assess affordability and performance. Monthly service costs plus the cost per GB (gigabyte) of downloaded content or data per month should be considered.

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Survey the providers in your area and make a list comprising their name, website address, service levels (upload and download speeds), and prices. Look for providers in all categories: telephone companies, cable TV companies, mobile wireless companies like cell phone carriers, fixed wireless companies, and other smaller Internet Service Providers (ISPs) that might serve your area. Pay particular attention to the small print in

the contracts. Many providers set an artificial limit of allowed gigabytes per month and may have additional fees set for additional gigabytes. Be sure to note what they are.

Ranking

There are two different but useful ways of ranking prices included here. The first method prices the middle-mile cost (which is passed on to consumers) and the second method compares rural pricing with urban pricing. If you want to use both, add the final scores together and divide by two.

Middle Mile Cost Method.

- If an OC-3 to a major ISP backbone location is available for under $2,000 per month, award five points.
- If a DS-3 for to a major ISP backbone location is available for under $2,000 per month, award four points.
- If a DS-3 to a major ISP backbone location is available for under $5,000 per month, award three points.
- If a DS-3 for under $10,000 per month, award two points.
- If a DS-3 to a major ISP backbone location for is available under $20,000 per month, award one point.
- If a DS-3 to a major ISP backbone location costs $20,000 per month or more, award zero points.

Comparison Pricing Method. Urban pricing should be derived from pricing in one of the five largest metropolitan areas in the United States—New York, Los Angeles, Chicago, Dallas and Philadelphia—for equivalent service levels of broadband (768 Kb/s in at least one direction). Be sure to include any service level caps (usually noted in gigabytes per month downloaded) in your calculations of price comparisons. Average downloads per month vary widely, but 10 gigabytes per month would be an adequate estimate for a broadband user with light video downloading. *[Note that FirstMile.US believes that tiered, bandwidth limited access should be available but believes that gigabyte caps themselves are not well understood by users and can be innovation inhibitors[3].]*

- If the price in your measured area equals or is less than comparable pricing in large urban areas, award five points.
- If the price in your measured area is more than 1.25 times but less than 1.5 times comparable pricing in large urban areas, award three points.
- If the price in your measured area is more than 1.5 times comparable pricing in large urban areas, award one point.
- If you have no broadband service, award zero points.

[3] Users should be able to purchased tiered, bandwidth limited access. If one buys 2 Mb/s service, they should be able to get a minimum of 2 Mb/s. If the network is congested, they should be able to get their minimum or at least their fair share of capacity based on the tier purchased. If 50 homes share access to a 100 Mb/s access, and if a user pays for 4 Mb/s service, and if the access line is congested (at >90 percent utilization?) the user should get twice as much capacity as the party who is paying for 2 Mb/s service.

Criterion 3: Coverage

In many cases in current broadband service provisioning, arbitrary or technology limitations are imposed, limiting service to a specific geographical area instead of an entire town/census block/zip code. As such, it is important to determine the available service penetration based on the number of households and businesses in the measured territory. Without an adequate accounting of coverage per household/business, many of the broadband supply measurements are misleading and create pockets of unserved communities. As has been noted by the GAO, the current FCC structure is flawed in that if one house is served in a zip code, the entire zip code is counted as having broadband.

How to Measure

The best way to measure this is to map both residences and businesses and overlay the map with service provider coverage. In urban areas, there may be city or county Geographic Information Systems (GIS) that already have maps. In some cases, cable franchise agreements can provide exact cable coverage footprint. For telephone companies, you can work with local staff to understand the footprint, although in areas with cable coverage, it is normally less that the cable footprint. Since many providers view their coverage map as strategic information, it may be necessary to estimate coverage thorough a survey of residents and businesses. Most mobile wireless carriers have excellent broadband coverage maps on their web sites, which can be transposed on your local map.

Ranking

- If you have at least one provider that provides broadband service at speeds faster than 768 Kb/s in either direction and the area being measured is 85 percent or more covered, award five points.
- If you have at least one provider that provides broadband service at speeds faster than 768 Kb/s in either direction and the area being measured is 50 percent or more covered, award three points.
- If you have at least one provider that provides broadband service at speeds faster than 768 Kb/s in either direction and the area being measured is 30 percent or more covered, award one point.
- If you have no provider that provides broadband service at speeds faster than 768 Kb/s in either direction and the area being measure is less than 30 percent covered, award zero points.

Criterion 4: Highest Upload and Download Speeds

Much of today's broadband infrastructure was built to support consumption, not production of broadband content. But, today's Internet uses and tomorrow's uses are becoming more and more symmetric—where users produce and consume content. As such, it is important to know evaluate both upload and download speeds individually when assessing broadband supply. While we don't include a specific measurement for

symmetric service in the Criterion below, you may wish to provide an extra point for providers who provide symmetric service.

Both federal and state entities are recommending a minimum level of upload and download speeds. The California Advanced Services Fund recommends minimum acceptable broadband speeds as 1 megabit per second for upload and 3 megabits per second for download. The federal suggestion for current generation broadband is 1 megabit per second for upload and 5 megabits per second for download. If an area is served by "radio", the speeds are lowered to 786 kilobits per second upload and 3 megabits per second download. The federal suggestion for next generation broadband is 20 megabits per second for upload and 100 megabits per second for download. Services that do not meet these standards should be ranked less desirable. Services that don't meet the current FCC definition for basic broadband of 768 kilobits per second (at least one direction) should not be considered as current deployed services.

How to Measure

Choose the provider that meets the highest speeds in your area. If they don't cover at least 50 percent of the area you are measuring, pick the provider who does. If none cover at least 50 percent of the territory, use the highest one, but make a note in your results. From their literature, website, or phone support, find out what the highest speeds for both upload and download. Note that in many cases, providers are not enthusiastic about disclosing upload speeds and neglect to include them. If you call, you will find that the customer support staff may not know either. You might want to have a number of people call to verify the upload speeds. Be sure to ask if that is the upload speed for your area. In some cases, the service representative will quote the highest speed the company provides, even if it is not available in your area.

Ranking

It's best to split this ranking into two equations: one score for upload speed and another score for download speed. After ranking, add them together for a total combined score.

- For upload speeds above 2 megabits per second, award five points.
- For upload speeds above 1 megabit per second, award three points.
- For upload speeds above 768 kilobits per second, award one point.
- For upload speeds below 512 kilobits per second, award zero points.
- For download speeds above 5 megabits per second, award five points.
- For upload speeds equal to or above 1.5 megabits per second but less than 5 megabits per second, award three points.
- For upload speeds equal to or above 768 kilobits per second but less than 1.5 megabits per second, award one point.
- For upload speeds below 768 kilobits per second, award zero points.

Criterion 5: Backhaul/Middle Mile Availability

A recent report from the New America Foundation states, "another key obstacle to universal high-speed broadband access is the connection of those last-mile networks to the Internet backbone. No community or network is an island. Increasingly access to the high-speed middle-mile links that carry Internet traffic to the backbone, and the escalating costs associated with transporting traffic among networks, have become fundamental barriers to spreading connectivity, promoting broadband competition, improving speeds and lowering prices." Backhaul or middle-mile availability estimates need to be gathered for the community being measured. You need to count the number of providers offering backhaul/middle mile services as well as their ability to add additional backhaul circuits. You might find that while the existing connectivity is adequate, there are no additional growth capacity is available to allow interconnection to a logical Internet peering point.

How to Measure

Much of this information is only going to be available from local experts who buy and/or sell communications services. It is best to find at least three experts and have them rank both the number of backhaul providers and the growth capacity available. Using a tool like Survey Monkey allows local experts to provide their input and add the combined values for easier scoring.

Ranking

- If there is more than one backhaul/middle mile provider with growth capacity, award five points.
- If there is only one backhaul/middle mile provider with growth capacity, award three points.
- If one or multiple providers have extremely limited backhaul/middle mile capacity, award one point.
- If there is no provider or no growth capacity from current provider, award zero points.

Summing Up Broadband Supply

Utilizing the scoring system described above provides a possible 25 points. Pairing the numerical score with a supply ranking as suggested below, provides a comprehensive view of your area and a way to prioritize communities most in need of attention.

- If the total sum of all five criteria is below 10 points, the area should receive a "none/underserved broadband area" designation.
- If the total sum of all five criteria is 10–14 points, the area should receive a "low served broadband area" designation.
- If the total sum of all five criteria is 15–19 points, the area should receive a "medium served broadband area" designation.

- If the total sum is 20 points or greater, the area should receive a "highly served broadband area" designation.

3. A Definition for Unserved and Underserved Definition for High-Population Urban Communities with Low Adoption of Broadband Is Needed.

Population density is not necessarily correlated with the rate at which broadband technologies are adopted. Moreover, theoretical broadband access does not necessarily lead to widespread adoption. These facts quickly become apparent when one visits certain neighborhoods of any of this country's major cities. In what we believe to be a hasty rush to judgment, too many have concluded that the words "unserved" and/or "underserved" refer primarily to rural areas of the country. We do not concur.

In urban communities, two neighborhoods may be merely blocks away from one another, but may be as different as are two entire states in a less populated area. For example, as of the end of 2008, San Diego County, where Carlsbad is located, had a population greater than that of Alaska, North Dakota, Vermont, the District of Columbia, and Wyoming combined.

In short, we believe that densely populated areas require different operating definitions for "unserved" and "underserved" than do rural areas. The reasons why households and businesses are not adopting broadband, particularly when there is ready access to services, may be different from the than the lack of access to service found in rural areas, but they are just as powerful. Because of this, it is imperative that a different definition be used for underserved urban communities that are not adopting broadband. We suggest that the definition for underserved be tied to measurable, empirically verifiable criteria that are known predictors of low broadband adoption. These include but are not limited to:

- Median income
- Head of household education level
- Whether English is second language
- Concrete measures of the level of ICT literacy (homes with low adoption of technology)
- Median age of residents
- Mean, median, and modal education level within the household

These should be tabulated at the smallest unit of geography feasible within the U.S. Census system: the block group. The simple reason for this is that more people are likely to live in some San Diego County zip codes than live in entire counties in more sparsely populated states.

Items that should be included in any assessment of "level of service" include:

- Whether the service was accessible—physically and financially—to the entire population or just a subset,

- Whether people had the equipment they needed to use it, and
- A very precise, granular and behavioral series of measures of adoption.

We also believe that the Department of Commerce has a rare opportunity to undertake ~~a~~ nationwide measurement of these criteria during the upcoming 2010 Census. The Census Bureau is unique in having both competence in and experience at designing and implementing research on such a massive scale, as well in the vital, technically demanding arena of data analysis.

The American Community Survey (ACS) adheres to the highest professional standards in sample selection (e.g., random selection within each subgroup to be measured and ensuring adequate numbers of responses in each "cell"[4] sufficient to produce measurable, statistically significant[5] differences, controlling for Type I and Type II errors[6]).

The "short" form of the Census is an effort to count literally every man, woman, and child living in the United States, along a number of key criteria such as age, gender, and race or ethnic background. The American Community Survey (ACS, formerly known as the "long form" of the Census, gathers more detailed information about a sample of US residents and rests on the same 'common denominator,' in terms of categories, definitions of terms, etc. and does the Decennial census, data from the Bureau of Labor Statistics, NAICS, and other critically important datasets produced by the Federal Government. The sample is quite large (between 1,437,969 and 2,142,964 at last count) and is designed to be generalizeable to the population as a whole.[7] Because Census data can be analyzed along with these other datasets without losing accuracy, as would occur if all each dataset different measurement schemes, the value of a rigorous, thorough, high-quality U.S. Census can be multiplied many times over, as innovators devise new ways of finding patterns in the numbers.

Thus, when it comes time to generalize from the sample to the population as a whole, we will have solid numbers, which will be accurate within a known band of random error. Among other things, each and every question (e.g., access to broadband) should be both valid (measures what it intends to measure) and reliable (measures it consistently and

[4] A "cell" represents a population subgroup, such as white men over 50 living in rural settings, or Americans of Puerto Rican descent living in the suburbs of Seattle.

[5] "Statistically significant" refers to the case where the result of a particular analysis of a data set is unlikely to be an artifact of random chance. The standard for an acceptable level of statistical significance is 95%, expressed as $p<.05$ (in other words, the likelihood of the result being a fluke is less than 5 percent.

[6] Type I and type II errors are measures of precision. Type I error describes the case where there is a high likelihood of finding no statistically significant difference when such differences actually exist (a.k.a. a false negative). Type II error describes the case where there is excessive likelihood that statistically significant differences will be found when they do not exist (a.k.a. a false negative).

[7] This is true with one caveat: the ACS only measures populations larger than 65,000. However, the geographic scope of the measurement is flexible, so that in the case of a sparsely populated location, unit of (geographic) measurement would simply be expanded to the point where it reaches the threshold of 65,000 residents.

accurately across time, place, and population group). Any results that are reported must meet all the standards described above.

Adherence to the clearly established, carefully codified and thoroughly tested standards for sampling methodology, appropriateness of the questions posed, and adequate levels of validity and reliability are the bedrock quality measures that must be achieved to render results generalizeable from a smaller group to a larger one. These measures are quantitative, rigorous, and have been tested for effectiveness for more than fifty years.

We now have the opportunity to build a national broadband network on the basis of empirical reality, measured with accuracy and fairness. If we seize this opportunity, all will surely benefit. To bypass it, by contrast, would fly in the face of the very notion of an information economy, and of everything this initiative strives to achieve.

4. Definition and Characterization of Public-Good "Grand Challenge" Applications Are Required.

FirstMile.US believes that the NTIA and RUS should define public-good "grand challenge" applications and the minimum network characteristics (speeds, latency, symmetry) that are required to serve them. We believe this is an essential component in evaluating the minimum acceptable level of broadband services.

We believe that Congress and the White House have been very clear with the American public about where the country's 'grand challenges' lie: healthcare, public safety, education, civic participation, energy independence/efficiency, and economic growth. The ARRA bill itself specifically mentions most of these.

As such, applicants should be encouraged to address more than one purpose. Applicants must be tasked with stating a complete holistic view of the region or geography that they are serving. They need to describe not only their own goals but the strategic vision that the nation must consider in order to meet the needs of the grand challenge applications and services. Applicants should be favorably evaluated if they demonstrate that they are looking at various grand challenge segments that need broadband services, and are looking for ways to create both a new supply system for broadband and one that enables interactions between underserved communities and public-good services.

The NTIA and RUS should set a minimum level of service characteristics including speed, use of dedicated and shared links, latency, and other technical criteria. The minimum level of service should include characteristics commonly used by the grand challenge applications. These characteristics should be considered for what will be practical, useful, and reasonable for technologies deployed in 2012. No awards should be made for technologies which do not allow users to access grand challenge applications. We believe that some of the federal discussion that lead up to the ARRA legislation espoused 'good-enough' rough criteria for speeds: current generation broadband is 1 megabit per second for upload and 5 megabits per second for download; "radio," the

speeds are lowered to 786 kilobits per second upload and 3 megabits per second download; and next generation broadband is 20 megabits per second for upload and 100 megabits per second for download.

However, other network performance criteria must be considered as well, since some technologies or management techniques may negatively impact the user's ability to utilize specific services. For example, latency is a known issue with some broadband technologies and management techniques.

In order to create a comprehensive strategy, we recommend that the NTIA and RUS immediately convene a workshop of technical experts to create a specific set of network criteria that adequately defines the minimum service levels needed to meet the grand challenge applications.

5. Strong Interagency Coordination to Support the Nation's Grand Challenges Is Required.

FirstMile.US believes that interagency coordination on grand challenges is imperative. We especially believe that the following agencies need to find coordination mechanisms among themselves, in order to accelerate the innovation potential of the ARRA spending and to leverage grants to deliver the best results. Agencies include:

- Department of Agriculture
- Department of Commerce
- Department of Energy
- Department of Health and Human Services
    - National Institutes of Health
    - Office of the National Coordinator for Health Information Technology
- Department of Homeland Security
- Department of Transportation
- FCC's Rural Health Care Pilot Program
- National Science Foundation

The National Coordinating Office (NCO), which coordinates Federal Networking and IT research, is a good example of interagency coordination that works. We suggest that NTIA and RUS investigate the model at the NCO as a possible option to replicate for purposes of this project—giving agencies a structured opportunity to work together to ensure that the American public gets more out of this funding than the initial targeted focused investments.

Through this interagency coordination, we recommend that the NTIA and RUS drive a national set of practices that enable shovel-ready policies, thereby lowering the federal permitting time from years to weeks for broadband installations. We also encourage NTIA and RUS to work with the appropriate governmental institution to create a set of

federal policies that provide the umbrella for successful broadband builds—policies that can be replicated at state and local levels.

6. NTIA and RUS Should Maximize the Opportunity to Create New Broadband Access

FirstMile.US believes that maximizing the opportunities for buildout (access) to those areas with no broadband service today is most essential task for the NTIA and RUS ARRA funding. Buildout in unserved areas is going to be expensive and should not be based on any type of traditional return on investment (ROI) criteria. The areas with no access are unserved because the ROI stinks.

Middle Mile and Community Connection Points

We believe that through strategic grant/loan investments both the NTIA and RUS can create the interconnection points needed to create a positive ROI for many areas with no access. Through funding of strategically located "open" middle mile infrastructure(s) paired with low-cost, regional "community connection points" (also known as exchange/peering/transit points), the NTIA and RUS can effectively ameliorate the enormous costs that have prevented many local broadband buildouts.

Funded middle mile infrastructure should:

- Be open and offer a pure transmission service with no discrimination among users or among the services, information, and applications users want to provide to each other.
- Be regional and serve multiple unserved and underserved communities along its path.
- Provide interconnection points at reasonable intervals as needed by local service providers.
- Create an ownership structure that provides a long-term pricing advantage to the region served. Novel concepts should be encouraged such as fiber condominiums, public joint powers ownership, and cooperatives.
- Include 'huts' for community connection points and agreements among service providers on how to best interconnect the region.

Community connection points (CCP) are the building blocks of new networks. They create community connectivity, essentially catalyzing companies to provide good first mile broadband solutions.

One can think of the community connection point as a very small, very cheap central office for broadband—in essence, a broadband commons. Peering among local networks, which allows providers to send and receive traffic from each other, occurs within the connection point. The local community networks peer with each other at the CCP, exchanging traffic without leaving the area (see Figure 3). CCPs act as regional hubs that:

- Keep local traffic as regional as possible.

- Allow remote community ISPs (and maybe end users) to choose providers at CCP, rather than having to use only the ones who can get to the community.
- Enables municipalities to provide a cost-effective interconnect method while staying out of the competitive service business.

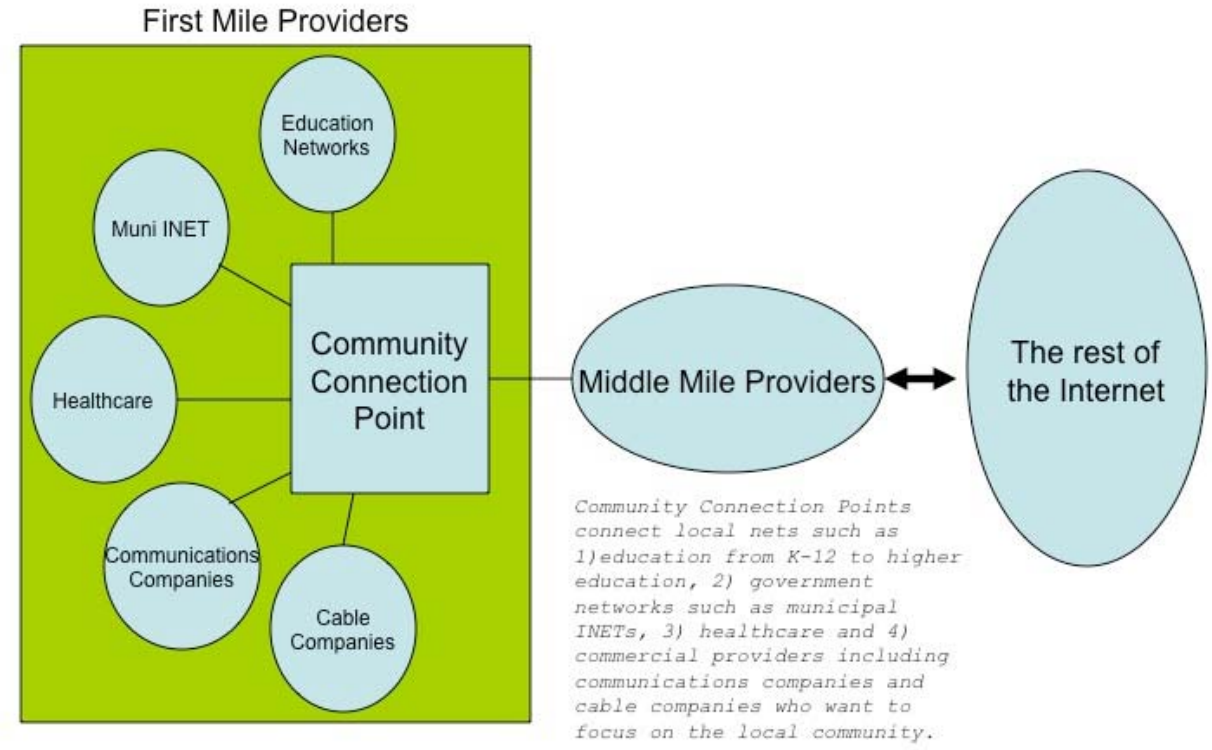

Figure 3. The Community Connection Point is a natural conduit for open infrastructure – allowing interconnection amongst providers and integration of 'grand challenge' institutional networks.

CCPs allow communities to provide facilities without providing services by connecting community networks to each other and can be an essential component of an effective open infrastructure. Middle mile infrastructure connects this community facility network to the outside world. A CCP allows any local community to easily and economically support more than one applications provider.

CCPs give communities what they need for scalable networks—building local interconnections to what people want: education, healthcare, and entertainment as well as

for communicating with colleagues, friends, and family. They offer a multitude of features, such as:

- Solid off-the-shelf technology
- Innovative connections at layer 1, 2 or 3
- Scope and choice for consumers
- Simple, fast and cheap to build and maintain

Moreover, community CCPs can:

- Encourage competition, driving down prices
- Provide communities with a technology center and leveraging technology staffing
- Serve as a hub to attract technology-oriented business
- Drive down middle mile costs
    - Middle mile costs in Canada decreased by 30 percent, while capacity quadrupled
- Allow a connectivity platform for application services
    - Voice, e.g., telephone calls
    - TV and other video
    - Healthcare: diagnosis and monitoring
    - Situational Awareness: public health, environment, weather
    - New ways of communication with friends and family

Community connection points are a novel and innovative solution for enabling the broadband first mile. They may be just the strategy that will enable smaller communities in the United States to move forward sensibly with fiber and wireless, thereby building new markets.

Other Infrastructure Criteria

At a minimum, FirstMile.US believes infrastructure proposals need to address: training, accessibility, affordability, and applications, as well as the number of grand challenge applications served, engagement of community to create an acceptable take-rate, a realistic management plan, long-term funding discussion focusing on sustainability, retail prices, and geographic coverage. In addition to the monthly recurring costs, retail price should be analyzed for usage caps, installation costs, and other one-time costs, as well as specialized user equipment that is a prerequisite for service. Usage caps, in particular, can be very detrimental to innovation and use of the net. Generally, applicants should be expected to demonstrate in their proposal:

- Understanding on how to drive broadband adoption
- Creation of new broadband business models, particularly those that are applicable to smaller populations with no or only monopoly coverage
- Crafting the formula for local communities so they can be in command of their communications future

7. Replicable Programs that Create New Adoption, Workforce Development, and New Applications Are Necessary.

FirstMile.US believes that the key goal of this funding is to create wider broadband adoption throughout the country and the subsequent job creation and economic development. Statistics show that vast majority of people who do not have broadband in the home or workplace are in areas where there is access to broadband, but for some reason have not purchased service. We believe it is important to leverage the ARRA funds to specifically target nonadopters and recommend that the NTIA and RUS consider allotting more funds than the Congressional minimums.

FirstMile.US recommends that the NTIA and RUS allot funds specifically for the development of replicable programs that target nonadopters. The programs should address applications, training or public awareness initiatives and define how they will increase adoption rates. Part of the applicant's program plan should be the delivery of a set of guidelines/best practices that can be utilized by other communities. In some cases, the funding will not deliver the promised adoptions, but FirstMile.US believes that it is equally as important to learn what doesn't work. As such, we recommend that the NTIA and RUS carefully consider projects that might be perceived as "risky" and adopt DARPA's "high risk, high reward" method of evaluation for a percentage of awards—an extremely high reward/payoff (e.g., 10 percent adoption increase over a wide area) may be worth the risk of funding the project.

FirstMile.US also believes that workforce development projects that train individuals and businesses to utilize broadband connectivity should be favorably considered along with traditional library, community college and ICT literacy programs. Many community-based organizations are doing remarkable work in this area, particularly with youth, and could extend their reach to additional individuals and businesses with ARRA funds. In addition, FirstMile.US believes that tailored workforce development programs with a focus on small business usage of broadband or services that support small businesses will have a significant impact on broadband adoption.

Development of software applications that are targeted specifically to nonadopters should be considered for funding especially in areas where socioeconomic equity needs to be achieved. Specifically targeted applications can be the tipping point and create the need for residential and business use of broadband.

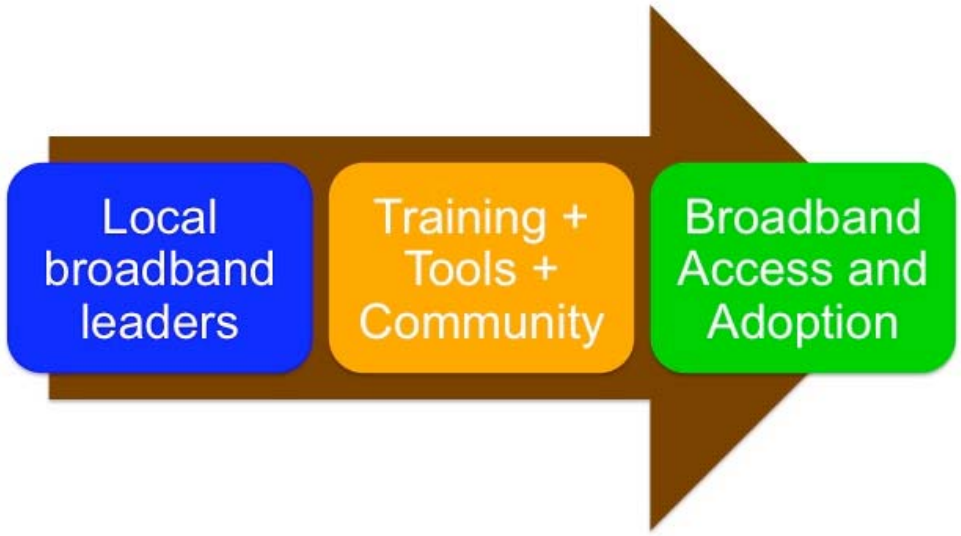

Figure 4. FirstMile.US believes that local broadband leadership is an essential component in sustainable, thriving broadband implementations.

Local leadership has the biggest and most dramatic effect on driving broadband demand, creating a community broadband spirit and attracting the attention of communications providers. The adage, "All politics is local" [8] holds true for creating broadband demand. In essence, "politics always was about values combined with instincts" and communities must take their local core values and marry them with the "broadband instinct." We believe that this is a key to catalyzing broadband demand and building sustainable self-sufficient broadband-enabled communities. As part of the mapping funds, pursuant to Public Law 110-385, the NTIA should encourage applicants who can develop and provide training, programs, and forums to assist in developing local broadband leadership.

8. Mapping

The NTIA is obligated to provide a broadband map. FirstMile.US believes that a national map is a smart strategy in order to help understand the magnitude of the broadband problem this nation is facing. We believe any national mapping effort needs to focused on the ultimate mapping goal: *figuring out where the underserved are* and providing enough visual information that leads to logical deductions on how increase broadband services. After all, a map is simply a visual representation of "other" data, but a visualization that is valuable to many.

In some respects, the mapping process itself – the journey—may be more important than the final map—the destination. We urge that the mapping be accomplished as locally as practical. Six California rural projects have demonstrated the usefulness of local mapping by utilizing the mapping process to cement strong relationships with local providers and

[8] Tip O'Neill

bringing the best broadband service to their rural areas. The previous statewide mapping effort left out all wireless ISPs and many other cable and telephone company infrastructure in these areas. One of the rural groups has identified well over 100 providers serving their area. Many of these providers will have no interest in a centralized mapping process, but would have interest if it increased their local presence and netted new local business.

Verifiable, Reliable Data Sources Must Be Utilized

Mapping—a handy tool if you know what to map and you have verifiable, reliable data sources—is like any other database: garbage in leads to garbage out. Or, in the alternate view, one can make a map say anything they want. The veracity of a national mapping effort boils down to where the data is created—publicly accessible, verifiable data is the most reliable way to build the maps and the only way the government should spend our tax dollars. Our earlier discussion of utilizing the Census process and its resultant data is exactly the type of data that should be utilized to map nonadopters and low adoption regions and could be used to map underserved rural or expensive-to-serve urban regions.

One of the major problems with any mapping is the treatment of the raw data. In the some existing broadband maps, the providers' required that the data be smoothed to blur any network "edges." The resulting map creates the impression that many unserved areas are served. This problem was visible in both rural areas and expensive-to-serve urban areas.

We recommend that the NTIA ensure that all data sources are scientifically valid and are not distorted when transferred to a map.

Grand Challenge Institutions Should Be Mapped.

The federal map should include the institutions that serve country's grand challenges and indicate which are underserved or unserved. One key focus of the ARRA funds is enabling the current grand challenge applications, especially in areas that lack access to the "brick and mortar" locations.

Standardized GIS Schema Must Be Created at a National Level.

Creation of a standardized GIS mapping schema is essential. We believe that it is necessary to provide a "roll-up" methodology utilizing GIS that can be locally customized by communities and providers. Our experiences with mapping lead us to believe that the journey is as important as the destination. One incredibly positive outcome of a mapping exercise is the development and sustainment of local partnerships/understandings that lead toward big broadband deployment and adoption. NTIA should require that any funds for mapping show how the process of mapping is leveraged into a much greater community and economic development activity.

Mapping Must Include More Data than the Combined Upload/Download Speeds.

When doing rigorous analysis of broadband for a region, it is imperative to understand the upload and download speeds in relation to the "grand challenge" applications that are essential to both the state and the federal government. These speeds are ever changing and will require a detailed knowledge of upload and download speeds per grand challenge application.

Broadband Services Should Be Mapped.

Broadband services can be delivered over wireline, fixed wireless, mobile wireless and other heterogeneous combinations of the above should be mapped. Instances of open infrastructure should be given special note on the map. Obtaining this data can be controversial and difficult. We recommend that publicly available data be utilized as much as possible, including Census data if appropriate questions can be included. We also believe that the NTIA should fund experimental scientific, software-based, passive data collection mechanisms wherein speed, latency, and GPS location data can be collected from users' computers directly. This would have two-fold outcome: 1) automatically collected data that can be parsed monthly and 2) a major dataset that will allow network scientists to better understand how networks work and what areas need significant research.

We do not believe that the federal government should obtain data directly from the broadband providers, as that will have a detrimental effect on local discovery and implementations. However, it may be prudent to require FCC-obligated broadband providers to cooperate with local initiatives that need data.

Map the Factors that Affect Adoption.

It is important to look at the factors that affect adoption and map these outcomes using scientifically valid assumptions. Examples include:

- Whether the service was accessible—physically and financially, to the entire population or just a subset,
- Whether people had the equipment they needed to use it, and
- A very precise, granular series of measures of adoption.

One specific example is expensive-to-serve areas where the cost of the local connection is reflective of the cost of the backhaul/middle mile to get to the nearest ISP aggregation point. In unserved or very underserved areas, this cost is so prohibitive that no provider has seen a reasonable return on investment. In other areas, the providers have instituted usage caps to cover this extraordinary cost.

The Federal Government, Tribal Governments, State Institutions, and Local Leaders Should Work Together to Determine the Variety of Geographical Areas Needed to Understand the True Nature of Broadband Deployment.

While the federal map will most likely rely on federally designated zones such as census-blocks, the tribal, state and local entities may find that other, more locally-oriented determinations should be utilized for mapping. Any database or GIS mapping schema should be flexible enough to allow groupings for multiple purposes.

All Federally-Owned, State-Owned and Native American-Owned Lands and Buildings Should Be Mapped.

This mapping will help drive a better understanding of and the actions required to provide an accelerated permitting process and government-owned facilities that could be leveraged in a national broadband strategy.