

**Before the
Federal Communications Commission
Washington, D.C. 20554**

In the Matter of)	
)	
Inquiry Concerning the Deployment of)	GN Docket Nos. 09-47 and 09-137
Advanced Telecommunications Capability)	
to all Americans in a Reasonable and)	
Timely Fashion, and Possible Steps to)	
Accelerate Such Deployment Pursuant to)	
Section 706 of the Telecommunications Act)	
of 1996, as amended by the Broadband Data)	
Improvement Act)	
)	
A National Broadband Plan for Our Future)	GN Docket No. 09-51

To: The Commission

**COMMENTS – NBP Public Notice #11
THE WIRELESS INTERNET SERVICE PROVIDERS ASSOCIATION**

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Table of Contents

Summary of Comments – NBP #11.....	i
Background.....	2
<i>About WISPA</i>	2
<i>WISPA’s Survey of the “Middle Mile” and “Second Mile” Problems</i>	3
<i>Recommendations</i>	5
Discussion.....	6
1. Network Components of Broadband Connectivity	6
<i>Middle Mile</i>	6
<i>Second Mile</i>	7
<i>Technology Options – Middle Mile</i>	8
<i>Technology Options – Second Mile</i>	11
2. Availability and Pricing of Middle and Second Mile Connectivity	14
<i>Middle Mile</i>	14
<i>Second Mile</i>	16
<i>Circuit-Mode Services</i>	16
<i>Proportionate Costs of Middle Mile and Second Mile Transport</i>	17
3. Pricing and Availability of Internet Connectivity	18
<i>Pricing</i>	18
<i>Proportionate Costs of Internet Connectivity</i>	21
4. Economics of Deployment	21
<i>Monopoly</i>	21
<i>Self-Provisioning</i>	22
<i>Government Action</i>	25
5. Nature of Competition and Availability of Alternatives	25
Conclusion.....	29

Summary of Comments – NBP Public Notice #11

The Wireless Internet Service Providers Association (“WISPA”) responds to the questions in the Commission’s Public Notice NBP #11 with recommendations on how the National Broadband Plan can address market conditions that prevent wireless Internet service providers (“WISPs”) from obtaining “adequate, reasonably priced, and efficiently provided access to both middle mile and second mile connectivity.”

WISPA’s recommendations stem from a recent survey of its membership, which shed much-needed light on the availability, accessibility and affordability of transport facilities. The survey results demonstrate that the following problems exist:

- For every link in the broadband delivery chain – middle mile transport, second mile transport and Internet connectivity – costs are higher where competition and access to Tier 1 carriers does not exist. In many cases, the costs are significantly higher and prohibit deployment.
- No single technology – copper, fiber or microwave – satisfies the needs of WISPs and consumers in rural, unserved and underserved areas because each is fraught with unique deficiencies.
- Rural WISPs, as well as those operating in urban and suburban areas, lack the scale and volume needed to attract discounted pricing.
- Affordable access to transport and connectivity facilities will become an increasingly critical problem as WISPs expand and consumer bandwidth needs increase.

Based on the survey results, which are discussed in detail in the Comments, WISPA offers the following recommendations for the National Broadband Plan:

Tariff Structure

The Commission should re-examine the tariff structure for middle mile and second mile transport with a goal of making rates in non-competitive markets subject to the rate structure that applies in competitive markets. Evidence shows that rates for middle mile and second mile transport are higher in areas where the ILEC is the sole provider of transport. WISPs should be able to obtain competitive rates from ILECs even in areas where no competition exists.

Assistance to Small Broadband Providers

In addition to changing the tariff structure, the Commission should foster programs designed to directly assist small broadband providers in achieving competitive rates for middle mile and second mile transport facilities.

Open Access

The Commission also should adopt regulations specifying the location and conditions by which a fiber provider must provide non-discriminatory access to its new and existing fiber at competitive rates. Together with the first two recommendations, this will help ensure that WISPs can obtain affordable access to transport facilities.

Additional Spectrum

The Commission should provide additional spectrum in the 3-10 GHz range for point-to-point middle mile and second mile transport. WISPs experience congestion in the licensed microwave bands, and allocating more spectrum will help alleviate this problem. In addition, the Commission should conduct a spectrum audit to determine whether microwave licensees are actually using spectrum and, if appropriate, consider rule changes to stimulate more timely use.

Additional Federal Funding

The Commission should advocate for additional federal funding, beyond the initial \$7.2 billion designated in the Recovery Act, to allow State and regional consortia to build and share fiber facilities, and provide government funding and tax credits to facilitate construction of more middle mile “on-ramps.”

ILECs

The Commission should remove the regulatory requirement that ILECs be involved in the local loop.

Access to Towers and Poles

The Commission should streamline access to government-owned towers and make utility pole attachments available at the same non-discriminatory rates that are available to cable television systems and providers of telecommunications services, as WISPA previously urged.

By incorporating these recommendations into the National Broadband Plan, WISPs will be able to develop an economic model that supports affordable fixed wireless broadband deployment to rural, unserved and underserved areas.

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**COMMENTS – NBP Public Notice #11
THE WIRELESS INTERNET SERVICE PROVIDERS ASSOCIATION**

The Wireless Internet Service Providers Association (“WISPA”) provides these Comments in response to NBP Public Notice #11 to assist the Commission’s analysis of the important “middle mile” and “second mile” aspects of the National Broadband Plan that the Commission is developing.¹

To respond to the Commission’s questions, WISPA conducted a survey of its membership and gained valuable insight into the middle mile and second mile markets. The survey results confirmed that wireless Internet service providers (“WISPs”) face severe challenges in gaining affordable access to adequate middle mile and second mile transport facilities. Due to a lack of competitive options and other factors, WISPs often are unable to extend last mile coverage to unserved and underserved rural areas of the

¹ See Public Notice, “*Comment Sought on Impact of Middle and Second Mile Access on Broadband Availability and Deployment*,” DA 09-2186, GN Docket Nos. 09-47, 09-51 and 09-137 (rel. Oct. 8, 2009) (“*Public Notice*”). WISPA will refer to the terms “middle mile” and “second mile” in the same manner as the Commission does in the *Public Notice*.

country where, in many cases, fixed wireless may be the only means by which consumers can have broadband access to the Internet. In urban and suburban areas, WISPs may lack the scale to purchase affordable bandwidth, and there is evidence of a lack of competition in those areas as well. Resolving the middle mile and second mile problems is of paramount concern to WISPs, the communities they serve and the unserved communities they desire to serve.

Background

About WISPA

Founded in 2004, WISPA represents the interests of more than 300 WISPs, vendors, system integrators and others interested in promoting the growth and delivery of fixed wireless broadband services to Americans. WISPA estimates that more than 2,000 WISPs operate in the United States today. WISPA's ongoing research reveals that WISPs cover more than 2,000,000 square miles in all 50 states. Using primarily license-free frequencies authorized under Part 15 of the Commission's Rules, WISPs provide fixed wireless broadband services to more than 2,000,000 people in residences, businesses, hospitals, public safety locations and educational facilities.

As the WISP industry has grown and challenges have become more difficult, WISPA has recognized the need to be a more active participant in the regulatory process. For example, WISPA filed extensive comments² and *ex parte* presentations³ promoting

² See WISPA Comments filed Feb. 20, 2007 in *Unlicensed Operation in the TV Broadcast Bands; Additional Spectrum for Unlicensed Devices Below 900 MHz and in the 3 GHz Band*, First Report and Order and Further Notice of Proposed Rulemaking, ET Docket Nos. 04-186, 02-380, 21 FCC Rcd 12266 (rel. Oct. 18, 2006).

³ See, e.g., Notices of Ex Parte Presentations from Stephen E. Coran, Counsel to WISPA, to Marlene H. Dortch, FCC Secretary, ET Docket Nos. 04-186 and 02-380, dated Aug. 1, 2008; Letter from Jack Unger, WISPA Secretary and FCC Committee Chair, to Marlene H. Dortch, FCC Secretary, ET Docket Nos. 04-186 and 02-380, dated Oct. 22, 2008; Notices of Ex Parte Presentations and Letters from Stephen E. Coran,

interference-free use of the television white spaces and has sought reconsideration of the TV white spaces rules seeking to eliminate costly and burdensome spectrum sensing rules and to amend other rules to make WISP deployment more flexible, cost-effective and attractive to investment.⁴ WISPA representatives have contributed to proceedings at NTIA, RUS and the FCC concerning the broadband stimulus provisions of the American Recovery and Reinvestment Act of 2009 (“Recovery Act”), seeking grant eligibility and selection criteria to best promote broadband service delivery to rural and/or unserved Americans.⁵ WISPA has participated in many aspects of the National Broadband Plan proceeding, advocating changes to policies and spectrum allocation rules,⁶ and appreciates the Commission’s special interest in seeking detailed information about the state of the Internet transport market.

WISPA’s Survey of the “Middle Mile” and “Second Mile” Problems

Notwithstanding their success in serving areas that other technologies cannot reach or other providers elect not to serve, WISPs face significant barriers to extending service to unserved and underserved areas where DSL and high-speed cable are not available. The Commission correctly observes that broadband providers require “adequate, reasonably priced, and efficiently provided access to both middle mile and second mile connectivity.”⁷ But in many areas of the country, be it Washington state or

Counsel to WISPA, to Marlene H. Dortch, FCC Secretary, ET Docket Nos. 04-186 and 02-380, dated Oct. 28, 2008.

⁴ See Petition for Reconsideration of WISPA in ET Docket Nos. 04-186, 02-380 filed March 16, 2009.

⁵ See generally Comments of WISPA in *A National Broadband Plan for Our Future*, GN Docket No. 09-51, filed June 8, 2009 (“WISPA NOI Comments”).

⁶ Comments of WISPA filed Oct. 23 in response to Public Notice, “*Comment Sought on Spectrum for Broadband*,” DA 09-2100, GN Docket Nos. 09-47, 09-51 and 09-137 (rel. Sept. 23, 2009) (“WISPA Spectrum Comments”); Comments of WISPA filed Sept. 30, 2009 in Notice of Inquiry, *Fostering Innovation and Investment in the Wireless Communications Market; A National Broadband Plan for Our Future*, GN Docket Nos. 09-157 and 09-51 (rel. Aug. 27, 2009)..

⁷ *Public Notice* at 2.

Washington, D.C., affordable connectivity options that deliver middle mile and second mile bandwidth often do not exist. As WISPA stated in previous Comments in this proceeding:

WISPs often lack affordable and competitive “second mile” and “middle mile” connectivity. Sparsely populated remote areas are more expensive to serve with any terrestrial technology, but in many cases fixed wireless offers the only sustainable business model. Yet, even with fixed wireless, lack of connectivity to the Internet backbone is a critical problem that must be addressed if broadband availability and adoption are to increase.⁸

In recent weeks, WISPA surveyed its members to shed additional light on these problems and to obtain “real-world” answers to the questions posed in the *Public Notice*. The survey essentially restated the questions in the *Public Notice* to gain the quantitative and qualitative information desired by the Commission, and elicited narrative responses that illustrated middle mile and second mile market conditions, especially in rural, underserved and unserved areas. The responses lead to several general conclusions:

- For every link in the broadband delivery chain – middle mile transport, second mile transport and Internet connectivity – costs are higher where competition and access to Tier 1 carriers does not exist. In many cases, the costs are significantly higher and prohibit deployment.
- No single technology – copper, fiber or microwave – satisfies the needs of WISPs and consumers in rural, unserved and underserved areas because each is fraught with unique deficiencies.
- Rural WISPs, as well as those operating in urban and suburban areas, lack the scale and volume needs to attract discounted pricing.
- Affordable access to transport and connectivity facilities will become an increasingly critical problem as WISPs expand and consumer bandwidth needs increase.

⁸ WISPA Spectrum Comments at 5.

Recommendations

From these conclusions, WISPA recommends that the National Broadband Plan include the following objectives:

- Re-examining the tariff structure for middle mile and second mile transport with a goal of making rates in non-competitive markets subject to the rate structure that applies in competitive markets.
- Fostering programs designed to directly assist small broadband providers in achieving competitive rates to middle mile and second mile transport facilities.
- Adopting regulations specifying the location and conditions by which a fiber provider must provide non-discriminatory access to its new and existing fiber at competitive rates.
- Providing additional spectrum in the 3-10 GHz range for point-to-point middle mile and second mile transport,⁹ and freeing up unused licensed microwave spectrum revealed pursuant to a spectrum audit.
- Advocating additional federal funding, beyond the initial \$7.2 billion designated in the Recovery Act, to allow State and regional consortia to build and share fiber facilities, and providing government funding and tax credits to facilitate construction of more middle mile “on-ramps.”
- Removing the regulatory requirement that ILECs be involved in the local loop.
- Streamlining access to government-owned towers¹⁰ and making utility pole attachments available at the same non-discriminatory rates that are available to cable television systems and providers of telecommunications services, as WISPA previously urged.¹¹

These recommendations are supported by WISPA’s survey results as reported in the detailed discussion that follows.

⁹ See WISPA Spectrum Comments at 19 (advocating allocation of an additional 300 MHz of spectrum for fixed broadband).

¹⁰ WISPA anticipates filing Comments in response to the Public Notice, “*Comment Sought on the Contribution of Federal, State, Tribal, and Local Government to Broadband*,” DA 09-2122, GN Docket Nos. 09-47, 09-51 and 09-137 (rel. Sept. 25, 2009).

¹¹ See WISPA NOI Comments at 20-21.

Discussion¹²

1. Network Components of Broadband Connectivity.

Middle Mile

The Commission seeks information on the amount of middle mile capacity each end user requires in order to ensure an adequate connection.¹³ From its survey results, WISPA has determined that capacity needs range from 50 kbps to 260 kbps per end user. As a rough estimate, middle mile bandwidth needs should be five percent of the aggregate bandwidth supplied to last mile business customers. There is no single answer that applies to all situations because capacity needs vary based on factors such as the customer mix (*e.g.*, rural, urban, residential, business, educational facilities, etc.), time of day and network management policies, and whether the middle mile circuit speeds are fixed or “burstable.”

In general, the larger the number of end users, the less middle mile bandwidth per end user is needed. At present, users in suburban and exurban areas can require up to ten times as much bandwidth as users in remote or rural areas because the differences between urban and rural lifestyles are reflected as a difference in Internet usage. Urban customers tend to use more video streaming and point-to-point applications which require more middle mile bandwidth. Over the next one or two years, it is likely that rural customers will become more like urban customers and thus require more middle mile bandwidth. One WISP estimates that its subscribers’ bandwidth requirements will double every 18-to-24 months. Rural areas that occasionally host large or special events also require more middle mile bandwidth.

¹² The Discussion follows the organizational structure of the *Public Notice*.

¹³ *Public Notice* at 2.

Not surprisingly, WISPA's survey showed that there were significant differences between residential and commercial usage patterns. On a per-user basis, residential users tend to use more bandwidth. Residential users also have a higher peak bandwidth demand than businesses. Residential usage peaks in the evening, while business usage peaks in the morning and around lunchtime. In general, residential bandwidth use is more "bursty," and business usage patterns are more consistent. Thus, for WISPs, the best business conditions occur when they serve a balance of both business and residential customers. However, because WISPs often serve predominantly residential customers in areas of low customer density where large carriers choose not to deploy, WISPs typically need more "burstable" middle-mile capacity from 4 PM until midnight in comparison to larger carriers serving a mix of business and residential customers in urban areas.

Second Mile

The Commission also requests information on the amount of second mile capacity that is needed to provide adequate broadband Internet access to an end user connection.¹⁴ WISPA's survey concludes that between 100 kbps to 300 kbps of second-mile capacity is needed for each end user. If one wireless access point feeds several other distant access points, as is often the case with rural WISP architectures, the second mile needs must be scaled up relative to the number of networked towers. Major second mile backhauls that serve many towers therefore require scalable capacity.

Compared to middle mile bandwidth, more per-user second mile bandwidth is needed because bandwidth is averaged over fewer customers. This is an especially important concept given that many WISPs serve primarily rural areas with fewer customers and less density than ISPs in more densely populated urban and suburban

¹⁴ *Id.*

areas. In response to WISPA's survey, one WISP explains the needs for second mile bandwidth as follows:

Certain types of traffic, notably VoIP, degrade noticeably if 2nd mile links are not designed with sufficient headroom. Web browsing and email are not significantly impaired if occasionally a peak consumes all the backhaul capacity. The effect on VoIP, gaming, VPN, video streaming, remote monitoring via webcams, digital trunking for 2-way radio towers, etc. cannot tolerate this. QoS in routers and radios can only do so much. VoIP is an important application in rural areas because of the high cost of landline phone service and the small local calling areas. We find that to offer service comparable to what is available on cable and DSL, we need to design backhaul links to never experience congestion.

Regarding usage patterns, WISPs need to maintain a balance of business and residential users to average out the inherent daytime bandwidth usage of business customers with the nighttime bandwidth spikes of residential users. As mentioned before, this frequently is not possible because most WISPs serve rural customers that are otherwise unserved by larger carriers. As a result, most WISPs must provision and/or build second mile connectivity that is "overbuilt" and is sized to provide more bandwidth (or more "burstable" bandwidth) compared to the second mile needs of large, more urban service providers.

Technology Options – Middle Mile

The Commission asks about the technology options for providing adequate middle mile connectivity in the future and the extent to which these technologies are available in rural and unserved areas.¹⁵ For the next five to ten years, the available technology options for rural and unserved areas will remain Part 15 unlicensed microwave, Part 101 licensed microwave and Ethernet over fiber. However, the availability and affordability of fiber continue to be a problem, and spectrum options also

¹⁵ See *id.* at 2-3.

have limitations. One survey respondent states that fiber providers “are unwilling to build out to us. Instead, we have built our wireless network to meet them.” Another confirms this, concurring that “LECs and private fiber companies take years if ever to get to rural areas.” Fiber is also very expensive in rural and unserved portions of the country, so WISPs will use a combination of fiber and microwave to reach affordable Internet points of presence.¹⁶ The cost of fiber often varies with distance – the further the fiber goes, the greater the cost.¹⁷

Other technologies, such as DS1 and DS3 over copper, are inadequate to support future broadband needs. Not one of the respondents to WISPA’s survey believes that copper-based technologies are adequate today, much less in the future. First, for WISPs, copper-based technologies are more expensive on a per-megabit basis than other technologies, perhaps because of tariffs and ILEC control. For instance, T1 transport as priced by ILECs can be ten to 100 times more expensive per megabit as compared to fiber-based Ethernet transport. DS3 may be enough for a single tower, but DS3 is

¹⁶ The Commission asks which fiber technology offers the most efficient means for middle mile connectivity. *See Public Notice* at 3. Quite simply, Gigabit Ethernet is the middle mile technology of choice for most WISPs because it (a) is the most cost-effective, (b) has enough capacity to meet both current and future needs, and (c) avoids the higher cost and higher technical complexity of OCn multiplexing and demultiplexing. In its survey response, one WISPA member explains that:

OCn involves the overhead of multiplexing that is primarily intended for telco TDM use, all that does is drive up the cost for transporting large amounts of data. Any new fiber middle mile installations can easily carry Gigabit fiber, and lower bandwidths can be addressed through CIR/MIR or burstable usage-based billing. There is a conflict of interest for the major fiber network operators to sell transport at reasonable prices to ISPs that appear to compete with the retail operations of these big network operators, even if the intent is to serve customers in rural areas that the big networks choose not to serve. So there is a crucial need for independent middle mile fiber projects that can break this monopoly and bring bandwidth from data centers in major cities out to small ISPs in unserved areas, as well as to large end users like schools and local government.

¹⁷ This is not always the case. One urban-based WISP reports that middle mile fiber prices may be lower over long distances where the market is competitive and capacity is readily available. As an example, the WISP can buy a 100 Mbps point-to-point connection from Washington, D.C. to California for \$1,000 per month, roughly the same cost for fiber between two data centers in the Washington area. In Washington, D.C., it costs the same to interconnect two adjacent buildings with fiber as it does to interconnect two buildings 50 miles apart surrounding the city.

typically multiplexed onto OC3 fiber, and available only in urban areas. DS1, DS3 and OC3 have additional costs in router interface technology. Second, copper-based technologies have limited bandwidth and cannot accommodate increasing consumer bandwidth needs. Each T1 represents only 1.5 Mbps of bandwidth and each end user now demands at least twice that amount.

Microwave and other spectrum options may be the best – and may be the only – alternative, but these have limitations as well. One respondent states that:

Microwave is cost effective in many areas where fiber access is limited. The larger challenge is often finding available spectrum capable of handling large capacity, long distance links. Cost of spectrum leasing/acquisition is also often a prohibitive factor.

Another WISP adds that “[t]he cost and availability of spectrum, and the unavailability of fiber transport, are major 2nd mile issues. As average usage per customer continues to increase, we are likely to exceed what can be done with license-exempt spectrum.”

WISPs also expressed concern that the Commission’s inventory of available microwave frequencies is dwindling because some carriers are obtaining licensed frequencies well before they are needed. This makes it more difficult for small WISPs to obtain spectrum for middle mile and second mile links. In some areas, all available Part 101 spectrum (particularly in the critical 11 and 18 GHz bands) may be consumed by large carriers. In rural areas, microwave paths often must cover longer distances, and it is difficult for WISPs to get enough 11 GHz spectrum for a 20-mile link without suffering rain fade. Spectrum in the 6 GHz band typically is not feasible due to regulatory

restrictions on antenna size.¹⁸ Of course, all microwave bands are limited by terrain and foliage.

WISPs thus are faced with an impending conundrum. Technologies such as DS1 and DS3 are inadequate for future (if not current) middle mile connectivity. Fiber solutions are often too expensive because there are fewer competitors and fewer buyers of high-dollar bandwidth to generate competitive pricing. Licensed microwave frequencies are becoming more difficult to obtain. To address these problems, the Commission's National Broadband Plan should establish as a priority the need to make more spectrum available for middle mile backhaul and connectivity.

Technology Options – Second Mile

Megabit or Gigabit fiber would be an excellent way to provide second mile connectivity, but many rural WISPs are forced to use some combination of unlicensed and licensed microwave systems that they build themselves because existing fiber is either non-existent or is not competitively priced. Even in the occasional instance where a fiber route may pass nearby, there is usually no port, and thus no way to gain access to the fiber. The cost of higher-capacity licensed microwave equipment is coming down, but often remains beyond the economic reach of smaller WISPs.

Fiber generally is not available to connect wireless towers to an aggregation point, and therefore most WISPs use wireless links to provide second mile connectivity to their towers. Although most prevalent in rural America, the same circumstances also exist in

¹⁸ The Commission should consider amending its rules to permit smaller antennas for 6 GHz links, as it did for antennas in the 11 GHz band. *See Amendment of Part 101 of the Commission's Rules to Modify Antenna Requirements for the 10.7 - 11.7 GHz Band*, Report and Order, 22 FCC Rcd 17153, 17163-17164 (2007).

urban and suburban areas. As a result, the tower-to-aggregation point distance varies based on the terrain and obstructions (trees, buildings, etc.), rather than on absolute distance.

Because wireless links to the towers are needed, WISPs require spectrum and the ability to re-use that spectrum. Over time, more last mile towers must be deployed, and hence more second mile wireless links (along with more enabling spectrum) are needed. This is occurring because customer bandwidth demands are growing and the customer base is growing, forcing capacity increases to the network edges. New towers must be built and be built closer to customers to allow greater re-use of the limited point-to-multipoint frequencies that are available and to provide reliable coverage at the higher bandwidths that are demanded by customers.

As is the case with middle mile facilities, copper-based technologies such as DS1 and DS3 will not be sufficient for second mile connectivity. DS1 is already not sufficient and is obsolete, and DS3 will likely not be sufficient. Further, the fiber used to deliver DS3 is generally not available between aggregation point and the tower, is controlled by the ILECs and is therefore not price-competitive.¹⁹

According to WISPA's survey results, over the next five to ten years, wireless (not fiber) will continue to be the primary second mile distribution technology. More second mile aggregation points will need to be built, and more wireless spectrum (Part 15 unlicensed, Part 90 lightly-licensed and Part 101 fully licensed) will be needed to distribute bandwidth to these aggregation points. In the northern, eastern and southern parts of the U.S. (generally flat-to-hilly with many trees) these additional aggregation

¹⁹ DS3 is usually delivered over fiber, not copper. Using fiber to deliver DS3 would "dumb it down" when that fiber could be used to deliver higher-capacity Ethernet bandwidth more effectively.

points will need to be within ten miles of the customers. In the western parts of the U.S. (larger valleys with usable hills and mountains, fewer trees) these additional aggregation points will need to be within 20 to 25 miles of the customers.

Other than point-to-point microwave, there are no other feasible options for effective and sufficient second mile connectivity. Point-to-point microwave is effective for second mile connectivity but it is limited by terrain, distance and restrictions on dish size. At busier locations, microwave also is limited by congestion. More high-capacity point-to-point microwave spectrum is needed, both licensed and license-free. The Commission also should act to prevent large 3G and 4G mobile broadband carriers from “tying up” excessive amounts of licensed spectrum for long periods of time when they are not actually using it.²⁰

Point-to-point wireless backhaul is most effectively deployed when sufficient licensed or unlicensed spectrum is available, unobstructed terrain exists, individual link distances do not exceed 30 miles, sufficiently strong towers are in place to support the backhaul antenna loads and leasing, engineering and other costs on available towers are reasonable and affordable. In addition, tower company sales personnel must be available to respond to tower space-leasing requests in a timely fashion.

Whether it is middle mile backhaul or second mile connectivity from a tower, licensed microwave is not cost-effective when *any one* of the above conditions *fail* to exist in a particular geographic area. Because there are many times when one or more of the above conditions are not present, WISPs cannot deliver adequate broadband capacity

²⁰ If and when the Commission conducts a spectrum audit, as WISPA and others have advocated, determining actual use of licensed microwave frequencies should be a key focus and rule changes may be in order to prevent warehousing of this spectrum. See WISPA Spectrum Comments at 19-20.

efficiently or economically and, consequently, there remain many unserved Americans in rural areas.

2. Availability and Pricing of Middle and Second Mile Connectivity.

Middle Mile

The Commission asks a series of questions about “the price, cost, and availability of middle mile and second mile connectivity, with a focus on rural, unserved, and underserved areas.”²¹

Based on the responses to WISPA’s survey, it is evident that a number of factors influence the cost of middle mile connectivity. First, cost varies enormously depending on how close a service provider is to a major data center. Gigabit Ethernet in a major data center can be as low as one dollar per megabit. At the other extreme, in rural areas WISPs may be forced to pay more than \$200 per megabit for OCn connectivity. Microwave connectivity is typically not purchased from carriers but is self-provisioned. The capital expense for a single Part 15 unlicensed microwave link is typically up to \$10,000 and for a Part 101 licensed link can be \$15,000 to \$20,000 or more depending on link capacity.

Second, the length of a middle mile circuit affects circuit price. DS3 and OCn can have very significant mileage charges. Sometimes Ethernet products have little or no mileage charges. However, in some cases, especially where fiber must be constructed or rented, the mileage costs can be significantly more than the bandwidth costs.

Third, the party from which the circuit is purchased influences pricing. Middle mile connectivity purchased from ILECs tends to be priced the highest because of ILEC

²¹ *Public Notice* at 3.

regulatory treatment (tariffs) and historical billing practices. CLECs tend to charge lower prices for connectivity but have relatively limited coverage. Interexchange carriers and competitive access providers are the least expensive. In rural, unserved and underserved areas, however, all of these middle mile offerings may be too expensive. One WISP explains its pricing experiences this way:

We get bandwidth in a 2nd tier city served by Verizon where there is essentially no competition, and in a 1st tier city served by AT&T. Verizon has essentially told us to pay tariff rates, take it or leave it. AT&T has told us the only way to get a discount off the extremely high tariff rates is individual case basis (ICB) contracts. To get an ICB contract, you have to either commit to a very large number of circuits, or present a lower quote from a competitor. It's not enough that lower competitive pricing exists, or that other customers have gotten lower ICB pricing on the basis of competitive pressure, you have to get an actual quote from a competitor. The only exception I have ever seen was on T1 circuits in Chicago where AT&T was so consistently higher than the competition that they created a standard discount table for certain CO's where there was competitive pressure, it was called "Metroblitz" pricing, the sales rep had to apply for sales director approval which was automatically granted. Unfortunately the discount was modest and still required a 3-5 year contract. I'm not aware of any standard discounts available on OpteMAN/GigaMAN fiber.

Fourth, the volume of bandwidth purchased affects pricing – the more bandwidth purchased, the lower the per-megabit cost. As a result, smaller local or regional WISPs that require less bandwidth generally pay higher rates than nationwide companies that purchase bandwidth in larger amounts. This no doubt has a significant affect on the inability of WISPs to procure affordable middle mile connectivity that will enable service to rural, unserved and underserved areas.

This problem of scale is not confined to rural areas. One urban WISP reports that its cost to build and deliver broadband over its own network was as high as \$200 per megabit on a 30 Mbps wireless backbone, after considering the high costs of roof rights and antenna collocation fees.

Second Mile

According to WISPA's membership survey, WISPs by and large do not purchase second mile connectivity from other providers because the ILECs with second mile facilities do not focus on providing service to competitors (or to end-users for that matter) and use incompetence (both real and feigned) as an excuse to avoid providing efficient service. When an ILEC makes service available, it is often overpriced at tariff rates. No WISP reported ever having significant discount pricing available, except in cases where competition exists. In rural areas, those cases are few and far between.

Rather than use ILEC-provided second mile facilities, most WISPs build their own licensed and unlicensed microwave links and buy or build their own towers to support their self-provisioned microwave links. Other alternatives are either to rent fiber from CLECs when it is available and cost-efficient or to provision their own fiber.

Circuit-Mode Services

For middle mile transport, WISPs will use circuit-mode services when they are available and cost effective, but in many cases the pricing and the performance of the local ILEC combined with the more complex and costlier interface equipment makes it necessary for WISPs to search for other more cost-effective, Ethernet-based options.

A DS3 interface module for a router can cost \$8,000. By comparison, a fiber interface module costs \$200. While some WISPs report that the cost of the equipment necessary to connect a DS3 circuit to their router is not significant, others report that the cost of interconnection equipment is significant enough to cause them to avoid using OCn connectivity. WISPs also report that bandwidth costs for Ethernet service are substantially less than costs for OCn-based bandwidth.

With regard to “functionality,”²² purchasing Ethernet service rather than OCn service allows a service provider to maintain consistent management functionality throughout their network. Managing VLANs, CALEA, and QoS is easier if the network is all-Ethernet.

Proportionate Costs of Middle Mile and Second Mile Transport

The Commission requests information on the portion of overall costs that is attributable to middle mile and second mile transport.²³ Not surprisingly, WISPs reported costs that vary tremendously depending on whether the area that they serve is urban, suburban, rural or remote – in general, the more rural or remote a service area is, the larger the percentage of the operating costs will be attributed to middle and second mile connectivity.

For an urban service provider, connectivity costs may be ten percent or less of the WISP’s overall costs. But for rural WISPs, connectivity costs may be as much as 60 percent of monthly costs. The high monthly recurring cost of acquiring and transporting Internet bandwidth to rural areas is the single largest reason why broadband Internet access is not available in many rural areas.

The Commission seeks specific examples of how middle mile and second mile pricing affects the business case for broadband deployment.²⁴ In addition to the information presented above, here are three observations WISPs offered in response to the membership survey:

We pay \$4000/mo for a burstable DS3 at a NOC to support 250 rural wireless customers. Of this, \$3000 is LEC cost for the DS3 circuit, and \$1000 is actual bandwidth cost from the upstream provider. This means

²² See *id.* at 5.

²³ See *id.*

²⁴ See *id.*

that before accounting for 2nd mile and last mile costs and bandwidth, it is costing \$12/month per customer just for middle mile transport. This alone keeps us from pricing at the \$25/month end customer price that would foster widespread adoption and be comparable to what urban customers pay for DSL.

We recently chose to service an area in [location redacted]. Wireless was the best choice to get service to the community. We had to build a tower, buy a building, make a land agreement with the town, install radio equipment at the tower and one of our other sites. Now we will have to upgrade the equipment at the next two sites in the chain to support the intended traffic volume for our [location redacted] system. We've spend [sic] about \$10k on the last mile, and will likely spend \$15k for the 2nd mile of that project. If it were closer, we could do the 2nd mile with fewer wireless hops, decreasing 2nd mile costs.

In urban America the lower cost of connectivity is counteracted with higher recurring costs for antenna roof/tower colocation, which are necessary to build in areas where it is not feasible for WISPs to build their own towers due to zoning restrictions. As an example, an Interstate PTP Ethernet fiber link between lit buildings might cost \$1000/month, yet a two hop (segment) wireless backbone would often have in aggregate of \$1000/month in just roof/antenna colocation fees. High 2nd mile roof colocation fees can make it difficult to deliver low cost broadband to low income areas.

These three examples fairly represent the plight of WISPs that provide fixed wireless broadband in rural, underserved and even urban areas of the country, and illustrate why many areas of the country remain unserved. Although wireless technology may be the only means by which broadband can be made available, in many cases the economic model will not support deployment.

3. Pricing and Availability of Internet Connectivity.

Pricing

The Commission asks a number of questions about dedicated Internet ports, correctly observing that the “price and availability of these ports may vary based upon

geographic location and whether those ports are obtained from Tier 1 or other Internet backbone providers.”²⁵

WISPs report paying from \$2 to \$300 per megabit per month to Tier 1 providers. One WISP reported paying \$80 per month to a Tier 2 provider. WISPs report that outside of the top 25 MSAs, Internet backbone connection costs are from two times to three times to as much as 20 times more expensive. One WISP serving rural areas of Washington state reports that:

In Odessa Wa. I pay \$200 per meg on a 10 meg burstable pipe. Plus \$800 per month for transport services.

In Ephrata Wa. I pay \$99 per meg on a 20 meg burstable pipe. Plus \$200 per month for transport services.

In Spokane Wa. prices of \$20 or less per meg are available, but there is no pipe available from there to here.

In Seattle Wa. I’ve heard of single digit per meg prices, transport to Ephrata Wa. would be a minimum of \$3,000 per month.

In another case, a WISP in suburban Washington, D.C. was quoted a price of \$200 per megabit on a 10 Mbps fiber transport pipe that terminated from the cable provider’s lit commercial building in Chantilly to a major data center 15 miles away. The WISP concludes that “[s]uburban areas with only a single fiber provider will often have prices as high as any rural area. Due to land elevations, wireless transport to that area was complicated with multiple hops, but wireless was the only financially viable option.”

Transport costs and competition both play a factor because the middle mile transport is largely owned by ILECs and cable companies that are not interested in sharing with competitors. Several WISPs report that bandwidth prices have declined over the last three-to-five years but have remained steady more recently. Another

²⁵ *Id.*

respondent estimates that prices are dropping approximately 25 percent per year. However, one WISP stated that “[t]ransport prices have come down in major cities but have not budged in smaller cities and rural areas where the LECs have no competition and no incentive to price at cost plus a reasonable profit” while another reported that it “can’t get competitive bids because most providers quote Verizon circuits which “blows the price up.””

In urban areas served by multiple providers, small wireless providers are not guaranteed the same prices as other carriers to access affordable broadband pipes. For example, Equinix, a necessary East Coast exchange, often charges WISPs excessive roof antenna colocation fees, a per antenna fee larger than the cost to purchase Gigabit Ethernet capacity from a fiber carrier. As long as conditions like this exist, a WISP’s financial value proposition is inhibited.

The Commission asks for the concentration ratio that ISPs use in purchasing backbone connectivity.²⁶ WISPs report concentration ratios ranging from 5:1 up to 50:1 with the average of around 20:1. At these high concentration ratios, an incremental megabit in the last mile generally does not immediately affect the need for additional second or middle mile bandwidth. A few respondents to the WISPA survey report that caching reduced their backbone bandwidth needs by up to 20 percent. However, most companies reported that they do not cache due to the highly dynamic nature of Internet content.

The Commission seeks information on the range of prices for Internet connectivity in the most urban and most rural markets.²⁷ The higher prices occur in the

²⁶ *See id.*

²⁷ *See id.*

most rural settings because of distance, availability, and the lack of competition. Prices “explode” as the distance from a Tier 1 provider increases. From WISPA’s survey results, one dollar per megabit per month access for Gigabit Ethernet is available in a large-city data center, while service providers in small towns pay \$250 per megabit per month, or more. Much of this difference is due to the fact that a direct connection to a Tier 1 provider is not available in small communities.

Proportionate Costs of Internet Connectivity

Internet backbone connectivity costs consume from 10 percent to 50 percent of the overall costs of responding WISPs, with the higher percentages in more rural areas that are located farther from a Tier 1 connection point. Higher per-user costs combined with the ability to deliver only lower tiers of bandwidth inhibit WISPs from providing service to many rural areas of the country. Without the availability of lower-cost Internet connectivity for rural service providers, this disparity will continue in the future. Thus, the rural business case is negatively affected by the higher costs of Internet connectivity.

4. Economics of Deployment.

Monopoly

In the *Public Notice*, the Commission next seeks information about the economics of deploying middle mile and second mile connections, asking whether high-capacity fiber is a “natural monopoly” in some locations.²⁸ Several WISP survey respondents agreed that, in smaller rural communities, fiber is provisioned only by a monopoly carrier. Further, in major cities, the ILEC and the cable operator form a duopoly. Neither wants to provide transport outside these major cities and outside the centers of smaller

²⁸ *Id.* at 6.

cities and towns, yet their very existence probably makes the investment risk too high for any independent company to enter the market and deploy new fiber.

The Commission can assist in the provision of fiber connectivity outside of major cities by mandating that middle mile providers publicly identify fiber circuits, available capacities and end points. Even though fiber may pass nearby, often the owner of that fiber refuses to add equipment that allows access to the fiber. The Commission could adopt regulations specifying the location and conditions by which a fiber provider must provide non-discriminatory access to its new and existing fiber at competitive rates.

Self-Provisioning

As discussed above, respondents to WISPA's survey reported a high incidence of self-provisioning, especially with respect to second mile transport. Smaller WISPs appear more likely to purchase both middle mile and second mile transport, whereas larger WISPs appear more likely to self-provision transport. In addition, WISPs in rural areas self-provision almost all the time because availability of transport facilities from other carriers is either limited or non-existent.

Capital expenses for self-provisioned microwave middle mile and second mile circuits are estimated to be from \$3,000 to \$10,000 per mile depending on bandwidth. Operating expenses are estimated to be from ten to 20 percent per year.

Capital expenses include the radios, antennas, service equipment and vehicles, backup power systems, site preparation and labor to install the link. Operating expenses include tower leases, electricity and maintenance of the gear, regular power use, network monitoring systems and software upgrades. There are several factors that affect these costs. The distance from the nearest point of presence affects both capital expenses and

operating expenses (maintenance). Also, because longer distances require more links, additional microwave radios, antennas and associated equipment will be required.

Operating expenses also increase as distance increases because more towers must be leased and more equipment maintained.

The Commission asks whether “existing long-haul fiber optic service providers offer either middle mile or second mile transport service to all communities that are passed by their long-haul fiber.”²⁹ In some communities, there may be no long-haul fiber available. Where fiber is available, fiber optic service providers do not offer services to all communities that they pass. According to WISPA’s survey results, some ILECs and Tier 1 providers may have fiber regeneration huts in small communities, but will not provide breakout access at these locations. One WISP received a quote in the range of \$300,000 to obtain local access to fiber facilities that pass through its community! That amount is well beyond the “reasonable” ability of a WISP serving a small rural community.

The Commission asks whether “the availability of adequate, reasonably priced, and efficiently provided middle mile and second mile transport infrastructure in an area [is] limited by access to capital.”³⁰ For WISPs that self-provision, middle mile and second mile transport are generally funded through operating revenues, and WISPs will only expand or upgrade service where there is demonstrated demand for service. With better access to capital, WISPs would have for financial resources available to build higher capacity links at the outset rather than being forced to invest multiple times in the

²⁹ *Id.*

³⁰ *Id.*

initial construction and then in each capacity upgrade. One WISP reported that pole costs and simpler rules for placing fiber on poles would help accelerate deployment.

The Commission also inquires about the extent to which Internet service providers work together to upgrade and share transport facilities.³¹ In some cases, WISPs have collaborated to upgrade or share middle mile or second mile facilities. For example, in Maine, some ISPs and WISPs work together to share middle mile facilities, and the state legislated the “ConnectME Authority” to expand broadband access to the rural areas of the State. In one Midwest state, one larger WISP wholesales middle-mile bandwidth to four or five smaller adjacent WISPs. In the Pacific Northwest, a Utility District deployed a shared fiber optic network that is open for middle mile, second mile and final mile use by all interested providers. In Colorado and New Mexico, a telco and a WISP collaborate to provide redundant Internet connectivity that is independent of the ILEC. In the Washington, D.C. area, a WISP wholesales bandwidth at near cost to other WISPs so that the benefits of volume-based costs can be shared.

WISPA also is aware that several states have filed for broadband stimulus funds for state-wide middle mile fiber loops. The government’s emphasis on the middle mile and the number of high-quality middle mile funding proposals makes manifest the dearth of middle mile options and the importance of expanding middle mile networks to improve and expand last mile service to end users.³²

³¹ *See id.*

³² WISPA is aware of one consortium of Internet service providers (some wireless) that are able to purchase volume-based discounted transport services from AT&T.

Government Action

What government action is necessary to facilitate construction of middle mile and second mile facilities?³³ WISPA's members suggest the following:

- Re-examining the tariff structure for middle mile and second mile transport with a goal of making rates in non-competitive markets subject to the rate structure that applies in competitive markets.
- Fostering programs designed to directly assist small broadband providers in achieving competitive rates to middle mile and second mile transport facilities.
- Adopting regulations specifying the location and conditions by which a fiber provider must provide non-discriminatory access to its new and existing fiber at competitive rates.
- Providing additional spectrum in the 3-10 GHz range for point-to-point middle mile and second mile transport, and freeing up unused licensed microwave spectrum revealed pursuant to a spectrum audit.
- Advocating additional federal funding, beyond the initial \$7.2 billion designated in the Recovery Act, to allow State and regional consortia to build and share fiber facilities, and providing government funding and tax credits to facilitate construction of more middle mile "on-ramps."
- Removing the regulatory requirement that ILECs be involved in the local loop.
- Streamlining access to government-owned towers and making utility pole attachments available at the same non-discriminatory rates that are available to cable television systems and providers of telecommunications services, as WISPA previously urged.

5. Nature of Competition and Availability of Alternatives.

In the final portion of the *Public Notice*, the Commission asks a series of questions about competition in the provision of middle mile transport services.³⁴ In instances where there is some competition – and in many areas there is little or none – providers generally compete on a circuit-by-circuit basis. In general, there is more

³³ See *Public Notice* at 6-7.

³⁴ See *id.* at 7.

competition among middle mile providers than among second mile providers. When a network operating center is near a major population center, there are more connectivity options and thus more competition. In more rural, second-mile areas there are fewer connectivity options, and thus little or no competition. When rural facilities need to be built to meet customer demand, the connectivity price is often so high that the customer declines and the facilities are never built.

The lack of competition over a vital but very expensive route (with no other competitive option) can drain funds that would otherwise be available to access (or self-provision) circuits on other routes that could be serving additional customers. To summarize, one overly expensive but vital circuit (for example, a middle-mile circuit to connect a rural WISP to the Internet) could cost so much that the WISP would be prevented from building out new second-mile circuits to end-user customers that are awaiting service.

The Commission asks whether the presence of a new middle mile or second mile transport provider affects price or product offerings.³⁵ In responding to the survey, WISPA members provide evidence that competition generally does *not* lower price, and that sometimes competitors in urban areas offer differentiated products or better service. Following are four illustrative responses:

[D]ue to high costs, very little price competition in our rural environment.

Qwest and Syringa Networks (owned by 12 independent small telcos) don't compete on a price perspective. There has been no reduction in middle mile costs with a second provider (they're also a telco).

LECs typically price according to an extremely high tariff price list that remains static for years despite falling technology costs. The only option given to customers to deviate from tariff pricing is to obtain competitive

³⁵ *See id.*

pricing, which then allows the LEC to deviate from tariff pricing. In effect, this allows the LEC to charge artificially high monopoly prices in any area without competition.

We don't see any real competition unless the provider builds their own facilities. Then they are very competitive. However, for most of this area CLECs are leasing their local loops from Verizon, and as such, the pricing is usually close to Verizon's.

Competition may develop for middle-mile transport in some urban areas and, if so, it may take the form of a new provider offering Ethernet service which then differentiates the new provider from the DS1, DS3, or OCn products that the incumbent provides.

WISPA received mixed results in response to the Commission's question about the impact of contractual terms and conditions. In some cases, a term requirement may encourage a potential competitor to build out to a new area. In other cases, a new competitor may have to "wait out" the expiration of existing multi-year contracts between a WISP and the ILEC before making its service available. Further, existing long-term contracts limit the entry of potential competitors until such time as contract renewal windows occur. Although long-term contracts help a provider to recoup the cost of their investment, if the investment costs were lower (such as with shared fiber, lower pole attachment costs or more modern technology like Ethernet), the investment costs would become more affordable and more competitive offerings would become available.

Whether individual middle mile routes are competitive depends on the location of the route. Three of the responses to WISPA's survey provide insight into existing and future demand for middle mile competition:

None of our routes are fully served by more than one facility based provider. In all of our cases some portion of the circuit is leased from Verizon.

The route is primarily route 1 up the coast. The ILEC and cable companies are the predominant facilities owners here and aren't inclined to sell affordable 2nd mile or middle mile services. There is plenty of demand, the potential uses just can't justify the regulated rates of the ILEC or the CLEC that doesn't actually compete.

I believe there is room and traffic for more than one provider in nearly all markets. Traffic volumes are growing fast enough that I believe all providers will be stressed.

There appears to be even less competition in the provision of second mile facilities. One survey respondent stated that “[n]one of our 2nd mile routes are served by anybody other than the ILEC.” Another stated that non-ILEC providers in rural areas “could do well with an Ethernet based offering if more barriers to entry were removed such as pole costs and CLEC administrative costs.”

Conclusion

WISPA's members have confirmed what has long been suspected – middle mile and second mile connectivity is not “adequate, reasonably priced, and efficiently provided” in many areas of the country where WISPs offer service, and inhibits deployment and availability of broadband where WISPs would like to offer service. WISPA's recommendations can help address these market failures. WISPA respectfully requests that the conclusions and recommendations discussed herein be included in the National Broadband Plan.

Respectfully submitted,

**THE WIRELESS INTERNET
SERVICE PROVIDERS ASSOCIATION**

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/s/ Jack Unger, Chair of FCC Committee

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