Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matters of	
International Comparisons and Consumer Survey Requirements in the Broadband Data Improvement Act	GN Docket No. 09-47
A National Broadband Plan for Our Future	GN Docket No. 09-51
Inquiry Concerning the Deployment of 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	GN Docket No. 09-137

COMMENTS OF GENERAL COMMUNICATION, INC. – NBP PUBLIC NOTICE # 11

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Summary

The lack of cost-effective terrestrial middle-mile transport is a major impediment to extending widespread broadband service to rural, unserved, and underserved areas. Nowhere in America is the need for middle-mile facilities to the Internet backbone more plain than in rural Alaska, where vast distances, severe climate, difficult terrain, and a widely dispersed population make middle-mile deployment difficult and costly. Many rural Alaskan communities are hundreds of miles away from the nearest road and depend almost entirely on satellite technology to transport traffic across the middle mile. But satellite service is expensive, has limited throughput capacity and inherent latency, and, thus, is not ideal for widespread, intensely used broadband services for the mass market. The challenge, therefore, is to replace satellite middle-mile transport with technologically and economically viable terrestrial middle-mile delivery, both within these remote, off-road regions and between these regions and the Internet backbone.

GCI is committed to providing modern broadband service over time to as much of the sparsely inhabited, off-road regions as it can on an economically feasible and sustainable basis. It is clear that the economic viability of deploying terrestrial second/middle-mile facilities over the next five to ten years will depend at least in part on government-backed capital, sustained support programs to anchor tenants, and the addition of broadband to Lifeline-supported services. Solving this business case problem may also require GCI to identify lower-cost technical solutions, develop new middle-mile revenue streams, and find partners to help shoulder the deployment burden.

Network Components of Broadband Connectivity. Satellite does not provide a cost-effective method to keep up with ever-increasing bandwidth needs at projected rates of growth for the mass market. GCI aims to migrate most of its second/middle-mile traffic from satellite to hybrid microwave/fiber systems where feasible, providing a regional broadband service and a critical piece of the middle-mile solution while freeing satellite bandwidth to those communities where terrestrial middle mile is not feasible.

Availability and Pricing of Middle and Second Mile Connectivity. Second/middle-mile access is typically available at competitive rates via fiber optic cable in most communities along the road network and some off-road communities in Southeast Alaska. In most off-road rural regions, by comparison, middle-mile satellite transport poses the biggest cost impediment to bringing advanced broadband services to rural Alaska.

Availability and Pricing of Internet Connectivity. Because there is no Tier 1 Internet backbone connection in Alaska, GCI mostly transports its own traffic via fiber to and from Anchorage and connects directly to Tier 1 providers in Seattle. Affordable Internet backbone connectivity is readily available via this route, and the price is nominal compared to the cost of second/middle-mile connectivity to rural areas.

Economics of Deployment. In rural Alaska it is difficult and costly to build out the second and middle miles to the sparse population and still earn an adequate return on investment. GCI has a history of overcoming such hurdles and has invested hundreds of millions of dollars to bring telecommunications service to its customers, not only in Alaska's cities and towns but also in its most remote villages. But the continued viability of these projects depends upon government-backed loan programs and equipment grants (to support anchor tenants) and high-cost and Lifeline subsidies to support last-mile infrastructure for voice telephony that can be upgraded to provide last-mile broadband service. The Commission must maintain existing support mechanisms and should consider including broadband service as a supported service under the Lifeline/Link-up programs.

Nature of Competition and Availability of Alternatives. The price for satellite middle-mile connectivity is subject to limited downward pressure from competition because the high fixed cost of operating satellite networks leaves little room for price reductions. Because the front-end costs of deploying microwave/fiber networks are substantial, the front-end retail prices are comparable to current satellite-based services to ensure a reasonable capital recovery period necessary to justify private investment. For those prices, however, the customer receives a much higher quality offering, enabling access to advanced broadband applications and services that satellite cannot reasonably provide. And, once costs of build-out are recovered, customers may enjoy the benefits from economies of scale that will reduce prices.

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Introduction

As the leading provider of broadband services to government, commercial, and residential users in Alaska, General Communication, Inc. ("GCI") understands that the lack of cost-effective terrestrial middle-mile transport[1] is a major impediment to extending widespread broadband service to rural areas. Nowhere in America is the need for middle-mile facilities to the Internet backbone more plain than in rural Alaska, where vast distances, severe climate, difficult terrain, and a widely dispersed population make middle-mile deployment difficult and costly. These same conditions that hamper build-

[1] For purposes of these comments, references to "terrestrial" facilities include both land-based technologies and undersea cable facilities.

out efforts also heighten the need for broadband communications to connect remote villages, families, students, health care professionals, first responders, and employers to the rest of the nation and the world. Accordingly, GCI welcomes the Commission's decision to focus the *Middle-Mile Public Notice* on the middle-mile problem in such "rural, unserved, and underserved" communities.[2]

Alaska's Second/Middle-Mile Problem

In Alaska, some communities are on the road network, while others are hundreds of miles from the nearest road and accessible only by airplane, boat, snowmobile, or dog sled. Population centers in these off-road communities are tiny, with larger regional hubs like Barrow and Nome boasting populations of only 4,000 and 3,500, respectively, and many isolated villages, such as Kupreanof, Kasaan, Bettles, and False Pass, having less than 50 residents. These communities beyond the road network – with some exceptions, primarily in southeast Alaska – lack even the basic communications infrastructure present in the lower 48. Modern digital cellular phone networks, for instance, are just now coming to much of Alaska.[3]

Moreover, most Alaskans depend almost entirely on satellite technology to transport traffic across the middle mile. But satellite service is expensive, has limited throughput capacity and inherent latency and, thus, is not ideal for widespread, intensely used broadband services for the mass market. Satellite links simply cannot deliver

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[2] *Comment Sought on Impact of Middle and Second Mile Access on Broadband Availability and Deployment*, Public Notice, GN Docket Nos. 09-47, 09-51, and 09-137 at 1 (rel. Oct. 8, 2009) ("*Middle-Mile Public Notice*").

[3] *Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993; Annual Report and Analysis of Competitive Market Conditions With Respect to Commercial Mobile Services*, Thirteenth Report, 24 FCC Rcd. 6185, 6358-59 (2009) (demonstrating the dearth of digital cellular coverage in most of Alaska).

economically feasible, urban-quality residential broadband Internet service. The challenge, therefore, is to replace satellite middle-mile transport with technologically and economically viable terrestrial middle-mile delivery, both within these remote, off-road regions and between these regions and the Internet backbone.

In contrast, Alaska's three largest markets – Anchorage, Fairbanks, and Juneau – although small by national standards,[4] have access to "adequate, reasonably priced, and efficiently provided" second-mile and middle-mile capacity to transport traffic to the Internet backbone. Like many metropolitan areas throughout the country, these communities, most of which are located on Alaska's comparatively limited road network, can obtain advanced broadband services on a competitive basis via GCI's hybrid network of coaxial and fiber optic cable, as well as from networks of incumbent competitors.[5] Because none of Alaska is on the Tier 1 Internet backbone, Alaska's middle mile has a second part, namely transport via fiber (both on land and undersea) from Anchorage, or

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[4] Anchorage has only approximately 365,000 people, ranking 137th nationally. Fairbanks has 98,000, ranking 344th. Juneau has only 39,000, ranking it 816th out of the 953 metropolitan and micropolitan statistical areas. Office of Management and Budget, Executive Office of the President, OMB Bull. No. 09-01, Update of Statistical Area Definitions and Guidance on Their Uses (2008), *available at* http://www.whitehouse.gov/OMB/bulletins/fy2009/09-01.pdf (listing, but not ranking, the metropolitan and micropolitan statistical areas); *see also* U.S. Census Bureau, Cumulative Estimates of Population Change for Metropolitan and Statistical Areas and Rankings: April 1, 2000 to July 1, 2008, *available at* http://www.census.gov/popest/metro/CBSA-est2008-pop-chg.html; Cumulative Estimates of Population Change for Micropolitan Statistical Areas and Rankings: April 1, 2000 to July 1, 2008, *available at* http://www.census.gov/popest/metro/CBSA-est2008-pop-chg.html.

[5] Some of the areas surrounding Juneau are not connected by roads, but nonetheless are served by fiber middle-mile connections because Juneau is the seat of state government, has higher population densities, and has relatively easy access to undersea cable. Accordingly, it is more cost effective to serve the surrounding rural communities via short fiber spurs.

in some cases Juneau, to the nearest Tier 1 Internet backbone providers in Seattle.[6] This transport requirement is well served today by multiple undersea fiber cables connecting Anchorage to the lower 48.

But GCI is committed to providing modern broadband service not just to these relatively populous areas, but over time to as many of the sparsely inhabited, off-road regions as it can on an economically feasible and sustainable basis. To that end, GCI operates, through its affiliate Unicom, Inc. ("Unicom"), DeltaNet, which is a terrestrial microwave second-mile network in the remote Yukon-Kuskokwim Delta ("Y-K Delta"). DeltaNet was financed largely by three loans from the Rural Utilities Service's ("RUS") Distance Learning and Telemedicine Program. DeltaNet connects about 40 rural villages, including Eek (population 272), Tuntutuliak (population 417), and Quinhagak (population 661), to Bethel, the regional hub (population 5,665) via terrestrial microwave facilities.[7] Bethel, in turn, links to the fiber network in Anchorage via two satellite networks. These terrestrial facilities significantly improve the quality of service within the region. Indeed, the majority of DeltaNet traffic is in-region, providing high-speed medical and educational services to villages surrounding Bethel. All out-of-region traffic originating or terminating on this system – to or from Anchorage, the rest of Alaska, or the rest of the United States and world – still traverses a satellite link, thereby continuing to impede high-speed, cost-effective consumer Internet service. GCI has developed a

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[6] As shown in Figure 1 below, GCI has deployed fiber optic cable in many of the areas in southeastern Alaska surrounding Juneau. The traffic from these communities is typically routed directly to Seattle.

[7] Alaska Division of Community and Regional Affairs, Alaska Department of Commerce, Community, and Economic Development, Alaska Community Database Community Information Summaries, http://www.commerce.state.ak.us/dca/commdb/CIS.cfm.

plan to provide middle-mile connectivity from Bethel to Anchorage using a hybrid microwave/fiber network, and has applied for Broadband Initiatives Program/Broadband Technology Opportunities Program ("BIP/BTOP") funding through its wholly owned subsidiary, United Utilities, Inc., for funding to support this plan.

The Business Case is Difficult

GCI has a vision, the TERRA project, for replicating the success of DeltaNet in four other regions up the western and northern coasts of Alaska and tying together those regional networks to each other and back to the Internet backbone in Anchorage, thus delivering for the first time middle-mile terrestrial broadband service to villages in each of those five regions.[8] Figure 1 below depicts the potential deployment.

[8] In addition to expansion in the Y-K Delta (Bethel), the TERRA project will likely include Bristol Bay (Dillingham), the North Slope (Barrow and Prudhoe Bay), Norton Sound (Nome), and the Northwest Arctic (Kotzebue) regions.

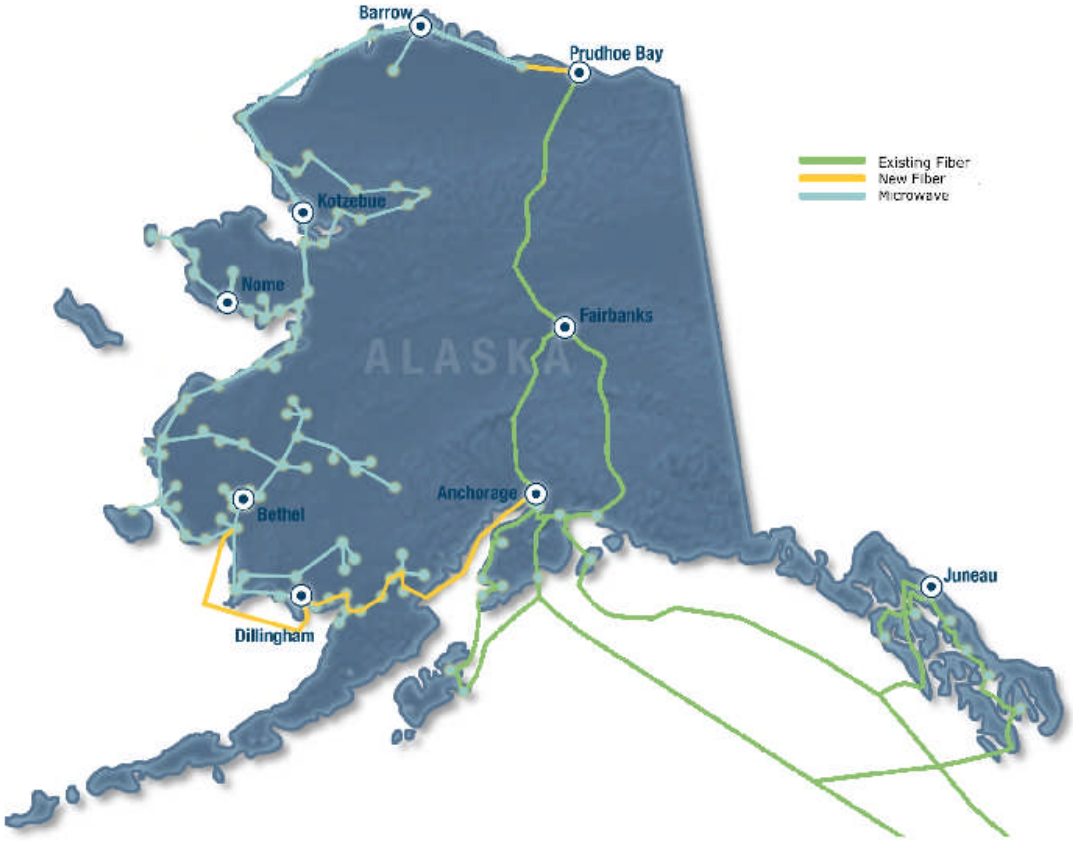

Figure 1

To make regional network infrastructure (second mile) deployment and operation in the four regions both feasible and sustainable, GCI will need anchor tenants – large health care providers, educational institutions, or government entities. Although the revenues generated by such anchor tenants can justify, in many instances, the deployment of such second-mile, regional networks, the business case for deployment of the terrestrial middle-mile facilities necessary to link those regional networks back to the Internet backbone in Anchorage is problematic. The revenue generated by anchor tenants alone is not adequate to justify the capital investment for the middle-mile facilities, and residential users in the region have a limited ability to pay for terrestrial broadband service. Solving this business case problem requires the outside support components that

made DeltaNet a success and also may require GCI to (i) identify lower-cost technical solutions, (ii) develop or find new middle-mile revenue streams, and/or (iii) find partners to help shoulder the deployment burden.

What Government Can Do

Deployment of broadband services in rural Alaska will require the continuation of existing support mechanisms, as well as the creation of new sources of support. Existing broadband deployment support loan/grant programs at RUS and high-cost universal service support and programs, such as E-Rate discounts for rural schools and the Rural Health Care programs under the auspices of the Universal Service Fund ("USF"), are critical to GCI's deployment of broadband services. In many areas, GCI relies on universal service support to construct last-mile facilities to provide rural Alaska with voice services, with supported wireless last-mile networks also easily capable of being upgraded to provide advanced broadband services once the middle mile has sufficient capacity to make the added data speeds usable.

The Commission should also add broadband to the list of services that the Lifeline/Link Up program supports, which would be particularly beneficial in tribal lands, providing customer-driven, demand-side assistance that can reduce the price point for broadband, increase broadband adoption rates, and, in turn, allow rural providers to expand build-outs and leverage existing infrastructure to provide advanced services. Such support to end users could generate a strong broadband customer base, replicating the successful support programs for voice services. Grants or loans to anchor tenants for equipment to support advanced telecommunications services, such as distance education and telemedicine can also stimulate demand for bandwidth, which, in turn, can justify

deploying the basic infrastructure to support the mass market. As discussed further below, the availability of such end user funding has been a significant factor with respect to the success of DeltaNet.

However funded, GCI foresees a five- to ten-year timeframe for construction of a TERRA-style terrestrial middle-mile network. Given Alaska's unique challenges in terms of terrain, weather and environmental considerations, and the extremely short construction season available in most of Alaska, unrealistic timetables are unlikely to speed deployment and should not be encouraged. It will never be reasonable to expect Alaska to deploy a network on a Sunbelt construction schedule.

GCI now responds to specific Commission questions.

1. Network Components of Broadband Connectivity

As an initial matter, most of rural Alaska does not have what the Commission defines as the second mile, "the transport and transmission of data communications from the first point of aggregation (such as a remote terminal, wireless tower location, or HFC node) to the point of connection with the middle mile transport."[9] End users in off-road communities are so spread out that there is often only a single aggregation point, which is collocated at or very near the satellite termination point that carries traffic over the middle mile to the fiber network in Anchorage. So, for instance, the Internet traffic from a village served by a last-mile Wireless Internet Service Provider ("WISP") network may

[9] *Middle-Mile Public Notice* at 1.

aggregate at the WISP antenna attached directly to the satellite earth station, or the distance can be spanned by a short microwave hop.[10]

DeltaNet, however, is an example of successful second-mile broadband infrastructure in remote Alaska. The terrestrial microwave network presents a solution for the technical, capacity, and bandwidth issues that hamper satellite service, but only for intraregional (village-to-village and village-to-regional center) communication. This is particularly important for regional anchor tenants, such as rural healthcare providers and schools. All traffic aggregated at the regional hub in Bethel exchanged with points outside the region, however, must traverse a satellite link to or from Anchorage, thereby introducing impediments such as limited capacity and latency that satellite technology presents in offering high-speed, cost-effective consumer Internet service.

Capacity

The Commission seeks comment regarding the amount of middle-mile and second-mile capacity required to provide adequate broadband Internet access to consumers and small businesses in any given area.[11] Based on empirical analysis of historic and current usage data, GCI today budgets approximately 50 kbps of second/middle-mile capacity per mass market user regardless of technology for an advertised up to 1 mbps download Internet access service. GCI closely monitors network congestion and has found that per-user capacity below 50 kbps can degrade the user experience at the advertised speed during peak usage. Thus, to provide an advertised speed of up to 1 mbps download service to a village of 100 subscribers, GCI would need

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[10] The same is also true for voice networks. There is usually a single switch for a local exchange carrier, which then can be collocated with an earth station or reached by a short terrestrial transport facility.

[11] *Middle-Mile Public Notice* at 2-3.

to provision 5 mbps of middle-mile capacity. While generous in most circumstances, 50 kbps per subscriber is not difficult to achieve in most fiber-connected communities and allows access to advanced applications without congestion.

This provisioning metric, however, works best with a critical mass of end users, rather than for small populations. For example, at 50 kbps of middle/second-mile capacity per user, GCI would need at least 20 users to provision just the 1 mbps of middle/second-mile capacity necessary to allow even a single user to receive an advertised 1 mbps service. Similarly, to provide the 3 mpbs downlink service suggested as desirable in the BIP/BTOP Notice of Funds Availability,[12] at 50 kbps per subscriber, GCI would need at least 60 subscribers to allow even one user to receive the 3 mbps advertised speed at any given time. There are many remote villages, however, with less than 20 subscribers and less than 60 households, and it is unrealistic to provide an adequate user experience by provisioning only the minimum middle/second-mile capacity required to meet the service requirements for a single user.

Thus, to serve smaller communities, GCI cannot rely on the 50 kbps metric, but instead must over-provision middle/second-mile bandwidth and offer lower advertised speeds. In Larsen Bay, for example, GCI serves 5 Internet subscribers at a bandwidth of up to 512 kbps. Using the 50 kbps-per-user metric here, GCI would theoretically be able to provide only 250 kbps of second/middle-mile capacity. Thus, not even one of the five

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[12] *See, e.g.,* Department of Agriculture Rural Utilities Service Broadband Initiatives Program and Department of Commerce National Telecommunications and Information Administration Broadband Technology Opportunities Program, Notice of Funds Availability and Solicitation of Applications, 74 Fed. Reg. 33104, 33130-31 (defining unserved and underserved as areas lacking minimum broadband transmission speeds of 768 kbps downstream and 200 kbps upstream and citing broadband transmission speeds of 3 mbps downlink as a desirable level of service).

users could access the service at the advertised speed at any given time. In this situation GCI elects to over-provision at greater than 50 kbps per user to achieve the required service quality, thus significantly increasing the cost of providing service. To provide a 1 mbps service, GCI would have to over-provision at a rate of more than 200 kbps per user, at a bare minimum. Even provisioning second/middle-mile capacity at this level would still result in congestion if two of the five subscribers were using bandwidth-intensive applications at once. That level of per-user capacity is simply uneconomical over a satellite middle mile.[13]

GCI's provisioning metric reflects today's engineering rule-of-thumb based on current usage data, but is not static. Rather, GCI vigorously watches for capacity saturation and service congestion and periodically increases its estimates. Based on past growth and current usage, GCI operates under the assumption that the demand for Internet bandwidth capacity will increase by 3% per month for the foreseeable future (or 43% per year), and attempts to stay ahead of bandwidth demand. Already lagging behind, satellite will not provide a cost-effective method to keep up with ever-increasing bandwidth needs for the mass market at these growth rates.

Technology Options

The Commission also requests comment on the technology options available to provide second/middle-mile capacity over the next five to ten years.[14] GCI hopes to migrate most of its second/middle-mile traffic from satellite to a mix of terrestrial

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[13] Satellite-based bandwidth pooling can group multiple small communities into a single provisionable entity, served by a single earth station, thus partially mitigating the small population per community issue. However, even pooled user counts often remain small enough that per-user bandwidth provisioning requirements are not economically sustainable.

[14] *Middle-Mile Public Notice* at 4-5.

microwave systems and fiber technology over that time period. This fiber/microwave hybrid approach is best suited to meet the challenges of the harsh Alaskan terrain, as well as complying with complex permitting requirements across federal lands with differing restrictions while offering the best case for economic stability of a terrestrial system. Microwave towers can be deployed over mountains and other areas where it is more costly or operationally impossible to use fiber, but with fiber, especially undersea cable, deployed where it will be most economical. By expanding the geographic scope of deployment of this technology over time, GCI intends to reduce its reliance on satellite for backhaul, providing a regional broadband service and a critical piece of the middle-mile solution.

Despite the inherent technical and economic limitations, however, GCI anticipates that the most geographically isolated villages in the Alaskan interior will be connected by satellite for the foreseeable future. Transferring traffic from satellite to terrestrial facilities in the coastal population centers will free additional satellite capacity to improve service to interior areas, but latency and cost constraints will continue to be a challenge for satellite-served areas.[15]

2. Availability and Pricing of Middle and Second Mile Connectivity

The Commission seeks comment generally on the pricing and availability of connectivity to the second and middle mile, "with a focus on rural, unserved, and

[15] As more traffic moves to terrestrial networks and continues to grow, and with more satellite capacity dedicated to specific, sparse routes, satellites will be worse at providing adequate capacity redundancy for outages. In that case, it is important that terrestrial networks provide a measure of redundancy, such as through self-healing rings.

underserved areas."[16] More specifically, the Commission asks what portion of the overall cost of providing broadband Internet service is attributable to second-mile and middle-mile service.[17] As discussed above, second/middle-mile access is typically available at competitive rates via fiber optic cable in most communities along the road network, as well as many off-road communities in Southeast Alaska. For these communities, access to the second and middle mile is competitively priced and does not impose a barrier to broadband Internet service.

In most of the off-road rural regions, by comparison, middle-mile satellite transport is very expensive and, indeed, is the biggest cost impediment to bringing advanced broadband services to rural Alaska. Even in the Y-K Delta, where DeltaNet has largely solved the second-mile capacity problem, traffic from rural villages still relies on satellite to bridge the middle mile from Bethel to the fiber network in Anchorage.

Almost all of the cost of delivering Internet or inter-region traffic is incurred in the building and operating of the satellite middle mile. Last-mile connectivity is provided through relatively inexpensive WISP networks, enhanced coaxial cable networks, or existing incumbent local exchange carrier copper lines. Mobile broadband would also present an economically viable last-mile option, but is similarly dependent on the availability of cost-effective second/middle-mile capacity to connect the terrestrial mobile towers with the fiber network.

Satellite capacity is comparatively expensive, and this expense does not decrease as additional users occupy bandwidth. Rather than enjoying economies of scale as demand increases, greater demand for satellite bandwidth requires additional costly

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[16] *Middle-Mile Public Notice* at 3.

[17] *Id*. at 3-4.

transponders to meet demand. Moreover, the supply of such transponders is finite in comparison to fiber-served routes with theoretically endless capacity.

With regard to pricing methods, middle-mile connectivity in Alaska via satellite for broadband services to rural communities is based on individually negotiated contracts, not tariffed rates.

3. Availability and Pricing of Internet Connectivity

The Commission asks for information concerning the pricing and availability of capacity from Internet backbone providers necessary to provide broadband Internet service to end users.[18] Affordable Internet backbone connectivity is readily available via this route, and the price, though variable, is nominal compared to the cost of second/middle-mile connectivity to rural areas. As mentioned, there is no Tier 1 Internet backbone connection in Alaska. To reduce the cost of Internet backbone access, GCI mostly transports its own traffic via fiber to and from Anchorage and connects directly to Tier 1 providers in Seattle. Peering arrangements for connectivity with large content providers such as Google, Microsoft, and Yahoo! also reduce the price of Internet backbone connectivity, but only larger ISPs have the capability to develop and technically manage these relationships. The cost per megabyte is much lower in a direct peering relationship, but smaller ISPs generally do not have this option.

The Commission also asks whether concentration ratios used by broadband ISPs in purchasing Internet backbone connectivity can be affected by caching, and to what degree.[19] In GCI's experience, caching can reduce second and middle mile capacity requirements, but only to the extent that a sufficient number of users in a last-mile

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[18] *Id*. at 3.

[19] *Id*. at 5.

network populate the cache with enough useful, frequently accessed information. On rural systems, with few people, the cache is not likely to be sufficiently populated to meaningfully enhance efficiency.

4. Economics of Deployment

The Commission requests comment about the economics of deploying middle/second-mile facilities.[20] As discussed, the capital and operating expenditures necessary to deploy and maintain such facilities in rural Alaska are high because vast distances, harsh terrain, extreme environmental conditions, and complex and limiting permitting processes make it difficult to build out the second and middle miles to the sparse, widely dispersed population. Achieving an adequate return on large rural investments is difficult because of the economically thin rural Alaska market (low average income/ability to pay coupled with a scarcity of potential anchor tenants) and the need to over-provision capacity to smaller communities.

The Commission also asks whether the availability of adequate, reasonably priced, and efficient middle-mile and second-mile transport infrastructure in an area is limited by access to capital.[21] For rural Alaska, the answer is yes. GCI has invested hundreds of millions of dollars to bring telecommunications service to its customers, not only in Alaska's cities and towns but also in its most remote villages. As a public company with responsibilities to its shareholders and creditors as well as to its customers, GCI has an obligation to develop a feasible and sustainable business plan with an appropriate return on invested capital to justify all of its investments. Otherwise, it will be unable to raise the required capital in the debt and equity markets.

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[20] *Id*. at 6.

[21] *Id*.

There is a feasible and sustainable business case underlying GCI's investment in DeltaNet. The Yukon-Kuskokwim Health Corporation ("YKHC") is the anchor tenant on DeltaNet, purchasing broadband connectivity from GCI and Unicom to provide a bandwidth intensive health service, including advanced high-definition video services for telepsychiatry and ophthalmology, which benefit significantly from low-latency, symmetrical, highly scalable bandwidth. YKHC's broadband purchase is supported substantially by rural health care USF support. Moreover, YKHC itself received a telemedicine grant from RUS that allowed it to purchase the high definition video conferencing endpoints and other equipment necessary to support telemedicine applications, without which YKHC would have had less of a need for broadband capability. The demand from YKHC and other large Y-K Delta institutions justified the build-out, which in turn inured to the benefit of remote village residents.

GCI believes that it can develop feasible and sustainable business plans in the current funding environment (including existing RUS and USF programs) for some, but not necessarily all, of the second-mile facilities for four additional regions targeted by TERRA. As noted above, however, developing a feasible and sustainable business plan for terrestrial middle-mile facilities to link regional networks to one another and back to Anchorage is far more difficult.

Thus, despite the general availability of capital, "some government subsidy or action is necessary to facilitate construction of second mile and middle mile facilities."[22] Some of that may be for access to capital, as through the RUS Distance Learning and Telemedicine or BTOP Programs, and some may be to support an anchor tenant's

[22] *Id*.

capacity to utilize new network capabilities to deliver critical public benefits to their communities. Success of similar networks will likely require similar government commitments, and will likely also require the development of (i) lower-cost technical solutions, (ii) new middle-mile revenue streams, and/or (iii) partnerships among providers to share the deployment burden.

In addition to loan programs and large equipment grants, the Commission must maintain existing high-cost and Lifeline subsidies to support last-mile infrastructure that provides voice telephony services to unserved residents. Although USF does not directly support middle-mile broadband connectivity, removing existing USF funds would hinder the ability to provide end-to-end broadband services to rural Alaska due to the shared infrastructure used to deliver telecommunications services in modern networks. Indeed, GCI's last-mile wireless platform currently providing voice service can be easily upgraded to provide advanced broadband services once the middle mile has sufficient capacity to make the added data speeds usable.[23] More directly, however, GCI believes that it is time to include broadband service as a supported service under the Lifeline/Link-up programs. Customer-driven, demand-side support will help to lower the price point for rural broadband adoption and improve the business case for deploying second/middle-mile infrastructure. Moreover, the ability to extend infrastructure critical to the delivery

[23] The Commission asks to what extent providers self-provide or integrate components of middle-mile and/or second-mile transport. *See Middle-Mile Public Notice* at 6. GCI self-provisions as much as possible to provide service from end to end, which is unique in the rural Alaskan market. Self-provisioning allows GCI to leverage telephony services as part of its business model for deploying infrastructure in a given location. In urban areas (Anchorage, Fairbanks, Juneau, and their suburbs, such as the Matanuska Valley) and in many of the regional centers, GCI is upgrading its cable plant and will provide telephone service predominantly over its own cable facilities, supplemented by resold services when necessary.

of robust mass market broadband services will further depend on advancements in cost-effective technology solutions, availability of additional revenue streams, and/or partnerships among providers to share the risk of building a network sufficiently robust to attract the anchor tenants necessary to support the business case. Ultimately, GCI estimates that bringing terrestrial middle/second-mile service to 50% of rural Alaska will require approximately $300 million in capital investment over the next five to ten years.[24] GCI is looking at every opportunity (including new technology, new revenue sources, and partnering) to enable a TERRA-style deployment. At the end of the day, deployment may depend on augmenting existing available support mechanisms. The Commission should, however, be wary of launching pilot and/or one-off subsidy programs that may create unsustainable "white elephants" or interfere with the operation of the market in a way that erodes the ability of GCI and other providers to maintain and enhance their existing rural service offerings. Such programs run the risk of wasting scarce federal dollars when market solutions are identifiable, funding unsustainable projects, and undermining existing private capital investment in network infrastructure – all to the detriment of taxpaying consumers. In contrast, access to government-backed loans and demand-side support can greatly enhance the ability of providers in the marketplace to bridge the second/middle-mile gap.

The Commission can also help reduce the costs of deployment by coordinating and streamlining the myriad licensing and permitting processes necessary to build a terrestrial second/middle-mile network. The costs and time required to navigate the zoning, environmental, tribal, historic, and FCC permitting procedures – each with its

[24] This estimate assumes that some parts of interior Alaska will likely remain satellite-served for the foreseeable future.

own process and governed by a different tribal, local, state, or federal entity – erects significant barriers to deployment. Thus, the Commission should do what it can to coordinate, consolidate, and expedite regulatory and licensing processes.

5. Nature of Competition and Availability of Alternatives

Finally, the Commission asks how firms compete in providing middle-mile transport services.[25] As discussed above, larger on-road communities typically are served by competing providers, offering choice for broadband service at fairly standard rates. Because most middle-mile connectivity to rural off-road communities in Alaska is provided by satellite, however, broadband service is typically provided according to contracts with individual pricing and/or competitive requests for proposals. Most Alaskan satellite-served areas have at least two providers, AT&T and GCI, and sometimes more, but there are still some areas – mostly small villages – where AT&T is the only provider. In GCI's experience, the price for satellite middle-mile connectivity generally decreases to some extent when a second middle-mile provider enters the market, but not dramatically, because the high fixed cost of operating satellite networks leaves little room for price reductions for either satellite facilities-based provider. However, given the high rate of growth for Internet traffic, the current market structure and economics cannot be assumed to be stable, as it will be extremely expensive, and likely impossible, for satellite-based providers to add satellite capacity to keep pace with traffic growth.

As discussed, the front-end costs of deploying terrestrial microwave/fiber to solve the second/middle-mile problem are substantial. Thus, to ensure a reasonable capital

[25] *Middle-Mile Public Notice* at 7-8.

recovery period necessary to justify private investment in such terrestrial facilities, the front-end retail prices are comparable to current satellite-based services. For those prices, however, the customer receives a much higher quality offering, enabling access to advanced broadband applications and services that satellite cannot reasonably provide. And, once costs of build-out are recovered, customers may enjoy the benefits from economies of scale that will reduce prices.

Conclusion

GCI is dedicated to furthering the Commission's goal of delivering the best broadband services to Alaskans as quickly as possible, even in the most remote villages, and improving the availability of cost-effective, high-capacity, terrestrial second/middle-mile transport facilities. Informed by experience serving the entirety of Alaska, GCI believes that terrestrial facilities can fill the second-mile and middle-mile void over a ten-year time horizon with continued access to government-backed capital, sustained support programs to anchor tenants, and the addition of broadband to Lifeline-supported services. With the support of these measures, the marketplace can ensure that the broadest possible subscriber base has affordable access to residential broadband services.

Respectfully submitted,

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