Achieving the Vision of Universal Broadband: Lessons from North America for Developing Regions

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Abstract:

Remote regions of North America share many of the characteristics of rural regions of the developing world and the islands of the South Pacific: small populations, long distances between settlements, and low or subsistence income levels.

This paper analyzes three issues from these northern regions of North America that confront those striving to extend universal broadband to rural and developing regions, such as the island nations of the South Pacific:

- **Availability** of facilities to provide connectivity
- **Affordability** of broadband services
- **Spectrum** for fixed and mobile broadband.

Availability is often hindered by assumptions of high costs and low revenues by prospective providers, discouraging them from extending or upgrading services. Capital subsidies may be required to provide incentives to providers to serve these regions. As a case study, the paper examines criteria for implementation of the Canadian Broadband Fund, a CAD750 million allocation over five years that was mandated by the Canadian regulator (the CRTC) as a component of its decision that broadband is a basic service to be available to all Canadians – including those in rural and remote regions.

Affordability can remain a challenge even when capital investments have been made for installation of broadband facilities in underserved regions. Operating costs may be high, whereas remote individual and institutional users tend to have limited incomes and budgets. Examples of competition in both Alaska and the Canadian North demonstrate the feasibility of opening rural and remote regions to competition. Examples from the U.S. are discussed that have been critical to providing affordable broadband in Alaska include operating subsidies to serve schools, libraries, and rural health care centers, and subsidies for low income residents.

Spectrum: Mobile and fixed wireless broadband as well as satellite services require spectrum allocations to serve rural and remote regions. Typically, access to spectrum is not an issue in rural regions because there are few providers and demand is limited. However, some spectrum is particularly appropriate for serving remote regions, such as C-band satellite frequencies, which are in widespread use and are generally not affected by rain, dust, or snow. Currently, these

frequencies are also coveted for 5G mobile wireless. This case study examines how these spectrum challenges that affect remote regions are being addressed in the U.S. and Canada.

The paper concludes with a summary of lessons in policies and strategies from these cases that are relevant for other isolated regions such as least developed countries (LDCs) and the island nations of the South Pacific.

KEYWORDS: Broadband, rural, policy, 5G, satellites, Pacific, Alaska, Canada

1. Introduction

Remote regions of North America share many of the characteristics of isolated regions of the developing world and the islands of the South Pacific: small populations, long distances between settlements, and low or subsistence income levels.

This paper analyzes three issues from these remote regions of North America that confront those striving to extend universal broadband to rural and developing regions, such as the island nations of the South Pacific:

- **Availability** of facilities to provide connectivity;
- **Affordability** of broadband services;
- **Spectrum** for fixed and mobile broadband.

2. Availability

Availability is often hindered by assumptions of high costs and low revenues by prospective providers, discouraging them from extending or upgrading services. In both Alaska and northern Canada, broadband access is limited. The U.S. Federal Communications Commission (FCC) currently defines broadband as 25 mbps down and 3 mbps upload speeds. The FCC estimates that 92.3 percent of the U.S. population has access to 25/3 service, compared with only 46.3 percent in rural Alaska. Only 30.5 percent of rural Alaskans have access to mobile LTE service with 10 mbps down and 3 mbps up, compared to 87.3 percent of the U.S. population.[1]

Broadband availability is also limited in northern Canada. About 61 percent of households in the Yukon and 55 percent in the Northwest Territories (NWT) had access to fixed internet speeds of at least 25 mbps, while only 29.9 percent of households in Nunavut had access to speeds of at least 5Mbps and none had access to 10Mbps or higher speeds.[2] Wireless coverage in northern Canada is also lower than in any of the provinces, and the penetration rate was also lower at 64.5 percent (subscribers as a percentage of the covered population). The number of subscribers with a mobile data plan in the North in 2016 was less than 1 percent of the Canadian total, and the growth from the previous year was only 5.6 percent, the lowest of any Canadian region.[3]

Capital subsidies may be required to provide incentives to providers to serve these regions. In Canada, a broadband fund is being implemented to extend and upgrade broadband in rural and remote regions. Somewhat similar capex funds have been mandated in other countries; the

relevant issues here are **the context, the funding mechanism**, and the **specific criteria** proposed for implementation of the fund.

2.1. CRTC Broadband Fund

In April 2015, the Canadian Radio-Television and Telecommunications Commission (CRTC) announced a proceeding "to conduct a comprehensive review of its policies regarding basic telecommunications services in Canada and of the telecommunications services that Canadians require to participate meaningfully in the digital economy." It included an examination of how these telecommunications are used by Canadians to access "essential services", what prices they should be expected to pay, and which areas are unserved or underserved. The Commission also stated that it would consider whether broadband should be considered a basic service available to all Canadians, and "what its role should be in ensuring the availability of basic telecommunications services, particularly in rural and remote regions of Canada."

The proceeding also addressed whether a funding mechanism was required in the region of the incumbent telecommunications provider serving Canada's northern territories and adjacent regions, "to support the provision of modern telecommunications services by funding capital infrastructure investment in transport facilities as well as the cost of maintaining and enhancing these facilities. It also asked "whether such a mechanism should be considered for other rural and remote areas in Canada." [4]

The proceeding was noteworthy in its duration (more than 20 months from the original announcement until the decision, with multiple rounds of written submissions and three weeks of in-person hearings) and in the participation of several consumer representatives and Indigenous organizations. The Indigenous groups included providers of internet services in Nunavut and in the northern regions of seven provinces, where most isolated communities have no road access. The Indigenous representatives emphasized that broadband is important to their communities for education, health care, accessing government services, and operating businesses and nonprofit organizations, as well as to individuals for staying in touch with distant family and friends, e-commerce, and entertainment.

In its decision, issued in December 2016, the Commission stated its universal service objective (USO) as: "Canadians, in urban areas as well as in rural and remote areas, have access to voice services and broadband Internet access services, on both fixed and mobile wireless networks."[5] The CRTC also declared that basic telecommunications services within the definition of the *Telecommunications Act* include fixed and mobile wireless broadband services as well as fixed and mobile wireless voice services.

The CRTC set ambitious targets of 50 mbps download and 10 mbps upload actual speeds, considerably higher than some interveners had proposed. It justified these targets as necessary to keep pace with global trends, noting that "Many of Canada's trading partners … are implementing digital strategies to achieve download speeds of 50 Mbps or more within the next few years…."[6]

Some Indigenous and consumer organizations pointed out that market forces had not resulted in extending broadband facilities in much of the North. [7] The Commission appeared to agree, noting that it had previously relied on market forces and targeted government funding for the continued deployment of broadband Internet service, but would now establish a new fund to extend and upgrade broadband for rural and remote regions. A total of CAD750 million is to be allocated over five years, with up to 10 percent of the broadband funds available over the first five years to be allocated to satellite-dependent communities to support operational costs and some related capital costs.

Licensing Procedure

In its decision in September 2018, the Commission stated that it would manage the fund internally, and that it would use a "comparative process" to select applicants rather than a reverse auction, as some major carriers had proposed (with the lowest bid for subsidy selected for funding.) The fund requires comparative applications rather than a reverse auction and provides opportunities for participation by community and Indigenous providers. Participation in the consultation by these groups appeared influential in the decision not to rely on auctions.

Source of Funds

The stated source of funds is Telecommunication Service Provider (TSP), i.e. carrier, revenues, including from retail internet and texting services. Thus the fund does not rely on government budget allocations, in contrast to many other infrastructure funds.

Application Criteria

In fall 2018, the Commission initiated a follow-on consultation on how the fund was to be administered and on eligibility criteria for applicants. This phase of the fund implementation process was critical, as "the devil is in the details." What organizations would be eligible – would applications be open only to major incumbents, or also to small, community and Indigenous providers? What requirements would they have to satisfy in terms of technical and financial resources and relevant experience? For example, the Guide made specific reference to Indigenous governments as being eligible, but specified that the entity or at least one member of a partnership or joint venture should have experience in infrastructure deployment and be eligible to be licensed as a Canadian carrier.[8]

Following this proceeding, the CRTC took the unusual step of publishing and requesting comments on a draft Application Guide for the fund.[9] Several Indigenous and community providers and other small ISPs took advantage of the opportunities to file comments in the consultation process and on the draft Application Guide.

The First Mile Connectivity Consortium (FMCC)[1], a nonprofit association of First Nations internet service providers, stated that it was concerned that certain aspects of the draft of the Application Guide "reflect the interests of well-resourced, urban-based, corporate telecommunications providers and omit some of the unique considerations that apply to non-

[1] The author is an advisor to the FMCC and has contributed to its submissions.

profit and Indigenous providers."[10] The FMCC stated that the Commission needs to recognize the important distinctions between private sector commercial telecom providers, not-for-profit regional organization providers, and individual community providers.

The FMCC made several recommendations for changes in the proposed requirements in the Application Guide:

- **Community consultation:** The draft Guide stated "… an applicant must provide evidence that it has consulted, or *attempted to consult*, with communities affected by the proposed project, either directly or through community representatives at the provincial, territorial, and/or municipal level, or in the case of Indigenous communities, at the band council or Indigenous government level." FMCC stated that it is not sufficient to state that applicants attempted to consult. They must provide evidence that they have consulted with communities and provided clear information about proposed projects, including their responses to any issues raised by the communities. (Italics added)

- **Meaningful consultation:** The Guide listed a market study as an example of consultation. FMCC stated that consultation should also include "meaningful consultation and informed consent" in the case of Indigenous communities. They noted that a market study is not adequate evidence of consultation because it could be done using available information (e.g. population, average income, public institutions, local businesses, etc.) without any interaction with the community.

- **Required investments by applicants:** FMCC stated that this requirement should vary depending on the status of an organization. For example, for Indigenous and/or nonprofit organizations, it should include reduced or waived financial contributions and in-kind contributions in lieu of cash contributions.

- **Coverage criteria:** The draft Guide stated that a mobile project would be considered to be of higher quality based on how many households would be covered by the project. FMCC pointed out that a criterion of number of households served will penalize applicants proposing to serve small remote communities. Therefore the "whole community" approach should be used to determine both the need for and the quality of the project (including anchor institutions, local businesses and organizations, community entities, etc. as well as households).

- **Open Access:** need for clarification. FMCC stressed that a clear understanding of Open Access requirements in both wholesale and retail contexts is an important part of ensuring competition, innovation and affordability, and should be clearly defined in the Guide for both applicants and the community representatives.

- **Limitations of rural data:** The CRTC specified maps and data sets to be used to determine available connectivity and project eligibility. The FMCC pointed out that there is limited reliable, robust connectivity data currently available in many rural and remote regions of Canada. This lack of data hinders attempts to monitor whether progress is being made to deliver improved broadband to these areas and may also be misleading.

For example, a single point of connection is interpreted as indicating the availability of services for a whole community, whereas there are many examples of First Nations with variations in access within a community. FMCC stated: "We reserve the right to correct and/or augment information in these maps and data sets."

- **Compliance and enforcement conditions** in the draft Guide were vague. FMCC stated that the Guide should specify that compliance and enforcement of obligations are required for all licensees and for funded projects. The language should include how oversight will be provided, and how compliance will be enforced.

- **Time required to apply to review and rescind, or vary a decision**, which the Commission proposed to limit to 30 days: FMCC proposed 90 days because "Indigenous organizations may require more time to get information on the decision to partners, consult with communities, and formulate a response to any issues of concern raised in the funding decision. … [c]ommunity consultation must be required to discuss the outcome and next steps concerning a negative funding decision."[11]

3. Affordability

Northern residents in both Alaska and Canada pay substantially more for Internet access – and for much more limited bandwidth – than do urban residents. Research carried out by the author and colleagues in northern Canada found that affordability is a major constraint for some northern Internet users, with numerous participants stating that usage caps made it difficult to take full advantage of Internet access and that basic monthly charges were not affordable for people on fixed incomes.[12] These findings are similar to those in studies carried out by Hudson et al. in southwest Alaska in 2012 and 2015.[13]

The lack of sufficient broadband in many communities and the high prices, including overage charges, result in what could be called the paradox of northern broadband. Underserved users say they need more bandwidth, but users with broadband access say they cannot afford to use as much bandwidth as they need to participate in the digital economy. Businesses and organizations cannot afford to use services as much as they would like such as webinars, Skype, videoconferencing, and cloud-based services. Residents say they can't afford enough bandwidth and data for social media and distance education.

3.1. Northern Canada

In the CRTC's Basic Service consultation discussed above, consumer representatives, Indigenous organizations, and individual citizens emphasized that Internet services, and broadband where available, are not affordable for many Canadians. Of particular concern to Northerners are data caps on fixed networks which result in expensive overage charges, especially as households are large, with many family members sharing a single connection. Often, subscribers are unaware of these overage charges until they receive their bill, resulting in what the CRTC called "bill shock." [14]

Subscribers in Iqaluit (the capital of Nunavut) paid $180 per month for 5 Mbps Internet service.[15] However, many communities in the remote North pay more for less. Data caps on downloads also limit the utility of broadband access. For example, in Igloolik, a community of about 1700 inhabitants in the central Arctic, residents would pay a total of $1075 per month. to download the Canadian average of 93 GB (assuming they could do so over the slow connection).

In its Basic Service decision, the CRTC chose not to address affordability directly, rejecting a proposal by a consortium of consumer groups to introduce a low income user subsidy similar to the Lifeline program in the U.S.(see below)[16] It did, however, take steps to address "bill shock" by setting a six month deadline for ISPs to include plain language in their bills for customers with overage charges about data used for common online activities, alternative data plans, and account management tools. Also, the Commission established as part of the USO that Canadians must have the option of subscribing to fixed broadband service with an unlimited data allowance – although no pricing guidelines or ceilings were specified.

3.2. U.S.: Alaska

Lack of Competition

In much of rural Alaska, prices for internet access also remain high. Rural middle mile has become a quasi-monopoly, and high wholesale prices discourage resale, which might provide lower prices or packages suitable for various categories of subscribers. Middle mile networks and pricing are unregulated at both the state and federal levels.

Targeted Subsidies

The U.S. provides several subsidy programs which are targeted at high cost regions and low income subscribers. In addition to capex funding, there are several operating subsidies available to Alaska broadband providers.

- **The Lifeline Program**, which provides subsidies for low income subscribers, now applies to both voice and data services.

- **The FCC's Connect America Fund (CAF)** will ultimately replace all High Cost support, which carriers in Alaska receive to subsidize their operations and thereby the price of services to subscribers. Eligible providers must offer both voice and broadband (previously, only voice services were required). For Alaska, the Commission adopted an "Alaska Plan" at the request of several Alaska operators to provide Alaskan rate-of-return carriers with the option of receiving fixed amounts of support over the next ten years to deploy and maintain their fixed and mobile networks.[17]

- **Other capex funds:** Alaska is eligible for several other FCC funding programs. The CAF Mobility Fund provides $300 million for mobile voice and broadband in high cost areas, plus $500 million per year in ongoing support. A fund for Tribal areas provides $50

million capital plus up to $100 million per year. The Remote Areas Fund has allocated $100 million per year.

- **The Schools and Libraries Program (known as the E-Rate)** allows qualified schools and libraries to request competitive bids to provide internet connectivity. Most Alaska rural schools qualify for a subsidy of 84 percent or higher, based on demographic and geographic criteria (low income and rural location). These schools and libraries often become "anchor tenants" for communities, because the operator that wins the contract is assured of a major revenue stream for internet services.[18]

- **The Rural Health Care Program** subsidizes the difference between cost of rural connectivity (e.g. at rural hospital) and comparable cost in major city in the state, i.e. Anchorage. Alaska has been a major beneficiary of this program, with subsidies greater than 95 percent of tariffed rates in some regions. One of the reasons for this high rate of subsidy is that prices have declined with increased competition in Anchorage, whereas rural rates with little or no competition have remained high.

These and other Universal Service Funds (USF) have been critical for Alaska, which has received more than $3 billion in USF funding since 1998. In contrast, with the exception of a relatively small high cost subsidy available to incumbent carriers with obligations to serve, there are no mandated operational subsidies in Canada.

4. Spectrum: Reallocations for 5G

4.1. The Need for Spectrum

Both the U.S. and Canadian governments have promoted the global and strategic potential of investment in 5G. The FCC stated: "These new services can unleash a new wave of entrepreneurship, innovation, and economic opportunity for communities across the country …. Moving quickly to enable this transition is important, as a new report forecasts that speeding 5G infrastructure deployment by even one year would unleash an additional $100 billion to the U.S. economy."[19] The Canadian government stated: "The development and deployment of 5th generation (5G) technologies will support Canada in becoming a global centre for innovation, and will allow Canada to be at the forefront of digital development and adoption through the creation and strengthening of a world-class wireless infrastructure."[20] Both governments seem willing to gamble on the "necessity" of plunging ahead with providing spectrum for 5G, without fully considering the implications for rural and remote communities.

Implementation of 5G, like other wireless services, depends on availability of suitable spectrum. The history of spectrum regulation has been marked repeatedly by the need to accommodate various new requirements for spectrum, and to balance the trade-offs, with efforts to share spectrum for various uses, to reallocate some frequencies for new services, and to move new applicants to as-yet unused parts of the spectrum.

Mid-band spectrum (around 3500 MHz) is attractive for mobile wireless providers because it allows use of smaller cells and therefore greater frequency reuse than lower frequencies. This spectrum is also useful for fixed wireless including point-to-point links in rural areas because it

offers more favorable propagation characteristics compared to higher bands. However, it is still used for "middle mile" microwave links in rural and remote areas where fiber backbone installation is prohibitively costly, such as over very long distances or through mountainous terrain (where mountaintop microwave transmitters can be used.

The 3.7-4.2 GHz band, known as C-band, is currently allocated in the United States exclusively on a primary basis for FSS (fixed satellite service) space-to-Earth downlinks and FS (fixed service) terrestrial services. Satellite operators use C-band for television transmission, typically to satellite stations where the signal is then retransmitted over cable networks or through local broadcast transmitters. They may also be used transportable terminals to uplink news, sports and other special events.

4.2. The Importance of C-band in Remote Areas

In remote areas, including Alaska and northern Canada, satellite operators transmit not only video but also interactive voice and data including internet services to and from isolated communities using these frequencies for the downlink. While higher frequencies for satellite transmission have been introduced, C-band is still preferable in the North because signals are not degraded by rain or snow, as can happen with higher satellite frequencies (such as Ku-band and Ka-band). Microwave towers using these frequencies have also been installed to extend broadband services in parts of Alaska and the Canadian North.

4.3. U.S. Proposals to Reallocate C-band

In 2018, the FCC opened a new proceeding (GN Docket No. 18-122) focusing exclusively on the 3.7-4.2 GHz band, seeking comments on how to protect incumbent earth stations, how much spectrum should be repurposed for flexible use including 5G, through what mechanism (i.e. market-based, auction, mixture), and under which timelines. In this docket it announced a temporary freeze on the filing of new or modified applications for earth station licenses, receive-only earth station registrations, and fixed microwave licenses in the 3.7-4.2 GHz band. It proposed that future applications for new earth station registrations would not be allowed, stating that "Limiting new earth stations in this manner would provide a stable spectral environment for more intensive terrestrial use."

Satellite providers raised strong objections over more intense use of FS in this band, as well as potential interference from mobile services. One satellite operator stated that "the interests of the most important stakeholders – i.e., the U.S. entities that rely on C-band satellite services to support critical communications – seem to be excluded from the decision making process." (FCC, 2018a)

The FCC requested comments on the economic benefits of introducing a new allocation for mobile in all or part of the 3.7 – 4.2. GHz band, as well as the social value of compensating satellite operators. However, its detailed proposals appeared to assume that the future economic benefits of 5G were worth the disruption of current FSS and FS services. The FCC suggested several approaches to addressing these disruptions. One proposed option is to compensate licensed earth stations in exchange for agreeing to no longer be licensed to receive in the 3.7-4.2

GHz band. It also suggested that the amount of spectrum repurposed should vary across geographic areas because in rural areas typically "the value of the spectrum remaining in FSS is relatively high while the opportunity cost of clearing less flexible-use spectrum is relatively low."

The FCC also proposes to sunset point-to-point FS services. It considers current point-to-point FS use of this band "minimal" with "only" 115 licenses, stating that "point-to-point FS use of the band has declined steeply over the past 20 years as common carrier and private operational fixed licensees migrated to fiber or other FS bands that offered more channelization options without the risk of interference disputes with earth stations and without the need to coordinate new or modified links within the band with GSO FSS."[21] However, this "minimal" use includes microwave backhaul in parts of Alaska and other regions without fiber backbone.

Freezing C-band satellite terminal registrations and sunsetting fixed service microwave have long term implications. In justifying the transition from satellite use of C-band, the FCC stated that FSS in the band is predominantly used for the delivery of video programming "with only a *de minimis* portion of the satellite capacity used to provide data services." However, with a permanent ban on new licenses for C-band satellite terminals, the FCC will effectively eliminate the opportunity for any future use of C-band satellites in the US, for both TVROs and interactive services in remote regions. Frequencies that have proved highly reliable and cost effective for FSS and FS services will no longer be available. There will be no incentive to continue to manufacture transmission and reception equipment for these essential services, regardless of whether or not this spectrum is put to use for 5G. And eventually new transmission equipment and antennas will have to be purchased and installed to replace the existing facilities.[2]

4.4. Canadian Proposals to Reallocate C-band

In 2018, the Canadian government[3] initiated a consultation on "Revisions to the 3500 MHz Band to accommodate flexible use and preliminary consultation on changes to the 3800 MHz Band" primarily to make these bands available for 5G services. Its stated objectives are to:

- "foster innovation, investment and the evolution of wireless networks by enabling the development and adoption of 5G technologies;
- support sustained competition, so that consumers and businesses benefit from greater choice; and
- facilitate the deployment and timely availability of services across the country, *including rural areas*."[22] (italics added)

As in the U.S., 3500 MHz spectrum is already used for other services such as satellite transmission and reception, and for fixed wireless broadband. Northern and remote communities

[2] At the time of submitting this paper, the FCC had not issued a final decision on future C-band satellite usage, having extended the period to receive comments on its proposals.

[3] The Canadian Radio-Television and Telecommunications Commission (CRTC) does not manage spectrum. The Ministry of Innovation, Science and Economic Development Canada (ISED), formerly Industry Canada, is responsible for spectrum management and licensing.

rely of some of these frequencies for telephony and internet services by satellites – the Fixed Satellite Service (FSS) – and in some regions by fixed terrestrial wireless systems (FS). These frequencies are also used in remote regions to transmit television signals for local over-the-air and cable distribution.

In its consultation paper, ISED proposed to accommodate 5G and existing services using these frequencies through a transition plan "that will allow for the timely deployment of mobile services in urban areas while providing rural providers of fixed services with more time to transition to [a] new flexible use system." Incumbent licensees that would interfere with planned deployment of new licensees in urban areas would be protected for six months, in surrounding regions for two years, while those in rural areas (population less than 30,000) would be protected for three years. Yet such protection does not guarantee that broadband services meeting the CRTC's speed targets of 50 Mbps down and 10 Mbps up would be made available in these rural regions.

Notably, licensees for large urban areas would be required to build out 30 percent coverage in the first 5 years, 50 percent after 10 years, and 70 percent after 20 years. These requirements are dramatically reduced for northern regions. After 20 years, licensees would be required to cover only 50 percent of the Northwest Territories population, and 25 percent in Nunavut.

Small ISPs, satellite providers and representatives of rural areas challenged various elements of the government's proposals. Small providers emphasized their need for spectrum and their role in rural connectivity: "The single most effective measure that the Government of Canada can take to promote rural broadband connectivity is to make spectrum available to small, regional, and rural service providers…. Making spectrum accessible to small companies in rural Canada will promote investment, innovation, employment, and economic development in rural Canada."[23] The importance of C-band satellite facilities for remote and northern regions was also noted by several satellite service providers and carriers that lease satellite capacity to serve the North, as well as the Canadian Broadcasting Corporation (CBC) which distributes radio and television programming via satellite in the North.

An association of First Nations providers stated that the issue is not timelines, but *available and affordable alternatives* to provide high quality broadband service in these regions and communities. "Therefore, services and frequencies for internet and broadband in the 3500 MHz band using fixed wireless and satellites should not be withdrawn in rural, remote and Indigenous regions and communities until reliable and affordable wireless broadband of at least 50 Mbps download and 10 Mbps upload is available using alternative technologies."[24]

5. Lessons for the Pacific and Other Regions

Economic benefits, social benefits, market forces, public interest, global competitiveness, universal access to reliable and affordable services – these often conflicting multiple goals face regulators and policy makers in many countries. While conditions vary, the experience in northern regions of the U.S. and Canada offers lessons relevant for other countries, especially those with rural or isolated populations.

Participation: Not all of the recommendations proposed above were adopted. Yet many changes were made in draft policies that would not have occurred without the participation of consumer organizations, Indigenous groups, and community and other small providers. It is imperative that such organizations participate in formal hearings and other proceedings by regulators and policy makers, rather than leaving testimony to the incumbents and their professional representatives.

The Details: While new funding sources to extend broadband and other services can help to bridge connectivity gaps, it is important to ensure that the terms of eligibility do not exclude potential competitors including small, Indigenous, and community providers, and that requirements for participation are appropriate for smaller providers.

Affordability: Availability of services without affordability severely limits the potential social and economic benefits of ICTs. The outcome may be "the rural broadband paradox" – that when broadband is finally made available, it is not affordable for many rural households and institutions. Innovative policies and strategies can address affordability, such as encouraging competition, regulating prices or elements such as data caps, and enacting targeted subsidies.

Rural Data: Government and/or operator data on rural coverage, transmission speeds, and service quality may be inaccurate or incomplete. Additional sources should be allowed to contribute more accurate or granular data for broadband planning and funding.

Continuity of service: Frequencies used for rural services should not be reallocated without a guarantee of continuity of available and affordable services using alternative spectrum or technologies.

Enforcement: License conditions such as local consultation, rollout deadlines, and quality of service metrics must include explicit means of enforcement.

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