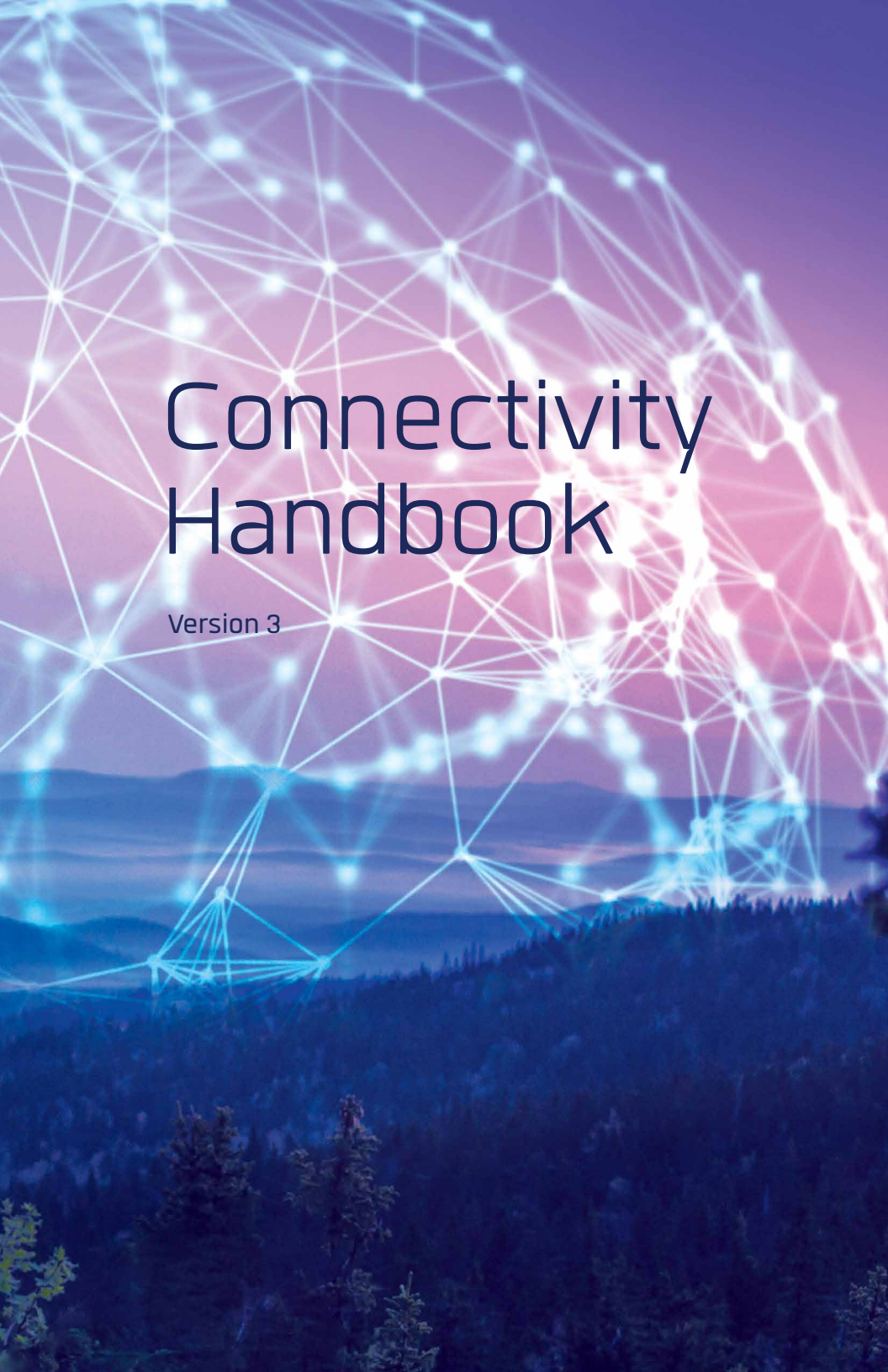

Connectivity Handbook

Version 3

How to Use this Handbook

This Handbook was developed to aid local governments in assessing the connectivity infrastructure landscape, and better understanding the various planning factors that influence when, where and how connectivity is expanded.

It is intended to help governments become more informed, engaged, and better prepared to take on leadership roles in defining key internet service deficiencies in unserved or underserved areas. The Handbook can act as a foundational resource to guide the early stages of developing regional connectivity plans. It describes practical approaches and steps toward defining, planning and supporting community-led reliable and sustainable broadband solutions. In Section 4 of this Handbook you will also find case studies to illustrate the benefits of connectivity and its impact on local economies.

This resource guide can help provide a starting point for leading a comprehensive connectivity planning process. There are many elements included in planning, such as identifying core service needs and priorities through community engagement, developing viable connectivity solutions and sustainable business models through collaboration with internet service providers. The Handbook primarily focuses on the key elements of the technical assessment that need to be addressed within the planning process to ensure desired outcomes of internet connectivity are achieved. This resource may also support the development of a vision around key community connectivity objectives to achieve greater economic, environmental and social outcomes.

The Handbook can serve as a reference to create connectivity goals centred on maximizing community benefits that advance key priorities, such as local economic development and resiliency, telehealth services and digital health solutions, modern delivery of education and skills training opportunities, climate adaptation capabilities, enhanced public safety measures, and emergency response capacity.

Photo: Dave Lampron, CBBC

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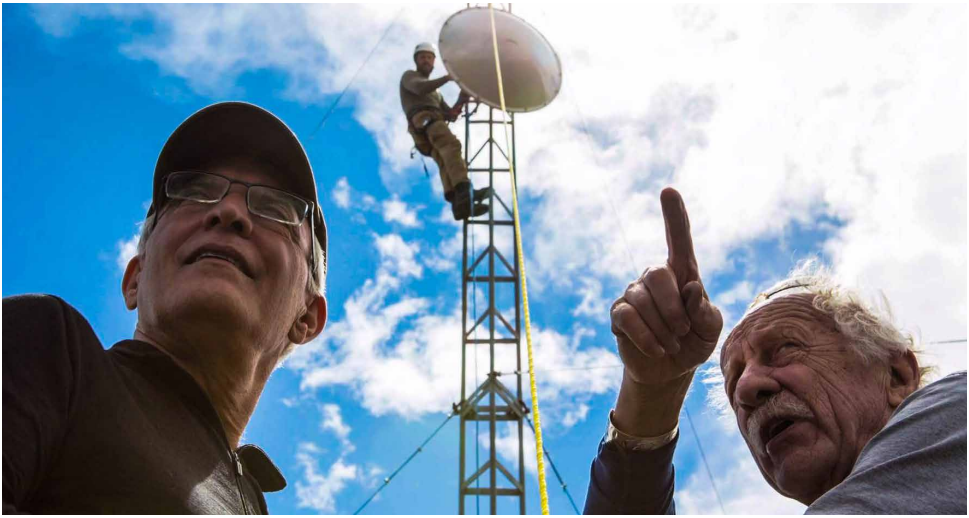


Photos: Tatlayoko Think Tank Ltd.

SECTION 1:
Connecting British Columbia

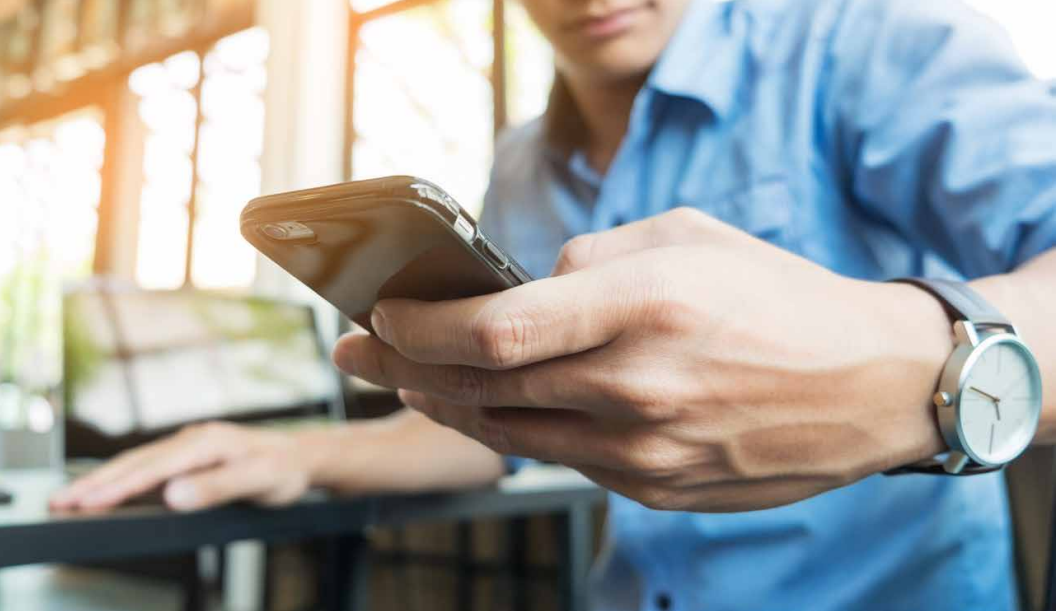
A Commitment to Connect

Connectivity is the ability to affordably access the internet services citizens need to fully participate in the digital economy. Internet connectivity is a strategic enabler that can lead to better health and wellness outcomes for communities, retool workforces by delivering education programs and skills training, capitalize on global tourism trends, respond to climate impacts, and transform regional and community based economies.

Internet services are a part of a broad group of telecommunications services and as such, are regulated by the federal government. In December 2016, the Canadian Radio-television and Telecommunications Commission (CRTC) determined that internet access was a basic telecommunications service, like land line phone service, thus confirming the importance of access for all. In support of its decision, the CRTC announced new funding to support a new universal service objective with a target of high-speed internet services (50 Mbps download /10 Mbps upload) available to 90 per cent of homes and small businesses by 2021, 95 per cent by 2026, and 100 per cent by 2030.

In 2019 the Government of Canada reinforced the importance of internet access with the release of the national connectivity strategy High-Speed Access for All: Canada's Connectivity Strategy. This federal plan recognizes that rural and remote communities have difficulty accessing high-speed internet, which inhibits citizens from taking advantage of the benefits the internet has to offer. The strategy also supports the work underway here in B.C., to help ensure all British Columbians have access to affordable, reliable, high-speed internet, regardless of where they live.

Through multiple broadband investment funding programs, including the provincial Connecting British Columbia program, communities can work with local internet Service Providers (ISP) to unlock the benefits of a digital economy. Taking a comprehensive and collaborative approach to connectivity planning better positions communities to ensure connectivity investments are optimized to benefit all citizens.



The Importance of Connectivity

Most British Columbians use the internet, and those who do not are helped and supported by those who do. The digital devices we carry in our hands, enable us, empower us, and give us choice, as long as they are connected to the internet. In just a few short years, the internet has evolved into a multidimensional communications medium and entertainment platform that also enables globally connected home-based businesses, urban/rural mobile working opportunities, significant energy efficiency cost-savings, and even enhanced solutions like real-time health monitoring of family members.

Connectivity brings together a broad group of stakeholders, programs and technologies to build our digital infrastructure—foundational to digital inclusion and a digital economy. Some benefits of access to high-speed internet include:

- **Building the economy**
- **Responding to climate change**
- **Delivering health services**
- **Providing education**
- **Ensuring public safety**

www.northerndevelopment.bc.ca/connecting-british-columbia#benchmarking-connectivity

Realizing the Benefits of Connectivity

Canada is among many countries redefining themselves as the global digital economy emerges. This is leading to an unprecedented opportunity for rural areas to access significant connectivity funding supports – providing regions and communities have strong, comprehensive connectivity plans. A comprehensive connectivity plan positions regions and communities to leverage a variety of partners both in developing the infrastructure and e-solutions needed to address local challenges and improve lives.

To also realise the full benefits of connectivity, internet services must have three characteristics: Access, Affordability and Speed.

Access

Access to internet service requires both the infrastructure to the community and the infrastructure within a community (last mile) that provides a link to the user.

British Columbia's infrastructure uses diverse technology yet has limited diversity of transport routes in many rural areas. If a single transport route into a community is damaged, the entire community may be left without internet services. This makes services (such as credit card transactions and real-time healthcare via video) vulnerable and restricts economic investment in rural and remote areas. Network diversity, or multiple transport routes, is an important aspect of network design to ensure reliable access to internet services.

Affordability

Affordable connectivity is critical for users to be able to use the internet service that supports the required applications they depend on. Improving affordability is critical in many rural regions where prices may be considerably higher for the same internet service that is offered in urban areas. Affordability is influenced by market forces and federal policies regulating telecommunication providers.

Speed

The availability of different internet speeds is critical for businesses, particularly if very high-speeds are required to transmit large files and applications such as video conferencing. Internet service speeds determine the type of internet content and services that users can access. It is important to understand that high-speed services require larger investments and are more expensive to maintain.

Investments in Connectivity Infrastructure

Millions of dollars have been invested throughout British Columbia to make broadband available to a majority of its residents. These investments, primarily by commercial internet service providers (ISPs), and in some cases through federal and provincial grants, have energized the use of broadband in many parts of the province.

Challenges to Connect

Internet service is a commercial commodity and the majority of BC's infrastructure is owned and operated by private companies. Canada's major carriers are focused on building new infrastructure to establish the network capacity that is needed to meet growing demands and maximize return on investment.

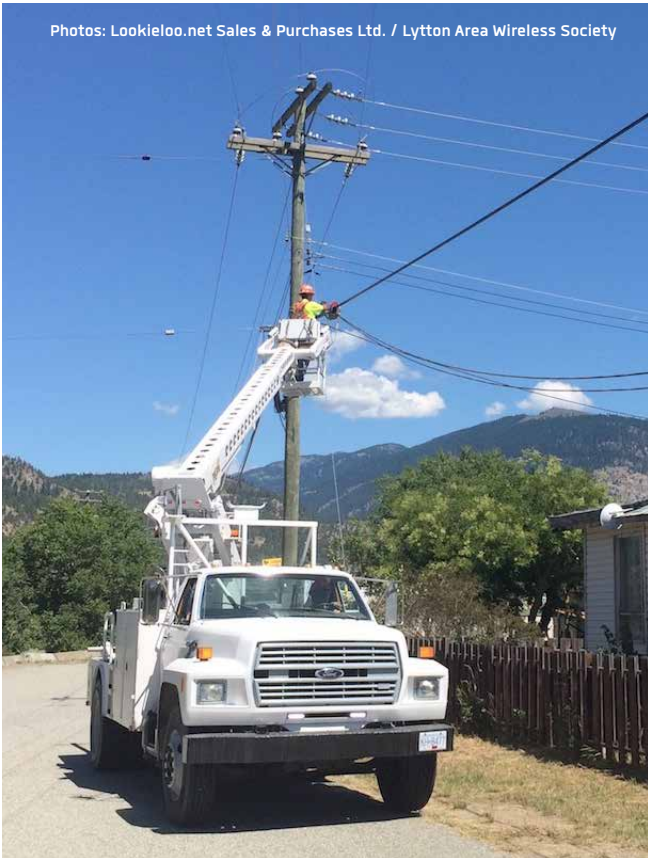
Major ISPs typically focus most of their planning and investment on urban areas with dense populations, seeking to best optimize returns on limited capital. Similarly, smaller ISPs based in rural areas typically focus on pockets of density to optimize return, particularly given the high cost of building and maintaining infrastructure. Other factors that contribute to connectivity challenges include:

- Proximity to high-speed transport such as fibre can often be the primary consideration for being able to upgrade or build a network to a community. Fibre transport has a large capacity and can deliver high-speed internet to a community if it is supported with the appropriate electronics. Copper-based and microwave transport have limitations that affect the available speed and increase costs of internet services to a community.

- In many cases, the costs to build some last-mile infrastructure within a community are prohibitive. For instance, in many smaller, rural communities, homes are spread out and the costs to bring fibre to the home may be several thousand dollars, outweighing any potential for a commercial return on investment. In these cases fixed wireless technology may be an affordable alternative.

- Developments in delivering internet services through wireless technology (similar to cellular networks) are advancing rapidly. Current technology is capable of speeds in excess of 100 Mbps and performance is improving as network capacity increases and wireless technology evolves. ISPs are now preparing for 5G wireless, which will support speeds up to a Gigabit/1000 Mbps).

  5G technology will provide a convergence between high-speed wireless services and basic cell services when it is implemented. Canadian ISPs have started to make public their plans for the deployment of 5G within the next few years. 5G offers the potential for fibre-to-the-home speeds with the flexibility of a mobile wireless connection.



Photos: Lookieloo.net Sales & Purchases Ltd. / Lytton Area Wireless Society

SECTION 2:
Connectivity Planning for Communities

What is a Connectivity Plan?

Connectivity infrastructure can be as critical and complex as other public utility infrastructure. Understanding the value of supporting investments for long-term community benefit is the starting point for effective connectivity strategies or plans. For local governments, developing a plan for improved connectivity is a multi-step process that involves working with various partners to assess needs, assets, opportunities and infrastructure. Connectivity plans enable communities to make better, more informed connectivity-related decisions to achieve greater economic and well-being benefits derived from connectivity.

The Value of Planning

Today, every aspect of community planning involves connectivity--directly or indirectly. Planning clarifies business models, roles, options and costs to enable decision-making. It also ensures investments in infrastructure that are expensive to build, maintain and upgrade are made once, leveraged and optimized, to achieve greater community and regional benefits:

- Increased awareness of community development opportunities (economic, social and environmental) that can be made possible through new or improved broadband access
- Understand and proactively address connectivity access and digital literacy
- Increase potential to attract future grant funding for broadband infrastructure into the region
- Increase potential for infrastructure investments to leverage program investments for e-solutions
- Increase potential for intelligent community applications that improve quality of life
- Increase potential to attract investment from major carriers and last mile infrastructure providers such as smaller ISP's

- Increase potential to attract new business to the area
- Increase ability to sustain rural and remote community populations
- Increased regional collaboration and cooperation on critical services

The Value of Community Engagement

Connectivity planning involves a diverse group of stakeholders, partners, programs and technologies to develop digital solutions and build infrastructure foundational to realising the goals and aspirations of communities. It is likely that many (or most) of these community partners will be involved throughout the connectivity planning process.

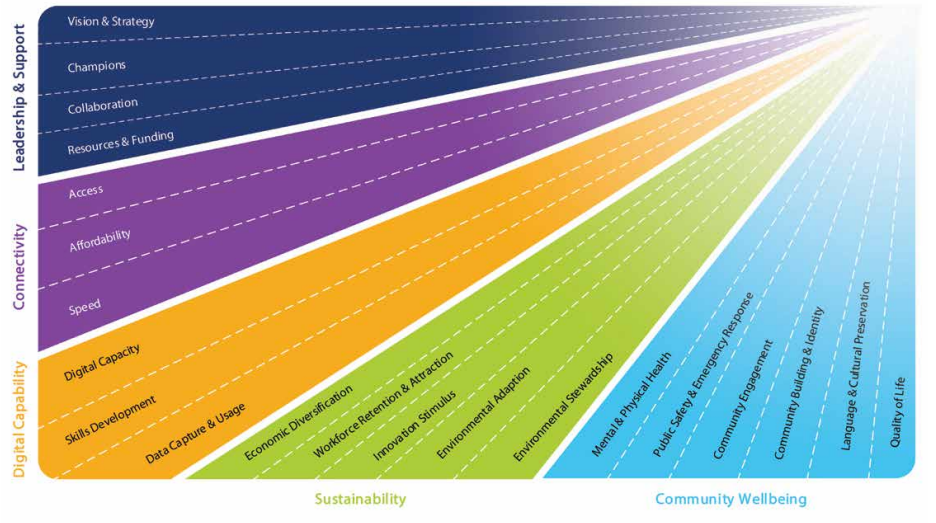
- Local ISP
- First Nations
- Funding partners
- Technical experts
- Government organizations
- Businesses and entrepreneurs
- Residents

It is important to engage with many stakeholders throughout the connectivity planning process to gather ideas about digital economy interests, community well-being priorities and explore what new possibilities are available for communities in the digital era. These may include plans for housing, economic diversification, environmental and social developments, etc. The findings will then be provided as a key input to last-mile broadband infrastructure solution requirements. Combined, this information creates a unique snapshot of the community's digital readiness and the location and type of infrastructure is informed by the community aspirations amongst other important technical considerations.

To obtain a holistic view of current connectivity and future goals, communities should undertake steps to assess needs and priorities. This section provides an overview of how to approach collecting, assessing and evaluating community information with a digital mindset.

Connected Communities has worked with BC communities to identify five foundational elements that create the conditions for greater community benefits to be realized through connectivity. The following Made-in-BC digital roadmap was developed with small communities and serves as a useful engagement tool that guides a holistic approach to connectivity planning.

Connected Communities: Success Factors

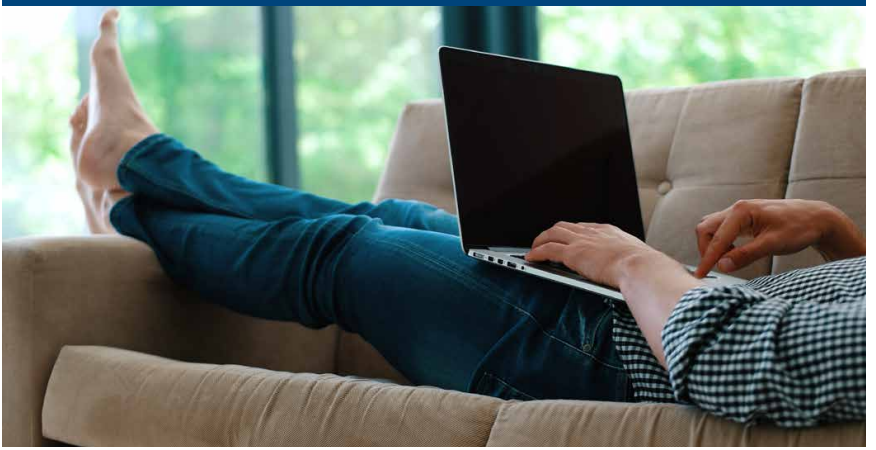


Step 1 Understand the Digital Landscape

British Columbians throughout the province are using Internet-enabled technology to make goods and services faster, cheaper, better and easier to access. Business models are changing, enabling enterprising people to stay local and work global, or move to where the lifestyle aligns with their values.

Educate yourself and your planning team on how digital is enabling change in other communities and sectors. Awareness and understanding addresses fears and concerns and can help to balance dialogue and enable residents to explore and work through the full spectrum of possibilities and consequences to determine the thresholds and guidelines for increased connectivity.

- Review case studies of communities that have transformed their strengths into new opportunities based on connectivity and e-service investments.
- Look for examples in healthcare, education, safety, security, sustainability, climate change, business and industry or other topics relevant to your region or community.
- Seek out people to join you in exploring the possibilities; post-secondary institutions (community development and sustainability programs), may have experts who can provide insight.



Step 2

Seek Support and Leverage Existing Planning Processes

When assessing connectivity needs and priorities, leverage existing planning processes including economic development plans, strategies, Official Community Plans (OCP), etc. Ideally, municipality and regional district plans will incorporate connectivity goals as this commitment will provide stakeholders and connectivity investment funders a clear picture of community support for expansion and where the benefits will be realised.

Step 3

Perform Key Planning Assessments

Consider your existing community strengths through a lens of digital opportunity. This section describes how to undertake an inventory of existing services, the underlying infrastructure and a vendor assessment. All are important to understanding community needs and priorities, existing infrastructure, build options, the role of the ISP and the potential role of regional and local governments in infrastructure deployment.

The following series of assessments will provide insight and considerations relevant to connectivity planning.

1. Assets
   - Geographical
   - Civic
   - Human-centered
2. Community Needs
3. Community Connectivity/Service Needs
4. Technology
5. Vendor

3.1 Asset Assessment

These physical, geographical and human centred inventories will capture place-based assets that highlight unique aspects of your communities and may give your area a potential competitive advantage. List as many attributes as possible as the array of data is important to exploring possibilities that will eventually be used as inputs to support key decisions.

Geographical:

- Waterways; mountains; ecosystems and wildlife habitat (i.e. bogs, wetlands, forests)
- Geographical features (i.e. caves, cliffs)
- Geological features (i.e. mineral deposits, attractive outcrops);

Civic Infrastructure:

- Industrial buildings
- Civic buildings (i.e. hospitals, health centres, fire stations, schools, community centres);
- Other (fire roads, water systems, camp grounds);
- Transportation networks (roads, airports, railways, trails).

Human-centred:

- Community leadership and vision
- Community values and norms (a legacy of local history)
- Demographics including education/skills and knowledge sets/labour force

Document your assessment of these assets in whatever form is most relevant in your context. The information can be incorporated with the Connectivity Assessment found on page 33 and used to provide a comprehensive map for planning purposes.

3.2 Community Needs Assessment

Understanding the community needs, and the challenges and priorities of the organizations that serve citizens, provides a reason and rationale for investment. Addressing needs or gaps in services supports connectivity investments being tailored to meet local governments needs and priorities.

Needs may already be identified through existing planning process. If not, broad community engagement is important. Residents, visitors, sector experts, specialists and special interest groups will identify an array of needs across a wide spectrum.

- Demographic needs (health or education)
- Economic challenges and opportunities (ex. Industry, tourism, etc.)
- Emergency preparedness

Try to understand the relationship between needs:

- Perhaps a gap in training underlies unemployment?
- Does a gap in in-home health care contribute to strain on local emergency rooms and increases healthcare costs for people on fixed incomes?
- Do emergency responders have sufficient connectivity to receive and send information in the event of an emergency or natural disaster?
- Do health practitioners have sufficient connectivity to access: EHR, EMR, PHR systems?
- Do practitioners require greater connectivity to coordinate with specialists or to conduct continuing education and professional development?

Where these needs intersect, potential areas of opportunity may exist that create a partnership to co-fund infrastructure and e-services. This could illuminate opportunities for infrastructure investment not recognized through a lens of providing services to every dwelling.

- Review existing regional and community plans (i.e. economic, OCPs, sustainability, emergency management)
- Review sector plans and priorities (i.e. Health Authorities, Distance Education, Forestry Plans)
- Engage an array of people, with varying perspectives to, unpack or supplement understanding
- Approach local experts (i.e. health, education) to provide and/or interpret their key statistics

3.3 Community Technical Assessment

Define the current connectivity situation

1. **Begin a review and assessment** by defining and documenting your current state with a map of your area that illustrates location, regional boundaries, number and extent of populated areas, existing infrastructure and service availability.

   Use Google Earth to create and exchange the maps and related information. This free software tool is versatile, powerful and a common standard for illustrating and sharing such information.

   - Place applicable Regional District and Electoral Area boundaries on the map.
   - Ensure that all unserved or underserved communities and/or targeted service areas are clearly marked/located on the map with place names. Once a complete list of unserved or underserved areas is established, that list should be made publicly available with sufficient detail to enable service providers to comment.
   - Document existing infrastructure/service coverage for both cell and internet services.

2. **Use spreadsheet software** (e.g., Microsoft Excel/Google Sheets) to organize baseline data and key contact information for communities as well as area associations, and ISPs serving those areas.

   - Include population and estimated numbers of households, businesses and institutions located within the targeted service areas.
   - Note the types of available service offerings from ISPs (e.g., cable, fixed wireless), including any related issues such as capacity or speed limitations.
   - Note the types and extent of carrier infrastructure and services
   - (e.g., fibre cable trunk lines, points of presence, cellular phone sites/ service coverage) including any related issues such as capacity or speed limitations.

3. **Use document software** (e.g., Microsoft Word/Google Docs) to prepare a brief narrative overview describing the communities and/or targeted service areas within your area/region, including their current situation with internet service availability from national ISPs and local ISPs.

4. **Define desired connectivity service levels** Review the information gathered and establish basic service level needs within the targeted areas for each user type (residential, business, institutions and others).

   For each targeted area, define:

   - Types of services
   - Levels of service/speed
   - Affordability/target for services pricing or cost Timing targets for services to be available

3.4 Perform a Technology Assessment

There are many viable technology solutions to expand connectivity, with each having different cost implications. Implementation of these options depends on physical network infrastructure and technologies.

Communities should work with local ISPs and perform a technology assessment for each targeted area that includes:

- A regional overview and summary identifying last-mile and transport solutions, including key internet gateways/access points.
- Narrative descriptions of technologies/network solutions available.
- Block diagram illustrating major network design and key components.
- Documented support as to practical considerations around speed and availability.
- A spreadsheet of the budgetary framework with preliminary cost estimates.

Options for communities typically fall into Wired, Wireless or Satellite solutions.

Wired Solutions

Wired, or physically connected cable solutions, are often considered the most desirable as they offer the highest speeds and reliability. They tend to be the most expensive solutions to deploy and are therefore usually dependent on a higher density of population/users to justify capital and return on investments. They include:

Coaxial Cable

Coaxial cable is commonly used for the distribution of cable television services and adapted for internet-based services. Cable services can provide much higher capacity (as compared with copper wire DSL), but are highly dependent on network design and the quality of multiple components and connections. Older cable networks often require upgrades of many or all major components to enable them to deliver reliable higher speed services.

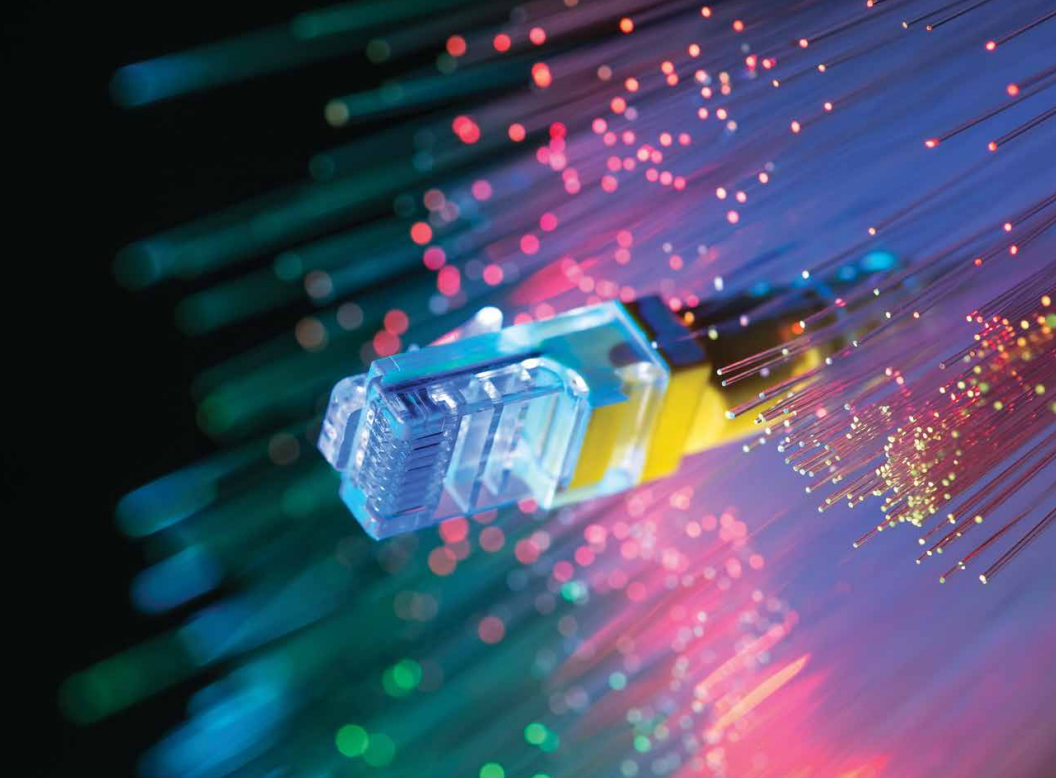
Available internet speeds from coaxial or "coax" cable networks are distance dependent and often capacity constrained by "party-line" style sharing or contention. Those issues are sometimes addressed by developing networks with fibre-optic cables to create hubs or nodes to improve service distribution and delivery/management.

Older or legacy cable networks may struggle to serve users with 5 Mbps speeds, while updated networks that employ the latest components (as noted above) should be capable of serving end users with speeds up to 1 Gbps.

Fibre-optics

Fibre-optics networks were developed for ultra high-speed and long-distance transport using newer digital technologies, focused on internet protocols and standards to support all types of communications. Speeds and capacity using this technology are effectively unlimited.

Such networks are typically more expensive to develop, but reliable and have a long effective life span. End users living in urban areas now commonly enjoy Fibre-To-The-Premises (FTTP) services at speeds of 150 Mbps. Higher speed services are also becoming more widely available, including 1 Gbps or more.



Wireless Solutions

Wireless solutions support a wide range of applications and network needs. They remain a key strategic focus particularly for the cellular businesses of most major ISPs. Accordingly, capital investments for some wireless solutions can be more easily justified for serving areas of lower population density. Wireless solutions include:

Mobile or Cellular networks

Mobile or cellular networks were developed by major ISPs to provide mobile telephone services and have been subsequently adapted to accommodate internet data services. Third generation (3G) services are still common, but very limited in data capacity or speed, and are being replaced by fourth generation (4G) services, usually based on the LTE standard (Long Term Evolution). Some pilot or demonstration projects are already using fifth generation (5G) services, mostly based on LTE-A (LTE Advanced, or LTE-Gig).

Mobile/cellular services using LTE are capable of meeting CRTC speed targets but are usually dependent on fibre-optic networks to provide adequate capacity to cell sites (towers and transmitter-receivers). Such networks are also expensive to construct and operate. Consequently, trends indicate that data usage limits will remain at expensive rates for a considerable time.

Nevertheless, competition and new advances in technology are changing these dynamics for internet service delivery. Examples LTE-A (next generation with higher speeds/capacity) and small cells or micro cells, offer much lower cost solutions to establish cellular phone services in small/local areas.

It should also be noted that mobile or cellular phone services are increasingly considered to be critical infrastructure for safety, security and emergency management. Accordingly, community leaders considering such issues, assessments and options, should determine the extent of existing coverage from mobile phone services offered by major carriers, and consider regional needs and options for extending the coverage and availability of such services.

Fixed Wireless systems

Fixed Wireless systems, including point-to-point radio links and broadcast (to multi-point), offer good solutions for last-mile/end user connectivity as well as point-to-point backhaul and long-range transport.

- Last-mile solutions commonly include Wi-Fi, particularly for connecting devices such as computers, tablets and smartphones. The inherent limitations of Wi-Fi with radio frequency contention, interference, distance and capacity often require that other solutions are utilized to bring reliable service connections to the premises (before using Wi-Fi for connecting local devices). Point-to-point solutions for that purpose include a variety of radio technologies, frequencies and standards (e.g., LTE) used in cellular networks.

- Transport solutions using point-to-point radio links are widely employed as practical lower-cost solutions, particularly for extending ISP networks. A wide range of radio technologies, frequencies and standards are utilized for such purposes (including LTE), but the inherent limitations of radio links are leading to replacement of radio transport with fibre-direct cable connectivity wherever that can be cost justified.

- Cost range is based on using inexpensive masts/mounts or light-to-medium duty towers and unlicensed radio frequencies. Costs can be much higher if heavy duty towers or remote sites are involved, or if licensed frequencies are required.

- Transport solutions using point-to-point radio links remain a practical necessity in many rural and remote areas, particularly for overcoming distances to serve small, dispersed populations.

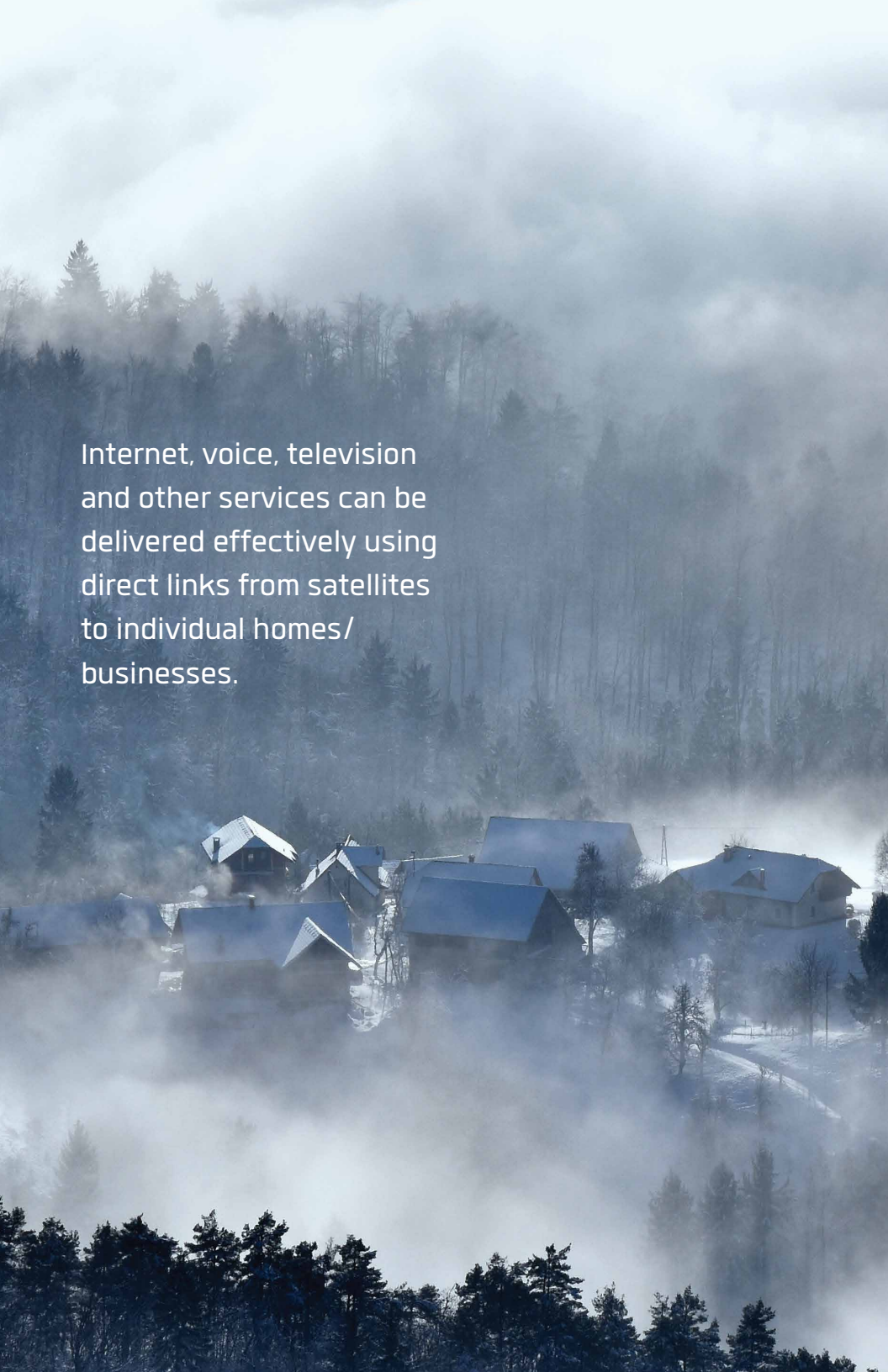
Satellite solutions

Satellite solutions for television and remote telephone services are well proven and continue to evolve with improved technology and capacity as well as competition and packaging with lower pricing.

These solutions tend to be considered as less desirable, if wired or terrestrial-based wireless solutions are available. However, modern satellite solutions are capable of providing higher data transfer rates/speeds that can meet or exceed new CRTC targets, and present important options with wide coverage and practicality that should be considered for remote locations and areas of very low population density.

Internet, voice, television and other services can be delivered effectively using direct links from satellites to individual homes/businesses. Satellite services can also be employed to support more complex hybrid network solutions, employing other technologies for last-mile including cellular, fixed wireless and even fibre networks.

Inherent issues with satellite direct services include higher latency (delays attributable to the very large distances that radio signals must travel), which present challenges for some applications (e.g., VOIP, interactive or real time applications, remote operations, gaming). They also tend to be affected more by weather related issues, including heavy rainfall and high humidity.



Internet, voice, television and other services can be delivered effectively using direct links from satellites to individual homes/ businesses.

3.5 Perform a Vendor Assessment

The Community and Technology Assessment processes as described in the previous sections help define the types of technology solutions that will support the desired outcomes, cost effectiveness and how much funding support, if any, will be required.

The Telecommunications Landscape: What You Need to Know

Building and maintaining infrastructure in rural and remote areas is expensive, and Internet Service Providers (ISPs) - public and private have to manage the bottom line. Capital investments are followed by maintenance costs, depreciation and ongoing investment to keep technology current.

In many cases, the cost to build the last-mile infrastructure within a rural community are prohibitive. For instance, in rural communities homes can be spread out over a large region. The cost to bring fibre to the home may be several thousand dollars, outweighing any potential for a commercial return on investment in fibre-to-the-premise (FTTP) builds. In some cases, wireless technologies may be more cost effective.

ISPs business cases are predicated on volume of subscribers and thus infrastructure builds will favour areas of density, even in rural and remote areas. Proximity to high-speed transport (the virtual equivalent of a major highway) can often be the primary determinant in being able to bring high speed internet to the home. Both high-speed transport and last mile infrastructure in the community need to be in place along with technical capacity and affordable cost structure to ensure the subscriber can realize the potential benefits of the service.

New technologies like 5G, promises fibre-to-the-home speeds with the flexibility of a mobile wireless connection. However, 5G will likely be deployed in high-profit areas first, and in less profitable areas over time. 5G technology will converge high-speed wireless services and basic cell services when it is implemented, and capabilities estimated by the industry include wireless speeds capable of up to a Gigabit (1000 Mbps)

Prepare to share

Depending on governance policies and leadership discretion, documentation prepared through the steps above could be shared with targeted vendors and/or advisors selectively and informally for feedback, or as backgrounders and supporting documents in a more formal public competitive Request for Information (RFI) or Request For Expressions of Interest (RFEI).

Contact potential vendors

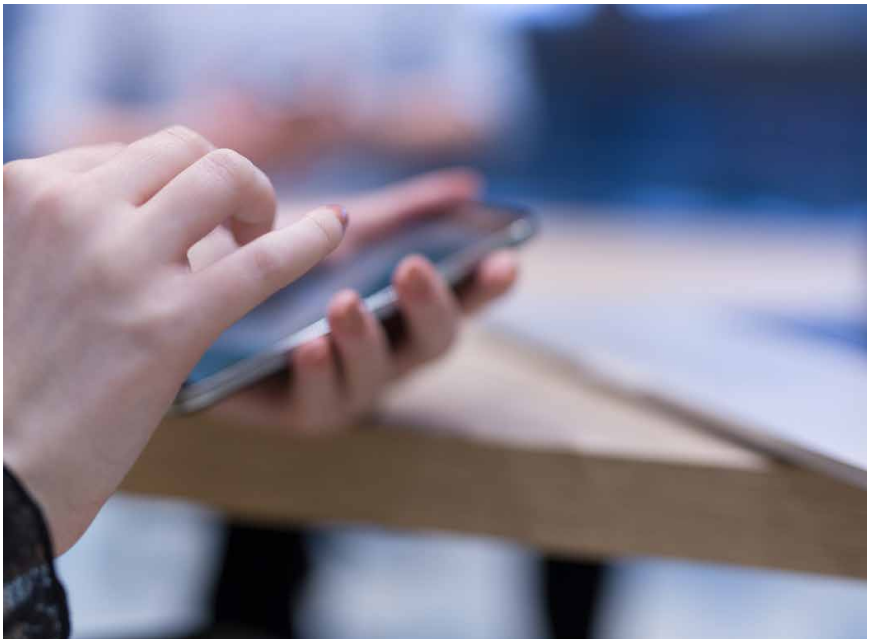
Preliminary contacts with vendors (particularly local ISPs) should be part of the process for vetting and/or refining plans for technology solutions, network design and budgetary costing. However, leaders must be cautious through this process to avoid prejudicing and potentially limiting or precluding any options for funding unless or until that matter is resolved. Any vendor discussions and/or RFI or RFEI documents should be specific in that regard. If external funding is to be sought, funder program rules or terms should be reviewed before defining detailed plans for procurement.

Identify local sources

Define what local resources might be utilized, contributed or otherwise leveraged and key requirements including process or timing implications and key milestones.

A documented situation assessment (as outlined above) and direct approaches for one-on-one discussions and negotiations with a single or finite (limited) number of ISPs need to be planned.

Typical public competitive procurement processes (e.g., RFEIs and RFPs) may ultimately be possible, but could also be impractical unless multiple ISPs or service providers are interested.



SECTION 3:
Funding

Funding for connectivity projects comes from a variety of sources and may also be available to assist with rural and remote community connectivity planning. Using this Handbook may help inform a Regional Connectivity Plan where local governments can outline a vision and specific objectives with their corresponding outcomes as well as demonstrate community support for ISP funding applications.

Funding Requirements

In addition to written support for connectivity projects, many funding programs have requirements for equity or investment by project proponents, recipients or borrowers, as well as risk assessments, value for investment, leverage and other considerations. As such, it is important for community leaders and project proponents to quantify existing community and regional assets that can be leveraged as well as any available real cash or in-kind contributions from the region and communities, and from ISPs operating in those areas. Options could include:

- Making space available in community-owned buildings or lands for local ISPs to situate equipment.
- Providing support services, such as power and access to roads, lands and facilities.

Such measures can have a significant impact in serving small communities and can be valued as contributions in-kind.

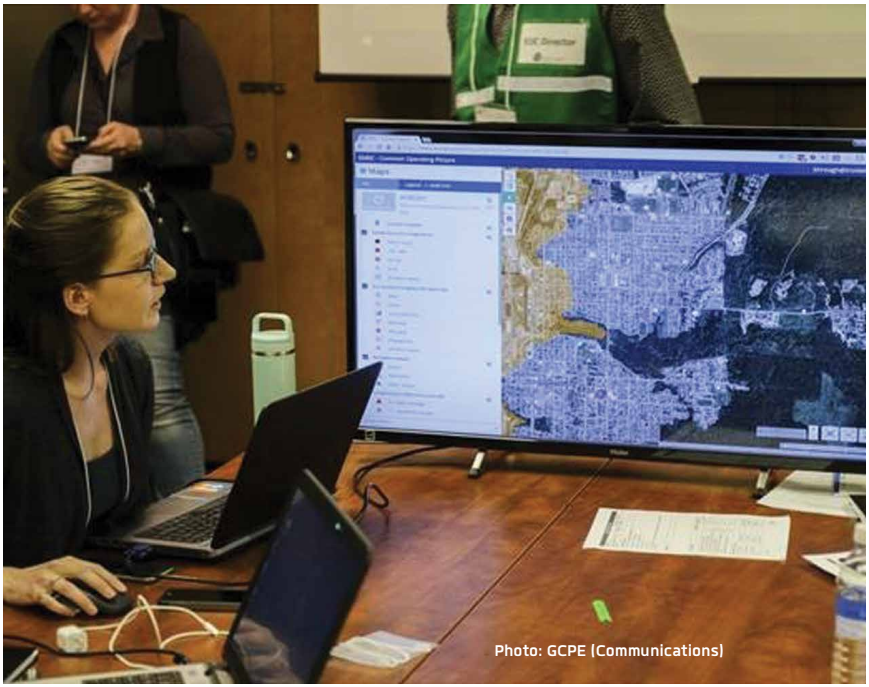


Photo: GCPE (Communications)

Public funding should be considered only when private capital and debt financing are not available or cannot be justified in terms of return on investment or cost of debt servicing. It is also important to note that most public funding programs are strictly for new capital development and require demonstration that operations of funded infrastructure projects will achieve accumulated operating balance or surpluses to assure sustainability within a reasonable period of time (usually less than 5 years).

In considering the process and terms of targeted funding programs, note any program-specific requirements for a submission, including contracting, project management, administration and reporting.

Consider if further information or resources are needed to meet such requirements and ensure that project plans provide for all such deliverables, resources and milestones, noting implications for timing and budget.

Finally, ensure that all proposal documents and support materials to accompany funding applications are updated to include proper provisions for all such issues and resources.

Funding and advisory partners

Links to some organizations with funding programs and advisory capacity include:

Northern Development Initiative Trust:
http://www.northerndevelopment.bc.ca

Union of BC Municipalities (Gas Tax Fund):
http://www.ubcm.ca/EN/main/funding/renewed-gas-tax-agreement.html

Canadian Radio-Television and Telecommunications Commission:
http://www.crtc.gc.ca/eng/Internet/Internet.htm

All Nations Trust Company: http://www.antco.bc.ca/

New Relationship Trust:
http://www.newrelationshiptrust.ca

Infrastructure Canada: Investing in Rural and Northern Communities Infrastructure
http://www.infrastructure.gc.ca/plan/rnc-crn-eng.html

Coastal Community Credit Union (Building Healthier Communities Fund):
https://www.cccu.ca/Personal/InOurCommunities/CommunityFundingPrograms/BuildingHealthierCommunitiesFund/

The list of links above is not intended to be exhaustive. Many other organizations have discretionary capital, programs and/or policies that may provide for unsolicited individual proposals. For example, federal government departments in that context include Innovation, Science and Economic Development Canada (ISED), Indigenous and Northern Affairs Canada (INAC) and Health Canada.

Some of the funding agencies listed above have resources that are willing and able to offer assistance or advice on how/where to obtain assistance in completing project plans and funding applications. All have published documentation explaining program rules and procedures related to application submissions and approvals. Leaders/proponents should review such documentation to confirm alignment of their project needs with the program requirements and assess their own state of preparedness to complete a viable application.

CHECKLIST

Define the current connectivity situation

1. Google Earth Map

- [ ] Regional District boundaries marked and named
- [ ] Communities and populated areas mapped and labelled
- [ ] Targeted unserved/under-served areas highlighted

2. Spreadsheet/Reference database

- [ ] Carrier/ISP company names
- [ ] Contact names and information
- [ ] Coverage/areas/locations served
- [ ] Services offered
- [ ] Network infrastructure in place

3. Narrative overviews of:

- [ ] Region
- [ ] Targeted service areas
- [ ] Local ISPs/providers and existing services

4. Community Connectivity Planning

- [ ] Identify core connectivity needs and priorities to ensure community benefits are optimized.

Define the desired connectivity service levels

1. Descriptions of the types of services available, purposes or uses and key applications, capacity/speed, timing targets for:

- [ ] Residential users
- [ ] Business users
- [ ] Institutional users
- [ ] Other users

2. For each targeted area, include narrative descriptions of:

- [ ] Types of services required
- [ ] Level of service/speed
- [ ] Affordability/target for service pricing or cost
- [ ] Timing targets for services to be available

Technology Assessment

1. Narrative overview of the technology/network plan

- [ ] For the region (transport, gateway/access
- [ ] For each targeted area (last-mile and backhaul)

Community Connectivity Assessment

Vendor Assessment

- [ ] Prepare/issue RFI or RFEI (as/if appropriate)
- [ ] Vet/revise technology/network plans & budget (based on vendor feedback)
  Confirm local resources to leverage and capital that could be contributed
  Confirm approach to funding & procurement
- [ ] Define key milestones & timing
- [ ] Consider procurement strategy

Access Funding

- [ ] Have a documented community plan for connectivity
- [ ] Confirm viable options and approach to funding
- [ ] Confirm application requirements and state of preparedness
- [ ] Further research and assistance as/if required
- [ ] Prepare/submit formal funding applications
- [ ] Confirm formal funding/contribution agreements
- [ ] Complete procurements and related contracts
- [ ] Plan for project management, including risk mitigation
- [ ] Plan for project/contract administration & reporting
- [ ] Confirm that schedules and budgets reflect all key milestones and resources, with realistic timing

Photos: Dave Lampron, CBBC

SECTION 4:
CASE STUDIES

Broadband in the Columbia Basin–Boundary Region

https://broadband.ourtrust.org/

This case study, prepared February 2016 and updated in May 2018, provides an overview of advancing broadband initiatives in the Columbia Basin–Boundary region.

Background:

British Columbia's Columbia Basin–Boundary region is very rural, with a low population density, large mountain ranges and widespread forests. This means that telecommunications infrastructure is an expensive investment, and does not generate a significant return for a traditional telecommunications carrier. As a result, many areas of the region remain underserved.

The development of robust connectivity in the region is essential to the area's economy, including workforce, entrepreneurs and home-based businesses. Essentials like health services, education and public safety rely on the availability of high-speed broadband connections.

In 2013, the regional districts (Central Kootenay, Columbia Shuswap, East Kootenay and Kootenay Boundary), the Ktunaxa Nation Council and the Village of Valemount came together to address this issue. They formed the Regional Broadband Committee. Columbia Basin Trust, which supports social, economic and environmental well-being, was also working to improve high-speed connectivity using its 724km high-speed network. The Trust and the Committee began collaborating to address this pressing issue, and developed a regional vision.

In 2014, the federal government announced the Connecting Canadians program, which funded rural internet service improvements. The Trust submitted a successful application in partnership with 12 internet service providers in the region for a project that would extend and improve service to over 11,000 households. The project is also

receiving funds from the regional districts of Central Kootenay, Columbia Shuswap and East Kootenay; Columbia Basin Trust; and the Province of British Columbia through the Northern Development Initiative Trust's Connecting British Columbia program. The project will be complete by March 2019.

Today, the Regional Broadband Committee, Columbia Basin Trust, along with numerous local service providers are continuing to improve service in the area. The regional high-speed network operated by the Trust now spans over 900km. The Regional Broadband Committee is also working on a connectivity report with an aim of identifying and quantifying the existing connectivity gaps. The connectivity report will help to ensure that future efforts are coordinated.

Lessons Learned:

Common Vision

Before the funding programs were launched, key local leaders in the region had already developed a common vision to improve rural internet services. These leaders were ready to build an application when the programs were announced, as the region already had a sense of what it wanted to accomplish, and was communicating its needs and approach to different levels of government.

Regional Approach

There are many communities and local internet service providers within the Basin–Boundary region. By submitting one coordinated application, all of the stakeholders were able to develop one project with significant impact, and work with funding partners with a consistent framework for matching funds.

Early Preparation

The Trust, in collaboration with the regional districts, indicated its interest as early as possible to internet service providers in submitting a coordinated regional funding application. Application forms require detailed information, so starting early made compiling that information easier.

Building on Strengths

The regional project built on each partner's existing strengths. It takes numerous partnerships both big and small to address rural connectivity gaps.

The Regional District of East Kootenay had fibre optic infrastructure that could connect rural internet service providers. The Ktunaxa Nation Council had fibre optic and wireless infrastructure and owned Flexinet, one of the internet service providers in the region. The Trust had recognized better broadband as a regional need and was lighting up a 724-km regional fibre optic network. The Province provided timely information on the broad technical issues and trends, as well as provided support to the regional process.

Existing Knowledge and Additional Resources

The stakeholders had not previously submitted a coordinated regional application for funding with such a multitude of partners. To coordinate the overall process, they engaged a consultant with experience in working on similar projects and in working with small rural internet service providers.

Photos: Dave Lampron, CBBC

Photos: Tatlayoko Think Tank Ltd.

Strathcona Regional District Broadband Strategy

This case study provides an example of an approach being taken by the Strathcona Regional District to build remote and rural community capacity through high-speed internet.

Background:

The Strathcona Regional District (SRD) is a partnership of four electoral areas and five municipalities. The administrative boundary lies within the traditional territory of several First Nations. Of the population of 43,000 residents, approximately 12,000 residents live in rural and remote communities spread across a large geographic expanse of approximately 18,500km2 that includes forested hills and alpine areas, islands and remote inlets.

Improving connectivity throughout the region has been a strategic priority of the SRD Board since 2014. While there are existing internet service providers and some telecommunications infrastructure within the region, current coverage maps for cellular and high-speed internet access show that there are still many communities which are underserved or completely unserved. This puts the communities in this region at a significant disadvantage. The availability of high-speed internet would enable the delivery of services and opportunities that are critical for rural and remote communities with vulnerable populations such as: telehealth and distance education, improved emergency preparedness and social connection as well as access to income generating activities.

Bridging the digital divide through improved broadband service is a shared priority of all levels of government. With the recent announcements of several funding programs to improve broadband infrastructure, the SRD worked to develop a regional broadband strategy. The goal being to better understand the connectivity landscape, to identify opportunities to secure more reliable, accessible and affordable high-speed broadband connectivity and importantly, to help advocate for digital service delivery and drive programs that increase uptake online participation in an increasingly digital world.

The Plan

The SRD engaged a consultant with expertise in the telecommunications sector to assist with the development of the strategy. This consultant guided staff on the research and stakeholder engagement required to be undertaken and developed guiding principles for the SRD. The plan has been released as a draft document for further engagement with key stakeholders and to support existing and future funding applications and programs. The key strategies established through the plan are set out below:

- Establish points-of-presence where eligible for public funding
- Support Independent ISPs for last-mile service delivery
- Encourage future proofing – fibre, cable TV network upgrades, WISPs to LTE
- Longer term: direct/transit access to Vancouver internet exchange and Fibre Links
- Improved data sets and developing a fibre plan for last-mile connectivity improvements in the Regional District
- Continued advocacy
- Promote a 'connected region'

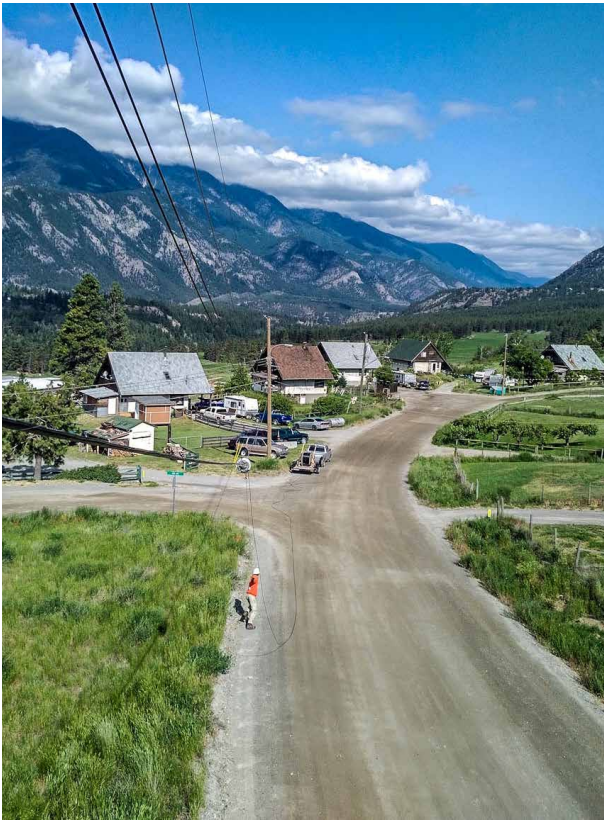
Reflection

Through engaging professional expertise, working with Network BC and consulting with stakeholders in the production of this strategy, the SRD has already taken key steps towards improved connectivity. There is a much deeper understanding and awareness of the challenges and opportunities facing the region and through this process valuable partners have been identified to help address these challenges and maximize opportunities. The SRD will be taking this strategy out to communities in coming months to further develop the social and economic analysis that will underpin future initiatives.

In January 2018, $33M in provincial and federal funding for the Connected Coast backbone subsea fibre project was committed to the SRD. This project is a collaboration with CityWest, a telecommunications company based in Prince Rupert, that will bring new or improved high-speed internet accessibility to 154 rural and remote communities, including 56 Indigenous communities – representing 44 First Nations – along the BC coast.

Going forward, the SRD is likely to continue to play a lead role in facilitating partnerships and securing funding for innovative infrastructure solutions and promoting end user benefits.

Improved connectivity remains a clear priority for the SRD Board and success in this challenging and new field is likely going to be a culmination of many factors.



Photos: Lytton Area Wireless Society

SECTION 5:
Resources

Links

Links are provided below for a variety of websites and organizations that offer support services and/or provide more background information such as success stories and case studies, and discussions about major issues and trends affecting technology, communications and internet-related services.

All Nations Trust Company
http://www.antco.bc.ca/
http://www.pathwaystotechnology.ca/

British Columbia Broadband Association
https://www.bcba.ca

Columbia Basin Broadband Corporation
https://ourtrust.org/our-work/broadband/

Federation of Canadian Municipalities
http://www.fcm.ca/home/issues/telecommunications.htm

First Nations Health Authority
http://www.fnha.ca/

First Nations Health Council
http://fnhc.ca/

First Nations Technology Council
http://www.technologycouncil.ca/

Network BC
http://www.networkbc.gov.bc.ca

Northern Development Initiative Trust
http://www.northerndevelopment.bc.ca

Glossary

Anchor Tenant: One or more key early customers on a network, often a business or government entity that provide a base revenue stream for the service provider. Anchor tenants are important to identify for network sustainability and business stability.

Backhaul or Transport: A network connection that transports data traffic from one Point-of-Presence to another or from a Point-of-Presence to a location that contains the internet gateway. An example would be a fibre connection that transports data between a small town to another location where it is offloaded to the internet.

Bandwidth: Bandwidth refers to how fast data flows through the path that it travels to your computer; it's usually measured in kilobits, megabits or gigabits per second.

Broadband (or High-speed Internet): A high capacity internet connection that enables quick and reliable online services.

Cable modem: Refers to a type of broadband connection that brings information to homes and businesses over ordinary television cable lines.

CCTS or Commissioner for Complaints for Telecommunications Services: An independent organization dedicated to working with customers and their telecom service provider to resolve complaints relating to telecommunications services.

Cellular: See mobile.

Coaxial or Coax: Is copper cable used by cable and telephone companies. Coaxial cable is sometimes used by telephone companies from their central office to the telephone poles near users. It is widely installed for use in Ethernet and other types of local area networks. Depending upon the carrier's technology and other factors, twisted pair copper wire and optical fibre may be used instead of coaxial cable.

Co-Location: An agreement between telecommunication service providers to share their facilities or infrastructure.

Customer Premise Equipment: Refers to any telecommunications equipment located at a subscriber's premises that is connected to a service provider's telecommunications network at a demarcation point. Examples include wiring, modems (DSL, cable, wireless) as well as antennae or other telecom equipment.

CRTC or Canadian Radio-Television and Telecommunications Commission: An independent public authority in charge or regulating and supervising Canadian telecommunications.

Demarcation Point: A point that separates the customer premise equipment and network from the service provider's network infrastructure equipment.

Dependencies: Also known as order of build, this is where separate projects depend on the completion of other projects in order to proceed and become operational.

Download: Data traffic travelling from the internet to the end user.

Downstream speed: Refers to the speed at which data flows from the information server to your computer.

DSL: Stands for digital subscriber line; it refers to a type of broadband connection that brings information to homes and businesses over ordinary copper telephone lines.

Fibre: Refers to the fiber optic medium and the technology associated with the transmission of information as light impulses along a glass, plastic wire or fiber. Fiber can carry much more information than copper wire and is less subject to electromagnetic interference. It can also send data over longer distances than copper wire.

Fixed Wireless: Refers to a type of broadband connection where information is sent between computers through transmission towers by way of high frequency radio signals. This technology typically does not support roaming or mobility of the user connection.

Gigabit: One thousand million bits.

High-speed Internet: Also referred to as broadband. A high capacity internet connection that enables quick and reliable online services.

Internet Gateway: A network connection that provides access to the internet for the service provider's network or last-mile distribution system.

IoT or Internet of Things: The inter-networking of physical devices, vehicles (referred to as 'connected devices' and 'smart devices'), buildings, and other items embedded with electronics, software, sensors, and network connectivity which enable these objects to collect and exchange data via the internet.

ISP or Internet Service Provider: An organization that offers its customers access to the internet.

Kbps: Stands for Kilobits per second, or thousands of bits per second. For example, most analog modems transmit at 56 Kbps or 28.8 Kbps.

LAN or Local Area Network: A data network intended to serve an area of only a few square kilometers or less.

Last-mile: The final leg in connecting homes, businesses and other institutions to a high-speed network connection.

Last-mile Infrastructure: The components used to connect homes and businesses to the internet service provider's Point-of-Presence. This may include routers, towers, antennae, fibre optical, cable, Digital Subscriber Line (DSL) equipment, cable modems, wireless radios and etc.

Locale: Can refer to a neighbourhood, community, subdivision, town site, reserve or village in a rural or remote area.

LTE or Long Term Evolution: A wireless broadband technology designed to support roaming internet access by cell phones and handheld devices. Because LTE offers significant improvements over older cellular communications standards, some refer to it a 4G technology, along with WiMax. With its architecture based on internet protocol (IP), unlike many other cellular internet protocols, LTE is a high-speed connection that supports browsing websites, VoIP and other IP-based services.

Mbps: Stands for Megabits per second, or millions of bits per second. This is a measurement of how much data can be transmitted through a connection. For example, 6 Mbps is approximately 200 times faster than a 28.8 Kbps analog modem.

Milestones: Significant stages of completion for your project(s).

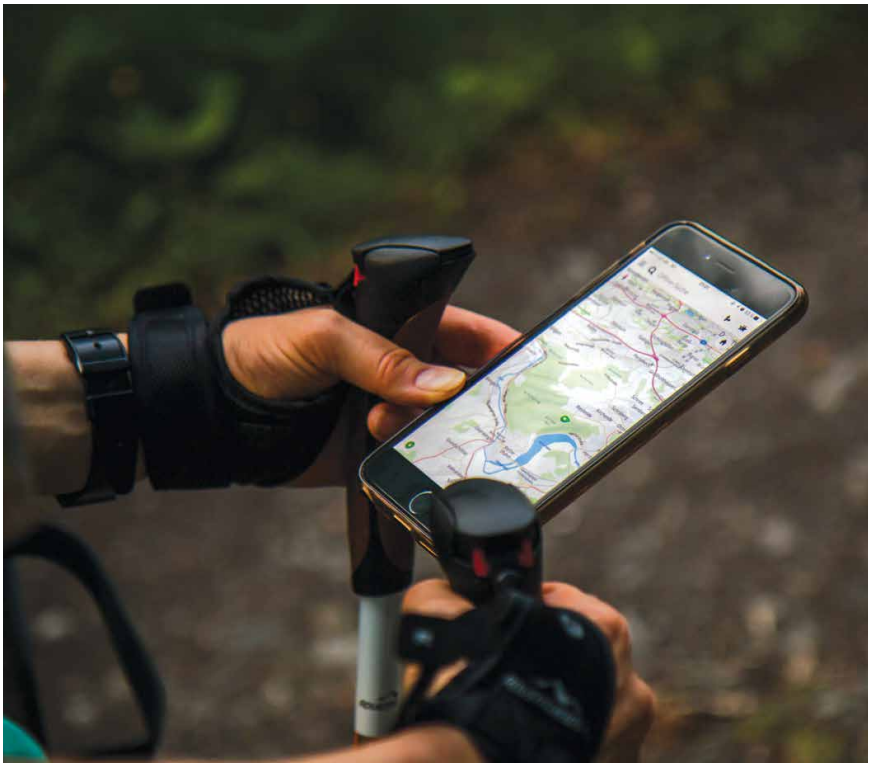
Mobile or Cellular: Refers to a type of communication network distributed over areas called cells, each served by at least one fixed-location transceiver or "cell site". Distributed cell sites allow a mobile user to remain connected to the network by having their connection handed off from one cell site to another.

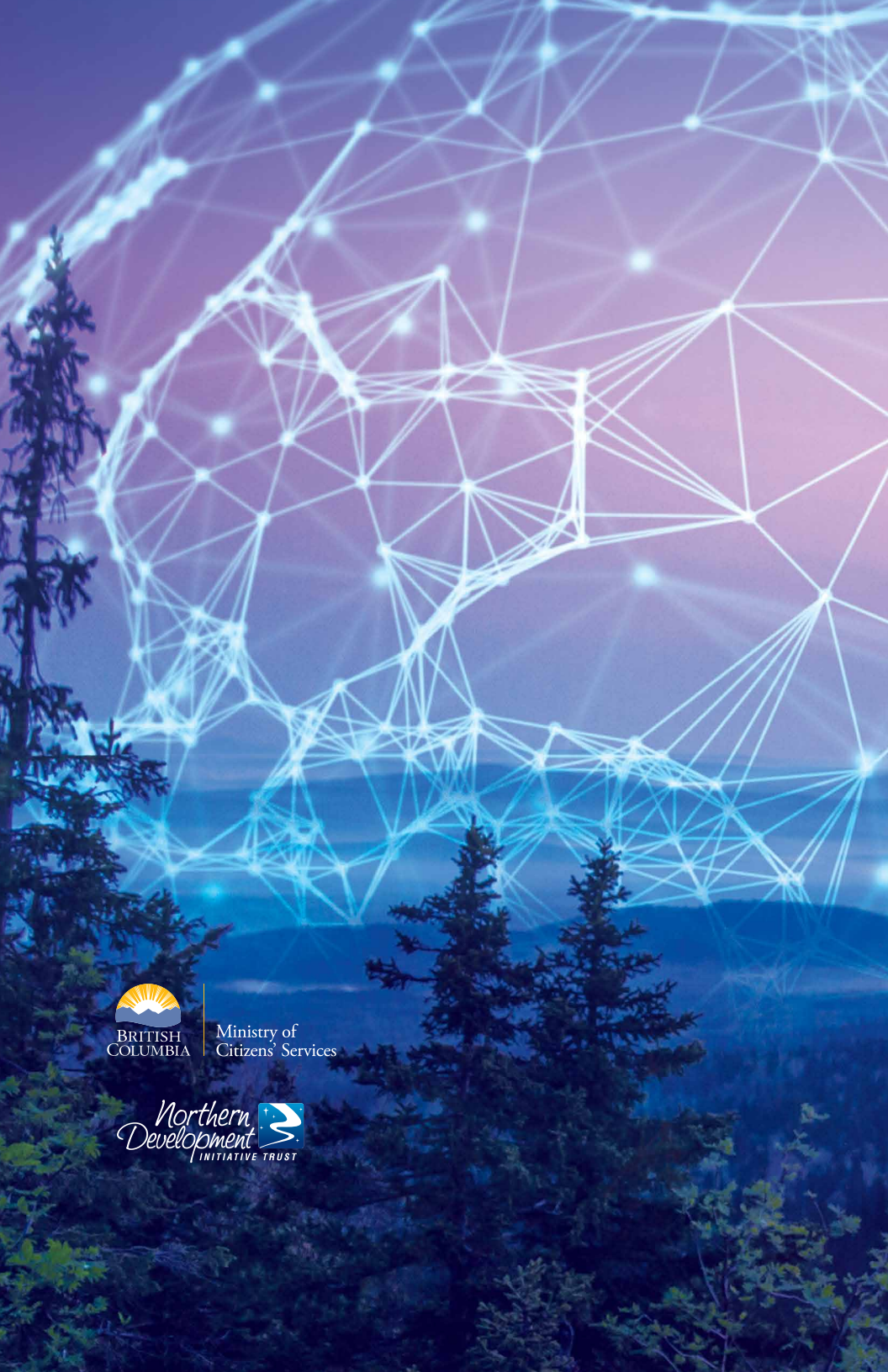
Network: A computer network is a data communications system that interconnects computer systems at different sites. A network may be composed of any combination of local area networks (LANs), metropolitan area networks (MANs) or wide area networks (WANs).

Point-of-Presence or PoP: A facility where internet service providers house servers, routers, switches and other communications equipment. A PoP is where an internet service provider's last-mile infrastructure connects to an internet gateway or extends to another point-of-presence that has an internet gateway.

Risks: When projects depend on outside factors to proceed. This can include order of build, grants from other sources, matching funding, Crown Land applications and approvals and etc.

Satellite: Refers to a type of network connection where information is sent from and arrives at a computer through satellite dishes.

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