Connectivity Handbook

How to Use this Handbook

The Handbook was developed to promote the importance of access to affordable, reliable and adequate broadband infrastructure to meet the needs of British Columbians.

This Handbook is intended to help local governments and community organizations become more engaged, taking on leadership roles in defining key service deficiencies and unserved or under-served areas; and, in developing practical plans that can lead to realistic and affordable broadband solutions to meet those needs.

The audience for this Handbook is community leaders, whose actions or coordination is important for advancing broadband initiatives. This includes local governments, including regional district and municipal officials, members of the Legislature, educators, private providers, industry business leaders, agencies, economic development and regional planning organization and others.
This document describes practical approaches and steps toward defining, planning and implementing such connectivity solutions. In various sections of this Handbook you will see references to case studies used to illustrate the benefits of broadband.

This Handbook is a resource to help in defining a starting point and in leading a process. It is NOT intended as a standalone resource or definitive guide to establish final plans, budgets or manage implementation. Professional advisory services, technical expertise and other resources will also be critical when designing broadband solutions.

This Handbook has been guided by a direction and input from a diverse cross-section of stakeholder interests. It is backed by many years of experience working in the telecommunications sector.

Table of CONTENTS

SECTION 1:
Connecting British Columbia

A Commitment to Connect

In December 2016, the CRTC established broadband internet access as a new basic standard. Until that time, local landline telephone service was the only standard deemed basic by the CRTC. The CRTC had previously called internet service vital and essential to life and success. In its ruling, the national regulator ordered the country's internet providers to begin working toward boosting Internet service and speeds in rural and isolated areas.

The CRTC established new objectives for internet services: fixed broadband services should now come with the option of an unlimited data package, and mobile wireless technology should be available not only in homes and businesses, but also along the country's major roads. In December 2016, the CRTC also set ambitious new targets for fixed broadband access of 50Mbps download and 10Mbps upload.

While public policy objectives now include making broadband available to all Canadians, the reality for residents in many rural and remote areas is that such services are still not available or adequate, and solutions to remedy that situation are not readily apparent.

In December 2016, the CRTC also set ambitious new targets for fixed broadband access of 50Mbps download and 10Mbps upload.

Access

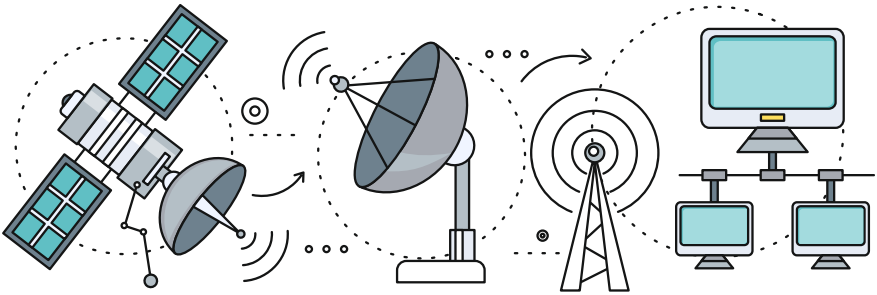
Accessible internet relies on the availability and reliability of backhaul infrastructure and the availability of diversified last-mile technology providing a link to the end consumer. British Columbia's infrastructure uses diverse technology, however has limited diversity of routes, particularly in the North. This makes basic services, such as credit card transactions and real-time healthcare via video vulnerable and impedes economic investment in rural and remote areas.

Affordability

Affordable connectivity is critical for enabling economic development and diversification, particularly in rural regions, and maintaining the competitiveness of British Columbia's industries. Improving affordability is critical for enabling economic development and diversification, particularly in rural regions, and maintaining the competitiveness of B.C.'s industries.

Speed

Speeds are critical for businesses, particularly in high-technology industries. Actual speeds determine the type of Internet content and services that users can access and is therefore critical to economic growth, educational opportunity and overall health improvement in rural and remote areas.



The Importance of Connectivity

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

Just about everyone in British Columbia uses the internet every day, and those who do not are helped and supported by those who do. The digital devices we carry in our hands, backpacks and totes 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 multi-dimensional communications medium used to watch TV, create home-based businesses and monitor the health of family members, even call 9-1-1.

Reliable and affordable broadband (high-speed internet) is a critical factor in delivering public services including education, health care, business, social and economic development, other government services, public safety, security and emergency management as well as mobile/cellular telephone. Accordingly, prosperity, growth, quality of life and the very sustainability of communities are increasingly dependent on broadband services.

Evolving technologies and market trends provide a compelling case that higher rates of growth and demand for Internet services and capacity must be anticipated. New and evolving technologies such as cloud computing, internet of things, artificial intelligence, block chains and many new and evolving applications and services build on new capabilities, creating more demand and requiring more capacity.

Equal opportunity, affordable access and participation in the digital connected world is already and will be increasingly critical for businesses and residents of communities everywhere to obtain all manner of services, also ensuring sustainability, health, safety, growth and prosperity.

Investments in Connectivity Infrastructure

Millions of dollars have been invested throughout British Columbia to make broadband available to a majority of the British Columbians. These investments, primarily through private funds, and in some cases through federal and provincial grants, has energized the use of broadband in many parts of the province. This has also served to promote demands for broadband coverage in other locations.

Canada's major carriers are focused on building new infrastructure as quickly as possible to establish the network capacity that is needed to meet growing demands.

Challenges to Connect

Major carriers typically focus their planning and investment on urban centres and more densely populated areas, seeking to optimize returns on private capital.

- Proximity to fibre transport can often be the primary roadblock to being able to upgrade or build a network to a community. In many cases, the cost to build the access network or last-mile connections are prohibitive. For instance, in many smaller, rural communities, homes are spread out and even if fibre is close, the economics of building last-mile facilities may be too challenging to justify the build.

- Developments in the area of wireless services are similarly instructive. Few major carrier wireless providers ever met the full potential of 3G wireless before they began deploying Long-term Evolution (LTE). While current LTE infrastructure is capable of speeds in excess of 100Mbps, few wireless providers today often deliver much more than 30Mbps, even in areas where they have access to fibre networks. Performance is improving as network capacity increases, and carriers are monitoring market developments while working to grow their own capacity and prepare for 5G wireless, sometimes referred to as WiGig (capable of speeds up to a Gigabit/1000Mbps). Google and Facebook are introducing pilot projects that deliver wireless services at Gigabit speeds. Carriers in Asia and Europe have also been more aggressive and successful in delivering much higher capacity services. Canadian carriers are lagging behind, but scrambling to catch up as they recognize the trends of business transformation, new competitive threats and growing consumer demand.

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

SECTION 2:
Connectivity Solutions for Communities

The following section describes practical approaches and steps toward defining, planning and implementing connectivity solutions.

The focus when identifying needs and outcomes should be on end users (residents, businesses, etc.) or last-mile solutions. Dependencies must also be considered with respect to the long-haul "transport" networks of major carriers and points of presence (POPs) or general "gateways" that make access available for local ISPs to operate their local/regional networks. These often include and may be constrained by "backhaul" for services distribution, collection and/or aggregation, as well as last-mile components for end-user connectivity.

Step 1 Perform a Community Connectivity Assessment

1. Begin a review and assessment by defining and documenting your situation with a custom 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 (carriers and ISPs).

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, internet service providers (ISPs) and carriers 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 major carriers and local ISPs.

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

Step 2 Perform a Technology Assessment

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

Communities should perform a technology assessment that includes, for each targeted area:

- A regional overview and summary identifying last-mile, backhaul and transport solutions, including key internet gateways/access points.
- Narrative descriptions of technologies/network solutions required.
- Block diagram illustrating major network design and key components.
- 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 with lowest ongoing operational costs. However, in some ways they offer less flexibility. 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:

Copper wire networks

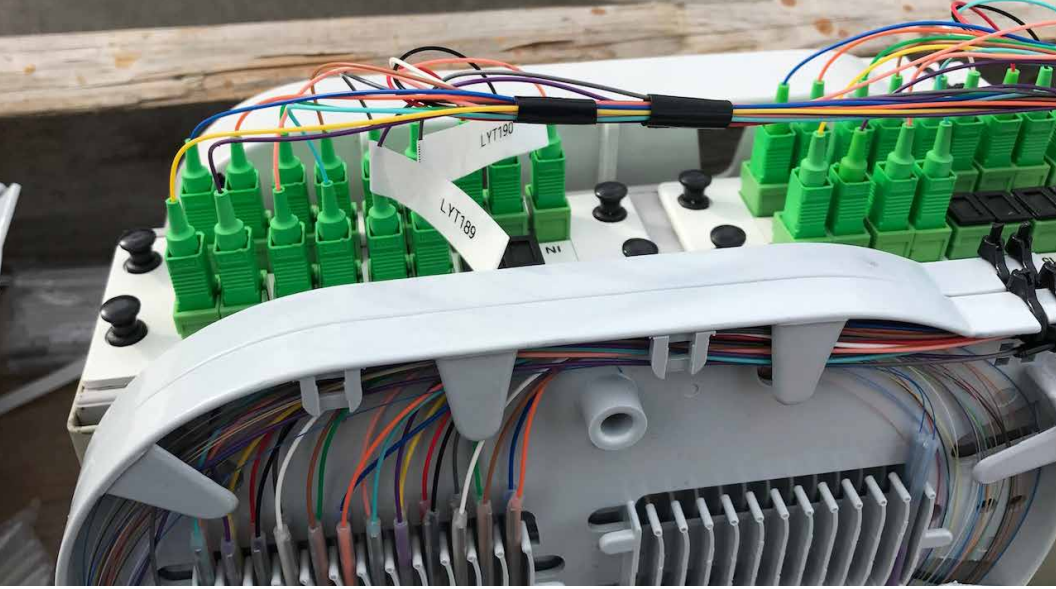
Copper wire networks, which were developed initially for voice telephony services, and subsequently adapted for internet services, now commonly DSL (digital subscriber lines). DSL services are limited in capacity or speed and are also dependent on distance from the carrier's "central office" (CO/switch) locations. Practical speeds available to end users can exceed 5 Mbps, but usually only within 1 km of the CO/switch, and speeds decrease rapidly as the distance between the CO/switch and subscriber increases.

The large scale of established copper wire infrastructure and investment in these legacy networks, and ongoing value for household land-line telephone and 911 emergency services, suggests that copper networks will be maintained and continue to be in service for some time. However, the inherent limitations of copper wire DSL services have already resulted in carriers refusing to make further investments in expanding such networks. Also worthy of note and consideration in some instances is that copper wire DSL networks are being decommissioned and, as a result, components or spare parts may be available at little or no cost. Some areas have taken advantage of such opportunities to implement or upgrade services where copper wire networks are already in place and alternatives are not readily available or affordable.

Common copper wire technology, including DSL, is incapable of achieving the new CRTC-recommended standard for minimum Internet speeds of 50 Mbps.

Coaxial or Cable TV Networks

Coaxial or Cable TV networks, which were developed for television services initially and subsequently 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.



Additionally, 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. Other critical elements of coax cable networks include:

- Head-end components including cable modem termination system/ equipment and related software (e.g., DOCSIS 2/D2 or D3);
- Cable plant (particularly coax cable, amplifiers, connectors, taps); and,
- End-user equipment (particularly cable modems).

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 exceeding 100 Mbps.

Most coax cable networks are dependent upon aerial access, above-ground, using utility poles that are owned by the electrical power utility or telephone company (e.g. BC Hydro, Telus). The pole access/rental cost for operating and maintaining aerial cable is becoming increasingly expensive, to the point of challenging viability for smaller cable TV operators and ISPs.

The installed cost for aerial cable distribution networks can be in the range of $10-$20/m, whereas installed cost for buried cable is much more expensive – often in the range of $40-$60/m. However, high operating costs for aerial cable, including access/rental charges, can negate capital cost differentials.

Coax cable technology is still considered to be cost effective for last-mile or end-user services, particularly as new connections can usually be established for $1,000 or less per subscriber.

Fibre-optics networks

Fibre-optics networks are based on the latest and most flexible/capable technologies for solid cable. They 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 cheaper to operate and more reliable. 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 1,000 Mbps (1 Gig) and 10 Gig or more. Commercial transport capacity is often contracted by/for carriers in terms or increments of services for 120 Gig or more.

The total capacity of a fibre network is typically many times greater than numbers stated above. Current technology allows up to 8,000 Gig per fibre (or fibre pair) and technology advancements are continuing. Fibre cables utilized for end user connections typically contain only 1-2 fibre strands, but cables for long-haul transport typically contain 12 or more fibre strands. Cables for local distribution networks often contain much higher numbers of strands.

The costs of fibre cable and related network technologies are declining (while becoming more powerful), but installation costs are considerable. Fibre-optic cable can be available for as little as $2-$3/m, but installed cable costs for long distance transport or backhaul are significant – typically in the order of $10-$20/m for aerial cable, $40-$60/m for buried and $10-$60/m for marine/subsea. Fibre cable technology is also becoming more attractive for last-mile connectivity. End-user service connections are now often planned with budgetary costs in the range of $2,000-$3,000 per subscriber.

Wireless Solutions

Wireless solutions support a wide range of applications and network needs. They remain a key strategic focus for many ISPs and particularly for the mobility or cellular phone businesses of most major carriers. In some cases, wireless solutions may be considered less desirable as they cannot match the highest speeds and reliability available with solid wired solutions, but they offer great advantages in flexibility and mobility, and tend to be cheaper to install. 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, which were developed by major carriers to provide mobile telephone services, and 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), but those technologies are not expected to be widely deployed by major carriers for some years to come.

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 & transmitter-receivers). Such sites are also expensive to construct – typically in the range of $500-750 thousand per new cell tower site. Other factors add to complexity and disincentives for new development, particularly in rural and remote areas. Consequently, trends are for data usage limits remaining with expensive rates for a considerable time. Nevertheless, competition and new advances in technology are changing these dynamics for Internet service delivery. Examples include the TELUS Smart Hub, LTE-A (next generation with higher speeds/capacity) and small cells or micro cells, offering

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 as 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 WiFi, particularly for connecting devices such as computers, tablets and smartphones, but the inherent limitations of WiFi with radio frequency contention, interference, distance and capacity often require that other solutions be utilized to bring reliable service connections to the premises (before using WiFi for connecting local devices). Point-to-point solutions for that purpose include a variety of radio technologies, frequencies and standards (e.g. LTE).

- End-user service connections are most often budgeted in the range of $500-$1,000/user.

- Backhaul 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 backhaul with fibre-direct cable connectivity wherever that can be cost justified.

- Typical installed costs for backhaul links to serve a local ISP network are often in the range of $10,000 to $50,000. That 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. Some distances to serve small, dispersed populations. Some considerations: radio links often require costly towers and support infrastructure.

- Depending on distance and capacity, the costs of radios and spectrum licensing can also be significant.
- Costs for ongoing operations and maintenance can also be substantial, and must be considered, compared with requirements for service capacity and opportunities for revenue and cost recovery.
- There are a wide range of radio technologies and frequencies (licensed and unlicensed) are utilized for building such links.
- Tower needs can vary widely and remote locations can be very expensive to develop and operate.
- Costs for a wireless transport link can vary widely accordingly from tens of thousands to hundreds of thousands, or even millions of dollars.

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.

Step 3 Perform a Vendor Assessment

The Community & Technology Assessment processes as described above will help to define the types of vendors that would be most suitable or desirable based on the types of solutions they provide, cost effectiveness, risk exposure/management, and other key factors.

Prepare to share

Depending on governance policies and leadership discretion, documentation prepared through Steps 1 & 2 above could be shared with targeted vendors and/or advisors selectively and informally, in part or in whole, or as backgrounders and supporting documents in a more formal and/or broadcast or public competitive Request For Information (RFI) or Request For Expressions of Interest (RFEI).

Contact potential vendors

Preliminary contacts with vendors (particularly local carriers and 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 other 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 carriers. Large scale capital investments are often planned and negotiated in such a manner for the development of fibre-optic/wired or Microwave Digital Radio (MDR)/fixed wireless solutions. Specific and contracted assurances may also be required, related to anticipated levels of revenue and return on investment.

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

Many community projects involve aspirations for supporting small local businesses and associations, but leaders should be mindful of experience, trade-offs and cautionary tales. While individuals and personalities may be critical to success, particularly in small communities, leaders should be mindful of the inherent limitations and risks of depending on small organizations and sole practitioners for maintaining high quality services with rapid response times for repairs and new customer requests. Concerns about capacity or quality of service can be addressed using public competitive procurement processes to engage external organizations that have established track records with businesses of a larger scale in other areas.

Satellite network solution vendors:

Satellite vendors offer retail packages and turnkey solutions directly to end-users so that no further planning, design or procurement is required beyond providing referral information from websites noted.

Terrestrial network solution vendors:

Terrestrial network solutions and related vendor/procurement options should be considered according to the separate types of required network service/functions (e.g., for transport, backhaul and last-mile).

Transport solutions and new carrier vendors:

Transport solutions, and options to bring new carrier services into a region or community (e.g. cellular phone service), usually depend on distance from established carrier networks, topography and potential service population as well as community, regional government, anchor tenants or project sponsor(s) supporting a business case for carrier investment.

Last-mile, backhaul and wireless vendors:

Last-mile and backhaul solutions, including fibre-optic cable for backhaul and fibre-to-the-premises (FTTP) as well as wireless (e.g. LTE/other options) for both backhaul and last-mile, may introduce more opportunities for competitive procurement. However, practical options are often dependent on local realities of dealing with limited numbers of small businesses that are willing and able to operate as ISPs.

Step 4 Access Funding

Most funders 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 carriers and 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 all can be valued as contributions in-kind.


Photo: Lytton Area Wireless Society

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 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-taxagreement.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 (Building Canada Fund):
http://www.infrastructure.gc.ca/prog/bcf-fcc-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 or programs and/or policies that provide for unsolicited or 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 carriers/providers and existing services

Define the desired connectivity service levels

1. Descriptions of the types of services required, 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/net work plan

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

Community Connectivity Assessment

2. Block diagram (illustrating major network components)

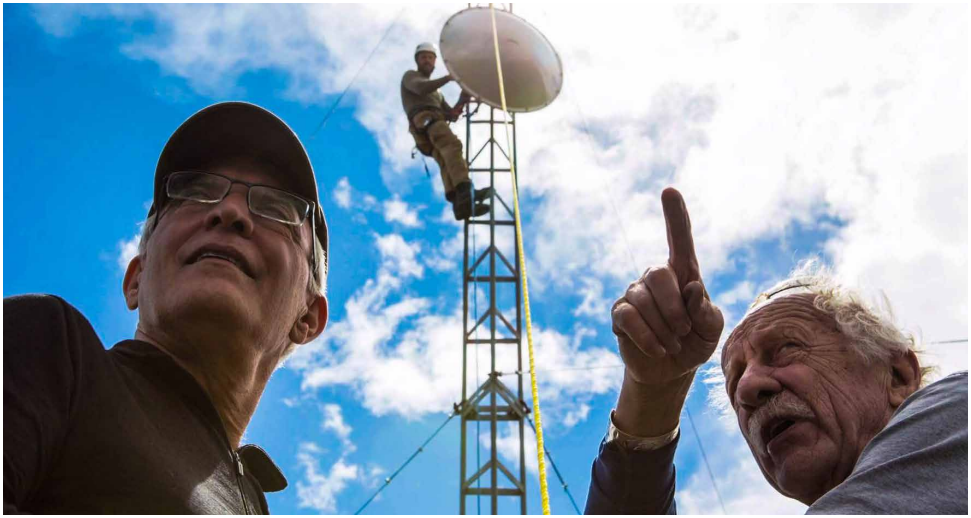
3. Budgetary framework spreadsheet (illustrating preliminary costing for development)

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 & capital that could be contributed
- [ ] Confirm approach to funding & procurement
- [ ] Define key milestones & timing
- [ ] Consider procurement strategy

Access Funding

- [ ] Confirm viable options & approach to funding
- [ ] Confirm application requirements & state of preparedness
- [ ] Further research & assistance as/if required
- [ ] Prepare/submit formal funding applications
- [ ] Confirm formal funding/contribution agreements
- [ ] Complete procurements & 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: Tatlayoko Think Tank Ltd.

SECTION 3:
CASE STUDIES

Broadband in the Columbia Basin–Boundary Region

https://broadband.ourtrust.org/

This case study, prepared February 2016, 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 seriously 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 724-km high-speed network. The Trust and 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 spring 2018.

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 small 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: All of the internet service providers had operating track records and knew where to augment service to more residents.

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. Network BC 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: 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

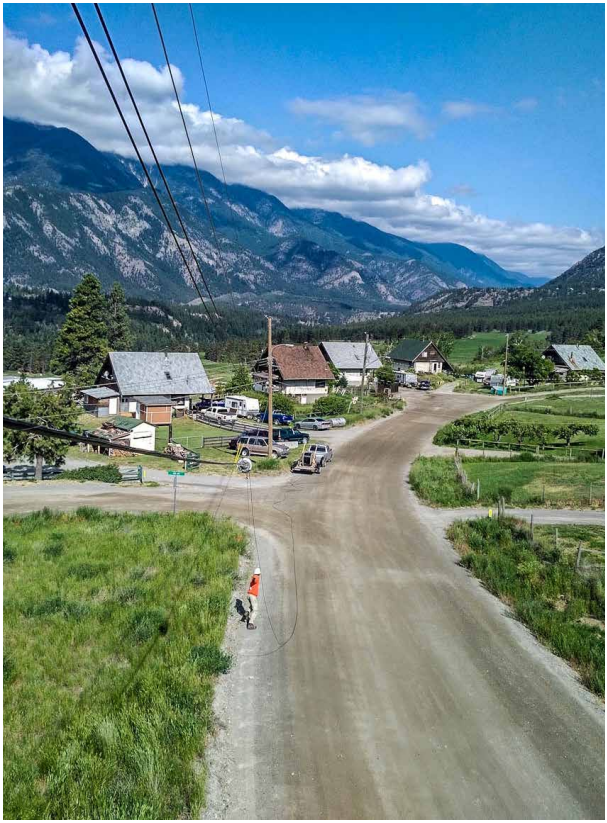
The SRD engaged a consultant with expertise in the telecommunications sector to assist with the development of the strategy. This consultant guided staff on the research and stakeholder engagement required to be undertaken and developed guiding principals for the SRD. The plan has been released as a 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 Regional District 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.
Going forward, the SRD is likely to continue to play a lead role in facilitating partnerships and securing funding. Should it so choose, the SRD may also consider establishing a regional broadband infrastructure service and taking a more involved approach to lead network development that can include contracting the construction and operation of a network. The SRD is looking to a growing number of local government entities such as the City of Campbell River's CR Advantage project as well as others across Canada that have taken a similar approach.

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 4:
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

Artificial Intelligence (AI): AI is often compared to the advent of the internet. It is automating work processes and computers. It is increasingly proving to be a vital element in fueling growth for businesses and economies and fast becoming a vital asset in helping them to grow. An example of an application of AI is in self-driving cars.

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): Broadband comes from the words "broad bandwidth" and is used to describe a high-capacity, two-way link between an end user and access network suppliers.

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

Carrier: Are generally divided into incumbent and competitive carriers. A competitive local exchange carrier (CLEC) is a provider competing with other, already, already established carriers called incumbent local exchange carriers (ILECS). The ILECs are usually the original carrier in a given area and receive different regulatory treatment from the newer CLECs.

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 http://www.ccts-cprst.ca/.

Cellular: See mobile.

Coaxial or Coax: Is copper cable used by cable and telephone companies. Coaxial calbe 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.

Full-Duplex (FDX): Refers to the transmission of data in two directions simultaneously, for example a telephone is full-duplex because both parties can talk at once.

Gigabit: One thousand million bits.

Half-duplex (HDX): Refers to the transmission of data in just one direction at a time. For example, a walkie-talkie is a half-duplex device because only one party can talk at a time.

High-speed Internet: Also referred to as broadband, high-speed Internet is an 'always on' fast connection to the Internet with a minimum download speed of 5 Mbps. Three of the most commonly used technologies to provide broadband are cable, DSL (Digital Subscriber Line) and wireless broadband.

Internet Gateway: A network connection that provides access to the Internet for the service provider's network or last mile distribution system. It is a network or networks that consist

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 kilometres 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.

Middle-Mile: The segment of a telecommunications network linking a network operator's core network to the local network plant, typically situated in the internet service provider's central office.

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.

Monetized donations or contributions: Means contributions of goods or services, other than cash from third-parties.

National Service Providers: Internet service providers who also provide service outside British Columbia.

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.

Scalability: The ability of a network to expand service to a larger area around the vicinity of the existing connected locale, or expand to permit a larger number of network customers.

Single End User: Where a single customer or business is the only user of the network.

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

Connecting British Columbia Program