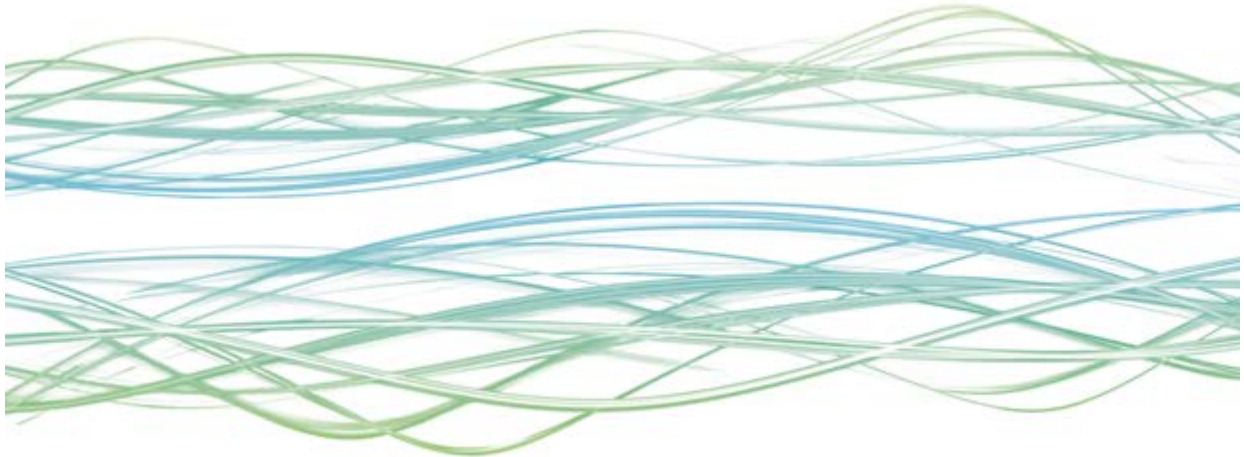
Broadband 101



What is Broadband?

- ‘Connectivity’ not just ‘Internet’
  - Digital municipal services like traffic cameras; local communication; store data
- “Always-on, high capacity data transmission network”
- Download / Upload speeds important
- Asymmetrical / Symmetrical connections
- Wired / Wireless - ‘Fibre to the Antenna’

Context - Broadband in Canada

- Once world leader - first to connect all public schools, libraries
- Over the past 15 years - losing ground
  - 2001 - OECD ranked Canada 2nd in broadband subscriptions per 100 inhabitants
  - 2014 - OECD ranked Canada 12th
- CRTC: nearly 20% of Albertans lack broadband; especially rural
- ITU notes broadband crucial in global economy, and to provide public services to citizens

Broadband Benefits

- Economic Growth
- Business
- Agriculture
- Government
- Health
- Education
- Public Safety
- Transport
- Teleworking
- Entertainment
- Tourism

Considering Future Use and Demand

All Canadians will need the capability to transmit gigabits per second of data and process terabytes of information. While this scenario will not be the case tomorrow, we maintain that this is the future our communications infrastructure must be prepared to handle. New infrastructure builds must anticipate and accommodate future needs.

- Alyssa Moore, Policy and Strategy Analyst, Cybera, appearance at CRTC hearings into broadband, April 27, 2016

Planning for the Future

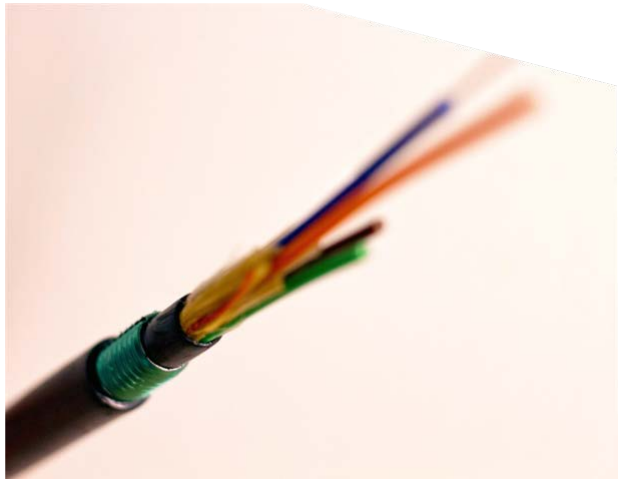
- Last 20 years - demand grows as devices, applications evolve
- Cisco:
  - Global Internet traffic to triple in next five years;
  - Number of connected devices to almost double by 2018;
  - Global streaming video in 2020 equivalent to 86 billion DVDs annually
- Internet of Things (IoT) - billions of networked ‘smart’ devices - buildings, agricultural equipment, medical devices, etc
- Need to develop **scalable** broadband systems
- Communities at different stages - develop their own solutions

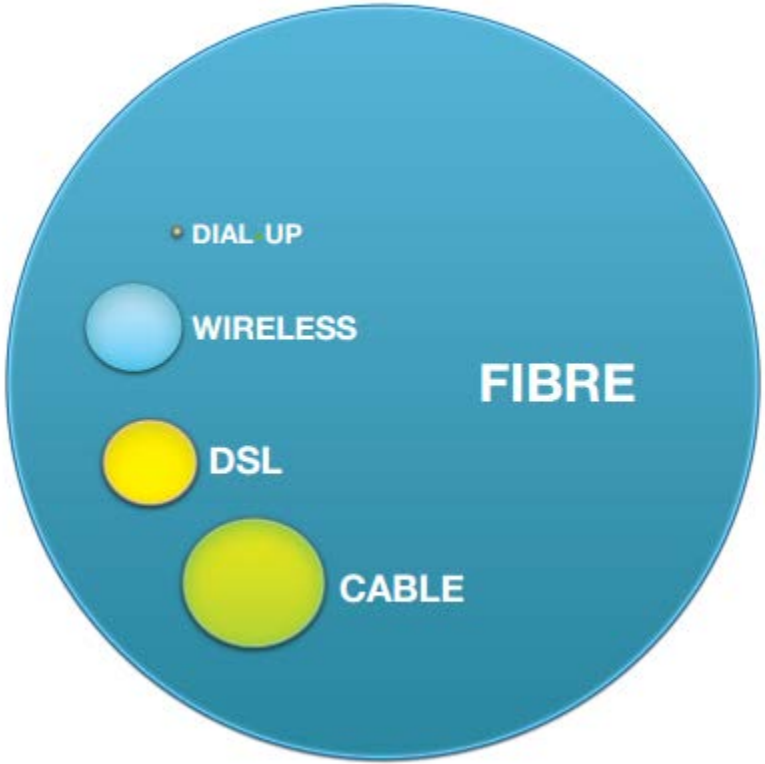
Type	User Types	How it Works	Advantages	Disadvantages
Fixed Wireless	Transmission by tower to fixed points, using wireless spectrum	Costs include tower deployment and maintenance and radio antenna infrastructure	Less intrusive to deploy; doesn't require wired connections with each home/ business	Requires line of sight to receiver; can face capacity constraints with multiple users
DSL	Transmission over copper telephone lines	Requires access to copper telephone lines	Uses existing and ubiquitous infrastructure	Slowest of the wired broadband connection types; performance declines with distance
Coaxial Cable	Transmission over coaxial cable	Requires access to coaxial cable lines	Fastest of legacy wired connection types (copper and coaxial cable)	Performance declines with congestion from multiple users
Fibre	Transmission over fibre optic cables	Costs include fibre deployment (trenched or aerial); potentially electronics at ends of fibre cables	Fastest of all connection types; allows symmetrical connections (same upload and download speed)	Expensive to deploy at first (compared to fixed wireless towers)

Fibre Access Technology

‘Open’ or ‘Closed’

‘Lit’ or ‘Dark’





Fibre Technology Overview

- Fibre-to-the-home/business/premises (FTTH/B/P)
- Generally 1 Gbps (1000 Mbps), though up to 10 Gbps
- Signals travel through fibre optic cable
- Allows symmetrical (equal) upload and download speeds, but most implementations asymmetrical
- Speeds limited by electronics attached to fibre optic cables
- **BUT** - full scale deployment more expensive than fixed wireless

Benefits of Fibre

- Scalable - enough carrying capacity to meet foreseeable future demands, supported by ongoing technical innovation
- Once capital costs (including conduit deployment) are paid, fibre relatively cheap to install, maintain and upgrade
- Lasts quite a long time - up to 100 years
- Supports other forms of broadband, such as fixed wireless
- Distance not a barrier - data transfers quickly
- Allows for symmetric connections - equal upload/download

Technology Background

Two types of connection:

1. **Backhaul**
    - To Internet infrastructure via Internet Exchange
    - Links your community to the world
2. **Last/Final Mile**
    - In community (households; businesses)
    - To backhaul via ‘Point of Presence’ / ‘Meet Me Facility’

Two Types of Connections

Community Broadband Stories I: WISPs

Fixed Wireless Access Technology (FWA)

- Speed up to 100 Mbps in the aggregate (but impacted by download/ upload split and number of concurrent users)
- Typically slower than wired links but sometimes outperforms DSL
- Transmits information via radio waves from towers to fixed points
- Receiver must be within line-of-sight of the tower to connect
- Towers connect to backhaul infrastructure through microwave (more common) or by wired connections (ideally fibre) (less common)
- Ideal for remote and sparsely populated areas

Examples of WISP Projects:

Grande Prairie

- Municipality set up program facilitating tower deployment for Grande Prairie Networks to operate WISP (Wireless ISP)

Parkland County

- Coalition of 7 municipalities working together (regional approach)
- Regional panel at 3pm on Thursday

Examples of Fibre Projects:

Olds: Community Owned and Operated Network

Taber: Partnership with Telus for fibre deployment

- Community panel at 1:15pm on Friday

Vulcan: Partnership with Axia for fibre deployment

Policy and Regulatory Background

Innovation, Science and Economic Development (ISED)

- Administers federal broadband funding programs

Canadian Radio-Television and Telecommunications Commission (CRTC)

- Regulates access to Internet (not content)

Provincial departments:

- Service Alberta - responsible for SuperNet – presentation 1:15pm Thursday
- Agriculture and Forestry - Final Mile Rural Community Program (funded 27 projects in 2012)
- Economic Development and Trade - Funded community broadband preparedness studies

CRTC Summary

- Arm’s length telecommunications regulator
- Authority over Canada’s telecommunication ecosystem
- Acts as a quasi-judicial independent body

Wholesale Access decision

- CRTC phasing in tariffed access to some wholesale infrastructure, including FTTH, starting in ON and QC
- CRTC just started phase 2 of disaggregation (moving to the West)

‘Basic Service Objective’ Review: Background

- CRTC reviews basic services every 5 years (approx)
- Most recent review - began April 2015; decision December 2016
- Is broadband a ‘basic’ / ‘essential’ service that all Canadians should have access to?
- If so, what’s the CRTC’s role in supporting delivery of that access to areas that otherwise lack a business case?

Decision Summary (CRTC 2016-496)

Broadband is designated a basic service

New target speeds: 50 Mbps / 10 Mbps

Requires ‘unlimited’ bandwidth option (no data caps)

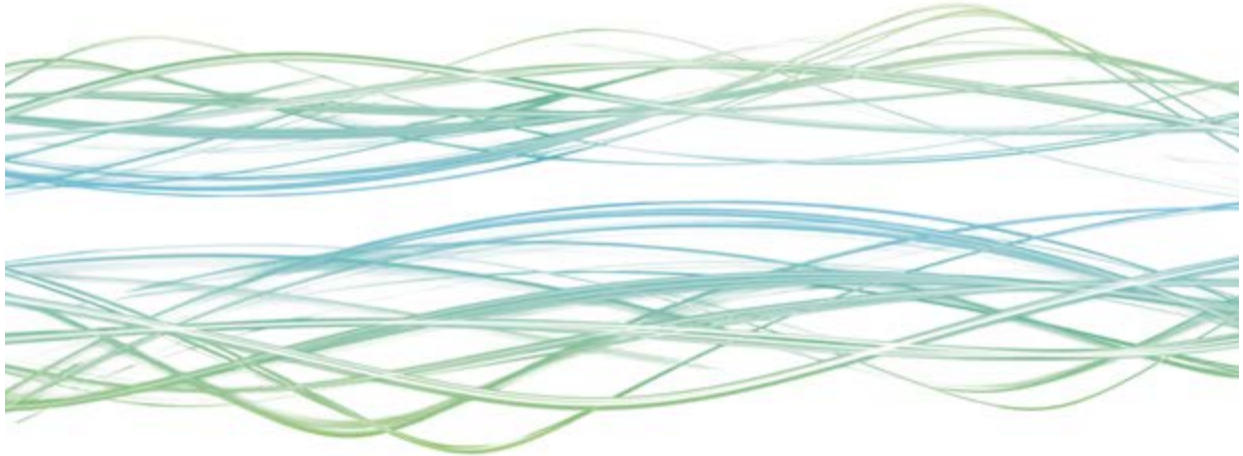
New infrastructure fund for ‘underserved’ areas:

- CAD$ 750 million over 5 years
- All qualified providers can apply
- Managed at arm’s length, based on objective criteria
- Fixed broadband and mobile wireless infrastructure
- 10% of annual funds reserved for satellite-dependent communities
- Source is Telecommunication Service Provider (TSP) revenues, including from retail internet and texting services

ISED Summary

- Innovation, Science and Economic Development (formerly Industry Canada)
- Presentation at 8:45am on Friday
- Administers federally funded broadband programs:
- Broadband Canada (2009-2012)
- Connecting Canadians (2014-2017);
- new Connect to Innovate program (2017-2021; worth $500 million)
- Regulates much of wireless sector and administers radio-spectrum licenses

Broadband 102



Basic Economics of Broadband

Technological Considerations - what type of technology do you want to use?

Ownership - who will own and maintain the infrastructure?

Service Provision - who will provide services over the infrastructure?

Business Model - what will be the revenue/cost model to support the broadband system?

Economic Considerations Linked to Technology

- Fixed wireless vs Fibre
- Fibre deployment: aerial vs trenched
- Wireless deployment: tower heights; connection to PoP
- Costs of electronic equipment
- Density, geographical spread and topography of your community
- Cost of crossings and rights-of-way (railway, pipelines, etc

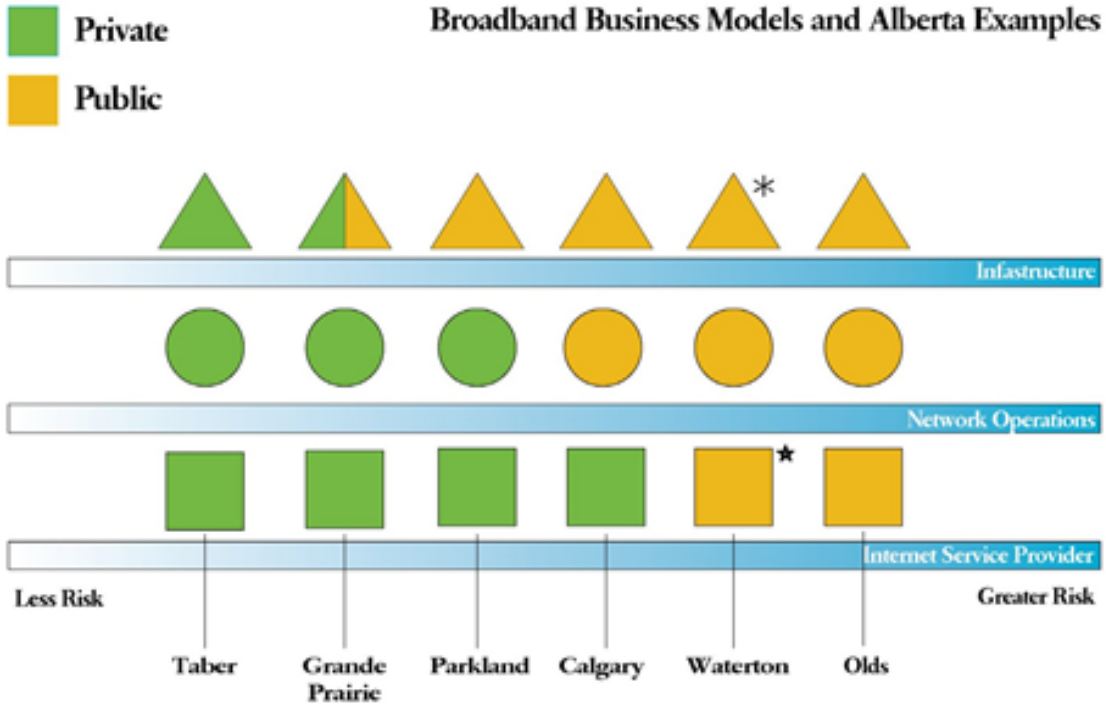
Ownership and Service Provision Considerations

Capital Costs

- Procurement and installation of infrastructure
- Amortizing capital expense - 10 years, 15 years, 25 years)?
- Infrastructure as a utility? (paid from local tax revenues)

Operations and Maintenance Costs

- Operating, maintaining, upgrading facilities (obsolescence?)
- Technical, administrative, marketing and support staff


Private
Public
Broadband Business Models and Alberta Examples
Infastructure
Network Operations
Internet Service Provider
Less Risk
Greater Risk
Taber
Grande Prairie
Parkland
Calgary
Waterton
Olds
RISK
* public-public partnership beteen Parks Canada and Waterton
★public-public partnership between Waterton and Olds

Technology Specific Considerations

Fibre networks

- ‘Open’ or ‘Closed’
- ‘Lit’ or ‘Dark’

Fixed wireless towers

- Tower sharing rules (ISED)
- Licensed or unlicensed (license exempt) spectrum

Ensuring redundancy and security

Community Engagement

- Identify development goals through structured planning and dialogue
- Shape broadband projects to enable widespread adoption and effective use
- ‘Whole Community’ approach - strategic planning on how bandwidth is paid for, distributed and managed
- Inform decisions on how infrastructure and bandwidth made available to deliver services such as e-health, e-learning, etc

Benefits of Community Engagement

- Supports leadership by providing information from constituents on local needs and priorities (political buy-in is key)
- Enables strategic planning, research and business support
- Helps build technical capacity and digital literacy through targeted training initiatives
- Educates residents on the benefits and uses of broadband
- Helps identify community champions

Engagement Process

- Whole community perspective addresses a diversity of users: individuals, businesses, organizations
- Consider both social and technical components: underlying local and transport infrastructure along with various uses
- Consider: availability, price, quality of service, interoperability, ownership, and accessibility
- Engagement takes a variety of forms, including surveys, focus groups, and planning circles

Example: Citizen Planning Circle in Olds

- Spring 2014; 13 diverse community members
- Participants heard background; contributed to policy
- Through facilitated discussions, developed action proposals to inform broadband in agriculture, business, education, and healthcare sectors
- Facilitated by Centre for Public Involvement (CPI) at the University of Alberta, supported by Alberta Agriculture and Rural Development, Olds Institute, and CPI.
- For more information, visit Olds Institute website: http://www.oldsinstitute.com/

Example: Axia Survey in Vulcan (Process)

- Meetings with community leadership
- Engage citizens – demonstrate 30% of residents express interest
- Evaluation – Axia surveys town (roads, utility paths, permits)
- Design – of fibre network
- Construction
- Sign up
- Installation

Image Source:
https://www.axia.com/alberta

More info: https://www.axia.com/alberta

Challenges and Pitfalls in Broadband Planning

- Lack of Community “Buy-In” / Defining the “Why”
- Achieving a Proper Needs Assessment
- Implementation Costs
- Competition or Uncooperative ISPs
- Population/cost ratio: Small population = low capital / high O&M – and vice-versa

Broadband Best Practices

- Dig Once
- Aerial Fibre Deployment
- Fibre Fed Towers
- Transition Planning
- Demand Aggregation
- Thinking and Working Regionally

Action Plan - Environmental Scanning

- Geographical
- Community and Socio-cultural
- Regulatory
- Economic
- Technology
- Partnership and Competition
- Human Resource

Geographical

- Distance to POP/availability of backhaul/connection to YYCIX
- Density and geographical spread
- Topology and line of site, climate (fixed wireless solutions)
- Trenching considerations (fibre solutions)

Community and Socio-cultural

- Community demographics and trends (aging in place, youth retention, family attraction)
- Attitude toward community/municipal ownership (history of cooperatives)
- Cultural nuances - attitudes towards bootstrapping
- Local priorities
- Community engagement

Regulatory / Policy

- ISED broadband programs (“Connecting Canadians”)
- CRTC decisions on wholesale access; review of basic telecommunication services
- SuperNet
- Economic Development and Trade (Government of Alberta) Broadband Preparedness Studies
- Other federal/provincial policies
- Municipal governance, rights of ways and bylaws

Economic

- Employment patterns/major employers and industry
- Diversification
- Considering small business use/advantages
- Financials including local municipal budget, funding support, grants, amortization models, willingness to pay

Technology

- Existing broadband infrastructure and service providers (especially existing dark fibre)
- Backhaul to YYCIX or YEGIX
- Asset Mapping
- Potential uses/demands of broadband
- Both current and future technology trends

Partnership and Competition

- Thinking and looking regionally - what are other communities doing; how can we work together
- Existing service providers (within and outside) - partnering with ISPs
- SuperNet
- Negotiating with ISPs/ previous best practices

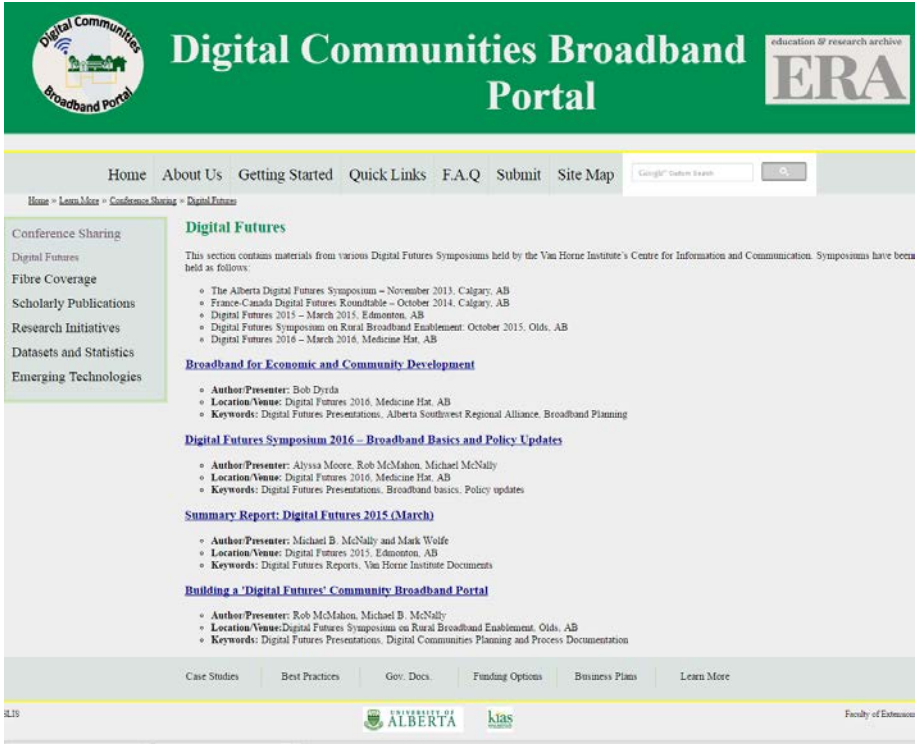
Human Resources

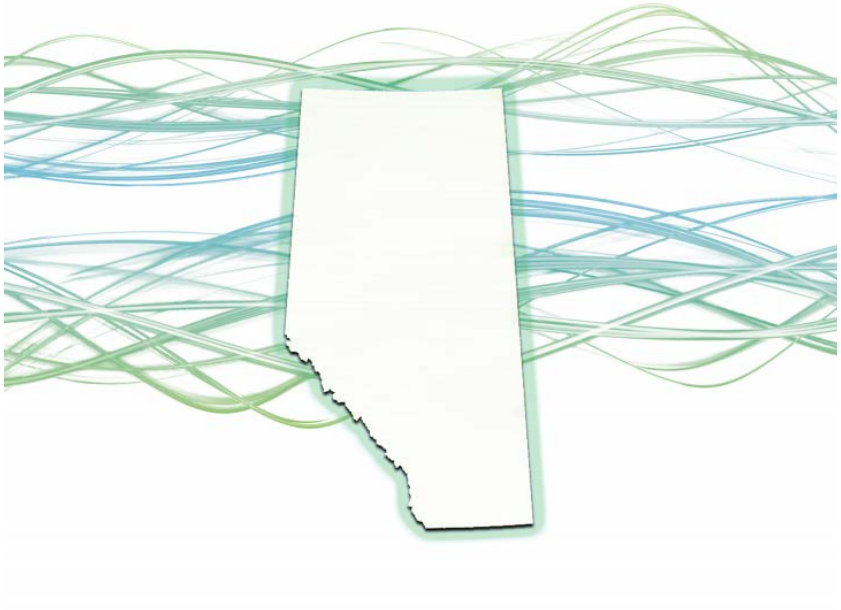
- Identifying expertise in different areas relevant for broadband projects such as financial, technical, policy and planning, administration, and community outreach
- Determine areas of internal knowledge and capacity and areas for seeking expertise from external sources


Create Cross-Functional Team
Mobilize broadband champions within the community
Build cross functional team with requisite skills (e.g. financial, technical, policy/ planning and community champions)
1
2
Community Needs Assessment (consider both current and future needs)
Asset Mapping
Identify best practices (e.g. dig once)
Learn from other communities (local and abroad)
Policy and Regulatory scanning and assessment (both internal and external)
Socio-cultural assessment (internal)
Economic assessment (current and future) (internal and external)
Competition and Partnership (internal and external)
Geographical assessment (internal)
Human resources (internal and external (outside experts/consultants))
Technological assessment (both current and future)
RFP for Feasibility study
Scan and Assess
Create Vision
Cross functional team generates vision for broadband solution within community
Consider potential linkages with neighbouring communities/ broadband initiatives
3
4
Timelines (with goals) and costs
Identify key responsibilities and roles
Choosing connection type
Selection of business and ownership/ governance models for feasibility assessment
RFPs for feasibility assessment
Plan Processes

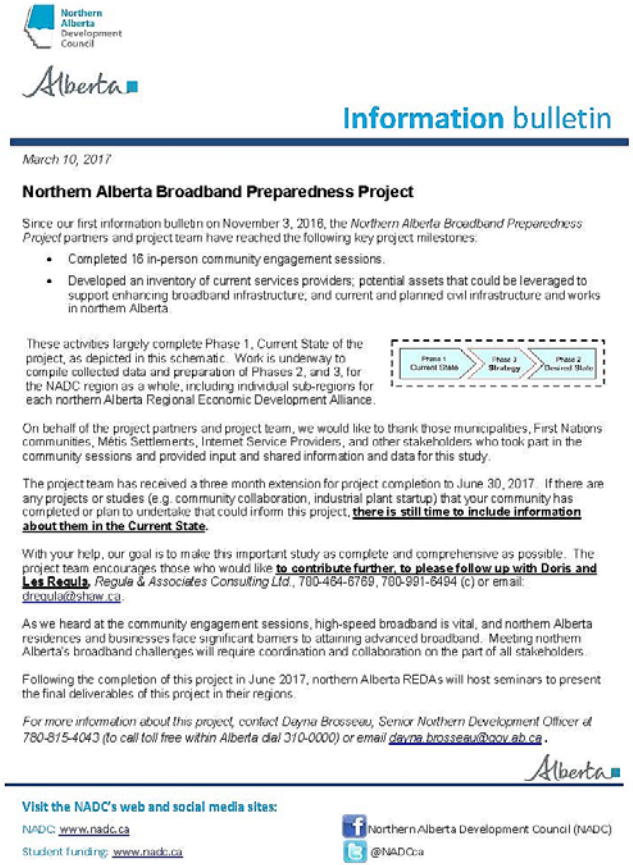

Engage Community
5
Buy in, promotion
Town hall meetings
Surveys/focus groups
Consider take-rate - demand aggregation
6A
Implement Internally
RFP Review and Evaluation
Identify financial resources
Internal approvals (bylaws and permits (rights of way))
Transition strategies (e.g. for Fixed Wireless to Fibre (over time))
6B
Implement Externally
Acquiring materials
Engaging with external partners
Grants and financing
Policy and regulatory considerations and clearances
7
Roll-Out Roadmap
Construction planning and scheduling
Testing
Service provision
8
Review and Evaluate
Obtain feedback
Enhance services
Plan for future

Resources (U of Alberta):

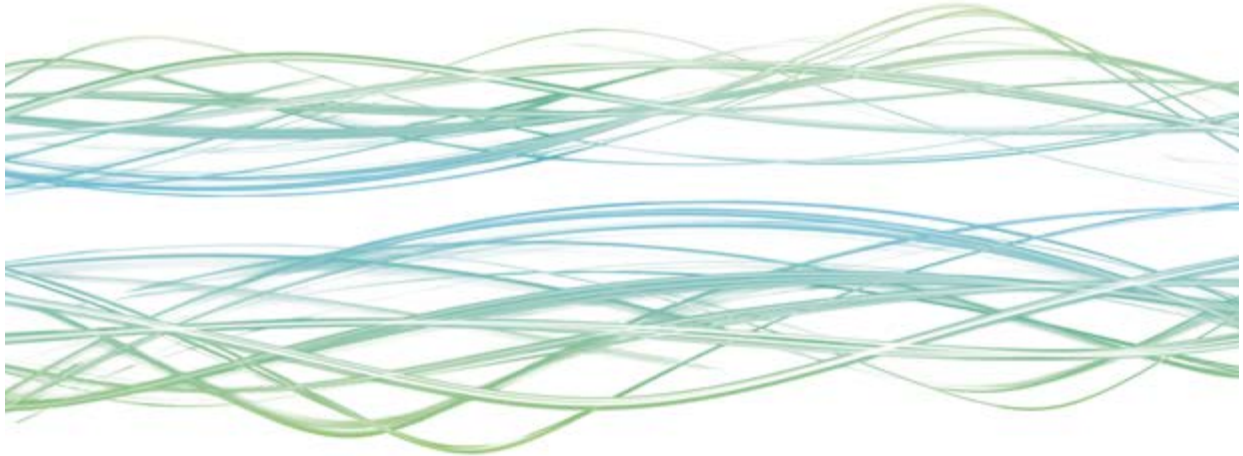




Resources (other):



CRTC’s Basic Service Decision



Background, Context, Process

- CRTC’s Basic Service Objective (BSO) outlines which services the Commission feels are essential, and that all Canadians should have access to
- First BSO came in 99 (Telecom Decision 99-16)
- BSO decision in 2011 (Telecom Decision 2011-291) did not declare broadband a basic service, but did set aspirational universal service goal
- 2016 decision (Telecom Decision 2016-496) redefines BSO by including broadband

Background, Context, Process

- Review of basic telecommunication services began with April 2015 Notice of Consultation
- Multi-phase consultation:
  - Over 25,000 pages of documents in first phase of written intervention
  - 30,000 respondents to EKOS survey
  - 3 week hearing in April 2016

Broadband as a Basic Service

- “We are in a day and age where everything is about broadband Internet. As a result, telecommunications regulation needs to be focused more on connectivity and capacity issues than on voice-related issues.” para. 17
- “There is general agreement by all parties on the importance of broadband Internet access services for Canadians to participate in the digital economy.” para. 21
- “Accordingly, the Commission hereby establishes a universal service objective: Canadians, in urban areas as well as in rural and remote areas, have access to voice services and broadband Internet access services, on both fixed and mobile wireless networks.” para. 37

Defining Basic Broadband

- Fixed broadband the priority, but wireless service should be available for premises and on major transportation roads (para. 64)
- “Canadian residential and business fixed broadband Internet access service subscribers can access speeds of at least 50 Mbps download and 10 Mbps upload.” para. 80
- Speeds should be actual delivered speeds, not just advertised (para. 81)
- There should be an option for a plan with unlimited data (para. 97)

Defining Basic Broadband

- Network infrastructure should be scalable to support speeds up to 1 Gbps (para 79) – this can be achieved by fibre or cable (DOCSIS 3.1) (footnote 30)
- 50/10 speeds should be available to 90% of Canadian premises by end of 2021 (para. 114) – currently 82% have access at the desired speeds (para. 79)
- Remaining 10% to gain access within 10 to 15 years (para. 114)

Quality of Service

- CRTC Interconnection Steering Committee (CISC) tasked with developing quality of service metrics (para. 110)
- Quality of service criteria include: latency, jitter and packet loss (para. 110)
- “The Commission expects that the quality of service metrics will reflect the objective that broadband Internet access **services in rural and remote areas be of similar high-quality as those in urban areas**.” (para. 110)
- CISC quality of service report due 6 months from Decision (by June 2017) (para. 111)

New Fund

- Closing the gap will require “billions of dollars” is premised on a “shared responsibility” and the new CRTC fund is to complement and not replace other private and public sector investments (paras. 128 and 135)
- Guiding principles:
  - Focus on underserved communities
  - Aligned with broader ecosystem of broadband investment
  - Managed at arm’s length, based on objective criteria, transparent, fair and efficient

New Fund

- Competitive process for building or upgrading access and transport infrastructure for fixed and mobile wireless infrastructure (paras. 138-139)
- Funding will start at $100 million and increase by $25 million over four following years to reach $200 million cap – total funding is $750 million (para. 145)
- 10% of funding each year is earmarked for satellite dependent communities (para. 150)
- “The Commission will initiate a **follow-up proceeding in early 2017** to examine these preliminary views and other matters related to the establishment of the funding mechanism.” para. 133

Mobile/Fixed Relationship

- Mobile included within definition of BSO
- Emphasis placed on mobile wireless on major transportation roads – “Major transportation roads include key interprovincial and international corridor roads, key linkages to these roads from population and economic centres, and key linkages from major roads that provide the primary means of access to northern and remote areas.” footnote 26
- Notably ISED regulates spectrum management
- Does the BSO decision necessitate a new *Spectrum Policy Framework*?

Other Issues – Affordability, Accessibility and Digital Literacy

- Decision contains several provisions on accessibility of services for persons with disabilities (paras. 211-217) and provisions on ‘bill shock’ (paras. 231-241)
- CRTC refrained from addressing affordability through retail rate regulation (para. 203)
- “Digital literacy is not within the Commission’s core mandate” (para. 245)
- However, both affordability and digital literacy concerns were addressed at length in the CRTC’s Submission to the GoC Innovation Agenda

Impacts and Future Issues

- Preparing for the new fund - $750 million (+ $500 million from ISED's "Connect to Innovate") - consultation on new fund for "early 2017"
- Wholesale Decision (2015-326) now expanding to the West
- Focus on scalable services – fibre, LTE (and eventually 5G) mobile wireless, cable (DOCSIS 3.1)
- Innovation Agenda outcomes – affordability and digital literacy ???
- Spectrum management considerations/revisiting the Spectrum Policy Framework???
- Converting access to uptake/penetration, and ultimately effective use