Yukon Telecommunications Development

FINAL REPORT

Prepared for Business & Industry Development Branch
Department of Economic Development
Government of Yukon

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Table of Contents

Tables

Figures

1. Executive Summary

This Report is the result of research, analysis and stakeholder consultations focusing on the state of telecommunications development in Yukon.

1.1 Current state of telecom services and network in the Yukon

The ensemble of the issues identified herein point to an urgent need for action to improve the investment profile and resultant speed, reliability and cost of broadband services in Yukon. Notably:

- Average Internet download speeds in the Yukon are 33% lower than those seen in the rest of Canada and 35% slower during peak usage times. Average Internet upload speeds are 47% below that of Canada, and over 50% lower during peak usage times.[1]
- Yukon consumers pay more for services with less capability. For example, for a 10 Mbps service Canadians elsewhere pay $54 per month. Yukoners pay 40% more for a 5 Mbps service.[2] In addition, Yukon consumers that exceed the usage included in their basic service package can pay three to five times more than their southern counterparts.
- And for high-end business service, the differential is even higher. A 50 Mbps IP-backbone service costs eight times more per month in Yukon than a similar service does in southern Canada.
- A similar situation exists for mobile services. Mobile service in the Yukon costs over double that seen in the rest of Canada, and there is very little geographic coverage, no highway coverage and less usage included in the packages.

[1] Based on end user speedtest.net data from mid-2011.
[2] Mbps is "megabits per second", transmission speed in millions of digital information bits sent each second.

- Service reliability is negatively impacted by the structure of the network backbone in Yukon since all traffic flows through a single point, Whitehorse, and there are many communities served by non-redundant links. These two factors mean that outages have a disastrous effect. Failure in a non-redundant link takes a community down in its entirety meaning even point-of-sale terminals cannot work since they are no longer connected to the Internet. A failure in Whitehorse can bring down the entire Territory, an event that in fact occurred recently.[3]

Services in the Yukon have not been keeping up with the rest of Canada, confirmed by analysis as well as based on the experiences of stakeholders interviewed for this Report.

1.2 Importance of telecom development to the economy

Service improvements to "catch up" are clearly needed in the Yukon. There is also a broader implication of making improvements to broadband service. There is a growing recognition of the economic benefits of increasing broadband penetration and speed, which improves digital connectivity and hence supports greater participation in the digital economy. This has an economic impact that would add to gross domestic product (GDP). This was estimated for Yukon to be potentially 2.6%, per analyses in this Report, and would be equivalent to $47 million in annual economic impact.

This increase in economic value would come from increased employment in ICT sectors, increased participation by remote communities in the digital economy, increased use of government services in communities (particularly aboriginal communities that are highly dependent on government), support for new incoming investment (e.g. backhaul for satellite stations, data centers, etc.), benefits to resource

[3] "Yukon phone, Internet services partly restored", CBC News, September 20, 2012

sector investments from availability of services, and increased ability to provide services such as tele-health and distance education.

Further benefits can be achieved in the public sector through improved access to government programs and other public services, which can have a major economic impact. In Sweden, it has been projected that Internet usage relating to public services – i.e. interactions between citizens and government – will grow over time to be 50% of total Internet usage.

1.3 Broadband service objectives and investments required

For Yukon to get improved services along with an improvement to GDP, a broad policy goal should be established. In other words, service objectives should be put in place that are consistent with the needs of the digital economy and this in turn can be used to drive investments.

For example, as a strawman target, a universal end-user service objective of 30 Mbps and 100 Mbps for the largest communities – similar to the broadband objective adopted in Europe – could be put in place. Supporting this would imply investments to yield a 4 to 5 fold increase in network backbone capacity in Yukon.

Northwestel makes continuing investments in its network, although not at a pace to support a 4 to 5 fold increase in its backbone capacity. And history has demonstrated that Northwestel is unlikely to invest in infrastructure that cannot be justified in a near-term business case. A lack of focus on long term objectives and chronic underinvestment in infrastructure prompted the CRTC to require Northwestel to produce a "modernization plan" and to initiate a "holistic" review of telecom in the North.[4]

[4] Initiated by Telecom Notice of Consultation, CRTC 2012-669, 6 December 2012

It is therefore in the interest of all Yukoners that the Yukon Government take on an enabling and proactive role to ensure that the economic benefits of broadband deployment are realized. Also since the Yukon Government is a very large customer for telecom and related services, it clearly can be an "anchor tenant" in any new initiative; in other words, looking to one-time investments to offset recurring expenditures being made now on telecom services. By consolidating voice and data services, Yukon Government could reduce direct monthly expenditures on ICT services, allowing it to invest the difference into improving the infrastructure in partnership with Northwestel or others.

One approach to dealing with the investments implied to meet digital economy objectives would be for the Government play a more direct role, establishing a partnering or operational arrangement in the backbone network, recognizing that essentially the backbone is public infrastructure, like roads and highways.

Before such a solution could be adopted, further assessment would be required to determine the level of Government intervention that would be warranted or viable, and this could also be subject for debate as part of the "holistic" review in 2013.

1.4 How to catch up while also building the digital economy

The challenge of addressing all of the issues needed to "catch up" while also building towards digital economy targets requires an overall plan and set of actions that will both "fix" what needs fixing while building for tomorrow. With this dual objective in mind, the Report identifies a series of actions that together form a roadmap for telecom development in Yukon, and which would be intended to lead to "bankable" projects.

A starting point for this would be to develop a Yukon Telecom "Prospectus". This would address the "entire" investment model and identify anticipated economic benefits,

with the starting point being a well-defined broadband speed objective (e.g. 30 Mbps universal service). The prospectus would then provide sound basis on which funding or other policy decisions could be made. The Prospectus would provide a set of projects, including initial scoping, and actions that the Yukon Government would undertake to promote and implement the overall plan.

1.5 Action plan – Roadmap Recommendations

An initial set of ten projects and recommended actions that could be considered is identified and stem from the analyses in this Report. These should be taken together and form a roadmap for future development of telecom in Yukon.

Development of the "prospectus" including setting community speed and capacity objectives would be a first step to setting goals and scoping out specific projects and initiatives. These could include the Yukon Government taking the lead as an enabler of a new utility backbone project. Another project that would have high economic value and spin-off effects could be development of a Yukon-based Data Centre (one with possibly outside investors that could also make use of it – i.e. an Amazon, Google, etc.). A project of this nature would require integration of a number of enabling elements, including in particular backhaul capacity, network reliability and electricity costs.

A key recommendation is that the Yukon Government should actively monitor Infrastructure Projects – Mines, Roads, Electricity, etc. The objective would be to ensure that telecom needs are included in new projects – Backbone and Wireless Access. This could be done via maintaining oversight over developments or more directly as part of permitting or other administrative processes.

Other recommendations focus on taking a more proactive role in CRTC processes relating to service pricing, given the CRTC's more consumer-oriented focus, promoting development of new local access facilities and use of existing licensed wireless spectrum not currently put into use, facilitating access for third parties to government tower and power assets, development of a Community back-up and diversity plan (possibly using pooled satellite capacity) and, consistent with an overall plan to prepare human resources for full participation in the digital economy, implement a Community-level approach for services, technical training and support.

In terms of a broad policy framework to guide Yukon's participation in policy and regulatory issues affecting the Digital Economy, consideration should be given to collaborating with other Northern governments. This could provide a stronger Northern "voice" on key issues, particularly given the lack of overall policy objectives at the national level. Specific goals, such as that of 30 Mbps universal access with 100 Mbps in the largest communities could focus on a full implementation horizon by 2020. This could be harmonized with an overall Canadian digital economy objective, should one be developed.

2. Introduction

This Report is the result of research, analysis and stakeholder consultations focusing on the state of telecommunications development in Yukon. The context, as set out by the Yukon Government can be summarized as follows:

> Ten (10) years ago the Yukon government undertook an extensive broadband upgrade program that positioned Yukon as one the best-connected regions in Canada, if not in North America. All communities were connected with a high-speed line, and over 98% of Yukon homes and businesses could subscribe to High Speed Internet at a rate that was similar to southern Canada. Significant activities were generated from the ability to remotely undertake business activity, and deliver tele-health and distance education services.
>
> However, industry groups have advised government that, over the last number of years, they perceive that telecommunication infrastructure development and service deployment in Yukon have not kept pace with the changes in technology, general industry offerings, and the requirements of the consumer and the business sector. This has resulted in a level of service that is considered to be less reliable, of lower capacity, and more costly in Yukon than typically found in southern Canada. The capacity and cost issues have been identified as limiting factors in the ability of the government to deliver programs as well as the ability of Yukon businesses to fully take advantage of the new trends in electronic commerce, telecommuting, and social media. The lack of capacity, reliability, and affordability of broadband has been raised consistently by the business sector as a barrier to development and growth.
>
> As the largest consumer of telecommunications services in Yukon spending a total of approximately $10 million (wired and wireless) per year, and in light of

the latest changes in the regulatory environment, as well as the recent technological and service delivery advances, the Yukon government is interested in investigating the opportunity, and options, for enhancing the Yukon telecommunications infrastructure and services, for both the public and itself.

The objective for this Report is therefore to provide actionable recommendations for telecommunications development in Yukon that are grounded on identified stakeholder needs and priorities, within the context of industry developments and trends.

The Report provides a road-map level strategy and directional thinking along multiple dimensions to account for stakeholder needs, industry and market developments and the specific context of Yukon and its economy.

It should be noted that the views expressed in this Report are solely those of Lemay-Yates Associates Inc. and not necessarily those of the Yukon Government.

2.1 Approach and Methodology

LYA's approach was to bring maximum value-added to the Government of Yukon by building on background and experience in the North, and leveraging extensive industry and analytical information in-house and background in relevant regulatory proceedings.

To support network performance benchmarking, LYA made use of an extensive dataset of Internet speed test results covering 33 countries and sortable for specific geographic areas. This dataset was sorted to provide tangible indicators of performance of services in Yukon. Other research was conducted to compare pricing for services, and to assess status of mobile and wireless deployment.

In addition, in terms of background LYA and its associate for this project, Mr. James Pratt, have been involved in many regulatory and policy-related proceedings in the telecom area in the past, including during 2011 in providing expert advice in CRTC Telecom Notice of Consultation 2011-302 concerning the regulatory framework for Northwestel as well as many earlier proceedings.

A key element of the approach in this Report is to focus on directional advice and on specific alternatives, plans and processes going forward. During 2012 Yukon stakeholders were involved in the development of an ICT Sector Strategy and in 2011 participated in workshops and discussions leading to the 2011 ACIA Report on the state of infrastructure in Northern Canada. Thus the issues for the telecom project at a "macro" level have already been examined and are, in general terms, well understood. Hence the value-added in – and focus of – the current project is to put particular emphasis on the question of "how do we get there"; i.e. recommendations for implementation, funding and ongoing processes which go beyond "good ideas" to provide actionable projects evaluated in the context of sound experience and valid comparisons. To reinforce this and to test ideas, stakeholders were consulted in interactive presentation sessions held in Whitehorse in August 2012.

3. Setting the Stage

3.1 National and global trends and regulatory changes

The overarching reality of convergence in telecommunications and information technology continues to shape all aspects of work, play, and almost every aspect of an individual's life, and how they conduct business. Convergence trends have reshaped customer expectations for access to voice, data and video communications on a whenever, wherever basis. Consequently the standard of service availability and quality expected by customers is universal and independent of location or technology.

Whether telecommunications and IT services allow for improved productivity, enhanced social connections, or better access to government services, the capabilities of advanced telecommunications have become deeply engrained in our business and personal lives. In this report 'telecom' and 'telecommunications' should be read as including all telecommunications and information services.

3.1.1 Importance of telecom to the overall economy

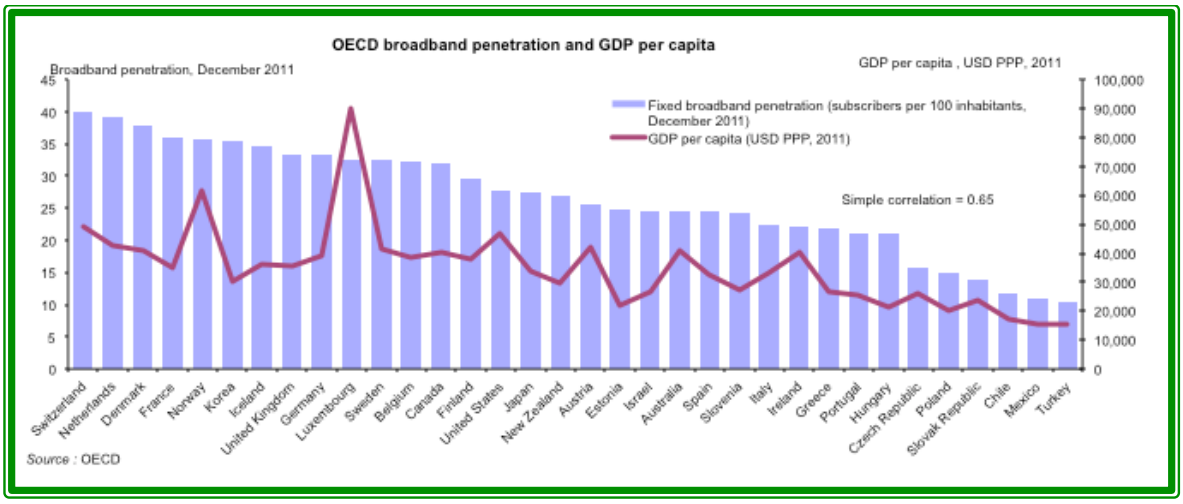
Telecom is an increasingly important component of the overall economy. In addition to typically growing at a faster rate than the economy on average, there are important spin-off effects from telecom.

Greater use of telecom and related services helps improve productivity for businesses, and declining prices for services provides added stimulus for growth.

Broadband penetration in particular has been shown to have a positive correlation with GDP per capita. Figures from the OECD show that countries with higher GDP per capita

– i.e. are more wealthy – are those where fixed broadband penetration is higher. This is illustrated below.

Figure 1 – OECD Broadband Penetration and GDP per capita



In fact broadband is not just correlated with higher GDP, but has been shown to be a contributor to it. There are a number of views of what the contribution is. According to the World Bank, for every 10 percent increase in penetration of broadband, GDP per capita in high-income economies grows by 1.21%.[5]

More recently the Inter-American Development Bank (IADB) concluded that for Latin American countries, the impact is higher at 3.19%.[6] On the other hand, in another study, it was concluded that: "for every 10 percentage point increase in broadband penetration, GDP increases by 1 percent."[7]

[5] "The Development Impact of Broadband", World Bank, *infoDev*, June 2009, Figure 1. Note: for low and middle-income economies the impact is higher at 1.38%.
[6] Presentation by IADB Broadband Platform representative, Americas Spectrum Management Conference, Washington DC, October 23, 2012.
[7] "Traffic and Market Data Report on the Pulse of the Networked Society", Ericsson, November 2011; Socio-economic impact of data speeds portion based on a study conducted by Ericsson, Arthur D. Little and Chalmers University of Technology.

In addition to penetration, broadband service quality – notably the speed of the connection – has also been shown to play an important role. Research has concluded that: "doubling a country's broadband speed increases its GDP by 0.3 percent".[8]

In Yukon, with broadband penetration in the range of 74% at present and data speeds that are relatively low compared to the rest of Canada,[9] improving these two factors could have a tangible benefit.

If broadband penetration were to move closer to 100%, and broadband speeds were to be in the range of 30 Mbps on average per household (similar to EU objectives), GDP per capita would be expected to increase by 2.6%.[10]

This would represent about $47 million in annual economic impact in Yukon, equivalent to increasing the size of Northwestel by over 20%, before considering similar impacts if a similar effect were to be seen in the other Territories.[11]

Mobile services are playing an increasingly important role in the telecom industry and the economy. Mobile services have grown significantly in most countries and the mobile segment has overtaken growth in the traditional "wireline" local and long distance businesses. As with broadband penetration, typically richer countries have higher mobile penetration, in spite of the fact that mobile services are often the best or only alternative to provide services in poorer countries.

The relationship between mobile penetration and GDP per capita (at PPP exchange rates) is summarized below for 45 countries.[12]

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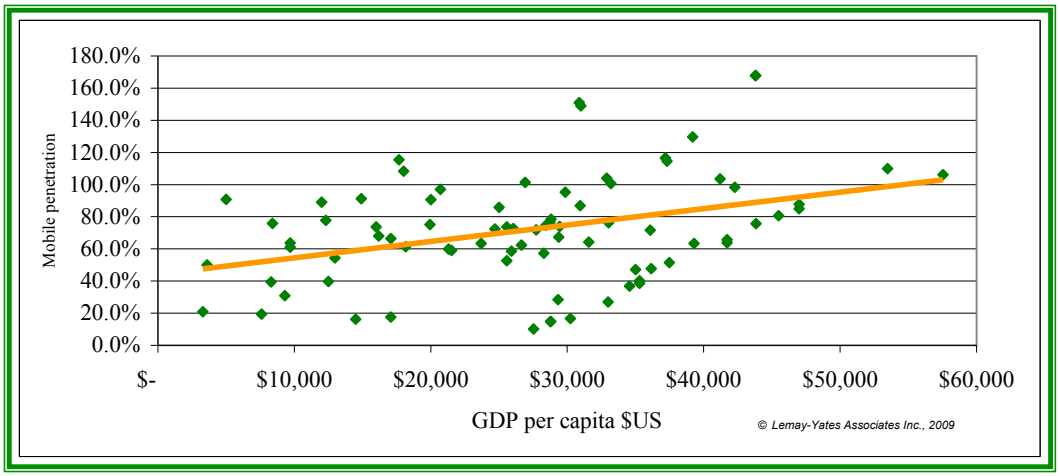
[8] *Ibid*, page 21.
[9] As discussed later in this Report.
[10] i.e. 20% improvement in penetration adding 2% to GDP and quadrupling of speed adding 0.6%
[11] Yukon GDP was approximately $1.776 billion in 2011 per Yukon Economic Outlook 2012; Northwestel's total 2010 revenues from all Territories were approximately $221 million per information provided by Northwestel to the CRTC.

Figure 2 – Mobile Penetration vs. GDP per capita



3.1.2 Canadian Telecom Industry Results

The shift in telecom reflecting convergence and advanced capabilities is reflected clearly in the results of the Canadian telecom industry players as summarized in the table below.

Table 1 – Evolution of Canadian Telecom Industry Revenues – 2001 to 2011

	2001		2011		*10 year*	*5 year*
Canada	$ B	% total	$ B	% total	*Growth*	*CAGR*	*CAGR*
Local/LD	$ 17.6	55%	$ 11.9	28%	*-32%*	*-3.8%*	*-3.7%*
Data/Internet	$ 7.6	24%	$ 11.7	27%	*54%*	*4.4%*	*4.6%*
Wireless	$ 6.8	21%	$ 19.1	45%	*181%*	*10.9%*	*7.1%*
Total	$ 32.0		$ 42.7		*33%*	*2.9%*	*2.9%*

CRTC Report to Governor in Council, 2003, Table 4.2

CRTC Communications Monitoring Report, 2012, Table 5.1.2

[12] From "International Review of Mobile Spectrum Prices and Licensing", Lemay-Yates Associates Inc, 2009

While the industry overall has maintained a 3% annualized growth rate over the past ten years, growth has been strongly driven by broadband and wireless services, offsetting declines in conventional local and long distance voice services.

The Canadian industry in 2011 was over $10 billion larger in annual gross revenue terms that it was ten years earlier. This growth occurred during a period where traditional local and long distance services declined by 32%, reducing industry revenues by $5.7 billion per year.

Growth in wireless and broadband has offset the decline in local/long distance, more than doubling over the ten-year period. Wireless in particular has doubled its weight – albeit at a rate of growth that has been slowing as the industry matures. Wireless now represents 45% of industry revenues with gross revenues up 180% over ten years.

These sea changes in the industry are a reflection of underlying consumer and business trends and an economic environment increasingly reliant on connectivity. Being connected to the Internet is now a major part of everyone's social and economic "lives", and has evolved to mean anytime, anywhere. So much so that the idea of a separate step to connect to the Internet is almost a thing of the past.

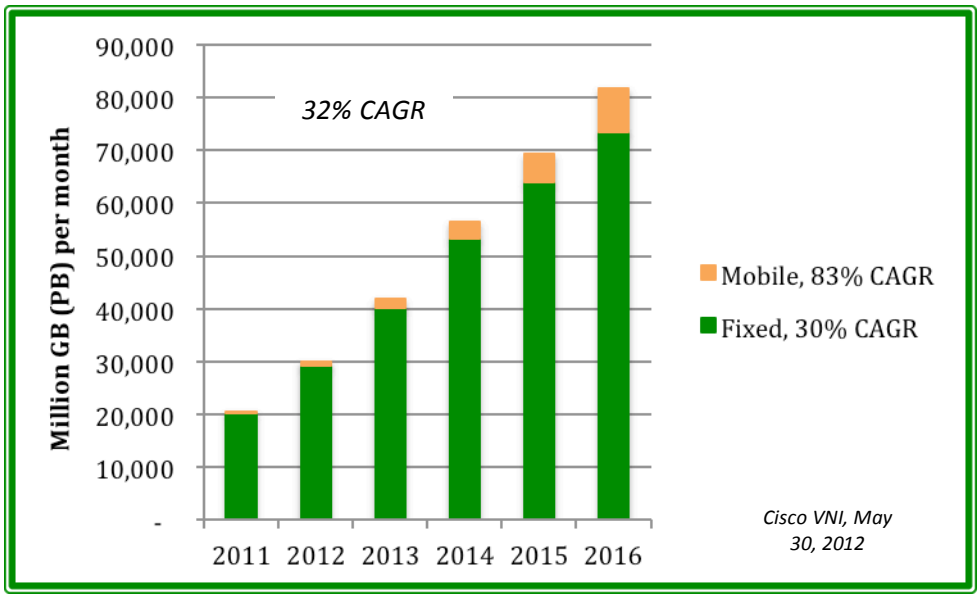
The central aspect of today's telecom environment is connectivity – broadband – both fixed and mobile. Ubiquitous, high-capacity connectivity has become the expected norm.

3.1.3 Data traffic growth

In telecom terms, increasing use of broadband connectivity translates into continued growth in the consumption of data, projected to grow by 30% per year for the next five years. While the bulk of data usage is expected to continue to be generated by Internet

use on fixed networks, mobile data will account for an increasingly important part of the telecom landscape.

Figure 3 – Global Data Growth Forecast per Cisco



Of note, the mobile portion of data growth – while relatively small in the overall picture – is growing dramatically. Over the year from June 2011 to June 2012, US mobile data traffic grew by104%, confirming the trend shown above.[13]

The global growth in data usage overall is being reflected in the Canadian market. In 2008 the average Canadian Internet subscriber downloaded 9 GB per month of data. This had doubled by 2011 to 18 GB per month reflecting a growth rate of 25% per year.[14]

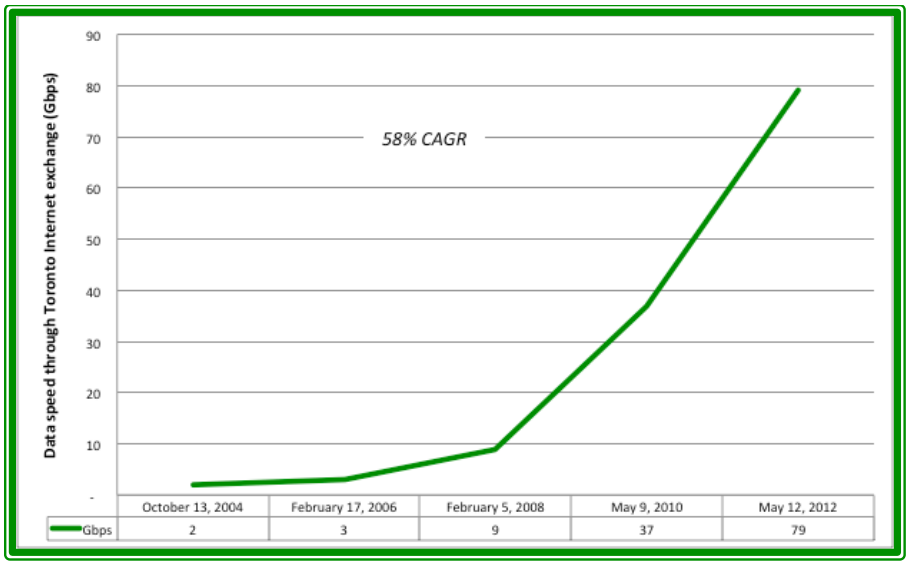
[13] CTIA, the Wireless Association, Press Release October 11, 2012
[14] Per CRTC… The figure for 2008 is from Communications Monitoring Report 2009, page 215, and for 2011 from Communications Monitoring Report 2012, page 147. Upload per customer was 3.8 GB per month in 2011, up from 3.2 GB in 2008.

Projecting this forward using the Cisco forecast – for fixed broadband – the average Canadian household will more than quadruple its data consumption, to a level of about 80 GB per month, consisting of over 65 GB downloaded and 14 GB uploaded.

Underlying Internet usage is increasing speed and traffic throughput on the network infrastructure that supports the Internet. Internet traffic is exchanged between large Internet Service Providers (ISPs) and peering points. The largest peering point in Canada is the Toronto Internet Exchange (Torix).

Internet traffic through the Torix peering point has been increasing in speed at a rate of 58% per year since 2004, from a throughput of only 2 Gbps to almost 80 Gbps by mid 2012.

Figure 4 – Toronto Internet Exchange Historical Traffic Growth



Underlying this evolution of the telecom industry is a changing telecommunications regulatory environment.

3.1.4 Regulatory Environment and Broadband Connectivity

Driven by the shifts in the telecom industry – regulators are increasingly required to deal with changes to established policies as a result of the increasing deployment of broadband infrastructure and new wireless technologies.

Traditional universal service programs, which were predicated on the existence of a single telecommunications connection to each premise to ensure voice connectivity, must now be adjusted to recognize the customer expectation that broadband is the new standard "basic" service. At the same time, the emergence of wireless, and in some cases VoIP through a cable connection, are viable alternatives for wireline in terms of providing for service coverage.

The significance of a defined standard for 'basic' service, from a regulatory standpoint is that policy measures have in the past been implemented to ensure that basic service is available universally, in all parts of the country. The High Cost Serving Area subsidy was implemented to satisfy this objective.[15]

It is interesting to note that in 1999, the CRTC's view was that the basic service objective should be "independent of the technology used to provide the service, and may change over time as service expectations evolve". Since then, the CRTC has been cautious about establishing a new regulatory standard for basic service because of a reluctance to increase the size and scope of subsidy that would be required to ensure that enhanced basic service standards would be satisfied for rural and remote users.

[15] CRTC Telecom Decision 99-16 defined basic service to include: Individual line service with touch-tone dialing, provided by a digital switch with capability to connect via low speed data transmission to the Internet at local rates; Enhanced calling features, including access to emergency services; Voice Message Relay service and privacy protection features; Access to operator and directory assistance services; Access to the long distance network and; a copy of the current telephone directory.

The importance of broadband connectivity is also translated into service speed objectives, recognizing that Internet applications, including those used by portable and mobile devices, increasingly required faster connections in order to support the user experience.

This is particularly important for video-rich media content, as well as for business computing requirements (i.e. to run cloud applications that could be hosted anywhere in the world).

In Canada, the CRTC has defined a basic service target for all Canadians to have access to broadband speeds of 5 Mbps by 2015.[16] The Commission specifically rejected proposals to subsidize basic service to achieve these target speeds, but did leave a small opening by indicating that they would "review the matter of funding mechanisms should market gaps persist". To date, no longer-term objective for national broadband capability has been established, and Canada has no high level policy for broadband deployment.

In the U.S., a minimum standard for "advanced telecommunications capability" has been defined by the Federal Communications Commission (FCC) in the US of 4 Mbps download and 1 Mbps upload.[17] Furthermore, both the US and the EU have much more aggressive policy-level objectives for broadband focused on 2020 as summarized below. These objectives provide a focus for funding initiatives to cover under-served areas, for licensing of new spectrum to support wireless/mobile broadband and for increasing participation in the digital economy.[18]

While the CRTC's target is relatively easy to meet with a variety of technology options – wired and wireless – a better long-term goal should focus on higher speeds such as 100

[16] CRTC Decision RP 2011-291
[17] Referenced at para. 3, Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans…, GN Docket no. 12-228, Notice of Inquiry FCC 12-91, August 21, 2012
[18] Broadband speed for example is important for businesses to participate in the digital economy, in particular with respect to upload speeds to support on-line collaboration, conferencing, cloud computing, file sharing, etc.

Mbps, which would be more in keeping with both customer expectations and other nation's benchmarks.

Table 2 – Broadband Speed Objectives – Canada compared to US, EU

		Broadband Access	
		Date	Objective
CRTC objective	CANADA	2015	All Canadians to have access to speeds 5 Mbps down and 1 Mbps up
National policy	US	2020	100 Mbps down and 50 Mbps up available to 100M households
	Europe	2020	30 Mbps down available to all; at least half of households with at least 100 Mbps access

Focus on broadband deployment has also been reflected in Canadian government programs, for example Broadband Canada.

Initiated in 2009, the Broadband Canada program, administered by Industry Canada, provided for $225 million of funding over three years to extend broadband coverage to un-served and under-served households. The call-for-applications focused on providing service of at least 1.5 Mbps in speed.

One small Broadband Canada project was undertaken in Yukon, but the Territory is generally covered due to the success of the Connect Yukon project. According to

published CRTC statistics, basic broadband availability in Yukon is at 100% of households.[19]

Even though 100 Mbps as an objective is well above the actual service rates seen in North America – and well above the Broadband Canada objective, this level may not be sufficient to meet the rapidly growing need for bandwidth. As part of its review of broadband measurement, the FCC is questioning whether the target for speed should be even higher.

This is based on the fact that streaming video is now more done in high definition, hence requiring more capacity, and that households often now have multiple devices all accessing the Internet at once.

In addition, speed alone overlooks other factors, such as latency of the service and the total capacity in GB that customers have available to them.[20]

3.2 Overview of Yukon telecom infrastructure

Northwestel is the incumbent telecom provider in Yukon and is a subsidiary of Bell Canada, the country's largest telecom operator.[21] Northwestel is the sole provider of facilities based service in Yukon, including voice, data and Internet infrastructure, and except in Dawson City, is the only cable television operator.

For mobile service covering Whitehorse, Northwestel transferred its operations to Bell Canada in January 2003. For other parts of Yukon, wireless service is provided by

[19] For 2011 per CRTC Communications Monitoring Report 2012, Table 5.3.6, page 157
[20] FCC Notice of Inquiry, *op.cit*.
[21] Northwestel became a subsidiary of BCE Inc. in 1988, of Bell Canada in 1999 (per Northwestel). Bell Canada is itself a subsidiary of BCE Inc.

Latitude Wireless, which is owned by Northwestel in partnership with Dakwakada Development Corporation (investment vehicle for Champagne and Aishihik First Nations).

Ice Wireless, an Inuvik based mobile operator, recently began offering service in Whitehorse.

3.2.1 Northwestel's physical network

The following map illustrates a portion of Northwestel's backbone network showing the major routes.[22] These terrestrial routes connect communities in the Yukon and the Northwest Territories, including the two largest markets of Whitehorse and Yellowknife.[23]

The network connects to providers in southern Canada in Fort St. John (BC) and High Level (Alberta).

[22] Initial Evidence of Northwestel, Telecom Notice of Consultation CRTC 2011-302 – Review of Price Cap Regulatory Framework for Northwestel and Related Matters, 13 June 2011, Appendix 1, page 1 of 1
[23] Communities in Nunavut are all served by satellite.

Figure 5 – Northwestel Physical Network (parts of Yukon and NWT)

The map illustrates the physical layer of Northwestel's network including fibre, microwave and satellite links.

It should be noted that there are additional portions of the routes that may now be fibre and not microwave as indicated on the map. For example, Northwestel recently announced completion of the fibre link across the new Deh Cho Bridge, which crosses the Mackenzie River at Fort Providence, NWT. The route from Yellowknife to High Level, Alberta is now all-fibre.[24]

[24] "Northwestel completes $18 million project to connect Yellowknife to Edmonton by fibre optic cable", Press Release, May 29, 2012

The network is largely configured a set of isolated links and is not structured in rings. A ring architecture would provide for traffic to follow a redundant route in the case of a cable cut or other network failure.

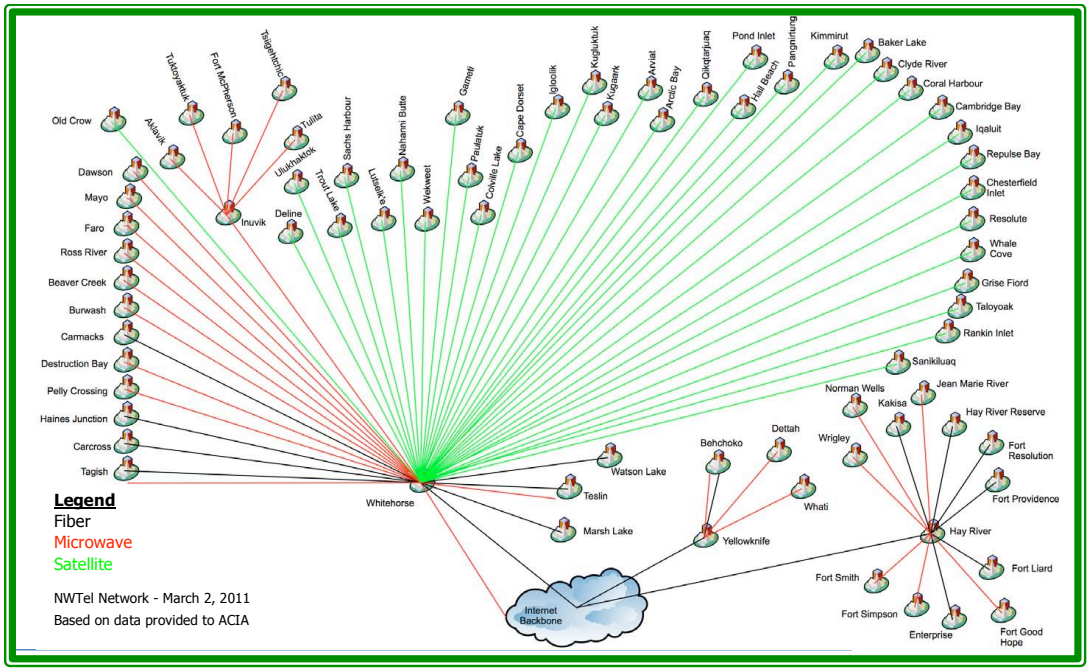
Certain portions of Northwestel's network utilize ring architecture, but most of the network does not. A cable cut for example on the main route north of Whitehorse has the effect of isolating all the communities north of Whitehorse. Some protection is in place south of Whitehorse. If a cable is cut south of Fort Nelson, BC, then traffic can be routed via the alternate route through Northwest Territory and then to High Level, Alberta.

3.2.2 Northwestel's logical network

The vulnerability of the network is clear when looking at the logical network – i.e. how the network is set up to route traffic. This is shown below.[25]

[25] Arctic Communications Infrastructure Report: *A Matter of Survival, Arctic Communication Infrastructure in the 21st Century*, prepared for the Northern Communications and Information Systems Working Group in April 2011 (referred to herein as the "ACIA Report"), page 67

Figure 6 – Northwestel Logical Network



Since all of the Yukon (and in fact Nunavut traffic as well) is routed via Whitehorse, any failure at the Whitehorse "node" will bring down the entire network.

This in fact happened recently due to an electrical failure at Northwestel's main office in Whitehorse.[26] This outage essentially shut down the entire Territory as well as much of Nunavut. The consequences of such outages are catastrophic, since the communities effected essentially are "out of business" for the duration of the outage since there is not only no telephone service, but also no connectivity for things like bank ATM machines, retail point of sale terminals, etc.

Thus while there is limited redundancy in place south of Whitehorse – as illustrated above where connectivity is provided in parallel by fiber cable and microwave systems,

[26] "Blown breaker caused massive outage in Yukon", CBC News, October 2, 2012

and where there is some physical route diversity – the network overall is highly prone to failure. And as capacity needs increase overall, network vulnerability will also increase unless efforts are made to increase investment in alternate routes as well as to build additional capacity on the alternate routes.

3.2.3 Existing network capacity

The table below summarizes existing Northwestel network backbone capacity by community, showing installed capacity for communities served by microwave and those served by fiber cable systems. Also, for reference, the % of the local population employed by the Yukon Government is shown by community.

Table 3 – Northwestel Backbone Capacity by Community

Community	Population	YG employees % of pops	Existing backbone capacity (Mbps) Microwave	Fiber
BEAVER CREEK	103	30%	24	-
BURWASH LANDING	95	6%	50	-
CARCROSS	289	24%	-	3,500
CARMACKS	503	14%	-	2,500
CHAMPAGNE	25	8%	-	-
DAWSON CITY	1,319	18%	155	-
DESTRUCTION BAY	35	57%	50	-
FARO	344	15%	155	-
HAINES JUNCTION	593	22%	-	2,500
KENO	28	8%	3	-
MARSH LAKE	619	8%	-	***622***
OLD CROW	245	11%	-	-
PELLY CROSSING	336	9%	155	-
ROSS RIVER	352	16%	155	-
STEWART CROSSING	25	8%	-	-
SWIFT RIVER	10	8%	-	-
TAGISH	391	0%	45	622
TESLIN	122	44%	135	2,500
UPPER LIARD	132	8%	-	-
WATSON LAKE	802	22%	45	2,500
WHITEHORSE	23,276	17%	270	10,000
Total	29,644	16%		10,000

Population per Statistics Canada 2011 Census
Yukon Government employment per ACIA Report page 30-31
Network capacity per ACIA Report page 62
Except for Marsh Lake updated from 155 to 622 Mbps per Northwestel

The presence of a number of relatively "thin" route microwave links has a number of implications. For example:

- The utilization of the various links is not known.[27] But it should be kept in mind that if service levels are expected to increase so end users experience speeds such as 100 Mbps (or higher, particularly for business connectivity) are to be provided, the microwave links would support very little actual throughput. Normal telephone company engineering principles would ensure that links are highly utilized, so on the existing microwave infrastructure there is likely very little capacity that could be used for new and/or higher speed services.

- For the Yukon Government's own needs, areas that are served by microwave and where there are higher concentrations of government employees are likely particularly stressed. Dawson City has a particularly high concentration of government employees and is also the site of a new hospital development. This community is currently served by microwave system and although Northwestel is planning to build a new connection there using fiber, it will still be on a "spur" route with no alternate route for backup.

- Even if the network could be configured in rings to increase diversity, the relatively low capacity microwave links of the existing network would be insufficient to provide adequate back up to the fiber links in any case and would have to be reinforced with additional capacity.

3.2.4 Deployment of facilities and presence of telecom providers in Yukon

Northwestel is the sole provider of "primary exchange services" (PES) – i.e. phone lines. Wireless service is available in 18 of 22 communities with Northwestel (or its parent Bell Canada) being the sole provider. Across Yukon, Northwestel is also the sole provider of high speed Internet service. While the Municipality of Dawson City runs its own cable

[27] Northwestel declined to provide utilization information due to confidentiality concerns.

television service, this does not compete with Northwestel. The Dawson City system does not provide high speed Internet service.

The table below provides an overview of the telecom providers in Yukon.[28]

Table 4 – Overview of Telecom Providers in Yukon – By Community

Prov	Community	PES	Northwestel Cellular	Other Cell Providers	Internet - DSL	Internet - Cable	Internet Wireless	Cable TV	Satellite TV
YT	BEAVER CREEK	N	N		N				X, Sh
YT	BURWASH LANDING	N	N		N				X, Sh
YT	CARCROSS	N	N		N				X, Sh
YT	CARMACKS	N	N		N				X, Sh
YT	CHAMPAGNE	N			N				X, Sh
YT	DAWSON CITY	N	N		N			M	X, Sh
YT	DESTRUCTION BAY	N	N		N				X, Sh
YT	ELSA	N			N				X, Sh
YT	FARO	N	N		N				X, Sh
YT	HAINES JUNCTION	N	N		N				X, Sh
YT	KENO	N			N				X, Sh
YT	MARSH LAKE	N	N		N				X, Sh
YT	MAYO	N	N		N				X, Sh
YT	OLD CROW	N	N		N				X, Sh
YT	PELLY CROSSING	N	N		N				X, Sh
YT	ROSS RIVER	N	N		N				X, Sh
YT	STEWART CROSSING	N	N		N				X, Sh
YT	SWIFT RIVER	N			N				X, Sh
YT	TAGISH	N	N		N				X, Sh
YT	TESLIN	N	N		N				X, Sh
YT	WATSON LAKE	N	N		N				X, Sh
YT	WHITEHORSE	N	N	B	N	N		N	X, Sh
		22	18	1	22	1	0	2	22

Other than Bell Canada, none of the large national carriers (Rogers, TELUS) are present in any of the Territories, nor are any new entrants. On the other hand, in the Northwest Territories competitive broadband Internet service is provided by SSI Micro in 26 of 35 communities. Ice Wireless provides mobile service in Inuvik and Yellowknife and soon in Hay River, Northwest Territories. In Nunavut, SSI Micro provides competing

[28] Attachment to Northwestel Rebuttal – October 5, 2011, presented at CRTC Hearing in Yellowknife, held pursuant to Telecom Notice of Consultation CRTC 2011-302. Note: The blue "B" in the table indicates service offered by Northwestel's parent Bell Canada in Whitehorse. In Dawson City, the municipal government owns a local cable television distribution operation. The two national satellite direct-to-home providers are present across the Territory. The red "X" represents Bell ExpressVu (now Bell TV), owned by Northwestel's parent Bell Canada. And "Sh" refers to the Shaw Direct service.

broadband Internet service in all 25 communities. Northwestel is the only mobile provider in Nunavut offering service in 8 of 25 communities.[29]

Other observations from the above table with respect to mobile:

- Mobile ("cellular") services identified above are that in general other than in Whitehorse the service is a 2nd Generation CDMA-1X which supports voice and low speed (100 kbps) data services.[30] This puts the services available in general in Yukon well behind the rest of the country, which typically is covered by HSPA+ technology that provides up to 42 Mbps in service speed.

- While the table shows that 18 out of 22 Yukon communities have mobile service available, there is no coverage of highways or roads connecting the various communities. The Yukon Governments MRS system on the other hand does cover the Yukon highway system, but is not available for use by the general public.[31] The MRS system also does not operate on commercial mobile frequencies, but is specialized mobile service that uses the 150 MHz VHF range.[32]

3.2.5 Regulation of Northwestel

Northwestel is the sole provider of facilities based service in Yukon, including voice, data and Internet infrastructure.

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[29] One of which being Iqaluit where service is provided by Northwestel's parent Bell Canada.
[30] Arctic Communications Infrastructure Report: *A Matter of Survival, Arctic Communication Infrastructure in the 21st Century*, prepared for the Northern Communications and Information Systems Working Group in April 2011 (referred to herein as the "ACIA Report"), page 53
[31] ACIA Report, *op.cit.*, page 73; note also the Yukon Amateur Radio Association has a linked system for VHF radio (145 MHz) covering highways. It also supports the Marine Distress System, which operates on VHF Channel 16 (ACIA Report pages 74-75).
[32] Per Northwestel.

Northwestel Cable, a subsidiary of Northwestel, began with a cable system in Norman Wells, later adding systems in Yellowknife, Watson Lake and Pangnirtung. In 2005 the cable system in Fort Nelson was acquired and in 2006, High Level, the first system outside Northwestel's serving territory, was added to the portfolio. With the acquisition of WHTV in 2007, Northwestel Cable took control of the cable facilities in Whitehorse.

In 2008, Northwestel Cable was granted a broadcasting license to operate a regional video-on-demand service in Whitehorse, Yellowknife, Norman Wells, Fort Nelson and High Level. The licence expires in 2015.Northwestel Cable was merged into Northwestel Inc in April of 2009. As a result, Northwestel has both telecom and cable facilities ownership in 3 of the 5 major centres in its serving area.

The cable facilities in High Level are also being utilized by Northwestel to offer local telephone service in competition with the incumbent TELUS. In 2008 a CLEC tariff submitted by Northwestel Cable was not approved by the Commission. Subsequent to the amalgamation in 2009, Northwestel applied for and was registered as a CLEC offering service in the High Level exchange area, in September 2011. It does not appear that Northwestel has, to date, filed the required CLEC tariff.

For mobile service covering Whitehorse, Northwestel transferred its operations to Bell Canada in January 2003. For other parts of Yukon, wireless service is provided by Latitude Wireless, which is owned by Northwestel in partnership with Dakwakada Development Corporation (investment vehicle for Champagne and Aishihik First Nations). An overview of providers by community for all services is covered in the next section.

Northwestel's wireline business, like that of other Canadian incumbent telcos, was regulated by the CRTC on a ratebase/rate of return method, which allowed the company to earn a fixed return on its assets, charging prices approved by the regulator. By charging

higher prices on 'discretionary' long distance services, the prices for 'public utility' local service were kept low. As competition for long distance began in other parts of North America, the regulated cross-subsidy arrangement broke down and a trend to revise service prices to match underlying costs began. Rate rebalancing posed the risk of dramatic local rate increases in the highest cost areas, like Northwestel customers. As a result, the CRTC in 1999 implemented a system where national subsidy fund support was awarded Northwestel, to offset the high costs of meeting the obligation to serve in rural and remote areas.[33]

Until 2001, Northwestel enjoyed a regulated monopoly in all telecommunications markets across the North. Pressure for competition in long distance (which had been implemented in southern Canada in 1992) resulted in a CRTC decision in 1998 where concerns raised by Northwestel about the implications for local service rates caused the Commission to undertake a further review.[34]

In November 2000, CRTC Decision 200-746 instituted long distance competition, with Northwestel to install equal access capabilities in Whitehorse, Yellowknife, Iqaluit, and Fort Nelson, while providing Northwestel revenue protection through subsidized carrier access charges. Submissions to allow local competition were opposed by Northwestel and rejected by the Commission. Further challenges to the local competition monopoly in the North were raised in 2003;[35] concerns were raised regarding the lack of competitive choice of long distance providers in 2005[36]; and in the review of Northwestel's regulatory framework in 2006, the company vigorously resisted local competition on the basis that

[33] CRTC Telecom Decision 99-16 Telephone Service to High Cost Serving Areas
[34] CRTC Telecom Decision 98-1Northwestel Interconnection of Interexchange Carriers and Related Resale and Sharing Issues
[35] CRTC Telecom Decision 2003-39 Initial Review of Northwestel Supplementary Funding
[36] CRTC Telecom Decision 2005-54 Northwestel Supplementary Funding for 2004 and 2005

the network was not capable and that expensive modifications would be required, an argument which the CRTC accepted.[37]

During 2011, the CRTC opened the North to facilities-based competition in a decision regarding the regulatory framework for Northwestel that echoed its 1997 "local competition" decision that applied to most of the rest of Canada.[38] Following this, Northwestel has put in place a Tariff for Local Network Interconnection to allow for alternate providers of local infrastructure to exchange traffic with Northwestel.[39]

In the 2011 decision, the CRTC observed that Northwestel "has failed to make the necessary investments in its network" and that its "infrastructure is aging and services comparable to those provided in the rest of Canada are unavailable in many remote communities." Also "concerned that this situation has likely affected the quality, reliability, and choice of services available to customers, as evidenced by a number of outages in various communities and the lack of service options" the CRTC initiated a "holistic" review of Northwestel's services and required Northwestel to develop a plan to modernize its network infrastructure and file a plan to do so within six months.[40]

The significance of this decision was signaled in the summary of Decision 2011-771, which states: "The Commission has decided that additional regulatory oversight is required, at least in the short term". This is an unusual step for the regulator, which has generally moved a long way towards deregulation through forbearance and deference to market forces, to conclude that the company's circumstances necessitate an *increase* in regulation.

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[37] CRTC Telecom Decision 2007-5 Price Cap Regulation for Northwestel
[38] Telecom Regulatory Policy CRTC 2011-771 – Northwestel Inc. – Review of Regulatory Framework, 14 December 2011
[39] Northwestel Tariff Notice (TN) 884; see: http://www.crtc.gc.ca/8740/eng/2012/n1_884.htm
[40] CRTC 2011-771, *op.cit.*, recitals and para. 40

The CRTC recently formalized the process surrounding the holistic review, and it will include a review of Northwestel's regulatory framework, and will also consider the modernization plan, subsidies and forbearance issues.[41]

As directed by the CRTC, Northwestel filed a modernization plan, but originally tied it to the CRTC's approval of Northwestel's parent BCE's acquisition of Astral Media Inc. As part of the purchase by BCE of Astral, BCE was required to allocate a portion of the acquisition price to "public benefits" spending. BCE proposed in this context that $40 million be added to the Northwestel modernization plan to deploy wireless technologies across the Territories. This proposal was reviewed as part of the CRTC Hearing in September 2012.[42] The CRTC rejected BCE's plan to acquire Astral, and Northwestel is now back to the "drawing board" on its modernization plan, which as noted above, will form part of the CRTC's "holistic" review.

The CRTC also recently put in place a new approach to voice network interconnection that applies across Canada and that reflects the increasing convergence of wireless and wireline services. In a Decision released in 2012, the CRTC established two important aspects of interconnection that reflect network convergence and which could help promote development of competitive alternatives in the North and elsewhere.[43]

First, the CRTC established that incumbents are required to provide interconnection based on Internet protocol (IP) technology. Specifically it requires that where incumbents already interconnect with their own affiliates on a IP basis (e.g. for mobile or VoIP service), they are required to make that capability available to competitors. Secondly, wireless carriers will be able to interconnect on the same basis as wireline carriers – i.e. by using so-called "bill and keep" shared-cost trunks. These provisions facilitate greater

[41] Telecom Notice of Consultation, CRTC 2012-669, 6 December 2012
[42] Broadcasting Notice of Consultation CRTC 2012-370
[43] Telecom Regulatory Policy CRTC 2012-24

access for small carriers that are more likely to operate on the basis of IP and wireless technology compared to what had been anticipated in the original interconnection regime established in 1997.

On the other hand, local interconnection in other parts of Canada is based on "local interconnect regions", which are collections of local calling areas. Northwestel does not have any groupings of local calling areas (i.e. calling from one community to another is always "long distance"), so effectively in Yukon this could imply that a competitor would have to interconnect in each individual community.

As part of the CRTC's approval of the Northwestel LNI Tariff, it set out that it would review overall network issues as part of the Northwestel Modernization Plan but in the meantime required Northwestel to add a specific list of points of interconnection (POIs) to the LNI Tariff.[44]

Also of relevance to the question of infrastructure development is the cost and technical capabilities of "backbone" services. Northwestel is the sole owner of terrestrial fiber and microwave facilities that connect Northern communities together and which connect the Territories to networks in southern Canada.

In 2011 SSI Micro, a Yellowknife-based ISP filed a complaint (so-called Part 1 Application) under the CRTC rules regarding Northwestel's backbone connectivity services and related pricing.[45]

In a Decision in early 2012, the CRTC agreed with the validity of SSI Micro's complaint and ordered Northwestel to file Tariffs for approval for its backbone services.[46]

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[44] Telecom Order CRTC 2012-401

[45] Filed June 27, 2011, see: https://services.crtc.gc.ca/pub/instances-proceedings/Default-Defaut.aspx?S=C&PA=T&PT=PT1&PST=A&Lang=eng

There are current proceedings underway reviewing the proposed Tariffs for these, notably for V-Connect (a Layer 3 IP-VPN service provided to large businesses and also available as a wholesale service) and for a new service called Wholesale Connect (a similar service to V-Connect but provided for competitive network operators).

3.2.6 Spectrum licensing

On a second regulatory "front", Industry Canada, which is responsible for spectrum licensing has initiated processes leading to the auction of 700 MHz (Mobile Broadband Service – MBS) and 2500 MHz (Broadband Radio Service – BRS) licenses.[47]

The first auction – planned for mid 2013 – will be for the 700 MHz frequencies. This spectrum was freed up by the conversion of analog terrestrial television services to digital. Since digital television channels are "compressed" relative to analog, the take up less spectrum "space". Existing stations are migrated to lower frequencies, resulting in the 700 MHz portion of the spectrum band becoming available for other applications. This is often referred to as a "digital dividend", since the re-deployment of 700 MHz frequencies to mobile broadband use has a higher economic and commercial value than the legacy television channels that occupied this range.

The 700 MHz band consists of 68 MHz of capacity that will be available across Canada, including Yukon.

The second auction, which will take place approximately one year later – i.e. no earlier than mid-2014 – is for the 2500 MHz BRS licenses. These licenses will be in the same

[46] Telecom Decision CRTC 2012-4
[47] Gazette Notice SMSE-002-12

frequency range as those that were held by Inukshuk (joint venture of Bell Canada and Rogers) covering Yukon.

The BRS range was initially licensed for fixed service. Inukshuk held the lower half of the band in Yukon. The upper portion – originally administered by the CRTC for wireless cable applications – has never been licensed in Yukon.

The BRS range – 2500-2690 MHz – is a common allocation in many countries and is being used for 4G mobile services in Europe. In Canada, licensees such as Inukshuk were able to convert their fixed licenses to mobile in return for giving back one third of their spectrum capacity for re-licensing. Inukshuk had been required only to cover Whitehorse by mid 2006. Bell and Rogers are shutting down the Inukshuk service and have converted the licenses to BRS.[48]

Hence Industry Canada's 2014 BRS license auction issue licenses for the returned portions of the BRS range as well as licenses in geographic areas of the country where legacy wireless cable licenses had never been issued by the CRTC. There will be a patchwork of licensing across Canada, but the opportunity of creating a national footprint of 60 MHz of paired spectrum suitable for new mobile service.[49]

[48] See for example: http://www.digitalhome.ca/2011/12/rogers-shutting-down-portable-internet-service-and-moving-users-to-more-expensive-3g-service/

[49] Paired spectrum means that the frequencies are provided in two sets – a set for uplink (from the customer device to the cell site) and a set for downlink (from the cell site to the customer device). Mobile service typically uses paired spectrum. Unpaired spectrum – meaning one set of frequencies that can be used for transmit or receive – was typically for broadcast applications (i.e. where transmission is only one-way). New transmission techniques are planned to use this spectrum either as supplemental downlink to paired spectrum, or in a time division duplex mode providing for use of the same frequency for transmit and receive.

In Yukon where the legacy wireless cable licenses were never issued in the upper portion of the band, there is additional spectrum that will be available in the auction – 20 MHz of paired frequencies and 20 MHz of unpaired.[50]

Thus the combination of the two auctions will result in an increase of 168 MHz of wireless spectrum capacity available to cover Yukon – 68 MHz in the MBS range and 100 MHz in the BRS range.

However, as earlier licensing activities indicate, notably of AWS spectrum in 2008, issuing licenses does not necessarily result in increased deployment and to date have not resulted in competitive entry in Yukon, as discussed in the next section.

Part of the conditions of license for 700 MHz focuses on coverage of rural areas, but this will not likely have a significant effect on Yukon. Industry Canada's coverage requirement for 700 MHz focuses on covering areas already covered by HSPA technology by existing providers.[51] The new coverage policy is thus unlikely to change anything with respect to broader coverage in Yukon. A future consultation will address possible coverage obligations for the 2500 MHz range.

Broad coverage in Canada is also assured by fixed service satellite (FSS) authorizations, also issued by Industry Canada. These historically have included two provisions important to Canada's North. First, Canadian satellites using Canadian orbital slots are required to be positioned to provide for national coverage (i.e. including the North). This is not a requirement for foreign satellite operators operating in Canada, but Industry Canada is proposing to maintain this provision of licenses for Canadian operators. Second, satellite authorizations include a "public benefit" condition of license. This

[50] Decisions on a Band Plan for Broadband Radio Service (BRS) and Consultation on a Policy and Technical Framework to License Spectrum in the Band 2500-2690 MHz, Industry Canada, February 2011, page 21
[51] Gazette Notice SMSE-002-12, Decision B4-2.

obligation provides that 2% of revenues be directed to initiatives to improve connectivity in remote areas. This requirement, among others, is subject to a current public consultation on satellite licensing.[52]

[52] Consultation on the Licensing Framework for Fixed-Satellite Service (FSS) and Broadcasting-Satellite Service (BSS) in Canada, March 2012

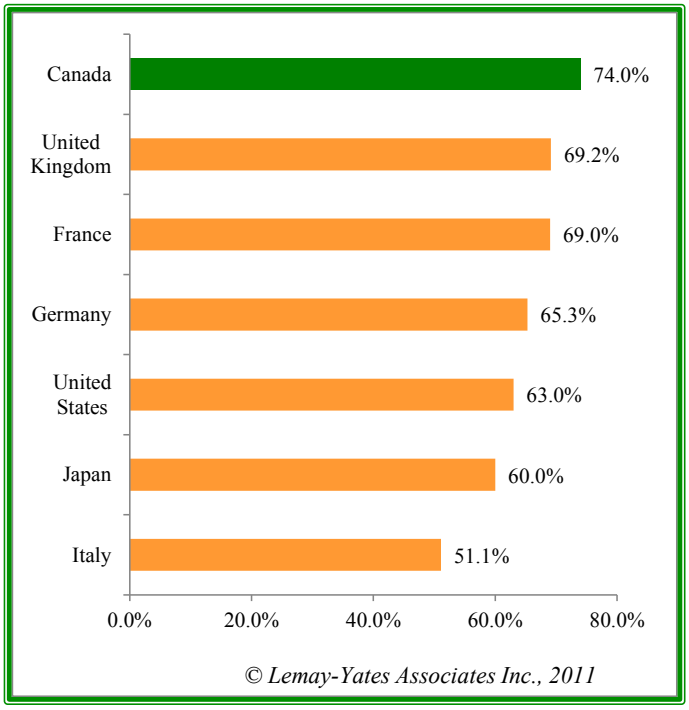
3.3 Current Yukon telecom environment

The current telecom environment can be discussed with two main themes that reflect the overall growth trend in the industry – access to sufficient bandwidth, and mobile coverage and capabilities.

3.3.1 Fixed broadband penetration

As noted above, fixed broadband at speeds of at least 1.5 Mbps is available to 100% of Yukon households. Fixed household broadband penetration measures the proportion of households who have actually subscribed to broadband Internet access service. Among G7 countries, Canada has the highest broadband penetration, at 74% of households.[53]

Figure 7 – Fixed Broadband Penetration in G7 Countries (% households)



[53] Based on information for all countries as of 2010 (to provide a common basis for comparison).

Fixed broadband penetration among other G7 countries ranges from 51% in Italy to 60% in Japan to close to 70% in the United Kingdom.[54]

Among the 33 OECD countries, Canada ranks 7th in terms of household fixed broadband penetration, below the Netherlands reporting the highest level at more than 86% of households. The average fixed broadband penetration among these 33 OECD countries is 60.9% of households.

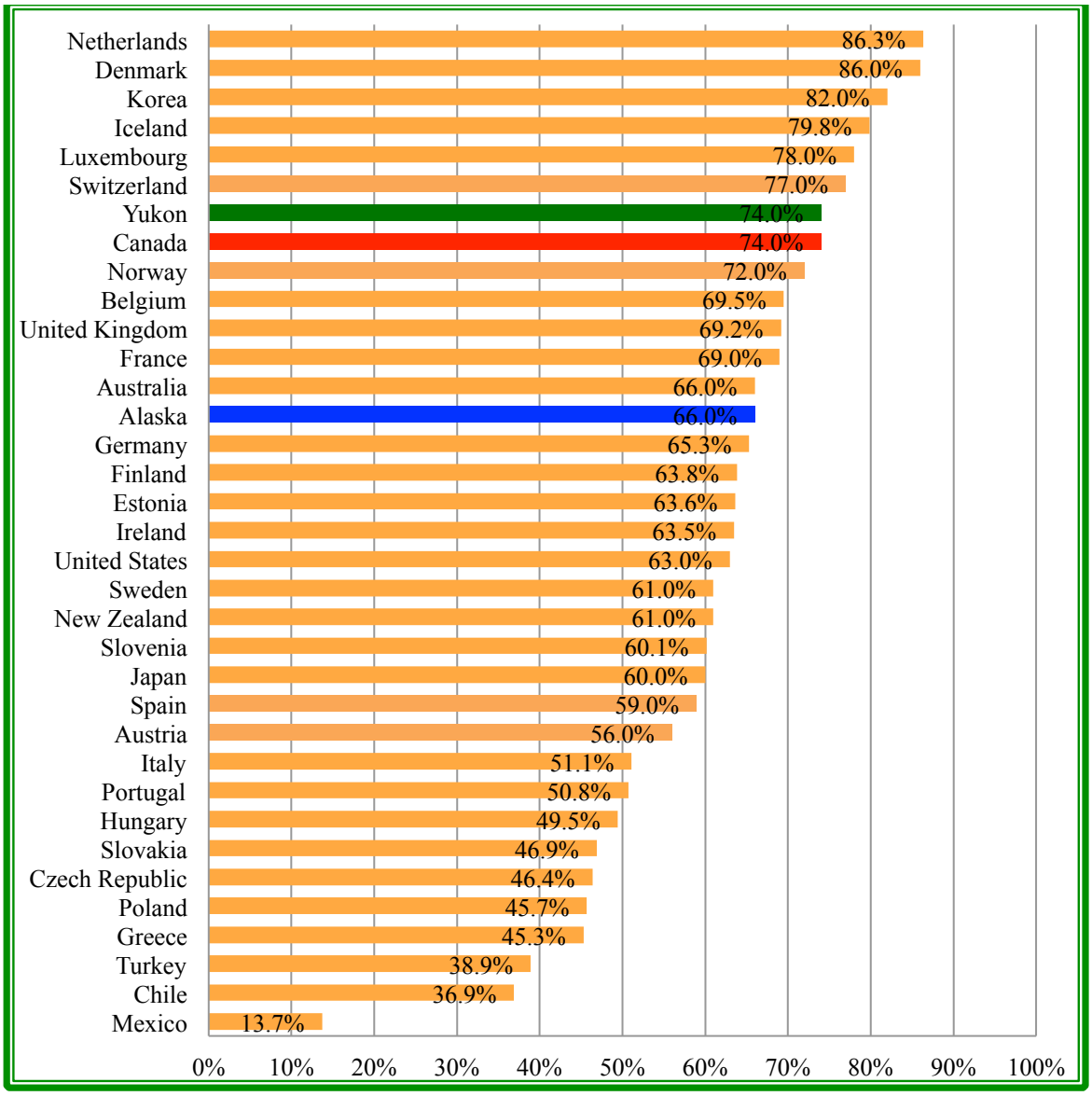
The following Figure shows Canada's ranking compared to OECD countries and also showing the overall penetration in Yukon as well as Alaska for comparison.[55]

Canada's fixed broadband penetration level is ahead of that of the US, ranked 17th with 63% penetration. Alaska compares favourably to the rest of the US, somewhat higher at 66% penetration, but below that of Yukon.

[54] A variety of sources were used to compare OECD countries on a common basis. This is discussed in the Report: "Comparative Assessment of Broadband Performance and Cost for Consumers in G7 and OECD Countries, Lemay-Yates Associates Inc., February 2, 2012 (prepared on behalf of Rogers Communications Inc. – the LYA Rogers Report). A copy can be obtained at www.LYA.com

[55] Sources: See LYA Rogers Report, *op.cit.*, Note: For Canada's Northern Territories the CRTC only shows the ensemble of Yukon, Northwest Territories and Nunavut, together with broadband penetration at the same level as the Canadian average overall of 74% in 2010. This is consistent with information available to the Yukon Government regarding penetration of broadband. The CRTC's 2012 Communications Monitoring Report (CMR) inexplicably shows broadband penetration in the North lower in 2011 than was shown for 2010 in the previous edition of the same report (See Figure 5.3.9 in CMR 2012 Report compared to Figure 5.3.9 in CMR 2011 Report). LYA is unable to resolve this discrepancy, but for comparison with OECD countries, the baseline figures are for 2010 for which 74% penetration as shown by the CRTC is consistent with information on the Yukon.

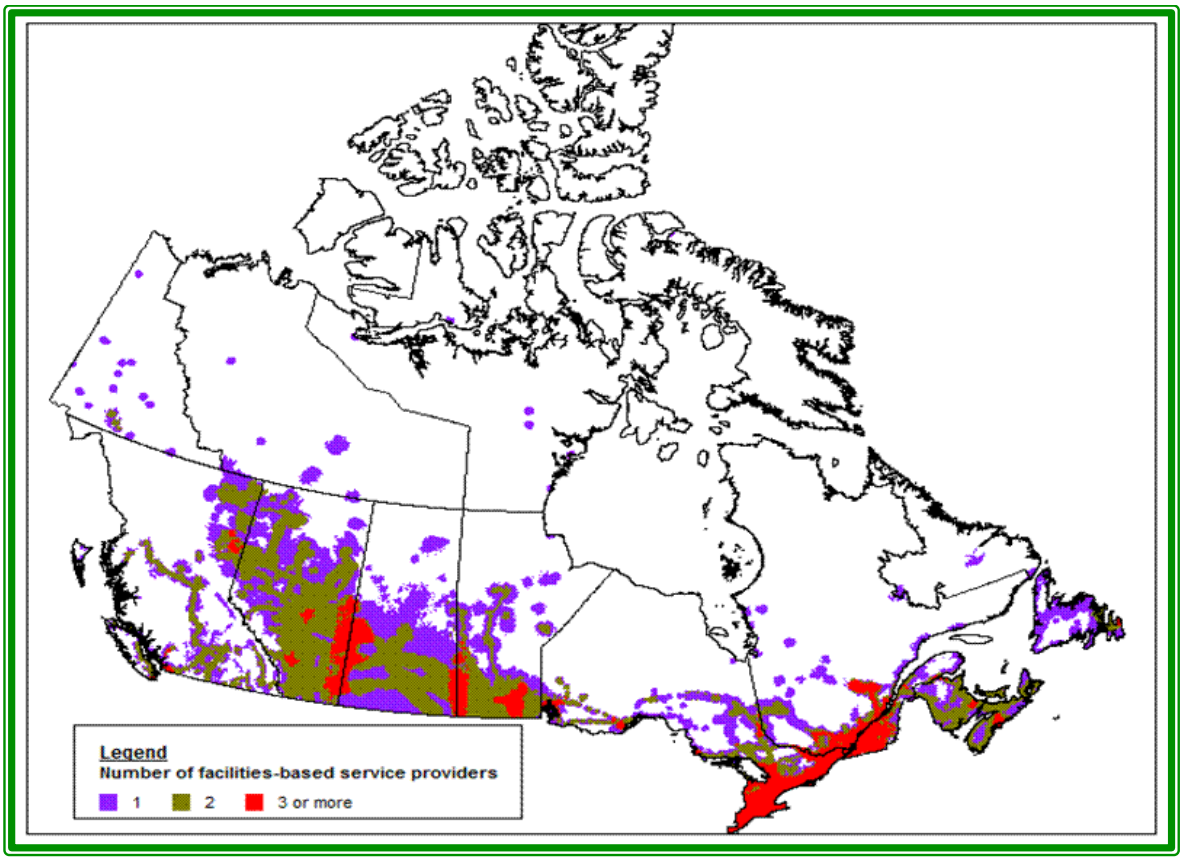
Figure 8 – Fixed Broadband Penetration in OECD Countries (% households) showing Yukon and Alaska



3.3.2 Mobile coverage and capabilities

As the following figure illustrates, mobile coverage in Yukon is very limited.[56] There is one facilities based provider (Bell Canada or Northwestel/Latitude Wireless).[57]

Figure 9 – Mobile Coverage in the Territories



[56] CRTC Communications Monitoring Report 2012, page 175. Note: the CRTC map appears to indicate two facilities-based providers in Whitehorse in 2011, which was not the case (although this may be referring to both Bell and Northwestel). Also the map does not show two providers in Northwest Territories markets where Ice Wireless operates (Inuvik, Yellowknife).

[57] Northwestel is a subsidiary of Bell Canada. Bell and Northwestel both have retail presence in Whitehorse. Latitude Wireless operates in the communities. Latitude is a partnership of Northwestel and Dakwakada Development Corporation (investment vehicle for Champagne and Aishihik First Nations).

Ice Wireless is in the process of launching service in Whitehorse in 2012, which will bring a second provider to Yukon's largest market.[58] Ice Wireless operates with 1.9 GHz PCS frequencies.

In core urban areas of Canada, there are usually three or more providers – i.e. Bell, Rogers, TELUS along with one or more new entrants such as Wind, Mobilicity, Public Mobile or Videotron. In less dense areas there are often only two physical networks – that of Rogers and the other consisting of the shared infrastructure of Bell and TELUS.

According to the CRTC annual Communications Monitoring report update, in 2011 the Bell Group had an 84% market share across the North, with the balance of 16% taken by "other" carriers, which refers to "smaller WSPs" like SSi Micro. None of the competitor market share is in Yukon. By comparison, competitor market share in other provinces is divided among 3 (and in some cases more) competitors, with incumbent market shares ranging from 73% in Newfoundland, to 28% in Ontario.[59]

While there is minimal mobile coverage in Yukon, the amount of spectrum issued that covers the Territory is essentially the same as the rest of Canada. The table below, however, shows that even though there are approximately seven licensees with spectrum in Yukon, covering six different bands, service has only been deployed by one provider.[60]

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[58] Ice Wireless/Iristel release September 18, 2012

[59] CRTC Communications Monitoring Report 2012, Table 5.5.5
http://crtc.gc.ca/eng/publications/reports/PolicyMonitoring/2012/cmr.htm

[60] The bands shown are the core mobile bands and others that can be potentially used for mobile service. Cellular 850 is the first generation mobile service band in the 850 MHz range, now used to support HSPA+ deployment. PCS 1900 refers to the second generation Personal Communications Services in the 1900 MHz range; licenses issued first in 1995 and by auction in 2001. AWS is the third generation Advanced Wireless Services band, which uses 1.7 GHz and 2.1 GHz frequencies, auctioned in 2008. BRS is Broadband Radio Service in the 2500-2690 MHz range. FWA is Fixed Wireless Access in the 3.5 GHz range – currently for fixed service, but similar to range used in Europe for mobile service. WCS is Wireless Communications Service in the 2.3 GHz range, potentially useable for mobile pending resolution of interference issues with the adjacent satellite radio band (used by Sirius/XM).

Table 5 – Licensed Wireless Capacity (MHz) and Approximate Deployed Sites by Band

	Bell/NWTel		Rogers		TELUS		SSI		Wind		Inukshuk		Yourlink		Xplornet		Total	
	MHz	Sites	MHz	Sites	MHz	Sites	MHz	Sites	MHz	Sites	MHz	Sites	MHz	Sites	MHz	Sites	MHz	Sites
Cellular 850	25	33	25	-	-	n/a	-	n/a	-	n/a	-	n/a	-	n/a	-	n/a	50	33
PCS 1900	20	4	40	-	10	-	40	-	10	-	-	n/a	-	n/a	-	n/a	120	4
AWS 1.7/2.1	20	1	20	-	10	-	-	n/a	40	-	-	n/a	-	n/a	-	n/a	90	1
BRS 2.6	-	n/a	-	n/a	-	n/a	-	n/a	-	n/a	65	?	-	n/a	-	n/a	65	-
FWA 3.5	-	n/a	-	n/a	50	?	-	n/a	-	n/a	50	?	50	?	25	?	175	-
WCS 2.3	-	n/a	-	n/a	-	n/a	-	n/a	-	n/a	30	?	-	n/a	-	n/a	30	-
Total	65	38	85	-	70	-	40	-	50	-	145	-	50	-	25	-	530	38

Note: same MHz issued as in rest of Canada; but only approx. 8.5% potentially in service (excluding AWS)
Per licensing information from Industry Canada

The Bell/Northwestel/Latitude service makes use of the cellular (850 MHz) and PCS (1.9 GHz) bands, deployed on 37 physical sites in Yukon, along with one new site for AWS (1.7/2.1 GHz) appearing to have been recently deployed in Whitehorse.[61] Before considering AWS, if all of the capacity were put to use on these sites – i.e. 45 MHz total – this would represent only 8.5% of the licensed capacity potentially available.[62]

With recent deployment of AWS by Bell, and of PCS by Ice Wireless, this would increase the % of licensed spectrum in service to approximately 14%, but both are currently only focused on Whitehorse.

The question of the variety of bands deployed, in addition to capacity, also impacts the types of customer devices that can be supported and their capabilities. For example, for Apple's newest iPAD, the version deployed in Canada is the same as that used by AT&T in the US. This version of the iPAD supports 700 MHz, Cellular (850 MHz), AWS (1.7/2.1 GHz) and PCS (1.9 GHz) frequency ranges.

[61] Note: The number of sites may be somewhat higher than shown as there appear to be records missing in Industry Canada's database. For example, Industry Canada shows one site in Dawson City, when there appears to be two based on discussions with stakeholders. Also, Ice Wireless does not appear in the Industry Canada database but is beginning to offer service in Whitehorse.

[62] The capacity per band is the licensed capacity. Site information indicates where capacity has been deployed but Industry Canada does not provide information on how much of the capacity is actually in use. Based on licenses held, Bell/Northwestel/Latitude has 45 MHz of maximum capacity potentially deployed on each site.

However, the different frequency ranges support different capabilities. For 4G LTE (fourth generation service based on "long-term evolution" technology) the iPAD uses the 700 MHz and AWS ranges. LTE is so-called 4th Generation mobile technology operating at speeds of up to 75 Mbps (with typical speed in the range of 12-25 Mbps). The 700 MHz range is not yet licensed in Canada, as discussed above.

Bell Canada has deployed HSPA and recently introduced LTE technology in the North, including in Whitehorse.[63] Deployment of AWS in Yukon appears to have started embryonically with one site now present in Whitehorse.

As noted above, as part of its proposed acquisition of Astral Media Inc., BCE (Northwestel's parent company) had set out a plan to deploy new wireless technology across the Territories. Given the initial deployment of an AWS site in Whitehorse, it is likely that Bell Canada would have rolled out 4G technology (LTE) using these frequencies, which are available to it across the Territories. Details of this nature however, were filed in confidence with the CRTC.[64] The deployment of the different bands is not just important for coverage and capacity but also to support different devices that operate with different mixtures of bands. Bell Canada has reportedly begun deploying LTE in the North, as discussed in the next section.

3.3.3 Future spectrum licensing

Future licensing via the next two spectrum auctions – 68 MHz of MBS and 100 MHz of BRS spectrum – will increase the total available in Yukon by over 30% (i.e. from 530

[63] Reply Comments of Bell Mobility, Consultation on a Licensing Framework for Mobile Broadband Serivces (MBS) – 700 MHz Band, Canada Gazette Notice No. DGSO-002-12, July 25, 2012, para. 31 and coverage of Whitehorse found at http://www.bell.ca/Mobility/Coverage_map

[64] Similarly no information was provided in the BCE/Astral proceeding about the investment required to provide the highspeed backbone facilities that would allow rural customers to actually make use of the 4G capabilities of their wireless phones.

MHz as shown above to almost 700 MHz. Without further deployment, this implies that the portion potentially actually in use could decline to 6% to 10%.

Further, the bulk of the deployment to date – most of the cellular sites and all of the PCS sites – are focused on Whitehorse, meaning very little coverage of the communities and no coverage of highways between communities.

3.3.4 Future infrastructure projects

There are many developments anticipated in the North that are being initiated notably with respect to deployment of fiber facilities.

In 2011 Northwestel identified a number of potential projects that would increase network diversity and add new facilities.[65] This included a proposed Pacific Northwest Fiber Ring connecting to Alaska, a regional ring through Yukon and the Northwest Territories, and connections to a proposed submarine cable to be placed across the Northwest Passage. Northwestel did not indicate if any of the specific projects identified are actually planned or funded.

Another possible fiber facility is the proposal from a Toronto-based group to develop a submarine cable along a route from Asia to Europe, passing through the Northwest Passage. This would be a 15,000 km route to be built at a cost of $640 million.[66] The nearest landing to Yukon is planned for Tuktoyakatuk. Tying into this system – if it is actually built – would be very attractive in terms of improving connectivity out of Yukon to the rest of the world.

[65] "Telecom Infrastructure in the North", Northwestel, PNWER Arctic Caucus, Yellowknife August 2011
[66] "Arctic Fibre", Northern Lights Conference, Ottawa, February 2012

One other project not yet built is a fiber cable facility to connect Inuvik, NWT to the south in order to provide for high bandwidth connections for the Inuvik Satellite Station Facility (ISSF).[67] Two possible routes to connect the ISSF with fibre have been the subject of study, one running from Inuvik to Checkpoint Junction, NWT (near Fort Simpson), known as the Mackenzie Valley route, and the other from Inuvik to Carmacks, Yukon, referred to as the Dempster route. Checkpoint Junction and Carmacks are the two closest places to Inuvik where existing fibre optic connectivity is available. The Government of the Northwest Territories has been studying the MVFL project with a view to implementation possibly as a public-private partnership (PPP) project.

Any or all of these projects could significantly increase capabilities, bandwidth, connectivity and reliability for Yukon telecom, but with no committed plans or timelines, these potential opportunities remain over the horizon.

3.4 Sector needs and issues

Connectivity is a critical lever for economic development, helping consumers and businesses access information and communicate more quickly and efficiently and to make use of electronic media in new ways, whether for watching live television, ordering merchandise, doing banking, working remotely, or accessing public services.

The importance of this new world of communications was highlighted in ACIA Report. In fact the impetus for the ACIA Report came from an assessment of the "fragility" of the telecom infrastructure in Arctic, notably that lack of deployed capacity makes it "easy to overwhelm" local wireless and Internet networks in the North.[68]

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[67] The satellite station was opened in August 2010. See: "Inauguration of Canada's First Arctic Satellite Station", Natural Resources Canada 2010/64, August 10, 2010

[68] Arctic Communications Infrastructure Report: A Matter of Survival, Arctic Communication Infrastructure in the 21st Century, Section 2.2, page 15

This finding identifies a potential risk for the continuity of government service delivery, notably in areas of health and education. The Report also noted the importance of mining and tourism to the Yukon economy, and the significant extent to which these sectors would benefit from improved telecommunications infrastructure.

In a survey of Government program managers, conducted as part of the ACIA Report process, the top issues identified were: bandwidth by over 80% of respondents and high costs to end users by 65% of respondents. This was followed by outages and latency issues, identified by 60% of respondents.

These top issues were also broadly reflected in consultations held with stakeholders in the context of development of the Yukon ICT sector strategy during 2012.[69]

Private sector stakeholders, for example, identified that there is insufficient existing ICT infrastructure, citing that current Internet connections are expensive[70] and not redundant, available bandwidth is insufficient for state-of-the-art ICT services such as cloud applications and video streaming, and that there are limited local data center capabilities to host servers and applications. The current monopoly on Internet service provision in Yukon (i.e. by Northwestel) was identified as an issue in the context of high wholesale access pricing that makes it difficult for ISPs to compete.

The high cost of business connectivity was also mentioned as, for example, restricting distance education to remote locations. The bandwidth is "unreliable and expensive" and based on older technology (frame relay – Connect Yukon). Mobile ("cell") services were identified as being "outdated".

[69] Focus groups were organized by BDC and YITIS in May 2012. Meetings were held with four groups: private sector, First Nations, Government and Education. Notes from Stakeholder meetings were provided to LYA by BDC for purpose of identifying key themes and trends from a telecom perspective.
[70] High cost of Internet services was also identified by other stakeholder groups, notably First Nations and Education.

In addition it was identified by Yukon Government stakeholders that even though there is a high connectivity of communities to the Internet, the available bandwidth is not sufficient for current applications. It was identified that current bandwidth is "saturated daily" and that entire schools are supported by T1 (1.544 Mbps) lines. Put another way, growth in applications and hence support for overall economic and social development is being throttled by the limitations of telecom infrastructure.

And there is a growing gap between services – Internet and mobile – available in Whitehorse relative to other parts of the Territory. This points to a further need to ensure that telecommunications infrastructure must be improved not only by increasing the capacity of the existing network, but also by extending capabilities to all Yukon communities. Some examples of projects suggested by stakeholders included rebuilding underlying infrastructure, building out Territory-wide fourth generation ("4G") mobile networks, building a "big redundant pipe" to southern Canada and Alaska.

4. Indicators and Stakeholder Views

A number of indicators were developed to capture the state of the current Yukon telecom environment. These indicators were also reviewed with stakeholders in broad ranging discussions in order to focus on directional ideas to gain inputs and perspectives for purposes of developing a roadmap for future development.

Indicators focused on broadband performance as well as on comparing service pricing in Yukon compared to the rest of Canada. With this as background and considering the other elements setting the stage for the discussion, inputs from stakeholders were grouped into key thematic areas.

4.1 Indicators for Yukon

This section focuses on key indicators for the Yukon considering the key themes of importance to telecom development: broadband infrastructure and mobile service.

- First, a comparative assessment of fixed Internet access downstream and upstream speed is provided, contrasting Yukon with Canada as well as other countries and Alaska. The basis for the analysis is a set of 52 million user speed tests from mid-2011.[71]
- Second, Internet and data service pricing is considered, both for retail and wholesale, showing Yukon compared to the rest of Canada, using CRTC defined baskets as well as some basic comparisons of specific offers, and,

[71] The user speed test database was acquired from Ookla, the company that operates the speedtest.net web site. The analysis herein builds on analyses conducted for Rogers Communications earlier in 2012. Discussion of methodology and the speed test data can be found in the LYA Rogers Report, *op.cit*.

- Third, mobile pricing is examined comparing Yukon to other markets in Canada. This is done using mobile service "baskets" used by the CRTC in its annual monitoring reports.

4.1.1 Fixed Internet Access Service Speed – Downstream

Downstream speed is the most important Internet parameter, particularly for residential customers. For typical residential applications such as web browsing and watching videos, the traffic is highly asymmetric. The customer makes a small request for a web page or for content (i.e. upstream) and the response delivers the web page or content to the customer (i.e. downstream). Thus the downstream portion of the traffic is much larger than the upstream.

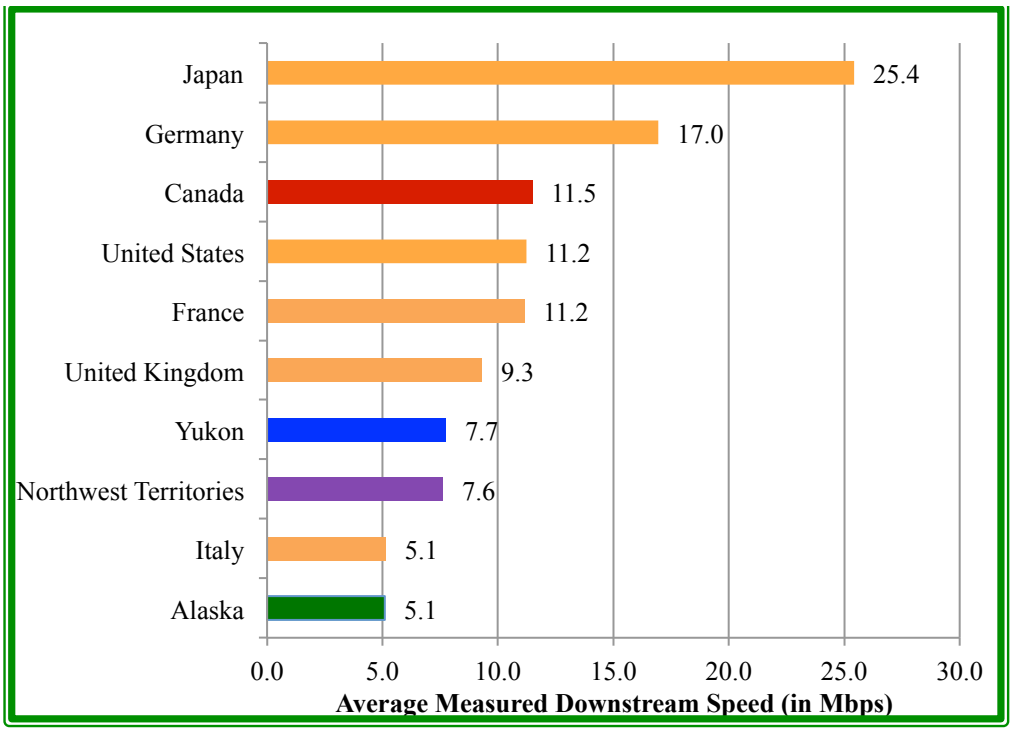
The faster the downstream signal is, the more "immediate" and timely the applications that are being used are.

For consumer take-up of Internet services and to promote use of services on line (such as health and education), downstream speed with the attendant immediacy of the application is of primary importance.

The following figure provides a comparison of average downstream speeds seen in Canada, Yukon and Northwest Territories relative to the G7 Countries and showing Alaska separately from the US average.

The speeds shown are the 24-hour averages based on user speed tests, as discussed above.

Figure 10 – Fixed Internet Access – Average Downstream Speed Comparison



On this basis, Canada has the third fastest speed in the G7, a performance that is due in part to the relatively high penetration of cable television operators. Cable Internet service is typically faster than telephone company DSL services and countries with greater cable penetration therefore typically perform better than those with greater relative presence of DSL.

The average download speed for Canada is 11.5 Mbps, with speeds seen in Yukon about 33% slower at 7.7 Mbps.

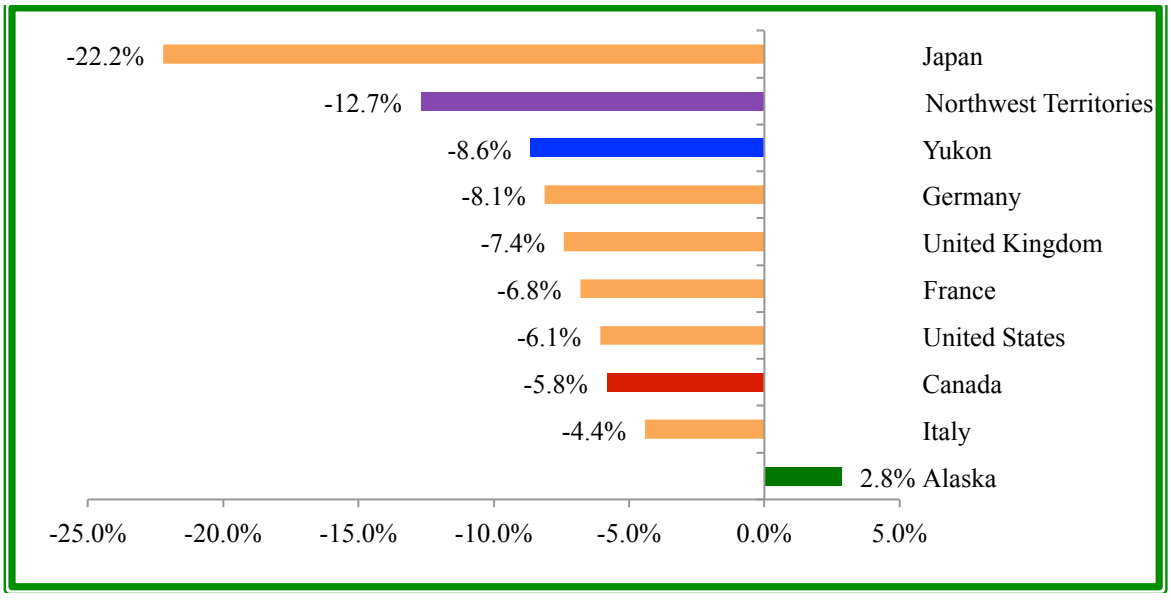
The US average speed is similar to that of Canada, but a bit slower. Alaska, which is Yukon's closest US neighbour, has considerably lower average speeds at only 5.1 Mbps.

These figures show that Yukon is lagging the rest of Canada, by about 33% based on a 24-hour average. On the other hand, much of Internet usage is concentrated in "peak" traffic hours – from 6 p.m. to midnight each day. This when the networks are under the most stress and people make the greatest use of Internet.

Considering peak times, the average Internet download speed in Canada declines by 5.8%, a performance which ranks well relative to the G7 countries, which tend to decline at a 6% to 8%.

At peak times, the performance in Yukon declines more than it does in the rest of Canada, by almost 9% or 50% more. Thus at peak times, average speeds in the Yukon are 35% slower than in Canada on average.[72]

Figure 11 – Fixed Internet Access – Peak Hour Downstream Speed Comparison



[72] I.e. Yukon average of 7.7 Mbps declining by 8.6% to 7.0 Mbps and Canada average of 11.5 Mbps declining by 5.8% to 10.8 Mbps.

Based on the set of user speed tests, the peak performance in Alaska appears to be better than the 24-hour average. This may indicate that networks are more robust in Alaska, but given the overall speed results on average are considerably lower than those seen in Canada.

To look at the source of the differences at peak times, the results for Canada were further disaggregated to identify the results by underlying Internet service provider (ISP). While overall in Canada the peak speed declines by 5.8% relative to the 24-hour average, this is largely due to provides other than the largest ones. The average download speed for Bell and TELUS combined declines by 4.8% at peak times and for Rogers by 4.6%. Other ISPs see their peak performance decline by 7.1%. These would include smaller regional telecom operators and cable companies.

In the Yukon, there is only one ISP – Northwestel. Northwestel provides DSL-based service across the Yukon and also cable Internet service in Whitehorse.

As the table below indicates, the DSL performance of Northwestel is considerable slower at peak periods relative to Northwestel's cable Internet service.

Northwestel Cable Internet performance of 11.2 Mbps is similar to the Canadian average download speed of 11.5 Mbps (cable and DSL combined) and at peak periods also declines by a similar percentage – 6.3% compared to the Canadian average of 5.8%. On the other hand, Northwestel's DSL service – already much slower at 4 Mbps based on 24-hour average – declines by 15% at peak times.

Figure 12 – Fixed Internet Access – Peak Hour Downstream Speed – Detail

	Average Mbps	Decrease in peak period
Bell/Telus	7.4	-4.8%
Canada	11.5	-5.8%
Other ISPs	14.0	-7.1%
Rogers	15.6	-4.6%
Northwestel		
-- Cable	11.2	-6.3%
-- DSL	4.3	-14.8%

These results tend to confirm some user perceptions of the quality of Internet service in Yukon – particularly in the communities (i.e. where only DSL service is available).

On the other hand it should be kept in mind that the speed test results are a snapshot in time (in this case mid-2011) and Northwestel may have upgraded some of its facilities in the intervening time.

4.1.2 Fixed Internet Access Service Speed – Upstream

Internet upstream speed is of growing importance in the digital economy. For important "social" applications such as those in health and education, the upstream performance of Internet facilitates transmission of video and images from the customer to the application provider such as a school or hospital.

For business applications, upstream performance is a critical factor in Internet. Upstream bandwidth is a key enabler for applications such as remote access to servers, for backing up of mission-critical data (i.e. sending data from a business to another location for

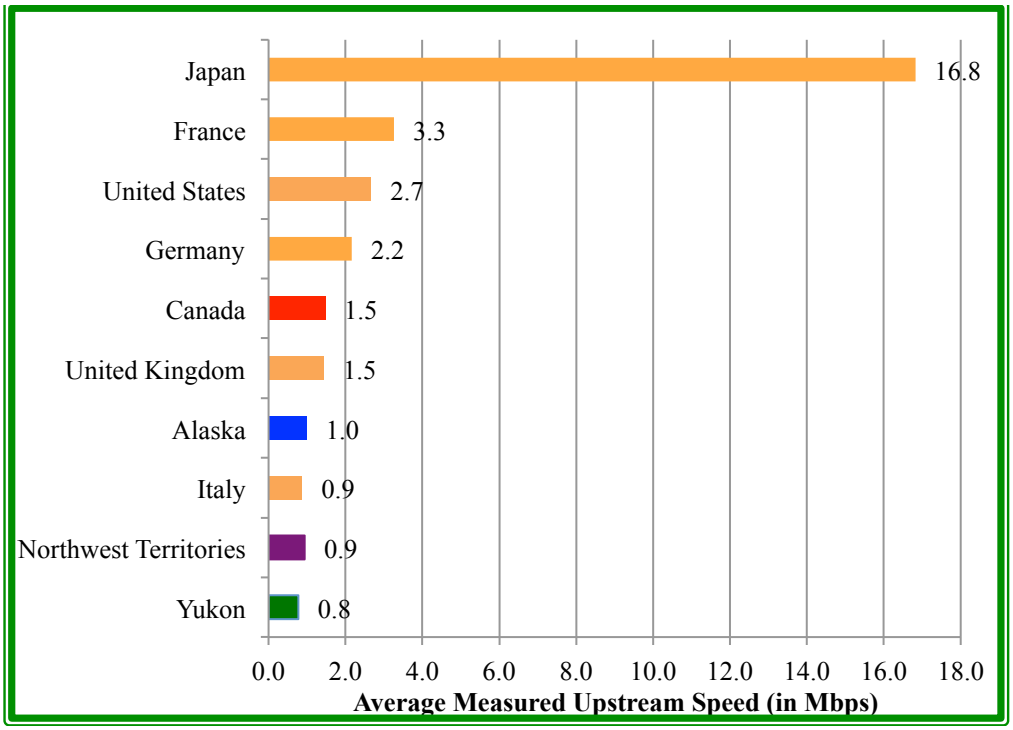
redundancy), for web-based services (such as e-commerce) and for collaborative work such as software development.

Upstream speeds are typically much slower than downstream speeds.

Telephone company DSL services have a limit on total throughput, which given the need for high downstream speeds for delivery of media and entertainment, the upstream is typically quite low. Cable Internet upstream speed is limited by the amount of capacity cable companies activate in the reverse direction on the cable system.

As shown below, the 24-hour average upstream performance in Canada is relatively low at only 1.5 Mbps. For Yukon it is even lower at 0.8 Mbps – 47% below the Canadian average.

Figure 13 – Fixed Internet Access – Average Upstream Speed Comparison



At peak times, from 6 p.m. to midnight, Internet upstream speed in Canada declines by 12%. In the Yukon, however, it declines by 26%. This means that the average upload speed at peak times would only be about 600 kbps.

Figure 14 – Fixed Internet Access – Peak Hour Upstream Speed Comparison

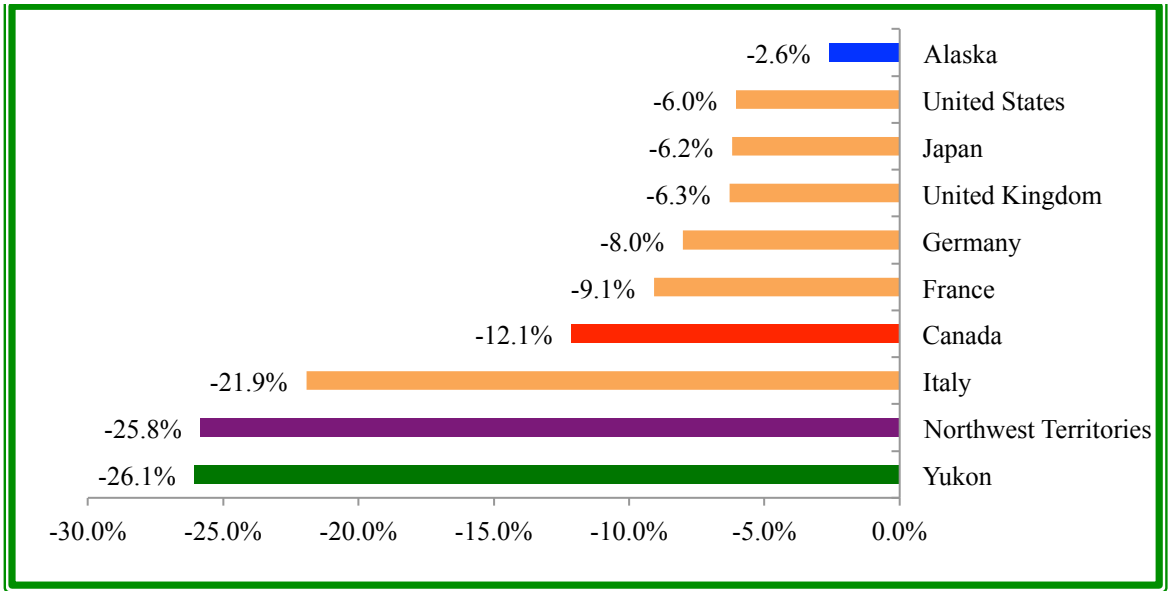


Figure 15 – Fixed Internet Access – Peak Hour Upstream Speed – Detail

	Average Mbps	Decrease in peak period
Bell/Telus	1.7	-15.5%
Canada	1.5	-12.1%
Other ISPs	1.5	-6.5%
Rogers	1.0	-16.6%
Northwestel		
-- Cable	1.1	-34.8%
-- DSL	0.4	-4.5%

Interestingly as shown above, it is cable Internet upstream peak performance in Yukon that declines the most, by almost 35% relative to DSL at 4.5%. Neither cable nor DSL service in Yukon provide adequate levels of service to support applications that require upstream capabilities.

To illustrate, for example, a small business can purchase an Apple MacMini server for only $599. This comes equipped standard with 500 GB of hard drive storage. Backing this up over an Internet connection running at 600 kbps (i.e. the upstream Internet speed to send the information offsite) would take about one week.[73]

4.1.3 Internet and Data Service Pricing

The flip side of service connection speed is price for the service. Typically Yukoners pay more for service and receive less compared to their southern counterparts. This applies to retail (consumer) Internet services as well as to business and wholesale customers.

The table below compares prices for advertised service packages in Canada and Yukon using the CRTC definition of retail fixed broadband service baskets. These service baskets provide a common base of comparison of advertised servcies, not necessarily reflecting market take up of different services.

Yukon pricing is shown for both cable (Whitehorse and Carcross) and for DSL Internet services, all provided by Northwestel. Typically, using the CRTC basket definitions, Yukoners pay a premium of up to 40% more relative to the service "sticker price" – e.g. for the Level 2 basket which groups services with speeds of 4 to 15 Mbps, the Canadian

[73] Of course ongoing back up would not require one week each time, since back up systems typically would only send files that have been modified for backup. The slow speed however provides an illustration of the type of problem that would be an impediment for small business development in the ICT space.

average according to the CRTC is a $54 price tag per month. In Yukon, this level of service is priced at $63 or $88 for DSL or cable service, respectively.

However within this same basket level, the Canadian average download speed is 10 Mbps, whereas in Yukon it is only 5 Mbps. And for upload, in Canada the average advertised speed is 2 Mbps but only 384 kbps or 512 kbps in Yukon.[74]

Table 6 – Fixed Broadband Internet Pricing – Yukon Compared to Canada

Broadband (fixed) pricing	Canada Average	Yukon Cable	Yukon DSL	Yukon relative to Canada
Level 1 (≤ 3 Mbps, 5GB)	$ 39	$ 42	$ 42	108% of the price
Download speed	1.9 Mbps	0.384 Mbps	0.384 Mbps	20% of the speed
Upload speed	0.5 Mbps	0.128 Mbps	0.128 Mbps	26% of the speed
Level 2 (4-15 Mbps, 20 GB)	$ 54	$ 63	$ 88	140% of the price
Download speed	10 Mbps	5 Mbps	5 Mbps	50% of the speed
Upload speed	2 Mbps	0.384 Mbps	0.512 Mbps	22% of the speed
Level 3 (16-40 Mbps, 50 GB)	$ 68	$ 84	n/a	123% of the price
Download speed	28 Mbps	16 Mbps	n/a	57% of the speed
Upload speed	6 Mbps	0.768 Mbps	n/a	13% of the speed
Level 4 (40+ Mbps, 75 GB)	$ 94	$ 120	n/a	128% of the price
Download speed	66 Mbps	50 Mbps	n/a	76% of the speed
Upload speed	8.6 Mbps	2 Mbps	n/a	23% of the speed

Speeds are "advertized" speeds; basket definitions ("levels") per CRTC
Canada per CRTC Communications Monitoring Report (CMR), 2012, Table 6.1.1, page 178
Yukon per Northwestel pricing September 2012
Note: In Yukon Cable Internet is only available in Whitehorse and Carcross; other communities are served by DSL only

Also, for the higher speed baskets – defined by CRTC as Levels 3 (16-40 Mbps) and 4 (40 Mbps and higher) – there are no equivalent services in Yukon for most of the communities. These service levels can only be found in Whitehorse where Northwestel provides cable Internet, although on average the price remains higher and the service speed considerably relative to the rest of Canada.

[74] Note: the CRTC basket approach uses advertised speeds. These are maximums and not guaranteed throughputs. As shown in the previous section, the realized speed based on speed tests is often lower than advertised.

Also, the CRTC baskets are confined to defining advertised prices for simply packages not accounting for add-ons, features, extras and notably usage charges. In Yukon, for customers exceeding their allotted usage bucket (i.e. GB's included per month in the regular monthly charge), Northwestel charges $7.50 per GB.

Thus while the basic sticker price comparison may show Yukoners paying in the range of 40% more for their monthly subscription compared to elsewhere in Canada, when usage charges are included the difference is far more marked and dramatic.

Table 7 – Fixed Internet and Data – Wholesale and Retail Pricing Comparison

Wholesale 50 Mbps per Mbps per month	
Yukon	Alberta
$ 240	$ 30
NWTel TN883A	Axia or Telus ranges $20-$33

NOTE: Australia NBN A$25-$35 per Mbps for 100 Mbps backhaul

Retail Internet			
Cable Internet		DSL Internet	
Whitehorse NWTel	Alberta Shaw	Whitehorse NWTel	Alberta TELUS
$ 83.95	$ 55.00	$ 87.95	$ 42.00
16 Mbps 70 GB $7.50 added GB	20 Mbps 200 GB	5 Mbps 60 GB $7.50 added GB	6 Mbps 150 GB
Whitehorse	Alberta	Whitehorse	Alberta
$ 159	$ 55	$ 238	$ 42
for a customer with 80 GB usage			

In Alberta, a typical cable Internet package providing 20 Mbps is available from Shaw Cable for $55 per month, including 200 GB of usage. For DSL, TELUS offers a 6 Mbps package for $42 per month, including 150 GB of usage. These are similar service speeds to those offered by Northwestel, but include far higher monthly usage allowances. Northewestel includes only 70 GB in its cable Internet offering and 60 GB in the DSL offering.

As one illustration (and not based on any real example or customer), if a customer were to have 80 GB of monthly usage using these Northwestel services, they would see an invoice of $159 using cable Internet or $238 using DSL Internet. On this basis, cable Internet would almost three times that charged by Shaw, and for DSL in the range of five times the price of TELUS.

Business and wholesale services fare even worse. A 50 Mbps IP-backbone service from Northwestel costs some eight times more per month than similar services available in southern Canada.

4.1.4 Mobile Service Pricing

As noted earlier, mobile service coverage is sparse and does not include coverage of highways. Again as with fixed Internet services, Yukoners pay more for the service and receive less for their money.

Table 8 – Mobile Service Pricing – Yukon Compared to Canada

Mobile Voice service baskets (2)	Vancouver	Toronto	Montreal	Average (4)	Yukon (5)	Relative to Canada
Level 1 Basket - low volume 150 minutes	$ 34.53	$ 34.38	$ 34.80	$ 34.57	$ 49.70	144%
Level 2 Basket - average use 450 minutes	$ 51.82	$ 51.48	$ 50.87	$ 51.39	$ 72.90	142%
Level 3 Basket - high use 1,200 minutes (6)	$ 98.82	$ 98.82	$ 99.22	$ 98.95	$ 327.80 $ 108.29	331% 109%
Mobile Data-only baskets (3)	Vancouver	Toronto	Montreal	Average	Yukon	Relative to Canada
Level 1 - 2 GB usage	$ 53.05	$ 53.05	$ 53.05	$ 53.05	$ 60.00	113%
Level 2 - 5 GB usage	$ 66.38	$ 66.38	$ 61.38	$ 64.72	$ 70.00	108%
Average over all baskets/levels	$ 60.92	$ 60.82	$ 59.86	$ 60.54	$ 137.74	228%

Notes:

1. Mobile basket definition per CRTC Communications Monitoring Report (CMR), 2012, page 173

2. Voice Level 2 basket includes 250 text messages; Level 3 basket also includes 1 GB of data (CMR 2012, Table A.4.3)

3. Data basket per CMR 2012, Table A.4.5

4. Basket prices for Vancouver, Toronto, Montreal and Average per CRTC CMR 2012, page 173-174; incumbent pricing

5. Yukon pricing per Latitude Wireless

6. Latitude Wireless does not offer a 1,200 minute plan or a similar high minute voice plan including 1 GB of data
Latitude Wireless Voice Level 3 basket could be Smart Extreme (700 minutes, unlimited data for $100)
or Unlimited Talk and Text (no data for $60)

Typically – compared to CRTC-defined service baskets – mobile service costs more than double in other markets in Canada.[75]

There are also some service differences. The CRTC for example includes a 1,200-minute of use basket, which also includes 1 GB of data transfer. There does not appear to be a similar package for comparison in Yukon. A Yukon customer with a need for a service package of this nature could take a "Smart Extreme" service that includes only 700 minutes but unlimited data. Or it could take the "Unlimited Talk and Text" package, which includes unlimited minutes and no data.[76] The former case would cost the customer 3x as much as that shown by the CRTC and the latter – including no data – would be about 10% more.

4.2 Stakeholders – Overview

Consultations with stakeholders were conducted to review the state of telecom services and infrastructure in the Yukon and to highlight approaches and ideas with respect to the role the Yukon Government could play going forward and what options would be to ensure viable future telecom infrastructure development.

4.2.1 Business, Government, Education, First Nations

Meetings were held in Whitehorse including representatives from Yukon Chamber of Commerce, Whitehorse Chamber of Commerce, Dawson City Chamber of Commerce, Holland America, Government Departments (Economic Development, Health, Education, Justice), Yukon College, and First Nations (CYFN). Industry Canada was interviewed by telephone.

[75] Note: The analysis uses "incumbent" pricing only. In other Canadian markets, the CRTC provides a comparison with entrants such as Wind Mobile or Videotron. These operators are not present in Yukon. Ice Wireless is beginning to operate in Whitehorse as an "entrant" in late 2012.
[76] Using pricing from Latitude Wireless. Bell Canada also has a retail presence in Whitehorse.

4.2.2 ICT Sector

The Yukon Information Technology and Information Society (YITIS) is in the process of developing a Yukon ICT Sector Strategy in concert with the Yukon Government. Inputs from stakeholders in that process from meetings held in May 2012 were reviewed. In addition, meetings were held with ICT Sector players: Total North, Polarcom, SDC Software, and Vandelay Systems.

4.2.3 Telecom Industry Stakeholders

Two meetings were held with Northwestel as well as follow up telephone interview. In addition telephone interviews were conducted with SSI Micro, Ice Wireless, Telesat, TELUS.

4.3 Key Stakeholder Themes

The following sections summarize key points made by stakeholders grouped into thematic areas. A number of the points were raised by multiple stakeholders and are presented herein paraphrased to capture the main elements.

4.3.1 Disparity of Communities relative to Whitehorse

- Internet is very important in the Communities – the North is more isolated, there is less to do, less disposable income – Internet is a less expensive form of entertainment. Also given remoteness access to government services (health, education, justice) is more important.
- There is no quality of service (QoS) between communities – some use of satellite for backup but delays are too long for many applications (health, education – justice applications remote visitations, witnesses).

- Quality of service (QoS) is also important for the planning of new facilities in communities (e.g. connecting hospitals – Watson Lake to new hospital in Dawson City).
- There is a lack of redundancy in backbone and this is a key issue – an outage shuts down the Communities altogether (ATMs don't work, stores close, etc.).
- DSL is often only service available (i.e. even if want to pay high price for V-Connect, it is not offered) and max 4 Mbps – results in businesses acquiring multiple connections to avoid overage charges; and no QoS guarantees.
- Past projects (Connect Yukon) resulted in non-uniform service available (only communities that had a school or YG office); there is inconsistent access across the Communities and some only have 256 kbps capacity – should define a minimum bit rate per community sufficient to support participation in digital economy.

4.3.2 Backbone Capacity and Investment are Lagging

- Lack of bandwidth to south impairs doing business with partners for applications such as e-health/tele-radiology, video conferencing, remote witness appearances (court services).
- Services are often hosted in south (e.g. in Alberta or BC for health applications, video for education) and there is no staff in communities – no connectivity or not enough capacity means not being able to provide the services or support the applications.

4.3.3 Service Pricing is Holding Back Development

- Retail customers exceed their Internet usage caps very fast on DSL… businesses go over even when subscribing to fastest package – some businesses use multiple connections to avoid overage charges.

- The cost of overage too high – Note: this was also a common complain in I.T. Sector survey results.
- Hotels are effectively "forced" to charge for Internet service due to overage charges.
- Increases in GB usage buckets are not keeping pace with growth in usage.
- Northwestel raises rates without improving the service.[77]
- Retail package pricing are 20-30% higher but business service pricing is much higher (300-500% higher). This inhibits the ability of businesses to operate in Yukon and stops many services from being possible.
- V-Connect pricing is very high and discourages companies from moving to Yukon;[78] services will always be more expensive in North, but business/wholesale should be different in similar proportion to retail (i.e. if retail is x% higher, then business/wholesale should also be x% higher).

4.3.4 Service and Network Reliability is insufficient for the Digital Economy

- DSL service – overall available to 90%+ households… but perceived to be very slow and that Northwestel is shaping traffic;
- Bandwidth was sufficient 10 years ago – but is not acceptable today – applications are "built" for southern environment/broadband.
- Lack of upload speed is a problem for businesses; trend is to use of more symmetrical services – needs 10 Mbps symmetrical to all communities.
- Connections drop and are of low quality – this impedes use of real-time applications (e.g. distance education – have had to shut down classes mid-delivery).

[77] However it should be noted that Northwestel's pricing is Territory wide – it does not reflect lower cost in Whitehorse and higher outside; if was cost-based then rural areas would likely be more expensive.
[78] V-Connect is a multiprotocol label switching (MPLS) service provided by Northwestel, which is used by large businesses to support data traffic connections between multiple locations.

- Northwestel not structured like small local providers; does not hire local… e.g. have a tech in Dawson City to serve Mayo (5 hour drive). Need more community-level sourcing.

4.3.5 Wireless… "Even 80-year old grandmothers bring their iPADs" to the Yukon

- But… there is no need for LTE in Mayo if there is no fibre to Mayo.
- Tourists and Government meetings in Communities… don't come anymore because there is no mobile coverage; meetings/conventions expect to have "technology" where they go (still come to Whitehorse but avoid Communities); Yukon is not competitive with rest of World.
- Even in communities with coverage – there is only basic service.
- Could deploy 450 MHz LTE for broad basic coverage as is being done in Brazil.
- Another option could be to get access to wireless frequencies not used by existing licensees (i.e. cellular 850 MHz via the RP-019 process).

4.3.6 Industry structure – Market cannot support multiple transport companies – There is a need to address ownership of backbone facilities

- Northwestel is a tiny part of Bell… It would be better if a Northern consortium were to purchase Northwestel from Bell (e.g. like Air North) then keep operations, profits, etc. in the North.
- There is a perception that Yukoners are getting "nothing" for the subsidy Northwestel receives and Northwestel tends to lag in technology.
- NWTel should consider partnering with City of Whitehorse and Yukon Government and other providers on cross-town networks in Whitehorse.
- Government could take a greater role in backbone development and could retain last mile competition (with local co-location infrastructure).

- Internet should be a "critical" government service; like other critical infrastructure, government should own it; there is no market in Yukon to support multiple transport companies. Nothing prevented Rogers from coming to Yukon except for lack of customers.
- Need subsidies to operate in Yukon – subsidies should be available to competitors not just Northwestel – and not just apply subsidies to phone service – "basic" service is now mobile and Internet.

4.3.7 Future Developments

- Electricity lines – possible project to connect to Skagway; Carmacks-Dawson line was completed in 2011… there was no fiber included with it.
- Mines – 5-8 new mines in coming years; Service to mines often only DSL available.
- Future road improvements (Tahini Hot Springs – 30 min from Whitehorse) – but often there is no power along the road (i.e. for wireless sites, etc.).
- Government buildings (including hospitals, schools) – wireless access points, etc.
- Could put a "telecom tax" on all new infrastructure projects;
- NWTel is a large IT employer (60% of ICT employment and largest private sector employer overall in the Yukon) and any changes in the telecom industry should result in continued high level on IT employment in the Yukon;
- Yukon Government overall (including related organizations) is collectively a very large part of NWTel's revenue base (probably relatively larger than elsewhere). YG should be more aggressive as anchor tenant… Departments and agencies should act together. Internet connections are routed via YG (YG already has a connection to NWTel in each community);
- Data center – there is not one that third parties can make use of (NWTel has its own) – could be developed but would have issue with backbone connection/cost;

also impeded by cross-town packet charges (overage charged for traffic within Whitehorse) and high power rates (e.g. relative to BC).

- IT infrastructure should be a commitment to economic development – need Federal $ to build it – needs to be Federal policy, otherwise won't have people living in the North.
- Lots of "programs" for funding – need to look at what programs are out there that are not being tapped into.
- YG should have ongoing monitoring of performance and price for services particularly for business services.
- YG needs to be stronger intervener with CRTC and Federal Government; and not focus just on Whitehorse;
- To have greater influence in regulatory matters – should have joint submissions with all three Territories.
- CRTC pays attention to what Territorial Governments say (more so than other interveners). YG needs more dedicated resources to participate in proceedings.
- Could have a new regulator just for North – last monopoly area of Canada.

5. Road map

The ensemble of the issues identified in this Report point to the need for concerted action to improve the investment profile and resultant speed, reliability and cost of broadband services in Yukon. The economic impact of broadband is increasingly recognized globally as important to growth and to participation in the digital economy. This section looks to make sense of the stakeholder findings to suggest a way forward, in other words not simply evaluating the problems, but putting issues into the context of possible solutions

Many countries have established broad policy goals for broadband connectivity – typically expressed in terms of service speed available to end users. Establishing such an objective provides a tangible expression of a required end result.

As a "strawman", Yukon could establish an objective of providing 30 Mbps service to everyone, and 100 Mbps to the largest communities (i.e. similar to the approach of the EU).

Using this as a starting point – and building on the issues identified from the analyses and stakeholder meetings presented herein – this Section first reviews plans in other selected countries to provide a "best of" view of ways to realize broadband objectives, then provides further background on the Yukon Government's role in past initiatives.

Taking all of this together the Report concludes with a suggested list of areas of focus that could form a roadmap for definition of projects and specific initiatives going forward.

5.1 Stakeholder Inputs and Discussion Points

Stakeholder feedback gathered in this project shows strong resonance with problems and issues identified elsewhere in the world, which is not surprising, since many of the concerns focus on common needs, like the voracious demand for more bandwidth shared by users around in the world. While the Yukon environment has unique characteristics, the needs of Yukon customers for connectivity, and many of the challenges faced by service providers, and policy makers, are the same everywhere.

Broadband connectivity – fixed and mobile – now the "norm" worldwide and are the key drivers for investment in the industry.

Furthermore, underlying data traffic expected to continue to grow – 30% per year – with increasing usage by mobile towards levels seen in fixed (in terms of GB consumption per month). Other jurisdictions have adopted policy goals for broadband connectivity: in the US and in the EU, a goal of 100 Mbps for every user is the objective. While Canada has an unofficial near term 5 Mbps goal (identified by the CRTC as a target without specifying means to achieve it) there is no overarching policy or long-term objective for the country.

Looking more specifically at the Yukon, it would seem that while overall broadband penetration is similar to the Canadian average, the take-up rate is likely to be higher than average, given the experience across the Territories. In other words, when high-speed service is made available, customers in the North are more likely to make use of it. With limited choices in information sources (radio, TV and even newspapers) compared to southern Canadians, access to the richness and immediacy of information available on the web assumes even greater importance. At the same time, Yukon customers are concerned that they are falling behind. Users complain that Internet connections are too expensive, are unreliable/not redundant, and there is insufficient bandwidth for advanced business

applications (e.g. cloud computing). Communities are often supported by relative little capacity and are "saturated daily". There is a growing gap of services/capabilities available in Whitehorse compared to other communities.

Review of the planned and anticipated developments for improving the capabilities of delivering high-speed broadband throughout Yukon suggests that the current trend will not provide solutions sufficient to meet customer needs on any reasonable time scale. The upcoming regulatory proceedings on Northwestel (Modernization Plan, Local Interconnection, Backbone Connectivity) will include examination of measures to promote new investment, encourage competitive entry, and improve service levels. However, with technical and economic hurdles to cross, the jury is still out on how much can be achieved through regulatory means, and how long customers will have to wait.

A number of fiber infrastructure projects have been identified by Northwestel and others (e.g. Arctic Fiber, MVFL), which would, if implemented, provide significant improvement in the backbone infrastructure needed to deliver high-speed access. Unfortunately there is presently not enough solid information on the likelihood of these projects proceeding in any certain timeframe, because of the uncertainties of economic impacts, regulatory approvals and funding.

Even once the backbone connectivity is addressed, the issue of local access to that infrastructure remains. Northwestel is the only provider of facilities-based service in Yukon, whether wired, cable or wireless, limiting the opportunities for competitive entry. For prospective competitors, wireless offers the quickest and lowest investment cost option of entering the access market. SSI Micro operates in NWT and Nunavut providing ISP services and business connectivity using satellite technology, and has a wireless license covering Yukon but has yet to deploy service. Ice Wireless operates in NWT

using Rogers' license, which covers all three Territories. Ice does not currently offer service in Yukon, but has announced plans for 3G cellular services across the North. [79]

New spectrum licensing offers the prospect of adding to available capacity in Yukon, but the reality is that even existing licenses are not being fully exploited. Past licensing to multiple providers has not resulted in deployment of new services, likely due to a combination of the obstacles of cost and the entrenched position of Northwestel in all access technologies. As a consequence, not only is customer choice more limited, but also the total available bandwidth capacity is less, and the capabilities of new customer devices more restricted.

Since the prospect is bleak for solutions to Yukon's current and future broadband connectivity needs evolving from the present combination of market forces and regulatory prescriptions, it is necessary to examine what other measures might be adopted to change this path.

The following sections consider examples of how other countries have addressed these problems and goes on to identify some steps that could be taken.

5.2 Initiatives in Other Areas – The "best of…" from programs and approaches elsewhere

This section considers plans and programs that support broadband infrastructure development in several other countries in order to generate ideas using the "best of…" from those initiatives; i.e. the elements of them that can be applied and adapted to the specifics of the Yukon. The objective is to apply these to the environment and economy in ways that are practical and implementable for the Yukon Government.

[79] https://www.icewireless.ca/documents/18_09_2012.pdf

It should be kept in mind that countries in this section were not chosen based on a broad survey. Most countries around the world have some form of digital economy strategy and/or broadband deployment plan, given the importance of these initiatives to socio-economic development and participation in the connected world.

Rather, LYA looked to regions of the world that have some geographic and socio-economic similarity to Yukon and also where government has taken a proactive role. And this not just in setting development policies but in actual implementation of telecom infrastructure investment.[80] Telecom development policy in any particular country is the result of an amalgam of factors, unique to each jurisdiction. While elements like geography and density may be comparable, other factors like the political system, regulatory philosophy, industry structure and extent of economic opportunity may be more important drivers.

The countries discussed in this section all meet these criteria: Sweden given its geographic positioning and national fiber backbone, Scotland due to its targeting of remote sparsely populated areas and governance structure similar to Yukon, and Australia due to its vast geography and focus on national broadband coverage.

The initiatives in Sweden and Australia are more government-driven and have more direct involvement than is typical in a North American setting, but the underlying objectives and approaches provide some useful input.

[80] Other countries sometimes used as comparable to Canada's North are Russia and Greenland. In the case of Russia there is a digital infrastructure strategy. Russian broadband penetration, though, is more driven by satellite and wireless than is the case in Yukon. Greenland may have similar issues to that of Yukon, but possibly starting further "back". The domestic backbone is microwave with satellite for far northern areas and access is DSL up to 4 Mbps, which is said to be "unaffordable" (See "Broadband Policies for the North", presentation by Heather Hudson, University of Alaska Anchorage, November 2011). Russia and Greenland geography is also more similar to that of Canada's other Territories and may have more elements of interest to Northwest Territories or Nunavut rather than Yukon.

5.2.1 Sweden

Sweden has a similar geographic position to that of Yukon and is similar in surface area. On the other hand, there are 9.5 million people in Sweden, making it much more densely populated. One characteristic of Sweden's national infrastructure is that much of it is State-owned. This includes the railway tracks and power lines. In the late 1990s Sweden embarked on a program to have the State-owned companies build a national fiber backbone. This came with a heavy government subsidy, but resulted in there being a fiber "presence" throughout the country.

In addition, rules were put in place that required the fiber owners to provide open access for local operators to connect to the backbone. Many municipalities in Sweden built out their own local fiber networks, which were then connected to the local point of presence in their community (often at the train station).

Today 85% of "urban" networks are owned by the municipalities themselves, which then sell dark fiber or capacity to Internet, TV and mobile service providers.[81]

This model of operation has proven to be quite successful in Sweden – with Internet access speeds typically available at 100 Mbps – but does not "transport" itself directly to the Yukon context given the state ownership of infrastructure and extensive rail and power networks.

On the other hand there are two take-aways that can serve to build on certain Yukon stakeholder themes:

[81] "Fiber Strategy in Sweden", Svenska Stadsnäts Föreningen (Swedish Urban Network Association), August 22, 2012, page 8

- Focus on a national backbone… While much of the national initiative was community-driven, it was recognized that the overall enabler would be the national backbone. As the incumbent telecom operator was not building out many parts of the country, the government took it upon itself to build out the network and to ensure it would be available on an open-access basis in all communities.

- Role of Government and public services… a major driver for the Swedish initiative was to provide better access to public services in the communities, from train schedules to health and education services. Going forward, the view is that "50% of the usage in the coming 15 years will be between citizens and public sector".[82]

From the Yukon perspective, the Swedish focus on national backbone and the importance of government services are two relevant themes.

Of course in Yukon the backbone network is already owned by Northwestel. The Yukon Government though could take a more proactive role in backbone development by focusing on basic infrastructure developments. This could mean, for example, acting to ensure that when infrastructure projects are being planned – e.g. for roads, electric power lines, bridges, pipelines, etc. – that they include a telecom "component". In this way, gaps in the existing backbone could be filled and over time provide improvements to the capacity and performance of backbone services.

Taking a proactive role in this is also consistent with the role of public services in the communities, notably for health and education given the remoteness from major centers. In terms of considering the scale and scope of telecom projects, the heightened capacity

[82] *Ibid*, page 19

needs for government-related services should help drive the deployment criteria for the infrastructure.

The Swedish example thus provides some direction in terms of focus on the development of backbone infrastructure as a key enabler and the social importance of government services. These are both directly relevant to the Yukon geographic context. On the other hand, the structure of the Swedish economy, driven by massive subsidies for the build out of the national backbone, does not have a particularly good parallel for Yukon. For a mechanism, one can turn to another example.

5.2.2 Scotland

Scotland also bears some similarity to Yukon. Although it is geographically much smaller and has a larger population it is characterized by areas that are remote and which are sparsely populated. Scotland is also largely a devolved government, with a similar structure to that of Yukon. Scotland has regional economic development authorities, but for telecom programs and licensing relies on the central UK government in London.[83]

In 2010 the regional government initiated a Digital Scotland program, which is intended to bring Scottish broadband infrastructure to "world class" levels by 2015. This was defined as moving towards the European objectives (at least half of households with 100 Mbps access by 2020), but with an interim 2015 focus to reach 40-80 Mbps. Currently Internet access is at 6 Mbps or less.

The first project of the Digital Scotland program is a "structured procurement" focused on building out next generation broadband access to the Highlands and Islands region in the north, focusing on rollout to 50 under-served communities. Based on responses to a

[83] The discussion of the Digital Scotland program and approach is based on interviews of a representative of the Broadband Policy Team of the Digital Directorate of the Scottish Government in early August 2012, as well are reviews of related documentation.

tendering process, it will be incumbent operator BT that will be responsible for the build out of backbone and local access.

The project is being managed by the Scottish Government via the Highlands and Islands Enterprise and is "gap funded". There are funds that have been made available from the national UK Broadband program and are being applied as a direct subsidy to the build out.

In addition, the Scottish Government has recently implemented a Community Broadband Scotland initiative, which will use a £5M fund to provide technical and organizational assistance, and offer seed money, to local broadband development in underserved rural areas.[84]

As with the Swedish example, the Scottish approach is not directly transferable to the Yukon context, but there are some take-aways that can serve to guide possible approaches in Yukon, notably:

- Unlike the Swedish emphasis on Government services, in Scotland the drivers for deployment are take-up by consumers and small businesses. In a 2010 survey, the regional government found that fully 25% of small businesses in the H&I region did not make use of the Internet. Given the importance of connectivity to economic development and to participation in the digital economy, take-up is an important factor. In the H&I project, therefore, funding is contingent on take-up of service and not just on making service available.

- The structure of the procurement, unlike the Swedish case, is not being fully funded from Government sources, but is gap funded. Ownership of the resulting

[84] Scottish Government news release, August 9, 2012
http://www.scotland.gov.uk/News/Releases/2012/08/broadband-rural-communities09082012

infrastructure remains with the commercial operator (in this case BT). This is similar to a least-cost subsidy mechanism, wherein the best proponent is the one that can build the most for the level of subsidy. In practical terms, the Scottish regional economic development authority is essentially channeling funds from the national program through the regional agency that tenders the project out.

- While the infrastructure will remain owned by BT, in addition to funding being contingent on take-up (which presumably has an implication for end-user pricing), the build out is also required to provide for points-of-presence for wholesalers to access the network. So considering essentially the same objectives – building "national" backbone, moving access to broadband speeds and providing open access for third parties – the Scottish mechanism to achieve this is completely different from that of Sweden.

The focus of the Digital Scotland project has some useful parallels for Yukon. Notably, with a driver of take-up, this in effect is the corollary of the objective of supporting government service delivery. In other words, if a driver of broadband deployment is public services such as health and education, then deployment objectives should by design also incorporate objectives of take-up.

Consumers have to be connected in order to benefit from on-line public services and to participate in the digital economy. The idea behind Community Broadband Scotland is to encourage the use of broadband by individuals and businesses and to encourage collaboration on local infrastructure projects, with the overall objective of improving the attractiveness of business cases in rural communities.

An initiative of this type would be particularly important in Yukon, especially for aboriginal communities where take-up is low and where increased broadband

connectivity – particularly for health and education, as well as for support of small-medium enterprises – would be very beneficial.

Also in Scotland, in the end it will be the national incumbent BT that will own and operate the facility and receive the subsidy. Unlike the subsidy system supporting Northwestel, however, the subsidy in the Scottish case is entirely transparent and subject to a tendering process. This is closer to the approach used by Broadband Canada, however in Scotland being run by the regional government that then accesses the national funds.

In terms of applying this to the Yukon context, the Yukon Government could consider its role as facilitator – of identifying sources of funding and "packaging" them into telecom development projects. There are many disparate sources of funding that could be applied to telecom projects in Yukon. Its specific role could range from simply acting to promote use of various funds and mechanisms to participating as a partner (e.g. via Yukon Development or another agency).

5.2.3 Australia

Australia provides an example of more extensive government involvement in telecom development. In 2009 the Australian Government set up a company – NBN Co. – to build out a national broadband network to replace the existing legacy networks. This includes a plan to build some 70,000 route-km of fiber while progressively buying back the networks from the incumbent operators. NBN will then operate as a wholesale-only provider, with open access, leasing services to operators that then use the backbone to provide service (via their own local access facilities or in some cases using NBN local fiber-to-the premises). The objective is to provide 90% of the population with 100 Mbps service, with a minimum of 12 Mbps to the "final" 10%.

This project was budgeted at about $43 billion, including $11 billion to pay Telstra (the largest incumbent) to decommission its existing network.

While somewhat more radical than the Swedish approach, the Australian example also emphasizes the importance of a national backbone with open access. The Australian Government recognizes that it is in essence creating a monopoly provider of backbone, and thus this comes with open access provisions and a strategy to ensure fair pricing in all parts of the country—urban and rural.

There is a perception amongst stakeholders, which appears to be recognized if not actually shared by the CRTC, that Northwestel is lagging in investment and has not upgraded its network sufficiently to provide adequate basic service, let alone serve as a platform for extending advanced services throughout the North. While the prospect of a solution it would likely be untenable in the Yukon context to suggest buying back Northwestel's network so the Government could build a new one. Thus, as with the other examples, the Australian approach cannot be transported directly to Yukon.

On the other hand, the emphasis on the importance of a national wholesale-only backbone, with open access and a commitment to ensuring parity in service pricing between urban and rural customers suggest that lessons might be taken from the Australian experience.

5.2.4 Alberta

Alberta's approach to extending broadband in the province has been to take an active role in designing and funding a broadband infrastructure while seeking to balance the impacts on the competitive market. Now comprising 15,000 km, SuperNet connects 429

communities, 87% using fibre.[85] The network has two components: the base network which links the core communities, and the extended network which connects a further 400 rural communities, providing a SuperPOP in each one. The Alberta SuperNet project was conceived in 2001 as a high-speed network connecting government facilities in 27 centres, and then as a means of extending broadband access connections to education, healthcare and local government institutions.

A Bell Canada subsidiary won the tender and entered an agreement to build and operate SuperNet, which the government would continue to own. Bell contributed $102M to build out the network; Alberta contributed $193M, and committed to a 10-year contract for services at a cost of $169M. Subsequent differences were resolved with a new agreement in 2005 where Alberta transferred ownership of the SuperNet base network to Bell Axia in exchange for a 40 year Indefeasible Right to Use the network. Alberta retains ownership of the extended network, but it is operated by Axia. Provisions include sharing revenue from SuperNet use by other providers.

The SuperNet project has been a clear success in establishing broadband connectivity to 4,200 government, educational, and healthcare facilities across the province, and in establishing a highspeed backbone network that will enable advanced applications.

SuperNet was also intended to utilize the high-speed backbone to enable extension of broadband service to rural communities, through a policy of open access. According to Axia, bandwidth is sold to ISPs at the same province-wide rate regardless of service volume. Local providers of Internet access, frequently using wireless, connect only at the SuperPOP to protect against bypass of the transport facilities—whether SuperNet or TELUS. There is evidence to suggest that this model can be effective in stimulating the development of competition in small rural markets. By the spring of 2011, Industry

[85] Axia marketing materials indicate some customers enjoy download and upload speeds up to 60 mbps.

Canada had issued 555 licences in the 512 to 698 MHz band for use in remote rural communities—450 of those licences were granted for Alberta.[86] The attractiveness of this result for the Yukon context is that it suggests there may be niche market opportunities for small providers, provided that the cost of backbone connectivity is at a manageable level.

While the open access approach allows for small service providers to build businesses in small local or regional niches, but does not guarantee that there will be competitive options in every rural community, either in service capability or in price.[87] Even with the benefits of the SuperNet backbone, there are small communities in Alberta where the market opportunities have been enough to attract ISP entrants, and the provincial government is implementing measures that will address this gap. The Final Mile Rural Community program allocated $5 M to fund projects that would provide connectivity in 'unserved' rural areas, defined as communities with less than 1.5 Mbps access.[88]

The SuperNet model represents an effective compromise between allowing competitive forces to extend broadband capabilities, and government intervention through involvement in building or owning the backbone infrastructure.

However, the substantial investment cost, plus the ongoing commitment to which Alberta has made to a single service provider suggest that this solution will not be feasible for Yukon without additional funding support.

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[86] Quoted in 'Connecting the Dots: Alberta Rural Broadband Coverage Study, Final Public Report', November 2011

[87] Reports show that not every SuperNet community has a competitive ISP market—there are communities where entry has not occurred. See Connecting the Dots Appendix D

[88] http://www1.agric.gov.ab.ca/general/progserv.nsf/all/pgmsrv437/$file/Final-Mile-Brochure.pdf?OpenElement

Furthermore, while market outcomes cannot be predicted, given the very limited economic opportunities in serving the smaller communities, there is little reason to expect that competitive entry would flourish, requiring additional programs to ensure local connectivity.

5.2.5 Alaska

Alaska represents an interesting case study because of the parallels that might be drawn from proximate geography and the differences in the development of telecommunications systems.

Alaska's population is approximately 772,000, dramatically more than Yukon's current estimated population of 35,000 and nearly seven times greater than the total of 111,000 across Canada's North. (All population numbers are 2012 estimates.) Interestingly, Alaska's population represents about 0.25% of the total U.S. population (2012 est. 314,500,000) where Canada's northern population is about 0.32% of the national total (2012 est. 34,755,000).

The telecommunications market in Alaska is characterized by surprisingly vigourous competition considering the size and remoteness of the market. The three major players are: AT&T Alascom, the successor to the pioneering communications network, purchased by AT&T in 2005, operating first as a long distance carrier but now also offering wireless and Internet services; ACS (or Alaska Communications) which offers both wireline and wireless services and owns and operates two marine fibre cable connections to the continental U.S.; and GCI which offers the whole range of telecom services, including cable, and had its own extensive fibre network with connections to the U.S. mainland. There are, in addition, a number of smaller players, operating primarily in local markets.

One example is Alaska Power and Telephone or AP&T, which provides power and telecom services to a number of small communities in Southeast Alaska (including Skagway). In its 2011 Annual Report, discussed the benefits to its stakeholders of investing in SAMN or the Southeast Alaska Microwave Network[89] with these words: "Internally it is the backbone of virtually all of the AP&T's data products and services. It provides a means by which AP&T can control (operating and services) costs to a much greater extent. Externally it extends AP&T's revenue reach into regional data transport markets with other carriers, provides redundant path options for industry competitors, and opens the door to long-term contracts with wireless providers and others looking to enlarge their service footprint."

This type of approach, a willingness to build business from a small area by providing good service and continuing to offer new services to customers is one that would work just as well in Yukon as in Alaska, given that the opportunities for entry were equivalent.

Despite the presence of competition throughout the state, there is a consensus view that subsidy intervention is necessary to achieve the nationwide broadband connectivity goals. Connect Alaska is a partnership established between Connect Alaska (a branch of Connected Nation, a national non-profit group, organized to promote the access to broadband) and the Alaska Department of Commerce. Funding comes from national funds from the Department of Commerce and NTIA, administered by the state.

One of Connect Alaska's initiatives is the Alaska Broadband Taskforce, which will provide a strategic broadband plan and coordinate activities across agencies and organizations.[90]

[89] The telecom revenues of AP&T in 2011 were just $15.1 M AP&T Annual Report 2011 www.aptalaska.com/forinvestors

[90] The NTIA has awarded $6.38 M in funding for Connected Nation Alaska for broadband development

The Task Force is comprised of representation from providers, academics, government funders and regulators. It has established a vision or providing every Alaskan with 100 mbps broadband connectivity by 2020.[91]

While there are potential advantages in the task force approach to developing policies and priorities is not certain that utilizing this idea would yield the desired benefits for Yukon. The nature of our need is clearly identified, and the infrastructure gaps are well defined. It would be useful to establish an objective for broadband capability, such as the 100 Mbps by 2020, the obstacles posed by access to funding and the overwhelming presence of Northwestel suggest a more focused approach to a solution.

5.2.6 Summary assessment – access, backbone, services, financing

Review of solutions implemented in other jurisdictions, and taking into account the needs identified in the stakeholder analysis, it becomes clear that the infrastructure problem can be broken down into two components: backbone and access facilities.

Where factors of geography, population or extent of economic development have limited the opportunities for private investment, the question becomes how best to finance the build out of telecom infrastructure. By definition the solutions considered must include public financing.

The different solutions adopted in other jurisdictions are the result of the unique combination of driving factors combined with the underlying philosophic or political perspective in each case. Some approaches start with direct government involvement — designing, building and perhaps even owning facilities. Others involve government in a

[91] Additional metrics for this vision include symmetrical upload and download speeds at 100 Mbps, target latency of 20 milliseconds, and 95% take-up rates.

less direct way—through public-private partnerships to fill gaps not addressed by private investment, or simply providing funding.[92]

These factors determine the role or approach which each government adopts. In the following diagram, the generic roles of government with respect to telecom infrastructure development are compared. In Sweden, and to a lesser extent Australia, the preference is for government ownership, though both are active in designing the solution. In Scotland, government ownership is not part of the equation, though there is a strong element of government in directing solutions, down to a significant degree of detail.

In Alaska the role of government is more akin to that of a booster, with a role of encouraging cooperation, providing guidelines and targets, and occasionally funding support.[93] The Alberta solution is more characteristic of a role for government as catalyst, where there is funding, and some ownership of infrastructure, but there is a clear goal of stimulating private sector growth, and in the case of SuperNet, a transfer of ownership interest. As a point of comparison, the characteristics of the Connect Yukon project would be more likely categorized as Government as Catalyst because the Yukon Government investment facilitated the extension of infrastructure for delivery of Northwestel services.

[92] A third alternative, government intervention in the market through regulatory fiat, is exemplified by the 2011 decision by Ofcom to mandate a 12% in wholes broadband rates for ISPs extending retail broadband services to rural areas. This would provide a 2-year 'stimulus' to encourage development of high-speed access in areas less likely to be reached quickly by market forces. This approach is likely more effective in the U.K. because of the absence of a single nationwide supplier like BT, as well as the policy commitment to a much less interventionist regulator in Canada. http://media.ofcom.org.uk/2011/07/20/better-value-rural-broadband/

[93] To be fair, there is a considerable amount of federal funding available for universal service issues like broadband to underserved areas, but even those initiatives are delivered through the private sector.

Figure 16 – Degrees of Government Involvement in Broadband Plans

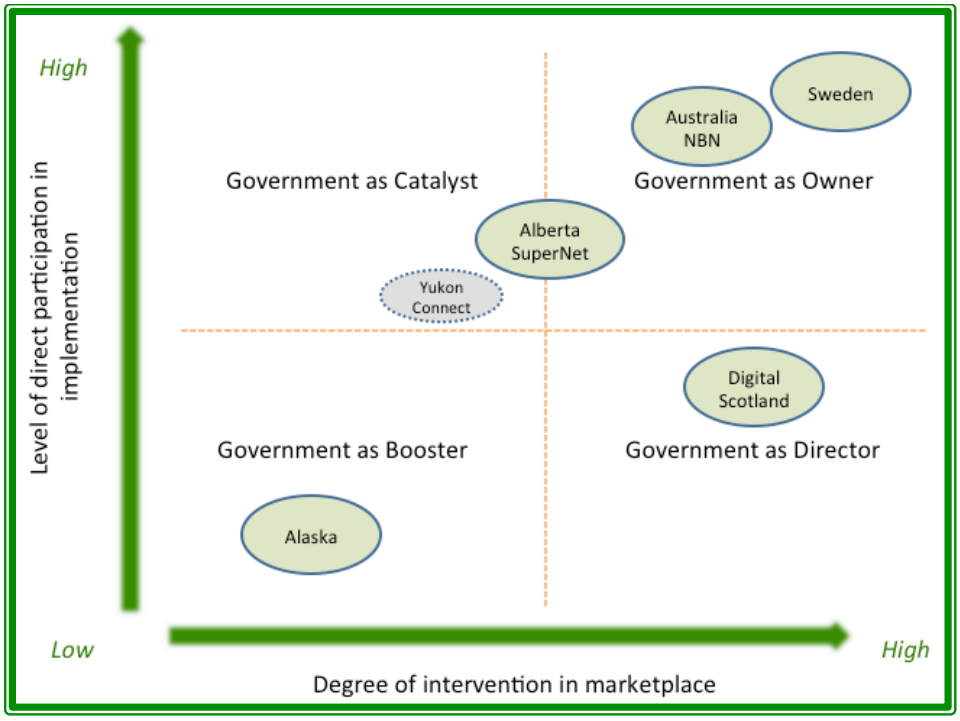

Table 9 – National Programs – Three Examples and the Approaches to Implementation

Parameter	SWEDEN	SCOTLAND	AUSTRALIA
Initiative	National Fiber Backbone and "Municipal" Networks (initiated 1999)	Digital Scotland (initiated 2010)	National Broadband Network (2009)
Internet speeds	Typically 100 Mbps now	Objective 40-80 Mbps 2015; "world class" by 2020 (currently at 6 Mbps or less)	Objective 90% of population with 100 Mbps; min 12 Mbps to "final 10%"
Access network	Community builds dark fiber to POP; open networks	Structured procurement for specific areas - initial focus Highlands&Islands where no cable TV, poor mobile coverage (procurement includes backbone and access); requires POPs for wholesalers	Fiber to premises
Backbone network	Fiber on State-owned Railway, Power lines to local POP		National backbone 70,000 route-km; wholesale only with open access
Service focus	Public services (e.g. train schedules), Health	Consumer and SME driven; survey (2010) found 25% of SMEs did not use Internet) - program of engagement/participation	NBN is wholesale only
Role of incumbents	Not involved (Telia) - was ignoring rural areas	BT is sole bidder for H&I project (2012)	Telstra paid (A$11B) to decommission copper networks progressively 18 months after NBN rollout by region
Financing	Backbone - Government funded €600M; Community networks community funded €700M	Government gap funded - financing contingent on customer take-up (not just coverage); initial Highlands&Islands project £120M (30 Mbps to all by 2020; at least 2 Mbps by 2015)	Government owned NBN Co. (2009); future private equity post-rollout (2023); A$43B cost estimate; concerned over privatized backbone (monopoly pricing; QoS in regional areas)

5.3 Role of Yukon Government

5.3.1 Role in Past Initiatives and Going Forward

The Yukon Government has established a credible role as an interested party in the development of telecommunications policy. As an intervener in CRTC proceedings since 1999 and a participant in major policy reviews like the Telecom Policy Review Panel in 2005, the government has advocated for Yukon interests and offered new ideas. Positions taken by the Yukon Government have consistently sought balance in considering the interests of all elements of the economic and social environment, having consideration for

the long-term benefits to Yukoners. So while objections have been raised to proposed rate increases, the Yukon Government has also maintained that a viable Northern-based telecom provider is important to the economy. Similarly, the Yukon Government has long maintained that the introduction of competition in telecommunications markets will not only benefit users through choices and market pricing, but will also provide Northwestel with the opportunity to improve in efficiency and customer service through the discipline of the marketplace.

At the same time, the Yukon Government is Northwestel's largest customer and is therefore in a position of significant leverage with respect to Northwestel's business success. Here again the government has traditionally taken a balanced approach, recognizing the mutual benefits of a strong partnership with the company. This takes into account the "big picture", because driving down profit margins through overly aggressive procurement policies, for instance, would result in savings for the government but could be detrimental to the overall Yukon economy.

The Yukon Government also has experience as a more direct participant in telecommunications development in the Connect Yukon project. With Yukon Government funding and direction, Northwestel was able to extend high-speed access to 11 communities, reaching about 95% of the population, and enabling the provision of healthcare and educational applications remotely. Since the program was initiated in 2000, the growth of applications and ever-greater user demands have dramatically increased the need for bandwidth and the requirements for quality and reliability. Stakeholder feedback demonstrates that the current infrastructure is not able to satisfy these customer needs, and it is self-evident that the ability to take advantage of future advanced applications will be impaired.

With the benefit of the Connect Yukon experience, and having regard to lessons available from other jurisdictions, the opportunity exists to develop an effective solution that is precisely tailored to the present and future connectivity needs of Yukon.

5.3.2 Implementation, funding sources, ongoing process, sustainability

Some approaches start with direct government involvement — designing, building and perhaps even owning facilities. Others involve government in a less direct way—through public-private partnerships to fill gaps not addressed by private investment, or simply providing funding.[94] For example, commitment to a government-managed infrastructure such as the Australian approach will be more likely to ultimately yield a controlled competitive environment, with more limited scope for innovation, and perhaps growth.

On the other hand, a policy framework that enables private sector driven infrastructure development, as is the case in Alaska, increases the depth and robustness of the economic environment, though perhaps at the cost of a controlled path of development. In the Australian model development can be rolled out steadily, given sufficient funding, with a deliberate eye on delivering capabilities to all segments of the market—urban or rural, dense or sparsely populated. But even where the private sector is counted on to drive investment, as in the Alaska model, there are times when targeted intervention by government, through policy or investment, remains necessary to ensure that goals for connectivity, service quality and availability are achieved.

[94] A third alternative, government intervention in the market through regulatory *fiat*, is exemplified by the 2011 decision by Ofcom to mandate a 12% in wholesale broadband rates for ISPs extending retail broadband services to rural areas. This would provide a 2-year 'stimulus' to encourage development of high-speed access in areas less likely to be reached quickly by market forces. This approach is likely more effective in the U.K. because of the absence of a single nationwide supplier like BT, as well as the policy commitment to a much less interventionist regulator in Canada.
http://media.ofcom.org.uk/2011/07/20/better-value-rural-broadband/

The Alberta experience makes clear that the solutions to enabling broadband connectivity in rural areas must address both the backbone infrastructure and the local connectivity. A further need to be filled is how to oversee the effective use of the high-speed network, which in Alberta is accomplished by Cybera, a publicly-funded agency which acts as a neutral expert guiding the development of the network and working with users and institutions on pilot projects to improve capabilities of the infrastructure.

The choice of solution must take into account sustainability, in other words the approach must be sufficiently dynamic to allow for future changes, whether those be in technology, in market demands by customers and market responses by providers, or in policy and regulation. Even after an "ideal" infrastructure solution were to be implemented, as new service demands or new service offerings arise that require further investment, the same economic decision tree will be used to evaluate a business case and there may well be situations where market forces alone will not be sufficient to ensure availability of the same services everywhere. This need not require an active government involvement, but there should not any misapprehension that the problem is solved once and for all. At minimum, the approach adopted (whether government is involved directly, indirectly or through a PPP) must include recognition that sustainability of the solution is an ongoing responsibility.

Having assimilated the range of possible options for involvement, what process might be followed to determine an implementation plan for Yukon? The full answer to this question must be determined by the Government but the following are steps that could be suggested in developing an implementation plan:

1. From the starting point that the needs to be addressed include both the backbone infrastructure and access infrastructure, examine priorities. It may be helpful to break down the needs into discrete elements, which could be evaluated as possible projects. Different frames of reference might be used here, such as: urgency (what

is most time critical); leverage (what is likely to have most impact); essentiality (what can we not do without).

2. Based on assessment of priorities, look at defining the scope of one or more high priority projects, as far as possible. The more detail that can be included in a project scope, the more effective this will be, but if the available information is insufficient to clearly define some parameters (construction cost, for instance) then responsibility for those determinations should be assigned.

3. Using the defined project scope, develop a project plan that includes possible funding sources, prospective partners, and role of government. This would include some conclusions, perhaps only preliminary, on feasibility.

4. With these conclusions it will then be possible to create a proposal that could take the form of a 'prospectus' that might be used to gain the support of prospective funders or partners. The proposal could just as easily form the basis for a P3 Business Case, if funding were being sought from PPP Canada, or even an RFP, if the decision were to be made favoring government ownership.

5. Consideration should be given to establishing a dedicated project team, possibly even at the beginning of this process, to clearly define the responsibility and confirm the commitment to action. Having regard to the options laid out by PPP Canada, it would be worth considering the option of assigning the responsibility of creating the proposal, and perhaps even negotiating terms for a deal, to a separate entity, which could be a non-profit.[95]

[95] The eligibility to apply for P3 funding from PPP Canada is limited to public authorizes, but includes "A private sector body, including not-for-profit organizations, whose application has been sponsored and submitted by a provincial, territorial, municipal or regional government, or First Nations" http://www.p3canada.ca/p3-canada-fund-eligible-apply.php. The advantages of working through a separate

The binary choice for funding an infrastructure project proposal is either public financing or private financing. For the purposes of this discussion, these two alternatives reflect "the goalposts" for the analysis, because as was demonstrated in the diagram of the solutions developed in other countries, the most likely, and most likely to be effective, outcome is some type of cooperative arrangement between public and private sectors.

Private funding

The likelihood of private investment being deployed to completely implement Yukon's broadband infrastructure approaches zero, at least in any reasonably acceptable timeframe. If and when private funding is made available, we know that it will not be universal but will focus on the best business case, leaving the remaining parts of the market dependent on public funding to enable comparable services.

As the incumbent provider Northwestel has now and will likely retain the position of the leading source of private infrastructure funding, therefore it will be important to consider the role and possible involvement of Northwestel in any project proposal. However, as experience has shown, Northwestel's first consideration in evaluating prospective investment will be return to its shareholder, rather than building broadband capacity for all Yukon users.[96]

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entity would include greater focus because of the sole priority, and the potential for increased flexibility in financing.

[96] Examples include Northwestel's ongoing reluctance to finish deployment of Call Management Services to all communities, even though SIP subsidy funds had been dedicated for that purpose; Northwestel's repeated insistence that the costs to upgrade equipment for implementation of local competition should be borne by competitors or customers, not by its shareholder. The CRTC specifically identified this concern in Decision 2011-771: "Since 2007, Northwestel has received over $20 million in annual subsidy for the provision of service in remote communities and its annual income from operations has nearly doubled to $69.3 million in 2010. Despite this, the company has failed to make necessary investments in its network."

However, the possibility of obtaining some level of funding from private investment should not be ruled out. There may well be instances of specific projects, such as completion of the fiber connection to Alaska, where other service providers might see an opportunity to extend their markets into Yukon, or where a Yukon business might exploit that connection to offer new or alternative services to users at home. The development of a prospectus that outlines the potential opportunities and the benefits of investing in the project could be an important step in evaluating and securing private funding.

Public funding

This does not attempt to offer and exhaustive list of specific public funding sources but rather looks at areas where funding might be a possibility, and at some of the considerations affecting the likelihood of the source.

One-off federal programs specific to building broadband infrastructure, like BRAND, are no longer available, so the option for federal funding support would be to seek to qualify under a non-telecom specific program. Opportunities to investigate might include: CanNor's Strategic Investments in Northern Economic Development (SINED); Transport Canada's Border and Gateways Fund (recognizing the points of interconnection with Alaska); or Infrastructure Canada programs, such as P3 Canada Fund, which will Round Five of funding in the spring of 2013.

In the federal arena, the agency charged with administering the Telecommunications Act, the CRTC, has made clear that it is not interested in adopting measures like incorporating broadband capability within the definition of basic service, explicitly citing the concern of subsidy funding.[97]

[97] In Telecom Decision 2004-64 the Commission determined that NCF funds could not be used to provide broadband service and noted that external funding "may still be available from other sources, such as Industry Canada"

Consequently, there is no ongoing federal program akin to those in Australia, or in the U.S. to address broadband connectivity, and unless Canada adopts a federal broadband policy which includes funding provisions, the responsibility for implementing broadband standards would seem to fall to the provinces, which has been the case in Alberta.

The question of whether Yukon might conceivably provide financing for broadband infrastructure along the lines of Alberta's SuperNet cannot be answered until a total cost estimate is developed, and the government funding options are considered. In the meantime, it may be possible to at least rule out some options. Funding alternatives involving a user tax are impractical due to the small population base—fees imposed at levels not so high as to deter take-up might take generations to recover the cost of infrastructure. Similarly, imposing a charge on service providers is not feasible because of the small economic base, and could also impede the policy goal of extending broadband service, as those charges would ultimately result in a pass through of costs to users.

Another avenue for funding support might be found through partnerships, perhaps with First Nations groups or agencies that would stand to benefit from the extension of broadband capacity to their communities.

Further work would be required to assess these options, and here again it would be very helpful to have in hand a prospectus that specified the costs, benefits and opportunities of the broadband infrastructure project.

5.4 Top 10 List of Things To Do

Combining the many technical and commercial issues that have been identified by stakeholders with the need for an overarching strategy for broadband deployment provides a tall order for telecom development in Yukon.

The challenge of addressing all of the issues while building towards a digital economy target that could be 30 Mbps universal service requires an overall plan and set of actions that will both "fix" what needs fixing while building for tomorrow.

With this dual objective in mind, the Report identifies a series of actions that together form a roadmap for telecom development in Yukon, and which would be intended to lead to "bankable" projects.

5.4.1 Yukon Telecom Prospectus

A starting point for this would be to develop a Yukon Telecom "Prospectus". This would address the "entire" investment model and identify anticipated economic benefits, with the starting point being a well-defined broadband speed objective (e.g. 30 Mbps universal service). Specific community capacity objectives including upload would serve to shape and define projects and priorities.

Part of this could also be to include Yukon Government as an "anchor tenant", in other words, looking to one-time investments to offset recurring expenditures made now on telecom services. By consolidating voice and data services, Yukon Government could reduce direct monthly expenditures on ICT services, allowing it to invest the difference into improving the infrastructure in partnership with Northwestel or others.

The Prospectus would provide a set of projects, including initial scoping, and actions that the Yukon Government would undertake to promote and implement the overall plan.

5.4.2 Next steps: Top 10 set of projects and actions

An initial set of projects and actions that could be considered and which stem from the analyses in this Report could be:

1. Set Community Speed and Capacity Objectives including Upload – Consistent with the Digital Economy context and the state of current infrastructure, which would set the specification and basic parameters going forward. As a strawman, an objective of 30 Mbps universal access and 100 Mbps to the largest communities should be "tested" for viability.

2. Yukon Government could act as enabler of a New "Utility" Backbone Project for Capacity and Diversity – either by acting as a promoter, by aggregating funding and/or by taking a direct stake in an initial project to build additional fiber links;

3. Yukon Government should actively monitor Infrastructure Projects – Mines, Roads, Electricity, etc. The objective would be to ensure that telecom needs are included in new projects – Backbone and Wireless Access. This could be done via maintaining oversight over developments or more directly as part of permitting or other administrative processes;[98]

4. Pricing of services is of global concern to Yukoners, whether it be regarding Internet "overage" charges for consumers or high-end high-priced MPLS services for businesses.

[98] Two examples of this: Proposal for a Railway from Fort MacMurray to Valdez, AK... it would clearly be advantageous to have a fiber along the line for connection to south and to Alaska. http://www.cbc.ca/news/canada/north/story/2012/11/20/north-yukon-railway.html. And Proposed Mining project: the feasibility study discusses infrastructure; in the overview material power and a road to the site, are mentioned but not telecom: http://www.selwynresources.com/en/news_index.cfm

At a socio-economic level, reduced prices and more reliable service would promote use of distance education, tele-health, etc. that in turn would contribute to greater wellbeing. There would also be increased participation in society as connectedness means people are less isolated and thus contribute to improving the economy overall. The Yukon Government does not regulate Northwestel and does not have a direct role to play other than to exercise its purchasing power as a large customer. On the other hand, the CRTC has been taking a proactive role in addressing concerns over backhaul pricing and with its renewed focus on consumer issues, could possible assist in addressing other pricing concerns in Yukon. In addition to the opportunity to increase involvement in CRTC proceedings affecting telecommunications development in the North, the Yukon Government should consider taking more active role in pursuing the development of a national broadband policy, through direct initiatives or through influencing federal policymakers;

5. Whether the Yukon Government takes a direct stake in projects or not, it should take a role in identifying and scoping new enabling projects, i.e. projects that are large enough in scope to have considerable direct impact as well as spin-off effects. The Yukon Government could lead the process to promote enabling initiatives and identify funding sources. One example with high economic value and spin-off effects could be development of a Yukon-based Data Centre (one with possibly outside investors that could also make use of it – i.e. an Amazon, Google, etc.). A project of this nature would require integration of a number of enabling elements, including in particular backhaul capacity, network reliability and electricity costs. Tackling this would be a major feat and one where the Yukon Government could have a role as promoter and possible investor (without doing things that arguably Northwestel should do on its own such as building capacity). Another could be to address the satellite earth station market. Enabling increased investment in Inuvik, NWT would have value to Yukon if there were a fiber route from Inuvik to Whitehorse. With this type of initiative one gets the direct benefits of the investment and related employment as well as spin-offs from improved services.

6. In addition to specific projects, the Yukon Government could promote development of new Local Access Facilities and Increased Use of Existing Wireless Licenses – Initiatives could be focused on opportunities for new parties to build local access (e.g. SSI Micro, Ice Wireless, or others) and/or on development of community-based initiatives;

7. Consider policies and initiatives that might pave the way for future competition. One such approach would be to facilitate Access for Third Parties to Government Tower and Power Assets;

8. Define policy and regulatory objectives and priorities specific to and focused on Digital Economy developments, and related to the projects and actions identified herein – broadband speed and capacity, "utility" backbone, infrastructure projects, community back-up, etc. This would complement the existing policy framework for participation in policy and regulatory matter to reinforce or shape positions in areas such as the subsidy system, Northwestel's modernization plan, spectrum licensing, and the overall regulatory framework for the North;

9. Develop a Community Back-up and Diversity Plan, identifying the economic and societal impacts, on a community-by-community basis, of losing connectivity, and evaluating possible solutions, which could be via terrestrial facilities or through use of pooled satellite capacity, the cost of which could possibly be offset by "public benefits" funding from Telesat; and,

10. Consistent with an overall plan to prepare human resources for full participation in the digital economy, implement a Community-level Approach for Services, Technical Training and Support.

The ensemble of these projects and actions provides a clear roadmap for telecom development in Yukon. As part of the development of the Yukon Telecom Prospectus, specific projects should be reviewed for initial viability and scoping, and an overall timeline put in place to meet the broad objectives. For example, the goal of 30 Mbps universal access with 100 Mbps in the largest communities could focus on a full implementation horizon by 2020. This could be harmonized with an overall Canadian digital economy objective, should one be developed.