Report for InternetNZ

Broadband Strategy Options for New Zealand

Stage one – research and analysis

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NETWORK STRATEGIES
• Telecommunications Strategy •

0 Executive summary

A future based on the status quo

Our review of current and pending broadband infrastructure and service offerings indicates that, in the absence of further public investment in broadband infrastructure, improvement in New Zealand infrastructure will be made only on a commercial basis. This will see enhanced services in the larger cities, and either lower-standard (or non-existent) services or high-cost services in other areas. We expect that rural and remote users will not see much improvement beyond the expensive satellite services that are available today.

The connection speeds that are currently available to the majority of the population are in general far below InternetNZ's stated target of 100Mbit/s for domestic users and 1Gbit/s for commercial users. There is no indication that in the short to medium term 'broadband' services in New Zealand will approach such speeds.

What can New Zealand expect in terms of broadband take-up over the short term? Market leaders in the OECD have seen huge growth, stimulated by the availability of high bandwidth services at a relatively low price – as an example, residents of the Swedish city Vasterås can currently obtain symmetric 100Mbit/s services from NZD49 per month, which compared with the DSL services Telecom New Zealand plans to deliver in four years' time still represents an enormous gap.

If the status quo is indeed based on a mix of 10Mbit/s and 20Mbit/s services to around 90% of New Zealand access lines, there is a distinct possibility that applications being developed for faster networks overseas may have limited relevance in New Zealand. It is

important to note that demand for bandwidth is still increasing in more developed markets, so is likely to increase in New Zealand for the foreseeable future.

In general, the history of the Internet has been one of innovation around network limitations but it is possible that the limitations in New Zealand's broadband status quo scenario will not be as severe in markets where Internet application innovation has traditionally been strongest. This scenario has a number of potential outcomes:

- New Zealand is economically disadvantaged as applications and application development concentrates on economies with excellent broadband infrastructure
- New Zealand manages to 'make do' with a lower level of broadband service which does not materially affect economically important applications
- New Zealand spearheads innovation on lower speed broadband applications which can be marketed to developing economies around the world.

Will current proposals save the day?

Both Labour and National have put forward proposals involving supporting open access networks but with considerable differences in detail, cost and scope (Exhibit 0.1). The New Zealand Institute (NZI) has another proposal which includes nationalisation of existing access infrastructure. The Labour Party proposal does not claim to achieve InternetNZ's desired 75% coverage of the population, while the National and NZI proposals do make this claim. Although the costs require further investigation, the assumptions of the proposal with the highest cost (NZI) cause us to doubt the accuracy of the estimate. We believe it to be an under-estimate of the true cost in attaining the desired level of coverage. As a consequence at this initial stage of our investigation we conclude that the financial proposals of the two major political parties would also not realise the InternetNZ target within ten years.

Telecom has committed NZD1.4 billion to deploying fibre to the node systems providing 10Mbit/s or better ADSL2+ access capability to virtually all lines in areas that it defines as Zones 1, 2 and 3 by 2012. While the planned FTTN network could be upgraded for higher speed broadband and wider coverage, options for this are likely to be very expensive.

	Proposal	*Total cost*	*Build time*	*Claimed coverage*
Labour Party	Broadband Infrastructure Fund	$340 million (plus at least $325 million of private sector funding)	5 years	–
National Party	FTTH	$2.5–3 billion	6 years	75% of population
NZI	FibreCo	$4–5 billion	10 years	75% of population
Telecom	FTTN	$1.4 billion	4 years	80% of population

Exhibit 0.1: *Summary of broadband proposals [Source: Government, National Party, NZI]*

Would any overseas models work?

From a review of overseas models for the development of broadband infrastructure it was clear that:

- incumbent operators tend to deploy high speed fibre broadband only when faced with effective infrastructure competition
- in a number of markets, infrastructure competition is not feasible, except possibly in certain highly populated areas
- open access to networks is seen to be crucial to ensure consumers obtain the benefits of competition in the absence of infrastructure competition
- some legal or regulatory intervention may be required to remove barriers to broadband expansion
- the choice of intervention model should be driven by factors specific to the local market, including (but not restricted to) the level of competition, the legal/regulatory environment and strength of local organisations
- local government is an important player in the establishment of broadband infrastructure, via active participation, as a provider of public funding, as anchor tenant, or as facilitator of comprehensive infrastructure planning across multiple utilities.

So, what models may be appropriate for New Zealand? Due to the lack of infrastructure competition for high bandwidth services, government must look to an infrastructure provider or wholesale provider model, rather than a vertically integrated provider. In terms

of a business model, we consider that those with the greatest chance of success would be public-private partnerships and utility business expansions. There is also clear evidence that demand-side initiatives (demand aggregation and stimulation) may have an important role in achieving desired take-up and ongoing viability of the venture, and thus should not be neglected when developing broadband strategies.

Broadband Strategy Options for New Zealand

Report for InternetNZ

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NETWORK STRATEGIES

1 Introduction

This report represents the first stage of a study for InternetNZ on the options for broadband strategy in New Zealand. The objective of the study is to detail available options for a New Zealand Broadband Infrastructure (NZBI) that are consistent with InternetNZ's six key principles with respect to broadband strategy:

- The NZBI must be structured in such a way to ensure service providers can fairly compete to deliver services to end-users.

- The NZBI must be funded in such a manner that providers can offer affordable services to the majority in each end-user category (e.g. families, businesses, schools etc). For the purposes of the strategy, the 'majority' should be considered to be a target figure of 75%.

- The strategy must enable NZBI to be rolled-out to the majority of end-users within a timeframe that enables New Zealand to be a leader rather than a follower within this area of technology.

- The bandwidth available and affordable to the majority of end-users should be unconstrained for the current and foreseeable future. Current thinking is this would mean 100Mbit/s for domestic users and 1Gbit/s for commercial users.

- The development of the strategy should not be constrained by existing or proposed political policies, although pragmatically it is recognised that politics will affect its acceptability to the government of the day.

- The NZBI should avoid excessive duplication to ensure efficient usage of installed infrastructure and to maximise the infrastructure spread achievable from the funding available.

The project is divided into two stages, the first stage being used to define the scope of the second.

Stage one

The purpose of stage one is, primarily through desk research, to assess the information available and use this to define the scope for stage two. Specifically, there are two parts:

- Literature review, including: existing models used by overseas jurisdictions to assist with the planning of broadband network rollout, and the policies and proposals published by various government departments, political parties and operators.

- Based on the literature review and other information available, determine the scope for stage two – that is, the level of detail of the analysis of the NZBI and the various options.

Stage two

Stage two involves the delivery of the main report. The scope of the report will depend on the outcome of stage one, but ideally will range from a summary of the current state of broadband in New Zealand and what a 'status quo' future scenario might look like, through to a business model that outlines how the NZBI might operate, including an outline of its costs, the services provided, funding options, possible road-maps for its deployment, and a discussion of the roles of the different stakeholders.

The main focus in Stage one has been the desktop review of a vast amount of literature within a relatively short space of time. This did not afford us the opportunity to undertake any discussions with third parties, either to obtain further information about current proposals or initiatives or to raise key issues with relevant stakeholders. It is anticipated that there will be more opportunity for stakeholder consultation during stage two of the work.

Following the current Introduction, Section 2 contains an assessment of the current situation in New Zealand, Section 3 discusses existing models for public sector intervention, Section 4 reviews current proposals for extending broadband infrastructure, and Section 5 presents a survey of overseas experience. Details of current national and regional broadband services are provided in the Annex.

2 Situation assessment

Our starting point is an assessment of the current and developing situation with respect to broadband in New Zealand. This represents a 'base case' for the NZBI (that is, what we would expect to eventuate, absent the NZBI). In this section we:

- review the current broadband situation in New Zealand, including a summary of the operators offering broadband services, the technologies used in the networks, and the broadband services being offered.

- make a preliminary assessment of the situation in the near future assuming funding and incentives to invest in broadband remain at the current level.

The results of our situation assessment will be evaluated in the light of InternetNZ's stated overarching principles: affordable services to the majority (75%) in end-user categories in a 'leader' timeframe as opposed to a 'follower' timeframe, with 100Mbit/s speeds to domestic users and 1Gbit/s to commercial users.

2.1 Broadband in New Zealand

2.1.1 Background

From 2004 the OECD has published a bi-annual list ranking its member countries in order of broadband uptake. New Zealand has historically ranked fairly low in this table, being in the bottom third of the OECD countries. The most recent listing, based on December 2007 data, is illustrated in Exhibit 2.1, and is the first time that New Zealand has moved out of

the bottom third, advancing from twenty-first place out of 30 in April 2007, to nineteenth place. This ranking is still lower than is desirable, however, and the government is aiming for New Zealand to reach the top half of the OECD rankings by 2010.

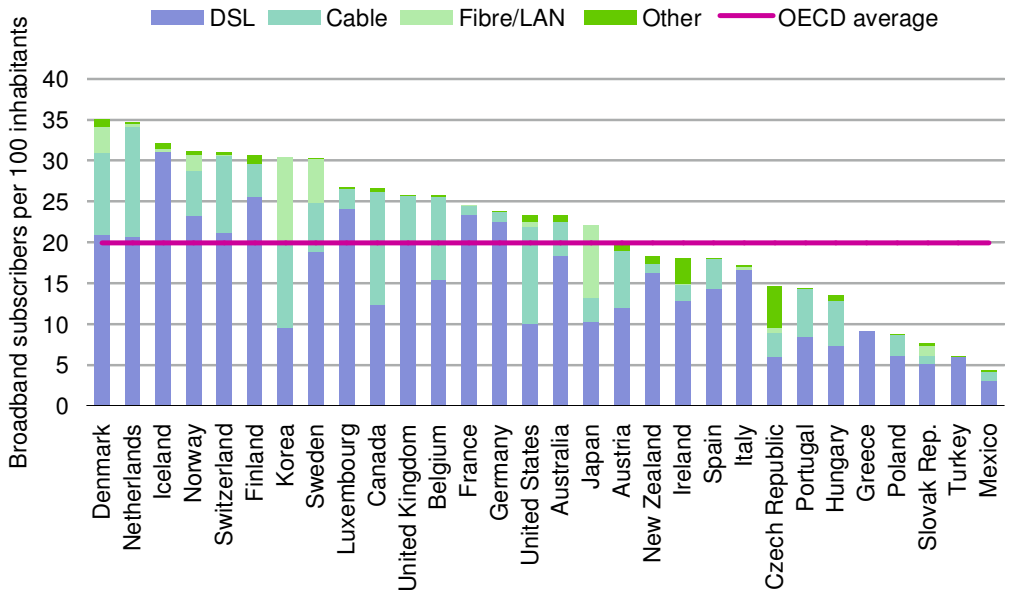

Exhibit 2.1: *Broadband penetration for December 2007 [Source: OECD]*

However, while there has been strong growth in broadband services, there has actually been very little increase in the overall New Zealand Internet market (Exhibit 2.2 – note that broadband services are described as 'non-analog'), which exhibited growth of just 1.6% in the six months to March 2008. Broadband growth is largely being driven by dial-up users moving to the superior service rather than take-up by new users. Prices for high bandwidth services (that is, more than 2Mbit/s) are high and most price plans have data caps – both are significant barriers for the rich multimedia applications that could be expected to appeal to potential users who have not yet taken up Internet services. Note that affordability will become an increasing concern in an environment undergoing an economic downturn.

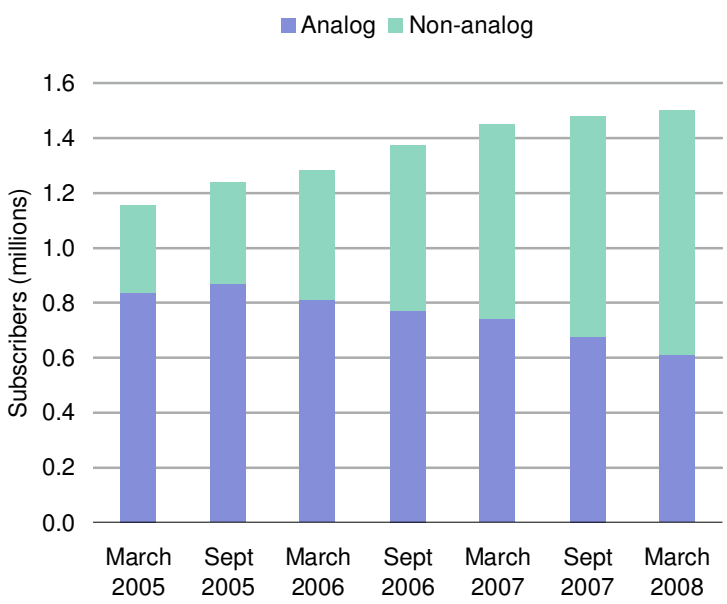

Exhibit 2.2:
Internet services in New Zealand, March 2005 to March 2008 [Source: Statistics New Zealand]

In a recent study[1] of broadband quality, New Zealand's ranking was found to be 35 out of 42 countries (Exhibit 2.3). The 'Broadband Quality Score' (BQS) was determined from download and upload throughput, and latency, measured from millions of records obtained through actual network speed tests. The study evaluated that the minimum threshold for today's applications would require a download speed of 3.75Mbit/s, upload 1Mbit/s and latency 95ms – and that New Zealand fell well below this threshold.

1 Oxford University and Universidad de Oviedo (2008) *Broadband Quality Score: a global study of broadband quality*, September 2008. Study sponsored by Cisco.

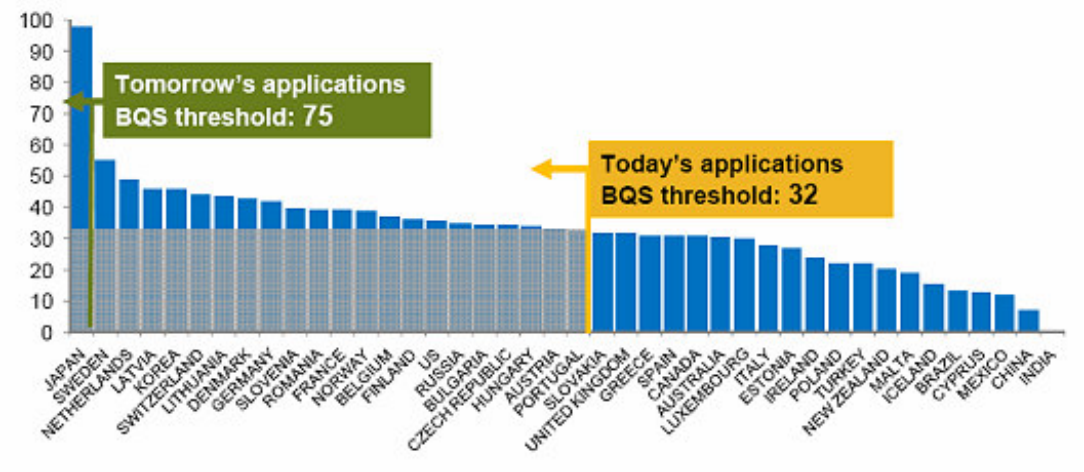

Exhibit 2.3: *Broadband Quality Score by country, August 2008 [Source: Speed Test database, expert interviews, BQS Team Analysis]*

Furthermore, this study viewed broadband leaders as being both 'penetration leaders' as well as 'quality leaders' – while New Zealand is seen as a short way behind the leaders in terms of penetration, it is far behind in terms of quality.

The New Zealand government launched the Digital Strategy initiative in 2005, a five year plan seeking to maximise the economic and social opportunities offered by ICTs. Included in the Digital Strategy is the Broadband Challenge, which aims to accelerate the provision of affordable broadband services to regional centres and previously unconnected areas and provides $24 million of partnership funding.

In 2006 the government undertook a telecommunications stocktake to consider developments in the telecommunications sector as a whole over a three to five year time period, with a particular emphasis on broadband. It was decided that new policies were required to close the gap between New Zealand and the higher-performing OECD countries. In particular, it was identified that there was a lack of competition in key market segments. The outcomes of the telecommunications stocktake included the following decisions:

- introduce local loop unbundling, to remove the current access bottleneck that is restricting competition

- remove constraints on the regulated Unbundled Bitstream Service, including providing for Naked DSL
- Telecom must prepare a set of regulatory accounts based around its wholesale business (accounting separation)
- the preparation and disclosure by access providers of information to facilitate compliance with the applicable access principles set out in Schedule 1 of the Telecommunications Act 2001.[2]

Since the telecommunications stocktake the unbundling of the local loop has progressed, with Telecom opening the first of its exchanges in August 2007. Further, Telecom was required to split its operations into three separate business units: access, wholesale and retail, with a separation date of 31 March 2008. Part of the separation agreement included a commitment by Telecom to roll out a $1.4 billion next-generation high-speed broadband network by 2012, providing speeds of more than 10Mbit/s to 84% of lines.

2.1.2 Current Government commitments and initiatives

Broadband Challenge Fund	The Broadband Challenge Fund, part of the Digital Strategy (five-year ICT action plan),[3] is a fund of $24 million to be used to establish 15 urban fibre networks and improve broadband access to rural communities. In the first round of applications in late 2006, $17.9 million was awarded.[4]
Broadband Investment Fund	In the May 2008 Budget, the Government announced the Broadband Investment Fund, consisting of $340 million to be made available over five years,[5] plus further funding of $170 million for connectivity in the health, education and government sectors. The

2 New Zealand Government (2006), *Government moves fast to improve Broadband*, http://www.beehive.govt.nz/node/25636m, May 2006.

3 http://www.digitalstrategy.govt.nz/

4 http://www.digitalstrategy.govt.nz/Funding/The-Broadband-Challenge/Broadband-Challenge-Update-Dec-06/

5 http://www.med.govt.nz/templates/ContentTopicSummary____35731.aspx

Broadband Investment Fund is made up of $250 million (operating) for high speed connections for businesses and key public users in urban areas (the 'urban fund'), $75 million (operating) to extend the reach of broadband in underserved areas (the 'rural fund'), and $15 million (capital) to improve New Zealand's international connectivity.

TSO review

The Government is currently reviewing the TSO (telecommunications service obligation). One of the aspects being examined is whether or not there should be a broadband TSO.[6] This would place more responsibility for funding on industry.

Digital Strategy 2.0

The Digital Strategy (2005) is a government-owned strategy that sets out to maximise the opportunities brought about by developments in ICT. Digital Strategy 2.0 updates this to take into account changes since 2005, particularly with the Telecommunications Amendment Act 2006. The Draft Digital Strategy 2.0 was released in April 2008; submissions on this document closed in May. The final version was released in August 2008.

The Digital Strategy 2.0 encompasses funds such as the Broadband Investment Fund.

2.1.3 Independent initiatives

Broadband Investment Forum

An independent group of senior representatives from industry whose purpose is to try to solve the issues surrounding broadband and to 'accelerate the deployment of advanced broadband infrastructure'.[7]

6 http://www.med.govt.nz/templates/StandardSummary____296.aspx

7 http://www.med.govt.nz/templates/MultipageDocumentTOC____34020.aspx

Digital Development Forum/Digital Development Council	The forum is an independent group from the wider digital community. Its purpose is to "provide an independent stream of advice to and dialogue with the government on the development and implementation of the Digital Strategy and related digital policy initiatives" and "facilitate the sharing of knowledge and learnings".[8] The Council's members are elected by the forum and its purpose is to engage with the Digital Development Forum on strategic priorities and to seek funding to develop, adopt, implement and manage a work programme that addresses issues and priorities determined by the Forum.[9]

2.1.4 Summary of current broadband offerings and coverage

A review of current national and regional broadband offerings in New Zealand uncovers examples of many different ownership structures, including:

- commercial (for example, Telecom, TelstraClear, Vodafone, Woosh, CityLink)
- public-private partnerships (for example, NEAL, Smartlinx3, The Loop)
- utilities seeking to extend their businesses (for example, Northpower, Vector, Counties Power, Network Tasman)
- co-operatives (for example, Velocity).

Information about the nature, availability and pricing of offerings of the above examples, together with additional examples, is provided in Annex A.

It is clear that the majority of the offerings are commercially driven. As would be expected these offerings tend to be focussed on the larger population centres, while the public-private partnerships are driven by the desire to address specific regional requirements and interests in less commercially attractive areas. As regards the rural and remote segment of

8 http://www.ddc.org.nz/digital_development_forum.php

9 http://www.ddc.org.nz/digital_development_council.php

the population, there are some satellite services available (for example, Farmside and Bordernet) but these are relatively expensive.

Exhibit 2.4 shows the geographical extent of various technological solutions for differing levels of broadband service in New Zealand. It should be noted that the DSL coverage listed in the table is based on Telecom New Zealand's view of what is possible with the cabinetisation process as stated in Telecom press releases.

Region	*DSL (% of residents and businesses with broadband coverage)*	*Fibre broadband available*	*Fixed wireless broadband available*	*Satellite broadband available*
National				✓
Northland	91	✓	✓	
Auckland	96	✓	✓	
Waikato	87	✓	✓	
Bay of Plenty	88		✓	
Hawke's Bay	91		✓	
Gisbourne	91		✓	
Taranaki	88		✓	
Wanganui	89		✓	
Manawatu	89	✓	✓	
Wairarapa	91		✓	
Wellington	98	✓	✓	
Tasman-Marlborough	91	✓	✓	
West Coast	93		✓	
Canterbury	93	✓	✓	
Otago	94		✓	
Southland	85		✓	

Exhibit 2.4: *Regions potentially covered by various broadband technologies [Source: Telecom New Zealand, other operators and service providers]*

The only offerings that claim to achieve speeds approaching the InternetNZ targets use fibre technology – for example, CityLink, Counties Power, KAREN, Northpower, Smartlinx 3 and The Loop. However in most of these cases while InternetNZ's broadband

speed goal may be achievable, its equally important goals of affordable and unconstrained services are not met, irrespective of the nature of ownership of the service provider.

One example is the commercial venture CityLink, which has open access fibre optic networks offering services to businesses in the Auckland, Wellington and Christchurch CBDs. Internet access is obtained through one of the ISPs that are connected to CityLink's network. Dedicated fibre links between two locations, and private connections between multiple business LANs are also available. Connections are offered at speeds of 4Mbit/s, 10Mbit/s, 100Mbit/s or 1Gbit/s. The 100Mbit/s service has a 20GB per month data cap, at a cost of $499 and a $295 CityLink monthly connection fee.

Another comparative example is from a community-based co-operative venture, Smartlinx 3. This venture has an open access fibre based broadband network for Porirua and the Hutt Valley and offers data plans for fibre connection that range from 10Mbit/s, with a 5GB data cap for $498 per month to 1Gbit/s with a 15GB data cap for $1898 per month.

2.2 What are our bandwidth requirements?

It should be recognised that the pressure on bandwidth is not simply from broadband Internet services, although certainly higher bandwidths are being demanded by customers requiring high data rates for telecommuting, games and transmission of multimedia (audio and video) files. In addition, there is an increasing move to use the network to supply 'triple-play' services – voice, Internet and video. Via IPTV, telecoms operators can compete with cable operators who have extended their service offerings to include Internet and telephony.

The most pressure on bandwidth over the next few years will be coming from digital video. High-definition TV is becoming more popular. In 2007 the International Cablemakers Federation (ICF) estimated[10] that the **near-term** requirement for all-digital triple-play will be 16Mbit/s to 48Mbit/s (Exhibit 2.5). We cannot assume that the household bandwidth requirements will be driven simply by a single application. There is potential demand for

10 International Cablemakers Federation (2007) "How much bandwidth?" in *ICF News*, issue 59, September 2007.

more than one simultaneous HDTV signal. There may be multiple HDTV sets within a household, or users may wish to watch one HDTV programme while recording another (which could be either HD or SD). At the same time, household members may also be on the phone, or surfing the Internet.

	Bandwidth		*Bandwidth*
Video services with MPEG-2 compression			
Internet (average user)	5Mbit/s	Internet (high user)	10Mbit/s
Telephony	0.1Mbit/s	Telephony	0.1Mbit/s
2 SDTV channels	6Mbit/s	2 SDTV channels	6Mbit/s
1 HDTV channel	16Mbit/s	2 HDTV channels	32Mbit/s
Total	*27.1Mbit/s*	*Total*	*48.1Mbit/s*
Video services with MPEG-4 compression			
Internet (average user)	5Mbit/s	Internet (high user)	10Mbit/s
Telephony	0.1Mbit/s	Telephony	0.1Mbit/s
2 SDTV channels	3Mbit/s	2 SDTV channels	3Mbit/s
1 HDTV channel	8Mbit/s	2 HDTV channels	16Mbit/s
Total	*16.1Mbit/s*	*Total*	*29.1Mbit/s*

Exhibit 2.5: *Downstream bit rates for all-digital triple play scenarios [Source: ITU, CRU]*

Application	*Range*	*Typical*
SDTV with MPEG-2	2–5Mbit/s	3Mbit/s
SDTV with MPEG-4	1.5–2Mbit/s	1.5Mbit/s
HDTV with MPEG-2	15–20Mbit/s	16Mbit/s
HDTV with MPEG-4	5–10Mbit/s	8Mbit/s

Exhibit 2.6: *Digital TV, bit rates per channel [Source: ITU, CRU]*

There will also be an increasing demand for upstream bandwidth. Applications such as interactive online games, high quality video-conferencing and large file transfers will require significant upstream bandwidth. Another example of an application requiring upstream bandwidth is video security applications that use the Internet to transmit video images from multiple on-site security cameras.

What about in the longer term? One industry analyst suggests that much greater bandwidth will be required than the 50Mbit/s downstream and 10Mbit/s upstream currently viewed as

appropriate for the high-end user. This analysis assumes that consumers' desired time to download media is proportional to their cost to store it:[11]

> In 2000, an affluent household with bandwidth of about 1 Mbps, could download an 8-song MP3 album (25 megabytes) in about 2 minutes, to a hard disk costing about [USD]10 per gigabyte.
>
> Today, storage costs 25 cents [US] per gigabyte (40 times less than in 2000), so it's not surprising that download speeds of 40 Mbps are already desired by affluent households.
>
> By 2015, storage will cost a penny per gigabyte. (It's hard to believe, but a [USD]100 computer-based hard disk will hold 10 terabytes, enough for more than 3 million MP3s or 400 Blu-Ray disc-quality movies.) A 25 gigabyte movie will cost the same to store on a hard disk as a 25 megabyte 8-song album did in 2000.
>
> By 2015, you'd want to be able to download that 25 gigabyte movie in about 2 minutes, implying bandwidth of 1 Gbps. Add live HD video streams and uploads, and the desired household bandwidth is even higher.

2.3 Status quo forecast

Our review of current and pending infrastructure and service offerings indicates that, in the absence of further public investment in broadband infrastructure, improvement in infrastructure will be made only on a commercial basis. This will see enhanced services in the larger cities, and either lower-standard (or non-existent) services or high cost services in other areas. We expect that rural and remote users will not see much improvement beyond the expensive satellite services that are available today.

The connection speeds that are currently available to the majority of the population are in general far below InternetNZ's stated target of 100Mbit/s for domestic users and 1Gbit/s for commercial users. There is no indication that in the short to medium term 'broadband' services in New Zealand will approach such speeds.

11 Hurd, J. (2008) "Bandwidth: how much is enough?" in *Telephony Online*, 1 July 2008.

While Telecom New Zealand is promising faster speeds within the next five years, these fall well short of the InternetNZ targets. Telecom stated in March 2006 that 20% of households have broadband[12] with a fastest DSL offering of 2Mbit/s for residential, with an upgrade to 3.5Mbit/s due in April 2006. In December 2007 Dr Paul Reynolds of Telecom stated that 'fixed line broadband [was] now available to some 93% of New Zealanders'.[13] In relation to its operational separation undertakings Dr Reynolds indicated that faster speeds would become more widely available over a four-year time horizon as cabinetisation proceeds.

> As a central part of these Undertakings Telecom has already committed to the accelerated rollout of fast broadband that will deliver next generation speeds and services to all towns and cities with more than 500 lines.
>
> Ninety-nine percent of these lines will be capable of supporting speeds of up to 10Mbps, while around 50% will be capable of up to 20Mbps.[14]

What can New Zealand expect in terms of broadband take-up over the short term? Market leaders in the OECD have seen huge growth, stimulated by the availability of high bandwidth services at a relatively low price – as an example, residents of the Swedish city Vasterås can currently obtain symmetric 100Mbit/s services from NZD49 per month (see Section 5.13), which compared with the type of services Telecom plans to deliver in four years' time still represents an enormous gap.

If the New Zealand market progressed along a similar path to the OECD market leaders, we expect take-up to be approaching 35 broadband subscriptions per 100 persons by 2010 (Exhibit 2.7). However if the New Zealand market continues with the status quo situation – with prices only gradually decreasing, data caps constraining usage of high bandwidth applications, and limited availability of affordable high bandwidth plans – potential take-up by 2010 is likely to be no more than 25 broadband subscriptions per 100 persons – with a strong risk that any economic downturn may place additional constraints on take-up.

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12 Telecom letter to shareholders, dated 3 March 2006.

13 Telecom New Zealand press release, *Telecom re-iterates commitment to world-class broadband deployment*, 19 December 2007.

14 *Ibid.*

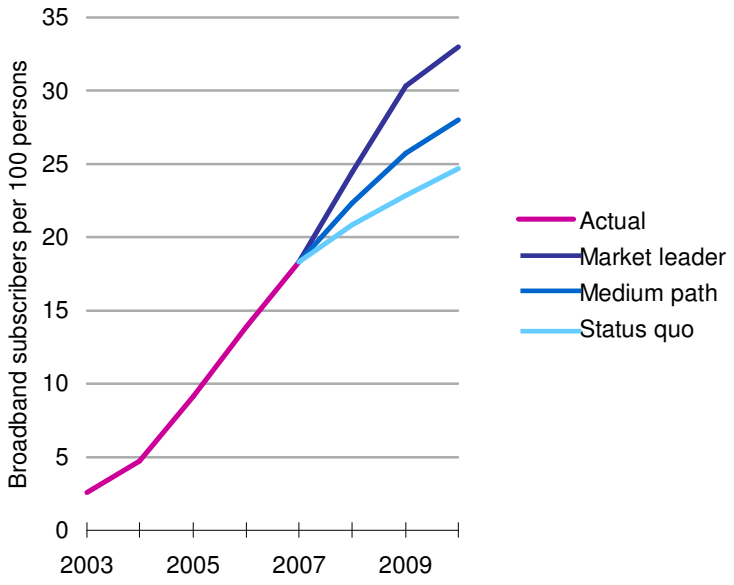

Exhibit 2.7: *Projected broadband take-up under three scenarios [Source: Network Strategies]*

If the status quo is indeed based on a mix of 10Mbit/s and 20Mbit/s services to around 90% of New Zealand access lines, there is a distinct possibility that applications being developed for faster networks overseas may have limited relevance in New Zealand. It is important to note that demand for bandwidth is still increasing in more developed markets, so is likely to increase in New Zealand for the foreseeable future.

In general, the history of the Internet has been one of innovation around network limitations but it is possible that the limitations in New Zealand's broadband status quo scenario will not be as severe in markets where Internet application innovation has traditionally been strongest. This scenario has a number of potential outcomes:

- New Zealand is economically disadvantaged as applications and application development concentrates on economies with excellent broadband infrastructure
- New Zealand manages to 'make do' with a lower level of broadband service which does not materially affect economically important applications
- New Zealand spearheads innovation on lower speed broadband applications which can be marketed to developing economies around the world.

3 Models for public sector intervention

In the United Kingdom, the Broadband Stakeholder Group (BSG) identified a number of different public section intervention models for broadband:[15]

- demand-side interventions
  - demand aggregation
  - demand stimulation
- supply-side interventions
  - procurement of a defined service
  - public-private partnerships
  - utility business expansion
  - co-operatives
  - working with property developers.

Note that the models are not mutually exclusive – it is not uncommon for demand-side interventions to be implemented in conjunction with a supply-side intervention, and for a number of differing models be implemented within a country.

Demand aggregation

Demand aggregation schemes seek to encourage user interest in order to achieve a level of demand that will reach a commercially viable threshold. This can be done by combining demand from several neighbouring areas (for example Verkko-osuuskunta Kuuskaista in Finland).

15 Broadband Stakeholder Group (2008) *Models for efficient and effective public-sector interventions in next-generation broadband access networks*, 9 June 2008.

Demand stimulation	Initiatives that encourage broadband usage are frequently employed to increase service take-up. This may take the form of an initial fee 'holiday' or discount, such as that implemented in its first year by the Dutch OnsNet network, or via the provision of content and other services as done by the Swedish network MälarNetCity.
Procurement of a defined service	Under this model, the public sector procures a service from a service provider, with the ownership of any assets being retained by the service provider. This model can be used to address distributional policy objectives.
Public-private partnerships	There are a number of different public-private partnership models (described in Section 4.2), with varying levels of participation and ownership by each partner. In general, it tends to be used when the public sector wishes to retain ownership of the asset. BSG notes that by retaining public ownership of a network, the public sector can change its service-delivery partner by re-tendering the contract, for example to replace an under-performing private-sector partner.
Utility business expansion	In a number of European countries – such as Denmark and Sweden – utility companies have expanded into broadband service provision to increase revenue streams and reduce deployment costs. In these countries, utilities are typically regional operators and have suitable ducts for deployment of broadband infrastructure.
Co-operatives	There are a number of instances of a local co-operative business model, such as Verkko-osuuskunta Kuuskaista (Finland) and OnsNet (the Netherlands). In this model, members pay a joining fee in addition to service subscription fees. Co-operatives are often small-scale, and thus may be subject to the higher risk of failure that can be associated with smaller operations. The BSG suggested that this risk can be reduced if there is a national co-ordinator for co-operatives.

Working with property developers	Costs may be significantly reduced when deployment is undertaken together with other civil works. Minimal investment is generally required from the public sector. Examples include Akelius Fastigheter and SABO in Sweden, and the Ebbsfleet Valley development in the United Kingdom.

3.1 Critical success factors

As we have seen, many different intervention models have been trialled, but which is the 'best'?

Clearly, the choice of the optimal model would depend on the characteristics of the market in which it is applied, as well as the overarching objectives of government and policy makers. BSG identified a number of critical success factors for "efficient and effective" intervention models:[16]

- not pre-empting the market unless there are good grounds to do so
- using the open-access network model
- designing to minimise barriers to adoption
- stimulating and aggregating demand
- anticipating risks via detailed planning
- compliance with state aid rules, and support via other legal frameworks.

BSG characterises an "efficient and effective" model as one which:

- defines clear goals in advance, with minimal political influence in network design
- invests the minimal amount required to achieve its goals
- limits market distortion
- provides competitive services to end users
- is delivered in a timely manner
- involves parties that are stable financially.

16 *Ibid.*

These principles are compatible with InternetNZ's six key principles (See Section 1).

It is also important to note the overarching objectives of regulators seeking to facilitate the growth of a market that can achieve the societal aims of a liberalised market. These typically include:

- technology neutral approach
- encouraging efficient investment
- promoting competition.

3.2 Value chain models

In a review of various broadband service options for the Hellenic Ministry of Transport and Communications,[17] it was found that the service model choice is driven by the competitive environment and the legal-regulatory framework:

- a vertically integrated provider ('end-to-end') model (incorporating the passive network, the active network and retailing to the end-user) can be a viable option if alternative network suppliers have high market share in FTTx target areas
- otherwise 'open-access network models' – via an information provider/communication provider model or a wholesale provider model – are the preferred solution (Exhibit 3.1).

17 ATKearney (2008) *Developing the Hellenic Ministry of Transport and Communications 5-year broadband strategy for Greece: preliminary results on development of strategy for Electronic Communications Industry in Greece*, May 2008.

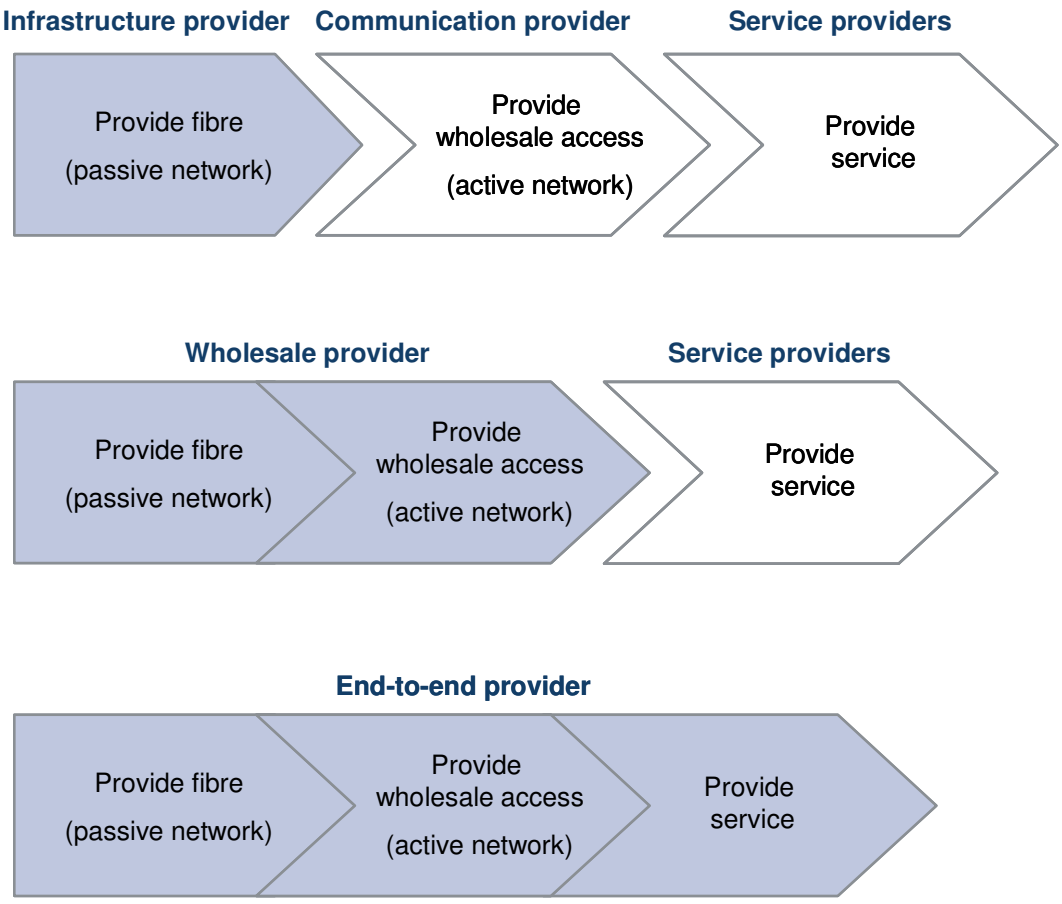

Exhibit 3.1: *Service model value chain [Source: ATKearney]*

There are many examples for these various models of the value chain from other jurisdictions, including:

- **infrastructure provider** – Singapore's proposal National Broadband Network
- **wholesale provider** – Gratel (Slovakia), MälarNetCity (Sweden)
- **end-to-end provider** – TDC (Denmark), Telekom Slovenije (Slovakia).

4 Review of current proposals

A number of broadband proposals have been proposed recently, including the New Zealand Institute FibreCo proposal and the policies of the two main political parties. In this section we review and assess the technical, practical and economic feasibility of the proposals.

4.1 Labour Party

Overview

Labour announced more than $1 billion to be spent over 10 years, focussing on high speed connections for high speed users.[18] Around half of this amount (for the first five years) was announced in the May 2008 budget (Exhibit 4.1), which includes:

- the Broadband Investment Fund (BIF), consisting of $340 million to be made available over five years,[19] comprising the Urban Fund ($250 million in operating funding for high speed connections for businesses and key public users in urban areas), the Rural Fund ($75 million in operating funding to extend the reach of broadband in underserved areas) and $15 million in capital funding to improve New Zealand's international connectivity via the deployment of a new trans-Tasman cable

18 Cunliffe, D. (2008) Fast forward to the future, speech to the 9th Annual Telecommunications and ICT Summit, 23 June 2008. Available at http://www.labour.org.nz/portfolios/communications_and_information_technology/speeches/23062008_fast_forward_to_the_future__david_cunliffe.html

19 Ministry of Economic Development (2008) *New Zealand's Digital Pathway: A Fast Broadband Future, Broadband Investment Fund: Draft Criteria and Proposed Process for Consultation.*

- further funding of $160 million for connectivity in the health, education and government sectors – policy mechanisms will be announced later this year.

Component	*Item*	*Estimated spend ($ millions)*
New funding for Budget 2008	Accelerating Broadband Investment (operating)	325.0
	Accelerating Broadband Investment (capital)	15.0
New Budget for Other Digital Strategy initiatives	Community Partnership Fund	6.0
	Digital Strategy Refresh Implementation	0.5
Existing Public Sector Connectivity Spend	Health Connectivity Spending	60.0
	Education Connectivity Spending	45.5
	REANNZ	7.8
	GSN	50.0
Digital Strategy Refresh New Initiatives	Digital Development Council	2.9
	Implementation of Telecommunications Framework (Including Commerce Commission Enforcement)	22.7
	Nextspace graphics cluster	4.0
	Delivering Digital NZ	4.2
	Aotearoa People's Network	5.8
	Anti-Spam Regulation	4.5
Total		553.8

Exhibit 4.1: *Five year broadband expenditure details [Source: Budget 2008]*

Funding from the BIF will be allocated to projects that meet the programme's criteria, and it is anticipated that any legal entity (including network operators, local authorities and community organisations) will be able to apply. Aggregation of applications will be permitted, however no more than 30% of the total funding will be spent in any single year.

Urban Fund

Seed funding will be provided as operating grants to projects that address government objectives and meet the required criteria. In particular, a minimum co-investment of an amount equal to the funding is required, with higher levels of investment preferred.

The priority in urban areas is to encourage the delivery of high bandwidth services to businesses and key public users – such as health organisations, tertiary organisations, schools and other public

and municipal entities – in a way that supports competition and future investment in high bandwidth technology to the home.

The government has determined that the most appropriate way to support these objectives is to provide seed funding for the deployment of open-access passive infrastructure (ducting and dark fibre) in urban centres and surrounding suburbs. Funding recipients must provide (at a minimum) wholesale access to the passive infrastructure for any third parties. Entities may also provide services to end-users, however the selection criteria are intended to prevent the emergence of vertically integrated monopolies.

Rural Fund

The priority for rural areas is to extend the reach of broadband into underserved regions, and so the focus of the Rural Fund will be to deploy broadband to communities, businesses and users in the health, education and government sectors. The chosen mechanism is a contestable and technology neutral process with sufficient flexibility to support the deployment of backhaul links, broadband access for the 'last mile' and pull-demand initiatives (for the health and education sectors).

Eligible areas will have no existing or planned terrestrial broadband (with minimum of 1Mbit/s). An interim network design objective of 5Mbit/s/1Mbit/s is being considered for terrestrially-based rural broadband projects – whereby projects should achieve 'high' coverage of 1Mbit/s and 'significant' 5Mbit/s coverage.

Key issues

The Broadband Infrastructure Fund appears to have no published objectives in terms of overall coverage targets. This may affect the ability to assess the success (or otherwise) of the programme. The nature of the programme appears to encourage smaller regional players, rather than a single provider with a nationally consistent approach – we stress that this should not be viewed as a negative comment, as the Nordic market, where there has

been considerable investment in fibre, is characterised by a large number of regional or municipal players (see, for example, Section 5.13). However, there is a risk that some regions may miss out on projects that meet the assessment criteria, which could result in an increasing digital divide for any areas left behind.

It should also be noted that the programme does not directly fund FTTH projects, however applicants must demonstrate the potential of the infrastructure to be extended to provide fibre to the home in the long term. The funded projects should enable the lowering of costs for subsequent FTTH deployment – whether this cost reduction will be sufficient to enable viable business ventures for FTTH to 75% of New Zealanders is uncertain.

This proposal offers the most funding that specifically addresses rural areas rather than focussing on the 75% of the population living in the largest urban areas.

We note that bandwidth objectives for urban projects have not been specified (although interim bandwidth requirements for terrestrially-based rural projects are being considered).

Considerable effort has been undertaken in development of the draft application process, including the evaluation criteria and in particular the assessment of project viability.

4.2 National Party

Overview

National's policy is to spend up to $1.5 billion of public money over six years funding an open-access FTTH (fibre to the home) network that will reach 75% of the population.[20] This figure includes the country's 22 largest cities and towns, down to the size of Blenheim.[21]

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20 National Party (2008) *Better broadband for New* Zealand, 2008 Policy Summary. Available at http://www.national.org.nz.

21 Estimated population 29 400 as at 30 June 2007 (Statistics New Zealand).

A key feature is that the roll-out will be rapid, with 'business premises, schools, health facilities and the first tranche of homes' reached within six years. This investment will be subject to five key principles:[22]

- the investment does not 'line the pockets of' or give undue advantage to existing broadband network providers
- open-access
- avoids excessive duplication of the network
- providing affordable 'worldclass' broadband services to 'everyday Kiwis'
- the public-private partnership remains focused on New Zealand's economic future and not the legacy assets of the economic past.

National expects that the private sector will contribute a further $1–1.5 billion to meet the total cost of the network.[23]

National will also double the Broadband Challenge Fund to $48 million, to be used in rural areas. It is envisioned that services to rural areas will be a mixture of fibre, satellite and wireless technologies.

Key issues

The National Party proposal does not contain detailed information. While the venture is stated to be a public-private partnership (PPP), it is unclear as to the precise ownership model of the network, and the responsibilities of each partner. There are many variations of PPPs for infrastructure projects, including:

- **traditional design and construction**, whereby the public sector commissions the private sector to build the facility under a contract, typically for a fixed price
- **operation and maintenance contract**, where the private sector operates a publicly-owned facility under contract to the public sector

22 National Party (2008) *Better broadband for New Zealand*, 16 July 2008. Available at http://www.national.org.nz.

23 http://businessday.co.nz/blogs/bottomline/2008/06/23/williamson-v-cunliffe-at-the-hyatt-ballroom/

- **lease – develop – operate** (LDO), where the private sector is awarded a long-term lease to operate – and possibly to expand – a facility
- **build – own – maintain** (BOM), where the private sector constructs, owns and maintains the facility, while the public sector leases and operates the facility
- **build – own – operate – transfer** (BOOT), where the private sector finances, constructs, owns and operates the facility for a specified timeframe after which ownership reverts to the public sector
- **build – own – operate** (BOO), similar to the BOOT model but the private sector owns the facility in perpetuity.

Given such a large commitment of public funds, National's policy should identify exactly what type of investment is being proposed. Furthermore, the policy does not define what bandwidth end-users can expect from the 'ultra-fast broadband' network.

We note that the population of urban areas down to the size of Blenheim falls slightly short of the National's claim of 75% of the population. Based on Statistics New Zealand most recent estimates[24] of population by urban areas the total actually comes to 72.9% of the New Zealand population.

The costs of FTTH are dependent on expected take-up. This affects where certain devices are placed in the network and the amount of fibre installed. The costs are also highly dependent on re-use of existing infrastructure (particularly main cable ducts). At the level of detail in the policy it is not possible to predict whether the overall cost is realistic.

If we assume that implementation will commence at the earliest in 2009, this means that the policy aims to achieve the desired coverage by 2016, in which case New Zealand will continue to lag the leaders in broadband.

24 Statistics New Zealand (2008) *Subnational population estimates: at 30 June 2007*, 23 October 2007.

4.3 New Zealand Institute

Overview

The New Zealand Institute (NZI) has a proposal for an entity that it calls 'FibreCo'.[25] While similar in some respects to the National Party's proposal for FTTH, it contains more detail on the ownership model of the network (for example, it includes the nationalisation of existing access networks). It also forecasts a higher cost for the network than the National Party, at $4 billion to $5 billion.

NZI's proposal seeks to achieve coverage of at least 75% of the population – which is claimed to include all towns with population greater than 20 000, which will extend to the towns of Pukekohe, Taupo and Timaru, all of which are smaller than Blenheim – by 2018. Based on Statistics New Zealand population estimates for 2007, this will encompass 74.6% of the total population, so NZI plans to serve a slightly greater proportion of the population than the National Party's proposal.

NZI estimates that the economic benefits of high-speed broadband would be in the range of $2.7–4.4 billion per year, with potential for further up-side.[26] This represents around 2–3% of total GDP.

Key issues

NZI's calculation of the breakeven point for the investment is very superficial and contains a number of highly questionable assumptions.

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25 New Zealand Institute (2008) *Delivering on the broadband aspiration: a recommended pathway to fibre for New* Zealand, April 2008. Available at http://www.nzinstitute.org.

26 Covec determined that the economic benefits for the Auckland region (Waitakere City, Auckland City and Manukau City), based on the NZI estimate, to be in the range of $971–1682 million per year. Source: Covec (2008) *Open access broadband in Auckland: demand, costs and benefits*, report for Auckland Regional Broadband Advisory.

Penetration rate will only be achieved in the medium to long term

NZI's estimate of 67% of homes passed to take up the service is not unrealistic. We note that 65% of households in Norway currently have broadband, 10% of the subscriptions being for services in excess of 8Mbit/s.[27]

However, this level of take-up will not be achieved as soon as infrastructure is deployed. It will take several years before FiberCo will reach this target penetration of the addressable market. Before that time, FibreCo would be realising far lower revenues on already deployed infrastructure.

Therefore, annual revenue per premise passed is far more likely to be extremely low in FibreCo's initial years of operation, gradually increasing over time to a figure that is more comparable to NZI's assumption.

This will clearly have an impact on the breakeven point for FibreCo.

Rate of return is low for this type of investment

NZI's assumption of a 10% required rate of return is quite modest. In Australia, Telstra has gone on record as seeking a rate of return of more than 18% for participation in the proposed national high-speed broadband network. Many commentators have seen this as excessive. The Centre for International Economics (CIE) notes that:

> This seems to be a high return relative to many other investments in the Australian capital market. Indeed, a rate of return of this size may be consistent with the abuse of market or monopoly power.[28]

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27 Statistics Norway (2008), *The Internet survey*, 1st quarter 2008.

28 Centre for International Economics (2008) *The Telstra return on a National FTTN Network*, report for the Competitive Carriers Coalition, June 2008.

CIE estimated that an alternative supplier would require a 13.5% rate of return. Optus, Australia's second largest carrier, suggested a 12% rate of return for the same investment.

The European telecoms commissioner has proposed a risk premium of around 15% for FTTH.[29]

Opex

The NZI assumption of 1% of capital is relatively low compared to typical regulatory cost models.

Asset life is longer than that normally used for fibre

NZI assumes an asset life of 40 years – this is typical of copper, however the asset life of fibre is normally 15 to 25 years (15 years for access and 25 years for core network).[30]

Given the above, we believe that NZI has under-estimated the breakeven point, which means that significantly more government funding would be required.

There is some confusion within the proposal over the coverage requirement – this is specified both as 75% of the population and 75% of premises. It should be noted that these are two quite different targets which may not be equivalent. NZI appears to assume that 'premises' are simply residences and thus does not include any potential business case up-side that could be accrued via the business segment of the market.

Aggregating government demand and government taking on a role as anchor tenant is similar to the Norwegian approach (as described in Section 5.10). Note that this is not sufficient to – as NZI claims – 'improve the penetration rates of FibreCo'. It will however create a better economic case for extending fibre to new areas, but the service will still need to be attractive to consumers, offering desirable applications and affordable packages. Having government as anchor tenant would certainly reduce the risk for the new venture; however, appropriate regulatory controls will need to be implemented to ensure that FibreCo cannot abuse its monopoly powers.

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29 Total Telecom (2008) *Reding proposes 15% FTTH risk premium, Euro-regulator alternative*, 26 June 2008.

30 In a survey of global telecoms companies conducted by Ernst & Young, the majority of operators used an asset life of 16 to 20 years for fibre access. See Ernst & Young (2003) *Global Telecom Depreciation Survey*, January 2003.

NZI suggests a multiple stakeholder model for FibreCo, with equity being held by central and local government, utilities, telecoms operators, service providers and investors.

4.4 Telecom

As part of the Operational Separation Commitments (to be fully implemented by December 2012), Telecom has committed NZD1.4 billion to deploying fibre to the node systems (cabinetisation) providing 10Mbit/s or better ADSL2+ access capability to virtually all lines in areas that it defines as Zones 1 2 and 3.

Cabinetisation

Telecom's cabinetisation plan involves deploying 3600 new cabinets over the next four years.[31] These cabinets will be either new installations or will replace some of the existing 8800 cabinets which already have appropriate short copper loop connections to their distribution serving areas.

The design of new cabinet areas is based on the rule that 99% of lines served from the cabinet will be engineered to have a maximum line attenuation of 60dB (measured at 1024kHz) at the customer's external termination point.[32] In practical terms this equates to ensuring that the copper run distance between the cabinet and the termination is less than about 2.4km of standard urban/suburban access network cable (0.4mm diameter copper).

Backhaul to the new cabinets will eventually be all fibre optic, mostly pulled or blown into the existing 9000km of cabinet feeder cable duct,[33] but with some additional trenching required where no duct exists.

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31 Mark Ratcliffe (2008), *Telecom New Zealand investor briefing day presentation*, 10 April 2008. Available at http://www.telecom.co.nz/binarys/chorus_briefing_day.pdf

32 Telecom New Zealand (2008), *Telecom separation undertakings*, 25 March 2008

33 Telecom Wholesale (2007), *Telecom Wholesale customer briefing*, 22 November 2007. Available at http://www.telecom.co.nz/binarys/telecom_cabinetisation_briefing_22_nov_2007.pdf

The committed timing for implementation of cabinetisation is:

- 30 June 2010, more than 1500 distribution cabinets installed or equipped with operational ADSL2+ or equivalent DSL capability
- 31 December 2010, more than 2200 distribution cabinets installed or equipped with operational ADSL2+ or equivalent DSL capability
- 31 December 2011, 99% of lines in Telecom's Zones 1, 2 & 3 engineered to have a maximum line loss of 60dB measured at 1024kHz at the customer termination point.

Details of the schedule for cabinet upgrades and planned new cabinet coverage areas can be found on Telecom's Chorus website.[34] Telecom's rollout over the next three years is expected to be:[35]

- financial year 2008/09 – 738 new cabinets
- financial year 2009/10 – 1177 new cabinets
- financial year 2010/11 – 1166 new cabinets.

Resulting geographic coverage (Zones 1 to 3)

In the Separation undertaking documentation,[36] the Telecom Zones are defined:

> Zones 1, 2 and 3 means the Telecom line density zones known as Zone 1, Zone 2, Zone 3a and Zone 3b and generally used by Telecom to describe those urban density areas of New Zealand served by telephone exchanges with a total line count of greater than 500 lines, and which at 30 June 2008 together include not less than 80% of total Existing PSTN Lines.

Before the 30 June 2008 deadline, Telecom was required to provide the Minister with a list of the exact population areas included in Zones 1 to 3. To our knowledge, the detailed

34 http://www.chorus.co.nz/cabinetisation-notices

35 Paul Reynolds (2008), *Telecom Corporation of New Zealand NZ Companies Day presentation*, March 2008, http://www.telecom.co.nz/binarys/paul_abn_mar_08.pdf

36 Telecom New Zealand (2008), *Telecom separation undertakings*, 25 March 2008

Zone boundaries have not been made publicly available, but the Chorus website provides a list of towns which are included in the upgrade.[37]

We note that Telecom has previously stated[38] that there is not a good correspondence between its own internal zoning criteria (based on typical network costs) and the Statistics New Zealand (SNZ) definitions of urban and rural boundaries. For this reason, it is possible that some Zone 1 to 3 Telecom areas may be designated 'rural' using SNZ definitions.

Lines outside Zones 1 to 3 are allocated to Zone 4 (Telecom rural, around 20% of lines). Although Telecom has made no specific commitment to providing broadband infrastructure to support these lines, we note that from an MED press release of March 2008,[39] that additional assurances have been obtained from Telecom concerning Zone 4:

> Telecom's level of investment in Zone 4 rural lines will not be less than (but may be greater than) the gross contributions that Telecom receives through the Telecommunications Service Obligations subsidy

Commerce Commission estimates of the gross TSO cost for the past few years are only partially completed at the time of writing this report, but are likely to be in the region of NZD50 million to NZD70 million per annum.

Already, many lines in Zone 4 areas have access to exchange- or cabinet-based DSLAMs through Telecom's commercial deployment or through government/community sponsored projects such as PROBE. Although such connections are technically designated to be broadband and can achieve high DSL access line speeds (up to 7Mbit/s), backhaul may be provided using one or more 2Mbit/s carriers on copper or wireless transmission systems.

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37 http://www.chorus.co.nz/f68,9481/9481_Town_list_by_regionFINAL8.9.08.pdf

38 Telecom New Zealand (2007), *Submissions on UCLL and Co-location draft Standard Terms Determinations*, 29 August 2007, http://www.comcom.govt.nz/IndustryRegulation/Telecommunications/StandardTermsDeterminations/UnbundledLocalLoopService/ContentFiles/Documents/Cross-telecom1.pdf

39 Ministry of Economic Development (2008), *Telecom Separation a Fact - Minister for Communications and Information Technology media statement*, 31 March 2008 http://www.med.govt.nz/templates/MultipageDocumentTOC____34436.aspx

Unlike lines in Zones 1 to 3, future Zone 4 broadband access has no guarantees concerning copper line attenuation, DSLAM type (may be conventional ADSL) or backhaul capability.

Comment on upgrading the FTTN network beyond 2012

The planned FTTN network could be upgraded for higher speed broadband and wider coverage through:

- further copper loop shortening with the placement of remote fibre fed cabinets within current distribution areas (similar to the AT&T Video Ready Access Devices – VRADs)
- FTTH
- expansion into Zone 4 areas.

Further loop shortening and FTTH scenarios are likely to be significantly more expensive than the current cabinetisation rollout. A key cost factor in both options will be the deployment of underground fibre cables in distribution areas with no existing ducting. Telecom has around 130 000km of distribution cable nationwide, and this is typically direct buried (i.e. underground cables placed directly into the ground without ducts).[40] Unless alternative techniques emerge, to overlay the Zone 1 to 3 distribution areas with fibre will require:

- many kilometres of new trenching in the lowest cost terrain possible (such as grass where available)
- drilling under roads footpaths and driveways where required
- re-instatement of road surfaces and kerbs when trenched or damaged.

Rolling out the FTTN architecture into Zone 4 areas would also require significant runs of new trenching as existing ducted cable runs are likely to be fewer than in urban areas.

40 Telecom Wholesale (2007), *Telecom Wholesale customer briefing*, 22 November 2007. Available at http://www.telecom.co.nz/binarys/telecom_cabinetisation_briefing_22_nov_2007.pdf

4.5 Others

Fibre Fund

The New Zealand Fibre Fund concept was developed in 2006, and is a model for funding the development of many open broadband networks throughout the country. Initially, the fund is envisaged as having four roles:

- broker and consolidator of loans
- manager of an application process
- provider of collaborative knowledge and support for open-access networks
- brand owner and marketer of the NZ Fibre Fund.

The fund will initially be accountable to the New Zealand government, as the seed funder, whilst later accountability will be split amongst the seed funder, the successful applicants, the funders and the open network community. The fund will use a revision of the broadband challenge application process to evaluate applications. The application process will require the funder and applicant to work together to develop a strong business plan to lead towards sustainable and profitable operations.[41]

This proposal appears to seek to address the funding requirements of multiple open-access networks with a type of partnership arrangement between funder and potential provider. It assumes that only seed funding from Government will be necessary and that commercially viable operations will emerge on the basis of this. While this may be possible in some specific areas, it is unlikely that this model alone would lead to 75% coverage of the population.

41 Digital Strategy (2008), *The New Zealand fibre fund*, 22 April 2008, http://wiki.digitalstrategy.govt.nz/(S(kwgc3h550eg4hf3urotoj1eq))/The%20New%20Zealand%20Fibre%20Fund.ashx

4.6 Conclusions

The Labour and National party proposals both involve supporting open-access networks but with considerable differences in cost and scope (Exhibit 4.2). The Labour party proposal does not claim to achieve 75% coverage of the population, while the National and NZI proposals do make this claim. Although the costs require further investigation, the assumptions of the proposal with the highest cost (NZI) cause us to doubt the accuracy of the estimate. We believe it to be an under-estimate of the true cost in attaining the desired level of coverage. As a consequence at this initial stage of our investigation we conclude that the financial proposals of the two major political parties would also not realise the InternetNZ target within 10 years.

Telecom has committed NZD1.4 billion to deploying fibre to the node systems providing 10Mbit/s or better ADSL2+ access capability to virtually all lines in areas that it defines as Zones 1, 2 and 3 by 2012. While the planned FTTN network could be upgraded for higher speed broadband and wider coverage, options for this are likely to be very expensive.

	Proposal	*Total cost*	*Build time*	*Claimed coverage*
Labour Party	Broadband Infrastructure Fund	$340 million (plus at least $325 million of private sector funding)	5 years	–
National Party	FTTH	$2.5–3 billion	6 years	75% of population
NZI	FibreCo	$4–5 billion	10 years	75% of population
Telecom	FTTN	$1.4 billion	4 years	80% of population

Exhibit 4.2: *Summary of broadband proposals [Source: Government, National Party, NZI]*

5 Overseas experience

The availability of the Internet is central to many countries' business and community development plans. To this end the accessibility of enabling broadband infrastructure is often seen as vital. There are varying levels of engagement by national and local Governments and so a number of different models are emerging. In this section we review models that exist for overseas jurisdictions with the aim of identifying suitable candidates for further examination in the New Zealand context.

The FTTH council has published global rankings for FTTH penetration. The countries where more than 1% of households are connected directly to high-speed fibre networks are illustrated in Exhibit 5.1.[42]

[42] FTTH Council (2008), With robust growth in fibre to the home subscribers, Asia-Pacific continues to lead in FTTH market penetration, 23 July 2008, http://www.ftthcouncil.org/?t=291

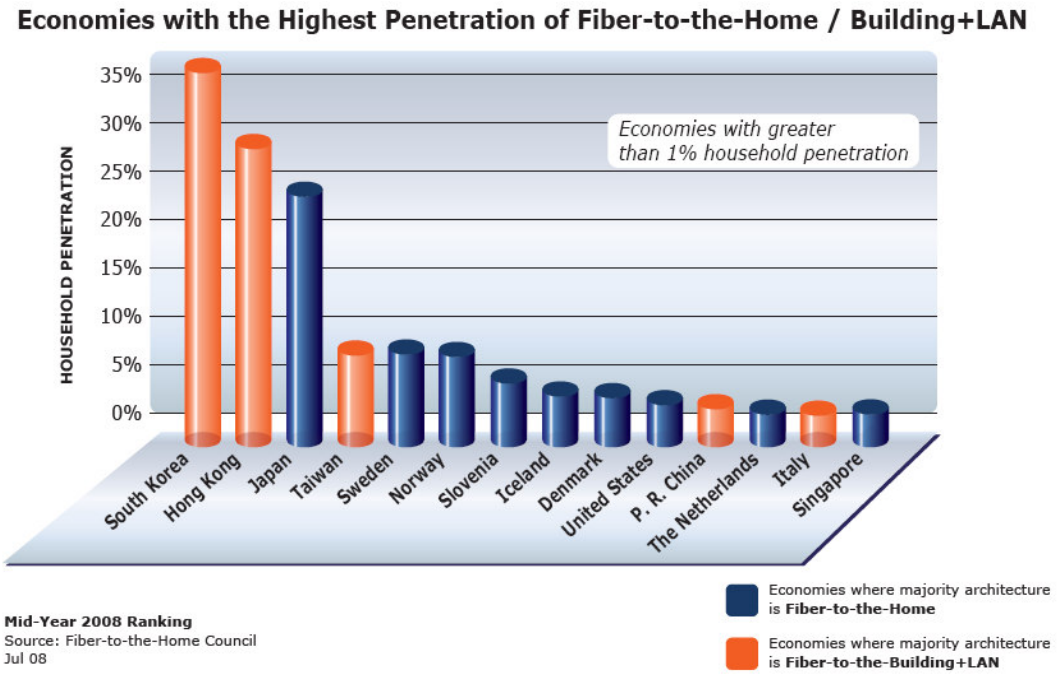

Exhibit 5.1: *Countries with greatest FTTH penetrations [Source: FTTH Council]*

5.1 Australia: implementing new public initiatives for broadband

The Australian Government has three new programmes aimed to improve broadband infrastructure throughout Australia.

The **Australian Broadband Guarantee** aims to provide all Australian residents with access to affordable 'metro-comparable' broadband services. Incentive payments will be offered to Internet service providers to supply services that satisfy the metro-comparable specification to residential and small business premises where such services would not otherwise be available. Metro-comparable services are defined as having a minimum download speed of 512Kbit/s, upload speed of 128Kbit/s and 3GB per month data usage, at a total cost of AUD2500 (NZD2677) over three years (including installation and connection fees).

Incentive payments will range from AUD1000 to AUD6000 (NZD1071–6426) per service, depending on the technology of the service solution, whether the service is an existing

service upgraded to become metro-comparable, or whether the location of the service requires costly installation (for example the ability to withstand cyclone conditions, or travel to a remote area).

Over the next four years, AUD270.7 million has been allocated to fund this programme, which will commence in August 2008.

The Government has also committed AUD4.7 billion (NZD5.0 billion) to fund a **National Broadband Network** (NBN), a new open access, high-speed, fibre-based broadband network, providing downlink speeds of at least 12Mbit/s to 98% of Australian homes and businesses. It is planned that the NBN will be deployed over a five year period. A request for proposals has been issued, with tenders due on 26 November 2008.

The Government funding contribution may take the form of debt or equity which would be required to earn a return – a preference for an equity investment has been indicated, although other forms of funding will be considered.

Concurrently with the NBN tender process, the Government is seeking submissions on policy and funding initiatives for areas outside the NBN coverage.

The final new Government initiative is the AUD100 million (NZD107 million) **Fibre Connections to Schools** (FCS), which seeks to deliver fibre connections offering services up to 100Mbit/s. Currently around 47% of schools have fibre connections. An implementation plan for FCS is expected to be released in December 2008. This initiative is the responsibility of the Ministry of Education.

5.2 Canada: Government and community initiatives

The Canadian Government has implemented several Internet related initiatives, through its department Industry Canada. Community-based initiatives aim to improve broadband connectivity to rural and isolated areas, and to provide Internet access to sectors of the population who may not have private access. Business-based initiatives aim to encourage the use of e-commerce and e-business.

Rural broadband access has been aided by two programmes:[43]

- Broadband for Rural and Northern Development Program, where communities without broadband access were eligible for funding to help develop their broadband business plans
- National Satellite Initiative, a joint project between Industry Canada, Infrastructure Canada and the Canadian Space agency, designed to make affordable satellite capacity available for the deployment of broadband services to isolated communities where satellite technology is the only practical solution.

Industry Canada's Community Access Program[44] provides affordable Internet access in public locations such as schools, community centres and libraries. This allows access to people who may not have Internet access in their homes or workplaces. The aims of this programme are:

- to help bridge the digital divide
- to aid electronic access to government services
- to encourage online learning and literacy
- to foster the development of community-based infrastructure
- to promote Canadian e-commerce.

One particularly successful example of a community broadband deployment can be found in Fredericton, New Brunswick. During the 1990s Fredericton had very little in the way of broadband access, and both the City Council and businesses in the area were becoming frustrated with the inability to adopt new business tools that increasingly were relying on the Internet. The City Council came to the realisation that waiting for existing broadband suppliers to come to Fredericton was not a viable option, so took it upon itself to develop the infrastructure. In order to comply with broadband provider licensing requirements the council incorporated a wholly owned company, e-Novations ComNet Inc, which became accredited as a non-dominant telecommunications carrier.

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43 Industry Canada (2007), *Broadband*, http://broadband.gc.ca/pub/index.html, May 2007.

44 Industry Canada (2007), *Community Access Program*, http://cap-pac.ic.gc.ca/pub/index.html?iin.lang=en, May 2007.

The City Council already had a requirement for reliable, high-speed connections to 15 sites throughout the municipality, that could not be adequately met by commercial providers. In addition to this demand, public meetings confirmed that there were many other organisations with similar requirements. Based on this validation, a sustainable business model was developed. A fibre optic Community Network would be built forming a ring around the city, with access granted on an annual membership basis. Funding for the network was obtained from the community, with the City Council providing e-Novations a CND65 000 (NZD81 420) loan to be repaid over three years and Smartforce, an e-Learning company providing a CND50 000 (NZD62 631) forgivable loan. BrunNet, the largest independent ISP in the province at the time, and the University of New Brunswick each agreed to prepay three years of membership fees.

Initially, e-Novations rented an existing fibre network from Group Telecom, but this network did not reach all the potential members, so this was not a viable long term option. The first fibre build by e-Novations occurred in 2001, with companies partnering in building extensions to the network where dedicated fibre connections between sites were required. The common requirement of dedicated Internet access was leveraged by pooling the bandwidth needed and purchasing in bulk, with e-Novations effectively becoming a commercial ISP. With fibre installation being relatively expensive, however, this has prevented it from reaching the entire community, especially more remote areas, or those with fewer potential users. To extend broadband access to these areas wireless was used instead. A move towards truly ubiquitous broadband access was initiated in 2003, with the establishment of the Fred-eZone. Over two years 300 Wi-Fi access points were deployed throughout the downtown and business corridors, providing blanket Internet coverage to 65% of the community. Internet access via the Fred-eZone is provided free of charge.[45]

The province of Alberta has a 13 000 km open-access wireless and fibre optic network, dubbed the SuperNet,[46] which provides high-speed connectivity to 429 communities. All of the province's more than 4200 learning facilities, health centres, libraries and government locations are connected. The network is owned through a public-private partnership between the Government of Alberta, Axia NetMedia and Bell Canada. The project was

45 The Fred-eChronicles.

46 http://www.albertasupernet.ca/

initiated by the provincial government, whilst Bell was responsible for construction, and Axia designed, helped to build and operates the network. Residential Internet access utilising the SuperNet is also provided to over 86% of Alberta's population through more than 30 ISPs.

In British Columbia, Network BC was created as a project office to address how to bridge the digital divide across the province. It was decided to use the existing Shared Provincial Access Network (SPAN/BC network) to accomplish this. The idea was that by expanding the network to include the demand of the provincial health authorities and the Crown corporations then the government could use the collective purchasing power to motivate telecommunications suppliers to provide high-speed open-access network connectivity to provincial communities. The provincial government entered into direct negotiations with its telecommunications suppliers to extend existing contracts. The primary method for connection of communities is using fibre optic cable, although some more remote communities use microwave radio or satellite connections.[47]

5.3 Denmark: utilities leading fibre deployment

Denmark has long been a leader in take-up of broadband services, as well as in fibre. DSL services are available to 98% of the population via the copper network of the incumbent operator, TDC. As at the end of 2007, the broadband market was dominated by xDSL (61% of the market), with 27% of subscriptions being for cable services and FTTH services comprising 3.6%.[48]

It should also be noted that according to the telecoms regulator, telecoms services in Denmark may be provided by any person, without the need to obtain a licence, registration or other requirements.

Most of the players in the retail FTTH market in Denmark (Exhibit 5.2) are regional utility companies, such as DONG Energy, TRE-FOR, Energi Midt and Syd Energi, however there

47 Network BC (2005), *Closing the digital divide for British Columbia communities*, April 2005.

48 National IT and Telecom Agency (2008) *Telecom statistics – second half of 2007*.

are also some broadband providers – for example ComX Networks and Dansk Bredbånd. According to the Danish Competition Authority, the utility companies planned to cover around one million households (40%) at a cost of DKK9.5 billion (NZD1.7 billion).

Both public (eg TRE-FOR) and private (eg DONG Energy) utilities have FTTH deployments.

	December 2006	*June 2007*	*December 2007*	*Market share December 2007*
Dansk Bredbånd	0	0	11 768	19.8%
Dong Energy	3 040	5 044	7 900	13.3%
TRE-FOR	1 769	3 593	7 628	12.9%
Energi Midt	2 232	3 446	7 020	11.8%
Syd Energi	3 334	4 885	6 752	11.4%
Midtvest Bredbånd	859	2 508	4 921	8.3%
SEAS-NVE	1 545	2 929	4 805	8.1%
Sydfyns Intranet	2 701	3 596	4 585	7.7%
Himmerlands Elforsyning	264	1 299	3 219	5.4%
ComX	2 673	2 870	2 908	4.9%
Energi Horsens	376	1 026	2 496	4.2%
FTH Bredbånd	1 223	309	0	0.0%
Other	2 049	3 567	7 106	12.0%
Total	22 065	35 072	71 108	100.0%

Exhibit 5.2: *FTTH subscriptions by provider [Source: National IT and Telecom Agency]*

TRE-FOR has deployed an open-access network. It has also signed partnership agreements with neighbouring utilities companies Energi Horsens and Oestjysk Energi, offering services under the Profiber brand. Their aim is to provide FTTH to all 400 000 subscribers of the three companies by 2012.

The fully privatised TDC is deploying a FTTN+VDSL network, which is expected to pass 400 000 homes by 2009, however the company notes that competition by the utility companies may force it to invest more heavily in FTTN and FTTH.

5.4 Finland: a co-operative model

As at the end of 2007, over 76% of broadband connections in Finland were DSL, with cable comprising around 12% of the market. The four main players are: Elisa (34% market share), TeliaSonera (29%), Finnet (14%) and DNA (13%).[49]

To date, fibre connections in Finland have lagged those in the other Scandinavian countries, although there are a number of active fibre initiatives.

Since 2007 the incumbent operator, Sonera (part of the TeliaSonera group[50]), has been deploying a high-speed broadband network in the larger cities.[51] This network will cover approximately 400 000 households (16% of all households) by 2009. In smaller cities broadband will continue to be provided via the copper network and wireless broadband will be used in rural areas. It is expected that the fibre broadband will offer speeds of up to 1Gbit/s once a new standard for in-house networks is adopted.

Sonera also plans to extend high-speed broadband coverage by upgrading its cable network, which will then enable services of up to 100Mbit/s.

One interesting initiative is that of Verkko-osuuskunta Kuuskaista (Network Co-operative Kuuskaista), which is building an FTTH network in the Kuusiokunnat area. This area covers 3400km^2, comprising six separate municipalities, and is located about 350km north of the Finnish capital Helsinki. The programme will reach around 10 000 households and 2000 (mainly small) businesses. The village networks are being built by Verkko-osuuskunta Kuuskaista and are being connected by a backbone network provided by the municipalities.

Kuuskaista is open-access, in that the network will be available for any service provider. The co-operative was founded in 2002 and has around 1600 members.

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49 Finnish Communications Regulatory Authority (2008) *Market review 2007*, 3 March 2008.

50 TeliaSonera is majority government-owned, with the Swedish State holding a 37.3% share and the Finnish State 13.7%.

51 Helsinki, Espoo, Vantaa, Kerava, Tampere, Lahti, Pori, Jyväskylä, Oulu, Turku, Hämeenlinna and Vaasa.

Funding for the initiative comes from a mix of public, European Union and private (co-operative members) funding:

- backbone network, owned by municipalities – EUR1.68 million (NZD2.62 million)
  - 45% European Union and TE Centre for Ostrobothnia (Finnish regional employment and economic development centre)
  - 55% municipalities
- stage I deployment (covering 12 villages, total 450 households) – EUR2.625 million (NZD4.10 million)
  - 45% European Union and TE Centre for Ostrobothnia
  - 30% municipalities
  - 25% co-operative members
- stage II deployment (38 villages, 2000 households) – EUR5–7 million (NZD7.8–10.9 million)
  - 45% 20-year loan from the European Investment Bank
  - 30% 35-year loan from municipalities
  - 25% co-operative members.

The cost per household ranged from EUR3000 to EUR12 000 (NZD4684–18 735) with the average being EUR4800 (NZD7494).

5.5 France: municipalities taking the lead with fibre

At the end of 2006, the Ministry of Economy, Finances and Employment published an action plan, which set a target of four million subscriptions to very high-speed broadband networks by 2012.[52] The main emphasis of the plan is to reduce the costs of deploying fibre optic networks. Civil engineering costs, which represent the largest costs of building an FTTH network, are to be reduced by ensuring that existing ducts can be utilised for deploying fibre, and that ducting is shared among operators. Access to ducting has not been equally available among different operators. France Telecom can roll out fibre in the ducts that it inherited from the former monopoly, whereas operator Numericable is replacing coaxial fibre with optical fibre. Other operators have begun to roll out fibre only in limited

52 Ministry of Economy, Finance and Employment (2008), *Fiber migration: a French perspective on very high-speed broadband.*

cases, for example in Paris, where the sewer network is accessible and passes under every building, or in Montpellier through the municipality's own ducts. The essential infrastructure of France Telecom's ducts is to be regulated to guarantee access for alternative operators. The regulator will have to ensure that all operators have access to ducts under equivalent conditions The regulations will include rules to optimise the space and usage of ducts, to ensure that there is non-discriminatory process in the ducts offer, and to have cost-oriented tariffs.

Access to buildings also represents a difficulty for laying fibre, with building owners often reluctant to permit the laying of fibre on their premises, fearing the creation of monopolies by building or neighbourhood. The desire is to limit the number of agents in common areas, whilst still being able to choose which operator to use. The suggested solution to this is for operators to share fibre installed in buildings. The first operator installs the fibre, then other operators have access to that fibre at a fibre aggregation point. In practice, operators have not applied sharing yet, and operational issues are still under discussion. There are to be regulations developed to require operators to share the last part of their fibre network, within buildings.[53]

The decision by the City Council of Paris in 2006 to lower tariffs for access to the sewer networks has encouraged FTTH deployments over the city, with multiple companies rolling out fibre. Telecommunications operator Neuf Cegetel operates a FTTB network connecting 1500 buildings in Paris. The telecom group Iliad announced in 2006 plans to invest up to EUR1 billion (NZD1.65 billion) between 2006 and 2012, to roll out FTTH networks over France reaching four million homes, starting with Paris. France Telecom piloted FTTH networks in Paris and Haute de Seine and now have plans to deploy FTTH in Bordeaux, Grenoble, Metz, Nantes, Nice, Lyon, Marseille, Toulouse and Poitiers from 2009.

Other municipalities in France have taken a leading role in providing FTTH services. For example, in 2005, the City of Pau launched an open-access fibre network intended to connect the city with the main backhaul. The network is owned by the City of Pau, with the project being both publicly and privately funded. The ownership model is a *délégations de service public* (DSP), similar to a PPP. A budget of EUR35 million (NZD58.2 million) was

53 ARCEP (2008), *FTTH in France: orientation of regulation, access to ducts, sharing of the last part of the optical loop*, April 2008.

proposed for the first three phases of the network build. Each of these phases took one year and covered about 12 000 households per year. The project aims to connect 55 000 households in Pau in total. By December 2007, 5000 customers had subscribed to the FTTH services.

LD Collectivités, which is 99.98% owned by Neuf Cegetel, operates 16 DSPs throughout France and provides connectivity between the different networks. The open access network covers about 3250 communities, and is comprised of more than 6500km of fibre, with WiMAX also used in remote regions. LD Collectivités operates purely on market driven principles, and demand must be at a certain threshold level before a DSP project will commence. As of March 2008, LD Collectivités had invested more than EUR400 million (NZD660 million) in the deployment of its network.

5.6 Greece: five year plan for broadband strategy

In February 2008, the Hellenic Ministry of Transport and Communications announced a five-year broadband strategy for the period 2008-2013, of which a key component will be the provision of FTTH to two million households (around half of all households) at an estimated cost of EUR2.5 billion (NZD5.36 billion). Alternative technologies such as WiMAX and satellite will be deployed in more remote areas.

Funding will be supplied by a combination of public and European Community resources, as well as private investment.

A public consultation on the broadband strategy is currently underway, and so precise details are still being finalised. The preferred model however is one in which an infrastructure provider controls the passive network; a separate communication provider offers wholesale access; and a service provider retails services to end-users.

Capital expenditure per subscriber will depend on the population density of the covered cities, with passive infrastructure per home passed (excluding vertical wiring) estimated to vary between EUR424 (NZD909) in Thessaloniki to almost EUR2000 (NZD4290) in

Kifissia. In Athens (population density around 10 000 persons per square kilometre) the cost is estimated to be EUR624 (NZD1338) per home passed.[54]

5.7 Iceland: Government and community support for telecoms operators

Optical fibre has been deployed in areas of Iceland by electronic communications companies for some time now. High-speed connections are very common in Iceland; there are two separate optical fibre networks, owned by Iceland Telecom and Reykjavik Energy. There is an optical fibre network encircling the entire country, and laying fibre to individual residential buildings has already begun in several locations. There is a high-speed (100Mbit/s) data transmission network linking all upper secondary schools and continuing education locations in Iceland. There is also a research network linking 16 universities and research institutes with speeds of up to 1Gbit/s.

The provision of high speed broadband in Iceland has been driven by telecom operators. The role of the state is considered to be to support the establishment of high-speed networks, in cooperation with local authorities and other interest groups in regions where it is not considered commercially viable. Local authorities and utility companies are also encouraged to consult with telecom operators about laying fibre as part of other utility projects. The government of Iceland has planned to alter construction regulations so that property owners are obliged to lay conduits for fibre to new constructions, and all electronic communications enterprises are authorised to install high-speed connections utilising these conduits.[55]

5.8 Italy: alternative operator driving fibre growth

Italy has the second highest take-up of FTTH services in Europe, exceeded only by Sweden, driven largely by the alternative operator FastWeb.

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54 ATKearney (2008) *Developing the Hellenic Ministry of Transport and Communications 5-year broadband strategy for Greece: preliminary results on development of strategy for Electronic Communications Industry in Greece*, May 2008.

55 The Ministry of Transport and Communications (2005), *Telecom policy statement 2005-2010*, June 2005.

FastWeb was established in 1999, as a joint venture between e.Biscom and AEM, the largest regional utility in Italy. The group included Metroweb, which was responsible for rolling out the optical fibre network , whilst FastWeb provided triple play services over the network. In 2001, FastWeb bought a network of cable TV ducts, known as Socrate, from the incumbent operator Telecom Italia following an anti-trust ruling. In 2003, FastWeb divested from Metroweb. Since then FastWeb has continued deployment of its fibre optic network. From company launch to March 2006, FastWeb has invested over EUR3.5 billion (NZD6.1 billion) in its fibre network, covering 23 000km and 45% of the population. From 2007 FastWeb's network was further expanded by another 1000km, to reach 50% of the Italian population and covering all main Italian cities.[56]

In 2007, Telecom Italia entered into an agreement with Metroweb to expand its fibre-optic network in and around Milan. Telecom Italia will gain access to about 70 000 buildings in Milan, partly through Metroweb's infrastructure, which was originally built by Milan's municipality to support FastWeb during its initial stages. The agreement gives the right to use Metroweb's infrastructure for 15 years (renewable for a further 15), and is part of Telecom Italia's plans to develop its next generation network across Italy, starting in Milan.[57]

In May 2007, Swisscom (the Swiss incumbent operator) became the majority shareholder of FastWeb.

Recently, FastWeb has signed an agreement with the Ministry of Communications and Infratel, a company controlled by the national agency for inward investment promotion and enterprise development, to promote the development of broadband infrastructure throughout Italy, with the goal of removing the digital divide. The aim is to share information on planning interventions in the digital divide areas and to combine efforts towards creating an integrated and advanced broadband infrastructure throughout Italy.[58]

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56 FastWeb (2007) *FASTWEB: the Board of Directors approves the network expansion plan*, media release, 8 August 2007.

57 Telecom Italia (2007), *Telecom Italia: agreement with Metroweb to expand fibre-optic network in Milan*, 30 May 2007.

58 Ministry of Communications (2008), *The Ministry of Communications, Infratel and FastWeb sign an agreement to promote the development of broadband infrastructure throughout Italy*, 7 April 2008.

Earlier this year, in one of the first instances of a sharing agreement between an incumbent operator and new entrant regarding fibre deployment, a memorandum of understanding[59] was signed between FastWeb and Telecom Italia to cover:

- joint planning for the realisation of civil infrastructure facilitating cable laying for the development of respective fibre optic networks – for example cable ducts along roads – to favour the development of new generation networks while eliminating further infrastructure duplication
- the exchange, under reciprocal conditions, of rights to use civil infrastructure
- joint study and testing of innovative techniques in civil infrastructure, such as the use of latest generation micro-tubing for laying optical fibre.

5.9 The Netherlands: co-operatives with Government support

In Nuenen, a small town on the outskirts of Eindhoven, South East Netherlands, a broadband co-operative was set up in 2004 with finance from a private investor, a bank and a government subsidy. This co-operative built an open-access fibre to the home network covering the entire town and delivering speeds of 100Mbit/s (the OnsNet network). Nuenen is an affluent area, and has a population of around 25 000 people in about 8500 households with approximately a quarter of the population being retired. The OnsNet project was led by the local housing corporation and Kees Rover from Close the Gap.[60] The residents were offered free connection and access to OnsNet for the first year, after which there would be a monthly charge for membership of the cooperative, plus additional costs for their chosen services, including Internet, telephone and TV.

The business model relied on significant take up, which in turn was reliant on the per household government subsidy that was available. The co-operative signed up 97% of households in advance for one year, with the subsidy going straight to the cooperative. The housing corporation financed the two points of presence of the network, and the private investor took a 5% share in the network. The bank provided the remaining required finance

59 FastWeb (2008) *Telecom Italia and Fastweb sign industrial agreement for new generation network infrastructure*, media release, 23 June 2008.

60 http://www.closethegap.nl/index.php?item=17

on a 20-year loan, based on the guaranteed initial penetration, with the loan secured against the network. The co-operative also came to an arrangement with a telco that agreed to buy the network from the bank for the remainder of the cost, in the case that the cooperative defaulted on its repayments. Beyond the first year, penetration has remained steady at around the 80% mark.[61]

In 2006, a large FTTH project was initiated in Amsterdam, the CityNet, which is aiming to reach 420 000 homes and business by 2013 at a cost of EUR300 million (NZD512 million). The network will be built by Glasvezelnet Amsterdam BV (GNA), which is one-third owned by the Amsterdam City Council, ING Real Estate Investment Management, and five large Amsterdam housing corporations. The network will be operated on an open-access basis by BBned, a subsidiary of Telecom Italia, with over 75 service providers lined up to provide services to homes and small businesses.[62] CityNet, in cooperation with three local carriers, has recently conducted a three-day test of 1Gbit/s connectivity for residential consumers over its network.[63]

A recent analysis conducted for the Dutch regulator (OPTA) of the business case for fibre deployment in the Netherlands[64] found that the initial capital cost of the incumbent operator (KPN) deploying a P2P Ethernet solution to 60% of the Dutch population would be EUR2088 (NZD3562) per subscriber and EUR1566 (NZD2671) per home passed.

A key factor in the viability of the business case is the duct cost. If duct cost was EUR30 (NZD51) per metre, breakeven for KPN would occur at an incremental net average revenue per user (ARPU) of EUR13.40 (NZD22.86) per month. It was concluded that there is a viable business case for KPN under this scenario if the operator maintained a line share of 60% (including both retail and wholesale customers).

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61 Broadband Stakeholder Group, *OnsNet – Nuenen's FTTH network*.

62 ING Wholesale Banking (2006), *European telecoms – CityNet Amsterdam: fibre-to-the-home is becoming a reality*, 24 February 2006.

63 Broadband DSLReports.com (2008), *Amsterdam tests residential 1Gbps fiber*, http://www.dslreports.com/shownews/Amsterdam-Tests-Residential-1Gbps-Fiber-97642, 11 September 2008.

64 Analysys Mason (2008) *The business case for fibre-based access in the Netherlands*, final report for OPTA, 24 July 2008.

The study also examined the business case for alternative operators using unbundled fibre and wholesale broadband access (WBA). While the business case for alternative operators was found to be less clear-cut than for KPN – depending upon whether sufficient incremental net revenue can be achieved to cover the cost – for high speed services unbundled fibre appeared to be cheaper than WBA. However, it was also found that unbundled fibre was not subject to strong economies of scale, meaning that small alternative providers would not be disadvantaged compared to larger providers. In addition, if the wholesale price of unbundled fibre was the same across all locations, then the cost per subscriber would not increase in areas of lower population density.

5.10 Norway: growing the market through demand-side interventions

The aim of the Norwegian Government is to ensure that everyone in Norway, regardless of where they live, will have access to broadband. The Norwegian broadband policy is based on the philosophy that:

> …broadband roll-out primarily should be market driven, and that successful eGovernment applications will help creating a demand that makes it economically viable for private suppliers to provide broadband access throughout the country.[65]

By 2005, this policy has resulted in broadband being available to around 95% of the population. Nevertheless the Government recognises that there are some small local communities where the total demand is too small to attract market investment in infrastructure, in which case some direct funding may be required. Note that Norway is not a member of the European Union and thus does not have access to financing through European Union Structural Funds.

The main vehicle for implementation of the Norwegian broadband policy has been the **Høykom** programme, which commenced in 1999, and was in its third phase of operation over the period 2005 to 2007. This programme has to date supported more than 400 projects, providing funding for up to 50% of total project costs. Høykom's funding budget for the period 2005 to 2007 was €30 million, and was financed by the Norwegian Ministry

65 Høykom Programme. Available at http://www.hoykom.no.

of Modernisation (now called the Ministry of Government Administration and Reform) and Ministry of Education and Research.

As the objective of Høykom is to stimulate the development and dissemination of broadband-based eGovernment applications, the programme does not in general fund infrastructure-based projects. Exceptions to this rule are remote district areas where the market is less likely to supply broadband infrastructure, and schools.

Examples of Høykom-funded projects which have driven broadband uptake include:

- implementation of digital X-ray across the (government-owned) hospital system, which has encouraged broader uptake of other ICT solutions within the health sector
- support for local government services delivered via broadband
- Høykom-School, which funded broadband infrastructure in schools and brought fibre-based backbone to areas with limited backhaul capacity.

The Norwegian terrain poses a challenge for network providers and is somewhat similar to that of New Zealand: the country is mountainous, with many deep valley and fjords. Most of the population live in small towns and villages. Oslo, the largest city, has only 557 800 inhabitants,[66] compared to the total population of 4.74 million, and there are only five cities with more than 100 000 inhabitants – Bærum, Bergen, Oslo, Stavanger and Trondheim – comprising just 25% of the national population.[67]

5.11 Singapore: open-access model for new national broadband tender

An open-access Next Generation National Broadband Network (NBN) is being planned for Singapore, with services to be available nationwide by 2015. The NBN will be capable of symmetric services of at least 1Gbit/s, however the initial provisioning will be for 100Mbit/s.

66 As at 1 January 2006. Source: Statistics Norway.

67 Statistics Norway (2008) Population and area in urban settlements, 1 January 2008.

The government plans a three-level industry structure:

- passive infrastructure operator (NetCo) – responsible for design, build and operation of the passive infrastructure
- wholesale operator (OpCo) – responsible for the design, build and operation of the active infrastructure
- retail service providers – purchase access from OpCo and compete to provide services to end-users.

NetCo is required to be structurally separate from its downstream operating companies (e.g. retail service providers). OpCo is required to be operationally separate from its downstream operating companies, and in addition must:

- offer fair and non-discriminatory wholesale broadband services to other operating companies and downstream operators through an Interconnection Offer, and the prices and terms and conditions of these wholesale offerings will be regulated
- meet all reasonable requests by any operating company for access to a basic set of wholesale services offered under its Interconnection Offer.

The government grant for NetCo is capped at SGD750 million (NZD1079 million), while the maximum grant for OpCo will be SGD250 million (NZD360 million).

The tender processes for NetCo and OpCo are currently in progress, with the successful NetCo bid expected to be announced in Q3 2008, and OpCo in Q1 2009.

5.12 Slovenia: new entrant fibre driving incumbent's FTTH response

As at January 2008, broadband penetration in Slovenia was 17.3 services per 100 persons, slightly below the EU average of 20%, with market share of the incumbent operator being 49.8%.[68] DSL is the dominant fixed broadband technology, comprising 71% of the market.

68 European Commission (2008) *Progress Report on the single European electronic communications market 2007 (13th Report)*, 19 March 2008.

Slovenia is one of the smaller Member States of the European Union, with just over two million people.

Despite its size, Slovenia is one of the top European countries in terms of FTTH deployment. The national incumbent carrier, Telekom Slovenije,[69] has embarked upon a fibre build programme ('F2') that aims to achieve coverage of 70% of the population by 2015. The programme is a key part of Telekom Slovenije's strategy to compete with new entrants and cable operators.

Estimated cost of F2 is EUR450 million (NZD1116 million), which is being part-funded by a EUR100 million loan from the European Investment Bank – the loan is also being used to fund xDSL and WiMAX rollout to areas beyond the FTTH coverage.

Another beneficiary for the programme – other than consumers – will be the Slovenian vendor Iskratel as this programme represented the first major order for its FTTH product line. Iskratel provides solutions for fixed, mobile and data networks, with its main customer base being within the CIS and extending to Central and Eastern Europe, Germany, South America and Africa.

Retail FTTH services were first offered in Slovenia by the new entrant T-2. T-2's offerings includes both VDSL and FTTH, with the latter deployed in seven urban areas, including the capital Ljubljana. The FTTH network is actually owned and operated by Gratel, a telecoms construction and maintenance company, which offers ISPs wholesale access.

5.13 Sweden: leader in municipal access models

The Swedish government's aim is to ensure broadband is available to all households by 2010.[70] To achieve this goal, the government plans to establish effective market competition without distortions or restrictions for broadband providers. This requires that

69 Telekom Slovenije is the leading operator in Slovenia and is 52.53% owned by the Republic of Slovenia. The Slovenian telecoms market has been liberalised.

70 The Swedish Government's National Post and Telecom Agency (2007), *Proposal for Swedish broadband strategy*, http://www.pts.se/Archive/Documents/EN/Proposed_broadband_strategy_eng.pdf, February 2007.

all operators have equal access to the 'last mile' copper network of the incumbent operator TeliaSonera. The government is currently investigating the most appropriate measures to take to ensure that equal access. In case of the private market failing to provide sufficient broadband access, the government plans to give support by funding some public fibre broadband networks. These networks will have minimum transmission rate requirements and will be open to other service providers. Municipal authorities will also be given social planning responsibility to ensure access to broadband infrastructure in their communities.

Swedish IT policy, consistent with EU policy, aims to ensure that access to broadband infrastructure is available to all by 2010, where 'broadband' is defined to have a minimum downlink bandwidth of 2Mbit/s.

While considerable progress towards this goal has been achieved, the Swedish regulator, PTS, has identified that there are barriers that will impede the continued deployment of broadband networks. PTS estimates that around 136 000 households have no access to existing or planned broadband, and that around SEK1135 million (NZD188 million) of government support initiatives will be required to address these barriers, of which half could be sourced from EU structural funds.[71]

PTS makes a number of recommendations[72] to ensure that the goal of universal broadband by 2010 can be achieved, including:

- government should impose minimum requirements on infrastructure established with public funds, such as minimum transmission rate
- broadband networks financed with central government support should be open to other service providers during the lifetime of the networks
- municipal authorities should be given a social planning responsibility to ensure access to broadband infrastructure
- government should consider drafting legislation to give municipalities more freedom to conduct cross-municipal collaboration in the broadband sector

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71 Post & Telestyrelsen (2007) *Proposal for Swedish broadband strategy*, 15 February 2007.

72 *Ibid.*

- municipal authorities that currently own broadband operations in areas where the commercial rollout of future-proofed broadband infrastructure has been carried out or is possible should consider disposing of such operations, or alternatively, taking special measures to ensure that competition is not distorted
- government should formulate a long-term objective for access to broadband infrastructure and strive for broadband to be perceived as a universal service when reviewing the USO Directive.

Fibre is recognised as the medium which provides the greatest transmission capacity, however PTS believes that infrastructure-based competition, in most situations, will not be feasible. PTS therefore has identified that its objective is to ensure service-based competition that uses the established fibre infrastructure. In order to achieve this, open access to the fibre networks is essential. However, PTS states that existing fibre networks – including those financed by public funds or owned by municipal authorities – are characterised by a lack of openness, and has a particular concern to ensure that publicly funding initiatives do not distort or impede competition.

While Asian countries – South Korea, Hong Kong, Japan and Taiwan – lead the world in fibre penetration, Sweden has the highest fibre take-up of any non-Asian country, with fibre comprising nearly 17% of residential broadband connections (Exhibit 5.3).

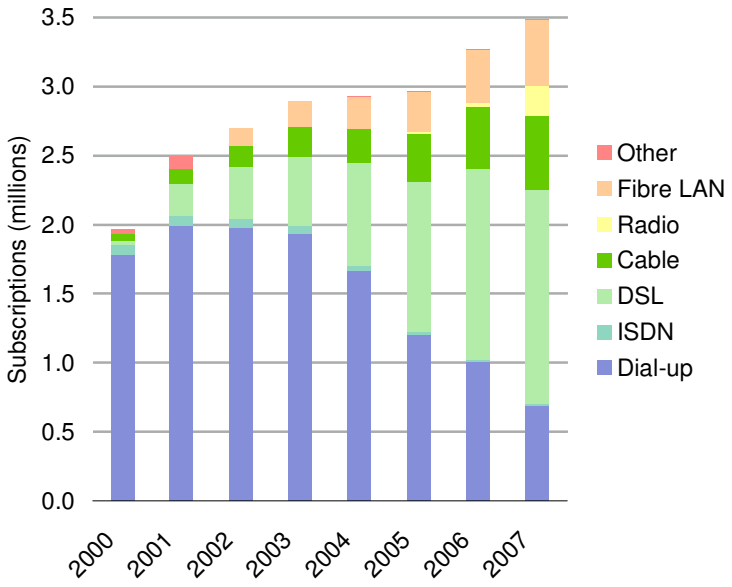

Exhibit 5.3:
Residential Internet subscriptions, Sweden, 2000 to 2007 [Source: PTS]

Sweden was an early mover with fibre. Bredbandsbolaget, now Sweden's second largest broadband provider, launched in 1998 as one of the first companies offering fibre-based broadband. Bredbandsbolaget was acquired by Telenor, the Norwegian incumbent operator, in 2005.

One of the earliest public initiatives was in the city of Vasterås, located 100km west of Stockholm. The municipal authority engaged the utility Mälarenergi (also owned by the municipal authority) to build a Gigabit Ethernet metropolitan network which is owned and operated by the subsidiary company MälarNetCity. Construction commenced in 2000 and was completed in 2007, covering around 83% of households.

MälarNetCity does not provide retail services – the network is open-access, with more than 25 service providers, including national providers (including the incumbent, Telia) as well as local companies. There are now more than 45 000 residential customers and over 2500 business customers, and prices are claimed to be among the lowest in Sweden (100Mbit/s symmetric service costs from SEK299 – NZD49 – per month). There is also a city portal which provides access to user content and a marketplace for businesses and organisations.

There are now 152 city networks in Sweden, reflecting an investment of more then EUR2 billion[73] (NZD3.1 billion). The networks pass three million homes (around two thirds of all households), and 95% of those networks offer dark fibre.

Despite this activity in fibre, the Swedish broadband market faces a number of issues. The competition between fibre owners, incumbent operators and cable companies is fierce, and there are examples of incumbents signing up a housing network for a guarantee of exclusivity. There has also been some consolidation in the FTTH market, as small public networks facing financial problems are sold.

One of the largest private owners of housing in Sweden, Akelius Fastigheter, has contracted the incumbent operator Telia to build a fibre network to deliver triple-play services to all of its apartment buildings. The agreement is for a nine-year period. Build-out will commence in Q3 2008 and is expected to connect 27 000 apartments in 37 municipalities over two years.

These types of initiatives are not restricted to private housing. The Swedish Association of Municipal Housing Authorities (SABO) plans to install FTTH to all of its apartments by 2012, providing up to 1Gbit/s to over 750 000 homes.[74] SABO is a national organisation representing not-for-profit housing companies. These companies range in size from 33 to 24 000 tenants. Currently around half of the apartments are connected to fibre.

5.14 United Kingdom: a mix of public and private initiatives

There are a number of public initiatives supporting broadband infrastructure. One such example, the Rural Broadband Access Project (RBAP) was funded by Advantage West Midlands (one of nine Regional Development Agencies in England). During 2006, RBAP rolled out broadband infrastructure to underserved rural communities within the West Midlands. This included the upgrading of BT exchanges as well as the installation of satellite and wireless base stations to serve premises beyond the reach of DSL services.

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73 Ericsson (2008) *Open networks*, International Conference on Broadband, Athens, 7 June 2008.

74 Interview with Anders Johansson, Senior Advisor ICT & Broadband, SABO, 26 May 2008. Available at http://latviantelecoms.blogspot.com/.

Ofcom notes that there are several reasons for public sector intervention for the provision of higher speed broadband services:

- market failure
- distributional policy objectives (including equity and social inclusion)
- lack of regional competitiveness.

However, guidelines issued by the Department of Trade and Industry note that there are risks involved:

> …any intervention, regardless of the rationale, risks distorting competition. This could end up disadvantaging commercial companies, perhaps deterring private sector investment for a long period, or duplicating investment that would have been made by the market. Such distortions should be avoided wherever possible and public interventions should only take place where the market has failed.[75]

BT is planning both FTTP and FTTC deployments, with the first starting in August 2008. In conjunction with Land Securities, BT will provide an FTTP network in the new Ebbsfleet Valley development in Kent, supporting data at speeds of up to 100Mbit/s. Approximately 10 000 homes will be built, along with six million square feet of commercial space and three million square feet of retail, leisure and community facilities.[76] BT is also planning to roll out fibre-based broadband to up to 10 million homes by 2012. This deployment will mostly involve providing FTTC in existing housing developments, which will initially support speeds of up to 40Mbit/s. BT plans to invest around GBP1.5 billion (NZD3.5 billion) in total on the programme.[77]

Providing fibre-based telecoms in new builds will result in significant deployments, with the UK government having a target of three million new build homes by 2020.

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75 Department of Trade and Industry (2007) *Public broadband schemes: a best practice guide*, February 2007.

76 BT (2008), *Faster broadband coming to Ebbsfleet Valley*, http://www.insight.bt.com/news/Faster-broadband-coming-to-Ebbsfleet-Valley/

77 BT (2008), *BT plans UK's largest ever investment in super-fast broadband.* Available at http://www.btplc.com/news/articles/showarticle.cfm?articleid=%7befd7b1fa-52ed-45bb-b530-734fac577e94%7d

Acknowledging this, Ofcom has recently released a consultation document with proposals for next generation broadband access in new build developments, designed to:

- ensure efficient and timely investment is open to different providers
- help providers successfully deliver services, through clear standards
- promote competition and protect consumers
- ensure equitable regulatory treatment of providers.[78]

H2O Networks Ltd, which provides fibre connectivity utilising the sewer system, is planning the deployment of FTTP in Bournemouth, making it the UK's first 'Fibrecity'. Work will begin on laying the fibre in September, and is expected to take two years. H2O Networks will be funding and providing the network at a cost of around GBP30 million (NZD70 million). The fibre will provide high speed broadband (100Mbit/s) to all of Bournemouth's businesses and more than 88 000 homes.[79]

It is not yet known the potential scope in the UK for fibre deployments such as those by H2O networks. Ofcom has recently announced that it will be undertaking an investigation into whether there is potential for commercially viable fibre deployment utilising the primary infrastructure networks of other utilities such as water and energy.[80]

5.15 United States of America: municipal government model in California

The City of Loma Linda in California is deploying a city-wide fibre optic network as part of the Loma Linda Connected Community Program (LLCCP). The building regulations are also to be modified to ensure that developments meet the needs of future communications technologies. All new commercial and residential developments will be required to have a fibre optics interface and copper cabling throughout. The goal of the LLCCP is to provide high-speed advanced telecommunications services to businesses and residents, to be

78 OFCOM (2008), *Next generation new build*, 16 April 2008.

79 Fibrecity (2008), *Welcome to Fibrecity*, http://www.fibrecity.eu/bournemouth/index.htm

80 OFCOM (2008), *Institution of Engineering and Technology speech, broadband Britain – towards the next generation*, 16 April, 2008.

managed similarly to traditional utilities such as water and sewer. The City is building the fibre network as well as providing Internet services.[81]

5.16 Summary

There are a wealth of examples of the varying models around the world, and indeed multiple models can be implemented within a single country (Exhibit 5.4).

81 http://www.ci.loma-linda.ca.us/asp/Site/LLCCP/AboutLLCCP/Introduction/index.asp

	Demand aggregation	*Demand stimulation*	*Procurement of a service*	*Public-private partnership*	*Utility business*	*Co-operative*	*Property development*
Australian Broadband Guarantee			✓				
National Broadband Network (Australia)				✓			
Broadband for Rural and Northern Development Program (Canada)				✓			
National Satellite Initiative (Canada)							
e-Novations ComNet (Canada)	✓			✓		✓	
Alberta SuperNet (Canada)				✓			
Network BC (Canada)	✓						
TRE-FOR (Denmark)	✓				✓		
Verkko-osuuskunta Kuuskaista (Finland)	✓					✓	
Reykjavik Energy (Iceland)					✓		
FastWeb (Italy)				✓			
OnsNet (Netherlands)	✓					✓	
CityNet Amsterdam (Netherlands)				✓			
Høykom (Norway)	✓	✓					
National Broadband Network (Singapore)			✓				
MälarNetCity (Sweden)		✓			✓		
SABO (Sweden)							✓
Rural Broadband Access Project (UK)			✓				
Ebbsfleet Valley (UK)							✓
H2O Networks (UK)					✓		
Loma Linda (USA)				✓			

Exhibit 5.4: *Intervention models used for selected initiatives [Source: Network Strategies]*

Nonetheless, there are a number of key themes that can be identified by our survey:

- incumbent operators tend to deploy high-speed fibre broadband only when faced with effective infrastructure competition
- in a number of markets, infrastructure competition is not feasible, except possibly in certain, typically highly populated, areas

- open access to networks is seen to be crucial to ensure consumers obtain the benefits of competition in the absence of infrastructure competition
- some legal or regulatory intervention may be required to remove barriers to broadband expansion
- the choice of intervention model should be driven by factors specific to the local market, including (but not restricted to) the level of competition, the legal/regulatory environment and strength of local organisations.

In our review of broadband initiatives around the world, a constant thread is that local government is a key player. The actual form of participation differs in the various initiatives, but may encompass any combination of the following roles:

- actively contributing within a public-private partnership
- providing public funding for the venture
- acting as anchor tenant for the broadband network
- easing regulations that may be a barrier to fast and efficient roll-out of broadband infrastructure
- managing rights-of-way.

So, what models may be appropriate for New Zealand? Due to the lack of infrastructure competition for high bandwidth services, government must look to an infrastructure provider or wholesale provider model, rather than a vertically integrated provider. In terms of a business model, we consider that those with the greatest chance of success would be public-private partnerships and utility business expansions. Co-operatives and working with local property developers can also have an important role in bringing coverage to smaller areas which may not be considered viable by larger players, however such initiatives require key local people to drive the implementation and be responsible for ongoing operations.

We also have seen that demand-side initiatives (demand aggregation and stimulation) may have an important role in achieving desired take-up and ongoing viability of the venture, and thus should not be neglected when developing broadband strategies.

Annex A: Regional and national broadband offerings

A.1 National offerings

Telecom

Telecom has a nationwide network comprising fibre and copper cable. The network business Chorus is in the process of implementing cabinetisation to extend the reach of the fibre section of the network, increasing broadband speeds available to customers. The aims for cabinetisation over the next three years are to provide broadband coverage to 80% of households, with more than 50% of households in upgraded areas able to access speeds of 20Mbit/s. 99% of households in townships with more than 500 lines should be able to access speeds of 10Mbit/s. Telecom's broadband plans range from $29.95 for a basic speed plan (up to 7.6Mbit/s download, 128Kbit/s upload) with a 200MB data cap and an $0.02 excess charge, to $149.95 per month for an ADSL2+ compatible plan (speeds of up to 24Mbit/s download and 1Mbit/s upload), with a 50GB data cap and an $0.02 per MB excess charge.

Mobile broadband is also available to about 80% of the country, through Telecom's 3G network. On average Mobile Broadband cell sites enable download speeds of 800Kbit/s and upload of 300Kbit/s. Mobile broadband plans start from $25 a month for 20MB data cap, with a $1.07 per MB excess charge, to $67.44 per month for 1GB data cap, with a $0.57 per MB excess charge. All prices include GST.

TelstraClear

TelstraClear has cable broadband networks in parts of Wellington, Kapiti and Christchurch. Broadband plans on these networks range from up to 4Mbit/s download speed and 2Mbit/s upload speed with a 10GB data cap for $50.95 per month, to 10Mbit/s download speed and 2Mbit/s upload speed and an 80GB data cap for $149.94 per month. A 25Mbit/s download speed and 2Mbit/s upload speed with a 120GB data cap plan is available in Christchurch only for $229.95 per month. Each plan allows an additional 1GB or 2GB data allowance to be purchased for $2.95. TelstraClear also resells Telecom ADSL broadband in areas that are not covered by their cable network. All prices include GST.

Vodafone

Vodafone has installed equipment in 21 unbundled exchanges in Auckland, and are planning to increase their coverage. Broadband plans come packaged with home phone plans, and range from $70 per month for up to 7.6Mbit/s download and 128Kbit/s upload speeds and a 1GB data cap, to $90 per month for the same speeds and a 20GB data cap. The speeds are throttled back to 64Kbit/s when the data cap has been exceeded. Vodafone also resells Telecom ADSL broadband in areas where they have not unbundled exchanges.

Vodafone also offer mobile broadband over its 3G network. Mobile broadband can be accessed for a casual rate of $1 per day with a 10MB limit, with $1 charge per additional Mb. Plans start from $29.95 per day for a 200MB data cap, to $79.95 per month for a 3GB data cap. All plans have the option of doubling the data cap for $10 more, with an excess charge beyond that limit of $0.05 per additional Mb. All prices include GST.

Kordia

Kordia's Extend wireless network provides broadband coverage to several rural and provincial areas of New Zealand. Internet access via the Extend network is available through several ISPs. ICONZ Extend wireless plans range from $93.33 per month for 256Kbit/s download speed and 128Kbit/s upload speed and a 1GB data cap, to

$220 per month for 512Kbit/s download speed and 128Kbit/s upload speed and a 5GB data cap. All prices exclude GST.

Kordia also provides Metro Wi-Fi hotzones in parts of Whangarei, Auckland, Hamilton, Taupo, Wellington, Queenstown, Dunedin and Invercargill. Internet access using Metro Wi-Fi can be purchased on a time basis, $9.95 for 24 consecutive hours of use, or $49.95 for 7 consecutive days, with no data caps. Otherwise access can be purchased on a data cap basis, from $14.95 for 100MB of data, to $79.95 for 1GB of data, with no time limits. All Metro Wi-Fi prices include GST.

Woosh

Woosh provides nationwide wireless broadband using radio communications standards that are based upon 3G mobile, UMTS. The technology does not require line-of-sight to the base station and uses signal reflections. Woosh Wireless Limited owns management right (MR100) at 2053 MHz to 2082 MHz.

The costs of the services include installation and equipment – $99 (12 month contract with $99 cancellation fee).

Monthly Plans:

- 200MB data cap – $24.95 per month
- 1GB data cap – $29.95 per month
- 5GB data cap – $39.95 per month
- 10GB data cap – $49.95 per month
- 20GB data cap – $59.95 per month

All plans have designed download speeds of 1.6Mbit/s. All prices include GST.

Farmside

Farmside provides nationwide satellite coverage. The service costs include installation – $149.95.

Monthly plans (excluding GST):

- 256Kbit/s download/128Kbit/s upload, 500MB data cap – $59.95 per month
- 512Kbit/s download/128Kbit/s upload, 1GB data cap – $99.95 per month
- 1Mbit/s download/256Kbit/s upload, 2GB data cap – $119.95 per month.

BorderNet

BorderNet offers nationwide satellite coverage (just need to be able to dial up ISP). Subscribers connect to the internet via a telephone line modem connection and run a data acceleration program known as Tellique, which sends Internet requests for data to the satellite earth station for delivery back to your PC via a satellite data path. Some applications such as VoIP use only the modem connection.

The service costs include equipment cost – $299 including GST. Installation costs from NZ $150 (ex GST) and travel costs will apply to some areas.

Monthly plans:

- 256Kbit/s, 500MB data cap – $29.90 per month
- 256Kbit/s, 2GB data cap – $49.50 per month
- 512Kbit/s, 3GB data cap – $63.00 per month
- 512Kbit/s, 5GB data cap – $94.00 per month
- 128Kbit/s, Unlimited data cap – $105.00 per month

1024Kbit/s is now available on all plans for $22.00 per month extra. When data cap, if applicable, is exceeded then additional data is charged at 12c per Mb. 12 month contract. Monthly plan prices include GST.

A.2 Regional offerings

Academic fibre networks

North Shore Education and Access Loop (NEAL)	NEAL is an urban fibre network in North Shore City which will connect schools in the area at speeds of up to 1Gbit/s. The network was built by Vector Communications, in partnership with the North Shore City Council with funding from the Broadband Challenge Fund. The network can also be used to provide high-speed broadband to connected schools through separate commercial contracts with ISPs.[82]
Kiwi Advanced Research and Education Network (KAREN)	KAREN is a high-speed fibre network (up to 10Gbit/s) connecting research and education institutes in Auckland, Hamilton, Palmerston North, Wellington, Christchurch and Dunedin, with regional connection to institutions in Hawke's Bay, Nelson and Rotorua through a series of 16 points of presence. The network also connects with similar education networks in Australia and the United States.[83]
The Loop	The Loop is a virtual fibre loop leased from Network Tasman around the centre of Nelson, to connect schools in the region at speeds of 1Gbit/s at no cost. There are spurs running out to Motueka, Marlborough and Picton. For schools not within the range of fibre, but less than 10km and within line of sight of a connected school will have a dedicated 15Mbit/s point to point radio connection.[84]

82 Vector Communications (2008), *North Shore Education and Access Loop*. Available at http://www.vectorcommunications.co.nz/NEAL/default.asp.

83 KAREN (2008), *About KAREN*, available at http://www.karen.net.nz/about/.

84 The Loop (2008), *The Loop learning network*, available at http://www.theloop.school.nz/.

Regional fibre and/or wireless networks

Northpower

Northpower has built the backbone of a fibre optic network in Whangarei, where 900 businesses, schools and medical sites will be offered voice, data and video products before the end of the year. Businesses will be offered speeds of up to 1Gbit/s, and private users up to 100Mbit/s. Northpower has signed a partnership with Telstra Clear as the first ISP to offer services over the fibre network.[85]

Kensington Park

A joint project between Telecom Wholesale and WorldxChange Communications will provide an open-access fibre to the home network for broadband in the new Kensington Park housing development in Orewa. Two variants of broadband over fibre will be trialled in the pilot project, the first being either a voice-only or broadband and voice service with 30Mbit/s download and 6Mbit/s upload speeds. A 30Mbit/s symmetrical service is planned for later in the pilot.[86]

Vector fibre network

Vector operates a fibre network in the metropolitan areas of Auckland and Wellington. The Auckland network stretches from Manukau through to Albany and Henderson to Pakuranga. The Wellington network is predominately located in the CBD. Services are provided through Vector Communications partner companies.[87]

Internet services over the Vector fibre network are available from ICONZ from $375 + GST per month.

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85 The National Business Review (2008), *Northland trail blazes fibre optic route*, 2 May 2008. Available at http://www.nbr.co.nz/article/northland-trail-blazes-fibre-optic-route.

86 Scoop (2008), *Next gen broadband piloted over open fibre network*, 19 June 2008. Available at http://www.kensingtonpark.co.nz/media/scoop.pdf.

87 Vector Communications (2008), *Our network*. Available at http://www.vectorcommunications.co.nz/network/our_network.asp.

Counties Power

Counties Power provides a fibre optic network serving the Pokeno, Papakura and Pukekohe areas (Exhibit A.1), with connections to other fibre networks. The network operates at speeds of up to 1Gbit/s. Internet access is obtained though a range of ISPs.[88]

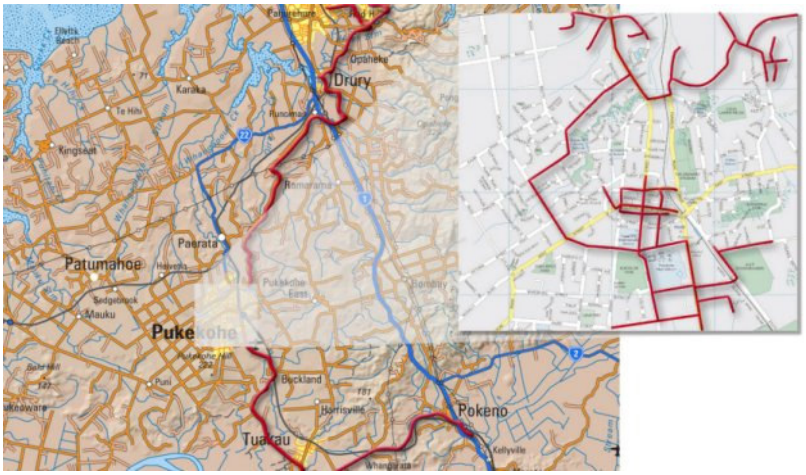

Exhibit A.1: *Coverage area of Counties Power fibre network [Source: Counties Power]*

Compass Wireless (formerly Wired Country)

The Compass Wireless network comprises fixed wireless access using 3.5GHz licensed spectrum. The network provides coverage to: Palmerston North, Christchurch, Tauranga, Rotorua, Pokeno, Onewhero, Pollock, Taurangaruru, Hamilton, Pukekohe – Franklin District, Papakura, Otahuhu, Auckland City, Mt Roskill, Henderson, Albany, Orewa, Warkworth, Leigh and Rodney Cape.

Wireless broadband service costs include installation of $99. Monthly plans range from 1Mbit/s download and 256Kbit/s upload with a 500MB data cap for $39.95 per month, to 2Mbit/s download and 256Kbit/s upload with a 20GB data cap for $129.95 per month. All prices include GST.

88 Counties Power (2008), *Fibre optic cable network*. Available at http://www.countiespower.com/fibre_optic.htm.

CityLink

CityLink has open-access fibre optic networks offering services to businesses in the Wellington and Auckland CBDs. A further network has recently been started in Christchurch. Internet access is obtained through one of the ISPs that are connected to CityLink's network. Dedicated fibre links between two locations, and private connections between multiple business LANs are also available. Connections are offered at speeds of 4Mbit/s, 10Mbit/s, 100Mbit/s or 1Gbit/s. CityLink also operates CafeNET, a WiFi service providing hotspots in various public spaces.[89]

Internet service costs through Xtreme networks include installation for City Link connected buildings:

- Connect 4 plan $495
- PublicLAN plans $1495

Monthly plans include:

- Connect 4, 4Mbs, 5GB per month data cap – $199 per month, with $0.05 per MB charge for exceeding the data cap
- PublicLAN100, 100Mbit/s, 20GB per month data cap – $499 + $295 CityLink monthly connection fee + $100 for 24 hour network support from CityLink, with $0.05 per MB charge for exceeding the data cap
- Connect 4, capped speed of 128Kbit/s, with no data cap – $300
- PublicLAN10, capped speed of 1Mbit/s, with no data cap – $800 + $295 City Link fee + $100 CityLink 24 hour support
- Connect 4, guaranteed speed of 128Kbit/s – $600
- PublicLAN100, guaranteed speed of 1Mbit/s – $2000 + $295 City Link fee + $100 CityLink 24 hour support.

89 City Link (2008), *Serious broadband.* Available at http://www.citylink.co.nz/.

Araneo

Araneo is a wireless and fibre based open-access broadband network providing coverage to Auckland and Wellington. Circuit speeds start at 2Mbit/s up to 1Gbit/s. Internet connection using the network is provided through several partner ISPs.[90]

Internet service costs include install of $600-$1200. Monthly plans range from 2Mbit/s, 5GB data cap for $300 per month to 10Mbit/s, 15GB data cap for $899 per month. A $0.05 per MB charge applies if the data cap is exceeded.

Velocity

Velocity is partnering with Hamilton Fibre Network in a collaborative project with Hamilton City Council, Wintec, University of Waikato and Environment Waikato to provide high speed broadband access to commercial buildings in Hamilton. The combined fibre networks of the partners span the city and allow speeds of 1Gbit/s. The network operates on an open-access basis and anyone in the central city area can subscribe and connect, with users being able to purchase Internet services from a range of suppliers. The initial rollout of the network has been funded by a $3.3 million grant through the Broadband Challenge Fund. The network is already operational but still has some expansion planned for the next two years.[91]

CRCnet

The CRCnet project has created a wireless Wi-Fi network platform that abstracts away much of the complexity of setting up a wireless network. Using the CRCnet platform the level of technical knowledge required to plan, build and operate a rural wireless network is significantly reduced, allowing communities to build and operate their own broadband wireless networks.

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90 Araneo (2008), *Araneo is broadband*. Available at http://www.araneo.net.nz/.

91 Velocity (2008), *Velocity open-access metro Ethernet*. Available at http://www.velocitynetworks.co.nz/index.php.

Three networks have currently been set up using the CRCnet platform:

- Rotorua schools network
- Urewera national park network
- Waikato network.

EOL

The EOL wireless network utilises public frequencies, and provides broadband coverage to the Bay of Plenty (illustrated in Exhibit A.2).

Service costs include the 'Neighbourhood wireless service' self install equipment (optional $150 for professional install) for $295 on non-contract connections

Carrier class broadband installation – from $595

Monthly plans:

High speed 'neighbourhood wireless service' (least expensive and most expensive plans shown only):

- 500MB data cap – $19.95 per month
- 50GB data cap – $215 per month

Carrier class wireless broadband (least expensive and most expensive plans shown only):

- 3GB data cap – $79.95 per month
- 50GB data cap – $721.95 per month

All prices exclusive of GST. Target Service Level for High-Speed Wireless is up to 3Mbit/s Bandwidth. Target Service Level for Carrier Class Wireless Broadband is 11Mbit/s Bandwidth.

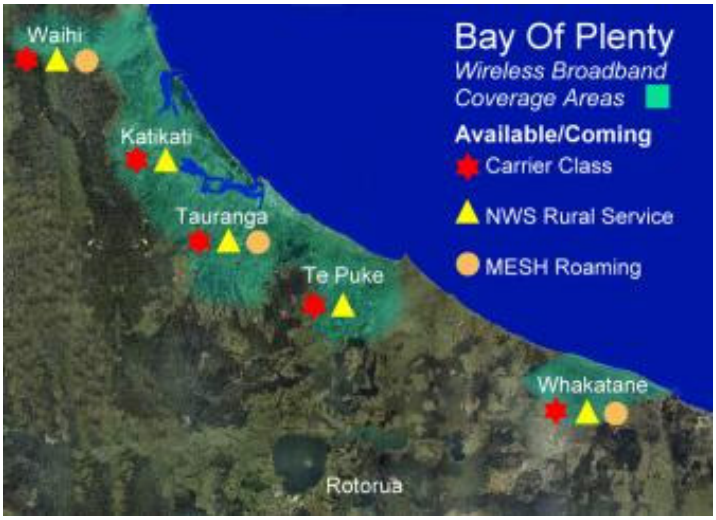

Exhibit A.2: *Map showing coverage of the EOL wireless network [Source: EOL]*

Airnet

Airnet is a wireless network using WiMax technology, which provides coverage to Hawke's Bay and Rotorua (illustrated in Exhibit A.3 and Exhibit A.4).

Exhibit A.3:
Map showing coverage of Airnet's wireless network in Hawke's Bay [Source: Airnet]

Exhibit A.4:
Map showing coverage of Airnet's wireless network in Rotorua [Source: Airnet]

InSPire Net

Manuwatu ISP InSPire Net has built a fibre optic network around the CBD of Palmerson North called MetroLAN, offering high-speed connectivity (10Mbit/s) to local businesses. Wireless connectivity is also available within Palmerston North City and surrounding areas, Ashhurst, Longburn and Pohongina Valley.

The costs of service for fibre connectivity include installation:

- $950 for casual contract
- $750 for 12-month contract
- $550 for 24-month contract.

Monthly plans range from $112.50 per month for a 5GB data cap, to $562.50 per month for a 100GB data cap. Once the data cap has been exceeded then the speed is throttled back to 64kbit/s.

The costs of service for wireless connectivity includes installation:

- $750 for casual contract
- $350 for 12-mopnth contract.

Monthly plans range from $69.90 per month for 1Mbit/s upload and download speeds and a 10GB data cap, to $450 per month for 2Mbit/s upload and download speeds and a 100GB data cap. Once the data cap has been exceeded then the speed is throttled back to 64kbit/s.

Digital Nation

Digital Nation is an open-access network provider, offering dark and lit fibre and Ethernet connections in Manuwatu and Tararua. Digital Nation primarily deals with wholesale connectivity to ISPs, Councils and Health providers.[92]

Airstream

Airstream's wireless network comprises microwave radio links which utilise the 2.4GHz and 5.8GHz radio spectrum, and provides coverage to the Manuwatu region (Exhibit A.5). The service costs include equipment and installation:

- 12 month contract term – $300
- Open term install – $499

A $349 early disconnection fee applies to the 12 month contract term installation. Some areas may incur additional installation costs. Prices include GST.

Monthly plans:

- 256Kbit/s download/128Kbit/s upload, 1GB data cap – $39.95 per month
- 256Kbit/s download/128Kbit/s upload, 5GB data cap – $45.50 per month
- 256Kbit/s download/128Kbit/s upload, 10GB data cap – $59.95 per month
- 512Kbit/s download/256Kbit/s upload, 1GB data cap – $64.95 per month

92 Digital Nation (2008), *Welcome*. Available at http://www.digitalnation.co.nz/home.html.

- 512Kbit/s download/256Kbit/s upload, 5GB data cap – $72.49 per month
- 512Kbit/s download/256Kbit/s upload, 10GB data cap – $87.90 per month

Once the monthly data cap for a plan has been exceeded the speed is throttled to 64Kbit/s. Prices include GST.

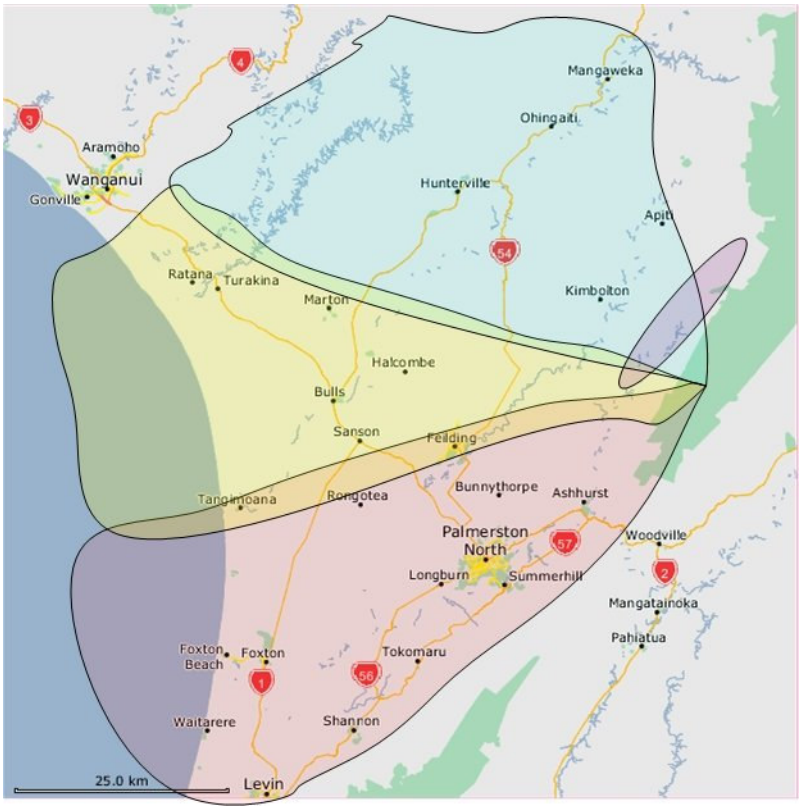

Exhibit A.5: *Map showing coverage of the Airstream wireless network [Source: Airstream]*

Wiz Wireless

The Wiz Wireless network provides broadband coverage to Wairarapa and Tararua districts, as illustrated in Exhibit A.6.

The service costs include setup and installation:

- Central Wairarapa – $400
- North Wairarapa – $600

- South Wairarapa – $600
- Self installation of radio equipment – $150.

Standard installation includes radio equipment for on the roof, standard roof mount and external cabling using the most direct route to a network ready computer. Prices exclusive of GST.

Standard repeater costs:

- Mega terrain repeater, suitable for community coverage (plan site, develop network, physically build a solar powered aerial. Backhaul and 180 degree horizontal area coverage. 25 km LOS range) – $30 000–$50 000 including installation and labour.
- Mega farm repeater (plan site, develop, physically build a solar powered aerial using 5.8GHz subscriber up to 25 km from terrain repeater and 2.5GHz equipment to connect end clients 5 km range from tower) – $5500–$9500 including installation and labour.

If a powered site is used then repeater costs are significantly reduced by not using solar panels. Prices exclusive of GST.

Monthly plans:

- Starter plan with rental option, 1GB cap per month – $20 per month + $50 per month equipment rental
- Standard Plan – 10 with rental option, 10GB cap per month – $80 per month + $50 per month equipment rental

Once the plan cap has been exceeded over-usage is charged at $10 per GB. Prices exclusive of GST.

- Commercial plan 10, 10GB cap per month – $120 per month
- Commercial plan 20, 20GB cap per month – $360 per month

Charges are for international usage only, with no daily limit. Once the plan cap has been exceeded over usage is charged at $10 per GB or part thereof. Prices exclusive of GST.

Exhibit A.6:
Coverage map for the Wiz Wireless network [Source: Wiz Wireless]

Smartlinx 3

Smartlinx 3 has deployed an open-access fast, (2Mbit/s – 10Mbit/s symmetrical), broadband network for Porirua and the Hutt Valley. Smartlinx 3's shareholders are members of the local community, including the Hutt, Porirua, Upper Hutt City Councils and the Hutt Mana Charitable Trust.

The fibre-based network reaches points of presence in Porirua, Lower Hutt and Upper Hutt. There is also a point of presence in Wellington, allowing connectivity to other networks including CityLink. Wireless is being used to widen the coverage of the network, while additional fibre is still being built within the cities.

Internet access is obtained through one of the ISPs connected to the network.[93]

Internet service costs through Xtreme networks include install of $750 for wireless connection, or $1499-$1999 for direct fibre connection. Monthly plans for wireless range from 2Mbit/s, 5GB data cap for $169 per month to 10Mpbs, 15GB data cap for $578 per month. Data plans for fibre connection range from 10Mbit/s, 5GB data cap for $498 per month to 1Gbit/s, 15GB data cap for $1898 per month. In all cases a $0.05 per MB charge applies for exceeding the data cap.

FX Networks

FX Networks owns and operates a fibre optic backbone network through the North Island. The fibre network connects Wellington, Palmerston North, Hamilton and Auckland. There are also points of presence at major cities in the South Island via partners. The network capacity is 40Gbit/s, expanding to 100-300Gbit/s within two years. FX Networks provide high-performance Internet and private networking services to businesses, government agencies and the ISP industry. Internet access can be obtained directly or through several resellers.[94]

Tasman Fibre Network

Network Tasman has built in 2005 a fibre optic network in the greater Nelson area. Network Tasman has formed a partnership with TelstraClear to offer telephone and high-speed Internet over the fibre network to business customers in Nelson, Richmond, Motueka and Blenheim. Excess capacity on the fibre network can also be rented out to customers who wish to directly link between sites without needing to go through an ISP.[95]

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93 Smartlinx 3 (2008), *Real regional broadband*. Available at http://www.smartlinx3.co.nz/Home.aspx.

94 FX Networks (2008), *Bringing New Zealand up to the speed of light*, http://www.fx.net.nz/Welcome/FX_Networks/Introduction.htm.

95 Network Tasman (2008), Tasman fibre network. Available at http://www.networktasman.co.nz/Tasman_Fibre_Network/Tasman_Fibre_Network.asp.

The Pacific.net

ThePacific.net's network is a hybrid of radio, fibre and microwave links, providing coverage to the top of the South Island (illustrated in Exhibit A.7). ThePacific.net has licensed 3.5GHz spectrum.

The costs of service include installation:

- Connection fee – $395 payable to ThePacific.net
- Installation fee – $250 estimated payable to installer

ThePacific.net retains ownership and maintenance responsibility of the customer premises equipment, and all equipment must be returned in the event of a disconnection. Prices are exclusive of GST.

Monthly plans include:

- 512Kbit/s download/512Kbit/s upload, 3GB data cap (over use charged at 2c per MB – $69.95 per month
- Flat rate 512Kbit/s download/512Kbit/s upload, 3GB data cap (once exceeded speed limited to 64Kbit/s) – $79.95 per month
- 512Kbit/s download/512Kbit/s upload, 7GB data cap (over use charged at 2c per Mb) – $99.95 per month
- Flat rate 512Kbit/s download/512Kbit/s upload, 7GB data cap (once exceeded speed limited to 64Kbit/s) – $109.95 per month
- 2Mbit/s download/2Mbit/s upload, 2GB data cap (over use charged at 2c per Mb) – $99.95 per month
- 2Mbit/s download/2Mbit/s upload, 30GB data cap (over use charged at 2c per Mb) – $299.95 per month

Monthly plan prices exclusive of GST.

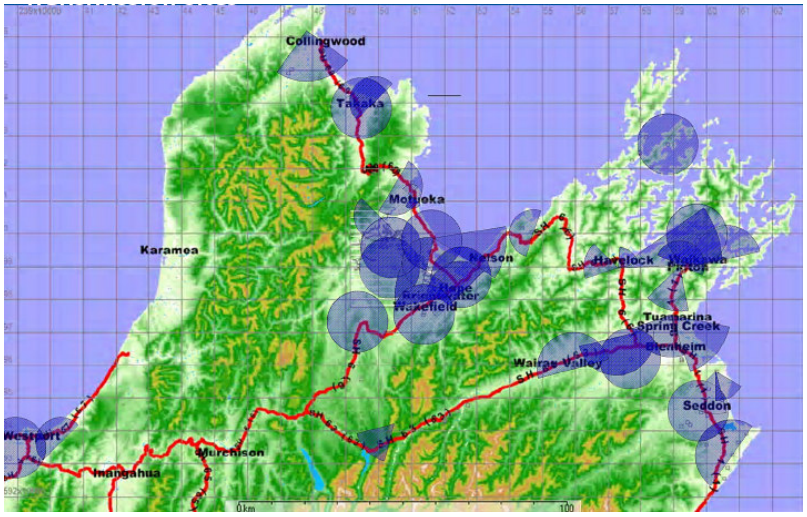

Exhibit A.7: *Map showing coverage of ThePacific.net's wireless network [Source: ThePacific.net]*

Amuri Net

Amuri.net operates eight antenna sites providing wireless broadband access to most of North Canterbury at speeds of up to 11Mbit/s. The costs of service include a set up fee of $55 plus $445 equipment cost. Monthly plans range from 384Kbit/s download, 256Kbit/s upload, 4GB data cap for $45 per month to 3Mbit/s download, 512Kbit/s upload, 8GB data cap for $99 per month. All prices exclude GST.

Geolink

GeoLink Wireless works on the basis of a "Community Network", where each connection becomes fully integrated into the wireless network which means that users do not have to connect to the main distribution point directly, but can 'bounce' off other users (such as their neighbour) to get connection. If you are in an area where you can not see your neighbour or a distribution point, the wireless equipment can be installed up to 75 meters from your house or building where it might be possible to get reception. If this is still not an option, a personal repeater can be installed on a near-by hill or vantage point providing you with coverage.

The service costs include equipment and installation costs (new connection):

- Connection – $449
- Installation – $80 per hour +$60 per hour for travel from nearest major town
- If repeater required – $600 equipment cost + installation at $80 per hour.

Monthly plans (no contract):

- 256Kbit/s download/128Kbit/s upload, 2GB data cap – $49 per month
- 256Kbit/s download/128Kbit/s upload, 5GB data cap – $69 per month
- 256Kbit/s download/128Kbit/s upload, 10GB data cap – $109 per month
- 512Kbit/s download/128Kbit/s upload, 2GB data cap – $89 per month
- 512Kbit/s download/128Kbit/s upload, 5GB data cap – $109 per month
- 512Kbit/s download/128Kbit/s upload, 10GB data cap – $149 per month

Additional data usage beyond plan cap is charged at $10 per GB.

AkaroaNZ

As of August 2006, Teldave Communications has installed a test wireless network into the Akaroa area. Most of the Akaroa township is covered with parts of other areas included. The network has been designed with further expansion capabilities catered for. Already Wainui and parts of Duvauchelle have coverage. It is expected that the standard 1Mbit/s connection will cost $500 to install an aerial and radio receiver and the monthly rental will be $50 +GST.