
REPORT 1
(1215/52/IM)

ICT POLICY – ENABLING ECONOMIC TRANSFORMATION THROUGH BROADBAND

1. Purpose of Report

To propose a vision for high speed broadband connectivity that will enable economic transformation of the Wellington economy and recommend that the Council's role should be to adopt this vision, and develop and own an implementation plan for the community to achieve it.

2. Executive Summary

Telecommunication has been a fundamental technology for modern society for a century, but in the last decade the potential capacity of networks and the services delivered over them have expanded exponentially. These high capacity "broadband" networks are fast becoming a "must have" infrastructure for globally competitive cities. Businesses, investors and skilled workers expect that cities will have affordable, very high speed, universally available broadband. In many cities this will soon be a given and attention will shift to the range and cost of services offered over this new layer of infrastructure. The risks for cities that are laggards are significant.

This report discusses:

- the importance of broadband
- broadband technologies and network characteristics
- the current situation and outlook in New Zealand and Wellington
- a broadband vision for where Wellington could be
- the potential roles of the Council and other stakeholders in achieving that vision.

It concludes that the Council has a key role to play in ensuring Wellington City has the necessary broadband infrastructure required to be globally competitive. The report recommends the Council adopt a vision for broadband and develop and own a plan for the community to achieve it. It further recommends that, in conjunction with other stakeholders, the Council investigate a role in facilitating provision of an open access broadband network infrastructure using a staged approach. This work is being developed in the context of the regional approach being undertaken through the Wellington Regional Strategy.

Importance of broadband

The benefits of high capacity broadband go well beyond faster internet speeds and more television channels. Drawing on research and case studies the report considers the significant potential for broadband as an enabler of economic and social transformation, and for it to establish Wellington as an internationally competitive city for knowledge workers and new economy entrepreneurs. The case for broadband includes applications in the areas of economic development, health, education, energy management, democracy, and community development.

Broadband technologies and network infrastructure characteristics

The major options of copper, wireless, and fibre technologies are discussed, with the clear finding that fibre networks offer unrivalled capacity and should remain the ultimate objective for communities. However, as an intermediate step, a fibre backbone and combinations of the above technologies could offer pragmatic solutions and deliver significant gains in performance.

The way in which telecommunications infrastructure is built up in layers is outlined, to facilitate the subsequent discussion of the roles of key stakeholders, including the Council.

Current situation and outlook in New Zealand and Wellington

Although CityLink provides a very high level of open access broadband infrastructure in the CBD, Wellington's (and New Zealand's) current broadband infrastructure and services are limited in comparison with other cities and countries. Nationally, broadband is recognised as a priority and government has provided some funding for fibre based backbone infrastructure¹ similar in concept to CityLink.

The report notes that most commentators expect continued steady investment in closed access broadband network infrastructure by private sector providers, but not at a pace that will provide fast, cheap broadband in acceptable timeframes. This is because providers are not incentivised to invest for the long term.

Broadband vision for Wellington

A proposed vision for broadband is presented, incorporating the critical elements for a network of:

- open access – to stimulate competition among services, not networks
- symmetrical capacity– to allow interactive two-way communication at the same speeds and capacities
- very high capacity – to support advanced services, and effectively remove capacity as a constraint.

Potential role of Council and other stakeholders

The report finds that the broadband infrastructure required for achieving this vision is unlikely to be developed by the private sector within an acceptable timeframe, and that the Council should play a role in its provision. Potential

¹ Commonly referred to as Urban Fibre Networks (UFN).

roles for the Council and other stakeholders are explored in the context of Wellington City's specific needs and unique advantages.

Preliminary strategic options for deploying broadband are discussed, and supplementary initiatives such as stimulating demand for broadband enabled services are identified. Finally the report shows a timeline for developing a full concept for the provisioning of fibre based, open access broadband infrastructure in Wellington. This includes identifying and engaging the various stakeholders in the project, and consulting with the community through the Draft Annual Plan process.

Appendix 1 - Definition of key terms

Appendix 2 – Short history of the telecommunications sector in NZ

Appendix 3 – Key stakeholder list

Appendix 4 – Government initiatives

Appendix 5 – Initiatives in other cities in NZ and key cities globally

3. Recommendations

It is recommended that the Committee:

1. *Note that the Council adopted the Information and Communications Technology (ICT) Policy in June 2006, at the time noting the economic development component would be developed subsequently.*
2. *Note that the Wellington Regional Strategy has identified broadband as a key enabler of economic growth and one of seven priorities and that the Council's position is being developed in the context of the regional approach.*
3. *Note that the Government's Digital Strategy provides a strong community endorsement for a more active public sector role in broadband. The 2007/08 and 2008/09 Draft Annual Plan processes will provide a further opportunity for community consultation on the economic development amendments to Council's ICT Policy.*
4. *Agree that Council's vision for broadband connectivity in Wellington City is:*

"That, by 2012, all of Wellington City will have affordable access to an interactive and open broadband network capable of supporting applications and services using integrated layers of voice, video and data, with sufficient two-way capacity in the city, and out to the world, to meet the ongoing information and communications needs of the city's residents, businesses, investors and institutions."
5. *Agree that Council has a key role in achieving the vision and this will include adopting and owning the vision and developing a plan for the community to achieve it.*

6. *Agree that the Council's role may also include facilitating provision of the broadband infrastructure required, and in developing demand.*
7. *Agree that further work be undertaken on this potential role for Council including:*
 - a. *issuing a Request for Concept document to engage potential industry partners in developing implementation options for the vision*
 - b. *engaging with key business, government and community sector stakeholders*
 - c. *consulting with the community through the 2007/08 Draft Annual Plan process*
 - d. *looking into policy changes that could be made to help achieve the vision (e.g. changes to the Subdivision and Roding codes of practice)*
8. *Agree that a further report on options for implementing the vision be brought back to this Committee by June 2007.*

4. Background

4.1 Previous work in this area

This discussion of broadband options flows from the Council's Information and Communications Technology (ICT) Policy, adopted June 2006. The Policy sets out a Council position that electronic information processing technologies including the internet, cellular, digital and wireless technologies have the ability to enhance the city's economic development, contribute to the well-being of the community, and enhance and increase engagement in local democracy.

Through this Policy, the Council has sought to build on the achievements of the *InfoCity Strategy* adopted by the Council in 1995. The vision of the Strategy was to:

“create an infrastructure that encourages the development of a wide range of advanced telecommunications products and services that can be delivered to, accessed and worked with by all Wellington residents, businesses and the global community.”²

One of the most significant outcomes of the *InfoCity Strategy* was the development of CityLink, a world-leading broadband infrastructure provider in the CBD.

² The Strategy was focused on increasing the city's business competitiveness and accelerating economic development. The role envisaged for Council was one of leadership, defined by having a part in:

- encouraging a paradigm shift towards technology
- ensuring the development of ICT infrastructure
- partnering with business and other communities to achieve its ICT objectives
- ensuring accessibility to ICTs across the community, particularly to disadvantaged communities.

The economic development portion of the ICT Policy is incomplete and continues to be developed through this report. It is underpinned by the Council's Economic Development Strategy, which has a focus on achieving a well-connected, competitive, and entrepreneurial/innovative city by encouraging the growth of the knowledge economy, enabled in part by the ongoing attraction and retention of highly skilled workers and investors.

Broadband infrastructure is also receiving considerable attention from policy makers at a regional and national level, in the development of the Wellington Regional Strategy³ and recent adoption of the Government's Digital Strategy⁴ (see section 5.4.3 for further information).

As part of this ICT Policy development, elected members have recently received briefings from Ernie Newman, the Chief Executive of TUANZ⁵ and Paul Budde, an independent telecommunications analyst from Australia, on:

- the current state of the New Zealand broadband environment
- the ways in which ubiquitous broadband connectivity is transforming social and economic activity in many cities
- the active role that many local authorities internationally are taking in ensuring that their cities are leaders in broadband connectivity.

4.2 What is Broadband?

"Broadband" is shorthand for "broad bandwidth". It refers generically to high capacity information/communication infrastructure with performance measured in *bits per second* (bps) bandwidth. This determines how much data can be transmitted through a part of the network (a fibre optic cable, copper wire or wireless signal) and how quickly.

Many products currently sold as "broadband" run at speeds under 1 Mbps (megabit per second), with some offering a few Mbps. This usually refers only to the downloading speed, i.e. the speed that data is transferred down to an end user or customer. Speeds for sending data from an end user back to the wider system (uploading) are typically much slower.

³The Wellington Regional Strategy identifies broadband as a key enabler of the region's economic growth and as one of its seven priorities. On January 30 the Wellington Regional Strategy Interim Committee agreed to a vision for broadband that:

"within a decade, all of the Wellington Region will have affordable access to an interactive, open access, broadband network capable of supporting applications and services using integrated layers of voice, video and data, with sufficient symmetrical capacity to meet the ongoing information and communications needs of the city's residents, businesses and institutions, and help catalyse a transformation in regional economic development."

⁴ The Digital Strategy was adopted by government in April 2006, and focused on three inter-related areas of activity, connectivity, content and confidence, for lifting New Zealand's digital performance into the top half of the OECD.

⁵ Telecommunication Users Association of New Zealand, a non-profit incorporated society, founded in 1986 by major corporate users wanting change and currently has over 500 member organisations

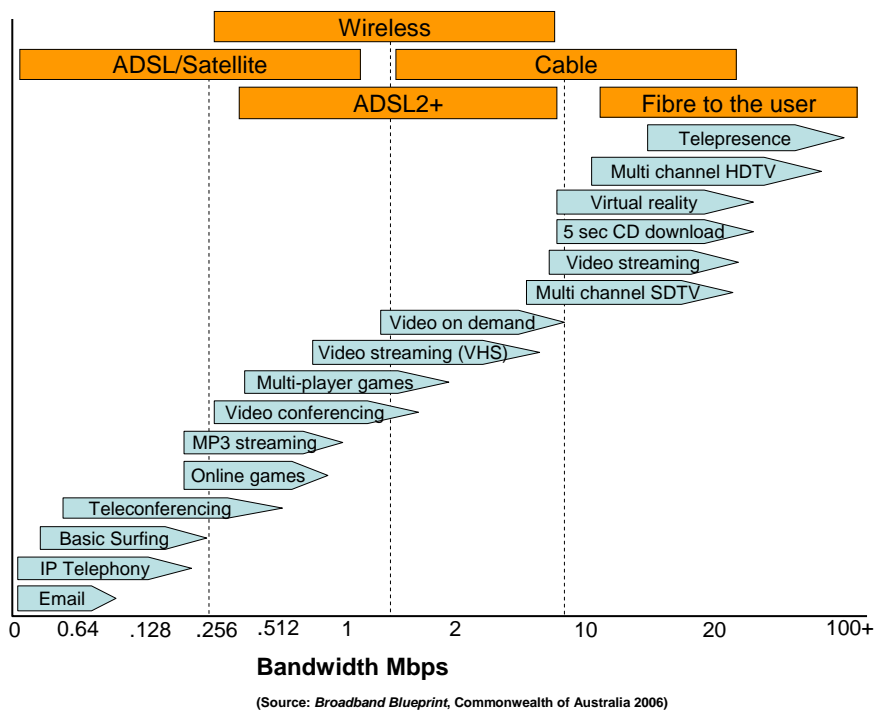
Until recently download speeds for end users were the most important because most end user activity involved pulling information off the internet to view it. Very small amounts of data, mainly emails, were uploaded. But over the last year social networking sites like MySpace and video sites like YouTube have fundamentally changed the upload bandwidth requirements. End users have become producers as well as consumers of information. Ensuring that upload and download speeds are both fast (a “symmetrical” system) is therefore becoming very important.

Indeed this notion of “customers” as producers doing business “with their peers” (peer to peer) is the transformative economic phenomenon that is changing the “internet” as we know it.

“True” or high capacity broadband, where the capacity constraint is in effect removed for both downloading and uploading, typically needs to run at speeds of tens of Mbps and up to 100 Mbps or more. It enables many applications to be run (often simultaneously), such as:

- video-conferencing – e.g. via an “access grid”, where people in a number of locations are able to meet together through video links
- telemedicine/online health services – e.g. remote diagnostics or surgery, linking elderly patients with a video nurse
- online education/e-learning – e.g. enabling schools to increase subject availability through videoconferencing, reducing costs to schools through shared resources
- increased entertainment opportunities – e.g. High Definition TV (HDTV), video on demand, online gaming
- improved telecommuting choices – e.g. enabling individuals to work at home on complex files/graphics, small businesses to overcome location disadvantage by being able to fully utilise internet based marketing
- energy sector innovations – e.g. such as “smart metering”, which enable energy savings.

The following graph provides an example of the broadband capacity needed to access certain applications/services.



Broadband is expected to transform the lives of residents and visitors as broadband networks impact dramatically on the business community and the way people live their lives. By way of analogy, when electricity was first provided to suburban communities for lighting, the subsequent applications that electricity enabled (refrigeration, heating, entertainment etc) were not even imagined. All these applications had dramatically transformative economic effects that completely altered human society. A similar evolution is expected with broadband.

5. Discussion

5.1 Why is Broadband important?

Broadband has the potential to help deliver a more prosperous, better educated, healthier, safer and more engaged city. Across all areas of life new applications enabled by it are expected to make a difference to our quality of life and economic development.

The telecommunications sector has been developing so fast that until recently there has been debate over the impact of broadband on economic development. In particular there has been a view that its main benefit is faster internet speeds and this was unlikely to have a significant impact on “real” business.

A study commissioned in 2005 by the Council on the economic benefit of CityLink for Wellington was only able to conclude that, while it had been beneficial to the city, the benefits could not be fully quantified and a strong business case could not be established to extend a CityLink-type network beyond the CBD. However, since 2005 international research on broadband’s

economic impact and residential uptake has become available. It confirms its importance as key network infrastructure with significant economic and social benefits.

Now more than 1,500 local governments across the world are planning or deploying broadband networks in their cities in an effort to capture these benefits for their business sector and communities (see Appendix 5 for further details).

5.1.1 Economic benefits

A 2005 study from the Massachusetts Institute of Technology⁶, looking at over 22,000 communities in the United States has concluded “unequivocally” that access to broadband does matter to the economy.

When comparing communities with widely available broadband to those without, (and controlling for other variables such as income, education levels, growth in previous periods, and urban/rural differences) the study indicated that the magnitude of economic impacts were:

- Employment growth – the presence of broadband added 1% to the employment growth rate between 1998-2002
- Increased house prices – in broadband enabled communities, median house prices were 6% higher in 2000 than in those without broadband
- New business creation – broadband enabled communities added nearly 0.5% to their new business growth rate over the period 1998-2002.
- New IT businesses - broadband added over 0.5% to the share of new businesses in information technology intensive sectors between 1998 and 2002.

In Stockholm, the availability of a community owned broadband network has catalysed innovation and competition with more than 60 new companies providing internet and other broadband-enabled services to residents and businesses.

The City of San Francisco determined in a January 2007 feasibility study⁷ that building a municipal fibre to the premises (FTTP) network would facilitate economic development by:

- enabling small business creation and growth
- enabling job creation and the enhanced, multiplied economic activity that accompanies it
- supporting businesses with very high bandwidth needs, such as digital media and software development
- attracting and retaining businesses of all sizes
- enabling workforce education

⁶ “Measuring Broadband’s Economic Impact” - Sharon E. Gillett, Dr. William Lehr, Carlos Osorio, (Massachusetts Institute of Technology Communications Futures Program), Prof. Marvin Sirbu (Carnegie Mellon University), Engineering and Public Policy, September 2005.

⁷ “Fiber Optics for Government and Public Broadband: A Feasibility Study”, Prepared for the City and County of San Francisco, January 2007 by Columbia Telecommunications Corporation

- enabling telework and distributed work
- stimulating economic activity
- enhancing the City's reputation for visionary and pioneering projects
- promoting private sector competition by providing a platform for numerous competitors to quickly and inexpensively enter the San Francisco market and offer competing, differentiated broadband services and access.

This and other evidence indicates that cities can derive significant tangible benefits from high speed broadband infrastructure - in terms of both economic development and quality of life for residents. Anecdotal evidence also suggests that for attracting investors, knowledge-based businesses and workers, broadband availability is especially critical, for three reasons:

- knowledge based businesses and investors tend to be heavy users of broadband
- knowledge workers tend to be familiar with broadband and expect it as a matter of course
- knowledge workers often have a preference for working from home, which again needs high quality, widespread broadband availability.

5.1.2 Residential and social benefits

Japan is a leader in the roll out of very high speed broadband with more than six million households with fibre to the home. A 2006 study⁸ looked at Japanese experiences resulting from this availability, concluding that:

- Residential customers account for 67% of the total broadband traffic - hence individuals in households become heavy users of high capacity, fast broadband when it becomes available to them.
- 63% of residential usage is for communicating with other people, not for accessing websites. This means that they are not just receiving information but are also becoming large producers of content that they send to friends and family (this might include videos, photos, music, teleconferencing etc.). This is possible because fast upload speeds are available.
- As bandwidth has increased, user demand has increased to match availability.

Residents of other cities have also benefited directly. Examples include video-nursing, which enables elderly residents to access quality and personalised medical care at lower costs to the health system; virtual classrooms which enable residents to access education resources that would otherwise not be available; and smart-metering of electricity usage, which is helping make cities more sustainable. These initiatives result in substantial cost savings in the health, energy and education sectors.

⁸ "Impact and Implications of the Growth in Residential User-to-User Traffic", Kenjiro Cho, Kensuke Fukuda, Hiroshi Esaki, Akira Kato, presented at SIGCOMM, Italy, September 2006.

5.1.3 Summary

Broadband is fast becoming an essential infrastructure for cities that compete globally. Businesses, investors and skilled workers will soon expect that a city has affordable, high speed, universally available broadband in much the same way they expect cities to have sound water, sewerage, energy and transport systems. Like these underlying infrastructures, broadband will be considered a given and residents, visitors and businesses will be focused on the range and cost of services that are offered over this new layer of infrastructure.

The establishment of the broadband network infrastructure, particularly fibre optic networks, is a new basic service for communities, the first for many decades. Because this new, high speed technology will be essential for communities to function successfully, cities that are laggards in its adoption will face significant risks. This is especially important for smaller, geographically isolated centres like Wellington that are competing globally.

Using the MIT study findings as a guideline, early adoption of broadband could, over a decade, result in many new jobs in Wellington, an incremental rise in household wealth, and the creation of numerous new businesses. This would be complemented by lower costs or better services for health, education and energy.

Together, these would give Wellington an immediate and sustainable competitive advantage vis-à-vis other New Zealand and international cities and better place it for future growth.

5.2 Broadband technologies

Broadband is currently delivered through a number of different technologies – copper wires, fibre optic cabling and wireless signals. Each technology or combination of technologies has different speed, capacity and investment return characteristics. As applications and services have grown in complexity and demand for them has increased, more bandwidth has been needed, and the speed of broadband networks has become increasingly critical.

The current networks across the city, between cities and out of New Zealand have all come under scrutiny, with questions asked about their technical capacity and the way in which they are currently managed.

1. Connectivity into and out of the city (i.e. the “state highways” and “international trade routes”). These are the big “pipes” which link the cities to the rest of the region, the country and globally to trading partners and potential markets.
2. Intra-city backbone (i.e. major arterial roads). These are medium pipes that carry the bulk of data traffic, allowing data to move around the city. The backbone can potentially link schools, medical centres, council facilities and businesses in suburban areas (i.e. a MUSH network⁹).

⁹ Networks developed by connecting Municipalities, Universities, Schools and Health providers.

3. Local connections to each home and building (i.e. local roads and driveways). These are the smaller pipes that link up streets and individual customers and are the final connection between the backbone and a home or premises. Because of the number of connections needed to link all homes and buildings, these “last mile” connections generally comprise the bulk of network infrastructure costs.

It is possible for different players to be responsible for different parts of the infrastructure. Likewise, it is possible for different parts of the infrastructure to be provided using different mixes of technology.

5.2.1 Copper wires

In New Zealand, the majority of broadband offerings currently available to households are over copper loop technology.

Many households still use “dial-up” connections, which at a speed restricted to a maximum of about .05 Mbps, only provide very limited services and do not qualify as broadband that will deliver the benefits noted previously.

ADSL¹⁰ (Asymmetrical Digital Subscriber Line) connections are the most common in Wellington houses. They use a more advanced technology and can be available at a number of speeds, largely depending on the length of the last mile copper loop, i.e. the distance from the backbone to a home or premises. Such technology, however, is still limited and as the name suggests, generally cannot provide symmetrical bandwidth.

VDSL (Very high data/bit rate Digital Subscriber Line) is more recent technology that can provide faster speeds and multiple services over the copper connection. This technology, however, is not available in New Zealand, largely because it is enabled by fibre cabling being rolled out to within 300m of each house (often called fibre to the node, FTTN). The average length of New Zealand’s copper loop is usually significantly longer than this. If it was available, VDSL would represent a significant step forward in terms of the speeds delivered, although in the medium to long-term copper (a 100 year-old technology) VDSL would not be capable of meeting the evolving needs of businesses and residents.

5.2.2 Fibre optic cables

Many of the cities involved in providing broadband infrastructure are doing so through fibre based networks. Because fibre optic cabling uses a data transmission method with immense capacity and scope for significant upgrading, it is widely accepted that its bandwidth is unlikely to be matched by other technologies for the foreseeable future. More and more data can be transmitted down the same strand of glass fibre by changing the electronics at each end, as evidenced by the recently announced upgrade to the Southern

¹⁰ Variants are ADSL2 and ADSL2+

Cross Cable between New Zealand and the United States. Fibre is seen as providing the most ability to future proof a city's high speed bandwidth needs.

5.2.3 Wireless services

Wireless technologies can provide a variety of broadband services and they receive significant media and popular attention. However they do not currently represent a broadband technology that has, or will have (using foreseeable developments), capacity comparable to fibre cabling. Apart from capacity, wireless can be limited by obstacles (buildings, hills) and some versions using unlicensed spectrum may be limited in range and subject to interference.

However, wireless technology will remain an important part of the mix because consumers have increasing expectations that they will be able to obtain mobile services as they move around a city, as well as fixed line services when they are at work or in their home.

5.2.4 Conclusion

Experience in other cities shows that the further fibre reaches out into the network (i.e. the closer it is to the home or premises) the higher the speed or capacity that can be achieved over the remainder of the network. The constraint is then isolated to a final link that can operate reasonably effectively over short distances. Therefore in the medium term it is likely that broadband will continue to be delivered through a mixture of technologies including fibre optic cabling, existing copper wires, and wireless options.

In the longer term there are technical constraints on the ability of copper or wireless to deliver ever increasing speed requirements. It is now a widespread expectation that fibre optic cabling to the premises and home will eventually be required. Fibre networks offer unrivalled capacity and should remain the ultimate objective for communities.

5.3 *Broadband network characteristics*

5.3.1 Network layers

Like other network infrastructure, broadband is composed of a series of layers, building on the basic right of way where the infrastructure is physically located, then the conduits, the enabling or transmission infrastructure, and finally the complex mix of differentiated services offered to end users.

Roading provides a useful analogy when considering broadband networks. Councils have a long established role in providing the right of way in which roads can be placed (designating road reserves) and then building and maintaining roads. However any user can have access to a road, and offer differentiated services that utilise the road (for example, couriers and taxis). The road is therefore "open access". The table below compares broadband with the current roading model:

Layer of Infrastructure	Component of Broadband Network	Role description	Equivalent component of the Rooding Network
Layer 0	<ul style="list-style-type: none"> • Right of way (overhead or underground) • Trenches • Ducts 	Providing: <ul style="list-style-type: none"> • Access to duct • Access to co-location facilities (e.g. cabinets, server rooms) • Access to aerial infrastructure (e.g. poles, trolley bus lines) • Access to rights of way (e.g. rail reserve, water reserve) 	<ul style="list-style-type: none"> • Right of way • Road reserve • Poles and holes
Layer 1	<ul style="list-style-type: none"> • Dark fibre • Radio masts & Radios • Lightwaves 	<ul style="list-style-type: none"> • Dark fibre leasing • Wavelength leasing 	<ul style="list-style-type: none"> • Streets • Footpaths • Bridges
Layer 2	<ul style="list-style-type: none"> • Ethernet switches 	<ul style="list-style-type: none"> • Own electronics on the end of fibre • Access is supplied to providers as VLANs, ATM or similar technology 	<ul style="list-style-type: none"> • Traffic lights • Road rules • Signage • Road markings
Layer 3 +	<ul style="list-style-type: none"> • Voice services • TV • Video • Internet Access 	<ul style="list-style-type: none"> • Provides true service to the premises • Ownership and operation customer premises equipment. 	<ul style="list-style-type: none"> • Cars • Trucks • Taxis • Couriers

5.3.2 Open access networks

The “open access” model for the provision of broadband infrastructure is being adopted by hundreds of cities worldwide, and it is the approach that has been used by Wellington’s CityLink network in the CBD. The Council has provided the right of way to CityLink (Layer 0 – trolley bus wires and road corridor), which then manages and owns a fibre-based infrastructure (Layers 1&2) allowing any telecommunications provider to sell its services and applications to consumers over it (Layer 3+).

“Open access” refers to the way in which broadband infrastructure can be managed; it does not relate to the choices of technology. Open access management can be applied at any layer. The open access model challenges the traditional vertically integrated telecommunications model, where there is no separation between the infrastructure operator and the retailer of services. (A

vertically integrated roading model would see the owner of the road toll all the traffic on it and probably own all the taxi services, bus service and couriers).

Vertically integrated models tend to reduce competition because of the high investment cost required for the underlying infrastructure. In this situation a company's investment in its own network is leveraged to provide competitive advantage in terms of the services to its own customers – there is little incentive to dilute that advantage by allowing others to use that network. This can affect the market by:

- keeping prices higher than they would otherwise be, as the cost of core infrastructure required to compete provides too high an entry barrier and multiple networks add cost and risk, and
- limiting the amount of innovation in new services and applications that are offered.

Generally, the long-term public policy goal of having open access infrastructure is to create a market for innovative broadband services and content. By lowering the barriers to entry into the market, open access can achieve:

- a level playing-field for all service providers to compete
- stimulate innovation as providers compete to provide new services
- reduce duplication and exclusive networks.

Open access is strongly supported by many international bodies (including the European Union) and is a common feature of many of the national broadband plans of EU countries and the recent proposals in San Francisco.

5.4 Current broadband situation and outlook

Wellington and New Zealand's current broadband infrastructure and services are limited in comparison with other cities and countries. Outside of Wellington's CBD, broadband typically has low speeds and is asymmetrical (i.e. slower upload speeds than download speeds). Many broadband plans also have data caps, restricting the amount of content that can be sent before additional charges apply.

5.4.1 New Zealand's situation

New Zealand continues to be placed below the OECD average for broadband uptake. Although there has been a significant increase in the number of households with broadband connections, New Zealand is still placed 22nd out of 30 in the OECD. Australia by comparison is ranked 17th.

New Zealand's entire telecommunications infrastructure was passed into private ownership in the early 1990's, with few limitations placed on their operation (see Appendix 2 for a short history of the telecommunications sector in NZ). Throughout the 1990's, the incumbent was the "default" telecommunications option even though competitive networks were established in parts of the country (e.g. Saturn/TelstraClear in some of the major centres and CityLink).

Since privatisation, the incumbent has acted as a private company is expected to – maximising the return to its shareholder. It dominates telecommunications in New Zealand.

Many commentators believe, however, that an outcome of privatisation has been limited ongoing investment in infrastructure – and particularly the infrastructure required to realise the transformative social and economic productivity enabled by broadband.

Although broadband uptake is increasing, New Zealand can be broadly characterised as an environment with:

- significantly lower levels of broadband connections than the OECD average
- broadband plans that are often slower and more expensive than those available in competitor countries
- caps on the amount of data that can be transferred by users, that act as a disincentive to innovation and for creators of original content
- incumbents unwilling to peer (i.e. directly connect their networks) within New Zealand, thereby forcing additional costs onto businesses that need to transmit their services to customers by longer routes (i.e. other national or international routes)
- potential restrictions on the evolution and large scale adoption of innovative applications (such as voice over IP technology¹¹, a basic service expectation for many businesses and individuals today)
- an almost complete absence of investment in fibre to the home or premises.

This is a serious situation that places New Zealand and Wellington at significant economic risk.

5.4.2 Wellington's situation

In terms of broadband services, Wellington City is better positioned than the rest of the country as a whole, although there is a profound difference between the services available in CBD and non-CBD areas. Initial work undertaken for the Council by Prashanta Mukherjee¹² in 2004 established that while Wellington City was well serviced in its CBD, outside of this it lacked access to fast, affordable broadband. The report estimated that this affected approximately 50% of Wellington's businesses, many of which are small to medium enterprises (SMEs) which could benefit from enabling broadband technologies.

The CBD has a competitive environment (largely due to the presence of CityLink) with four fibre optic loops being operated in the central city. Telecom and Cafenet also operate well developed wireless networks within this area (of the 122 wireless hot spots that these two operators have between them, 113 are within the CBD¹³). There is also growing interest from other private sector providers to install wireless connectivity in the CBD.

¹¹ A technology where voice calls are made over a broadband network rather than a telephone network.

¹² Prashanta Mukherjee, "ICT Strategies and Options to support Economic Development", submitted to the Wellington City Council on 2 August 2004.

¹³ Source : Telecom and Cafenet websites, accessed on 13 Sep 2006.

There are fewer competitive offerings outside the CBD. Subscribers have access to the regular Telecom and Telstra commercial offerings, which are detailed below. These tend to be available through normal copper phone lines, with wireless access being provided in only a few locations. Operators like Vodafone have also started offering a low capacity broadband service through mobile phones using their 3G networks, but these tend to be both slower and more expensive than traditional, “fixed line” broadband.

Currently few of the desired connectivity outcomes are widely available outside the CBD:

Outcome	Bandwidth required	Availability outside Wellington CBD	International availability and cost in \$NZ (per month)
Digital media transfer / Institutions	100 Mbps and above sym	Not available	Singapore: \$120. Japan: \$75
Advanced online gaming	20 Mbps asym	Not available	Singapore : \$100 U.K. : \$70
HDTV capability	10 Mbps asym	Telstra: \$133	Singapore : \$65
Video-on-demand	3 Mbps asym	Telecom and Telstra: \$80	Singapore / U.S. : \$45-50
Basic video conferencing	512 Kbps sym	Telecom /Telstra, starting at \$80	Singapore, U.S., and India: \$30-45

Notes:

- Not available: relevant offering generally not available, but may be available on a case by case basis
- International comparisons are from the providers’ websites and industry e-zines, converted at current exchange rates. Comparisons are indicative as plans vary due to restrictions on speed and data transfer allowed.¹⁴

Wellington’s situation, however, also presents some unique opportunities and advantages that can be leveraged:

- it has “broadband intensive” sectors like research institutions and digital media
- it forms a large enough market to interest potential broadband service providers, if entry costs are lowered sufficiently
- public ownership of assets that can potentially be used to lay fibre, such as abandoned pipes, the sewerage networks and the overhead trolley network.

5.4.3 Likely next steps for the Government and private sector

Over the last three months, Council officers have met with a wide range of stakeholders from the private sector and government to develop an understanding of the short, medium and longer term plans of central government, incumbent telecommunications providers and new entrants into the market. A full list of who has been, or will be, consulted is included in Appendix 3.

¹⁴ 1 S\$ = 0.982 NZ\$, 1 US\$ = 1.55 NZ\$, 1 GBP = 2.9 NZ\$, 1 INR = 0.03 NZ\$ 1 € = 1.87 NZ\$

a) Central Government Plans

Nationally, central government has identified broadband as a priority for enabling economic transformation. It has outlined a Digital Strategy, where increased connectivity is one of the three key identified “enablers”.

The Broadband Challenge programme is a major initiative to support the Strategy. It provides contestable funding designed to accelerate the roll out of fast broadband in the regions, helping bring them up to the same level as Wellington’s CBD. \$24 million was budgeted for this initiative in 2006/07 but the government is yet to determine if additional funding will be made available from July 2007.¹⁵ The open access approach underpins the Strategy and is a requirement for applicants wishing to secure funding from the Broadband Challenge.

The other two “enablers” – content and confidence¹⁶, are being acted on concurrently, most significantly via the Digital Content Strategy¹⁷ and the Community Partnership Fund¹⁸.

Other significant government initiatives are¹⁹:

- The regulation of the incumbent through the Telecommunications Act
- Kiwi Advanced Research and Education Network (KAREN)
- Government Shared Network (GSN)

But there is little indication, from the meetings that Council officers have had with a range of officials, of a will for government alone to fund the rollout of high speed broadband network infrastructure around the country. The sheer cost of establishing this fibre network infrastructure to homes and premises is a significant hurdle, and a more likely scenario appears to be regional leadership that builds on the initiatives above, with the possibility of additional seed funding from government as delivered through the Broadband Challenge.

Appendix 5 summarises initiatives in other cities in New Zealand and globally.

¹⁵ Note: \$16 million of a possible \$20 million (after accounting for administration costs) has already been allocated.

¹⁶ “confidence” in this context relates to network security, and New Zealanders possessing the necessary ICT skills and the confidence to use them.

¹⁷ The *Digital Content Strategy* is the government’s five-year vision for “unlocking” New Zealand’s stock of content and providing all New Zealanders with easy access to information that will strengthen national identity and community. It seeks to enable individuals, organisations and businesses to create, access, share, use, preserve and protect a broad range of quality content.

¹⁸ Through the Community Partnership Fund, \$20 million of contestable funding was made available to community groups and organisations who are undertaking initiatives to increase access to computers, increase the confidence of communities in using computers, and in helping to develop local content.

¹⁹ See Appendix 4 for more information on these initiatives.

b) Wellington Regional Strategy

The Wellington Regional Strategy (WRS) has identified broadband as a key enabler of the region's economic growth. Research work for the WRS indicated that investment in broadband, along with fostering international air links, provided some of the highest potential for economic development leverage. Broadband is one of the strategy's seven priorities and is expressed as:

- a vision for broadband
- recognition of the need to urgently implement a strategy for achieving the vision
- an interim target broadband speed of 5 Megabits per second (Mbps), and a final target of removing data transfer speeds as a constraint.

The Council's investigations into broadband are being undertaken within the context of the vision and goals outlined in the Regional Strategy. The rationale for broadband improvement apply in a similarly way to the balance of the region, and investment is already underway through SmartLinx 3 Limited (a public private partnership) to provide core broadband infrastructure using a similar concept to CityLink. The possibility of wider rollout across the region will form an integral part of any planning for changes in Wellington City, and a 'Regional Xchange Forum' has been established by the region's councils for the purpose of co-ordinating broadband initiatives.

c) Likely private sector approaches

In the short to medium term a situation similar to today is likely to prevail. For high speed connections to residents' homes, businesses and institutions:

- the CBD and large clients will continue to have a wide choice of broadband services, but the suburbs and non-CBD residential customers will not
- broadband performance, while improving steadily, will fall short of the level needed to drive transformative economic and social development
- pricing will continue to be a barrier to adoption.

With respect to ubiquitous wireless services in the CBD and sub-regional centres:

- the economics of wireless services mean that several private sector providers are likely to continue to expand this service, particularly in the CBD. Other sub-regional centres such as Johnsonville or Kilbirnie are less likely to see this happen.

Finally, for broadband connections from Wellington to the rest of the world:

- Wellington's international internet traffic will continue to be routed via Auckland. There are three fibre connections between Wellington and Auckland, of which two sell speeds that match what is available through CityLink. In many cases, ISPs²⁰ purchase limited bandwidth on the fibre, sharing this amount between all of their customers.
- the same is true for the international internet traffic to and from Auckland. Wellington's international internet traffic will continue to be restricted by

²⁰ Internet Service Providers.

the bandwidth ISPs purchase either directly from the “Southern Cross Cable” (the one cable available, which directly links New Zealand to Australia and North America), or from larger carriers and brokers. This bandwidth can be expensive, and again, is usually shared, constraining the rapid expansion of “digital trade” between Wellington and the rest of the world.

It is important to note that the private sector is investing in the deployment of some fibre optic infrastructure, and will continue to do so. Generally, this will not be open access. As noted above, discussions have been held with the larger infrastructure providers to develop an understanding of future investment plans.

In the longer term (15-20 years), the private sector may make the investments necessary to provide a closed access, high speed broadband (by replacing copper wire at the end of its technical life with fibre cabling). However, availability and pricing would continue to be dictated by commercial considerations, as it is today, not factoring in any of the social benefits or transformative economic benefits.

d) Summary - “Status Quo” outlook

Neither central government nor the private sectors are focused on delivering a broadband infrastructure for Wellington where broadband is available at the level where it can:

- allow the city to capture the transformative economic and social benefits of high speed, low cost broadband
- enable Wellington City to again be a world leader (in the same peer-group as San Francisco, Seoul and Singapore).

Indications are that this “status quo” outlook is unlikely to change as a result of the government’s regulation of Telecom or from a change in investment policies of major telecommunications providers.

The Council therefore faces two broad options:

1. Leave the roll-out of broadband to the market, allowing the status quo scenario described in this report to play out. This would probably deliver some form of broadband across most of the city in the long-term, but not at the desired level, or

2. Intervene in some way, to alter the status quo scenario. This could be in a similar way to the *InfoCity* strategy in the mid 1990’s or the initiatives being developed by other international cities. It would involve the Council again facilitating or catalysing the development of a new open-access network.

5.5 Recommended Broadband Vision for Wellington

Based on international evidence, there appear to be significant benefits to both Wellington residents and businesses if the city is able to overcome the current constraints on broadband. Accordingly, the Council’s role should begin with

developing and owning the broadband vision for the City and preparing a plan for the community to achieve it.

By its nature, discussions around broadband tend to revolve around speeds, technology choices and internet access. Officers consider that a better approach is to keep the focus on the desired outcomes for the City, and develop a vision for broadband connectivity that reflects this. The following vision is recommended:

"By 2012, all of Wellington City will have affordable access to an interactive and open broadband network capable of supporting applications and services using integrated layers of voice, video and data, with sufficient two-way capacity in the city, and out to the world, to meet the ongoing information and communications needs of the city's residents, businesses, investors and institutions."

This is broadly in line with the objectives being pursued by other leading city governments in places like Amsterdam, Seattle, Stockholm, Brisbane and Singapore. This vision incorporates the critical elements of:

- open access – to stimulate competition among services, not networks
- symmetrical capacity– to allow interactive two-way communication at the same speeds and capacities
- very high capacity – to support advanced services, and effectively remove capacity as a constraint.

Examples of ways in which this vision could help make Wellington a better city to live and work are:

- Engineering consultants can work on a complicated engineering drawing from home. Collaboration with other engineers and business partners across the country is enabled by the entire team seeing the same drawing via their networks and high quality monitors.
- Digital content professionals can balance professional and family responsibilities by working from home two days a week. Using the network, work files from their office can be summoned and sent quickly.
- The City Council meets on an issue that affects neighbourhood businesses. Many citizens attend the hearing over two-way video—from home and from community centres.
- Elderly patients living alone can get answers to medical questions and quick diagnostics through video nurse services linked to web cameras.
- The children in an immigrant family do not yet speak English. They are able to go to their local school, yet take classes in their native language using a video conference connecting several New Zealand or even international schools.

- Utility meters are linked through broadband and can provide users with information about their own energy use, enabling energy savings of 5-15%. In emergencies they could lower energy use from non-essential devices.
- Residents, as a whole, having increased access to electronic information from around the world, increasing their quality of life.

5.6 Why would the Council have an additional or new role in broadband?

The nature of broadband infrastructure, and the magnitude of the potential benefits for Wellington City, strongly suggest that the Council should take a proactive role in facilitating its provision.

The Council occupies a unique position with its focus on the long-term interests of the city's economic and social development. It considers these interests over very long time horizons (50 years) unlike private sector infrastructure providers. Local government has always been concerned with access to basic services, and it has been involved in actively delivering these where necessary, including water, sewerage, roads, (and electricity and gas for the majority of the city's existence until their recent privatisation). The Council is also in a position to facilitate discussions and partnerships between different sectors of the city that might not otherwise meet to discuss common goals.

With respect to the private sector there are a number of factors that lead to the conclusion that local government will need to take a leading role in ensuring a high speed, affordable network is present throughout Wellington:

1. Scale of the investment required. Undertaking the civil works to lay fibre and install the other technology necessary to create a broadband network requires an investment only likely to deliver a return over a period of up to twenty years, whereas a telecommunications company would typically be looking for a return over a three-to-five-year period. The difficulty created by the need for a high initial investment is exacerbated by the risk of achieving a critical mass of customers in the face of competition from other, similar networks.
2. Likelihood of cherry picking. The private sector will probably invest in fibre to the home over the medium to long term. But this is likely to occur in a piece meal manner, with cherry picking of the most lucrative markets within the city, risking a digital infrastructure divide and leaving the public sector to supply only the least economic parts of the network. If the public sector decides to ensure an open access network across the entire city it can average the costs of roll out between high return and lower return parts of the city.
3. Inability to monetise many of the economic development and social benefits. Many of the benefits that will arise from speeding up the roll out of a high speed network are very difficult for the private sector to

capture. Benefits to the education, health and community sectors in particular may not be directly translated into monetary savings or may have long pay back periods that the private sector is not prepared to factor into its business case when deciding to invest. The value that a step change in economic development has for the city as a result of high speed broadband is also difficult for the private sector to capture.

4. Risk – the chicken and egg problem. Broadband service and content providers may be reluctant to invest until they are confident that the network will be built, while telecommunication companies may be reluctant to build the network because they are not sure that the services and content will be there to drive customer demand.
5. Sunk investments - The major telecommunication companies have already made large investments in the existing copper communication network and may be reluctant to invest in new networks that lower the value of their past investments. Already this investment is worth less than in the past with, for example, competition from cell phones, and the unbundling of the local loop. Incumbents are currently incentivised to delay the roll out of fibre to maximise the return from their sunk investment.

These points illustrate similar issues to other network infrastructure, where a single, shared infrastructure, often publicly owned, is the most appropriate solution, rather than multiple privately-owned networks.

For these reasons, if the Council is focused on capturing the significant benefits (and avoiding the risks) for the city that arise from being an early adopter, it will also need to play an active role in broadband connectivity.

5.7 The nature of the Council's potential role in broadband

Ever since the *InfoCity Strategy*, the Council has continued to have roles in broadband. The Council has been:

- an advocate: Through such mechanisms as its submission to the Government's Digital Strategy, the Council has been an advocate for open access, fibre-based networks being made available across New Zealand.
- a facilitator: Council staff currently work closely with broadband providers to facilitate the rolling-out of new broadband networks across the city.
- a funder: by contributing both to CityLink in 1995 and Cafenet in 2001.

In determining the Council's potential future role in ensuring broadband infrastructure is provided, a number of preliminary assumptions are made based on the previous discussion. Council would need to:

- support a fibre-based network – to provide for technology that will “future proof” the city and ensure that the capacity constraint is removed
- support an open-access network model – as a prerequisite to stimulating competition and innovation in the provision of services and applications.

- ensure universal access (or close to it) – providing affordable, high speed broadband connectivity to every household and business across the city
- act as an honest broker – taking a role in facilitating partnerships between different stakeholders in the community
- adopt an approach that balances the need to have a competitive broadband infrastructure with the potential costs involved.

One of the simplest roles the Council could take on, and which a number of territorial authorities in New Zealand are already doing, is to use its role as regulator/policy maker to encourage broadband roll-out. For this reason, it is recommended that officers look further into policy changes that could be made to help achieve the vision (e.g. changes to the Subdivision and Roding codes of practice, etc.).

5.7.1 Staged approach

The ideal broadband scenario is citywide deployment of a fibre-optic network, where fibre is used for both the backbone and the last mile to every household and premises in the city. This, however, comes at a substantial overall cost so although working towards this ultimate outcome is recommended, a staged approach is suggested.

Stage 1: Backbone and “MUSH” spurs

The first stage would be the deployment of a fibre backbone network across the city. It would connect major council buildings, libraries, medical centres, schools, major private sector businesses, etc. This would involve approximately 100 km of fibre, and preliminary estimates of the cost of this vary between \$10-30 million, depending upon the extent to which the overhead trolley network, existing ducts, and opportunities from other road opening activity can be used (in the situation where overhead cables are used, officers will also examine long term plans to underground the cables).²¹

It should be noted that, although costs are given, they are very preliminary and a detailed technical study would be required before a final plan is developed. Further, the costs given are costs for the total project, of which Council’s direct investment may be only a part, and revenues to offset these costs are expected²².

Stage 2: Fibre to the Node (FTTN) + Copper or Wireless Last Mile

Once the backbone is in place, extensions can be made from the backbone to a point where it can meet an open access last mile link (which could be wireless, fibre, or copper). The length of the copper loop has been noted as a significant barrier to obtaining high broadband speeds. FTTN can help shorten the copper loop and make fast VDSL broadband connections available as an interim solution. Preliminary estimates of the cost of doing this vary between \$5-10 million (in addition to Stage 1) for the entire city.

²¹ This would be similar in extent to the network currently being built in North Shore City in partnership with Vector.

²² It should also be noted that such networks have proven to be very valuable assets – as an indicator, the CityLink network, which was set up with \$85,000 in 1995, has recently been sold for \$24 million.

It is likely that the presence of a fibre backbone or FTTN would lower the barriers to entry for wireless providers over the last mile. This would be likely to result in widespread development of wireless solutions (possibly involving some cherry picking on the part of private providers). As noted earlier in the paper, foreseeable technologies indicate this is a medium term solution and ultimately fibre to the home will be needed. It could also be an option for the Council to invest directly or with partners in wireless last mile connections.

Stage 3: Fibre to the Home (FTTH)

Fibre to the Home (FTTH) and Fibre to the Premises (FTTP) includes the extension of fibre optic cable to customers. The cost of running fibre down streets and roads is significant, since this would involve approximately 1000 km of fibre to ensure a single pass of all streets and roads in Wellington City.

Cities internationally that are rolling out FTTH are typically financing the investment through some or all of public-private partnerships, contributions from central government and innovative approaches to mortgage financing/loans for individual households or businesses (i.e. to enable customer owned fibre/copper).

It should be noted, that this final stage may not be necessary. The ultimate objective is the availability of a network that can deliver performance that removes speed as a constraint. Although it currently seems very unlikely, investigations may show that technologies other than fibre will be able to achieve this.

5.8 The Council's role in demand initiatives

The economic and social transformation envisaged will require good uptake of the broadband infrastructure. In other international examples demand side initiatives have been developed in parallel, along with initiatives focused on ensuring communities and individuals have opportunities to access and become skilled in using ICTs.

The government's Digital Strategy recognises there are three enablers in getting the response to ICT right – Connection, Content and Confidence:

“Connection is necessary but not sufficient – it simply provides the means. Confidence gives us the skills and a secure online environment, whilst accessing or creating Content provides a compelling reason to make it happen.”²³

The two completed components of the Council's ICT Policy fit with the governments identified enablers of “content” and “confidence”. The e-Community component directly links to “confidence”, with its focus on ensuring disadvantaged people and communities are able to access and receive training on new technologies. The e-Democracy component contributes to content by providing web-based facilities for people to participate online and provide content that can be shared with the Council and others in the community. The community information held by the Council's libraries, archives and other

²³ p10 of the Digital Strategy.

cultural entities (i.e. the Museum of Wellington City and Sea, the City Art Gallery) provide additional drivers for making content accessible.

Council officers are working with potential users of broadband enabled services to understand further how the Council could encourage this type of demand.

Currently, two initiatives are being investigated:

- A pilot project, initially connecting seven Wellington schools with a very high capacity link, which will look at shared learning between schools through multi-casting and video conferencing facilities
- A project by ICT Capital aimed at stimulating ideas for effectively using broadband infrastructure.

Central government agencies and private companies are also initiating new applications and services that require broadband. Further initiatives will be explored by Council as part of the project, in the health, energy and education sectors.

6. Proposed Next Steps

6.1 Community and stakeholder consultation and engagement

Significant community consultation on broadband has already occurred through the Wellington Regional Strategy. The Draft Annual Plan processes for 2007/08 and 2008/09 will offer further opportunities to consult, with financial projections as part of the 2008/09 Draft Annual Plan consultation in April 2008.

During the development of this report, extensive consultation has occurred with stakeholders. This has included all incumbent telecommunications companies, new potential entrants into the market, major public and private sector users of a high speed broadband network, a range of consultants that operate in this sector, key government departments and influential community leaders (a full list of stakeholders is provided in Appendix 3.). This report has been peer reviewed by an independent telecommunications consultants, Prashanta Mukherjee and Jamie Horrell.

While leadership of the project will clearly stay with the Council, an ongoing inclusive approach is planned:

- stakeholders, especially potential technical partners, will be encouraged to work with Council to develop implementation options
- Wellington business and community stakeholders will be engaged through a Stakeholder Group, which will act as an expert review group and as champions of the project. This group will incorporate the offer of assistance by Rod Drury and Sam Morgan when they appeared as a deputation to the Council in February 2007
- ongoing engagement with key government agencies will continue, including the Ministry of Economic Development and the Department of Prime Minister and Cabinet

- a close linkage to other developments in the Wellington region will be maintained through the existing Regional Xchange Forum, and planning will allow for wider rollout of solutions across the region.

6.1.2 Request for Concept

The next stage of engagement is to ask for expressions of interest from industry partners through a Request for Concept (RfC) designed to elicit input from them on how best to implement the Council's broadband vision. This will include consideration of the most appropriate business model, the role of Council and other stakeholders, financing options and technical details.

It will reflect the assumptions outlined to guide Council's role in broadband connectivity. Specifically these are a commitment to:

- a fibre-based solution with the option of wireless last mile as an interim solution
- an open access network
- universal access for the city (95%+ of premises and households)
- explore innovative financing solutions including public/private partnerships
- a staged approach for the roll out
- Council maintaining control of the broadband deployment/vision to ensure that the economic development and social benefits of the infrastructure are delivered for the benefit of the city, its residents, businesses and institutions.
- focus on infrastructure rather than services.

7. Timeline

If Council adopts the recommended broadband vision for the city, and agrees that Council has a key role in developing a plan for the implementation of that vision, officers envisage the following next steps:

Date	Task
March 2007	Form an Expert Reference Group drawn from key business, government and community stakeholders. This group will provide high level expert advice and serve as champions.
March 2007	Release a Request for Concept to elicit help from potential industry partners in the design and financing of the broadband network. It recognizes that there is likely to be a greater variety of feasible options available if these are generated by a set of industry participants, rather than internally by the Council.
April 2007	Undertake community consultation tying-in with the Draft Annual Plan consultation.
June 2007	Report to SPC on the: <ul style="list-style-type: none"> - Outcome of the RfC process - Proposed approach to achieving the vision, drawing on the information provided by the RfC

8. Conclusion

Broadband is becoming a fundamental infrastructure for cities that compete globally. Businesses, investors and skilled workers will soon expect that a city has affordable, very high speed, universally available broadband infrastructure in much the same way that they now expect cities to have potable water, sewerage systems, reliable energy supplies and suitable transportation systems. This underlying infrastructure will be considered a given, and residents, visitors and businesses will instead be focused on the range and cost of services that are offered over this new layer of infrastructure.

There is significant potential for broadband as an enabler of economic and social transformation, to establish Wellington as an internationally competitive city for knowledge workers and new economy entrepreneurs.

The broadband infrastructure required for achieving this vision is unlikely to be provided by the private sector within an acceptable timeframe. Council will have to play a role in ensuring its timely provision. At the very least this will require the Council to develop and own a vision for broadband connectivity and develop and own the plan for the community to achieve that vision. It is further recommended that, in conjunction with other stakeholders, the Council investigate a role in provision of an open access network using a staged approach.

In summary:

- Broadband is about much more than fast internet access – it is an enabling communication and information transfer technology and the recommended objective should be to remove current capacity constraints
- The availability of fast, cheap broadband is likely to have a significant impact on economic development and quality of life for residents.
- Fibre optic cable appears to be the only technology that can deliver the capacity required – fibre to the home and premise should be our end objective.
- A range of technologies will contribute to a high capacity network, wireless for example can allow significant mobility benefits.
- Our current network is outdated and slow, and rapid action is required to remedy this for Wellington to remain globally competitive (and preferably at the forefront)
- Current providers have few plans for significant new investment because of likely risks and return periods. There is a solid case for the Council to investigate a role in the provision of the core infrastructure as it does for other network infrastructure.
- That role should be limited to owning a right of way and possibly fibre cable. It should not extend to delivery of services over that network.

Contact Officers: *Paul Desborough, Manager, Strategy Unit, Bryan Patchett, Senior Strategic Adviser and Adele Gibson, Senior Policy Adviser*

Supporting Information

1) Strategic Fit / Strategic Outcome

This report supports Council's Economic Development Strategy. It contributes to the Council meeting the following outcomes:

Outcome 3.4 Better connected

Outcome 3.5 More prosperous

Outcome 3.6 More competitive

Council having a role in broadband also contributes to the Council meeting its identified strategic priorities for 2006-09 – particularly in contributing to the implementation of the Wellington Regional Strategy, which identifies broadband as one of its seven priorities.

2) LTCCP/Annual Plan reference and long term financial impact

The project comes under activity 3.4.1 – Facilitator: Information and Communications infrastructure. This project does not currently have a budget. It is likely that a budget will not be considered until the 2008/09 Draft Annual Plan deliberations.

3) Treaty of Waitangi considerations

There are currently no Treaty of Waitangi considerations. Mana whenua will be consulted with in the ongoing stakeholder engagement.

4) Decision-Making

This is currently not a significant decision.

5) Consultation

a) General Consultation

The consultation undertaken to date has been detailed in Section 6 of the report. General public consultation is scheduled through the 2007/2008 and 2008/09 Draft Annual Plan consultation processes.

b) Consultation with Maori

Mana whenua will be consulted with in the ongoing stakeholder engagement. Maori will be consulted through the 2007/08 and 2008/09 Draft Annual Plan consultation processes.

6) Legal Implications

Council's lawyers have not yet been consulted on this issue. Advice will be sought during the development of the Request for Concept, if this is agreed to by the Committee.

7) Consistency with existing policy

This report is consistent with current policy – as it will be replacing the InfoCity Strategy, which sets out the role the Council has had in facilitating access to broadband in the city.

Definition of Key Terms

ADSL (Asymmetrical Digital Subscriber Line) – This is the most common fixed connection for broadband and it uses the existing copper lines. It enables faster data transmission over telephone lines than a conventional dial-up modem can provide. The asymmetric nature of the connection means that the downstream speed is faster than the upstream speed.

Backbone network - Transports massive volumes of data traffic around cities, and between cities and countries. There is no single backbone network, rather many networks in which service providers exchange traffic with other providers.

Backhaul - The process of transmitting data from multiple dispersed points (e.g. households, businesses, cell phone towers) to the central telecommunications network, usually using fibre cables.

Bandwidth - The rate at which data can be transmitted through a telecommunications system. Bandwidth is defined in bits per second (bps).

- 1000 bps = 1 Kbps (kilobit per second)
- 1000 Kbps = 1 Mbps (megabit per second)
- 1000 Mbps = 1 Gbps (gigabit per second)

Dark fibre - The fibre optic infrastructure currently in place but not in use. Optical fibre conveys information in the form of light pulses so the 'dark' means no light pulses are being sent. Dark fibre can also refer to infrastructure that is in place but not yet ready to use.

Dial up - Internet access involving a modem-to-modem connection across telephone lines between the user and the internet service provider (ISP). The ISP then routes the connection to the Internet. Unlike broadband access, dial-up access is a temporary connection, because either the user or the ISP terminates the connection. The maximum theoretical connection speed is 56kbps.

High speed broadband - A broadband service which delivers data at rates capable of supporting next generation services, such as interactive video, broadcast-quality television and videoconferencing.

FTTH/P (Fibre to the home or premises) – An extensive network of fibre optic cabling that reaches every home or premises, allowing maximum speeds.

FTTN/C (Fibre to the node or curb) – A network of fibre optic cabling that reaches to street cabinets within a few hundred metres of each premises or house, and allows much faster speeds to be delivered over the last few hundred metres of copper wire cables.

Local loop unbundling – Opening the final few kilometres of copper cabling, from the telephone exchanges to each house or premises, to competition so that any telecommunications company can run its services over the copper wires.

Open Access – A system that allows any telecommunications operator to provide its services and applications over the broadband infrastructure – including the backbone, and the connections to each home or premises. This is in contrast to vertically integrated systems where the owner of the infrastructure can restrict who runs services over it and therefore prevent competition.

Upstream/upload and downstream/download – This refers to the speed of the broadband connection in each direction. Downstream/download refers to speeds from an external point to your Internet connection. Download is typically faster than the upstream speed (from your Internet connection out to the rest of the Internet).

A Short History of the Telecommunications Sector in NZ

1.1. The Post Office Era

Up until 1987 telecommunications in NZ was the responsibility of the New Zealand Post Office. This was a full Government department with its own minister and driven by a public sector "universal service" philosophy. The basic service was voice calling with high charges for national and international toll calls. The NZPO developed a sound "PSTN" (public switched telephone network) but it was perceived to be a bureaucratic and inefficient operation with little innovation and a poor customer service record.

The winds of change began to blow in 1987 when NZPO was divided into three State Owned Enterprises (SOE); the telecommunications division re-emerged as the Telecom Corporation of New Zealand.

1.2. Privatisation

After three years operation as an SOE, Telecom (as it was now known) was put on the market; its subsequent sale for \$4billion was NZ's largest single transaction up to that point. Public concern over the continuation of local free calling was allayed with the creation of the "KiwiShare" which saw Telecom committed to continuing to provide universal service.

New services such as cellular phones were added in the late 1980s and in the mid-nineties Xtra was launched as Telecom's ISP (Internet Service Provider). Customer service improved dramatically.

One key aspect of the sale was that Telecom was complete and the entire infrastructure passed into private ownership.

1.3. InfoCity Strategy

In Wellington, a number of key initiatives began to take place under a WCC strategy called "InfoCity" that was to provide a key aspect of the city's ongoing digital competitiveness. It recognised that as a result of efforts to link WCC buildings with fibre optic cable, a very high-speed data network could be created in the city at a far lower cost than the traditional telco approach. This was done by utilizing the city's overhead trolley bus cable network.

This led to the creation in 1996 (with a WCC cornerstone shareholding) of CityLink, now NZ's leading open access fibre optic network operator. Other InfoCity initiatives included the 20/20 Trust, e-Vision, Smart Newtown and City Net (one of the world's first dial-up Internet service providers).

1.4. Wellington in the 90's/00's

In addition to these WCC activities the Wellington region saw other initiatives over the next ten years including:

- Saturn Communications (later TelstraSaturn then TelstraClear) built an overhead cable "HFC" (Hybrid Fibre Coaxial cable) network throughout Wellington City to deliver a "triple play" of subscription TV, Internet Access and Voice Telephony to Wellington households with a high uptake rate. Telecom responded on a street by street basis offering lower monthly rates to consumers with access to a competitive network.
- United Networks (later Vector Communications) saw an opportunity with their purchase of Wellington's gas reticulation network to lay fibre linking the Hutt Valley with parts of the Wellington CBD. This fibre is available for corporate use and is not currently open access.

1.5. The Impact of the Internet

With the global rise of the Internet in the mid-nineties, demand grew for households to have Internet connections in addition to their usual voice services. Many of New Zealand's original ISPs grew out of Wellington's early on-line efforts including Actrix, Paradise and NetLink.

From 1998 onwards a variety of residential broadband access technologies became available in Wellington including wireless, ADSL and cable modem. These technologies allow faster connections and free up the fixed telephone line. Today people are leading increasingly digital lives and turn to the Internet for their news, entertainment, education, employment and social needs. Wellington has a thriving digital economy and features many of New Zealand's leading digital content creation businesses.

This pervasive growth in the need for fast ubiquitous Internet access has led to increasing dissatisfaction with all current forms of broadband with the exception of high-speed fibre connections.

1.6. Telecom's Privatisation

With its new focus maximizing shareholder value Telecom has developed into a very profitable multi-billion dollar business dominating electronic communications in New Zealand. It has used the infrastructure base it started with to offer a broad suite of services to NZ homes and businesses and has delivered very high returns to investors.

Telecom has been careful to limit its infrastructure investments to those required to keep its platforms competitive but it has been lucky to have the protection of its "bundled" vertically integrated structure. Telecom has used this position to meet challenges right across its range of service offerings from mobile (Bell South/Vodafone) fixed line (Clear, Telstra, Saturn etc) and the Internet.

The challenge Telecom now faces is for its offerings to remain competitive. It needs to spend around \$1.5 billion nationally to push more fibre out into its network to deliver the future services that consumers are starting to demand.

1.7. Keeping Pace

Over the last decade the digital revolution has moved from the corporate and academic world into everyone's day to day lives. Consider this recent comment.

"The growth of the Internet and its corresponding network traffic has been immense. In 2006, 20 networked homes produced as much network traffic as the entire Internet did in 1995. And this is only the beginning – network loads could grow 200, 300 percent." - John Chambers, chairman/CEO of telco supplier Cisco.

Familiar technologies such as the film camera have virtually vanished in less than a decade; teenagers carry cellphones with more video capability than a news crew of just ten years ago. And all of this content requires networks to travel over. Just like the location of key transport hubs shaped development in the last two hundred years so digital infrastructure is shaping the 21st century. Some countries have taken an early lead.

South Korea has a very high uptake of broadband, and countries like Canada and Sweden have initiatives to push fibre optic cables out into all their communities. It

has recently been estimated that the global services market in the US alone will be \$300 billion by 2010; many of these dollars will be spent in areas like healthcare, lifestyle and entertainment.

1.8. Telecommunications Reform

The New Zealand Government has been increasingly concerned that NZ is not growing as fast as our trading partners in our uptake of broadband and our adoption of digital services. Government has put in place a number of strategies under the broad heading of the NZ Digital Strategy.

These include:

- Project Probe – Extending broadband to provincial and rural NZ (in Wellington's case Makara and the Ohariu Valley)
- The Broadband Challenge – Developing Urban Fibre Networks
- The Community Partnership Fund – Supporting digital content and confidence building initiatives.
- The Digital Content Strategy – Ensuring NZ's content (especially culture and heritage) is available on-line

And following a telecommunications "stocktake" in early 2006 the Government introduced the Telecommunications Amendment Bill which is the most fundamental change to the structure of telecommunications in NZ since 1987.

The key outcomes of the new legislation are:

- The "operational separation" of Telecom into distinct wholesale, retail and network "businesses" that are required to work equally with all parties.
- "Local Loop Unbundling" (or LLU) – replicates a common feature of overseas telecommunications markets in the requirement for the incumbent telco to provide access to its copper "final mile" network to all parties at a fixed price.
- "Naked DSL" – this is the requirement to provide competitors access to a Digital Subscriber Line broadband connection without the need for voice line as well.

These requirements are currently being finalized and it is hoped they will stimulate a broad range of initiatives and innovations in the market. Telecom for example has said that it is developing an investment plan to resolve broadband performance issues. Telecom will announce the results of a fundamental review of broadband services on 30 April 2007.

1.9. Looking Forward

To meet the ever-growing demand for capacity on digital access networks only one telecommunications infrastructure technology consistently offers the capacity to deliver and that is "Ethernet" over fibre optic cables. The trend is for fibre to move from the current CBD circuits out to key suburban locations and eventually to the household itself.

Key Stakeholder List

Type	Organisation
Technical Group	Telecom
	Telstra
	Cisco
	IBM
	Ericsson
	Vector Communications
	Vodafone
	Citylink
	FX Networks
	Araneo
	Smartlinx
	Digital Air
	Central Government Stakeholders
MED	
DPMC	
NZTE	
ACC	
Ministry of Education	
Ministry of Health	
Digital Strategy Advisory Group (DSAG)	
Wellington Stakeholder Group (Opinion leaders and champions)	CCDHB
	Greater Wellington (WRS)
	Massey University
	VUW
	Wellington Secondary Schools
	TUANZ
	Internet NZ
	Vision 2020
	NIWA or other CRI
	Infratil
	WETA
	NZ Property Council
	NZ Stock Exchange
	Wellington Chamber of Commerce
	Trademe
	Xero/Wellington 2.0
	Tindall Foundation
	OnTrack
	Tenths Trust & Ngati Toa
	Vector Networks
Positively Wellington Business	

Government Initiatives

Significant government initiatives linked to The (New Zealand) Digital Strategy (www.digitalstrategy.govt.nz) are:

- *The regulation of the incumbent through the Telecommunications Act* (including local loop unbundling, structural separation and making “naked DSL” available). As of now, the exact impact of Government’s regulatory decisions on broadband performance and affordability is unclear. It should be noted that most commentators are expressing doubts about any rapid transformation of the broadband market, as the local loop unbundling (i.e. making the loop “open access”) does not provide an incentive for the incumbents to invest in extensive new fibre infrastructure in the medium term, or even necessarily provide a stronger “backhaul” network to support this primarily copper local loop.
- *Kiwi Advanced Research and Education Network (KAREN)* – a next generation telecommunications link providing 10 Gbps connectivity between New Zealand’s tertiary institutions, research organisations, libraries, schools and museums, and the rest of the world was launched in 2006.

KAREN enables those connected to:

- exchange large volumes of data quickly
 - gain access to large scale national and international infrastructure, and
 - collaborate better on research and education projects at a distance.
- *Government Shared Network (GSN)* – This is a new network that will enable government agencies to share information and deliver services at higher speeds and more cost effectively.

It provides:

- A secure fibre-optic network connecting government agencies in Wellington
- A wide area network (WAN) connecting government agency sites anywhere in New Zealand on a secure voice and data capable network.
- Services including internet access, IP telephony, secure remote access and offsite data storage.

Initiatives in other cities in NZ and key cities globally

Auckland

The Council has agreed to take a facilitative role, resolving that Auckland City's involvement "should centre on activities, which primarily have a catalytic effect, enabling the market to operate in a manner, which ensures the delivery of more competitive broadband offerings with the objective of pursuing access to affordable broadband for most Auckland residents by September 2010."

It has chosen to be proactive in this role and is funding the development of business cases for specific projects looking at:

- WIFI projects focused on the CBD and CBD fringe
- MUSH network focused on the CBD and broader Isthmus,
- Council laying ducting when future road works occur
- Micro-trenching to deploy fibre networks
- Content initiatives to encourage uptake of broadband.

For 2006/07 \$450,000 has been allocated to work on these business cases and in 2007/08 an additional \$600,000 has been set aside. Further funding is expected to be required as the business cases are developed and decisions are made. At its August meeting the Committee discussed specific partnership options. These discussions were confidential.

Smartlinx3 Limited (involving Hutt, Porirua and Upper Hutt cities)

Smartlinx 3 is deploying an open-access mixed fibre and wireless network in Hutt City, Upper Hutt and Porirua. The core of the network is intended to be fibre across urban and suburban areas, with intention to use licensed and unlicensed spectrum wireless to deliver full community coverage. This network will extend Smartlinx3's existing network in the region.

The project originated as part of a strategy to retain (and attract) creative and innovative businesses in the Hutt, by filling gaps in the connectivity available to them. The strategy was to develop a community initiative from the long term sustainability perspective.

The focus is on users at the upper end of the bandwidth market. In a manner similar to CityLink, the network will consist of fibre based high speed broadband available directly to high end users like tertiary and research institutions, as well as business and community organisations. Wireless is being used as a complementary technology. The presence of business clusters has helped in the physical deployment. Connections are available to residential users, but the current pricing and speeds may effectively make this a very small part of the business.

The project would have continued irrespective of the Broadband Challenge funding – however, the pace is now being stepped up. A large part of the coverage is expected to be complete in about 2 years.

The fibre deployment has included:

- allowing use of council controlled abandoned pipes where feasible
- laying ducting when council road works occur,
- use of council network for CCTV surveillance, and
- micro trenching to allow laying of fibre

Inspire Networks (Palmerston North)

Inspire Networks has been laying duct and/or fibre around Palmerston North for the last several years. This has been achieved largely due to an agreement between Inspire Networks and the local roading contractors – who have agreed to lay duct whenever they are digging trenches in the road.

The Council is involved at a minimal level, as they have agreed to allow Inspire Networks to lay duct in the trenches dug as part of their upgrade plan for the city's water mains.

Inspire Networks is open access, and sells both “lit” fibre (100Mbit and 1Gbit) and dark fibre.

Canterbury Development Corporation (CDC)

Christchurch City Council's investment company, Christchurch City Holdings Ltd, in its Statement of Intent for the year ending 30 June 2007 has signalled a likely move into infrastructure investments that will support a knowledge-based economy. The company plans to move beyond traditional hard infrastructure of roads, rail, water, electricity, ports and airports and into ICT infrastructure.

The bulk of the work on broadband is being done by Canterbury Development Corporation (CDC), and Christchurch City Holdings (CCHL). CDC is the economic development arm of Christchurch City Council, and CCHL is the investment arm. CDC have been working on broadband for some time now and handed it over to CCHL two or three months ago. They now work collaboratively on the project.

The strategic focus is, in the short term, on developing the higher end of the bandwidth market, i.e. 10-15 Mbps. The intent is to facilitate investment in the higher end of the market, in particular in areas where the private sector is not likely to act. The belief is that for the next two to three years, the existing providers will offer sufficient capacity at the lower end, and that the development of wireless will bridge demand.

The cost for providing fibre to 80% of the residents has been estimated at \$600-700 million. This does not appear to be under serious consideration. The application proposes the primary focus will be on the council, universities, schools, health and business tenants.

In terms of technology, both fibre and wireless are seen to be necessary and complementary. A policy to make it compulsory to lay new ducting in the event of any new road works or sewer works appears to be under consideration.

Vector Communications and North Shore City

Vector Communications working with North Shore City Council proposes to build a 38 km extension to their existing fibre network that will connect directly to schools, libraries and council offices in the North Shore region. Universities, hospitals and businesses will also have access to the network. The network is intended to be a pilot for similar proposals in the Auckland Region.

Hamilton City Council

The application proposes to improve and extend the fibre network owned by the Hamilton City Council and currently used for inner city security. As such the Broadband Challenge has acted as a catalyst to join up the dots and make the best use of existing assets, and will deliver cost effective broadband to schools, other educational institutions, health providers, council organisations and local business. The proposal sets up a Network Owner - Hamilton Urban Fibre Network (UFN), made up of local authorities and government bodies that will own the network, and lease it to a private entity Lite-Up, who will operate and manage the network.

Nelson Marlborough Inforegion

The Nelson Marlborough Inforegion (a regional broadband enabling organisation) proposal is to expand fibre capability to Marlborough's main population centres, and to establish internet exchanges in Nelson (NIX) and Marlborough (MIX) to provide local and national interconnect to local high speed network users. The funding is sought to create a network operating company to set up and run the Internet exchanges, and to create fibre links to connect Picton to Blenheim.

Amsterdam

The CityNet project has begun the roll out of fibre to all 420,000 homes and businesses over the next 7 years at a cost of NZ\$ 580 million. The first 40,000 households will be connected by the end of this year. The network will be run on open-access principles and is a joint venture between the Amsterdam City Council, five large Amsterdam housing corporations, and ING Real Estate Investment Management (one third each invested equally).²⁴

Brisbane

The city and the Queensland government have completed the business case for their Project Vista roll out of FTTP to all Brisbane households. This will be at a cost of NZ\$550m. In addition wireless trials for deploying nodes in government buildings and other public locations are underway and Telstra is set to install 45 wireless broadband sites.

Philadelphia and San Francisco

Both cities have signed agreements with Earthlink to build ubiquitous WiFi networks throughout their cities with speeds of 1Mbps. In Philadelphia the roll out cost is expected to be NZ\$20 million for 135 square miles of coverage. Earthlink is renting space on 4000 lighting poles around the city. It will provide subsidised Internet access for low income families and share revenue with the city. Most residents will pay \$20/month. Both networks will operate on open-access principles.²⁵

San Francisco

In addition, San Francisco will complement this with Google who will provide a slower 300Kbps free wireless service throughout the city. San Francisco City Council passed a resolution to evaluate the costs, benefits and technical issues associated with providing FTTP in conjunction with their planned upgrading of the sewer system²⁶, and in the resulting January 2007 feasibility study²⁷ found that building a municipal fibre to the premises (FTTP) network would facilitate economic development.

²⁴ CityNet Amsterdam: Fibre to the home is becoming a reality from European Telecoms Sector Update, 24 February 2006, ING Wholesale Banking.

²⁵ EarthLink, Google team in S.F. Wi-Fi bid, Cnet News.com 22 February 2006

²⁶ City and County of San Francisco Resolution, 5 October 2004

²⁷ "Fiber Optics for Government and Public Broadband: A Feasibility Study", Prepared for the City and County of San Francisco, January 2007 by Columbia Telecommunications Corporation