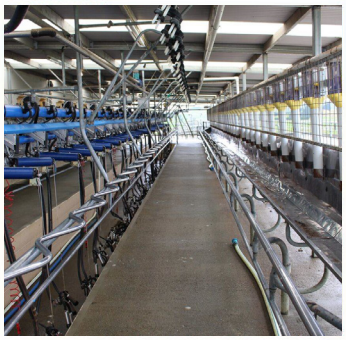
Southland

Southland District Council
People First
Te Rohe Pōtae O Murihiku

Invercargill
CITY COUNCIL

GO RURAL CITY LIVING
DISTRICT COUNCIL

# Digital *Strategy* 2015

Venture Southland
www.venturesouthland.co.nz

# **Strategy** *Overview*

## **Strategic** *Vision*

*Digital connectivity drives community and economic development throughout Southland.*

***Connection:*** *Southlanders can enjoy a world-class, affordable, ubiquitous telecommunications service at a universal price.*

**Capability:** *Southlanders have the skills, knowledge and security they need to leverage the benefits of broadband and mobile connectivity.*

**Content:** *Southlanders benefit from improved services, efficiency and innovation from digitising and sharing content, undertaking real time monitoring and leveraging the potential of big data.*

## Goals

***Connection:***

- Fibre Everywhere: By 2030 all homes and businesses in Southland, rural and urban, are serviced by Fibre Broadband
- LTE Everywhere: By 2020 all inhabited parts of Southland have 4G LTE mobile cellular service, or better
- Government and business investment is coordinated to enable future proofed and affordable solutions which leverage existing broadband and mobile infrastructure
- ICT is recognised by Local Government as fundamental infrastructure underpinning economic performance and community cohesion in the same way as roads and energy infrastructure
- Southlanders have free access to the internet from Public libraries and/or Community Hubs in their local communities
- The viability of public wi-fi networks, including library based services and the planned Gore CBD installation, is analysed with a view to expanding the availability of Wi-Fi for the benefit of residents and tourists alike

# **Strategy** *Overview*

## Goals

***Capability:***

- Digital enablement training and advisory service supports Southland residents to gain the skills and confidence they need to access the internet, connect with others and use digital technology to achieve their goals
- The sustainability of rural communities is supported through enabling residents, community groups and businesses to access and use digital technology
- Community groups are supported to use and engage with digital technology to make efficiency gains, create connections with members, optimise volunteer resources and to develop innovative new ways of working
- Schools, education and training establishments provide students with access to technology and skills development opportunities
- Older people are supported to develop and grow their digital skills to enable them to continue to participate and contribute fully in their community and employment
- All Southland businesses are able to access and use business applications including mobile friendly websites, social marketing, online banking and accounting, cloud applications, real time data and online security
- Businesses are supported through Digital Enablement training, the Regional Business Partner Programme and Lean training initiatives to remain competitive, access new markets, make efficiency gains and innovate through the use of digital technology.
- Southlanders are confident in the security and privacy settings of broadband and mobile services.

***Content:***

- Local Government considers the digital dimension of new infrastructure, community and regional projects, to ensure that the benefits of new technology are being leveraged
- Digital First: Core Council Services, including rates and other payments, consents, consultations and community projects will be fully digitised by 2020
- World standard presentation and communication with the world about Southland as a destination to visit, live, work and play
- Local Government takes a shared approach to collecting, analysing and leveraging real time geological, climate, soils, water, road use and other data

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# Preamble

Southland has developed two previous Digital Strategies which this strategy builds on:

- "Blazing a Trail to the Information Highway', 2001
- 'Connecting to our Future', 2008

This document encompasses the updated Southland Digital Strategy, a review of progress against the 2008 Strategy and a Digital Enablement Plan.

Technology has moved on and demand has grown considerably since the Strategy was produced in 2008. However the core principles of the strategy remain as relevant now as when it was written.

## The 2008 Digital Strategy *Vision*

*"Southland is an excellent place to live, learn and do business, enabled by a world class, affordable telecommunications network which serves the whole of our community."*

**Requirements for**

- *"Always on, always available."*
- *"Always best connected to the best service."*
- *"Secure"*
- *"Affordable"*
- *"Content and services match user needs."*

This Strategy has been prepared for the whole Southland region by Venture Southland, a Joint Committee of Council, in consultation with Invercargill City Council, Southland District Council and Gore District Council and with input from Environment Southland.

In preparing the Digital Strategy consultation has been undertaken with the local community:

- Consultation with local communities at proposed new ultrafast broadband, rural broadband and mobile sites through Venture Southland's Community Team.
- The Southland Mobile and Internet Survey 2015 which was open to all residents of Southland. 720 businesses and residents responses were analysed and informed the bid. Many of their comments are included within the supporting documentation.
- Over 80 businesses were consulted at a Digital Enablement Workshop organised by Venture Southland in partnership with NZTE.

This report also draws on the technical knowledge which Venture Southland has developed through managing a range of other contracts and projects in the communications sector, including the initial scoping and design for the Invercargill Urban Fibre Network and the management of contracts with the European Space Agency, Planet Labs and Rocket Labs for Space Tracking Services from the Awarua Ground Station.

# Introduction

Southland is a geographically diverse region, encompassing 12% of New Zealand's landmass. With 2.4% of the population, Southland Industry produces 15% of New Zealand's tradable exports. The region's productive capacity rests on the land and value-added production; farmers and other rural businesses need access to fast and reliable internet and mobile services in order to continue to grow productivity and skills and retain competitiveness within a fast changing global economy.

70% of Southland's GDP comes from exports and Southland has the third highest regional GDP per capita in New Zealand. In 2013-2014 Southland's economy grew by 11%, the highest rise in GDP within New Zealand, representing an addition of $550 million to the local economy and cementing its position as a leading export region.  Southland has the highest employment and participation rates in the country and an aging workforce. To retain our young people and attract skilled workers to Southland, connectivity to global culture and family and friends around the world is essential.

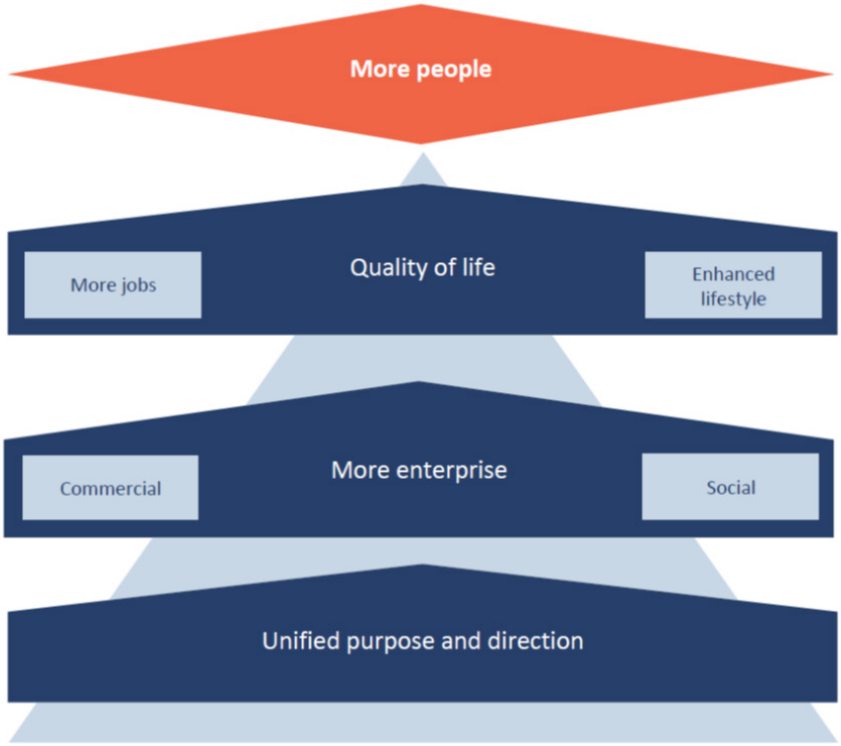
Much of Southland's productive sector and a significant proportion of support industries are based in rural areas where internet and mobile coverage remains slow, unreliable or unavailable. Southland has many remote communities whose viability is undermined by poor access to communications services. Many of Southland's most popular tourist attractions and touring routes are also in areas where broadband and mobile services are limited.

At the time of developing this Digital Strategy, a parallel Southland Regional Development Strategy 2015 was also undertaken, which identified that digital connectivity is essential to enable effective regional development.

Digital infrastructure is noted as a key enabler of regional development which requires focused attention:

"State of the art digital connection and capability is essential for this strategy to proceed."

*Southland Regional Development Strategy 2015*




The Southland Regional Development Strategy

# The Strategy

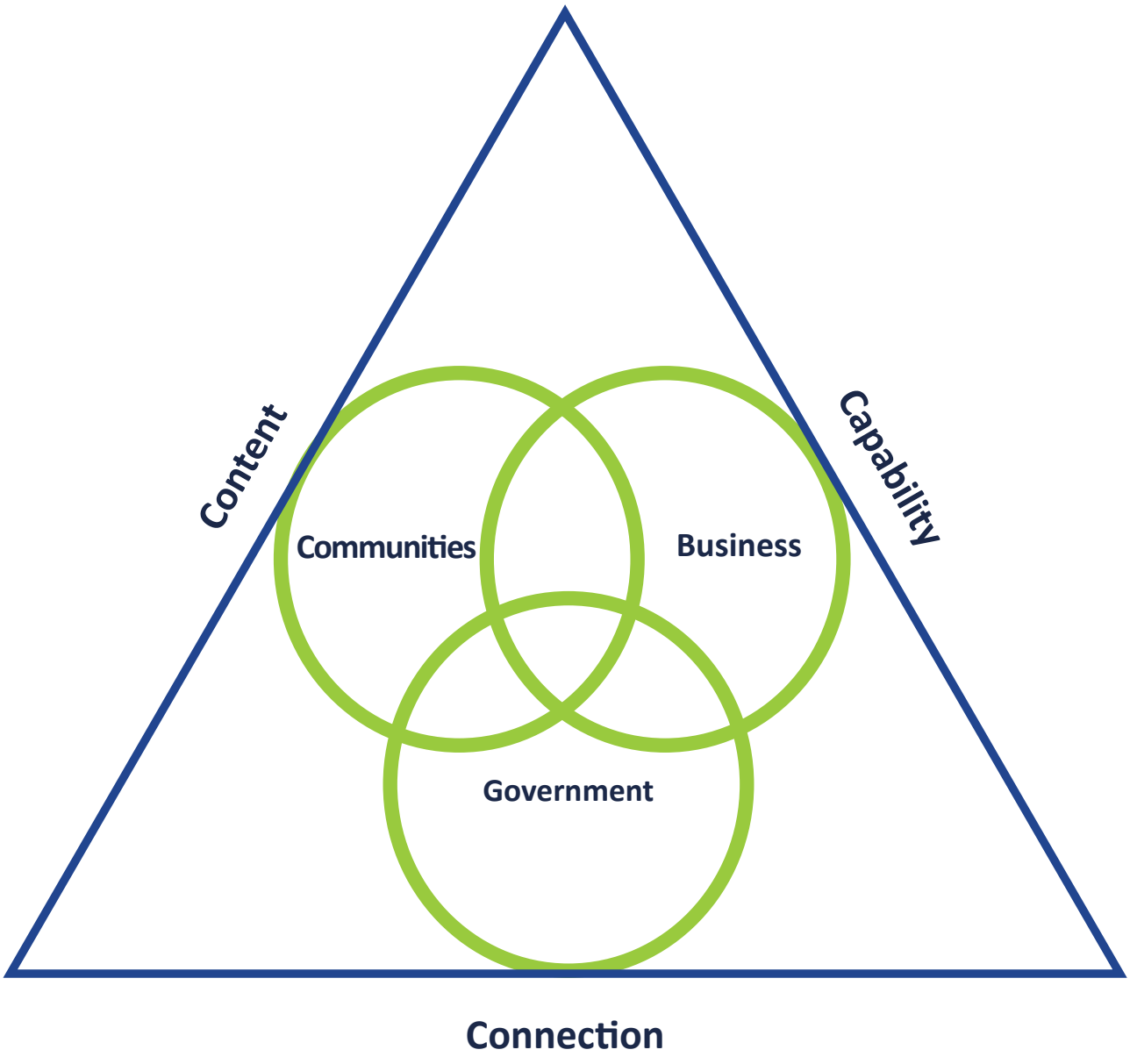
## Strategic *Vision*

*Digital connectivity drives community and economic development throughout Southland.*

***Connection:*** *Southlanders can enjoy a world-class, affordable, ubiquitous telecommunications service at a universal price.*

**Capability:** *Southlanders have the skills, knowledge and security they need to leverage the benefits of broadband and mobile connectivity.*

**Content:** *Southlanders benefit from improved services, efficiency and innovation from digitising and sharing content, undertaking real time monitoring and leveraging the potential of big data.*



# *Connection*

## **Strategic** *Vision*

*Connection: Southlander's can enjoy a world-class, affordable, ubiquitous telecommunications service at a universal price.*

***Goals***

- ***Fibre Everywhere: By 2030 all homes and businesses in Southland, rural and urban, are serviced by Fibre Broadband***
- ***LTE Everywhere: By 2020 all inhabited parts of Southland have 4G LTE mobile cellular service, or better***
- ***Government and business business investment is coordinated to enable future proofed and affordable solutions which leverage existing broadband and mobile infrastructure***
- ***ICT is recognised by Local Government as fundamental infrastructure underpinning economic performance and community cohesion in the same way as roads and energy infrastructure***
- ***Southlanders have free access to the internet from Public libraries and/or Community Hubs in their local communities***
- ***The viability of public wi-fi networks, including library based services and the planned Gore CBD installation, is analysed with a view to expanding the availability of wi-fi for the benefit of residents and tourists alike***

Connection of the whole of community to broadband and mobile services remains a priority of the strategy despite the advances which have been made in provision of services since 2008. There are still too many areas where connections are poor, unreliable, slow or prohibitively expensive.

It is important for Southland's telecommunications infrastructure to be managed at a strategic level to make best use of assets and to provide the highest level of service in the most efficient way to customers across the region. The importance of the telecommunications infrastructure to business and the community means that it requires the same level of oversight as transport or energy infrastructure.

The rural economy, which is the backbone of Southland, is made up of many small, often isolated businesses who require access to quality services to enable them to continue to compete in the global marketplace. All businesses no matter their location should have an internet connection of adequate standard to enable them to access basic services. Speed and data allowances need to be adequate to manage email communications (including download of invoices), online banking, cloud accounting, basic e-commerce, basic social media and marketing management and automation of key operational functions e.g. procurement and stock management.

Increasingly industry standards, including video communication and real time monitoring require a higher standard of connection. Systems like LIC Automation Pro Track Vantage and MINDA, while they do not have particularly high data requirements, need always on internet. In 2015 41% of rural business said that the internet does not meet their needs and without improved connections, this will only increase as business requirements grow.

# Connection

Data and connection requirements for both business and residential customers will continue to grow. Therefore the technology chosen for network infrastructure investment and service delivery standards set need to be future proofed so that the network delivers value for the lifetime of the investment. This strategy proposes that nothing less than region wide fibre and LTE is required to enable Southland to continue to grow, respond effectively to market disruption and enable innovation.

Good mobile and internet connections in rural locations are essential for businesses wanting to attract and retain younger staff. 27% of rural businesses in 2015 have found that lack of internet/ mobile connection is affecting their ability to attract staff.

It should be noted that the mobile network is an increasingly important channel for internet connection. 71% of Southlanders use their phones to access the internet and significant numbers of rural residents reported using their phones to undertake key tasks like internet banking due to inability to use slow internet connections. Mandated roaming, along with additional infrastructure investment, is recommended to enable a capital efficient solution which serves the needs of communities and travellers across Southland.

The provision of public wi-fi and public access to the internet through libraries and planned community hubs is an important aspect of regional commitment to enabling all Southlanders to benefit from digital technology.

| CONNECTION ACTION | RESPONSIBILITY | TIME-FRAME |
|---|---|---|
| Continue to explore alternative options for delivering internet to rural locations | Venture Southland | Ongoing |
| Support local providers to make use of RBI fibre to schools to provide local solutions other users in the area | Venture Southland, TLAs | 2015-2018 |
| Monitor developments in use of digital technology to ensure that internet services keep pace with user requirements | Venture Southland | Ongoing |
| Establish a joint approach between Southland District Council, Gore District Council and Invercargill City Council in developing policy and protocols on digital and communications technology | TLAs, Venture Southland | 2016 |
| Encourage greater use of Local Peering facilities available in Invercargill – Help ensure the resilience of the local network in case of connection issues in the North Island | Venture Southland | Ongoing |
| Availability to own network infrastructure as required | Venture Southland Trust | 2015 |
| Lobby for second Trans-Tasman fibre optic cable to land in Southland | Venture Southland | Ongoing |
| Share learning from the forthcoming implementation of Public WiFi in Gore and explore the benefits of local area Public Wi-fi services in Invercargill, Te Anau and other key locations. | TLAs | 2016 |
| Promote the benefits of connecting to broadband, including fibre where available to ratepayers, businesses and community groups | TLAs, Venture Southland | 2015-2018 |

# Connection

| CONNECTION ACTION | RESPONSIBILITY | TIME-FRAME |
|---|---|---|
| Provide free wi-fi spots and computer terminals in libraries and other locations, such as proposed community hubs, to access online Council services | TLAs | 2016 |
| Provide a video conferencing hub for businesses and community groups to use to bridge the gap for those whose internet connections are lagging | Venture Southland, TLAs | 2015 |
| Fund a Digital Engagement Officer to assist residents and business with accessing broadband services and making good decisions on use of digital technology | Venture Southland | 2016 |
| **Advocacy for:** | | |
| A joint Central and Local Government long term strategic plan for the development of telecommunications services in Southland | Venture Southland | Ongoing |
| A critical appraisal of the proposed network architecture and network development strategy | Venture Southland | Ongoing |
| Network coverage and performance be independently verified | Venture Southland | Ongoing |
| Use and upgrade of existing infrastructure to new technology, including the wireless towers installed by Woosh | Venture Southland | Ongoing |
| Fibre provision into rural areas and explore creative partnership solutions for funding and implementation | Venture Southland | Ongoing |
| Deployed wireless and mobile technologies are contemporary standards based and support a future proofed technology integration pathway | Venture Southland | Ongoing |
| Roaming across Mobile networks be mandated | Venture Southland | Ongoing |
| Existing service contracts be reviewed and updated to reflect current technology standards | Venture Southland | Ongoing |
| Continued upgrades to cabinets and for fibre connections to be made available for smaller towns | Venture Southland | Ongoing |
| Advocate for continued upgrades to existing infrastructure to maintain standards, as there is reporting of degraded infrastructure and overloaded cabinets in some areas | Venture Southland | Ongoing |
| Advocate for legislative change to allow for easy use of power and transmission lines for communications | Venture Southland | Ongoing |
| Advocate for a large scale server farm in Southland | Venture Southland | Ongoing |

# Project

## Promotion of Take Up of Broadband Services

Venture Southland has been instrumental in promoting the benefits of broadband services to residents, businesses and visitors to Southland. The feedback received to the Southland Internet and Mobile Survey and the response to the work Venture has been doing to prepare for the MBIE bid has revealed the extent of continuing challenges many people are experiencing in connecting across Southland.

Demand for fast internet is higher than suggested by the uptake statistics for Ultrafast Broadband, which show Southland as lagging two percentage points behind the rest of the country.

Our research shows that interest is high but and there is much confusion about how to access fibre broadband. 75% of urban respondents are aware of the Ultrafast Broadband Initiative. 45% report that they would like to access the service but don't know how to. In rural areas there is widespread confusion about how to go about accessing fibre along RBI fibre routes serving towers, in those limited areas where it is available. Customers are reporting not being able to receive a straight answer from either their Internet Service Provider or Chorus as to whether they can access the fibre, which in many cases they have seen being laid along the road outside their home or farm. In addition we have received anecdotal feedback that technicians are not able to advise customers when they know that if they tried an alternative service provider they would be able to receive an improved service. Rural customers with no access to fibre are confused about whether to choose RBI where it is available or to stay with their existing provider. They report being sold an alternative plan only to find it is no better or even less reliable to the service they were already on.

Our strategy to promote uptake across the region will be implemented following the information provided by MBIE as to which sites have been chosen for upgrade. It has two areas of focus:

- Raising awareness of the options for connections and benefits of connecting to the best internet option available at a customer's address
- Providing advice and advocacy to help overcome the communication and logistical challenges being reported by customers looking for an improved service

This strategy will also be supported by the Digital Enablement Training Initiative for businesses and community groups detailed under "Confidence".

### Awareness

All three Councils and Venture Southland will use their ratepayer, business and community communications channels to update consumers on the options available in their area. These channels include:

- Invercargill City Council Community News, facebook, twitter and YouTube channel "ICCTV"
- Southland District Council newsletter "First Edition"
- Gore District Council e-newsletter "Chinwag"
- Venture Southland Digital, Business, Community and Tourism e-newsletters, radio community updates, facebook and Linked In.

# *Project*

## Independent Advice and Advocacy

The focus of Venture Southland has been responding to individual customer queries from across the region, which have arisen in response to the work we have been doing in preparing for the bid and will continue to do so until the bid process finishes.

At the Digital Enablement Event which we held for business in June all National and Local telecommunications providers were invited to attend, of which Spark, VelocityNet and Focus Technology chose to do so. The businesses present were able to discuss their needs and particular situations with the Providers.

We are putting together a funding package for a part time Community Digital Liaison Officer to be in place at the beginning at 2016 for a one year period. We have applied to InternetNZ for $15,000, with the remainder of the $55,000 budget being met by Venture Southland, from the Impetus and Investment fund. This role will focus on two areas:

- To increase awareness and streamline technology pathways and options for end users
- Increase digital competence through enablement support

Venture Southland is engaging with Chorus, with the goal of bringing together technicians with Local Government infrastructure officers to examine how to overcome barriers to connecting to fibre for those rural customers who are adjacent to RBI fibre and willing to pay the connection costs but unable to find a pathway through the technical challenges (e.g. being on the opposite side of the road).

**Budget**: Awareness Absorbed within existing marketing budgets
**Owner:** Venture Southland
**Independent Advice and Advocacy:** $55,000 (subject to funding)
**Total:** $55,000
**Timeframe:** December 2016

# *Project*

## Gore District Council CBD free Wi-Fi Project

The Council has looked at a free Wi-Fi in the past. However, it was only after linking with First Retail Limited and committing to making Gore the most commercially resilient provincial town, that the Council decided to ramp up the initiative. Free Wi-Fi is seen as helping drive more customers into the centre of Gore and to enhance their retail experience.

Free Wi-Fi is also seen as helping retailers be more connected to each other and to their customers as more and more people shop online. Many Gore retailers do not have any online presence and are missing out on the multi-billion dollar market online retailing has become.

Whatever retailers do, customers will increasingly use their mobiles to check prices, look for reviews, and find more detailed product information. The Council sees the free Wi-Fi as giving retailers the chance to harness this trend and turn it to their advantage by using mobile to enhance the level of information available to customers.

For example, they could prompt customers to visit web pages with reviews of the products they are considering in store. This could be a powerful driver of sales.

Gore's status as the southern-most motor home friendly town is also a key in the Council support for free Wi-Fi. Motorhomers are a multi-million dollar group who rely on their mobile devices to gain information and stay connected; hence free Wi-Fi is a great lure for them.

Gore District Council's proposal is to offer:

- Fast Wi-Fi Access to the Internet: Users will have an unparalleled Wi-Fi experience to their favourite sites
- Ease of Usability: The simple login process and bandwidth available will encourage repeat business.
- Service Installation: Install Wi-Fi devices throughout the public areas in the CBD. Paramount to service quality is the design density of the wireless coverage to ensure a high performance Wi-Fi service.
- On-going Management: The GDC is looking to partner with a provider that has an established helpdesk and an experienced team to enable a fully managed Wi-Fi service.
- Proposal

The Council has put together a 14 page Request for Proposal for free Wi-Fi in the central business area, as well as for the Gore Multisports Complex, a popular location for residents and visitors. The GDC expects to pay a single price per month for the overall service, or an upfront contribution to installation costs and a reduced monthly rental. This is also negotiable with the vendor dependent on the final solution offered.

The Council has not made capital projections for this project at the time at the completion of this strategy being completed.

It is hoped to have free Wi-Fit available before this year's Christmas trading. Since the prospect of free Wi-Fi became public, there is a huge expectation among retailers it will happen. Nearly everyone sees it as a major boost to the retailing experience Gore has to offer.

# Project



**Proposed Wi-Fi Regions**

**Budget Forecast:** $10,000 - $20,000 (Dependent on RFP process)
**Owner:** Gore District Council
**Timeframe:** December 2015

# *Case Study*

## Community Hubs in Southland District


**Wyndham, Main Street**

The Community Hub concept, bringing Southland District Council services and other key community services together, is being explored as an opportunity for smaller rural towns.

Many of Southland's smaller communities are experiencing similar challenges: isolation; limited public transport options, aging populations, declining commercial services and buildings effected by changes in Earthquakes standards.

The Community Hub concept aims to bring together Council and Library services with other local services, with the potential to include other commercial services also being explored. Key to the Council's digitisation strategy is to ensure that older people and remote communities with lower levels of connectivity have the same access to services and opportunities as people in larger locations. The Community Hub concept would include computers for community use, with the option of wi-fi also being considered

# *Capability*

## **Strategic** *Vision*

***Capability:*** *Southlanders have the skills, knowledge and security they need to leverage the benefits of broadband and mobile connectivity.*

***Goals***

- ***Digital enablement training and advisory service supports Southland residents to gain the skills and confidence they need to access the internet, connect with others and use digital technology to achieve their goals***
- ***The sustainability of rural communities is supported through enabling residents, community groups and businesses to access and use digital technology***
- ***Community groups are supported to use and engage with digital technology to make efficiency gains, create connections with members, optimise volunteer resources and to develop innovative new ways of working***
- ***Schools and education establishments provide students with access to technology and skills development opportunities***
- ***Older people are supported to develop and grow their digital skills to enable them to continue to participate and contribute fully in their community and employment***
- ***All Southland businesses are able to access and use business applications including mobile friendly websites, social marketing, online banking and accounting, cloud applications, real time data and online security***
- ***Businesses are supported through Digital Enablement training, the Regional Business Partner Programme and Lean training initiatives to remain competitive, access new markets, make efficiency gains and innovate through the use of digital technology.***
- ***Southlanders are confident in the security and privacy settings of broadband and mobile services.***

To get the best value from the infrastructure investment in broadband, people need confidence in the security of broadband, information on what is possible to achieve and the skills necessary to make use of new technology to leverage benefit for the region.

Confidence in the safety and security of data and personal information was a high priority in 2008 when the original Digital Strategy was written. People are less concerned about security and privacy online as the technology has become more ubiquitous and people's familiarity has increased.

While security continues to be a priority, the focus of the strategy now turns to supporting communities, businesses and individuals to leverage the benefits represented by improved broadband infrastructure.

# *Capability*

More businesses are online. In 2015 77% of Southland businesses have a website and 63% are promoting their business using social media (up from just under half in 2014). 27% of businesses planned investment in IT in 2015, up from 19% in 2014. (Southland Business Survey 2014 and 2015).

As part of Venture Southland's role as NZTE and Callaghan Innovation Regional Business Partner we have been supporting businesses with their challenges in connecting to fibre and have organised training events to help upskill businesses in the latest use of cloud, apps and other online software.

This work dovetails with our successful business efficiency, productivity and skill development programmes which are highly dependent on businesses being able to take advantage of the opportunities presented by world class telecommunications technology. All three TLAs and Venture Southland are committed to continuing to raise awareness of the benefits of broadband to encourage both uptake of new service offerings and how to maximise the benefits these services offer to communities and businesses.

| CAPABILITY ACTION | RESPONSIBILITY | TIME-FRAME |
|---|---|---|
| Deliver Digital Enablement Training Programme for businesses and Community Groups | Venture Southland | 2015-2016 |
| Assist business to gain competitive advantage from digital investment whatever their stage in the business journey (Start, Grow, Innovate, Export) | Venture Southland | Ongoing |
| Provide access to training to support businesses to leverage the benefits of broadband and mobile technology, including digital enablement training, business efficiency programmes such as the Southland Lean Cluster, Entrepreneurial support for Tech Start ups and support for R&D funding applications for digital technology | Venture Southland | Ongoing |
| Promote the benefits of remote working/ teleworking, particularly for people living in our rural communities (dependent on adequate connection) | Venture Southland | Ongoing |
| Support businesses developing apps through the Regional Business Partner Network and in response to strategic challenges and opportunities and for key industries (including the rural sector) | Venture Southland | Ongoing |
| Support community groups use and engage with new technology, accessing funding, reporting on progress, managing volunteers and communicating goals | Venture Southland, TLAs | Ongoing |
| Explore ways in which digital technology can support Local Community Planning activities: Community Group engagement, support for project planning, asset mapping, feasibility assessments | Venture Southland, TLAs | 2016 |
| Promote community projects which upskill and build confidence, including promoting skills for older people, people in remote areas and areas of social exclusion | Venture Southland. TLAs | Ongoing |
| Support schools, educational and training establishments to leverage the benefits of ultrafast broadband and engage students in ICT learning | Venture Southland | Ongoing |
| Promote the use of Real Me as foundation to ensuring security of personal information and services online | Venture Southland | Ongoing |

# *Project*

## Digital Enablement Training

The final strand of our Broadband promotion strategy is to increase uptake of broadband through giving people access to the information and skills they need to leverage the benefits of a faster connection. Venture Southland will continue its programme of Digital Enablement Training which began with a workshop in June which was attended by 80 businesses, and which focused on using digital technology, particularly apps, to increase productivity, efficiency and sales. The budget for this workshop and follow up 1-2-1 mentoring was $15,000.

The second workshop will be aimed at the retail sector and will focus on how to implement a bricks and clicks strategy, both implementing and competing against e-commerce.

Further workshops are planned for both business and community groups, the focus of which will be based on feedback from users.

Workshops will be funded through core funding from Venture Southland, participant contributions and, based on participant eligibility, from NZTE Business Capability funding and the Venture Southland Community Enterprise Training fund.

**Budget:** $40,000
**Project Owner:** Venture Southland
**Timeframe:** December 2016

# Case Study

## Invercargill City Libraries & Archives Digital Services

The Invercargill Library has a range of digital services, which cut across the main strategic goals of the strategy: Connection, Content and Confidence.

### Connection

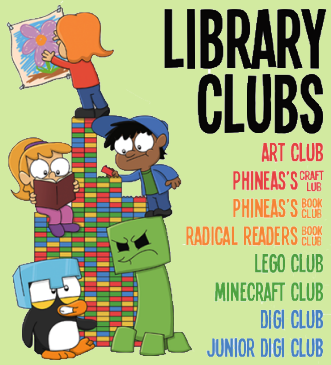
Free public Wi-Fi provided through the Aotearoa People's Network Kaharoa is available at the City Library. In addition thirteen free PC terminals are available in Invercargill and two in Bluff. Two extra terminals in Invercargill are offered under a user pays option.

Between the 2013/2014 and 2014/2015 periods Wi-Fi sessions have replaced PC terminal sessions as the most common way to access the internet.

Use of the terminals has declined from 66,339 uses (29,654 total hours) in 2013/2014 to 49,916 uses (28,114 total hours). The average session time rose from 27 mins to 34 mins over the same period.

Wi-Fi sessions have increased over the same period from 14,961 users/ devices (43,090 sessions) to 19,255 users/ devices (54,780 sessions).

"People use the service for a whole range of uses, from keeping in touch on facebook, to applying for jobs and dealing with Government departments like the Department of Immigration. People also use it to play games and watch YouTube. The most recent thank you we received was from someone who was using the computer to complete their University application and work on their poetry" - Library Manager




### Confidence

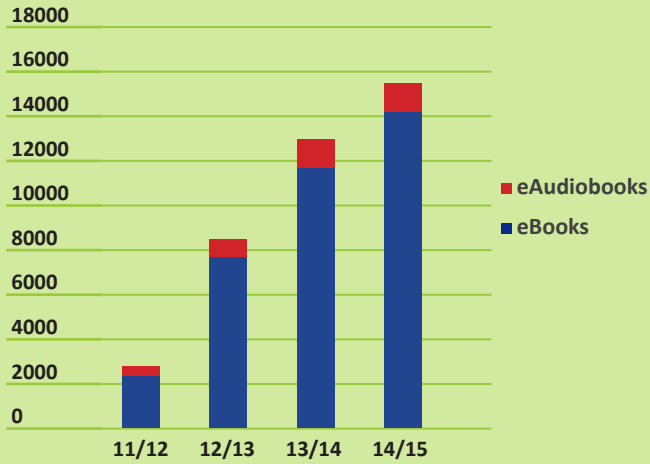
KickStart adult courses are available at the Library to help people build their confidence in computer basics and in using facebook. The Digi, Junior Digi and Minecraft Clubs are available to young people to grow their digital skills after school.

### Content

eBooks and eAudiobooks are available for people to borrow through Overdrive, the South Island Downloadable Zone. Library members also have access to databases, MediaNet and newspapers online.

Issues of eBooks are still growing and eAudiobooks are becoming increasingly popular.

The Library has just entered into a partnership with the DIA on digitising the "Southern Cross", a weekly Southland newspaper published from the 1890s through to the 1940s. This will eventually become part of PapersPast, an extremely popular website.



# *Case Study*

## Enrich@ILT – An ICT Rich Learning Environment

Enrich@ILT operates one-day-a-week classes that provides specialised curriculum with specialised staff for 7-11 year olds (Year 3-6 students) from local state schools who have been identified as having outstanding academic and/or creative ability.

Students attend the programme outside of their normal schools one day a week.

Students are referred to the programme based on outstanding academic and/or creative ability (or potential ability), identified by their school and/or family.

Enrich@ILT offers a differentiated programme which encompasses acceleration, extension and enrichment in order to meet students' individual needs. This individualisation ensures both engaged and motivated learners, but also the opportunity to develop individual characteristics and skills.

The ongoing support from the Invercargill Licensing Trust and the ILT Foundation has provided a unique opportunity for gifted and talented children from Invercargill schools.

**Students at** Enrich@ILT

Some ICT Projects covered:

- Computer programming, or 'coding' using the 'Hour of Code' ( http://code.org/learn ) and Scratch (scratch.mit.edu). With highly popular game themes like Angry Birds and Flappy Bird, the students use problem solving strategies to help navigate through each level of learning. Students are also using the scratch format to create their own games and presentations
- Google drive accounts: Students have gmail accounts and use these on a regular basis. Students work on projects via docs and slides which can be shared with staff
- Students use on line tools for presentation of projects: such as powtoons.com, emaze.com
- We are entering movies and photographs to enter the MADE awards as part of the digital storytelling talent development

# *Content*

## **Strategic** *Vision*

*Content: Southlanders benefit from improved services, efficiency and innovation from digitising and sharing content, undertaking real time monitoring and leveraging the potential of big data.*

***Goals***

- ***Local Government considers the digital dimension of new infrastructure, community and regional projects, to ensure that the benefits of new technology are being leveraged***
- ***Digital First: Core Council Services, including rates and other payments, consents, consultations and community projects will be fully digitised by 2020***
- ***World standard presentation and communication with the world about Southland as a destination to visit, live, work and play***
- ***Local Government takes a shared approach to collecting, analysing and leveraging real time geological, climate, soils, water, road use and other data***

Fast reliable internet and mobile services represent a huge opportunity for innovation for individuals, community groups, businesses and local agencies in Southland. It is essential that we take advantage of the opportunity presented by the roll out of ultrafast broadband to enable us to lead innovation, rather than being reactive to forces of market disruption and competition.

When linked with process reengineering, such as that supported through the work of the Southland Lean Cluster, the digitisation of Council services will provide significant efficiency gains. However we need to move beyond efficiency into innovation.

90% of the data in the world has been created in the last few years. Size, speed and structure have changed. Structure is now loose with video, images, biometrics etc able to be organised and searched Unlocking and sharing data will not only benefit Councils but though making data available to the public will enable innovation.

# Content

| CONTENT ACTION | RESPONSIBILITY | TIME-FRAME |
|---|---|---|
| Support process analysis and re-engineering to enable Council services to be provided online | TLAs, Venture Southland | 2015-2018 |
| Support the use of new technology to share content from community events and projects | Venture Southland | Ongoing |
| Use digital connectivity and technology to connect with the world and share stories of Southland as a destination to visit, live, work and play | Venture Southland | 2015 |
| Support of local culture and language in content | Venture Southland | Ongoing |
| Promote the use of real time measurement of environmental data to enable more efficient management environmental protection, resource use, pollution and climate change | Venture Southland, TLAs | 2015-2017 |
| Undertake data collection, analysis and sharing to promote better infrastructure management | TLAs, Venture Southland | 2015-2018 |
| Undertake real time traffic monitoring in order to better understand flows of tourists and other drivers enabling improved tourism attraction and service development and accident prevention strategies | Venture Southland, TLAs | 2016 |
| Explore the possibility of a Community Cloud where small business services, local government service provision, procurement, instant fault reporting, transparent consultation, networking and innovation would all be possible. | Venture Southland, TLAs | 2016 |
| Explore use of cloud systems for Local Government to reduce energy use through data centres (allowing for maintaining of service standards) | TLAs | 2015-2016 |
| Promote use of smart meters and real time data to enable loading management benefits in electricity management | Venture Southland | Ongoing |
| Promote the use by business of content rich data to support business efficiency, innovation and decision making | Venture Southland | Ongoing |
| Promote the development of weightless exports and digital export opportunities | Venture Southland | Ongoing |
| Promote the use of digital technology in delivering emergency management and response services and advocate for regional emergency management plans to include scenarios where mobile and internet networks fail. | TLAs | Ongoing |

# *Case Study*

## E-Government

Digital Services

All three Territorial Local Authorities make digital services available to ratepayers.

**In Gore District, people are able to:**

- pay rates;
- pay debtors accounts;
- pay water accounts;
- pay an infringement notice and
- lodge an enquiry or request for service

**Invercargill City Council's** online payments facility allows for customers to pay Council debt and/or fees online, including (but not restricted to) property rates, infringements (parking, animals, building, RMA), dog registration renewals, water bills, dog impoundments, and other Council debt (debtors).

**Southland District Council** enables people to pay their rates and dog registrations online as well as make requests for service.

Southland District Council is committed to empowering customers through digital technology. Online services will enable people to track progress of building consents, resource consents and LIMS. Greater access to spatial data from initiatives such Venture Southland's Topoclimiate data and forthcoming Areomag survey, when combined with district plan zoning information, will enable better land purchase and planning decisions. Mobile apps represent a great opportunity for ratepayers to register request for service and receive alerts on road conditions and water outages on the go. Southland District is also planning to improve consultation by enabling people to contribute their views and then read about results and policy decisions all in one place.

# *Case Study*

## E-Government

### Searchable Interactive Information

Councils make a range of information available online for public use.  Some examples:

Southland District Council makes available to the public spatial data, including property information, underground utilities and administrative boundaries through the Webmap application.

Southland District Council Digitisation Plan is in the process of being rolled out. Public access to digitised property information will be via the Council website. The website will require enhancements to allow searching and viewing of property information and secure return of property information from the EDRMS. The website enhancement must be completed and live by July 2016 when the digitisation starts. Digitised property records Project scope includes:

- Fit for purpose EDRMS that is capable of meeting Council's present and future needs.
- Property Classification structure that meets the needs of Council and the security needs for online public access.
- Offline and mobile access to EDRMS is particularly important with regards to enabling Council to be able to operate anywhere in the District given property and future applications will be digital.
- Website access to property files
- Ability to stamp, measure and annotate plans.
- Identification of heritage properties in order to retain the physical file as an archive

Invercargill City Council has a searchable database of cemetery records.

Environment Southland makes available soil moisture data assisting farmers with making effluent management decisions.

### Consultation

Consult South (consultsouth.co.nz) is a new online resource making it easier for Southlanders to make their voices heard as part of consultations undertaken by Invercargill City Council, Southland District Council, Gore District Council, Environment Southland and Venture Southland. Launched in mid 2015, four consultations have already been profiled.

# *Case Study*

## The Kia Mate Toa Southland War Memorials Database

The Southland War Memorials' Database has been compiled by Venture Southland with funding support from the Southland Rural Heritage Trust and the Lottery Grants Board (Department of Internal Affairs). The database brings together information on more than 400 war memorials and honour boards across Southland, and represents the first comprehensive regional listings of war memorials and war dead.

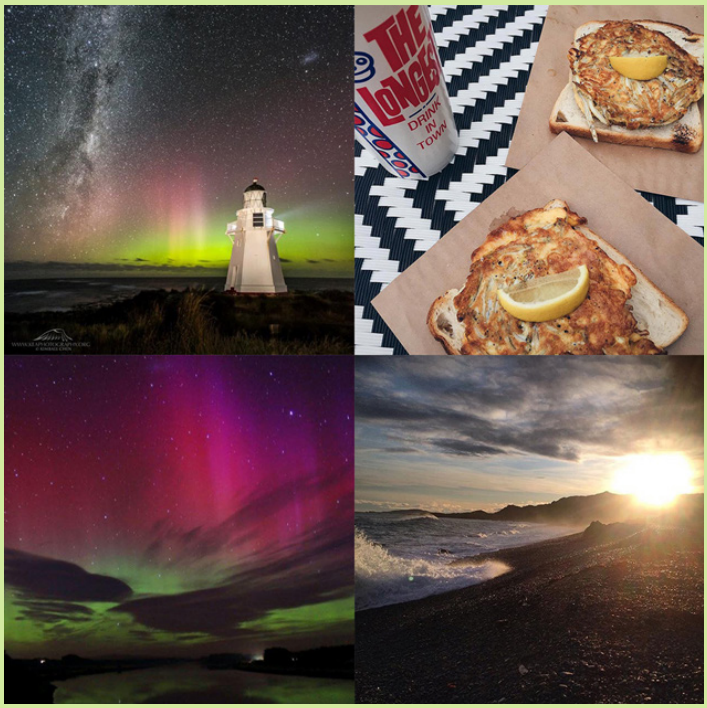
Links will also be provided to entries on each soldier on the Kia Mate Toa Southland Soldiers' Database, the Auckland War Memorial Museum's Cenotaph Database and the Commonwealth War Graves Commission's website.

The information on this database will be progressively expanded to incorporate information on the Southland dead from all wars commemorated on memorials and honour boards across the region. The database will also enable local communities to discover the identities and stories behind the names on their local memorials, so that on each ANZAC Day 'we will remember them'.

http://www.kiamatetoa.com/memorials.php

# *Case Study*

## Using Social Media to Promote Our Region



**Popular images from Southlandnz Facebook page**

Online content is becoming a key part of travellers business & holiday research, decision making and booking process. 36% of online travellers visit social networking sites to influence destination selection and this is increasing every year. Social Media is a core component of destination marketing at Venture Southland.

Southland NZ is on Facebook , Instagram, Twitter, YouTube, Google+ & Snapchat. Our key aims are to:

- Provoke an emotional connection with Southland
- Distinguish Southland from other destinations
- Inform new and positive thinking about Southland
- Motivate travellers to visit Southland

Over 5 million people have seen photo and/or video content promoting Southland on Facebook. Many more have seen content on our other channels.

Our post reach, as a percentage of fans, is 87%, well above the average post reach for Facebook (5 – 11%).

Over the course of the year, over 416,000 people have been inspired to engage with our content, clicking like, commenting, or (importantly) sharing it with their own friends and family. This represents an engagement rate of 7% - well above the Facebook average of 0.14%.

These statistics represent a commitment to high quality imagery, real time posting (live from events such as the Aurora Australis), encouraging user generated content (through the #mysouthland hashtag and fan photo Friday segment) and the creation of video content.

Venture Southland works with a wide range of tourism operators in promoting Southland. Their ability to leverage the potential of social media and digital marketing to reach a global audience rests on their ability to connect to their social media channels no matter where they are in Southland.

# *Case Study*

## Southland Demonstration Farm App Development

**Southland demostration farm at development**

Southland Demonstration Farm came to Digital Stock one weekday after a flurry of excited emails to discuss developing a timesheet app to collect compliance data they could use for benchmarking. This was a need that had arisen out of their involvement in Venture Southland's Lean Dairy Programme, which focuses on how to drive waste out of the business and make better use of workers time on farm. Venture Southland had also supported a research project digitizing and analysing timesheet data which informed the development of the app.

Digital Stock spent an entire afternoon with Business Manager Stacy McNaught, applying the Lean Canvas to his idea to figure out how we were going to help him build his mobile app, taking a mundane task that is critical to his business and automating it.

Brilliant ideas like this are normally simple. With simple in mind and a one month execution period Digital Stock set out to build his app. Stacy is extremely progressive and has ideas that have productivity as the number one goal. The Southland Demonstration Farm has found that the payback period for this app has been fairly short, giving him a simple to use product and accurate data he can use to manage the business and provide to external parties.

The learnings gained from the implementation of this app as well as other learnings from the farm, whether in the area of HR or Technical aspects of farming are shared and discussed on their active facebook page which is updated several times a week.

# Project

## Real Time Data for Efficiency and Innovation

Southland, as a region, is committed to capitalising on the opportunities presented by fast reliable internet to gather, share and analyse data from a range of sources to provide more efficient services, as well as to promote innovation. To this end a number of projects are being implemented and opportunities being explored for Territorial Local Authorities to work together to leverage data.

Three projects which are in the early stages of implementation are detailed below:

- Visitor flow and information requirements, gathered via an app used by Free Independent Travellers using campervans, to inform the tourism strategy and new product development
- Traffic flow analysis gathered from fixed installation sensors and utilising data from State Highway Contractors Opus Consultants, used to inform visitor services and tourism strategy
- Road surface analysis gathered via app and drone to support road infrastructure decision making

There are many more opportunities for data to be leveraged and for Councils and other agencies in Southland to work together to share and innovate.

One key area is environmental monitoring and protection. Environment Southland's monitoring systems (remote or manned) out in the field rely on telecom and broadband. Most of those sites are in rural locations and in some cases require radio links for data upload. Our web site provides the public direct links and access to real-time (or as near as) data particularly for flood and high river /rainfall events. Those are used by farmers as early warning systems to move stock from at risk areas.

Other data is gathered and stored in "Hilltop" and then transferred via telemetry back to regional house and into IRIS (Integrated Regional Information System). IRIS then can be used with GIS system. There is an increasing trend within the organisation to gather information on site, or to access Council data from onsite via mobile devices. However this is reliant on good systems through Wi-Fi, 3G or 4G to get rural monitoring teams' immediate download and uploads of data at site, which is not always possible. In many situations data collection in the field for updating IRIS has to be done disconnected and synced back in the office, however with improved connections Environment Southland hopes to make further efficiency gains through utilising real time data. Environment Southland is reviewing the methods by which we collect, share and utilise data in order to be able to better leverage the value this data represents.

**Environment Southland water monitoring**

# *Project*

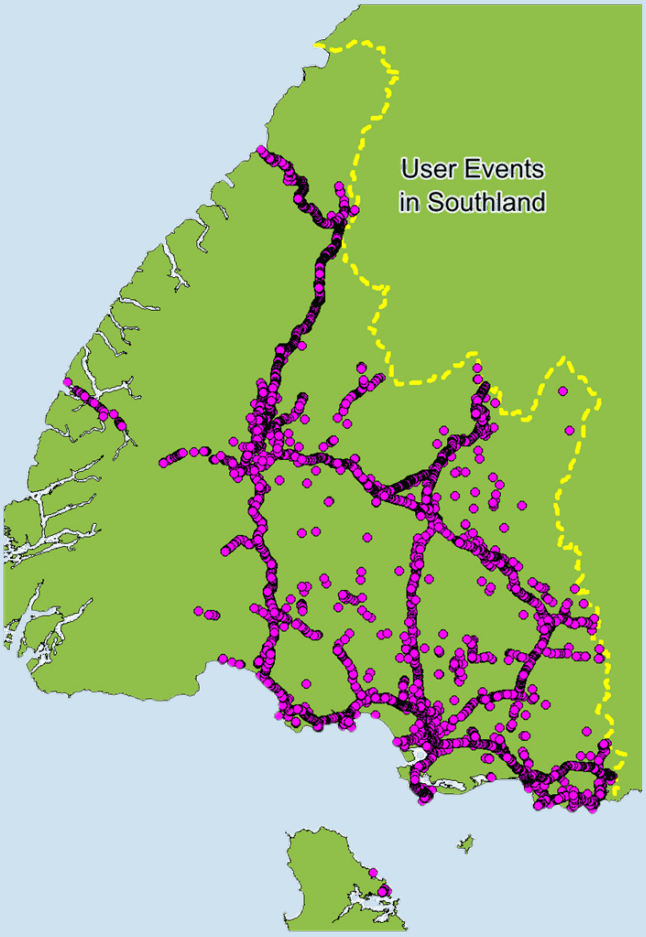
## Visitor Flow

Venture Southland is undertaking a pilot project using the app GeoZone, which provides meta data from the Free Independent Travellers (FIT) who use the app to find information on local services while they travel.

Analysis of three months of data from the winter season (June – August 2015) showed the movements of 1500 app users as they travelled around the region, noting where they were when they asked for information on local dump stations, toilets, and other facilities and attractions. It is possible to analyse where travellers are from, the route they take while in the region and the services they are looking for while they are here. This level of market intelligence has never been available before and combined with user surveys and other data will enable greater focus for tourism marketing and attraction activities.

While the data is already very rich, real time monitoring relies on ubiquitous mobile coverage. At present data is stored for later upload in the many blackspots and non-coverage areas of Southland where tourists travel.

**Budget:** Forecast costs $3000 - $5000 per year
**Project Owner:** Venture Southland
**Timeframe:** 2015 Ongoing




**Visitor flow pilot project data**

# Project

## Traffic Analysis


**Vehicle Counter demostration**

A number of fixed installations are being planned to monitor traffic flows on key parts of Southland's State Highway network. Information on direction of travel, type of vehicle and other variables will be used to inform Tourism services and strategic development.

The chosen technology provides robust real time count, speed and vehicle classification data in all types of weather and light conditions.

Installations are planned for:

1. Invercargill North
2. Manapouri (Weir Rd.)
3. Colac Bay (Orepuki – Riverton Highway)
4. Te Anau to Queenstown and other specific locations such as Southern Scenic Route

Long-term monitoring enables the distinction between short term variation in visitor flows and long term trends, and the distinction between changes due to weather conditions, holidays, events and other variables.

The data gathered will be used in conjunction with MBIE stats data, mobile network data, Census and Weather data to create a rich resource for modelling and decision making.

**Project Owner:** Venture Southland

**Budget:** $150,000 (subject to funding)

**Timeframe:** 2016

# Project

## Road Surface Analysis

3D Mapping and Modelling by UAV/ Drone

The roading network managed by Southland District Council is one of the largest and most geographically dispersed in the country. Infrastructure investment decisions must be carefully weighed to make the most of a limited budget in an area of comparatively low population. This decision making is being supported from real time data gathered from aerial imagery provided by drone and technical data gathered via mobile phones in the field and managed through the app RoadRoid.

Council have recently purchased a UAV (drone) to capture aerial imagery of the roading network and issues Council face such as slips, flooding, accident investigation and the likes. Having a reliable and powerful connection to the internet is helpful while working remotely in the field as this provides the opportunity to load reliable online maps that are used to assist the operation of the UAV. However this is not available in many areas so data is presently primarily uploaded on return to the office.

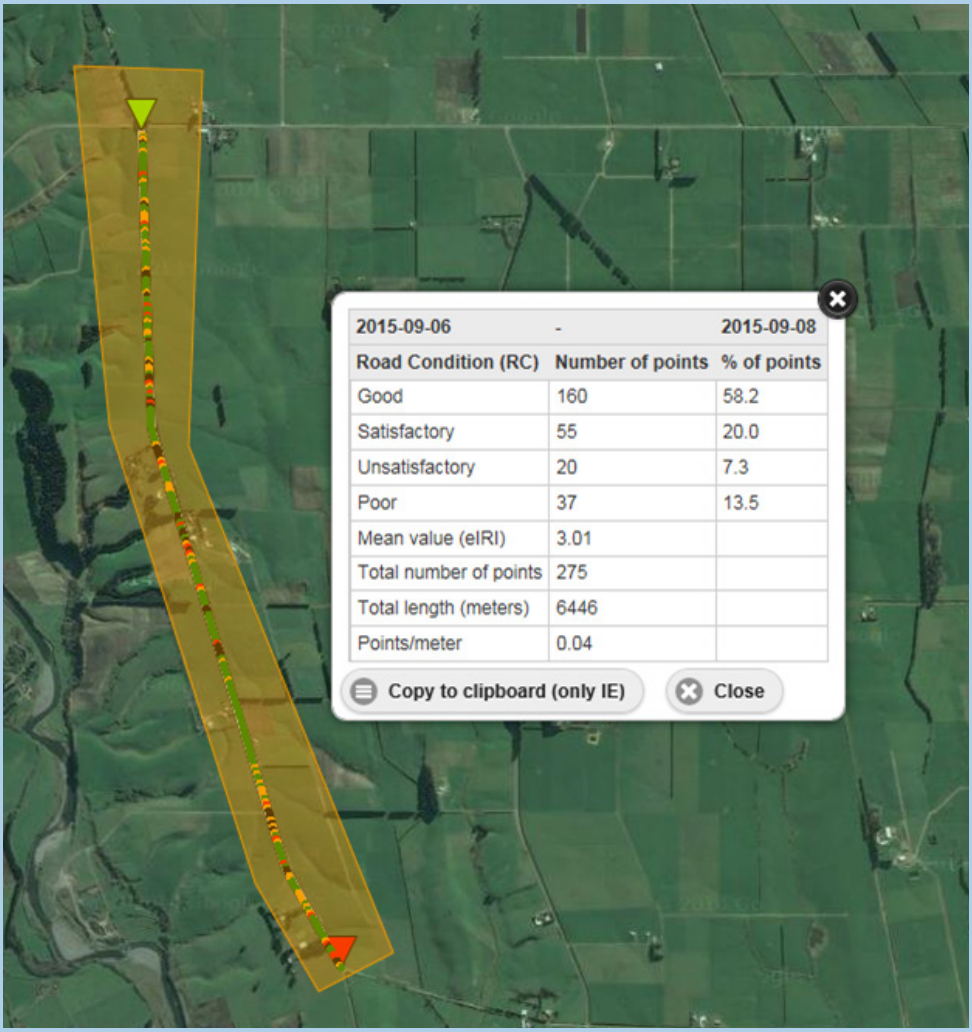
An active broadband connection also improves the precision of the GPS locating devices that the UAV utilises and increases the accuracy of mapping and modelling that is produced from the data captured.

RoadRoid is a road roughness application that runs on android phones. The application measures the roughness of any particular section of road surveyed (either sealed or unsealed) by using the existing sensor technology within the smart phone. The roughness is recorded in terms of the International Roughness Index (IRI). The application also records the altitude, speed and has an automatic photograph function for keeping record of what the road looked like during the survey.

The data can be uploaded actively out in the field via mobile broadband or when the android phone is within range of the SDC Wi-Fi network at the office.

# Project

## Road Surface Analysis




Data Mapping from RoadRoid app

The data and photos of the survey are uploaded to a cloud database which is hosted by RoadRoid in Sweden. From here the data and photographs can be accessed by the RoadRoid website, which conveniently maps and displays the results of each particular survey.

Southland District Council use this application to give a non-subjective result of a road, and to monitor deterioration of roads (due to traffic volumes, weather etc) over different parts of the region. It is also a great tool for investigating a road after Council receives a request for service, in particular in relation to to unsealed roads.

**Project Owner:** Southland District Council
**Budget:** $5000 + $150 a month
**Timeframe:** 2015 Ongoing

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# Appendix 1.

## Southland Digital Strategy 2008: 2015 Review of Action

| | Action | Category | Responsibility | Progress | Undertaken? | Still Current? | Future Actions |
|---|---|---|---|---|---|---|---|
| **Customer Access Network** | | | | | | | |
| 7.1 | Advocate for smaller towns to be included in Telecom/ Spark's Cabinetisation programme | Connection | VS | Advocated for Gore & Matau-ra's inclusion in UFB. | Y | Y | Advocate for fibre to all Southland cabinets |
| 7.1 | Assist Telecom and Vodafone augment cellular networks through advocacy and facilitation | Connection | VS | Advocated for Slope Point and Round Hill sites (provision of tech/ economic/ social business case) Slope Point successful | Y | Y | |
| 7.1 | Advocate for improved and expanded rural cellular coverage | Connection | VS | Ongoing engagement with Vodafone | Y | Y | Advocate for widespread introduction of LTE cellular services throughout Southland |
| 7.2 | Monitor developments in communications and advocate for terrestrial internet services with QoS that matches user requirements | Connection, Government | VS | Independent report commissioned from Tony van Horik 2015 reveals considerable gap in service standards. Ongoing advocacy | Y | Y | Propose standards, prehaps in conjunction with the Telecommunications Commissioner. |
| 7.3 | Advocate for improved cellphone coverage throughout Southland | Connection, Government, Business | VS | MBIE Bid 2015. Proposal for roaming advanced. | Y | Y | |
| 7.5 | Advocate for gaming and experimental access to MFN solutions | Content, Connection, Community | VS | Invernet proposal implemented. Superceded by fibre - available commercially. | N | N | |
| 7.6 | Actively work with Government to develop telecommunications legislation and regulations that benefit the economy | Connection, Government | VS | Submitted on this topic in 2010 | Y | Y | Also work with Telecommunications Commissioner and the Commerce Commission |

## Southland Digital Strategy 2008: 2015 Review of Action

| | Action | Category | Responsibility | Progress | Undertaken? | Still Current? | Future Actions |
|---|---|---|---|---|---|---|---|
| **Backhaul** | | | | | | | |
| 8.1 | Monitor Telecom's Cabinetisation Project and advocate for connection to the cabinets by competitive network backhaul providers | Connection, Government, Business | VS | Monitored and reported on implementation process to Council | Y | N | |
| 8.1 | Advocate for sound NGN (Next Generation Network) adoption | Connection, Confidence, Government | VS | Advocated for KAREN network. Raised funded for temination technology and point of presence at SIT ($400,000). Still in operation. | Y | N | |
| 8.2 | Advocate for Woosh Wireless and others to establish an alternative route through to Te Anau | Connection, Confidence, Government, Business | VS | Advocated for roll out of fibre backhaul to Te Anau - completed by Chorus in 2008/9 | Y | N | |
| 8.2 | Actively lobby for a second Trans-tasman fibre optic cable to land in Southland and affordable serve on this cable | Connection, Confidence, Government, Business | VS | Advocated for in 2010 as part of national Pacific Fibre initiative. Failed through lack of funding. Dropped in 2012 | Y | Y | |
| 8.2 | Advocate for public good fibre optic cable to be installed over the length of the South Island | Connection, Confidence, Government, Business | VS | Engaged with Telstra Clear and FX Networks to support fibre connecting South Island. Resulted in Inv - Qtown and Inv - Christchurch connections. | Y | N | Propose development of an automatic cutover system to provide route redundancy in case of major failures on SI links |
| 8.3 | Work with REANNZ and network providers to establish affordable KAREN connection to Awarua Station. | Content, Connection, Government, Business | VS | Continuing to work with Chorus and DTS to get fibre to Awarua. KAREN no longer relevant solution due to commercial work at site. | Y | Y | |
| 8.4 | Monitor telecommunication progress in Southland and if warranted consider how Kordia could be used to facilitate further progress | Connection, Community | VS | Technology of Kordia now superceded | N | N | |

## Southland Digital Strategy 2008: 2015 Review of Action

| | Action | Category | Responsibility | Progress | Undertaken? | Still Current? | Future Actions |
|---|---|---|---|---|---|---|---|
| **Interconnection** | | | | | | | |
| 9.1 | Advocate for local peering in Invercargill | Connection, confidence, content, community, government, business | VS | Established peering exchange at Invercargill Public Library. | Y | Y | Encourage greater use amongst ISPs |
| 9.2 | Work with suitable businesses, ISPs and network service providers to facilitate carrier-neutral, multilateral internet peering and demand aggregation at SIX to meet needs of education, business and residential sectors | Connection, confidence, Government, Community, Business | VS | Demand aggregation no longer as relevant due to more competition in the market. | Y | N | |
| 9.2 | Assist users to aggregate their communications service requirements to encourage suppliers to provide competitive and affordable pricing | Confidence, Govt, Comm, Bus | VS | Demand aggregation no longer as relevant due to more competition in the market. | Y | N | |
| 9.3 | Work towards gaining full network connection between all ISPS and providers at SIX exchanges | | VS | Achieved KAREN connected at the Public Library | Y | N | |
| 9.4 | Seek funding for and establish a KAREN POP in SIX | Conn, Content, Comm, Govt | VS, Invercargill Public Library | Achieved KAREN connected at the Public Library | Y | N | |

## Southland Digital Strategy 2008: 2015 Review of Action

| | Action | Category | Responsibility | Progress | Undertaken? | Still Current? | Future Actions |
|---|---|---|---|---|---|---|---|
| **Infrastructure and Regulatory** | | | | | | | |
| 10.1 | Advocate to ensure region is served by moden, affordable and reliable communications infrastructure capable of providing all services required by users. | Conn, Confidence, Govt, Bus | VS | Ongoing | Y | Y | |
| 10.2 | Advocate in local planning proceses for mandatory adoption of protocols that encourage co-siting and co-location. (All cable ducts and manholes are able to be shared easily and affordably). | Conn, Govt, Bus, Comm | VS | Advocated locally. Superceded by Central Government mandate. | Y | N | |
| 10.2 | Advocate for legislative changes to allow for affordable and easy access to duct-lines and manholes by CLECs | Govt, Conn | VS | Advocated. Standard adopted. | Y | N | |
| 10.2 | Advocate that the rationale and effects of Local Loop unbundling and de-averaging on rural networks be revisited and dealt with in a manner to ensure investment | Conn, Govt | VS | Advocated. Now implemented - Chorus network open to all carriers; shared infrastructures. | Y | N | |
| 10.3 | Prepare funding proposals and engineering specifications for Woosh sites | Conn, Comm, Govt, Bus | VS, Woosh, Communities | Undertaken. | Y | N | |
| 10.4 | Actively support and encourage CLECs to roll out infastrcture | Conn, Govt, Bus | SDC, GDC, ICC | Engagement with Chorus, Powernet and through MBIE UFB and RBI processes | Y | Y | Work with local ISPs |
| 10.4 | Seek for control of new subdivisions, underground ducts and vaults to rest with TLA rather than Telecom | Conn, Govt, Bus | SDC, GDC, ICC | Superceded | N | N | |

## Southland Digital Strategy 2008: 2015 Review of Action

| | Action | Category | Responsibility | Progress | Undertaken? | Still Current? | Future Actions |
|---|---|---|---|---|---|---|---|
| **Infrastructure and Regulatory** | | | | | | | |
| 10.5 | Provide expert advice and assistance to SDC, GDC, ICC in developing policy and protocals on communications | Conn, Govt | VS | Ongoing | Y | Y | |
| 10.5 | Propose legislative change to allow for easy use of power and transmission lines for communications | Conn, Comm, Govt | VS | Advocated. MED took it on as a project - still ongoing | Y | Y | Continue Advocacy role |
| 10.5 | Support TLAs to enable improved processes around erection of communications infrastructure | Conn, Govt | VS | Ongoing | Y | Y | |
| 10.5 | Review of this strategy in four year's time | Govt | VS | Review taking at 7 years rather than 4. Strategy remains appropriate but has been updated to reflect current technology and trends in use | Y | N | |
| 10.6 | Availability to own network assets as required | Confidence, Conn, Community | VS Charitable Trust | VS Charitable Trust owned Woosh assets for two years prior to handover. Function continues to exist. | Y | Y | |
| 10.7 | Advocate for aggregation of demand in Invercargill and rural towns | Conn, Comm, Govt, Bus | VS | Superceded | Y | N | |
| 10.8 | Seek funding and academic interest to undertake a study of Southland telecommunications market | Conn, Govt | VS | Tony van Horik report 2015 | Y | Y | Revisit this work in 2020 |

## Southland Digital Strategy 2008: 2015 Review of Action

| | Action | Category | Responsibility | Progress | Undertaken? | Still Current? | Future Actions |
|---|---|---|---|---|---|---|---|
| **Content and Services** | | | | | | | |
| 11.1 | Work with Christchurch school of Music, after school tuition businesses and others to develop distance learning options | Content, Comm, Bus | VS | Not continued | | Y | Explore opportunity further |
| 11.1 | Develop distance sports training | Content, Comm, Bus | VS, Sports Southland, Sparc | Not taken forward | | ? | Follow up with Academy of Sport to see if this is still current |
| 11.1 | Investigate how Web 2.0 applications can assist sports clubs with membership growth and participation | Content, Comm, Bus | VS, Sports Southland, Sparc | Web 2.0 no longer current terminology. | | ? | Investigate apps and social media |
| 11.2 | Advocate for more affordable archival data storage from Telecom or private options | Bus | VS | Widespread availability through Cloud | | N | |
| 11.2 | Assist with Council offsite storage at SIX | Govt | VS, ICC, SDC | Complete | Y | N | |
| 11.3 | Encourage development of Walled Garden Network throughout Invercargill | Content, Conn, Comm | VS | Now known as Local Area Wifi - Still relevant | | Y | Develop business case for Local Wi-fi provision as appropriate |

## Southland Digital Strategy 2008: 2015 Review of Action

| | Action | Category | Responsibility | Progress | Undertaken? | Still Current? | Future Actions |
|---|---|---|---|---|---|---|---|
| **Content and Services** | | | | | | | |
| 11.4 | Collaborate with interested parties to purchase or lease Layer 2 access, develop SIX and proposed MFN to develop business model and support for Layer 3 MFN network in Invercargill | Conn | VS | Superceded | Y | N | |
| 11.5 | Assist Library and others develop online databases for a wide range of users, including library systems and GIS | Content, Govt | VS | One Library Programme was established | Y | Y | Undertake further work required to share GIS capability |
| 11.6 | Review and continue providing media bridges in Invercargill | Connect, Busines, Govt | VS | Was undertaken. Now superceded | Y | N | |
| 11.6 | Review and encourage support for teleworking | Connect, Conf, Bus | VS | Delayed due to lack of widespread availability of connectivity fast and reliable enough to support teleworking | Y | Y | Further promotion in areas which has technology to support remote working |
| 11.8 | Facilitate permanent fibre connectivity to Invercargill sports and cultural facilities to enable broadcast facilities | Connect | VS, CUE, National Broadcasters, ICC | Completed as part of the Urban Fibre Loop. Now superceded by general fibre availability | Y | N | |
| 11.9 | Advocate for large scale server farm to be established in Southland | Content | VS | Engagement on a number of projects including data storage and Bit mining. Conversations ongoing | Y | Y | Continue engagement with commercial providers as appropriate |
| 11.1 | Upgrades to school hardware, LANs and knowledge | Connect | Schools, MoE, VS | Provided typical data specs, performance criteria to schools to assist with procurement. Completed. | Y | N | |

## Southland Digital Strategy 2008: 2015 Review of Action

| | Action | Category | Responsibility | Progress | Undertaken? | Still Current? | Future Actions |
|---|---|---|---|---|---|---|---|
| **Content and Services** | | | | | | | |
| 11.11 | Facilitate e-commerce through establishing integrated affordable e-commerce package | | VS, Bus, Training providers | Commercial ecommerce packages for Micros and SMEs widely available. Undertaken awareness raising activities including workshop for businesses | N | N | Raise awareness and provide skills development for businesses in ecommerce |
| 11.12 | Encourage development of productivity packages for rural sector | | VS, Industry bodies | Through R&D funding; Lean Dairy | Y | Y | |
| 11.13 | Encourage space and science and technology projects to Southland | | Scicne community, space sector | Establishment of Awarua Satellite Ground Station; Promotion of space industry in schools | Y | Y | |
| 11.14 | Investigate and develops apps | | VS, TLAs, Business, Tourism | StQry app implemented in Tourism sector. Walking access app. Support for Southland Demonstration Farm's timesheet management app, produced by Digital Stock | Y | Y | |
| **Security** | | | | | | | |
| 12.1 | Encourage adoption of SIX and Invercargill Exchange building for off site data storage | | VS | Superceded | N | N | |
| 12.2 | Advocate for Two clicks access, One password infrastructure | | VS | RealMe adopted. Processes still remain overly complicated such as within the health sector | Y | Y | Explore potential for further Health project |

# Appendix 2

## Engagement Plan

| Group/ Industry | Workshops | Survey | Roadshow | Digital Journey | Meetings | Social Media |
|---|---|---|---|---|---|---|
| **Community** | | | | | | |
| Southland residents | | Internet & Mobile Survey | | | | VS Facebook page Southland Times facebook page |
| Community Boards and Groups | Digital Enablement Workshops | Internet & Mobile Survey | | | Meetings | |
| Te Ao Marama | | Internet & Mobile Survey | | | Meetings | |
| Te Pune Kokori | | | | | Meetings | |
| Waihopai/ Aparima/ Hokonui Runanka | | | | | Meetings | |
| ICC Ratepayers | | Internet & Mobile Survey | | | | Community News, facebook, twitter, ICC TV (YouTube) |
| GDC Ratepayers | | Residents Survey Internet & Mobile Survey | | | | Chinwag E-newsletter |
| SDC Ratepayers | | Internet & Mobile Survey | | | | First Edition Quarterly Newsletter |
| Advocate for large scale server farm to be established in Southland | Content | VS | Engagement on a number of projects including data storage and Bit mining. Conversations ongoing | Y | Y | Continue engagement with commercial providers as appropriate |
| Upgrades to school hardware, LANs and knowledge | Connect | Schools, MoE, VS | Provided typical data specs, performance criteria to schools to assist with procurement. Completed. | Y | N | |

## Engagement Plan

| Group/ Industry | Workshops | Survey | Roadshow | Digital Journey | Meetings | Social Media |
|---|---|---|---|---|---|---|
| **Business** | | | | | | |
| Venture Business Network | Digital Enablement Workshop Retail Sector Workshop | Internet & Mobile Survey | | 80 businesses completed to date - Offered during Client Assessment Process | | |
| Chamber of Commerce | | Internet & Mobile Survey | | | | |
| Eastern Chamber of Commerce | | Internet & Mobile Survey | | | Meetings | |
| Tourism Liaison Group | Digital Enablement Workshop | Internet & Mobile Survey | | | | |
| Destination Fiordland | | Internet & Mobile Survey | | | | Raise awareness and provide skills development for businesses in ecommerce |
| Gore City Centre Project | Retail Workshops | | | | | |
| **Education** | | | | | | |
| Primary Schools | | Internet & Mobile Survey | | | Meetings | |
| Secondary Schools | | Internet & Mobile Survey | | | Meetings | |
| Enrich ILT | | Internet & Mobile Survey | | | Meetings | |
| SIT | | Internet & Mobile Survey | | | Meetings | |

## Engagement Plan

| Group/ Industry | Workshops | Survey | Roadshow | Digital Journey | Meetings | Social Media |
|---|---|---|---|---|---|---|
| **Education** | | | | | | |
| Community College | | Internet & Mobile Survey | | | Meetings | |
| Southern REAP | | Internet & Mobile Survey | | | Meetings | |
| Parents | | Internet Speed Test | | | | School facebook pages and newsletters |
| **Local Government** | | | | | | |
| SDC | | | | | Meetings - Council; Executive | |
| GDC | | | | | Meetings - Council; Executive | |
| ICC | | | | | Meetings - Council; Executive | |
| Environment Southland | | | | | Meetings - Council; Executive | |
| MPs | | | | | Meetings | |
| **Industry - Telecommunications** | | | | | | |
| Chorus | | | | | Meetings | |
| Vodafone | | | | | Meetings | |
| Spark | | | | | Meetings | |
| Installer Services | | | | | Meetings | |
| VelocityNet | | | | | Meetings | |

# Appendix 3

## Telecommunications Technology Roadmap

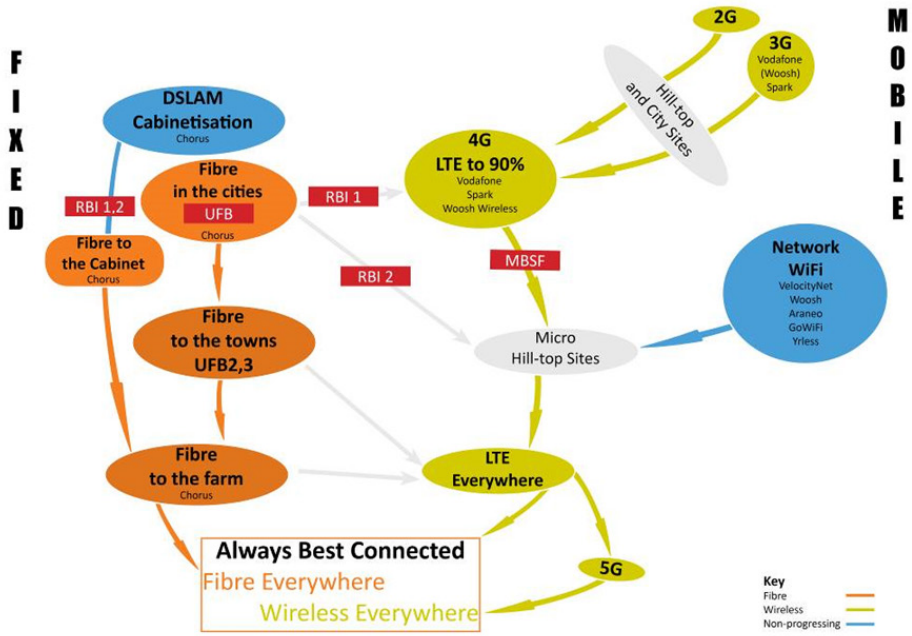
The roadmap to provide fibre to all premises, including fibre to the farm, will take a progressive implementation, leveraging from fibre to the cabinet work, and advancing UFB and related effort to provide fibre to the premises in the towns.

It must be recognised that both the fibre-optic cable deployment for customer reticulation and back-haul connectivity are long term infrastructural assets: fibre-optic cables should have at least a 50 year economic life and hill-top masts and towers have in excess of 50 years lives. These key pieces of infrastructure also provide enduring pathways for other technologies to provide performance enhancement, such as current and future versions of wavelength division multiplexing, and as platforms for improved wireless and mobile technologies. Venture Southland is strongly of the view that as a first priority, network capital co-investment should be directed at these core elements.

In order to facilitate telecommunications developments strategically, Government investment should be aimed at increasing the amount of open-access Layers 1 and 0 deployment to achieve the widest possible coverage. In this light, the most important long-term strategic investments are:

1. To deploy open-access fibre optic cable throughout Southland to every dwelling and business,
2. To establish open-access hill-top towers and accommodation at accessible sites throughout Southland.

What is needed now is a 15 year action plan to deploy an integrated solution to provide fit-for-purpose telecommunications throughout Southland.




Proposed telecommunications development roadmap for Southland. Green indicates LTE development, Orange indicates fibre-optic cable development and blue indicates non-progressing solutions.

It is important to note that the most important investment components of any telecommunications network deployment fall into the OSI Physical Layer 1 (cable) and what is sometimes called Layer 0: site access, towers, electricity supply and consents. Any debate concerning telecommunications deployment and investment that centres on the OSI Layers 2 and up is spurious as the actually electronics hardware has an economic life well below 10 years. Investment in Layers 1 and 0 is not only the most costly, but the equipment may have economic lives of up to 50 years, and so are the most critical.

## Fibre Everywhere

Because single-mode fibre-optic cable reticulation provides the foundations for almost any cable telecommunications protocol, providing fibre-optic reticulation to every dwelling in Southland would be an investment that will not become obsolete within any foreseeable future and its utility can be easily upgraded over time merely by changing out the termination electronics at relatively low cost.

Recognising the age of the Southland underground telephone reticulation network and its design transmission limits, and the first objective may be approached by concentrating effort in the first years towards laying fibre-optic cable from exchanges to each and every cabinet. These cabinets are, in turn, augmented with the installation of adjacent low-cost DSL cabinets. In some circumstances where the number of subscribers connected to a cabinet are low, back-haul from the cabinets could be provided by wireless, or the cabinet could be dispensed with and fibre-optic cable be extended to the subscribers' premises.

The underground copper telephone network in Southland was largely laid from the late 1970s through to 1989. These cables are coming into its fourth decade and they have a 50 years design life. The cable reticulation is serviceable and when the cross-connection cabinets are swapped out with low-cost DSLAMs, reasonable broadband service is possible for limited distances. In most cases it is necessary to overlay the cabinet feeder cable with fibre-optic cable to provide sufficient backhaul capacity and this is where most of the expense lies in rural areas. Chorus have been actively "cabinetising" their local loop in the towns and cities for some time as by using their existing underground duct networks to pull through the fibre-optic backhaul at low cost. Under RBI1, Chorus has made some useful inroads to cabinetise some rural areas in Southland. The strategic value of the cabinetisation programme lies in its ability to provide cable-based broadband service to a (limited) number of customers at relatively low cost, but at the same time establishing the foundations for eventually overlaying the remaining copper reticulation cable with fibre-optic cable.

An interim solution proposed by some network providers is to provide low-cost wireless backhaul to remote Chorus cross-connect cabinets and install their own DSLAMs adjacent. This solution is especially attractive where the wireless backhaul can accommodate the traffic and the cost of laying fibre-optic cable is high. However, it can still only be seen as an interim (10 years) solution because of the inherent shortcomings of copper cable discussed earlier.

Because copper cable has very high transmission loss compared with fibre-optic cable, the copper reticulation cable cannot be seen as a long term, high-capacity reticulation solution. Compounding the transmission limits is that while ADSL and ADSL2 can withstand the very significant electric fence interference experienced in rural areas, at present there is no VDSL mitigation.

## LTE Everywhere

Most of Southland has cellular coverage that is provided by relatively easily accessed hilltop stations. To extend the network further into the hinterland requires adoption of techniques pioneered by the smaller telcos, where minimalist sites with farm track access, powered by solar PV are the norm.

We specify 4G LTE for the wireless deployment here because to provide ubiquitous coverage, the Layer 0 requirements will perforce have to be met. While developments within this period will progress wireless to beyond 4G, there would appear to be consensus around the world that 4G will provide the mainstay of mobile wireless and cellular deployment in the foreseeable future. Experience shows that the cellular generations have lives of at least 15 years, cementing this position. Regardless, a mitigating factor is that modern wireless front-ends now all use software define radio technology, meaning that to migrate from one protocol to another (say, LTE to WiMAX), little more than a firmware change is needed.

Of course, any deployment will need to lever from existing investments and arrangements. The model set out above describes how this could be achieved. The model falls into three parts: those technologies that lead to providing widespread deployment of fibre-optic enabled services; wireless technologies that lead to ubiquitous 4G LTE deployment; and interim technologies that provide adequate service now, but are unlikely to be able to scale to provide universal service, or are technologically limited. The model is now described, and the non-progressing technologies are discussed first.

The wireless non-progressing technology is WiFi. WiFi was never designed to provide community-wide Internet service, but the low cost, ready availability and low power consumption of the access points allowed entrepreneurs to deploy networks quickly and at low cost. It is used for everything from providing hot-spots to rural network access to providing backhaul. In as far as it goes, the service WiFi provides has been exceptionally good and the coverage has been very useful. It is well suited to small, very low cost hilltop sites.

The difficulty is that Wi-Fi protocols deal poorly with wide-area, scalable deployment and were never designed to provide carrier-grade service. Its use of unlicensed radio spectrum means that catastrophic interference from other users can never be discounted. Bandwidth and customer bandwidth management is very limited compared to those available from purpose-designed protocols and standards.

The mobile roadmap can be seen as a straightforward progression of upgrading the established 2G and 3G cellular sites to 4G LTE over time and then, through the MBSF and RBI, to establish new micro hill-top sites and re-purpose WiFi hill-top sites to extend coverage into more sparsely populated areas. LTE technology allows for relatively low-cost extension sites that consume low power that could be deployed to replace WiFi access points at these sites provided that sufficient back-haul can be arranged.

The simplest solution to achieving LTE Everywhere is for Venture Southland to closely co-ordinate the network operators. This is unlikely to be a popular result for Vodafone and Spark. Another solution would be to arrange a community and customer funded buyout of the Woosh Wireless network in Southland, assisted with RBI and MBSF funding, to form a community co-operative company, which would be responsible for upgrading the Woosh Wireless 3G technology to LTE and then operating the network.

While Vodafone and Spark start their 4G rollouts, 5G technology development has begun. It is widely agreed that 5G will operate on radio spectrum between 10GHz and 100GHz. Atmospheric and rain attenuation at these frequencies are severe, which will fundamentally limit its effective range. It should not be seen as a long-range solution as its operating range will be less than one kilometre without active repeaters.

Very high data rates are anticipated for 5G, but currently the analogue front-end radio components are struggling to deliver the necessary performance required. Given the expected rate of technology development, where it takes roughly 4 to 5 years for a technology to get beyond research laboratories and another 4 to 5 years before it becomes affordable, it is unlikely that 5G CPE will be affordable and widely deployed within the next 12 years. 5G wireless technology need not be considered as a widely useful deployment tool for rural telecommunications within the 15 years view of this proposal.

## Proposed Southland Pilot Project

It is often overlooked that New Zealand's remarkably diverse geography must be served by an equally diverse infrastructure; a long, skinny telecommunications network design that suits the West Coast does not match the Southland Plains, for example. Regional planning can more easily take advantage of and be attuned to geographic features, population trends and such like than centralised planning.

One advantage that smaller cities such as Invercargill have over large cities is that the consequentially smaller networks can be understood by a single person. For example, just the backhaul network for Auckland is more complicated than the entire Southland reticulation network. This means that it is possible to minimise operating overheads in Invercargill compared to Auckland, or even Dunedin.

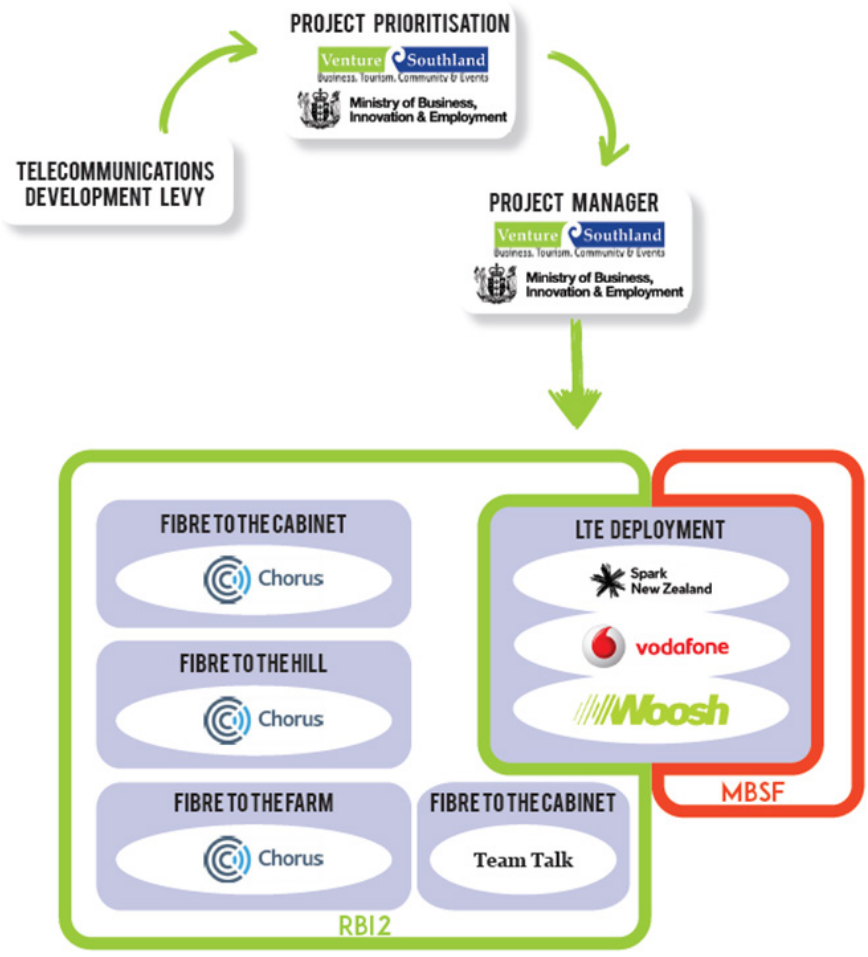
In this light, and taking into account the technological constraints raised earlier, Venture Southland proposes a pilot programme to deliver an integrated solution that will deliver marked improvement to Southland broadband and cellphone access through an innovative application of RBI, UFB and MBSF allocations due to Southland. In essence, it is proposed that Venture Southland act as a bulk funder to manage a roll-out of terrestrial Internet and cellular services in the region.

Venture Southland proposes to work in partnership with MBIE and preferred telecommunications network providers to develop an agreed, fully-costed, and integrated technology roadmap that can be achieved over a 15 year period. Once such a roadmap is agreed, Venture Southland proposes to work in partnership with MBIE and telecommunications network providers to award funds to UFB2, RBI2 and MBSF projects in Southland, and oversee their deployment and acceptance testing. The components are described in the diagram below, which indicate the priorities and likely network partners.

Venture Southland would to provide the following services to MBIE to ensure that an optimal outcome is reached:

1. Work with telcos, local wireless providers and the community to prioritise UFB, RBI and MBSF initiatives in Southland,
2. Work with telcos, local wireless providers and the community to prioritise UFB, RBI and MBSF initiatives in Southland,
3. Provide oversight and advice for the deployment of network infrastructure,
4. Oversee network compliance and acceptance testing
5. Monitor operational performance.

This sort of work is not new to Venture Southland: during its roll-out, Venture Southland was responsible for reporting to Ministry of Education and Ministry of Economic Development on capital expenditure on, and performance of, the Woosh Wireless network that was funded under the Major Regional Initiative and Project PROBE. This included of acceptance testing and preparation of completeness certificates. For the first two years of its operation, the Woosh Wireless network in Southland was effectively owned by Venture Southland by way of a General Security Agreement, and Venture Southland was responsible for reporting to its Councils on developments and performance. Venture Southland also ran a customer local market penetration programme and Connecting Communities Programme prior to network deployment to drive up customer demand.



# Appendix 4

## The State of Broadband and Mobile Infrastructure and Services in 2015

### Customer Satisfaction

The 2015 Southland Internet and Mobile survey revealed that there is still considerable work to be done to provide residents with a connection which enables them to be *"Always on, always available."*

Venture Southland consulted widely with the community, including through the Southland Internet and Mobile Survey which received responses from 720 residents and businesses from all over the region between March and May 2015.

**Southland Internet and Mobile Survey Key Findings:**

- 47% of rural respondents and 39% of urban respondents report that they or their family regularly experience problems with their mobile coverage which significantly impact on their lives.
- Less than half (48%) of people in rural areas can use their mobile phone in their home, compared to 73% of people in urban areas.
- Only a third (34%) of people working in agriculture can use their phone at home or work.
- 71% of respondents use their mobile phone to access the internet.
- In rural areas, 50% have heard of the Rural Broadband Initiative but most are unaware of any impact on their service. 4% have noticed any improvement; the same proportion believes their service has actually grown worse.
- 39% of people in rural areas and 21% of people in urban areas believe their internet service is slow or unreliable
- 40% of people in rural areas and 27% of people in urban areas would like to be able to stream video or TV but are unable to
- 75% of urban respondents are aware of the Ultrafast Broadband Initiative. 45% report that they would like to access the service but don't know how to.
- 83% of businesses are using their home internet connection to run their business: of these, 32% have a very or impossibly slow internet connection.
- 24% of rural businesses and 9% of urban businesses say that the quality of their internet and mobile services is affecting their ability to attract staff.
- 41% of rural businesses and 15% of urban businesses say that their internet service does not meet their needs. An additional 38% of urban businesses and 10% of rural businesses forecast that their internet service will no longer meet their needs in two years.

The findings of this research reflect feedback from just under 300 residents in Eastern Southland in 2008, which revealed the social impact on many groups, including older and younger people, caused by poor mobile service.

**Summary of Technological Developments since 2008**

There are four broad connection technologies available to connect users to the Internet: twisted-pair copper cable, fibre-optic cable, wireless and satellite. In Southland the first two are typically deployed as underground cable. Wireless can take the form of dedicated Internet wireless service, or via the cellular telephone network.

There are a number of providers who are implementing their own infrastructure investment and service provision, with little coordination. As a result in some areas there is duplication, while in others there is very limited or no service alternative to satellite, with its attendant latency and cost limitations.

**Fibre and Ultrafast Broadband**

In the provision of Ultrafast Broadband (UFB), Chorus have been laying fibre in Invercargill under UFB1. This is not the first fibre made available in Invercargill, earlier cabling connected some businesses and cabinets. Chorus have completed their cabinetisation programme in Invercargill, providing fibre to the cabinet.

Chorus have laid a number of fibre-optic cables in rural Southland under RBI, which there is an option for customers to connect to. However, in most areas these are very small lengths of cable in the vicinity of schools and the typical cost of a rural connection to fibre costs around ten times more than an urban connection

**Wireless and Rural Broadband**

Woosh Wireless 1Mbps service has provided broadband access to nearly 90% of Southland since 2007. As part of the Rural Broadband Initiative (RBI) Vodafone have provided 700MHz and 2100MHz bands with 3G and more recently LTE equipment in many of the same areas which Woosh covers. Spark have announced that they will deploy a 700MHz point-to-multipoint fixed Internet service, which will overlay both the Vodafone and Woosh networks. Yrless, Velocity Net and Areneo have been deploying small-scale WiFi networks in response to demand from groups of rural customers unable to access or not happy with the level of service from other providers.

Chorus has deployed a number of rural DSL cabinets in rural Southland, mostly under RBI. There is eveidence that the earlier deployments of DSIAMS are no longer capable of meeting prescribed data speeds and in many cases, these have not been connected to nearby fibre.

**Mobile Phone Services**

In the area of provision of mobile phone coverage, Vodafone have been building out a 3G network on 900MHz for mobiles only. Spark have been deploying their own mobile cellular service.

## Network Developments since 2008

**Satellite service**

Traditional satellite broadband service from geostationary satellites is not able to provide the quality of service required by future and many present users because of the high latency inherent in such service. Also the throughput of satellite transponders limits the total capacity of satellite service. Satellite service based on relatively low cost small-sat satellites have been proposed for some years SpaceX recently announced plans to provide Internet access through a global network of about 4,000 satellites starting before 2020. To this end, SpaceX raised $1 billion in funding from Google and Fidelity in early 2015.

Drones and balloons have also been mooted to provide Internet access. Google's Project Loon, a ring of solar-powered balloons in the stratosphere that could begin delivering Internet service to mobile phone users in the Southern Hemisphere was predicted to become commercial some time in 2015, though there is no sign of this at the time of writing. A field trial was conducted in Canterbury in 2013 with unknown results. By partnering with telecommunications companies to share mobile spectrum, it is intended that customers would connect to routers on the balloons with their LTE cellphones phones and other LTE-enabled devices. The signal is then relayed across the balloon network and back down to the Internet on Earth. Each balloon can provide connectivity to a ground area about 40 km in diameter.

**Cable network**

The customer access network is that part of the telecommunications network which connects to the customers' premises, or for mobile users, the customer CPE. Until more recent years, the customer access network in Southland has been based on copper pair cable, which connected to distribution cabinets and telephone exchanges.

The digital telephone exchanges owned and operated by Telecom New Zealand throughout Southland have 10 to 15 year design lives and were all built between 1983 and 1991. The youngest exchange is now 17 years old, the oldest is 25 years old and most are over 20 years old.

Much of the copper reticulation cabling in rural Southland was laid between 1978 and 1990. This had a 20 year design life as far as capacity was concerned and a 40 year functional life was anticipated. This cable is now mostly between 18 and 30 years old. Much of the cable reticulation was designed for ISDN transmission limits, giving rise to city and urban reticulation designs using unloaded 0.4 mm2 cable, with a transmission limit of 3.8 km and the rural areas were reticulated with unloaded 0.63 mm2 cable, with a transmission limit of 6.8 km as shown in Figure 2. Some of the rural distribution cabinets contain electronics for 'subscribers PCM', which extends the range for another 6.8 km. Those rural connections which are beyond these transmission limits are served with loaded cable, or 'subscribers multi-access radio', which means that they are unable to use data communications faster than 9800 kbps. The rural star networks are not easily re-engineered for smaller reticulation distances.

Efforts to modernise New Zealand's telecommunications networks have so far been successful in the cities and largest towns where Chorus provides business-grade fibre-optic cable access and the UFB programme is well under way, and 3G – and soon 4G - mobile cellular coverage is nearly complete. The same cannot be said for much of rural New Zealand, where RBI and private sector investment has, with few exceptions, been successful only in providing fibre-optic cable access to schools. While RBI cable can be accessed by customers that the cable passes, the cost of a connection starts at $6,000 and depending on the distance from a joint, rapidly escalate to many tens of thousands of dollars.

## Wireless

### Texting

SMS texting's use as a reliable telecommunications medium that remains operational when other mobile and landline media fails during civic emergencies was proved in the Christchurch earthquakes. It is now considered a standard format for broadcasting status updates and warnings by Civil Defence. Customers in poor connection areas value texting but still report delays of many hours in receiving texts, sometimes with whole batches being received at once.

### Mobile telephony-data convergence

For at least the last 20 years, telecommunications and computer engineers have been predicting "convergence", where voice and data telecommunications combine. This has been achieved to the extent that the words "digital" and "telecommunications" are now close to synonymous and smartpads and smartphones are as much regarded by the general public as media-rich telecommunications appliances as computational devices. Nowadays, a device that is not connected to the Internet will be regarded by most people as being effectively lame. Convergence is close to becoming complete, with applications such as Viber and Skype eroding the voice market and LTE becoming the de facto voice standard where voice is treated as just another data stream.

Convergence is not altogether welcomed by cellphone service providers: answering the increasing demand to allow users to transmit image (photograph) data and streaming video also allows users to bypass the speech path of their cellphones to access Skype, gTalk and other VoIP services. It is not possible to circumvent VoIP without adversely affecting the other services and so leaves open a likely path to effectively undercut the cellphone business case.

### Improvised wireless technologies

In the wireless and cellular world, it is common to find first-in, affordable technologies and protocols to be adapted (or 'kludged') to provide a satisfactory improvised service. We have seen this where wireless Internet providers have adapted or deployed WiFi (IEEE802.11) technology to provide point-to-multipoint wireless broadband service in their communities from low cost solar powered hilltop sites. WiF used in this manner cannot provide good data or link security, nor easily manage customer quality of service. It is not designed to be scalable.

Similar improvisation has become apparent through the RBI1, where Vodafone has deployed its 900MHz 3G HSDP+ cellular service for point-to-multipoint service. It is not clear that advantage of relatively cheap CPE outweighs the 3G HSDP+ protocol burden associated with providing with mobile capability, cell hand-over and such-like for fixed stations.

We are aware that at some sites at least, Vodafone have sought to migrate their point-to-multipoint fixed service to 700MHz and 2100MHz bands, leaving 900MHz for mobile telephony and data, but this still leaves the 900MHz service at risk of congestion. Regardless, the strongest drawback of using mobile technologies is that they cannot easily prioritise users, meaning that the quality of service for customers is unpredictable, depending on local cellsite demand.

A difficulty with improvised wireless technologies is that low cost, lower power consumption WiFi networks are readily deployed in remote sites, but they do not have a strong upgrade path, are often limited by back-haul bandwidth, are not scalable, do not have access to replacement technologies (for instance, without support of a major carrier support, upgrading to LTE is not an option) and limited investment capital. There are at least four small-scale niche WiFi operators in Southland that offer excellent service that at present, but who can be expected to struggle in the future as fibre-optic cable and LTE eats into their market.

### Spectrum management

As Venture Southland has raised with MBIE with respect to the Digital Dividend, the lower UHF frequencies (700MHz in particular) should be restricted to providing broadband service to non-line of sight customers so that their grade of service and availability is not restricted by service to customers that could be provided with spectrum that can only operate over line of sight, noting that the higher frequencies do not hold bandwidth at the same premium as the lower bands. A code of good practice is required to be established for the lower bands so that their intrinsic value is not squandered.

### Mobile roaming

The days when mobile telephone operators would use their network coverage as a basis for marketing strategies are long over. For the most of the New Zealand population, who live in urban areas, coverage is effectively complete and duplicated. In the cities, where 2Degrees operate a network, coverage is triplicated. Indeed, neither Telecom/Spark, nor Vodafone have marketed their overall mobile coverage as a point of distinction since 2009. Spark New Zealand currently claims it provides 3G mobile services to approximately 97% of populated areas across the country and expects 4G coverage “would grow over time to similar levels”. Vodafone New Zealand claims that their 1300 cellsites cover “97% of where Kiwis live, work and play”.

The only locations where coverage is of vital importance are the rural areas, where users are obliged to carry two cellphones – one on each network – to improve their chances of being within coverage, or they experience piecemeal reception. For this reason, in Southland, Opus International Consultants engineers carry two cellphones, and so do many Southland District Council engineers.

We note that international visitors to New Zealand have no difficulty roaming over the Vodafone network with their own cellphones and only require Global Roaming to be turned on in the cellphone. Overseas visitors can also roam on the Spark network. Both Spark and Vodafone allow roaming over each other’s network for emergency 111 service. There can be no insurmountable reason why any modern cellphone cannot roam over all of New Zealand’s cellphone networks.

We seek that not only must the MBSF sites allow for open access roaming, but any new LTE sites under RBI.

We also seek that within a reasonable time, both Spark and Vodafone must be required to allow seamless roaming over each other’s networks where they do not provide their own service.

## Co-siting and co-location

At present market and non-market impediments exist which thwart any good intentions for telecommunications network providers to co-site, or co-locate their equipment. This can include incumbents requiring large up-front application fees, providing expensive and slow engineering investigations, charging newcomers access prices that tend towards average and not marginal costs, and tardiness in dealing with applications. Our experience is that it is usually cheaper and always easier to establish a new mast, or tower than it is to co-site equipment and plant.

The result is that strategic sites suffer from a proliferation of towers and masts. For example, there are three towers on Winton Hill, the antennas on all of which could be easily co-sited onto the Woosh Wireless tower. Telecommunications network providers do not understand that it is a privilege to spoil a landscape by building a tower and not a right. That said, there have been some responsible approaches to preserving landscape values, most notably Telecom New Zealand's Mt Pillans site above the Milford Track.

By demanding unreasonable leases for sites, power lines and so forth also have the result of hindering network expansion, or adoption of further, less desirable sites.

## 5G

5G technology, which will operate on radio spectrum between 10GHz and 100GHz, is currently being developed. Given the expected rate of technology development, it is unlikely that 5G CPE will be affordable and widely deployed within the next 8 years. Regardless, the propagation characteristics of 5G spectrum rules it out from anything but short range telecommunications and so is not suitable for widespread rural telecommunications.

## Heterogeneous Networks

Heterogeneous Networks (Hetnet) involves a mix of radio technologies and cell types working together seamlessly. base stations, often installed on rooftops, cover large areas and many users. This is the backbone in the Heterogeneous Network solution. Small, wireless transmission links connect the base stations and the rest of the network. Indoor Pico base stations takes over the customer connection when moving indoor, noting that some 70% of traffic is generated indoors. Wi-Fi is used as a complement in small indoor/outdoor hotspots and micro base stations with full features can be used to cover indoors and outdoor crowded areas.

Deployment of Hetnets in Invercargill, Gore and the larger towns are highly likely over the next ten years.

## Technical and logistical challenges

*This summary is based on feedback received from residential and commercial broadband and mobile customers; technical information provided by telecommunications companies and an independent report undertaken by Advanced Technology Solutions Ltd. Mapping of service coverage on Southland's State Highways on both the Vodafone and Spark networks was also undertaken by Opus consultants.*

- Southland has historically been above the New Zealand average for the take up of broadband services and (barring current UFB) this trend is continuing - especially in the rural areas. It is clear, however, that with the increased availability of, and dependency on internet based services, customer expectations are rapidly increasing and survey results show that more than 40% of users are dissatisfied with the performance of their service. A large proportion of users claim that the service is "unusable" during peak times. This is true for rural areas in particular.
- While the uptake of mobile technology (internet and mobile phones) is at least on par with the rest of New Zealand, it is evident that the quality of the services provided throughout Southland is significantly below requirements with close to 50% of users regularly experiencing problems that impact their business and personal lives.
- With the opening up of telecommunication competition that included infrastructure, the Government has created an environment where markets with perceived low returns, such as Southland, are being largely ignored for major investment. In the past 20 years, any significant investment in telecommunications infrastructure has only come about as a direct result of subsidies, lobbying, and intervention from local and central government. Without this continued intervention, the quality of telecommunication services in Southland will continue to fall behind the rest of the country and growth opportunities will be hindered.
- Difficulty of finding out what connection options are available and will best suit a business. Challenges of communication between Chorus, the owner of infrastructure, the Internet Service Providers and subcontractors to determine where responsibility lies for poor service, connection issues and decisions to make upgrades to service.
- Feedback from Internet Service Providers to customers that their poor service is caused by old cabinets, for which no upgrade is planned.
- Decline in internet service following upgrade in service – In many cases customers say that dial-up was more reliable than the upgraded services offered by telecommunications companies.
- The current UFB programme will result in nearly 17,300 residences being able to access fibre broadband services in Invercargill, Gore and Mataura by June 2016 (Gore doesn't start until August 2017). To date, around 13,000 residences in Invercargill have access with around 1,300 connections made.
- The take-up rate of 10.4% is below the national average of 12.8%. This lower than average uptake is seen as the result of; (1) fewer retailers in the region selling the service, and (2) lack of public awareness, promotion and information regarding the services on offer. There has also been feedback from some businesses of difficulty and delays in getting fibre installed.
- Costs of connecting to fibre have been noted as a barrier by some in rural areas, with costs being an average ten times higher than in urban areas.

- Without a quantitative analysis of end user performance, it is difficult to determine whether or not a supplier has met its contractual service provision obligation under the RBI programme. The Venture Southland survey, however, does create sufficient concern for further investigation regarding the performance and capacity of the this network. Vodafone states that the network performance is "managed carefully", but much more transparency is required as to how this is done and what the results are.
- The cellular network (including data) is by its nature a contestable network and there are no guaranteed performance levels. It is not possible to prioritise data services to fixed mobile RBI customers and the loading on a cell site will vary greatly during the course of a day and over the peak tourist season. This appears to contradict the Government's requirements under the RBI contract.
- Irrespective of whether or not the RBI contractual connection performance has been achieved, the fixed cellular connection specification for minimum throughput needs to be reviewed as it currently appears inadequate to cope with modern Internet services and customer expectations.
- There are reports that in some locations cell sites have reached their capacity for fixed Internet connections under the RBI programme. While this has been stated by some Vodafone resellers and installers, it has not been stated by Vodafone and its position is that there is no hard limit on the number of RBI connections to its sites.
- A co-ordinated Internet speed test survey in various areas to get quantitative data on service quality would be of benefit. The results of these tests should be used check against service provider obligations where government contracts are in place and inform further investment.
- Vodafone has plans to upgrade its RBI sites to LTE (no dates given) but this is again will only service as a stop-gap measure for high end non-mobile users and have limited geographic coverage. A modem change will be required for RBI connections to make use of this higher performing LTE service.
- The contractual obligations on Vodafone for the delivery of RBI1 only require a very basic level of service which is no longer keeping pace with technological development and the requirements of today's business environment. The Vodafone contract stipulates minimum performance speeds which are equivalent to those expected from a 2000 dial up service. It is therefore not surprising to see these concerns being reflected in the customer feedback.
- Many customers have been told, has been capped to limit the number of customers to 100.
- The incumbent (pre RBI) broadband network investors in Southland are of the opinion that the RBI as well as not being effective has seriously undermined both the pervious private sector and Government sector funding and has been a disincentive for applying new capital to network improvements.
- While less than 1% of Southland residences do not have a mobile phone, 47% rural residents and 39% urban residents regularly experience mobile coverage problems which significantly impacts their lives. This clearly indicates that while mobile phone penetration is high, the coverage provided is significantly below requirements.
- With only minor exceptions, much of the existing mobile network infrastructure and subsequent coverage areas are duplicated in Southland. The proliferation of duplicate/overlapping mobile network infrastructure by Vodafone and Spark in low population density areas needs to be reassessed with a view to sharing of that infrastructure, especially where that infrastructure is being subsidised by government. Competition requiring duplication of infrastructure does not appear to be serving the Southland region well in low population density areas and creates a disincentive for suppliers to invest. With more revenue on offer through roaming arrangements, there will be a greater incentive to invest in marginal areas.

- It is clear that large areas of Southland have little to no mobile phone coverage. With limited funds, a targeted approach is required to achieve the greatest impact (economic and social benefit) for key industry sectors. Any further builds of infrastructure should therefore be undertaken in consultation with the local economic development agency. Venture Southland has identified three high priority areas for the expansion on mobile services which cover main arterial routes, tourist areas and farms.

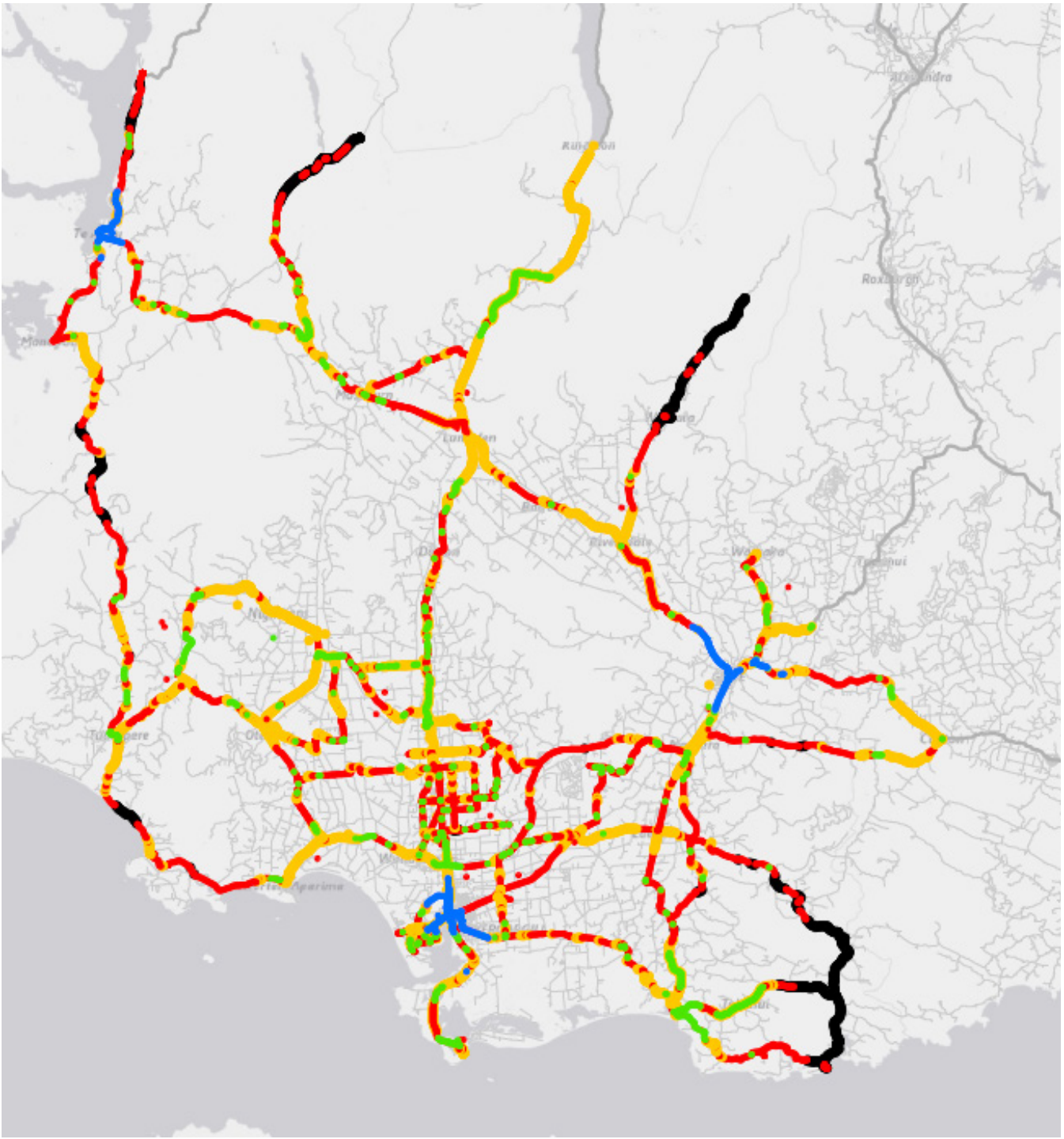
***Recommendations from the independent report by Advanced Technology Solutions:***

- Preparation of a joint Long Term Strategic Plan for the Development of Telecommunication Services in Southland - to be undertaken jointly by central and local government with assistance from key suppliers (include cost estimates). This should provide a roadmap to a point where capacity and coverage become non-issues and ensure efficient investment to achieve the greatest benefit for the region in the shortest time possible.
- Establish a closer relationship and Statement of Works between local councils and suppliers in order to: (1) efficiently overcome council consent requirements; (2) better target infrastructure development for the community priorities; (3) stimulate demand for services; and (4) ensure any new buildings and building sites include telecommunications infrastructure consistent with the Long Term Strategic Plan.
- That mobile networks be extended into remote areas (where subsidies may be required) by building an "open" single network infrastructure which accepts connections from all national service providers through a "transparent" national roaming agreement (Note: Vodafone already has a selective roaming agreement with 2degrees
- It is clear that because of the high level of customer dissatisfaction, expectations of the fixed broadband services are not being met in many areas. Networks are not maintaining pace with the ever increasing demand for Internet based services - especially in the rural areas where dependency on these services is high. Ultimately, therefore, fibre optic cables must be extended further into remote locations and innovative ways of funding and achieving this must be explored by local government with supplier input.
- It is understood from Vodafone that recent changes have made it possible for emergency services calls ("111") to roam between networks should the handset's home network not be visible. As this is a key issue for road and farm safety and more clarification is required as to the network conditions under which this occurs
- With customer service expectation ever increasing, the minimum performance standard for the rural broadband service must be revised. The current "minimum peak" standard has set the minimum performance (average throughput of 45kbps over a 15 minute period) standard too low and is not being actively monitored
- An open and transparent method of testing network performance should be established. Network providers must be encouraged to be more open regarding performance issues such that a realistic cost versus performance equation can be established and external assistance provided where appropriate.

The involvement of an independent body such as the Telecommunications Commissioner is recommended. Minimum standards must also be revised on a bi-annual basis.

- Provide further encouragement for private wireless internet providers to share the fibre cable to rural schools in order to upgrade and extend internet access to the local community near the school. (Yrless and VelocityNet in Southland are implementing a small number of projects based on distributed Wi-Fi networks around schools to provide community broadband).
- Make greater use of the already established remote Woosh Wireless sites to provide higher performance broadband access should be considered
- Over the past 10 years, Venture Southland has proven itself to be a worthy partner with central government and telecommunications providers for the enhancement of services in Southland. (No other Territorial Authority has been as successful in this). This organisation has a good understanding of the needs of the region and has been a worthy advocate for the people and industries of Southland. A partnership with this organisation is essential for extracting the most benefit from any further investment by both central government and service providers.
- Southland continues to be a powerhouse for agriculture and tourism and there are significant indirect economic benefits to New Zealand to further grow these industries through the availability of ubiquitous, fit for purposes, telecommunications services. For this reason, the strategy by central government for attending to high population areas first must be modified to benefit these highly productive industries. A more targeted approach is therefore required to gain maximum benefit for any further infrastructure investments.

In the first week of May 2015 Opus International Consultants undertook field tests of the strength of signal of both the Spark and Vodafone networks on Southland's State Highways and other key transport routes using the latest Samsung S5 handset. The fullsize A3 maps have been included as a separate attachment to the ROI. Below are images of the overview for the region as a whole showing the widespread blackspots and poor signal areas experienced across the region. The first map shows the Spark Network and the second Vodafone. Black areas indicate no signal, red areas signal so weak that holding a call is challenging. Full size maps and close ups are included in the appendices.



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Project No: 6-VQ420.82

**Spark Measured Cellular Region Signal Strength: Southland**

**Legend**

**Spark**

**dBm**

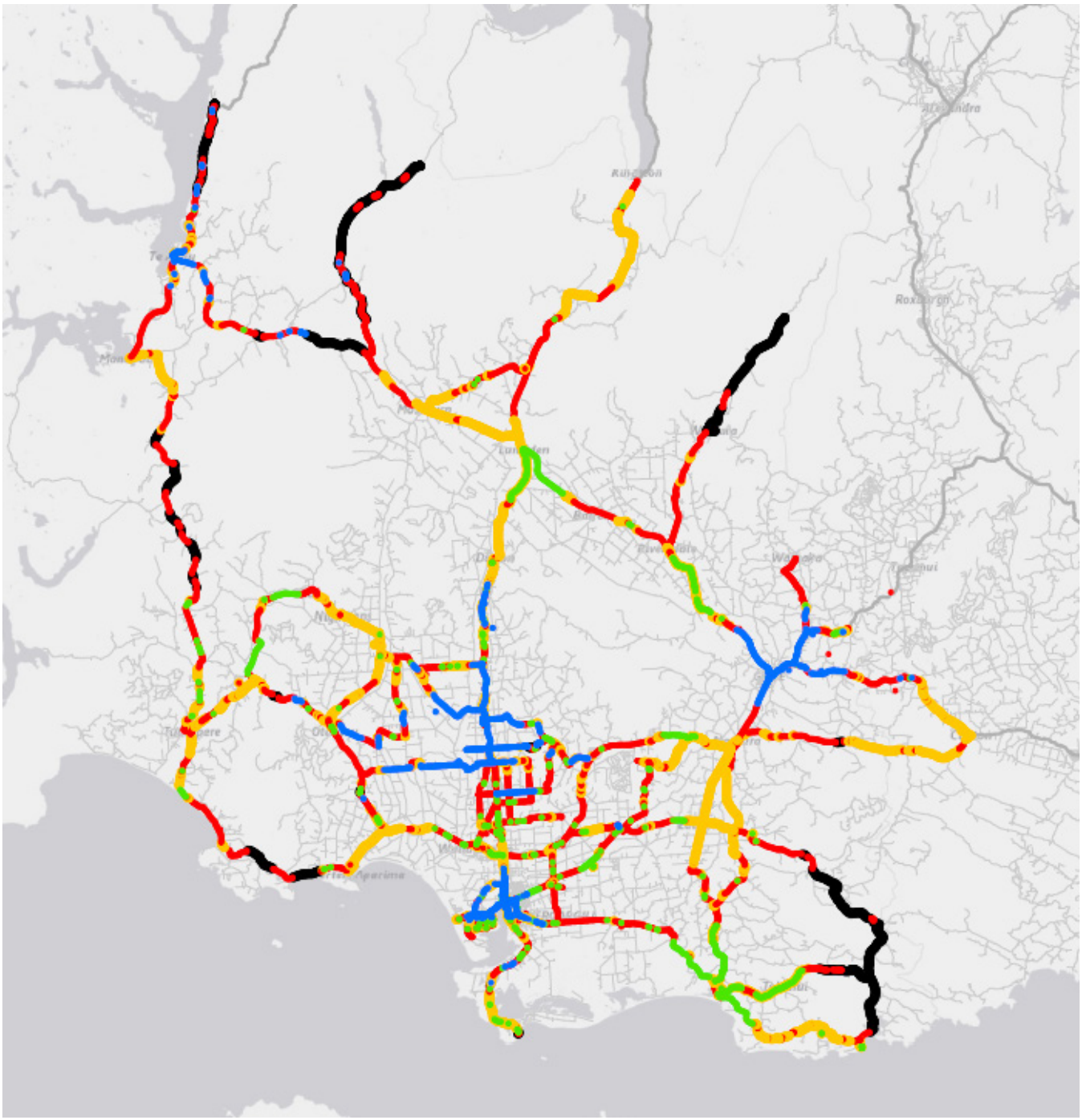
- -50 to -80 (Good)
- -89 to -80 (OK outside)
- -89 to -120 (Unable to hold call)
- LTE 4G
- No Connection
- State Highway
- Local Road

0 10 20 30 km

1:800,000 @A3

Projection:
NZGD 2000 New Zealand Transverse Mercator

| Date: 15/05/2015 | Revision: 4 |



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**Vodafone Measured Cellular Region Signal Strength: Southland**

Legend

Vodafone

dBm

- -50 to -80 (Good)
- -89 to -80 (OK outside)
- -89 to -120 (Unable to hold call)
- LTE 4G
- No Connection
- State Highway
- Local Road

0 10 20 30 km

1:800,000 @A3

Projection:
NZGD 2000 New Zealand Transverse Mercator

| Date: 15/05/2015 | Revision: 5 |

# Appendix 5

## Network stimuli

Personal telecommunications throughout Southland began as telephony and providing individual service remained as a fundamental focus of New Zealand Post Office and later Telecom New Zealand up until 1990, by which time individual automatic telephone service had become ubiquitous. In Southland, the fixed-line telephone network was almost entirely based on underground cabling, with cables following almost every Southland road. Starting in 1987 for Southland, cellular service began to be rolled out and through the following decade moved from being a rich person's toy to an everyday tool. With the digitisation of both the telephone and cellphone networks and the end devices starting in the 1980s, 'convergence' - where voice and computer-related data transfer came together - was considered to be a logical and planned phenomenon. It was expected that ISDN would provide the route for convergence, but from 1993, the Internet protocols gained supremacy, leading to some serious network readjustment that has still to be fully implemented. In 2015, fixed telephone line service penetration had already begun to decline and low-cost smart phones and tablets ushered in convergence. In 2014, there were more machine devices using the Internet than humans, further challenging the telecommunications environment.

### Convergence

Even as late as the 2008 Digital Strategy, Convergence was considered to be an important goal still to be reached. The introduction of the iPhone – the first real example of consumer-grade convergence [1] - midway through the year before was expensive enough that widespread adoption of smart phones took a further five years. Driven by affordable high definition touch screens, adequate computational power and matching battery performance, market success came about through the creation of App stores for consumers. It will soon be impossible to buy a cellphone that is not smart. The LTE cellular service is, in fact, essentially a data service with telephony as an adjunct- the opposite of even 3G cellular service where voice service was still the main focus.

The implications of convergence are very serious for telecommunications network providers: so-called 'over-the-top' service providers who provide value-added service using the essentially dumb telecommunications networks turn out to be the profitable market segment. Worse, the apps are able to bypass the previously lucrative voice channels which telephony depended on and provide voice services essentially for free. The cash-flow lifeblood for telecos is in jeopardy as a result.

### Internet of Things

First talked about more than 15 years ago, the Internet of Things (IoT) is where objects and people connect wirelessly. Wi-Fi, Bluetooth Smart (also known as Bluetooth Low Energy, or BLE), KNX, ZigBee and proprietary IoT devices and protocols are currently available and under continued development. Until recently, there has been some conjecture as to how the IoT could provide useful services, but, regardless, it is projected that 30 billion devices will enter into the IoT ecosystem by 2020. Assisted by the growing adoption of IPv6 protocol for the Internet, it becomes technically possible with IoT for a domestic heatpump to not only be controlled by the homeowner, but by the homeowner's electricity retailer. Further, the electricity for the heatpump could be billed by a different provider, or come bundled with the heatpump at the time of purchase. The IoT will become ubiquitous as so-called energy harvesting chipsets (where energy sources such as motor vibrations provide useable energy) become matched to ultra-low power mixed signal processors, wireless devices and sensors, all at low cost. These requirements have only just come together and one can expect a maturity in the market and (true) exponential growth to continue as a result.

A telecommunications concern regarding IoT is that although the data payloads transferred are very small, the IPv6 Internet protocol headers may be 40 times larger than the payload. The IoT devices pass a lot of small packets at a very low bit-rate to each other, but this "chatter" has the potential to consume considerable Internet bandwidth when IoT devices become more commonly deployed. While likely to not be of concern to fibre-optic connections, this is not necessarily true for wireless and LTE networks used for fixed service. It is not clear what the full implications of IoT are.

[1] *In fact, Steve Jobs introduced the iPhone at its launch as a combination of three devices: a "widescreen iPod with touch controls"; a "revolutionary mobile phone"; and a "breakthrough Internet communicator".*

[2] *For example, RIPE Atlas is a global network of probes that measure Internet connectivity and reachability, providing an unprecedented understanding of the state of the Internet in real time. See https://atlas.ripe.net/about/..*

## Video services on demand

The introduction of YouTube in 2005, coupled with sufficient worldwide broadband take-up to support it, proved to be the turning point for on-demand Internet video services. Since then, video on demand services have been promoted in New Zealand, but copyright difficulties still exist. It can be expected that these difficulties will be overcome in the near future. Streaming television, similar to streaming radio, may or may not excite public interest as the broadcasting model for television ignores the preference for customers to dictate what they want to see and when.

There is also the possibility that customers will require high definition video conferencing. One could expect that this would be desirable for smartphone users who want to show scenes in real time, or demonstrate activities, but is nonessential for customary person-to-person conversations where a 'talking head' adds little to the experience.

Paradoxically, consumers want to watch increasingly high definition video (which requires more bandwidth) at home and in their offices to watch, but often settle for the convenience of relatively low definition, small screens of tablets.

Some pundits had proposed 3D video as the next 'big thing', which would have doubled bandwidth demand for video. However, the difficulties in making good 3D videos and its implicit viewing inconvenience makes 3D video relatively unattractive for almost all users. It is no longer strongly promoted as a selling point for television sets.

Nonetheless, multiple super high-definition video services are possibly the only uses that could drive Internet bandwidth demand to above 30 Mbps per household. Big screen high definition 4K (and better) videoconferences with perhaps four or more screens at each end require operating bandwidths in the order of 1Gbps. When all the relevant technologies become commoditised, one could finally expect teleconferencing performance to be such that it will find widespread acceptance as a replacement for travel. It would be realistic to expect that the hardware will become affordable for businesses over the next five years.

## Performance Bottlenecks

What is not clear is the extent to which there is suppressed demand for high bandwidth Internet services, because the experience for many users is influenced by a number of different bandwidth bottlenecks. In practical terms, most customers are ill-equipped to identify the cause of bandwidth bottlenecks, noting that there are a myriad of causes, starting from the user's computer, through the local network, and network retailers, wholesalers – both national and international – to the far-end server.

Because the speed and reliability of Internet experiences are not consistent over time, even for the same connection, customers' expectations would tend to be set by the average or worst experiences they encounter rather than the best experiences, even if they are unhappy with them. For this reason, for example, users may tend to use Skype with the video turned off as their default setting. As Internet performance improves, bandwidth demand can be expected to increase as confidence in performance grows with it.

There are attempts to identify Internet performance bottlenecks, using 'probes' deployed in end-users' LANs . Much more monitoring of the network is required to identify and rectify bottlenecks and improve user confidence.

[1] *In fact, Steve Jobs introduced the iPhone at its launch as a combination of three devices: a "widescreen iPod with touch controls"; a "revolutionary mobile phone"; and a "breakthrough Internet communicator".*

[2] *For example, RIPE Atlas is a global network of probes that measure Internet connectivity and reachability, providing an unprecedented understanding of the state of the Internet in real time. See https://atlas.ripe.net/about/..*

# Appendix 6

## Metcalfe's Law and Southland

It is not always grasped by some telecommunications providers that telecommunications networks differ markedly from other utility networks: unlike, say, a power utility where connecting one more customer to the network benefits that customer, a new customer on a telecommunications network provides utility to himself, but also some 3 billion other users who can now contact him. Metcalfe's Law describes how the utility (or value) of a telecommunications network increases by the square of the number of its users. What is not so obvious is that this law points to a critical mass of connectivity after which the benefits of a network grow larger than its costs. The difficulty is that the costs are not necessarily accrued by those who collect the revenue, which is where cross subsidisation strategies becomes important.

Most telecommunications experts will be familiar with Metcalfe's Law, which describes how the utility (or value) of a network increases by the square of the number of its users (because, unlike service utilities, telecommunications networks provide service to both the calling and called parties).

There are two corollaries to Metcalfe's Law that are not so well known:

1. Metcalfe himself observes [3] that his law points to a critical mass of connectivity after which the benefits of a network grow larger than its costs. The number of users (N) at which this critical mass is achieved can be calculated by solving

$$CN=A(N-1)2$$

which quickly simplifies to

$$CN=A(N)2$$

where C is the cost per connection and A is the value per connection. The N at which critical mass is achieved is:

$$N=C/A.$$

It is not much of a surprise that the lower the cost per connection, C, the lower the critical mass number of users, N. And the higher the value per connection, A, the lower the critical mass number of users, N.

2. Melody [4] shows that the economics of network expansion are such that the calling opportunity multiplier is always higher than 2, meaning that the unit costs of network extensions can be more than twice the telco's average costs per customer before high cost subsidies need to be considered at all. The incremental revenue benefits to the telco will be much greater than the charges billed to the additional subscribers, as there will be increased calling by those already on the network to the new subscribers. When this is combined with the fact that rural and remote area subscribers generally use the network at a higher than average level and incur even higher charges due to the much greater proportion of long distance use, several times the average customer extension cost can be justified on a cost recovery, if not a profitable basis, when a network wide analysis is undertaken. This helps explain why universal service need not be a significant subsidy issue in most countries.

In Southland, we have been able to capture the costs of rolling out the Woosh Wireless network and are able to demonstrate that Metcalfe's Law is approximately held to be true, as set out in Figures 1(a) and 1(b).

[3] *http://vcmike.wordpress.com/2006/08/18/metcalfe-social-networks/*

[4] *W H Melody in "Telecom reform: Principles, Policies and Regulatory Practices, ed. W H Melody, Tech. Univ. of Denmark, 1997.*

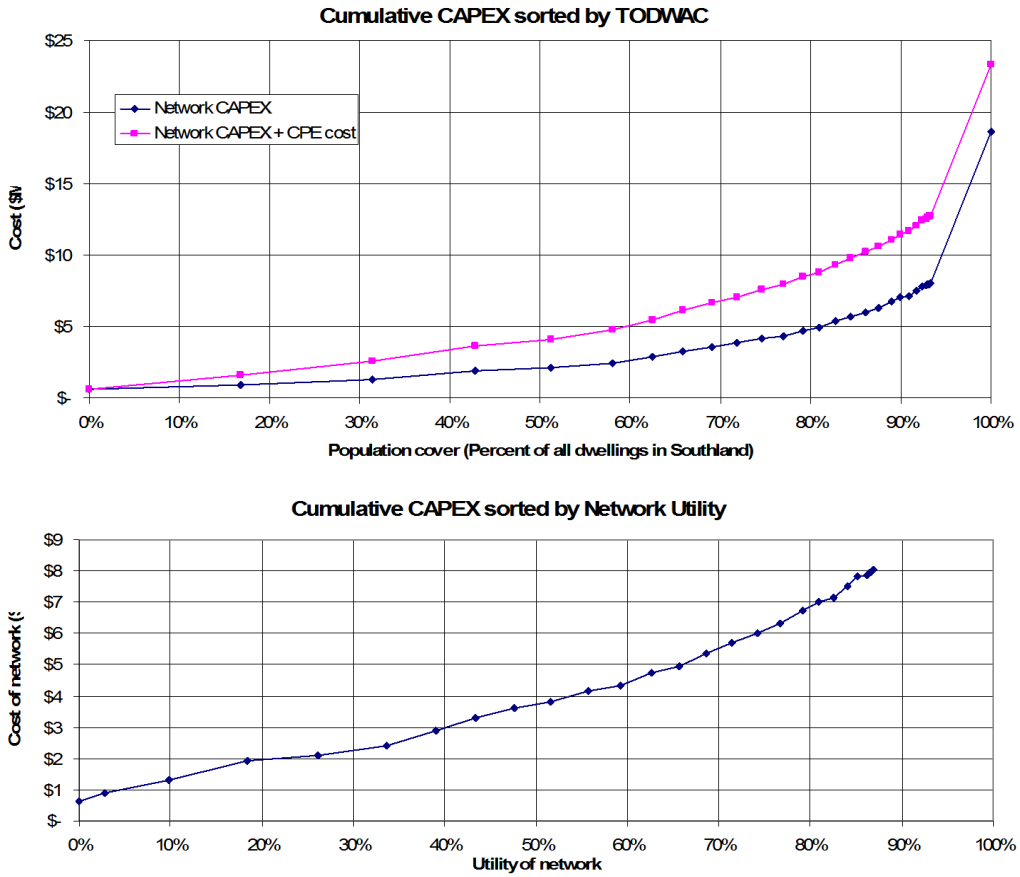



Figure 1. Southland wireless broadband Internet network CAPEX, (a) as a function of coverage, and (b) as a function of utility as described by Metcalfe's Law. Note that in 1(a), the last 5% of subscribers are provided with satellite service.

- For most people, telecommunications has little price elasticity: people need it at whatever the cost (within reason).
- Rural Broadband Initiative (RBI) is not extending rural broadband coverage in Southland over that already achieved by Woosh Wireless in 2005
- A minimum target market penetration for broadband in the order of 95%, in both rural and urban areas. This is Venture Southland's conclusion from applying Metcalfe's Law, which states that the utility of a network increases by the square of the customers connected.
- A corollary to Metcalfe's Law: there is a critical mass of connectivity after which the benefits of a network grow larger than its costs
- A further corollary is that the last customer connected is the most valuable customer for a communications network, as opposed to a utility network where that customer is the least valuable in terms of other customers.
- Broadband connection is more important for rural customers than for urban customers. A long term strategy is required to ensure that all rural customers can be offered both fibre-optic connectivity (noting that underground twisted-pair (telephone) copper cable had become universal in Southland by 1990) and 4G service

[3] *http://vcmike.wordpress.com/2006/08/18/metcalfe-social-networks/*

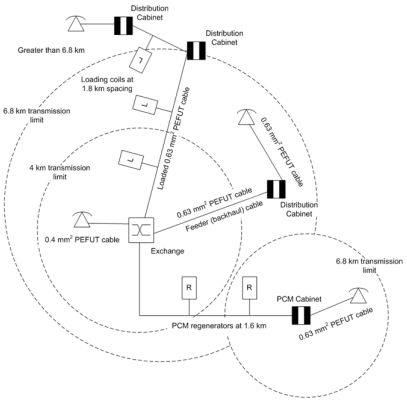
[4] *W H Melody in "Telecom reform: Principles, Policies and Regulatory Practices, ed. W H Melody, Tech. Univ. of Denmark, 1997.*

# Appendix 7

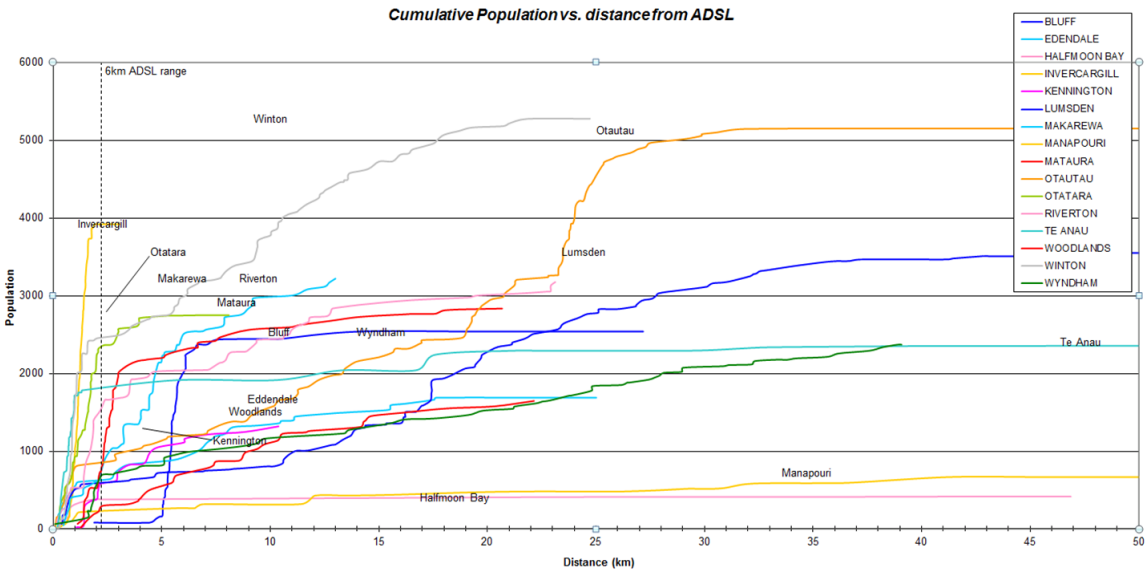
## Local Loop transmission limits

Between 1979 and 1991, a concerted effort by New Zealand Post Office and then Telecom New Zealand saw the replacement of Southland's antiquated open-wire party lines and manual telephone exchanges with the latest technology: underground, copper cable reticulation providing individual service, meeting the transmission standards set out for ISDN technology. This cost in the order of $10M per year, including telephone exchanges and transmission bearers.

In the rural areas, the cabinet reticulations were designed for fixed gauge 0.63mm PEFUT cable with the intention of eventually swapping out cross-connect cabinets for electronics. This gave a useful design range of 6.8 kilometres from any cabinet to any customer. Not coincidently, the ISDN transmission limits are very close to today's DSL transmission limits, showing a way in which an interim solution can be forged.




Southland NZPO copper cable reticulation ISDN design rules



# Appendix 8

## Technology developments

In the information technology and telecommunications world, it typically takes three to five years from when a technology is first presented in the academic journals and conference papers to when it becomes commercially available. It generally takes at least another three to five years from when such a new technology is launched until it becomes affordable and comes into widespread use, should the technology succeed .

For this reason, the technology that can be expected to be available and used in Southland over the next five years can be confidently predicted. The actual technology that can be anticipated to be being implemented in ten years time is a little more uncertain although the general direction in which the technology will trend is quite clear now.

A number of key, so-called laws of technology can be used with confidence to assist in predicting future trends:

- Moore's Law states that semiconductors double in complexity every two years.
- The corollary to Moore's Law is that the price of information and communications technology halves every two years. While Moore's Law does not apply to copper, or fibre optic cables, it does apply to the equipment connected to the ends of these cables.
- Metcalfe's Law describes how the utility (or value) of a network increases by the square of the number of its users. This law points to a critical mass of connectivity after which the benefits of a network grow larger than its costs.

These so-called laws are described in Appendix 3. In addition, the Stackellberg game is used to analyze competition in an oligopoly market, i.e a market with a few suppliers, which is also applicable to telecommunications networks in New Zealand .

For at least the last 15 years, telecommunications and computer engineers have been predicting "convergence", where voice and data telecommunications combine seamlessly with computing, or ICT. This has been achieved to the extent that the words "digital" and "telecommunications" are now close to synonymous and computers are as much regarded by the general public as media-rich telecommunications appliances as computational devices. Nowadays, a computer that is not connected to the Internet will be regarded by most people as being effectively lame. This strategy accepts that convergence is close to becoming complete  indeed, the Apple iPhone is an obvious example of commercially available consumer level convergence  and so makes no clear distinction between telecommunications and computing.

Over the next ten years, we predict that among many small business and most residential users, lap-top computers and mobile computing will become prevalent. Even if 4G wireless technology is not immediately forthcoming, we believe that its mantra of "ABC" (Always Best Connected) is set to become entrenched as an all-encompassing telecommunications mode for many users.

If telecommunications services and networks are to serve into the foreseeable future, then they at least need to accommodate the current needs of our younger generation. In order to establish what telecommunications services should be considered necessary, we conducted two focus group studies and one in-depth survey of Southland teenagers (See Appendix 4).

[5] *For example, WiMax was first mentioned in the journals in 2001 and is only now becoming used commercially.*

[6] *For example, it can be shown that at a perfectly revealing equilibrium, the second mover earns the lowest and the third mover the highest expected profit of three players, essentially the situation in Invercargill.*

The opinions of all participants were extremely consistent, so that the findings can be regarded as highly credible. The key findings fly in face of conventional wisdom and indicate that even our own thinking of five years ago is dated in terms of how modern day telecommunications services are used and regarded. We found that for teenagers today:

- In many cases, fixed line telephony has little relevance and is seldom used,
- Email, even when accessible, is regarded as unresponsive and old fashioned; it is usually reserved for communicating with "old people"
- Ability to send and receive SMS messages with cell phones at all times is considered essential,
- Interactive, permanently on-line social networking through the Internet is vitally important in how youth express themselves, are perceived by their peers and how they communicate amongst themselves,
- High speed access to search engines, file sharing and instant messaging are all considered essential for success at school, both academically and socially.

Those who may consider that Youth's need to be permanently connected is merely a passing fad, or is trivial, overlooks the importance of how Youth nowadays operate, communicate and work. For instance, we discovered that those youths who live in rural areas and are deprived of cell phone and broadband Internet coverage at home are socially ostracised by their peers. We learnt of some youths who would roam all around their parent's farm desperately looking for locations from which they could SMS their peers. For these youth, Marshall McLuhan succinctly sums up the situation in his famous axiom, "The media is the message".

To support the requirements of mobile and portable computing, wireless networking in various forms will become ubiquitous. This will most likely take the form of WiFi networks in most homes, cafes and suchlike, connected to WiMax and/or 3G wireless, or cable backhaul to the Internet . In turn, WiMax might be conveniently connected to POPs via Ethernet over PON and instead of Fibre to the Home as a long term goal espoused elsewhere, all that may be necessary is Fibre to the WiMax Node. These nodes could be mounted on lighting standards along streets, or along shop facades.

Popularisation of 4G and/or WiMax will likely further remove the necessity for fixed wire technology for other than "penultimate mile" solutions for the majority of users. That said, we are not so sure that consumers will actually relinquish existing copper cable connectivity and we predict that only larger businesses, of say 15 staff or more, accommodation, education institutes and schools will warrant fibre running into their buildings. Indeed, continuing developments with ADSL technology will likely allow more than adequate bandwidth within Invercargill and Southland towns via the existing copper cable over the life of this strategy. (Once terminated in the home, we then predict that most users will mostly use WiFi for networking all but their appliances, servers and large scale media – such as large screen displays).

Following the recent developments in vectored digital spectrum management , which is the general case of the better known MIMO technology used in emerging wireless systems, it is highly likely that commercial solutions to allow existing copper cable networks to support distant 200 Mbps connections will be coming widely into use within ten years. Indeed, dynamic spectrum management looks to provide an evolutionary path towards ubiquitous single-line 500 Mbps customer DSL service; the death-knell of copper cable has been prematurely sounded regularly over the last 15 years at least, but the large world-wide existing investment in it means that those owning it will want to keep it going for a long time yet.

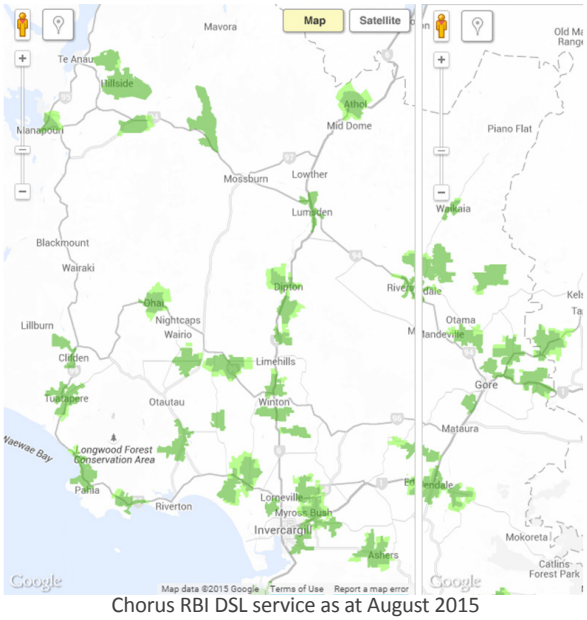
[5] *For example, WiMax was first mentioned in the journals in 2001 and is only now becoming used commercially.*

[6] *For example, it can be shown that at a perfectly revealing equilibrium, the second mover earns the lowest and the third mover the highest expected profit of three players, essentially the situation in Invercargill.*

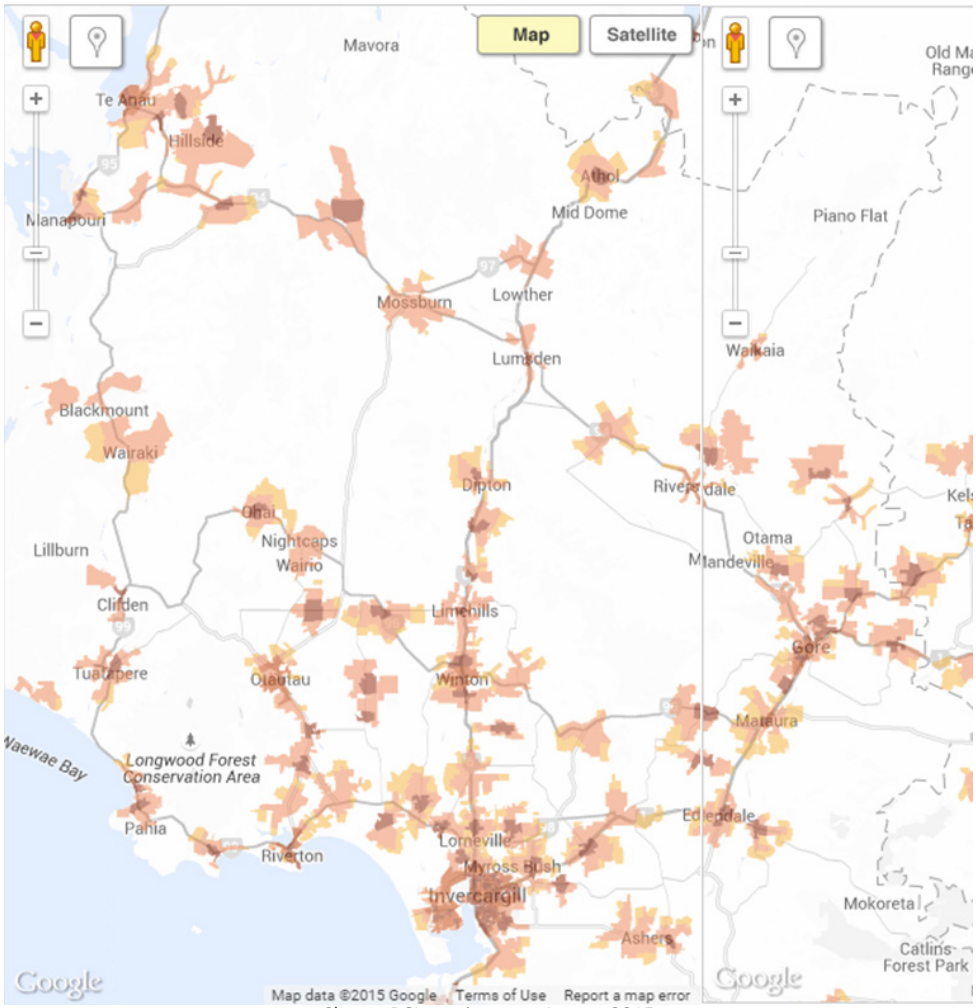
# Appendix 9

## Broadband coverage in 2015

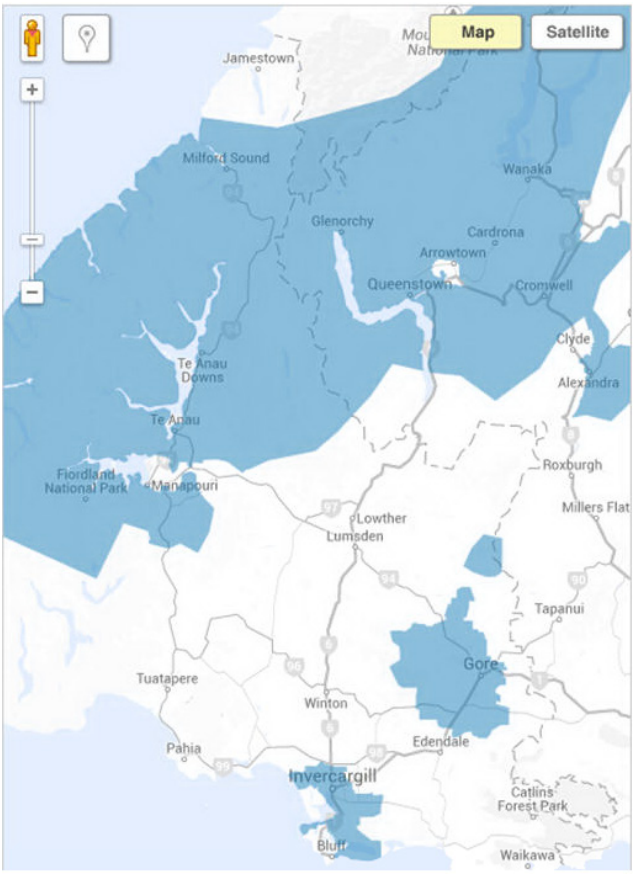

Chorus RBI1 fibre-optic map as at August 2015



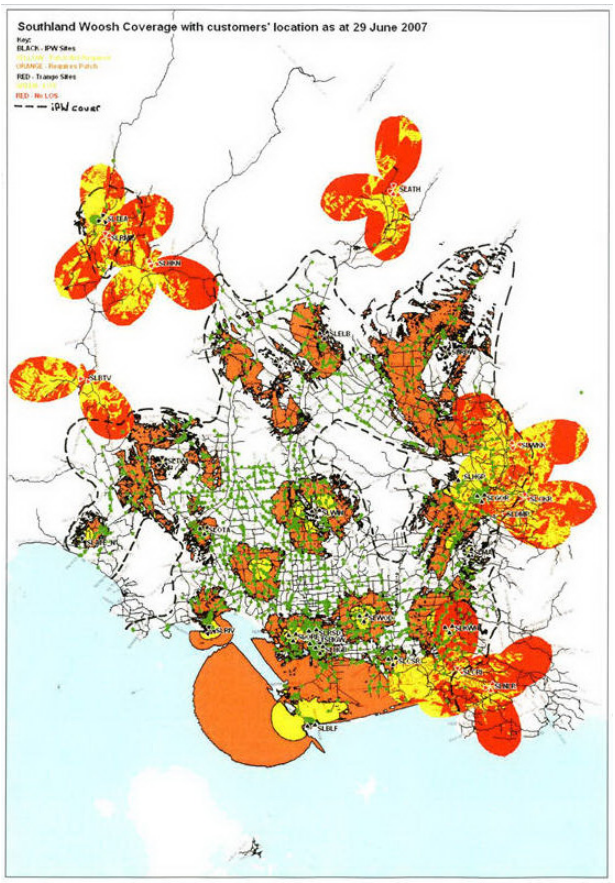

Chorus RBI DSL service as at August 2015




Chorus DSL service as at August 2015




Chorus Business fibre coverage area as at August 2015. (One wonders if Chorus are indeed able to provide service into half of Fiordland).




Woosh Wireless coverage map as at 29th June 2007. Combined with Telecom's ADSL technology, between 93% and 97% of Southland dwellings could access 1Mbps or better broadband at competitive prices. The green dots represent Woosh Wireless wireless customers. Note that actual coverage exceeds the predicted coverage areas.

# Appendix 10

## Digital Dividend

In 2008, Venture Southland submitted to MED on the opening up of the 700MHz spectrum, or Digital Dividend. The submission centred on the need to ensure that the 700 MHz Band is used so that it best serves rural and remote populations, for which this band is well suited, and the rapid deployment of a ubiquitous, affordable and universal broadband network. We are also committed to supporting any approach that extends and improves rural and remote cellular coverage.

It would be a waste of a valuable, scarce economic resource for the 700 MHz Band to be used to provide broadband access for areas that could be alternatively served with higher frequency, S-Band, equipment. This comes about because S-Band and higher frequency deployment is not well suited for rural coverage due to the very high absorption losses from trees and macrocarpa hedges at those frequencies, but not the 700 MHz Band. In short, we see the 700 MHz Band as a first priority providing in-fill coverage where population densities do not make S-Band deployment economic.

We express our concern that the economic prosperity to the nation that can be brought about by providing comprehensive, affordable, and universal wireless broadband to rural areas through using the 700 MHz Band far outweighs any short term profits to Government that can be obtained from leasing the spectrum. We urge that any tendering process gives higher ranking to bidders who will actually deploy a useful network to rural and remote areas than just award leases based on bid price.

We suggested that the German approach (Digital Dividend: Insights for spectrum decisions, ITU, August 2012) to most effectively utilise the 800MHz spectrum freed up by the digital dividend. It can be summarised:

- Four priority classes are categorized:
  - Priority 1: Towns/villages with less than 5 000 inhabitants;
  - Priority 2: Towns with 5 000 to 20 000 inhabitants;
  - Priority 3: Towns with 20 000 to 50 000 inhabitants;
  - Priority 4: Towns/cities with more than 50 000 inhabitants.
- In terms of these priorities, each Federal State compiled its own list of all areas needing coverage.
- There is a general requirement for each assignee to meet the obligation with 800 MHz spectrum.
- Other technologies are credited (with the exception of satellite).
- The degree of coverage to be met is 90 per cent of the population by 2016.
- Towns of priority 2 may be provided with broadband access based on the usage of frequencies in the 800 MHz band not before a percentage of 90 per cent of towns/villages of priority 1 has been provided with a sufficient broadband access, regardless the technology used. Towns of priority 3 may be provided with broadband access based on the usage of frequencies in the 800 MHz band not before a percentage of 90 per cent of towns of priority 2 has been provided with a sufficient broadband access, regardless the technology used. Towns/cities of priority 4

# Acronyms and Glossary

## Acronyms and Glossary

| | |
|---|---|
| ABC | Always Best Connected, the slogan for 4G wireless network services |
| Affordable | At a price that accurately reflects the average, true cost of universal service, without surcharges to account for monopoly profits, structured to encourage users to access and use a service. |
| AJAX | Asynchronous JavaScript and XML is a group of open source inter-related web development techniques used for creating interactive web applications, intended to increase the web page's interactivity, speed, functionality and usability. AJAX is the centrepiece of Web 2.0 |
| b | Bit, the fundamental unit of binary data |
| B | Byte, a standard package of eight bits |
| Backhaul | The part of the network that transports aggregated, or multiplexed data |
| CLEC | Competitive Local Exchange Carriers. In New Zealand, Telecom New Zealand |
| CO | Central Office, telephone exchange |
| CPE | Customer Premises Equipment, the equipment in the user's premises, or the mobile device used by the customer |
| IEEE | Institute of Electrical and Electronic Engineers |
| GPS | Global Positioning System, the US satellite positioning system. |
| ILEC | Incumbent Local Exchange Carrier. In New Zealand, TelstraClear, CityNet, Woosh Wireless and others |
| IP | Internet Protocol, a connectionless protocol used by the Internet and closely aligned to the Ethernet protocol commonly use in LANs |
| ISO | International Standards Organisation |
| ITU | International Telecommunications Union, a United Nations agency dealing with telecommunications, including publishing Recommendations, which have the status of standards. |
| KAREN | Kiwi Advanced Research and Education Network |
| kbps | Kilo bits per second; 1024 bits per second |
| LAN | Local Area Network |
| Last mile | The network component in a cable network that connects to a subscriber's premises, usually after the backhaul, if any. |
| Layer 2 network | A network that only transports data provided to it, without routing; essentially an ISO Physical Layer service |
| Layer 2 network | A network that routes data based on a variety of parameters; essentially an ISO Data Link Layer service |
| Marginal cost | The cost to extend an existing service, or network to provide service to an additional user. |
| Mbps | Mega bits per second; 1024 kilobits per second, or 1,048 million bits per second |
| MFN | Metropolitan Fibre Network, formerly known as a Municipal, University, Schools and Hospital (MUSH) network |
| MoRST | Ministry of Research Science and Technology |
| mS | Millisecond |
| PABX | Private Automatic Branch Exchange; a small telephone exchange, or switch, at the customer's premises |
| Peering exchange | A switch, or router where ISPs and network services providers transfer data destined for each others' networks to those networks |
| Penultimate mile | A term coined to describe the network component that connects the Last mile network components to an exchange, or POP from an aggregation point |
| POP | Point Of Presence, typically a node on the Internet to which customers can connect |
| PSTN | Public Switched Telephone Network, the technical name for the traditional telephony network |
| Roaming | Use of a mobile telecommunications device outside its primary operating area |
| SIX | Southland Internet Exchange, a peering exchange in Invercargill. In this strategy, depending on context SIX may mean the accommodation for the peering equipment, or the peering equipment itself. |
| SMS | Short Message Service; the technical name for cellphone texting |
| TSO | Telecommunications Service Obligation, an instrument currently intended to guarantee at least minimum telecommunications service levels to all New Zealanders |
| VSAT | Very Small Aperture satellite Terminal, typically two way satellite services on dedicated circuits using small dish antennas |
| VoIP | Voice over Internet Protocol, the technical name for telephony over the Internet |
| Web 2.0 | Web 2.0 is the moniker for the currently emerging set of Internet-based tools and the philosophy on how to use them |
| WiFi | Brand name for a popular wireless networking technology using the IEEE 802.11 protocol, designed for wireless LAN networks, but also used to a limited extent to provide metropolitan area networking. It is capable of up to 54 Mbps |
| WiMax | Brand name for wireless networking using the IEEE 802.166 protocol, designed for metropolitan area networking. It is capable of up to 70 Mbps. |
| WLAN | Wireless Local Area Network |
| 2.5G | The most common cellphone network generation in New Zealand and theoretically capable of up to 170 kbps. It is being progressively replaced by 3G networks. |
| 3G | Third generation cellphone network, which is capable of multimedia services and theoretically capable of up to 2 Mbps |
| 4G | |
| 5G | The next generation cellphone/wireless network that is currently being formulated through the academic journals and conferences. It will operate at millimetre microwave frequencies and will provide very fast broadband services over short (less than 1 km) distances. |



[i] *Niyato D, Hossain E. Integration of WiMAX and WiFi: Optimal Pricing for Bandwidth Sharing, IEEE Communications Magazine, May 2007, pp140-146*

[ii] *Eriksson P, Odenhammar B, VDSL2: Next important broadband technology, Ericsson Review No. 1, 2006.*

[iii] *Cioffi J M, Jagannathan S, Mohseni M, Ginis G. CuPON: The Copper Alternative to PON 100 Gb/s DSL Networks, IEEE Communications Magazine, June 2007, pp132-139.*

[iiii] *Tsatsanis M, Gudmundsson T, Multi-line DSL System Architectures, Aktino, 2005.*