PUBLIC VERSION

Crown Infrastructure Partners

Briefing for Incoming Ministers - **Connectivity**

November 2020

Hon Dr David Clark, Minister for the Digital Economy and Communications

Commercial in Confidence

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Crown Infrastructure Partners (CIP)

- CIP is the Crown's delivery agency for telecommunications infrastructure programmes
- CIP partners with and funds private sector telecommunications network operators to deploy infrastructure
- John Greenhough (Chief Technology Officer) leads connectivity work at CIP. Current programmes are:
  - Ultra-fast Broadband (UFB) programme
  - Rural Broadband Initiative phase two/Mobile Black Spots Fund (RBI2/MBSF)
  - Regional connectivity initiatives
    - RBI1[#] rural capacity upgrades programme
    - Infrastructure Reference Group digital connectivity programme
    - West Coast and Southland fibre links
    - Marae digital connectivity programme
  - Public Safety Network programme (emergency services – Vote: Police)

** RBI1 is the first Rural Broadband programme (circa 2012 – 2018)*

- Board of 5 directors; Chair – Mark Binns; 24 staff; CEO - Graham Mitchell

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Executive summary: progress

- **NZ has world class digital infrastructure**
  - Top end OECD fibre coverage
  - 22nd world ranking broadband speed, ~134Mbps Speedtest (Australia 60th)
  - First country with full shared mobile in rural
- **All connectivity programmes are progressing well**
  - **UFB**: 83% pop coverage; will complete end 2022 – 86% coverage
  - **RBI2**: 55,000 households/businesses covered; complete 2023 – 84,000 covered
  - **Mobile**: Towers - 159 : 550 by 2023
    State Highways - 771km : 1,405 by 2023
    Tourism - 52km : 168 by 2023
  - **Marae**: 500 applied, 300 connected : 650 by 2022
  - **Fibre links**: 40km deployed now : 360km by 2022
  - **Islands**: Chatham Islands/Stewart Island covered; Great Barrier TBC
  - **RBI1 capacity upgrades**: ~60 towers upgraded by 2021
- **$671m to be invested by CIP over next 3-4 years**
- **CIP issues public Quarterly Broadband report each quarter, and monthly reports to Ministers on connectivity programmes progress**

Executive summary: opportunities

- Feedback from industry and communities indicate these opportunities:

Withhold - Free and frank
s9(2)(g)(i)

Connectivity programmes overview: $671m

Regional digital connectivity

Fibre links

Marae digital connectivity

West Coast connectivity

West Coast / Southland fibre links (backhaul)

Marae digital connectivity programme

West Coast connectivity

Rural capacity upgrades

IRG digital connectivity

Public Safety Network

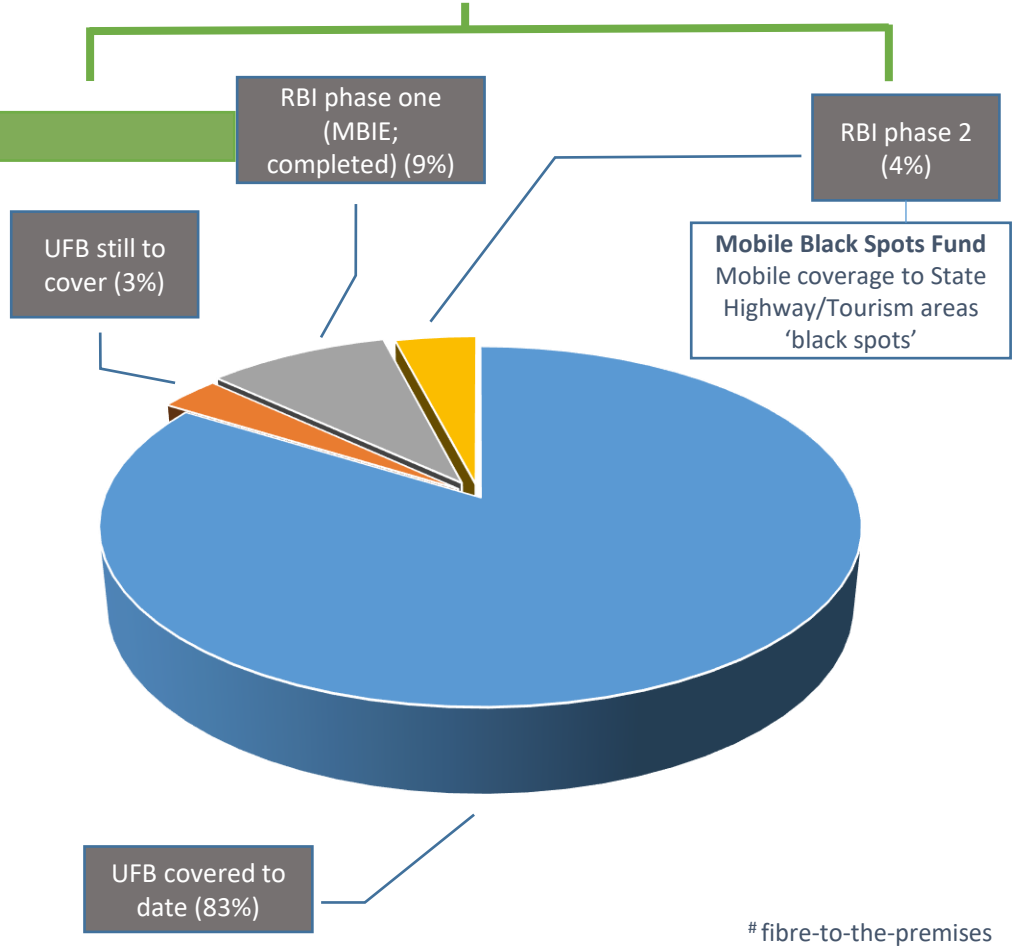
RBI1 rural mobile capacity upgrades

IRG digital connectivity programme, focussing on capacity-constrained rural areas

Public Safety Network

Ultra-fast Broadband (FTTP[#] to 86% of population)

Rural Broadband Initiative phase 2 (last 4% of population)

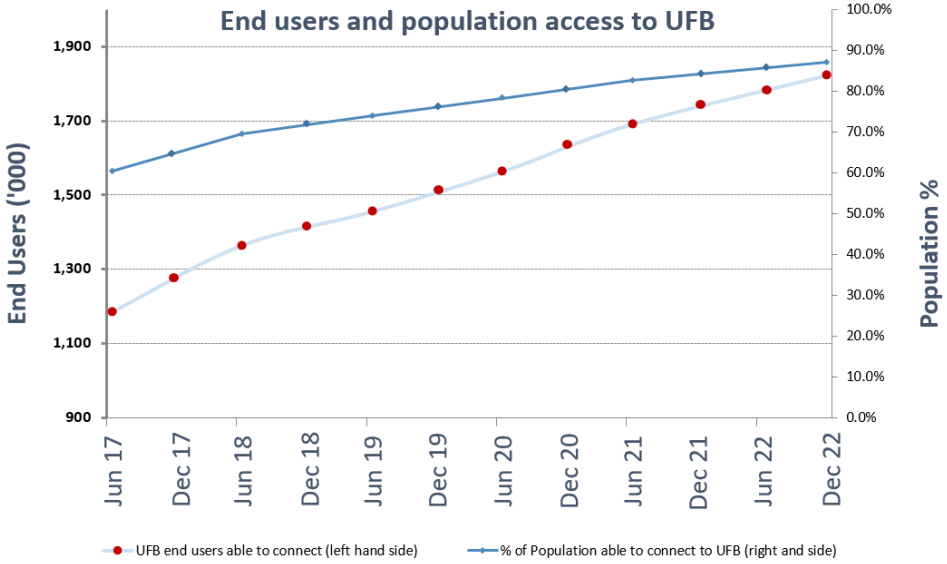


[#] fibre-to-the-premises

National population coverage for UFB and RBI programmes

UFB - 86% population coverage by 2022

- Original UFB programme to provide fibre-to-the-home to 75% of New Zealanders was completed on time and under budget in December 2019 – significant milestone
- UFB expansion programme continues to be rolled out – completion 2022
- 405 cities/towns and 86% population coverage when complete



- CIP manages UFB contracts until 12/2021 under transitional regulatory arrangements
- From 01/2022 Commerce Commission new UFB fibre regulatory regime

UFB programme funding

Crown Infrastructure Partners

Northpower FIBRE

ultrafast FIBRE

CHORUS

enable fibre broadband

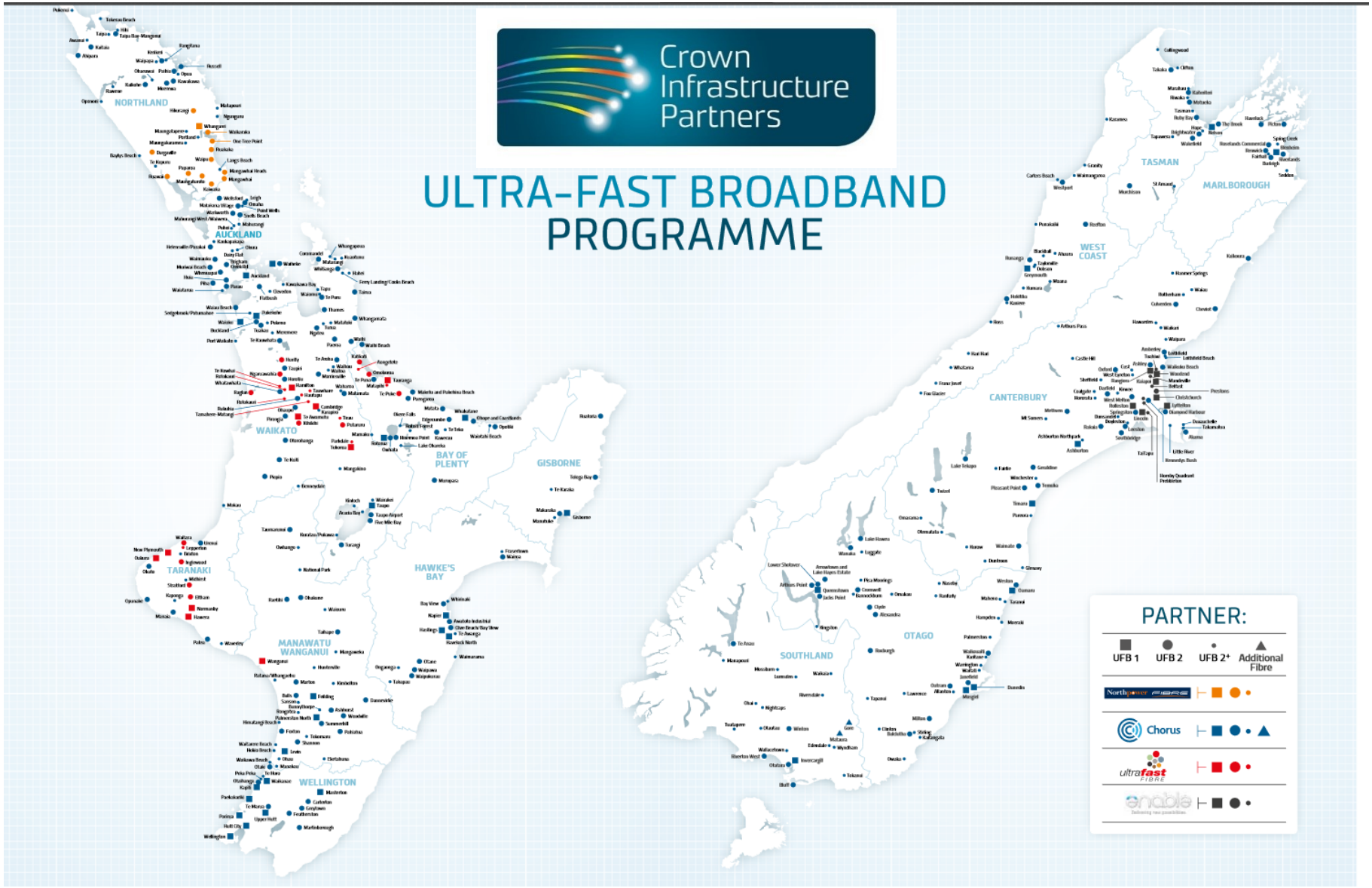
Four UFB partners

- Northpower Fibre (Northland), Ultra-Fast Fibre (Central North Island), Enable Networks (Christchurch) and Chorus (everywhere else in UFB footprint)
- CIP advances interest-free funding for a portion of 'communal' UFB network (the network down the street)
- UFB partners fully fund installations of the UFB service for residential customers
- UFB partners charge retailers a monthly wholesale fee and retailers charge end-users for the retail service
- Crown funding is repaid by UFB partners

$1.55 billion appropriated/investment $1.74 billion

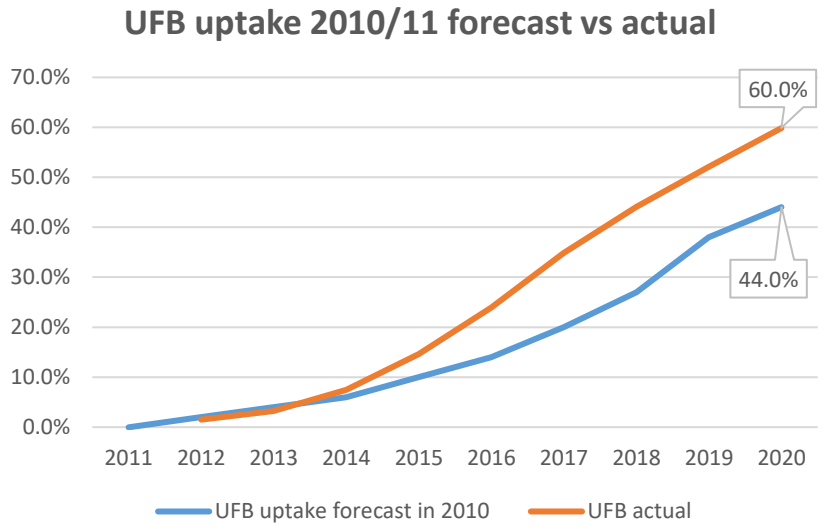
- Appropriated funding of $1.55 billion
- CIP is investing $1.74 billion in the UFB programme
- Additional $190 million from UFB partners funds returned
- Total private sector co-investment of ~$5.7 billion

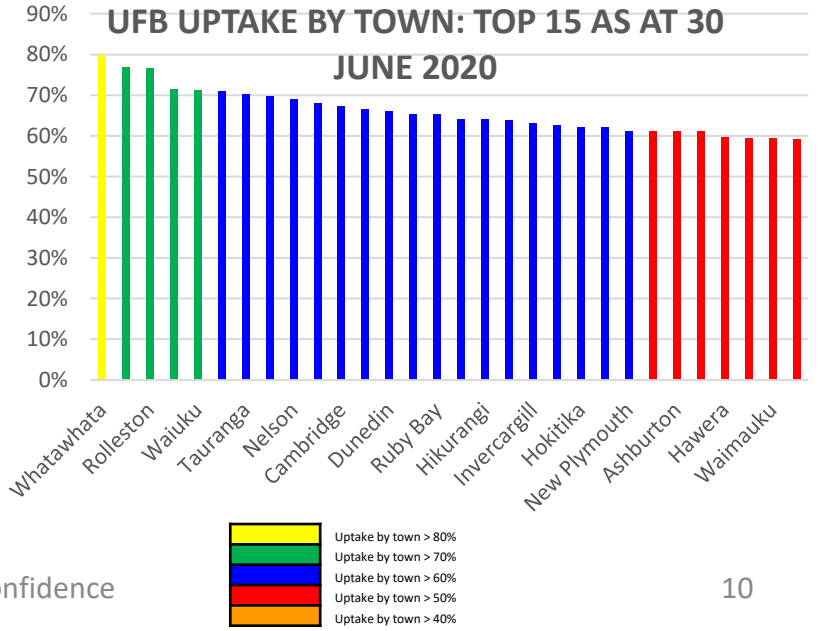
405 towns and cities to receive UFB



UFB progress – 83% coverage

- **216 towns/cities** have UFB coverage; 80 under build currently
- **1.68 million** households and businesses, including all urban schools and hospitals
- **83% of the population** has access to UFB
- 1 million connections achieved in June 2020, **uptake at 62%** versus the original forecast of approximately 44%
- UFB network performed very well during the COVID-19 level 4 lockdown – no congestion
- World leading network
  - Average speeds ~234 Mbps
  - 1 Gbps very popular with 8 Gbps available to households





132 UFB expansion towns now complete…

76 UFB expansion towns with build underway

- Hikurangi
- Waipu
- One Tree Point
- Ruatoria
- Thames
- Ruby Bay
- Mandeville (Christchurch)
- Tai Tapu (Christchurch)
- Tuahiwi (Christchurch)
- Tologa Bay
- Otaki
- Picton
- Ngāruawāhia
- Stratford
- Cromwell
- Moerewa
- Summerhill
- Runanga
- Putaruru
- Tirau
- Helensville
- Kerikeri
- Taupiri
- Ruakaka
- Wairoa
- Opunake
- KatiKati
- Reefton
- Te Puru
- Eltham
- Waihi
- Motueka
- Waimauku
- Baylys Beach
- Hokio Beach
- Manapouri
- Pareora
- Takapau
- Ongaonga
- Waikawa Beach
- Maungakaramea
- Mangawhai
- Te Kowhai
- Waihi Beach
- Huntly
- Inglewood
- Lake Hawea
- Wanaka
- Carterton
- Te Kauwhata
- Waverley
- Kaikoura
- Kihikihi
- Waiau
- Glenavy
- Mossburn
- Rotherham
- Wairakei
- Duntroon
- Kaponga
- Horotiu
- Ohaupo
- Otatara
- Bay View
- Longburn
- Omokoroa
- Acacia Bay
- Hokitika
- Ngatea
- Dargaville
- Maungatapere
- Ohau
- Punakaiki
- Hawarden
- Tauwhare
- Hahei
- Ratana
- Ahaura
- Renwick
- Marton
- Kawerau
- Kingston
- Waikaia
- Waikari
- Manaia
- Te Puke
- Winton
- Waimarama
- Waitara
- Matamata
- Raglan
- Southbridge
- Te Anau
- Kuaotunu
- Whangapoua
- Aongetete
- Muriwai Beach
- Kaiteriteri
- Kurow
- Manakau
- Leeston
- Blackball
- Lepperton
- Lake Okareka
- Tapu
- Matatoki
- Otematata
- Riversdale
- Taylorville
- Waipara
- Kaitaia
- Waiatarua
- Westport
- Coromandel
- Snells Beach
- Midhirst
- Benneydale
- Te Kopuru
- Mangawhai Heads
- Te Awanga
- Maketu
- Turua
- Waiomu
- Whirinaki
- Omarama
- Leithfield Beach
- Tapanui
- Culverden
- Cust
- Dobson
- Ahipara
- Paengaroa
- Portland
- Karamea
- Waiouru
- Kaiwaka
- West Eyreton
- Kimbolton
- Pirongia
- Paeroa
- Greytown
- Opotiki
- Whatawhata
- Leithfield

Rural Broadband and Mobile Black Spots Fund: ~NZ$350 million

Crown Infrastructure Partners

Total outcomes:

- ~84,000 rural households and businesses (RBI2)
- ~1,405 km State Highways (MBSF)
- ~168 Tourism sites (MBSF)
- ~ 550 cell towers
- Pop % ~4%
- Total pop with broadband 99.8%

inspire.net

Local > Reliable > Fast > Broadband

PRIMO WIRELESS
CONNECTING TARANAKI

Rural Connectivity Group

Lightwire

STRATANET

New Zealand Technology Group

Investing in tomorrow

0800 000 945
ultimatebroadband.co.nz

gisborne.net.nz
NETWORKING & BROADBAND SERVICES limited

AoNet BROADBAND

Zelan WIRELE

WiFi Connect

Evolution Networks

WIZWIRELESS
rural broadband

Unifone

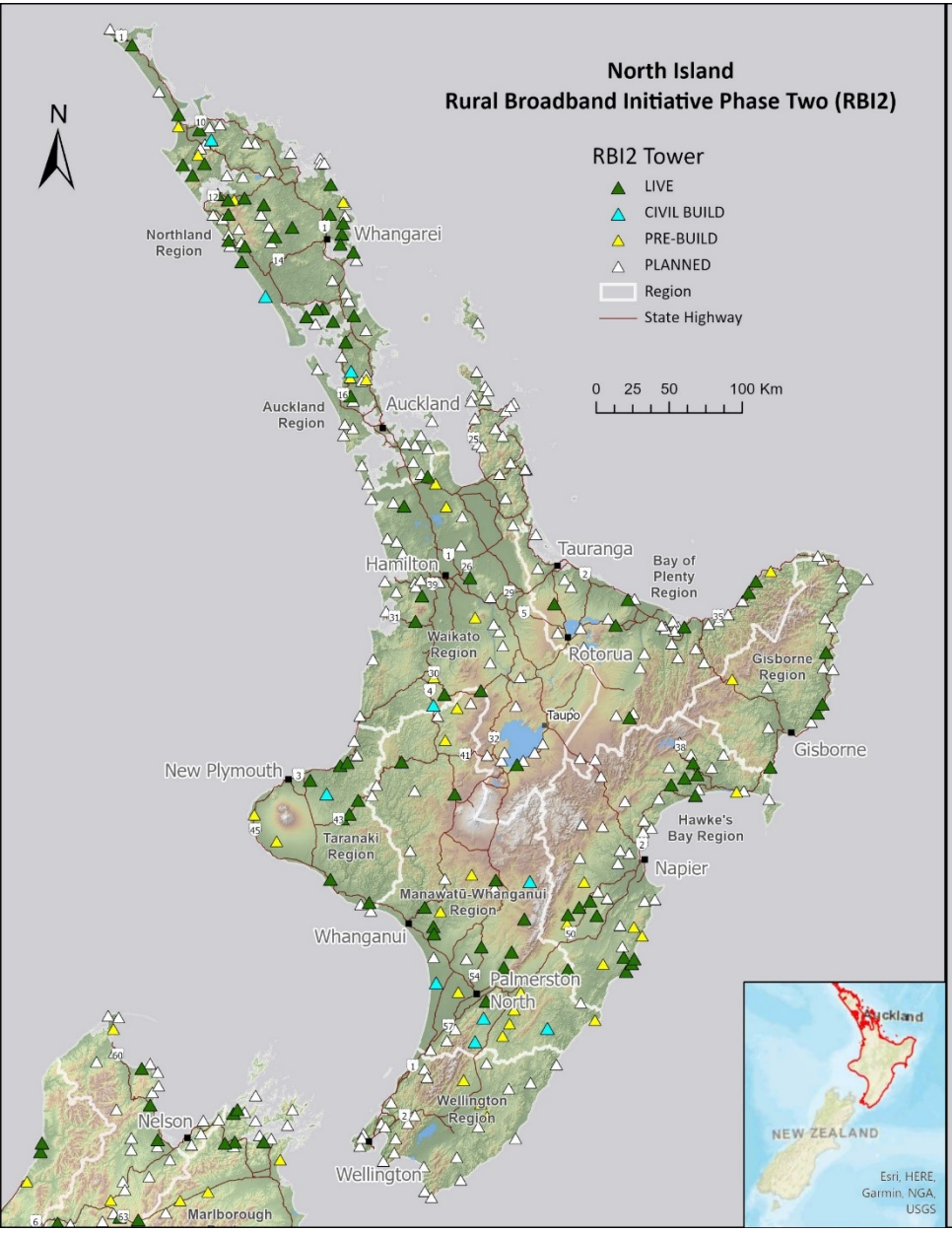
amuri.net

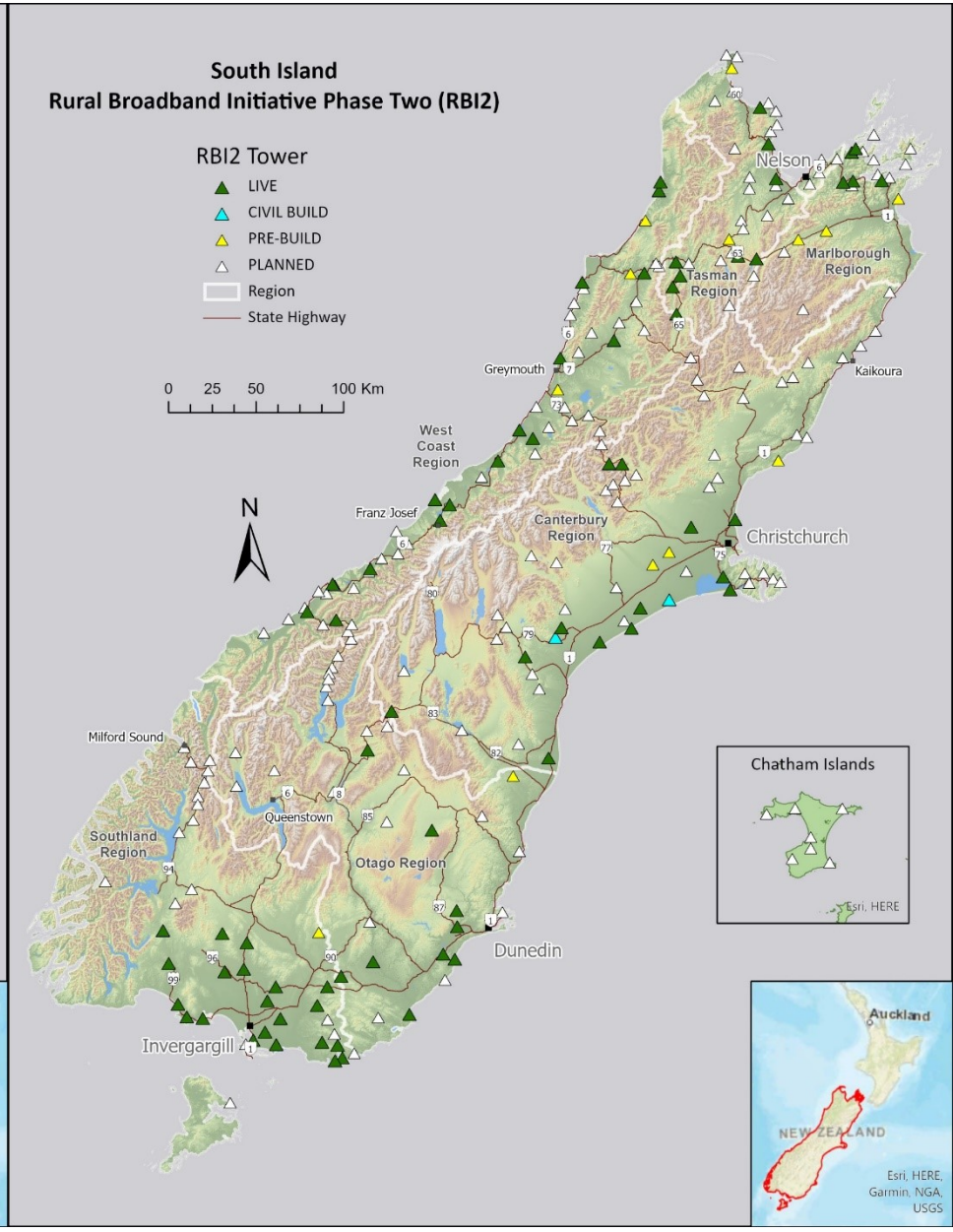
Velocitynet

thepacific.net
BROADBAND SOLUTIONS

kiwiwifi

New mobile towers built and to be built





Commercial structure - Rural Connectivity Group

- Rural Connectivity Group (**RCG**) is a joint venture subsidiary of the 3 mobile network operators (**MNO**s)

Crown Infrastructure Partners

$250M grant funding

Spark

2degrees

vodafone

1/3 ownership each
$75M funding

Rural Connectivity Group

Broadband	Mobile state highways	Mobile tourism
End Users contracted: 38,072 End Users complete: 12,859 % complete: 34%	KMs contracted: 1,253 KMs complete: 557 % complete: 44%	Tourism sites contracted: 152[1] Tourism sites complete: 38 % complete: 25%

159 mobile towers on air out of ~550 (29%)

Customers of all 3 mobile operators can use all towers

MOCN: Multi-operator Core Network
All 3 mobile operators share:

- Towers
- Radios
- Antennae
- Spectrum

- ~550 mobile towers
- Lowest cost

[1] Additional State Highway and tourism site coverage is to be provided commercially by some of the Mobile Network Operators

Commercial in Confidence

Move to highly efficient, shared rural mobile infrastructure

RBI1: Co-location tower – 3 MNOs

- Multi-antennae – one set for each carrier (9+)
- Vodafone 4G spectrum 80 MHz & co-location
- Older radios - less capacity
- Max capacity 1,465 Mbps 488/244 connections
- Coverage addresses/Towers : ~490/tower
- Co-location capacity can be added i.e. Spark

RBI2/MBSF: MOCN tower – 3 MNOs

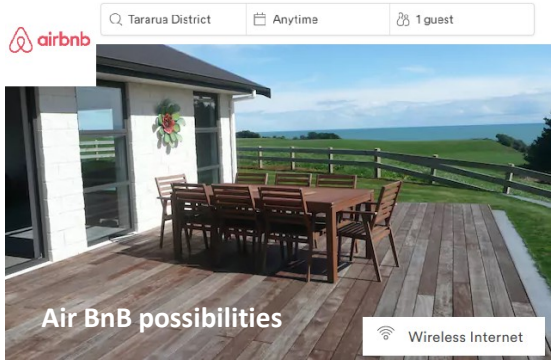
- Single-antennae/sector – shared by all carriers (3)
- Up to 160MHz available at latest 4x4 Radios
- Software upgradeable to 5G in future
- Max capacity 2.65Gbps/4.2Gbps
- Max connections: 884/442
- Coverage addresses/Towers : ~90/tower

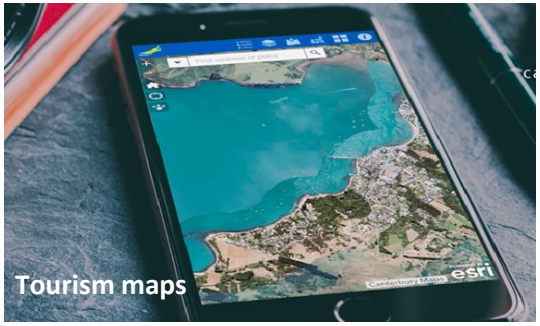
Commercial in Confidence

Kaitaia - RBI1 capacity gap: impact of increased usage

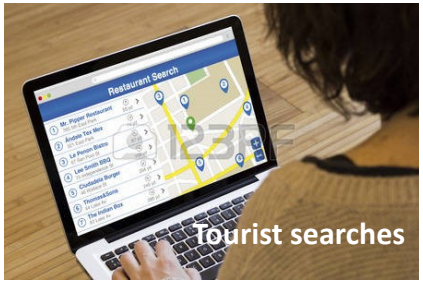
Withhold – commercially sensitive
s9(2)(b)(ii)

Mobile Black Spots Fund – Safety and tourism





- 3G using multi-operator radios fall back to support 111 (emergency)
- Emergency caller location
- Emergency cell broadcast
- Support new emergency services network being developed
- Power resiliency and lower power usage
- State Highways and Track/Cycle Ends



WELLINGTON FREE AMBULANCE
We are the ones. 111

NEW ZEALAND FIRE SERVICE Whakaratonga Iwi

St John

Combined coverage with emergency services on all mobile networks

RBI2/MBSF progress – 30 September 2020

~51,904 rural broadband end users *

% Complete

62% (+22%)

~629 kilometres mobile coverage

45% (+33%)

50 tourism areas mobile coverage

30% (+18%)

Primo tower - Kaitake

* Includes contractual and new commercial coverage

WISPs

Chair: Mike Smith, Ultimate Broadband

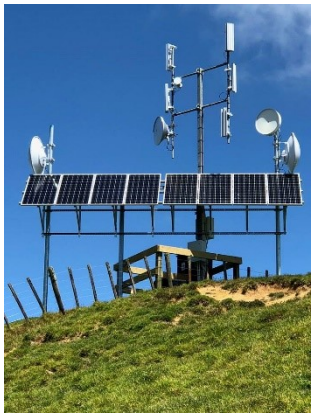
Secretariat: Ernie Newman

- CIP's 17 wireless ISP (**WISP**) partners are rolling out rural broadband in remote areas around New Zealand
- Keen to work with Crown on more coverage; interest in 3,500Mhz; emergency calling power issue

- **Evolution Wireless Limited -** Opotiki and Whakatane
- **Kiwi WiFi Limited** - Tasman and Nelson
- **Lightwire Limited** - Waikato and Bay of Plenty
- **Strata Networks Limited** - Auckland and Northland/Tai Tokerau
- **Thepacific.Net Limited** - Marlborough and Tasman
- **VelocityNet Limited** - Southland
- **Zelan Limited** - West Coast
- **WiFi Connect** - West Coast and Bay of Plenty
- **Gisborne.net** - Tairāwhiti and North Hawke's Bay
- **Wiz Wireless** - Wairarapa, Wellington
- **Inspire.net** - Manawatū and Whanganui region
- **AmuriNet** - North Canterbury
- **AoNet** - King Country, Manawatū and Whanganui
- **Ultimate Broadband** - Central/South Canterbury
- **Primo Wireless** - Taranaki
- **Unifone** - Otago
- **NZ Tech** - Central Hawke's Bay

Wiz Wireless

WiFi Connect



Lightwire

AoNet

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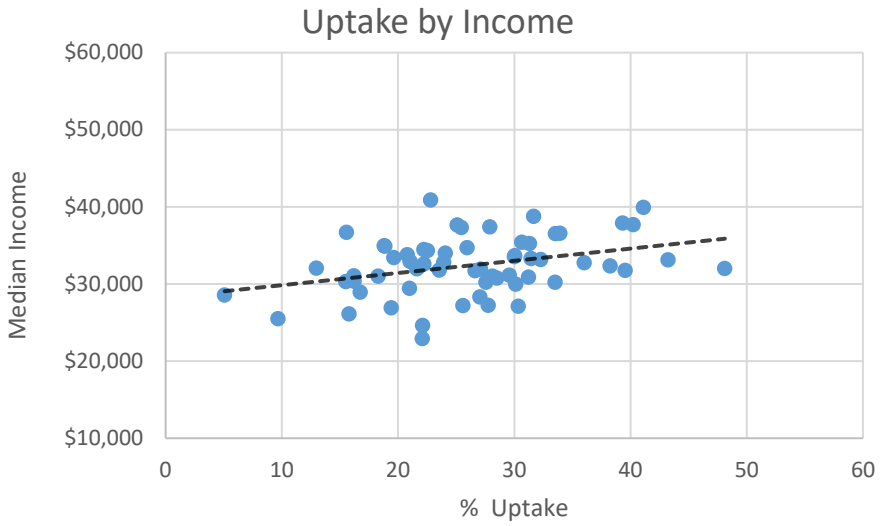
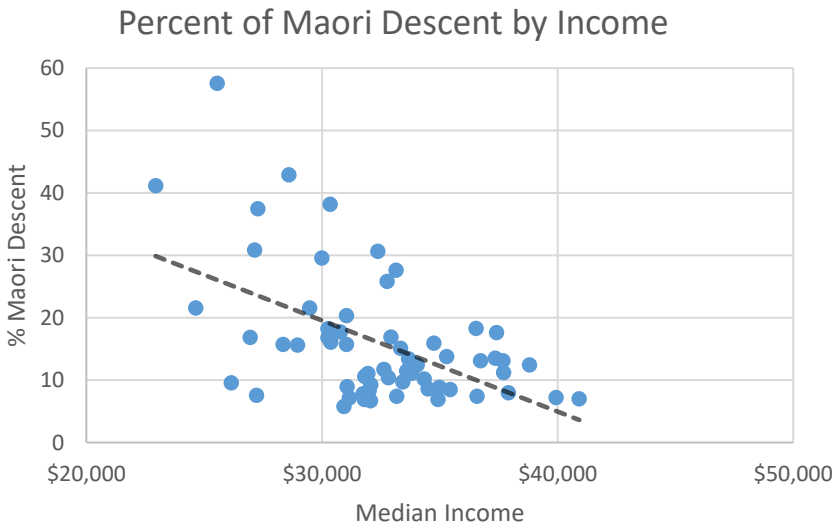
Chatham Islands

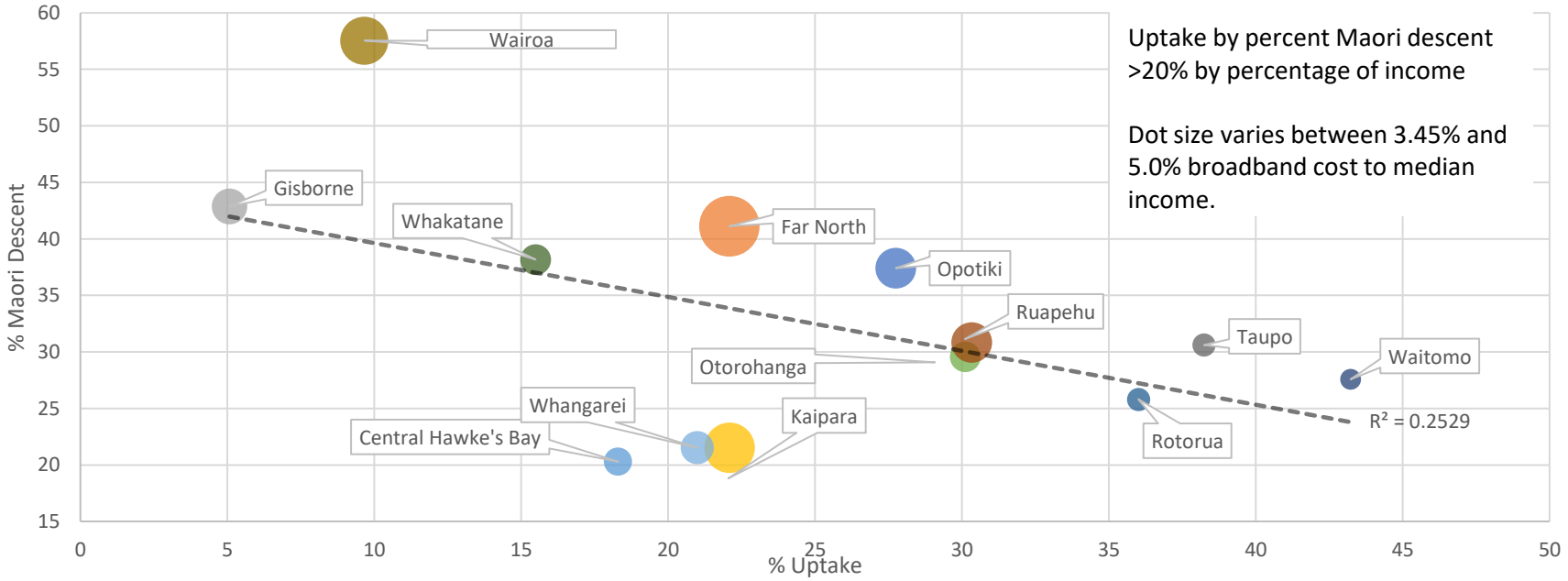
"First time for mobile and significant internet upgrade"

Withhold – commercially sensitive
s9(2)(b)(ii)

Digital divide income versus uptake in rural areas







Uptake by percent Maori descent >20% by percentage of income

Dot size varies between 3.45% and 5.0% broadband cost to median income.

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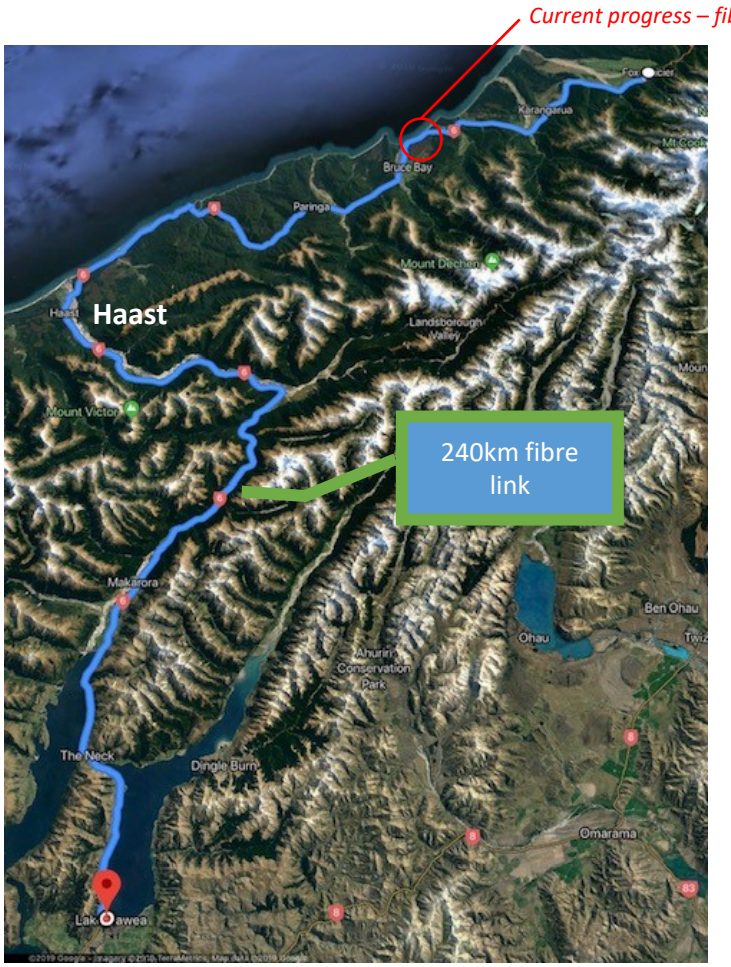
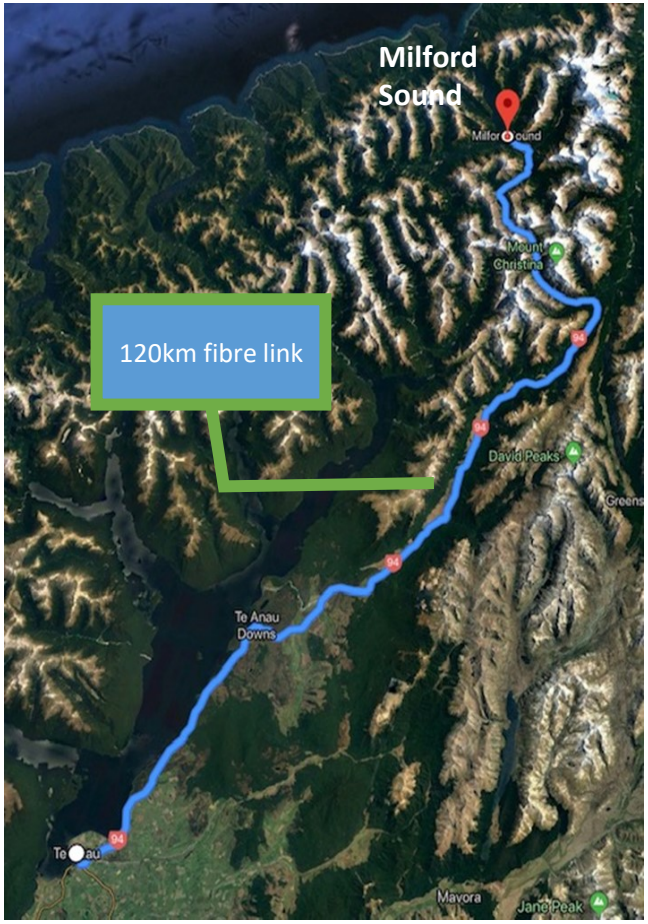
Fibre links – West Coast and Milford Sound: $49.5m

- Two fibre links contracted by CIP to be deployed with funding from the Provincial Growth Fund (PGF)
- Connectivity and resilience in some of the most remote parts of New Zealand
- West Coast - 260 kilometres from Fox to Hawea
- Southland - 12 kilometres from Te Anau to Milford Sound



- Early build focusing on bridge crossings and culverts
- For the West Coast link, work on the aerial line between Fox and Jacobs River has begun (~40km complete)
- Milford Sound link some work commenced
- Completion 2022/23
- Delivery partner:



Fibre links – West Coast and Milford Sound

- Rock saw being used for deployment of the fibre links, recently arrived from Australia

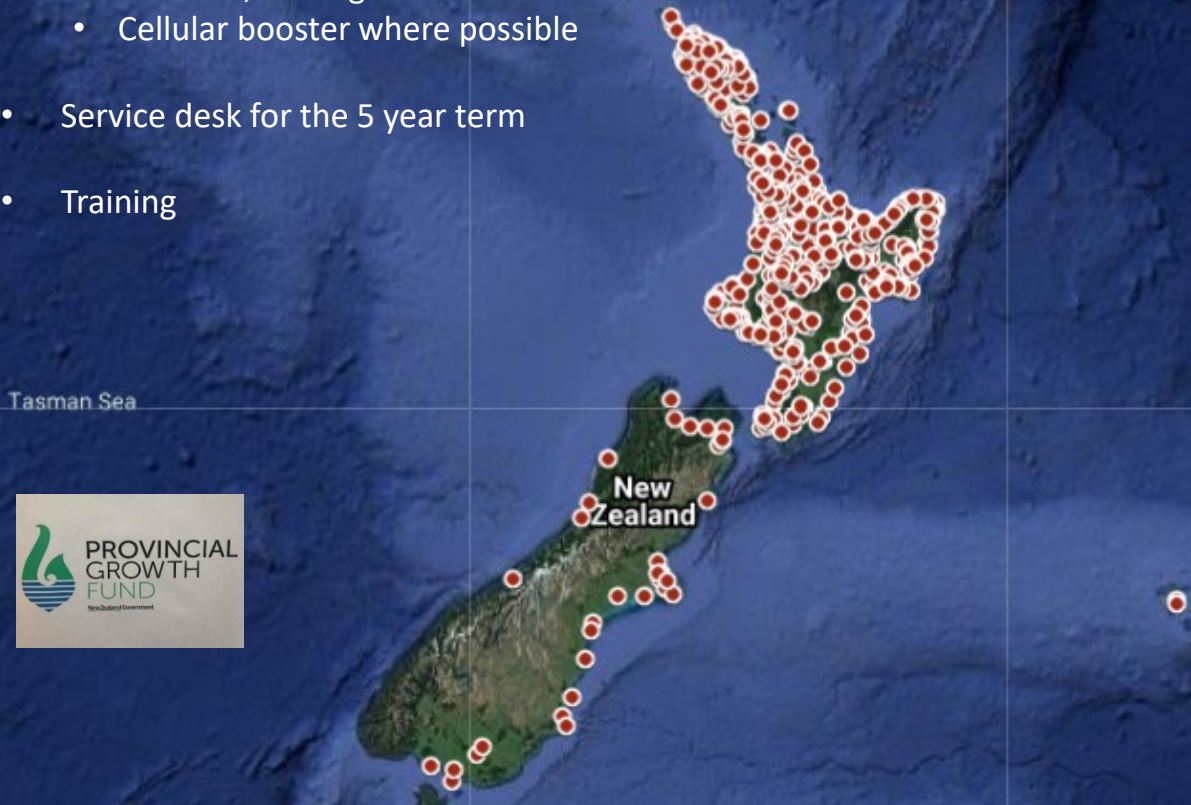
Marae digital connectivity programme

Te Puni Kōkiri Ministry of Māori Development

Crown Infrastructure Partners

- Best broadband available at each marae location – fully funded for 5 years
- Essential hardware including:
  - Up to 3 Wi-Fi boosters;
  - Smoke alarm;
  - Up to 3 internet streaming cameras
  - Cabinets, cabling etc
  - Cellular booster where possible
- Service desk for the 5 year term
- Training

Tūrangawaewae Marae



PROVINCIAL GROWTH FUND

~870 eligible marae nationally
500 applications
300 connected
220 hardware installed

$17.9m total funding including:
- IRG $3m
- CIP-funded $2.4m
- PGF $12.5m

Nov 19, contracted → Sep 20, ~500 applications → June 21, applications close

Marae digital connectivity programme

Omaha marae near Leigh

4G Antenna

Wi-Fi booster

Internet camera

Video-conferencing bundle

RBI1 capacity upgrades programme

- Government allocated $15 million in savings from the Ultra-fast Broadband initiative to improve rural broadband capacity COVID-impacted by:
  - upgrading some existing rural mobile towers
  - upgrading wireless backhaul
  - installing external antennae on households
- Focus on 'stop sell' RBI1 areas (households can not get broadband)

Withhold – commercially sensitive s9(2)(b)(ii)

Withhold – commercially sensitive
s9(2)(b)(ii)

26

Infrastructure Reference Group digital connectivity programme

- $50m funding to address rural connectivity issues that arose during COVID-19 lockdown (again mainly RBI1 mobile towers), including:
    - increased broadband capacity to areas that experienced congestion
    - further funds to connect broadband to more marae that can provide a rural digital hub ($3m allocated)
- This investment would be across most regions with an emphasis on Tai Tokerau (Northland), Bay of Plenty, Waikato, Top of South and Canterbury, and, secondly, Gisborne, Manawatu-Wanganui, Auckland rural area and Otago and thirdly Hawkes Bay, West Coast, Taranaki, Wellington (rural), and Southland

Withhold – commercially sensitive
s9(2)(b)(ii)

Withhold – commercially sensitive
s9(2)(b)(ii)

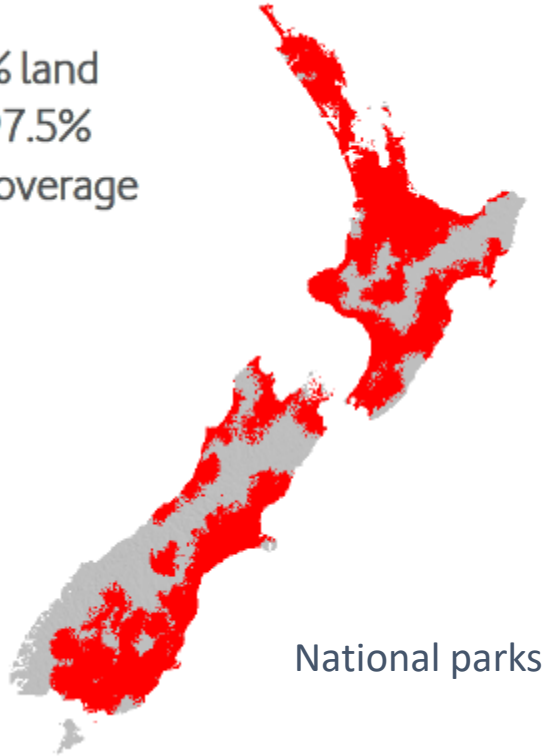
Public Safety Network

- Communications capability is critical to the safe and effective provision of emergency services for our communities
- Existing communications networks do not provide these rich data capabilities and many have reached end of life
- Objectives:
  - provide Emergency Services with reliable access to secure communications when needed
  - meet Health and Safety requirements while delivering emergency services' legislative and contractual obligations for New Zealand
  - provide a sustainable communications capability for Emergency Services
  - govern the development of critical communications capability
- Minister for the Digital Economy and Communications is an oversight Minister together with Ministers of Finance, Infrastructure and Police

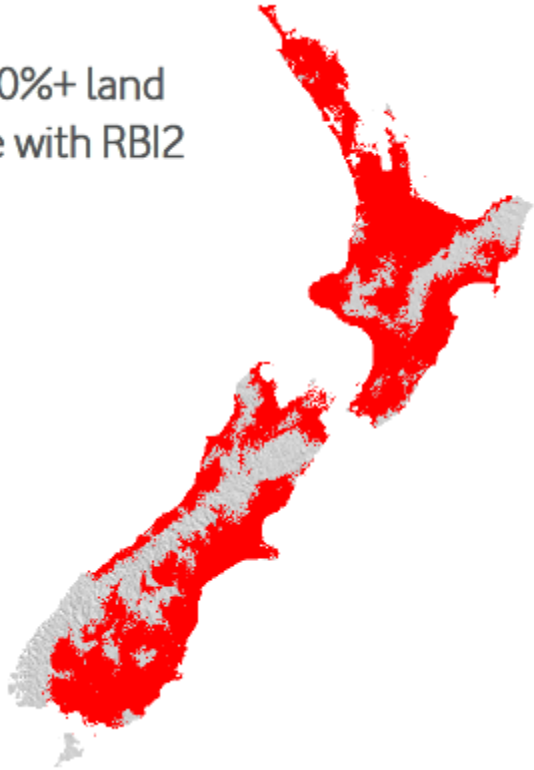
- CIP is infrastructure procurement delivery partner for the Public Safety Network
- New network will be a combination of mobile and land mobile radio technologies

Expansion of IOT coverage

NB-IoT 48.2% land coverage & 97.5% population coverage



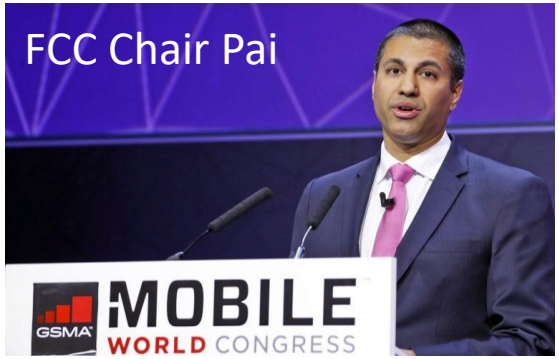
NB-IoT 70%+ land coverage with RBI2



National parks: 30% of NZ's land mass

Internet of things

US 5G developments



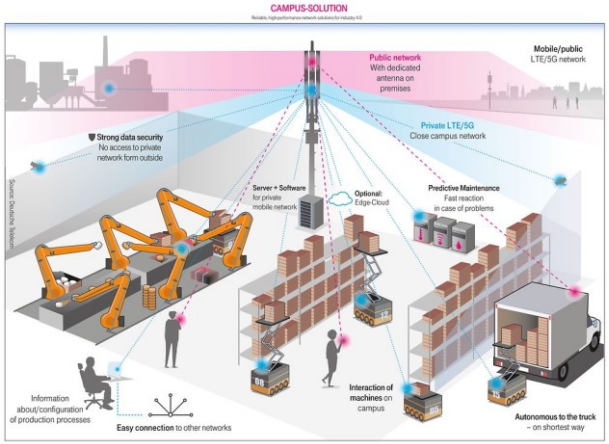
High-band: 24 & 28 GHz in operation auction of 37, 39, 47 GHz now
Mid-band: auctions mid 2020 for 2.5, 3.5 GHz also announced 6 GHz
Low-band: 600 MHz in operation

Four CTOs of mobile operators focus

- *Millimetre deployments initially*
- *Stadiums, Industrial, FWB*
- *600 MHz for rural*
- *Waiting on mid-band for mobile*

T-Mobile's 5G FCC commitments

- *97% US pop with 5G in 3 years*
- *99% US pop with 5G in 5 years*
- *Home broadband nationwide inc. rural*



5G for industrial & logistics
All 4 US MNO CTOs stated as key focus

5G

FWB 300Mbps assured
Peaks at up to 1 Gbps
Uses millimetre bands
US$50/mth VZ mobile
US$75/mth non-VZ

Commercial in Confidence

Agencies CIP works with – connectivity

- CIP works closely with relevant Government agencies for connectivity work programmes:

MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT
HIKINA WHAKATUTUKI

Communications Policy team, Building Resource and Markets branch – policy oversight

TE TAI ŌHANGA
THE TREASURY

Ownership monitoring team and National Infrastructure Unit

PROVINCIAL DEVELOPMENT UNIT

Marae and other PGF digital connectivity programmes

Te Puni Kōkiri
Ministry of Māori Development

Marae digital connectivity programme

Where to in three years' time?

Withhold - Free and frank s9(2)(g)(i)

Telecommunications infrastructure opportunities

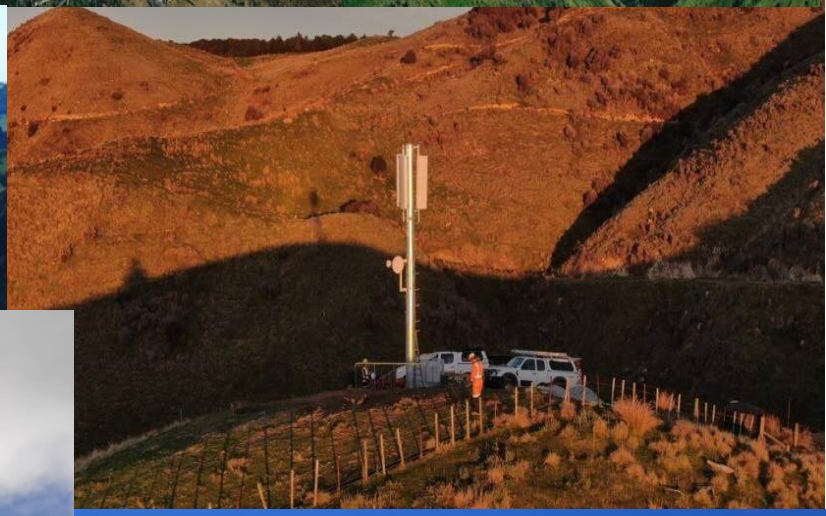
Withhold - Free and frank s9(2)(g)(i)

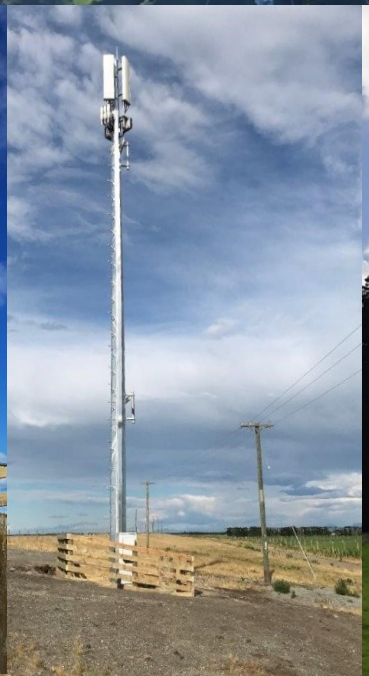
Connectivity: Health & safety and funding

Withhold - Free and frank s9(2)(g)(i) and commercial Sensitivity s9(2)(b)(ii)

Commercial in Confidence

Rural tower builds





Annex – Technology

Telecommunications technology overview

Crown Infrastructure Partners

UFB fibre

Fastest available

- Residential 1/0.5 Gbps
- Business up to 10Gbps
- Dark fibre – almost unlimited
- Utilises light signals down optical glass from a laser
- Each fibre 96 wavelengths
- Wavelength ~ 100Gbps
- Long-life ~ 40-50 years
- Electronics at either end upgradeable
- Dedicated path per customer in network
- Distance 20km GPON
- Backhaul 1000s kms

Copper xDSL

Observed aver & max Mbps

- ADSL1 ~ 5/0.13 (6.3)
- ADSL2 ~ 10/0.8 (21)
- VDSL ~ 35/25 (80)
- Utilises radio frequency on existing copper lines
- Is contended in network
- Improves when fibre deployed to cabinets
- Technology has speeds increasing over time
- Distance dependent, VDSL drops after 1-2km ADSL after 5-6km
- G.fast new technology up to 1Gbps ~100m

Wireless

Uses line of sight radio

- Shared bandwidth off antennae or dedicated
- Backhaul is shared
- Utilises public (Wi-Fi) and licenced spectrum
- Used for backhaul and broadband access
- Lowest cost to deploy
- Latest technology provides dedicated bandwidth of 50-75Mbps plus
- Needs line of sight
- Distance up to 10-20km
- Widely deployed in NZ

Cellular/Mobile

Cell site has 3 segments

- 4G ~ 150Mbps/seg
- 4.5G ~ 1Gbps/seg.
- 5G ~ 10Gbps/seg
- Each segment shared by customers in segment
- Higher concurrent use slows bandwidth down
- Best performance near to cell site - less interference
- Range depends on frequency 3-30km
- 700Mhz 4G is best for rural - penetrates trees etc
- Fixed & mobile flexibility

UFB architecture

1. Duct containing multiple tubes which fibre is “blown” through
2. Residential house. UFB terminates in an ONT, which converts fibre light signal to Ethernet and end-user’s Wi-Fi router, which distributes internet around home
3. Multi-dwelling unit (MDU) – fibre built to each apartment
4. Street cabinet or fibre access point where fibre is split 24:1 (at least) to provide service to multiple premises
5. School: all schools have UFB available in urban areas
6. Central Office or Telephone exchange where UFB network commences and connects to retail service providers
7. Chorus technician van

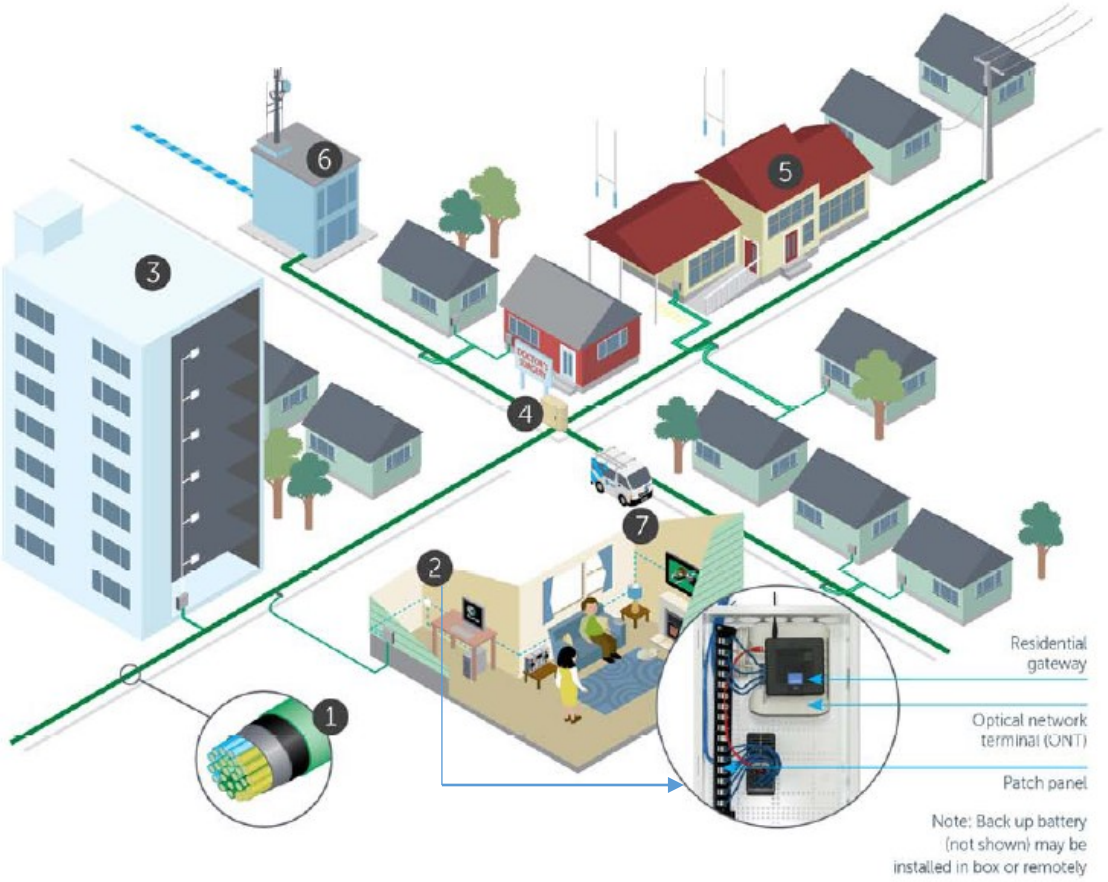


Image credit: Chorus

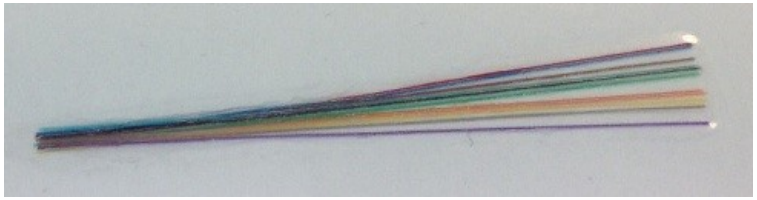
UFB equipment

Core aggregation switch in Central Office/POI
Aggregates traffic to pass to Retailers

Optical Line Terminal (OLT)
Optical equipment that "light" the fibre with lasers to carrying internet data

Optical splitter in cabinet
Light from a single fibre is split 24:1 to 24 individual fibres for each house

Micro ducts in cabinet
Fibre is blown through micro-ducts to the home



Individual glass fibre strands the thickness of a human hair

External termination point on house where fibre enters the house

Optical termination unit (ONU) converts optical light to Ethernet in the home

Retailer router connects to ONU with Ethernet cable provides voice, Wi-Fi & internet in the home

Wireless technologies

Wireless technologies are best suited for broadband in areas where the population density is low

Crown Infrastructure Partners

Fixed wireless / cellular mobile

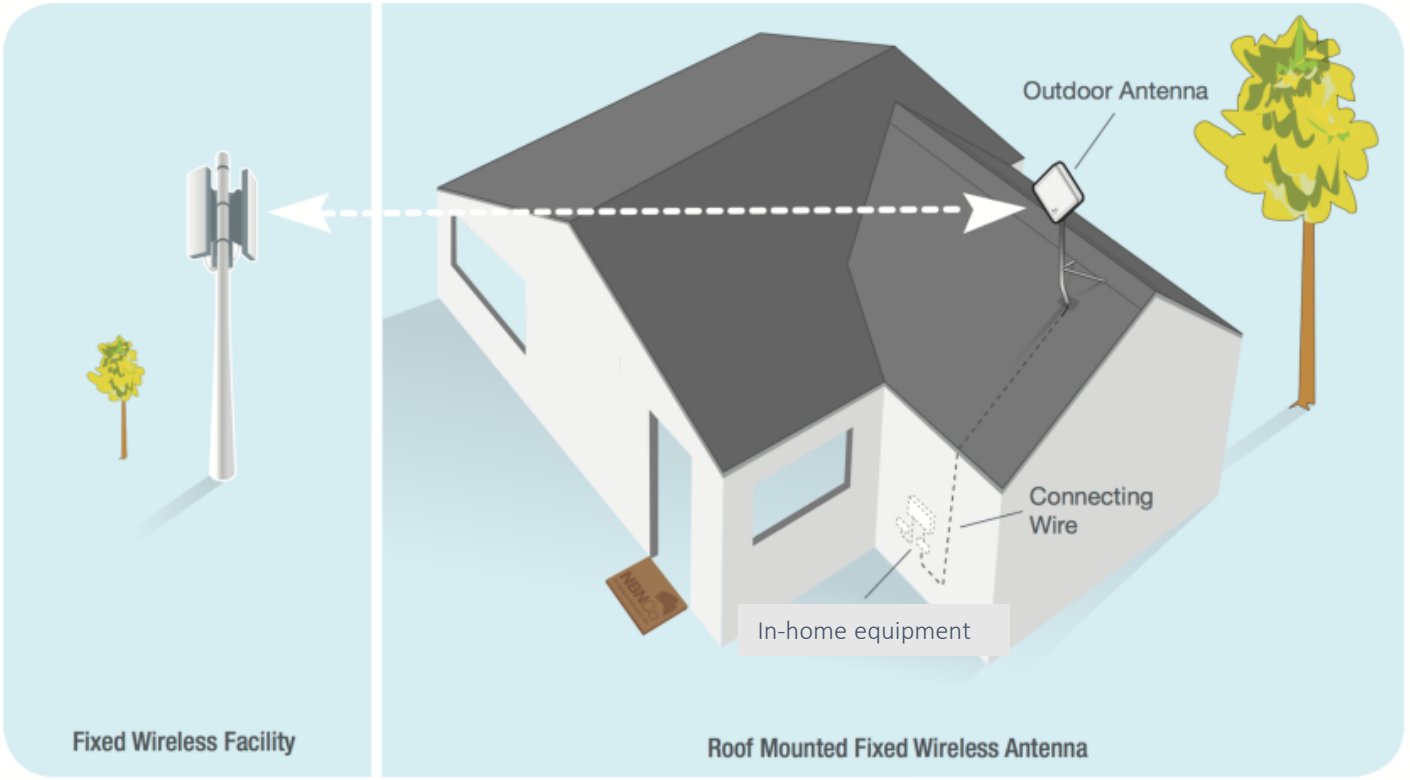
- Traditional mobile cell towers with radio antennae
- Data transmission using radio waves
- Capacity depends on number of 'segments' in the site, mobile technology used (currently 4G and 3G) and amount of 'backhaul' to tower

Wireless

- Towers with radio antennae (but use different technology to the mobile cell towers)
- Data transmission using radio waves
- Capacity depends line of sight to tower, wireless technology used and amount of 'backhaul' to tower

How does ‘fixed wireless’ work?

- ‘Fixed wireless’ provides an in-home broadband and phone connection, using an outdoor antenna placed on the roof of the home
- This antenna connects to the mobile network, just like a mobile phone does, but in the home it replicates the landline/landline connection to the modem/Wi-Fi router



(Source: NBN)

Glossary

Glossary

Term	Description
Greenfields	New subdivisions or infill housing
Install Satisfaction	Measures satisfaction by end customer of the complete installation process.
Interconnection	Is where one telecommunication network is connected to another typically where an RSP connects their network to a UFB wholesale networks.
IOT	Internet of things uses lower bandwidth spectrum but has very long range for transmitting data to small devices.
Kbps	Is the transmission of 1,000 bits per second.
Layer 1	Is the first layer in the Open System Interconnect mode and is essentially dark fibre.
Layer 2	Is the second layer in the Open System Interconnect model and provides Ethernet Services i.e. lit fibre.
LTE/4G	Long-term-evolution, the 4G mobile standard
Multi Dwelling Unit (MDU)	Premises such as apartment blocks having more than one potential end user.
MBIE	Ministry of Business, Innovation and Employment, monitor CIPs connectivity activity.
Mbps	Megabit per second, or data transfer equivalent to 1,000 kilobits per/sec.
MNO	Mobile Network Operator i.e. Vodafone, Spark and 2Degrees.
MOCN	Multi-Operator Carrier Network. MNOs share antennae, radio, spectrum to a single core interface.
MORAN	Multi-Operator Radio Access Network. MNOs share antennae and radio, spectrum split.
NDP	Network Deployment Plan – agreed annually with Partners.
NGCC	Next Generation Critical Communications – mission critical mobile broadband and voice network for Police, Fire and Ambulance.
NIPA	Network Infrastructure Project Agreement being the core contract between CIP and deployment partners for UFB, RBI2, MBSF and Fibre Links.
Optical Wavelengths	The various light lambdas (different colours of ultraviolet light) in a single fibre optical link, a single fibre can support 96-120 wavelengths or lambdas.
Orders	Orders by RSPs for new connections to UFB or RBI (excludes change orders)
PDU	Provincial Development Unit; part of MBIE and administer PGF.
Peak Speed	Is the term to describe the speed achieved on a telecommunication network at peak utilisation, this is typically between 8-10pm and is driven by video streaming.
Peering	Is an arrangement between different internet service providers where they allow their networks to interconnect and pass traffic which improves the efficiency of the internet for end consumers.
PGF	Provincial Growth Fund
Premise	A premise represents a single building structure (i.e. house, block of apartments, school, business complex etc). It is a payment point defined under UFB contract and measured using APD (agreed premise database) where agreed or NDP.

Glossary

Term	Description
Premises/End User handed over	Premises/End Users that have passed contractor testing by partner and have been handed to CIP for UAT testing. Once passed UAT, funds are advanced to the Partner.
Premises/End User handed over	Premises/End Users that have passed contractor testing by partner and have been handed to CIP for UAT testing. Once passed UAT, funds are advanced to the Partner.
Premises/End User completed	Premises/End Users that have passed CIP UAT testing and UAT certificates have been issued. The most complete measure of build completion.
Priority users	Businesses, schools and hospitals
Project to Date (PTD)	Cumulative total of current month and all previous month's performance or plan.
RAN	Radio Access Network: the radios on each mobile tower.
RBI1	Rural Broadband Initiative 1, the Governments first rural broadband initiative (circa 2011/12) managed by MBIE covering ~9% of population.
RBI2/MBSF	Rural Broadband Initiative Expansion covering 4% of population and Mobile Black Spots Fund for state highway and tourism sites.
Retail Service Provider (RSP)	A provider selling retail telecommunications services such as broadband or mobile to the market.
Right of Way (ROW)	A UFB installation down a long driveway requiring fibre to be laid over another property with the benefit of an easement or the like.
Service Level Agreements (SLAs)	Service levels which deployment partners have agreed to meet (in contract with CIP, with Retail Service Providers, or both). Measures percentage of installation dates agreed with customers being met and time to restore faults.
Single Dwelling Unit (SDU)	Premises such as freestanding houses which have a single potential end user.
TRIFR	Total recordable injury frequency rate; measures injuries notified per 1 million hours worked.
User Acceptance Testing (UAT)	Testing of newly built parts of the UFB network by CIP in order to determine that the network meets specifications and quality requirements, prior to payment to the Partner.
UFB connections	Number of end users that have connected to UFB service. There can be multiple end users per premise. NB: UFB connections exclude connections which allow RSPs to connect their network to UFB, as these do not correspond to end users.
Uptake	Connected end users divided by end users able to connect.
VoLTE	Voice over LTE provides packet voice of 4G mobile.
Wholesale Services Agreement (WSA)	Agreement between Chorus/LFCs and their RSP customers for the provision of wholesale UFB services.

Glossary

Term	Description
WISPs	Wireless Internet Service Providers participating in RBI2.
3G	The third generation of wireless mobile achieving download maximum speeds of 21-42 Mbps per cellular sector and typically 4-8Mbps per user. Also commonly used for standard voice services on mobile networks using typically 800-900MHz and 2100MHz spectrum bands.
4G	The fourth generation of wireless mobile achieving up to 150Mbps (most common) or as high as ~1Gbps for LTE advanced per cellular sector and typically 12-60Mbps per user typically using 700, 1800, 2300 and 2600 MHz spectrum bands, also referred to as LTE.
5G	The fifth generation of wireless mobile typically using high bandwidth typically 3500MHz and 20-35GHz spectrum bands, achieving speeds of 1Gbps to 10Gbps per cellular sector.