
REANZ

31 OCTOBER 2016

THE REANNZ NETWORK

AARON MURRIHY
aaron.murrihy@reannz.co.nz

REANNZ



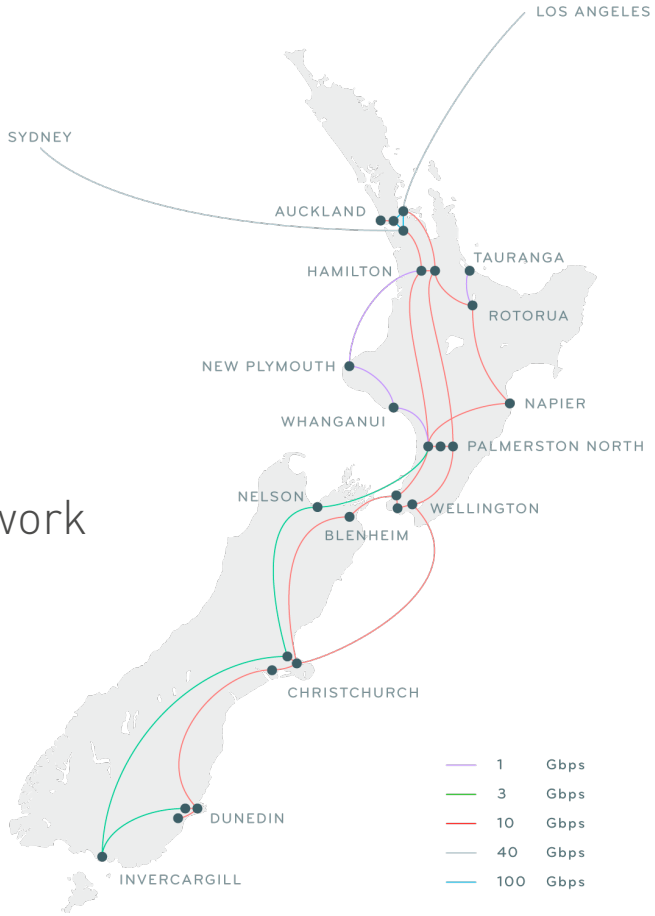
REANNZ?

RESEARCH AND EDUCATION ADVANCED NETWORK NEW ZEALAND



WHO ARE REANNZ?

- New Zealand's national research and education network provider
- Formerly known as KAREN
  - Kiwi Advanced Research and Education Network
- Formed in 2006 – 10th birthday!
- Crown-owned, membership driven



UNIVERSITIES

AUT University

Lincoln University
Te Whare Wānaka o Aoraki
AOTEAROA · NEW ZEALAND
New Zealand's specialist land-based university

Massey University
Te Kunenga ki Pūrehuroa
University of New Zealand

The University of Auckland
Te Whare Wānanga o Tāmaki Makaurau
New Zealand

UC University of Canterbury
Te Whare Wānanga o Waitaha
Christchurch New Zealand

University of Otago
Te Whare Wānanga o Otāgo
New Zealand

Victoria University of Wellington
Te Whare Wānanga o te Ūpoko o te Ika a Māui

The University of Waikato
Te Whare Wānanga o Waikato

CROWN RESEARCH INSTITUTES

agresearch

ESR

GNS Science
Te Pū Ao

Landcare Research
Manaaki Whenua

NIWA
Taihoro Nukurangi

Plant & Food Research
Rangahau Ahumāra Kai

Scion
forests · products · innovation

INSTITUTES OF TECHNOLOGY, POLYTECHNICS AND WĀNANGA

Ara
institute of Canterbury
Ara rau, taumata rau

Bay of Plenty Polytechnic Tauranga
Te Kuratini o Poike

EIT
Eastern Institute of Technology

Manukau Institute of Technology
Te Whare Takiura o Manukau

nmit
Nelson Marlborough Institute of Technology
Te Whare Wānanga o Te Tau Ihu o Te Waka a Maui

Otago Polytechnic

Southern Institute of Technology

Te Whare Wānanga o Awanuiārangi

Unitec Institute of Technology
Te Whare Wānanga o Waiheke

UCOL
Universal College of Learning
Te Pae Matauranga Ki Te Ao

WelTec
Wellington Institute of Technology

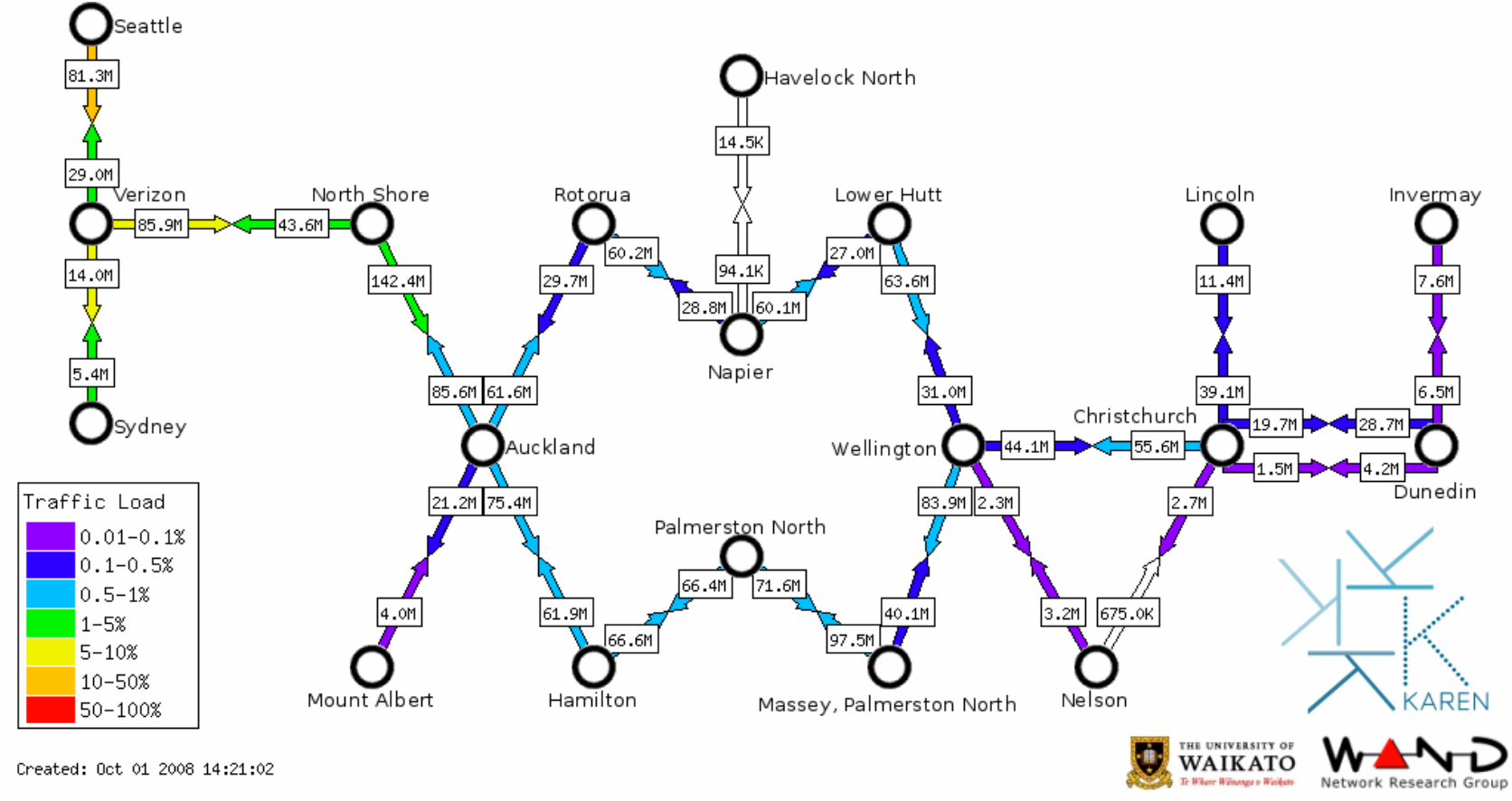
WITT
Western Institute of Technology at Taranaki

Whitireia
New Zealand

HISTORY

2006 - v1.0

- Built by TelstraClear
- One big layer-2 network
  - Did the job early on, I suppose…
- Only two routers on the network
  - Wellington
  - Auckland
- Limited to providing R&E interconnectivity only
  - No ISP services
  - 80M via Seattle
  - 5M via Sydney



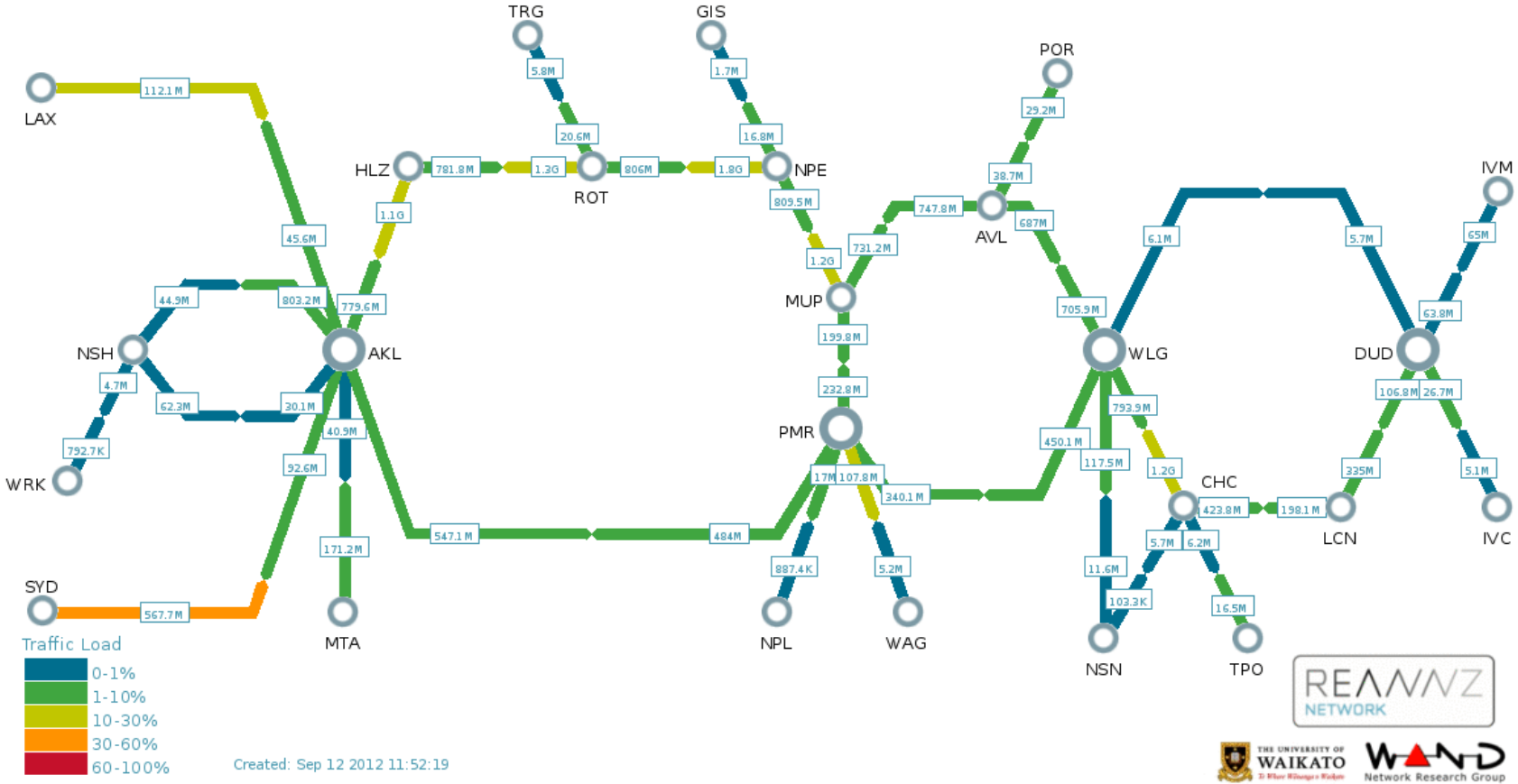
http://weathermap.reannz.co.nz/animations



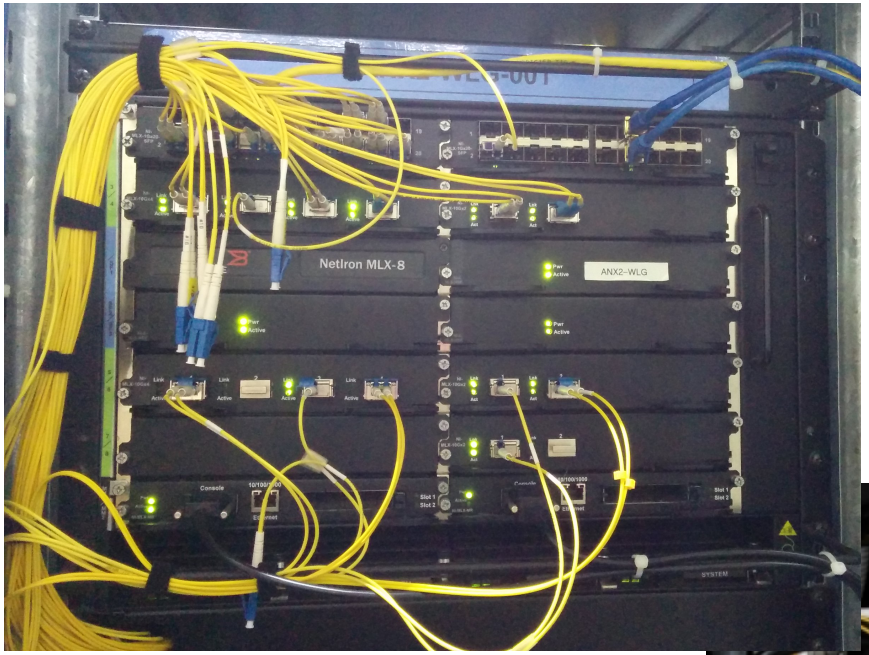

Juniper

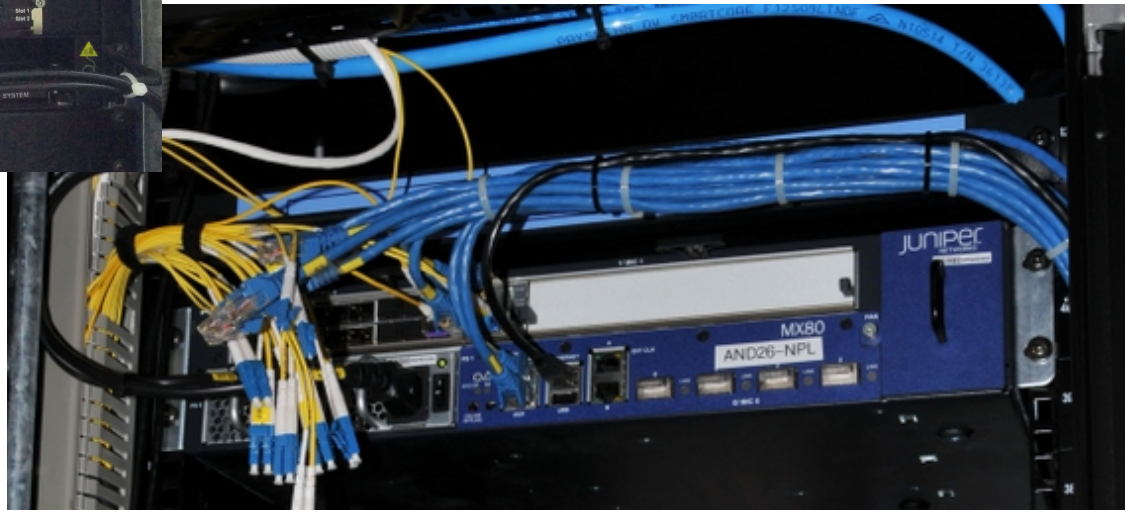
2010 v1.5

- Added more distribution routers to the network
  - Juniper MX80
  - Work around layer-2 limitations
  - Improve stability
- Brocade MLX replaced Extreme
  - Metro Ring Protocol (MRP) instead of EAPS
  - Nested rings start to reduce single points of failure
- Migration to FX Networks (now Vocus) from TelstraClear
  - Management by Dimension Data



http://weathermap.reannz.co.nz/animations


NetIron MLX-8
ANX2-WLG


juniper
MX80
AND26-NPL

2012 – NEW DIRECTION

- Network had proven the demand– needed to move on to expand its services
- Major push for removal of SPOF
  - Without that the trust in the network wouldn't be there
- Would end up with rings in rings in rings
- MRP already failed too often
  - L2 control protocols often fail closed not open - so have a habit of looping in grey failures
  - CPU load cascaded failures

MOVING TO MPLS

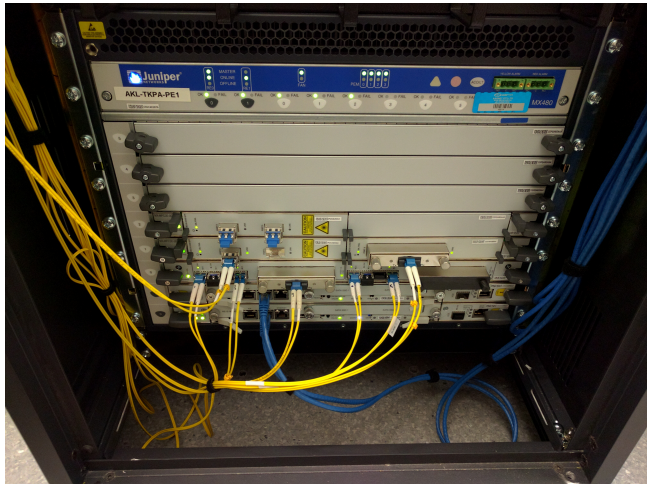
- Conversion to MPLS from L2 protection
- Needed to be transparent to end users
  - L2 VLANs -> VPLS
  - No L3 services change
- L2 resilience solved
  - Could now add extra resiliency without an increase in complexity
  - Actually increase reliability

A NEW FOUNDATION

- Complete the move to a full service provider
  - Wider services than just R&E
- Simplification for members
  - Complexity moves into REANNZ away from membership
- International collaboration with AARNet
  - First 100Gbps paths around Auckland
- Operations in-house inside REANNZ
- Co-owned national fiber network with Vocus


FXMDR
infinera
infinera
infinera

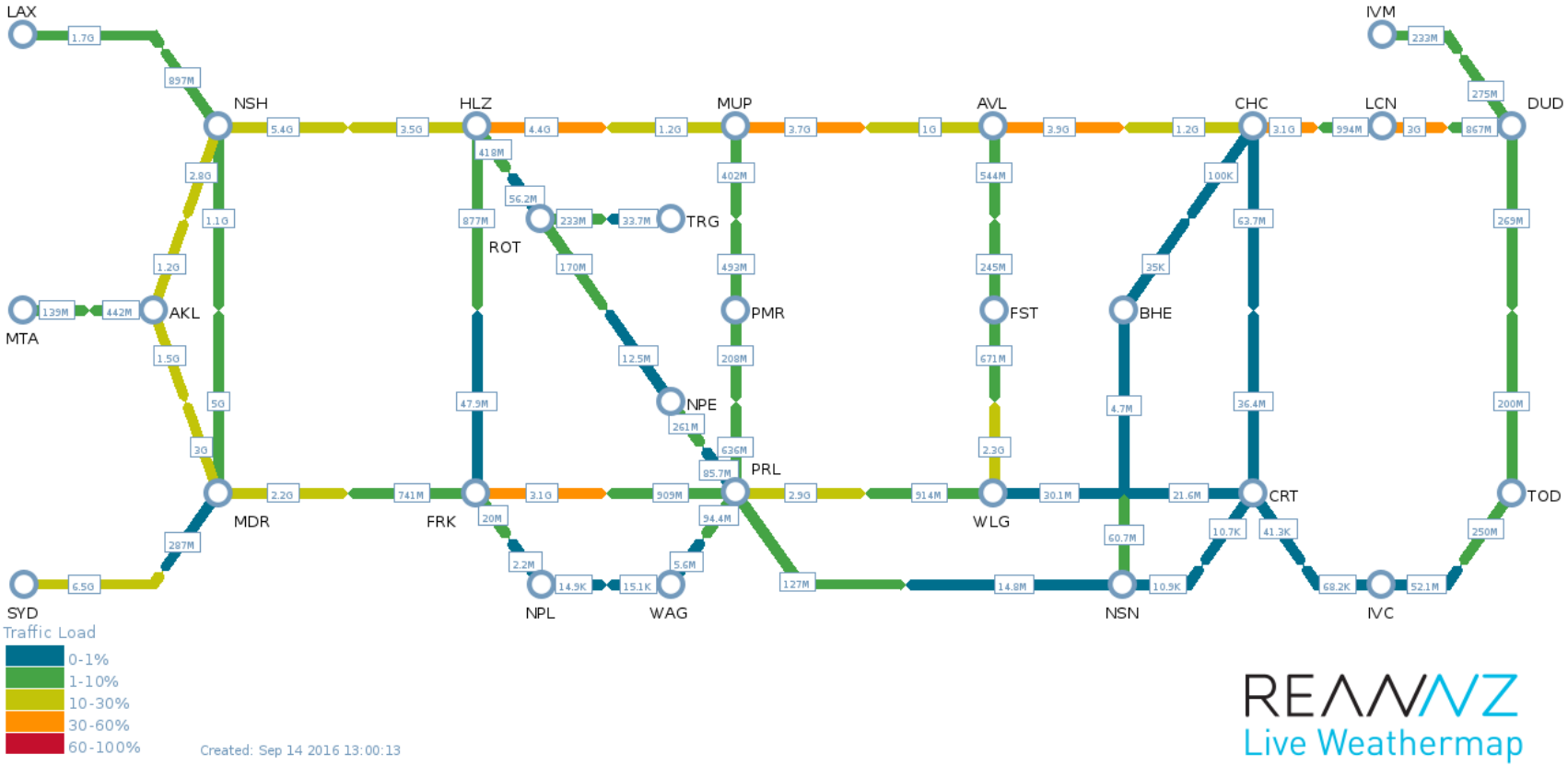

Juniper
AND12-NSH
MX480


Juniper
AKL-TKPA-PE1
MX480


infinera
infinera
infinera

THE NETWORK TODAY

AND BY TODAY I MEAN
AT THE END OF 2016
(OR THERE ABOUTS)



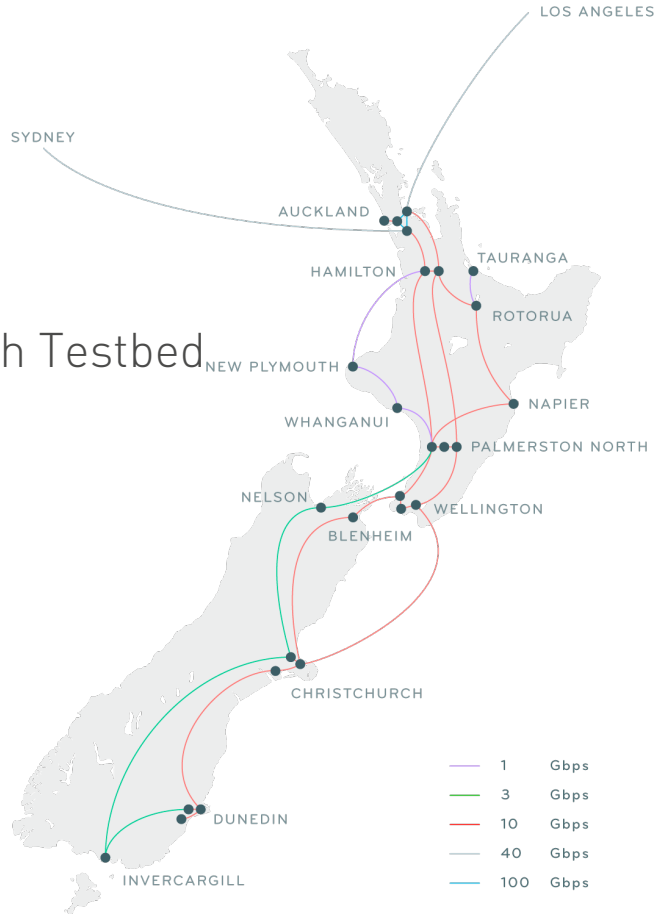
http://weathermap.reannz.co.nz/animations

HARDWARE

- Juniper MX (80, 104, 480) for core routing
- Juniper EX (3300, 4300, 4600) for CE device
- 20G primary backbone down the whole country
  - 100G roadmap being investigated
- Infinera Optical Platform
  - Co-owned with Vocus
  - Managed by Vocus
- 3rd party optical or data links

CONNECTIVITY

- 100G international R&E connectivity
  - Southern Cross Trans-Pacific Optical Research Testbed
  - TEIN
- 10G international commodity
  - 6.7G via Sydney
  - 3.3G via LAX
- 2G domestic commodity
- 10G and 1G connections into IXs
  - AIX, APE, WIX, CHIX
- Several direct peerings



MPLS ARCHITECTURE

- Simple IPv4 network between all boxes
  - OSPF routing
  - OSPF costs based on bandwidth & latency
- Full mesh between all nodes
  - “Statically” configured
  - Only ~30 nodes
- 100% virtualised services
  - Base routing instance only has routes for MPLS and management

PRIVATE LAYER-2 SERVICES

- Site to site L2 services for member WANs
- Member to member L2 services for private interconnect
- All Jumbogram capable (> 9k IP MTU)

LAYER 3 SERVICES

- Member Peerings
  - Typically BGP
- Upstream Peerings
  - Internet Exchanges
  - Domestic connectivity – Vocus
  - International connectivity – AARNET
  - International Research connectivity
- Caches
  - Google
  - Akamai
  - Netflix

TOOLS

- Weathermap
  - provides traffic information between POPs
  - weathermap.reannz.co.nz
- Icinga
  - Fork of Nagios
  - Host and Service up/down visualisation and alerting
  - Fully automated config generation
- Smokeping
  - Actively measures latency and loss
- IPAM
  - IP address management

TOOLS

- Scruffy
  - Port Information Graphing
    - optical light levels
    - traffic utilization
    - errors
  - RRD-based
- JFLOW
  - Traffic Profiling
  - Flow Analysis
- Rancid
  - Configuration backup
- Myriad of bash/python/perl scripts run intermittently via cron

FUTURE

WHERE TO NOW?

- Automation – Model Driven Network
  - Improve efficiency
  - Reduce likelihood of human error
  - Many insane and exciting possibilities
- SDN
  - Faucet
- 100G Backbone
- Member network management
- Hawaiki Cable project
  - REANNZ is a founding customer
  - Finally, an alternative submarine cable into NZ
  - Provide a huge surge in available international bandwith


REANZ