

Connecting Rural Communities using WiFi

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CRCnet Overview

- Introduction
- Current Network
 - Design Decisions and Experiences
- Example Deployment - Huiarau
- Configuration/Management
- Next Generation Node

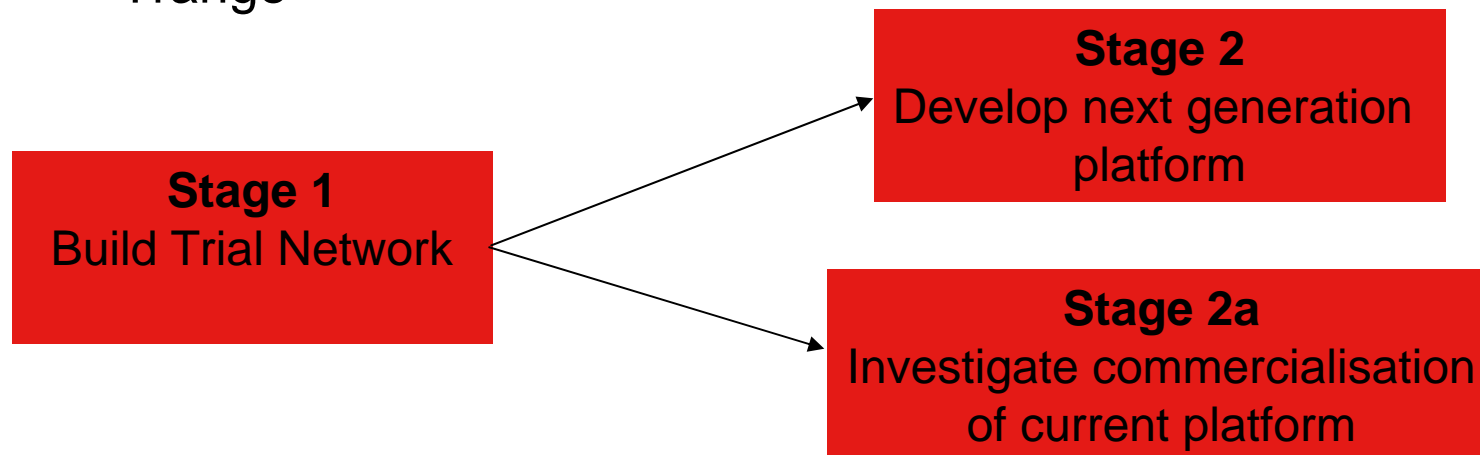
Introduction

- Project started 2.5 years ago
- Rural communities were frustrated by low speed unreliable Internet access
- Develop a new platform suitable to deploy future generation (>>10Mbps) wireless networks in rural and remote areas
 - Based around a tree/mesh architecture

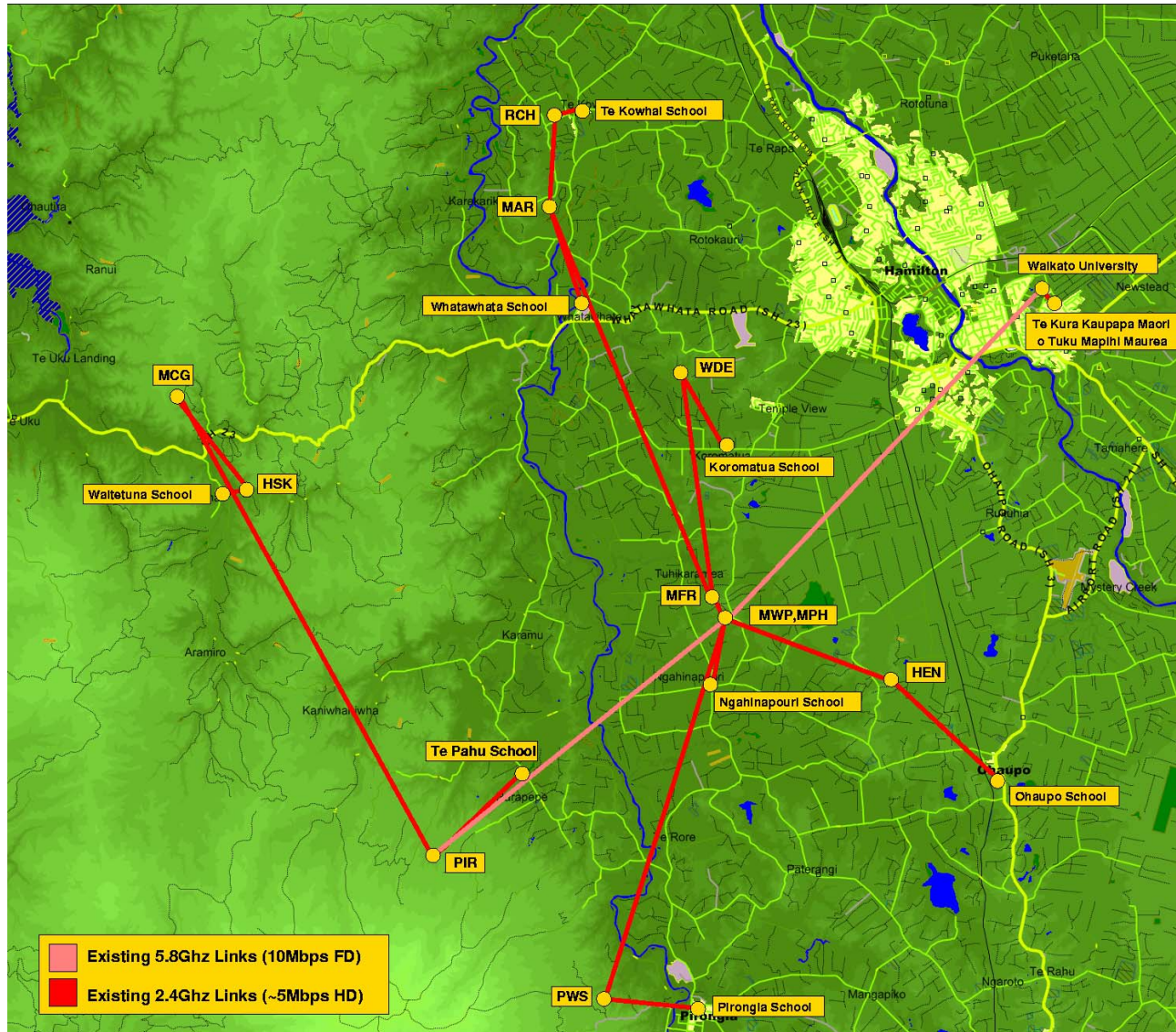


Stage 1 – Build Trial Network

- Range of equipment
 - 2.4Ghz (802.11b)
 - Orinoco radio cards and APs
 - Advantech and Soekris Biscuit PC
 - 5.8 GHz
 - Proxim QuickBridge20
 - Trango



Current Topology



RCH Site



Pirongia Site



Subscriber Unit Prototype

- Contains Soekris Biscuit PC with PCMCIA slot and running custom Linux distribution
- 15.5 dB Antenna
- Single power over Ethernet cable
- Future versions based on smaller Biscuit PC, miniPCI card and much smaller enclosure
- True Linux PC allows full firewalling and unix services
- Control and administration can be a provider or subscriber responsibility

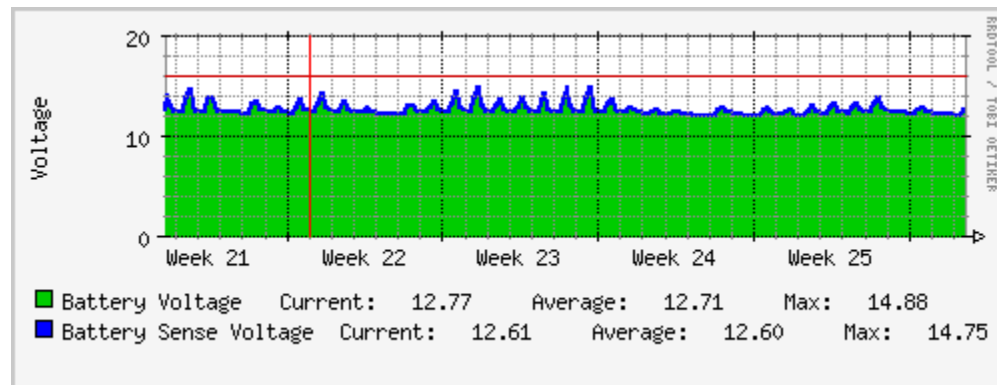
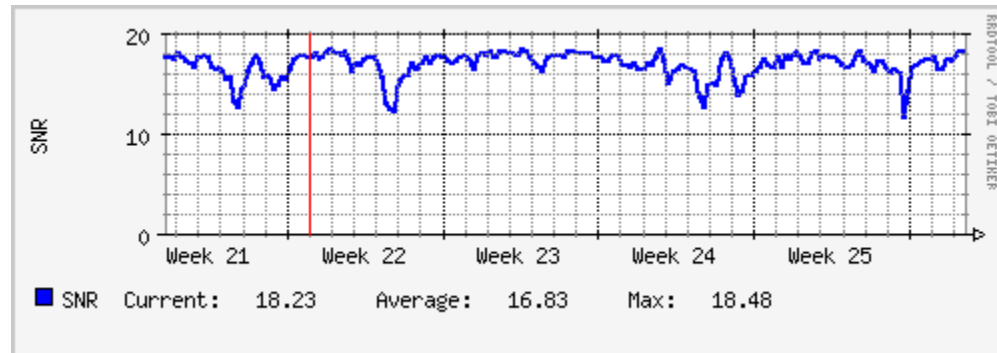


Network Design

- Layer 3 routed
 - Intelligence at all points in the network
 - Flexibility of Linux permits this
 - Price of router
 - CPU / power requirements
 - Measurement and monitoring made much simpler
- “Big” users all connected via point to point ad-hoc links
 - Avoid some problems in the 802.11 mac
 - Point to Multipoint not scalable
 - Still take advantage of cheap, mass produced radios
 - 3.5 – 5mbps more than capable of supporting small schools

Network Monitoring

- As with most networks, the more monitoring the better
- Remoteness of many links demand as much predictive monitoring as possible
 - Radio Signal levels
 - Solar site charging, battery and load levels
- Graphs are good for trends but also need alert systems
 - Too many graphs to look at every day



Design Issues

- Low Population density
- Rolling landscape
- Traditional high cost cell deployment not flexible
 - Too small a customer base
 - Locations to cover area hard to find and very poor access
- Low cost, simple to deploy repeaters permit “following” landscape
 - Almost all schools on trial network require a repeater location to reach them

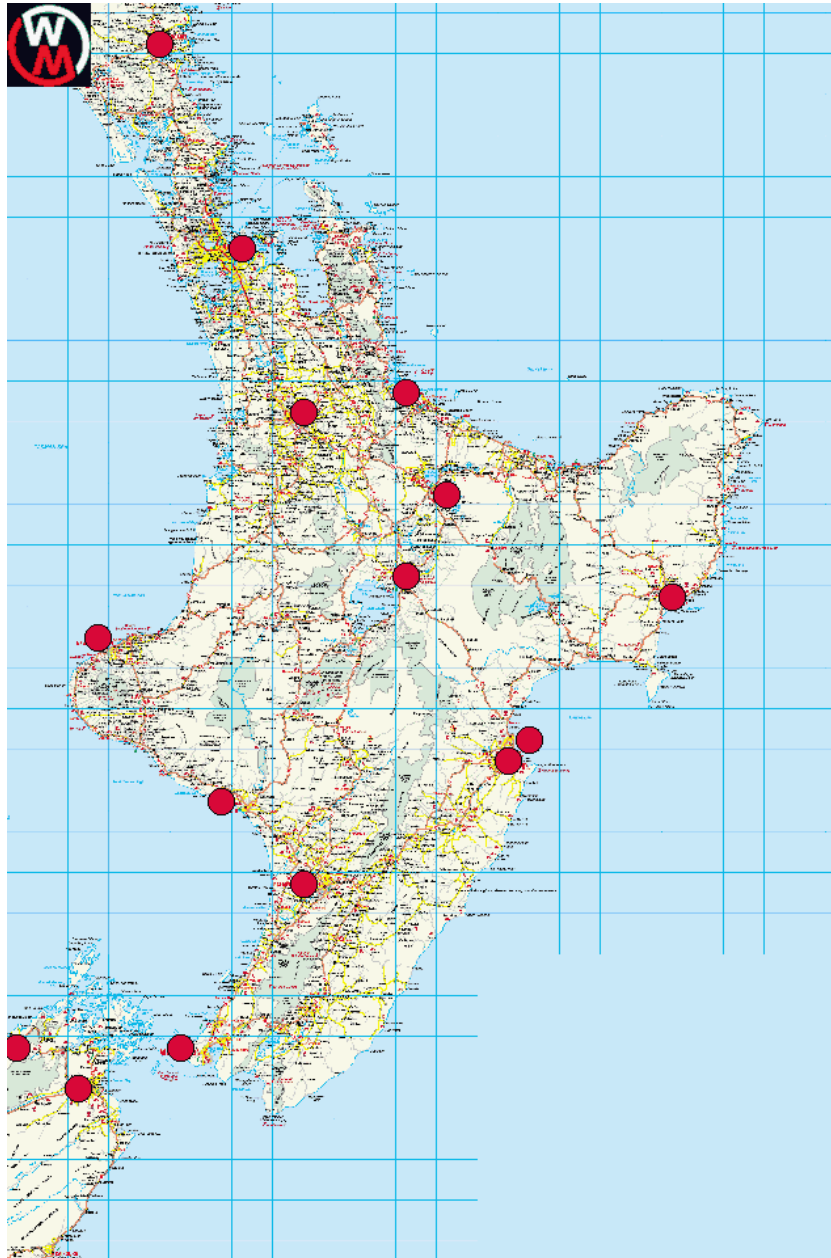
Applications

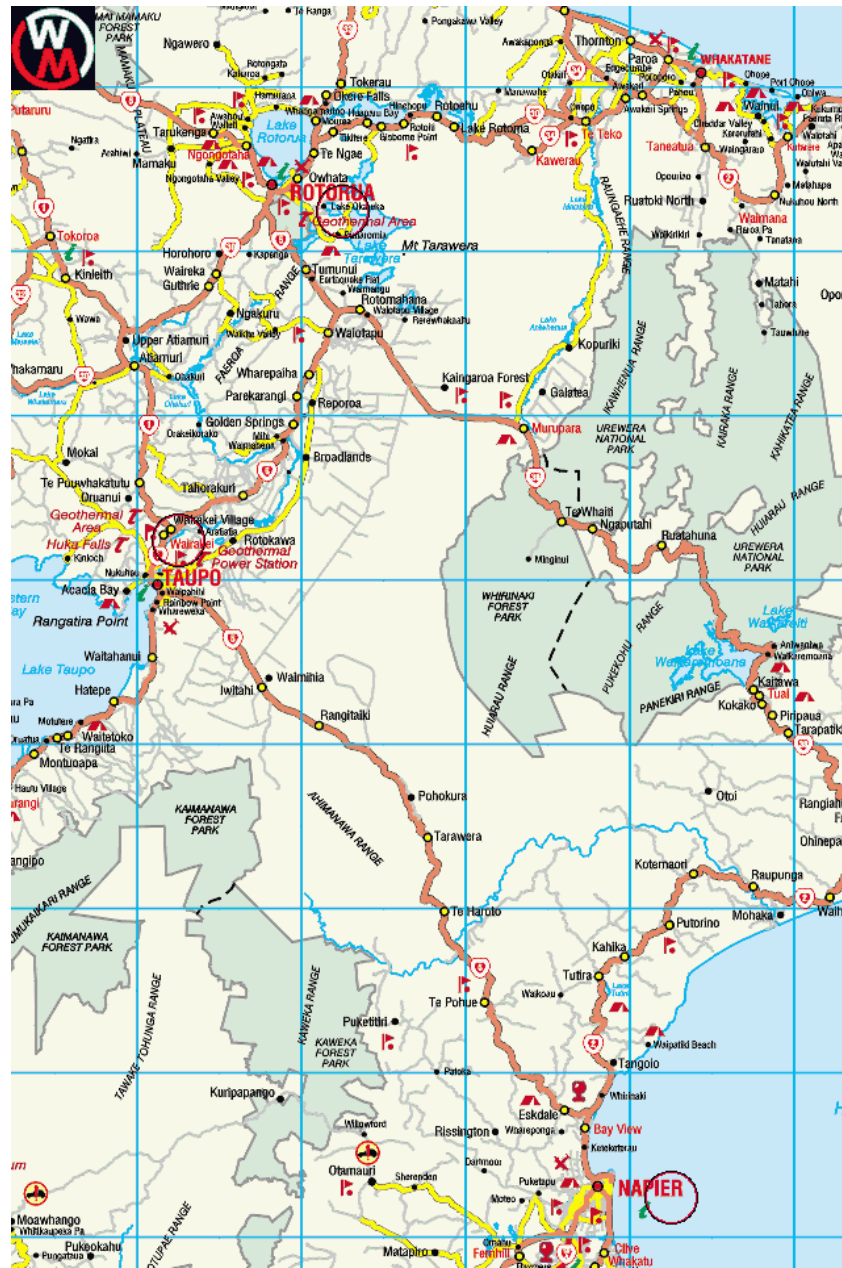
- Applications drive the network design
 - For schools
 - Web Surfing
 - Email
 - Video Conferencing
 - Web casting
 - Content filtering
 - Remote backup
 - Windows update
- Expertise required for many applications is still too high



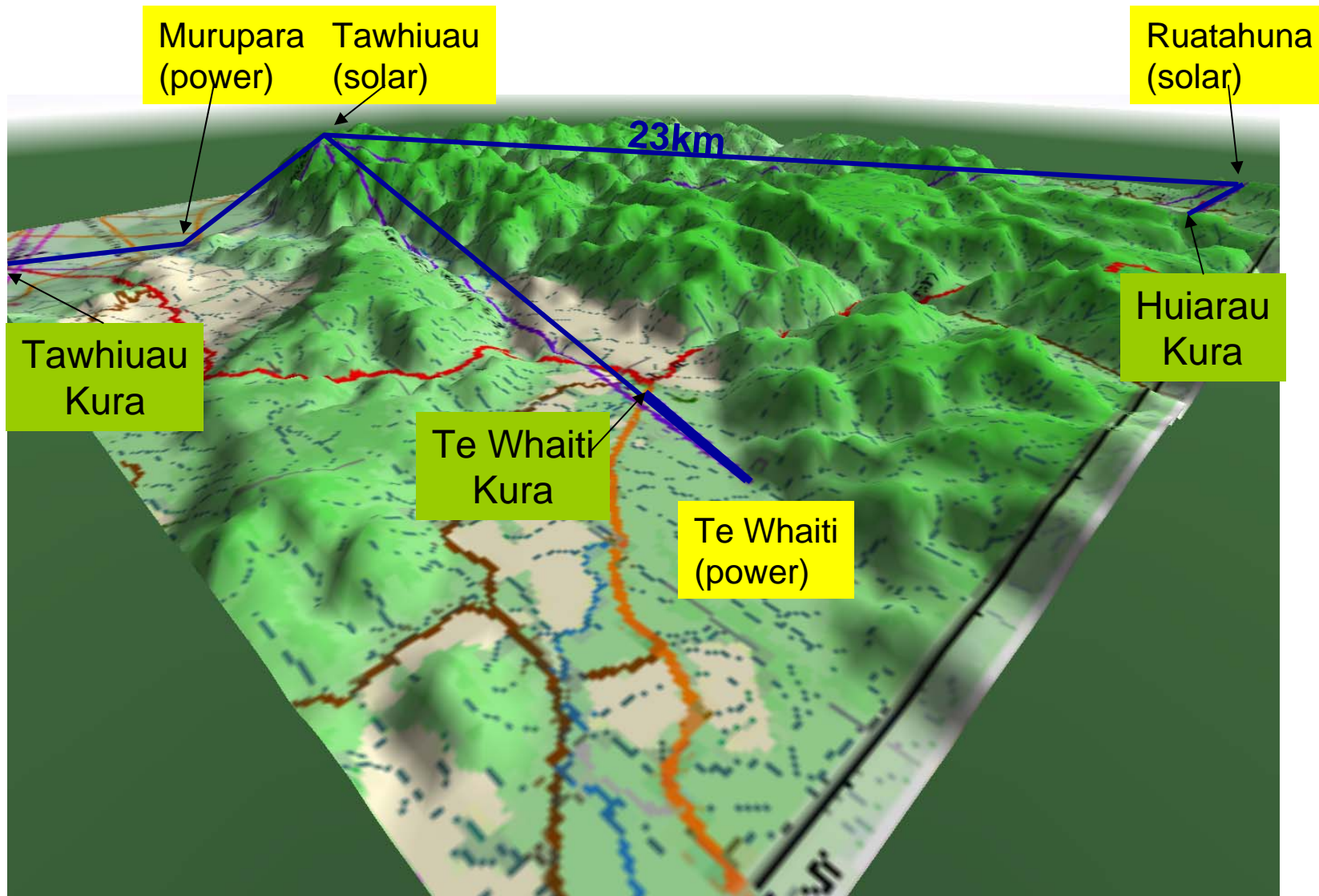
Example Deployment

- Attempting to connect 3 schools back to local township
 - Regarded as 3 of the most remote schools in NZ
- Stage 1 deployment
 - Two solar powered repeaters
 - Two hour hike required to reach one, limited helicopter access. 4WD tractor access only to second site.
 - Total of 4 wireless links
 - 23km longest hop
- Technology based on trial network
 - With all issues pushed much further
- Community input
 - Planning and building

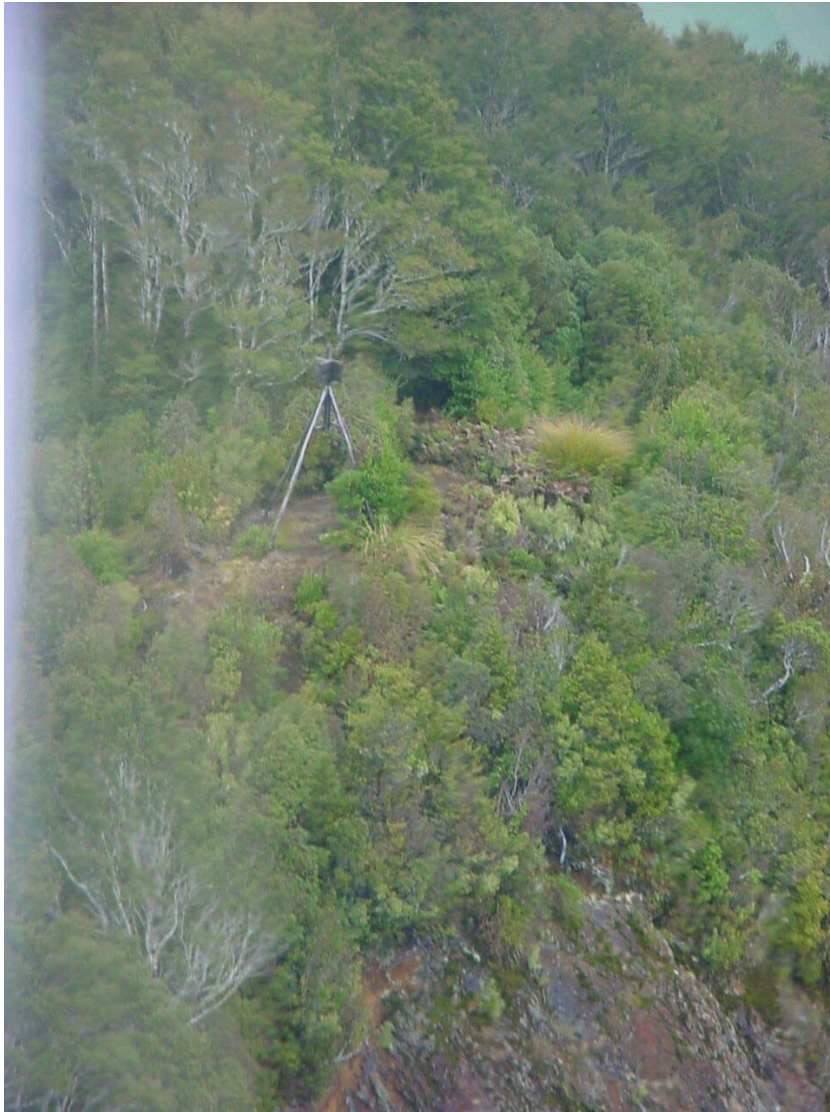




3-D Map



Tawhiuau Repeater





Solar Repeater







Configuration/Management

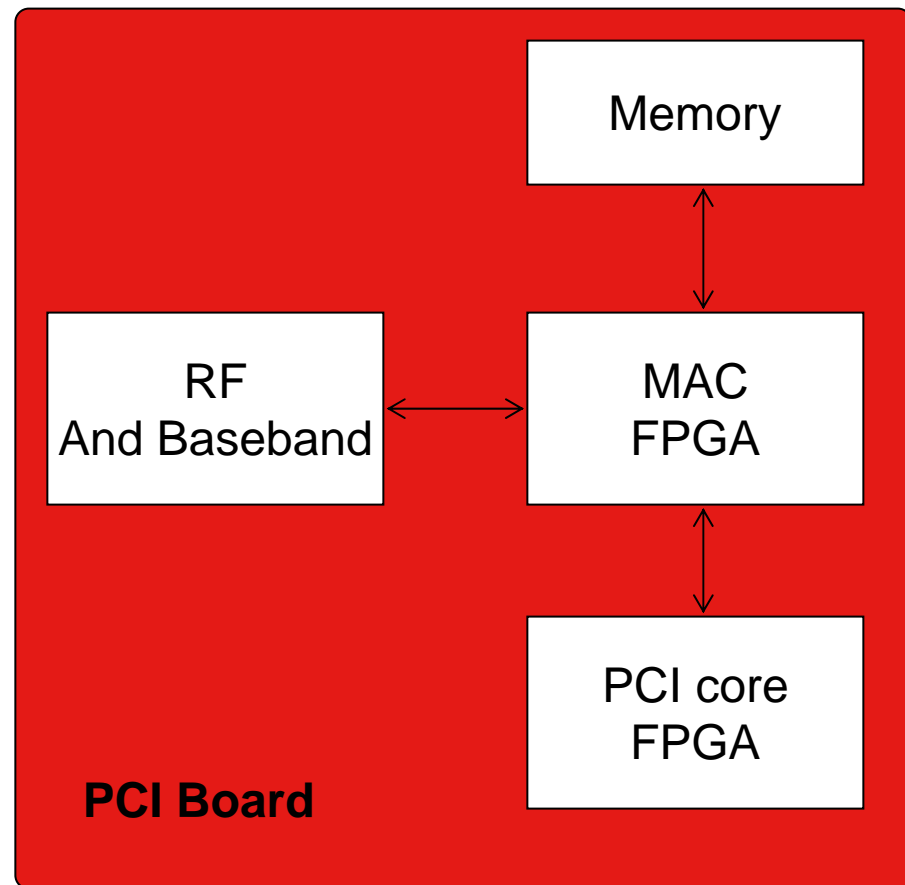
- Complex set of tools to manage current trial network
- Need an integrated set of tools to minimise expertise required to build and manage new networks
- Currently building a new web-based configuration/management tool
 - Aimed at the network provider to maintain all repeater and subscriber equipment centrally
- Monitoring, measurement and alerting all integrated

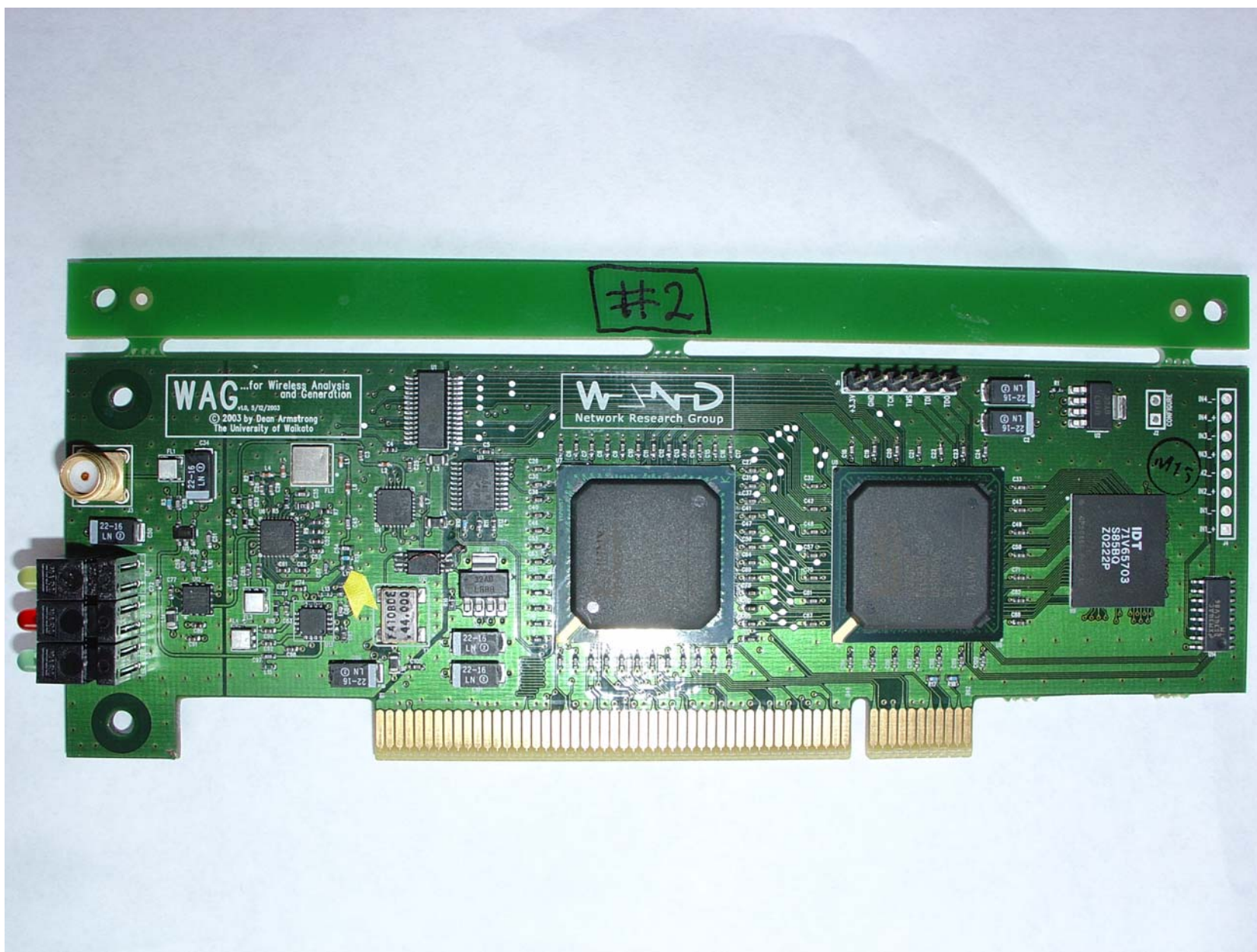
Stage Two - Develop new platform

- Easy Installation and maintenance
 - Use of multipoint to multipoint
- Customised link layer protocols
 - Possibly 802.16 or HyperLANII
- Mesh like features
 - Ability to follow landscape
 - Self forming and self healing
 - Routing
- Support for Quality of Service
- Multiple radios and sectorised antenna

Design of a new node

- Goals:
 - Easy to install
 - Low power
 - Multiple radio interfaces
 - Implement own MAC
- Iteration One
 - PCI card inside a PC





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