Connecting Rural Communities using WiFi

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CRCnet Overview

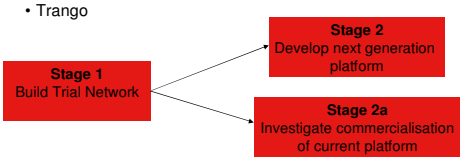
- Introduction
- Current Network
  - Design Decisions and Experiences
- Example Deployment - Huiarau
- Configuration/Management
- Next Generation Node

Introduction

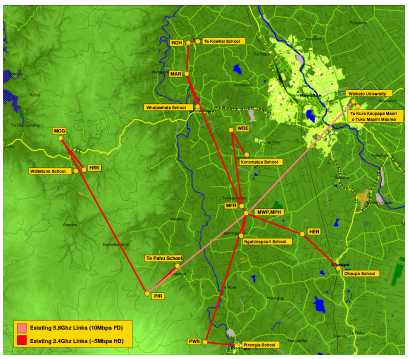
- Project started 2.5 years ago
- Rural communities were frustrated by low speed unreliable Internet access
- Develop a new platform suitable to deploy future generation (>>10Mbps) wireless networks in rural and remote areas
  - Based around a tree/mesh architecture

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

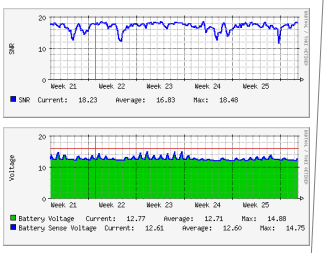
- Contains Soekris Biscuit PC with PCMCIA slot and running custom Linux distribution
- 15.5 dB Antenna
- Single power over Ethernet cable
- Future versions based on smaller Biscuit PC, miniPCI card and much smaller enclosure
- True Linux PC allows full firewalling and unix services
- Control and administration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

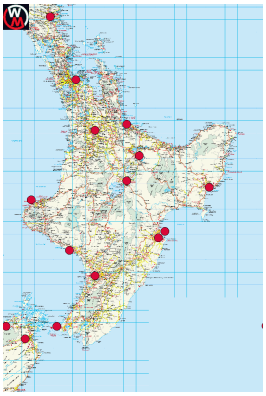
- Low Population density
- Rolling landscape
- Traditional high cost cell deployment not flexible
  - Too small a customer base
  - Locations to cover area hard to find and very poor access
- Low cost, simple to deploy repeaters permit "following" landscape
  - Almost all schools on trial network require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

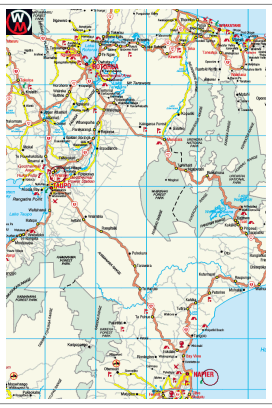
Applications

- 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

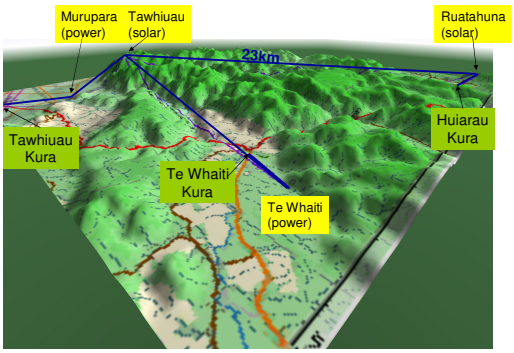
Example Deployment

- 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

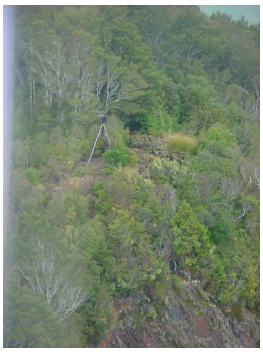




3-D Map



Tawhiuau Repeater



Solar Repeater

Configuration/Management

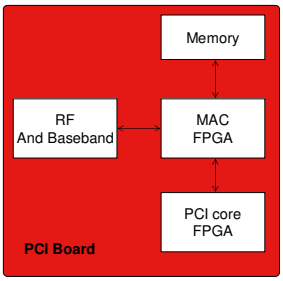
- Complex set of tools to manage current trial network
- Need an integrated set of tools to minimise expertise required to build and manage new networks
- Currently building a new web-based configuration/management tool
  - Aimed at the network provider to maintain all repeater and subscriber equipment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

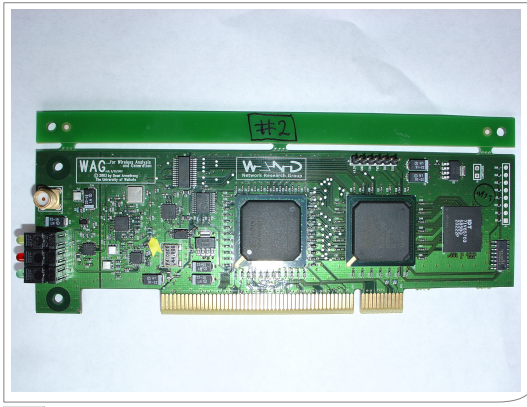
Stage Two - Develop new platform

- 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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