

# Building a Modern Research Network using a Public-Private Partnership – the New Zealand example (and a model for Africa?)

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## Abstract

Research networks face the continual challenge of obtaining high end, flexible connectivity at a price level that is affordable for end users and those funding the network. The development of new cloud-based products and services allied with the rapidly growing demands for traffic pose major challenges for funding agencies.

The original REANNZ network was procured from a commercial telecommunication provider using a standard request for proposals (RFP) process. REANNZ had to take what the vendor could supply with little flexibility to allow for innovation and the type of high bandwidth on demand services required by modern NRENs.

The need for a national network upgrade at a time of financial constraint drove REANNZ to investigate a shared investment model - a variant on a Public Private Partnership (PPP) where the Crown would invest in a privately held company to the benefit of both parties.

The successful implementation of this strategy has now delivered a shared network that will grow over time from the current 10Gb/s to 2Tb/s (2000 Gb/s). This will provide 200x more capacity at about 60% of the current costs.

**Keywords:** NRENs, Public-Private Partnerships, Investment Models, Shared Network

## 1. Introduction

This paper outlines the remake of the Research and Education Advanced Network New Zealand Ltd (REANNZ) networking and operating models to better serve its users at New Zealand's universities, Crown Research Institutes, and Institutes of Technology and Polytechnics. Through the use of a simple Public Private Partnership model REANNZ and FX Networks have jointly created a Shared Network – a high-performance, scalable network infrastructure optimized for 'big data', supported by a new way of managing the network itself. REANNZ now has the autonomy and flexibility to roll out new products tailored to the scientific and research communities. As a private company, FX Networks has had Crown funds invested in a hardware platform that allows them to offer a wider range of high-end products and services to their commercial clients. Both parties benefit for their own sectors.

## 2. Background to REANNZ Ltd

REANNZ was established in 2005 and is listed under Schedule 4A of the Public Finance Act 1989. Under this Schedule, the Crown itself is the majority or sole shareholder – in REANNZ’s case its shareholders are the Minister of Finance and the Minister of Science and Innovation. Each Minister holds an equal number of shares on behalf of the New Zealand public. REANNZ is not a Crown Entity listed under the Crown Entities Act. However, it is the intent of shareholding Ministers that REANNZ acts in a manner consistent with the Crown Entities Act. REANNZ is also subject to the Official Information Act.

REANNZ is the high-performance networking organisation serving the unique needs of the New Zealand research, education and innovation sectors. REANNZ’s vision *‘is a New Zealand where transformative ideas flourish and the exchange of knowledge is completely unconstrained by physical location, ensuring our nation’s prosperity and wellbeing. In the service of that vision, our mission is to provide cutting edge network services, unparalleled infrastructure and groundbreaking tools that enable collaboration and accelerate education, science and innovation<sup>1</sup>’*.

When the REANNZ network was launched in mid-2006 (and known initially as the Kiwi Advanced Research and Education Network) it had procured a relatively standard (i.e. commercial) 10Gbps backbone service from an existing New Zealand telco provider. This provided the backbone connection between all 8 universities and an additional 8 national research institutions (those provide a range of niche applied research services in agriculture, climate modelling, geological research, forestry and so on). A number of larger polytechnics (specialising mainly in vocational education) also connected to the network at that time. International transit was purchased out of New Zealand utilising the Southern Cross Cable Network to R&E peering points in Sydney and Los Angeles.

However, by 2012 REANNZ’s members’ needs were changing – a number of New Zealand researchers were working on the joint bid with Australia to be the joint site of the Square Kilometre Array Telescope, a high-end genomic sequencing facility had been established in the south of the country and with the increasing uptake of cloud services from providers such as Amazon and Microsoft, there was an increasing need for a range of cost-effective, highly specialised and flexible network services. However, it was apparent that it was unlikely that these services would be obtainable via the commercial telecommunications market, which had a marked aversion in particular to providing dark fibre services.

With its existing network due for an upgrade in 2013, REANNZ therefore saw an opportunity to help make NZ’s research, education and innovation community more globally competitive with a network that was more reliable, easier to use and less expensive. In order to be successful, the project needed to:

- Deliver value-for-money for the investment;
- Future-proof the supply of bandwidth services; and
- Be undertaken without the need for additional Crown funds (to REANNZ as a Crown-owned entity).

In addition, 2012 also saw the onset of the Global Financial Crisis. As a small economy of 4.5 million people reliant primarily on agricultural exports, tourism and a growing ICT sector the New Zealand government instituted a freeze on public sector expenditure. It was unlikely that the government would allocate the required level of funds to upgrade the REANNZ network to meet the projected demands of its users.

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<sup>1</sup>[http://reannz.co.nz/sites/default/files/201314\\_statement\\_of\\_intent.pdf](http://reannz.co.nz/sites/default/files/201314_statement_of_intent.pdf)

### 3. Investment Options and the Way Forward

REANNZ then investigated a number of options for ownership (see Figure 1 for summary). These included:

- a) continuing with the existing Managed Service (i.e. maintain the status quo)
- b) developing a wholly-owned network
- c) developing a shared ownership model

Investment Model	Benefit	Risk / Problem
Status Quo (Managed Services)	<ul style="list-style-type: none"> <li>• Certainty of market supply</li> <li>• Well understood, standard market service</li> <li>• Simplest and lowest risk operating model for REANNZ</li> <li>• Expenditure is mainly operational – there is very little capital asset exposure</li> </ul>	<ul style="list-style-type: none"> <li>• Affordable for the first few years, but rapidly decreases to approach the same (poor) affordability of the full ownership option</li> <li>• Increasing dependence on 3rd party service provider quality of service and responsiveness</li> <li>• Per-unit cost of bandwidth purchased rises continuously – i.e. there is no opportunity for incremental cost benefits</li> </ul>
Full Ownership	<ul style="list-style-type: none"> <li>• Certainty of ability to buy underlying Fibre IRU's if desired (available through the existing FX Networks contract)</li> <li>• REANNZ has complete control and management.</li> <li>• Provides maximum flexibility to respond to unexpected demand</li> <li>• A scalable platform easily segmented to provide for other public-good activities at incremental costs</li> </ul>	<ul style="list-style-type: none"> <li>• Unaffordable to establish in one project (insufficient cash)</li> <li>• Highest cost option over the entire period</li> <li>• Highest business risk /lowest affordability</li> <li>• Expenditure is mostly capex, with small opex component</li> <li>• Highest capital asset base and risk</li> </ul>
Shared Ownership	<ul style="list-style-type: none"> <li>• Lowest cost option for both capex and opex</li> <li>• The most affordable option – cash reserves increase over the forecast period</li> <li>• The increasing cash reserves provide the basis to grow the international capacity faster if demand is evident</li> <li>• The lowest per-unit cost of bandwidth provision</li> <li>• Even if the cost model errs on the low side and actual cost is 2x the model, there is sufficient cash headroom to retain this as a viable option</li> <li>• Provides the same degree of flexibility to cope with unexpected demand</li> <li>• A scalable platform easily segmented to provide for other public-good activities at incremental costs</li> </ul>	<ul style="list-style-type: none"> <li>• No market exposure – this has never been done in NZ to date</li> <li>• May not be achievable (market may not offer, or may not provide an acceptable offer)</li> <li>• Actual cost may be higher than modelled (there is no benchmark on which to base the cost apportionment used in the model)</li> </ul>

**Figure 1: Investment Model Analysis:**

After discussions between REANNZ and its shareholding Ministry a potential PPP approach was identified, beginning with REANNZ conducting a market assessment in early 2012. This assessment identified future data sources and the services the community would need over the next 5-7 years. As a result REANNZ then issued an RFI (Request for Information) to

understand the New Zealand telecommunication market's willingness to sell dark fibre and enter into a network sharing arrangement. The RFI was issued to the only five known service providers that could realistically respond affirmatively to the RFI.

The key criteria for the selection was to identify existing providers with either a partial or complete national fibre cable infrastructure who would be operating an optical transport infrastructure and/or considering an infrastructure upgrade. This approach was taken to avoid creating a market signal that REANNZ might help fund a new market entrant to build a new competitive national infrastructure.

This RFI closed on 29 August 2012. The evaluation was relatively straightforward; nil responses were received from two providers, one was a wholly non-compliant response, and Telecom New Zealand Wholesale submitted a partially compliant response that offered a shared optical network sometime in the future, but no possibility of access to dark fibre. The final response, from FX Networks<sup>2</sup> (the incumbent REANNZ network provider and one of three national backhaul providers in New Zealand) provided a wholly compliant response that offered a) access to a shared optical transport network and b) access to dark fibre through the arrangements that had previously been negotiated during the procurement of the current national network.

FX Networks saw this as an opportunity to gain access to Crown funds that would not otherwise be available. REANNZ and FX Networks then negotiated a mutually beneficial network sharing arrangement, which was approved by REANNZ's board and shareholding Ministers in early 2013.

- 1) The proposed transaction was premised on:
  - a) REANNZ's need to have a high-capacity network that:
    - i. could meet the specialised, high-performance needs of the research and education community;
    - ii. was cost-effective;
    - iii. could be upgraded to meet future capacity and performance needs in a cost-effective way; and
  - b) FX's need for additional capital to support the upgrade of their national backbone network.

Under the terms of this deal:

- 2) REANNZ and FX then negotiated a partnership deal that met both of these sets of needs. The proposed transaction had three core elements:
  - a) purchase by REANNZ from FX of dark fibre and Indefeasible Rights of Use (IRUs) over dark fibre to create a REANNZ-owned dark fibre footprint in the North Island
  - b) upfront "at cost" capital contribution by REANNZ to the purchase of equipment to upgrade FX's existing network, resulting in REANNZ having the right to access 25% of the capacity of the upgraded network and
  - c) purchase by REANNZ of optical equipment to support its ability to access the shared network

The Shared Network and REANNZ optical hardware

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<sup>2</sup><http://www.fx.net.nz/>

- 3) REANNZ's contribution to the shared network is approximately US\$3 million, which is a 25% contribution to the cost of the Infinera DTN-X<sup>3</sup> network hardware being purchased by FX Networks to upgrade its national network.
- 4) In return for this up-front payment towards the equipment cost for the network upgrade, REANNZ now has the ability to use 25% of the capacity of the upgraded network, and have access to the network lighting and management equipment.
- 5) This model allows REANNZ to essentially operate its own network, but for a much lower investment than purchasing a complete national network itself.

#### **4. Benefits to REANNZ**

REANNZ now has all the advantages of a wholly owned network infrastructure model, with significantly less capital investment (US\$5 million less) and lower on-going operating costs (US\$100,000 per annum) than originally budgeted. Importantly, it has allowed REANNZ to continue to meet the growing demands of its membership without recourse to further Crown funds.

REANNZ now has total control over the provisioning of its circuits and capacity can be added at the low, incremental cost of new hardware. A major benefit to REANNZ was also that it could finally gain access to the diagnostic information it needs to improve network performance in support of its users' data-intensive scientific application plus access to a full set of network lab equipment that it can use to develop and test new services prior to market release.

By agreeing to cover only 25% of the capital and operational costs, REANNZ gets access to up to 2 terabits per second of capacity (200 times its current network). This will allow both REANNZ and FX Networks to achieve a greater return on investment for their respective stakeholders than if each acted independently. As a result, REANNZ is now able to offer the New Zealand R&E community a low-cost, facilities-based innovation platform for science and research, while FX Networks enhances its ability to provide cutting-edge services ahead of the market and at below market costs.

#### **5. The Approach to Public-Private Partnerships in New Zealand**

Like many countries in recent years, New Zealand has taken an increasing interest in the provision of infrastructure using a variety of Public Private Partnership approaches. In the early 1970s local councils in New Zealand began using modified versions of PPPs to provide roading, sewerage systems, infrastructure maintenance and other related facilities. By the early 2000s the use of this mechanism had become so widespread that local councils were being required to have a dedicated PPP policy as part of their strategic plans.

In 2008, the then opposition National Party's pre-election policy on infrastructure development expressed the need for more investment in infrastructure through greater private sector involvement and "*greater use of public private partnerships for the development and management of infrastructure assets (National Party, 2008)*".

Upon winning the General Election in late 2008 the new government implemented their manifesto promise. The advantages and disadvantages of PPPs have been well documented elsewhere. Internationally there have been some high profile failures of this mechanism as a model and so the renewed New Zealand government's interest in this approach as a funding mechanism did not meet with acclaim in some domestic sectors.

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<sup>3</sup><https://www.infinera.com/products/DTN-X.html>

The government has now implemented a number of PPP projects, the largest being a new prison near Auckland that will have a total cost (including capital and operating costs) of approximately US\$700m over 25 years. This prison is being developed using a consortium process led by Serco, a UK company.

In addition two new large schools in a rapidly growing part of Auckland have been built using a consortium of New Zealand companies who will build own and operate the schools' infrastructure, and who will then lease the school facilities to the Crown. The consortium will not be involved in such areas as curriculum design/delivery, teacher recruitment or professional development.

The government has now indicated that PPPs should be considered for projects or programmes with whole-of-life costs in excess of US\$20 million. The country's high standards of public sector governance, procurement processes and probity are seen as important in delivering a fair and transparent market place for interested vendors.

The New Zealand Office of the Auditor-General has noted;

*The public sector relies on continuing competition, capability, and contestability throughout the private sector to maintain efficiency and an innovative spirit. The private sector relies on continued governance, stewardship and accountability throughout the public sector to ensure that the public's interest is effectively represented, monitored, and, ultimately, satisfied.*

## 6. Summary

The REANNZ/FX Networks Shared Business Model is a first for New Zealand, although it has been implemented elsewhere. It has delivered substantial cost savings for REANNZ and the Crown while substantially improving performance and capacity.

Infrastructure developments in Africa are currently occurring using a range of models, including PPPs through organisations such as the Southern Africa Development Corporation, the African Development Bank and the World Bank. The latter organisation suggests a shortfall of up to US\$50 billion in public capital to develop the range of transformative projects in power, water and transport projects that Africa needs.

The New Zealand example provides a successful model for NRENs in general, where there is some innovation and competition within the country and possibly for other sectors where capital availability is not great, but innovation and imagination are to be found in abundance.

## References

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## Biography

Douglas Harré is currently the Member Relationship Manager at REANNZ Ltd. Prior to

taking up this position in early 2013 he held the position of Senior ICT Consultant at the Ministry of Education's National Office in New Zealand where he was responsible for the development and deployment of a range of major infrastructure and eLearning programmes to 2500 schools. He has a B.Sc. in Geography and a Graduate Teaching Diploma from the University of Canterbury. He has spent 15 years teaching in secondary schools in New Zealand and the United Kingdom.

