



# APNIC IPv6 Trip Report

6–10 March 2007, Sydney and Brisbane



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## **Introduction**

This report summarises the REANNZ Technical Specialists' (Clayton Ejiofor and David Brownlie) trip to Australia in March 2007 to attend the APNIC IPv6 training. Secondary objectives were to hold meetings with AARNet and Verizon.





## Summary

If the IPv6 workshop was an indicator of other APNIC sessions, they cover a variety of useful information about the deployment of technologies in the Asia Pacific region in addition to imparting the prerequisite technical information. This is useful for a NREN such as KAREN as it provides insight into the focus of our International peering partners.

The meetings held with AARNet and Verizon were also highly useful. The AARNet meeting provided the opportunity to discuss the evolution of the AARNet network with their technical experts. General technical discussions ensure that REANNZ has a better technical understanding of the NRENs we interact with and that a similar understanding of KAREN is held by those NRENs.

## IPv6 Workshop

*Cecil Goldstein, Manager Training and Education Unit, APNIC*

*Champika Wijayatunga, Senior Training Specialist, APNIC*

The information presented on the first day of the workshop focused on the background to IPv6 and the theoretical and practical concerns around adopting the technology. This information is substantially the same as the [information that was presented in Hong Kong at the end of 2006](#).

The group also discussed the [evolution of IPv6](#) and the likelihood of the [wide scale adoption of IPv6](#) as a fundamental technology in internet networking.

## AARNet

*Alan Cowie, Manager, Sydney International GigaPoP, AARNet*

*John Nichols, Infrastructure Development Manager, AARNet*

*Ivan Philips, Infrastructure Specialist, AARNet*

The AARNet meeting was opportunity for REANNZ to discuss technical and architectural issues with a group that has been in the Research and Education (R&E) network space for more than a decade.

While the approaches to delivering the Australian R&E network are subtly different, many of the technical issues are similar. This is particularly the case with international peering, BGP routing policy and the desire to reach geographically remote locations.

*James Sankar, Director Applications & Services, AARNet*

The discussion with James was critical in understanding the direction that services, built on the core network, might take. The network forms the foundation for other services to be constructed on, either as core services or by members in support of R&E outcomes. It is important that all factors are weighed with the technical considerations when architectural discussions concerning the core are held.

### **Verizon Business**

*Glenn Watkins, New Zealand Country Manager, Verizon Business*

*Sunny Cheung, Technical Consultant, Verizon Business*

*Elizabeth Webster, Service Manager, Verizon Business*

*Patrick Poon, Technical Consultant, Verizon Business*

The meeting with Verizon was primarily operational in focus, discussing the status of the International network. Items that were discussed included:

- Management platform access
- International circuit resiliency
- Jumbo MTU enforcement
- Juniper M10i resources
- North Shore POP resiliency/redundancy.



## **APNIC IPv6 Workshop**

**Cecil Goldstein, Manager Training and Education Unit and Champika Wijayatunga, Senior Training Specialist, APNIC**

The attendance at the IPv6 workshop was the primary reason for this trip. IPv6 is one of the features offered by KAREN however the uptake of IPv6 as a technology has not been large to date. Internationally, the majority of the practical IPv6 implementations have primarily been in Germany, France, Japan and Korea.

The workshop assumed no prior knowledge so some basics of networking and IPv4 were covered briefly. After a quick refresher on the history of IPv6 development and some of the features that are currently included in the protocol stack, the rest of the day was devoted to covering operational aspects of using IPv6. What was readily apparent is that, while IPv6 can be used right now, many of the additional features and peripheral integrations are still changing, for example one of the rules listed in the APNIC course notes was dropped in January 2007.

The second day of the workshop focussed on the practical use of IPv6 in the network. This began with an exercise on subnetting for IPv6. This is fundamentally the same as IPv4 subnetting, but with the addition of hexadecimal values and on a larger scale (128 bits compared to 32 bits). It should be noted that while hexadecimal values are used in the notation of the IPv6 addresses and networks it is still necessary to convert these numbers to binary before working with sub networks. The key point is that if you can subnet in IPv4 you will quickly adjust to subnetting in IPv6.

The exponential increase in the possible network and host numbers available in IPv6 has implications for DNS administration and the management of PTR records. The result is that more administration will be required unless changes are made to the way DNS works with IPv6, or a means of automating the administration at an application layer is developed.

There was acknowledgement that some aspects of IPv6 are still in flux, for example DHCP is not working as envisaged and addressing for mobile devices poses potential security issues and is currently being reworked.

The installation of IPv6 protocol and the majority of the testing and troubleshooting steps are very similar to the traditional IPv4 methods. The addition of a link local address (similarly the ability to broadcast at layer 2) makes local network connectivity and testing much easier with IPv6. The major addition to the testing methods is the ability to use IPv4 to ensure layer 1 and 2 connectivity is valid in the event that configuration problems are encountered with IPv6. While this worked well it did prove that people are very familiar with IPv4, and the new IPv6 protocol is different enough for people to feel uneasy about troubleshooting with it.



## **AARNet Meetings**

**Alan Cowie, Manager, Sydney International GigaPoP, John Nichols, Infrastructure Development Manager, Ivan Philips, Infrastructure Specialist, AARNet**

The initial part of the meeting focussed on contrasting the development of the two networks' infrastructure components. The AARNet network has been in existence in one form or another for many years, starting with AARNet 0 and progressing through to AARNet 3 which is the current network designation. AARNet's funding model differs from that of REANNZ in that though it is mainly self funding from the sale of services, it receives central government grants for infrastructure upgrades; it has also been able to get access rights to distressed fibre assets (NextGen) for significantly less than the cost of their creation. There has been an evolution of technology and services over more than a decade that has lead to AARNet's current position, by comparison the KAREN network is in its infancy.

AARNet is a licensed Carrier in addition to being a NREN, having the capability to provide physical fibre where it is logical to do so. AARNet has 2 pairs of fibre forming the majority of their backbone network. This provides a



theoretical maximum of 32 light paths that could be used to provide services to their community. Currently only 2 of these paths are lit.

This has allowed AARNet to build 3 logical delivery methods across the physical backbone they provide.

- Light path – the provision of a wavelength for the exclusive use of a member
- Layer 2 connectivity – similar to KAREN but targeted as a means of interconnecting different sites via VLAN.
- IP (Layer 3) Service – layer 3 network provision which is the core delivery method for most AARNet members.

AARNet dictates the customer premise equipment (CPE) used to terminate the connection for members. This allows for a consistent, predictable delivery to the edge of the IP backbone and allows them to extend the service delivery point to the member's site rather than the POP which is where the demarcation point is for KAREN. This aligns with AARNet's position as both a commodity Internet Service Provider (ISP) and a Carrier.

Commodity Internet provision is offered to members of AARNet, and accordingly an STM-1 and 2 STM-4 are provisioned to the US via SCCN to carry this traffic, AARNet then peers with multiple organisations in the US for commodity traffic. R&E traffic is carried on a separate logical bearer which offers 10Gbps to the US with separate peering arrangements maintained for R&E routes; this cable takes a physical path through Auckland. Peering decisions are made on the basis of reducing latency to major partners or reducing cost through the use of more cost effective paths. A great deal of focus has been given to the control of peering and BGP routing policy ensuring efficient and effective use of the network.

Domestic peering is treated somewhat differently and is open to any ISP and based on the ability to provide peering in Adelaide, Perth and one other state capital.

Geography is as much of a challenge to providing the domestic network in Australia as it is in New Zealand, though the problem for AARNet is distance while for New Zealand it is topography. The provision of high bandwidth services to Tasmania remains a challenge due to legacy provider issues.

Internationally, AARNet has devices located in Fiji, Hawaii, Frankfurt, Singapore and various locations across the mainland US.



**James Sankar, Director Applications & Services, AARNet**

Discussions with James focussed on the development of higher layer services based on the strength of the core network. Voice Over IP (VOIP) and Video Conferencing are the two services of most interest.

VOIP services have meant the introduction of Quality of Service (QoS) to the IP Backbone, or layer 3 service, offered by AARNet. VOIP has tended to involve some effort in constructing the service but then becomes transparent to the users who simply use it.

Video conferencing has been more complicated. AARNet has preferred not to encourage members to use services such as Skype or peer to peer applications. The AARnet focus is twofold

- 1) Creating a booking system around its preferred technology which is the Codian platform, encouraging its members to “lease” unused space on their conference bridges to other members to make more efficient use of their communities’ assets
- 2) To create an interconnectivity product to allow equipment that is running on commons standards (i.e. H.323, H263, H264 & SIP) to seamlessly join video conferences.

AARnet are also working to enhance their authentication middleware solution, it is currently based around shibboleth. James mentioned that they were looking to upgrade their implementation to one that conforms to OASIS SAML V2.



## **Verizon Business**

**Glenn Watkins, New Zealand Country Manager, Sunny Cheung, Technical Consultant, Elizabeth Webster, Service Manager, and Patrick Poon, Technical Consultant, Verizon Business**

Discussions with Verizon focussed on operational issues and matters arising during the transition of KAREN from project mode to production status.

Elizabeth agreed to arrange access to the Verizon management reporting platform for David and Clayton to allow maximum visibility of changes and incidents relating to the operation of the network. It is possible that the management platform is being upgraded in the short-term in an effort to provide greater functionality and additional features.

Overall there was a reasonable degree of satisfaction with the processes in place. The operations of the international portion of the KAREN network appear to be working as planned. It was noted though that the Sydney link had on occasion reached 25% capacity after only 3 months of operation.

The issues of path protection and security of REANNZ capacity during major cable incidents was raised with Verizon, Glen commented that REANNZ circuits were assured from both an architectural and contractual standpoint.

A brief discussion was held on Jumbo frames and the 9000 byte maximum transmission unit (MTU) that will be enforced on the KAREN domestic network. It is important for Verizon, as the providers of the international component of the network, to understand the reasons behind this direction and to consider the technical implications associated with it. Verizon was asked to provide MTU information on all peering points.

The Juniper M10i routers located in Auckland, Sydney and Seattle were discussed. Particular focus was given to the capacity of the M10is and the physical components that are currently installed in them:

- M10i in Sydney has a spare GigE port
- M10i in Seattle has a spare GigE port
- All M10i routers have 3 spare slots that can be used for various modules.

This discussion introduced the REANNZ plan to provide further levels of resiliency and redundancy in the North Shore POP. Currently this POP is critical for international connectivity, which was highlighted by a recent outage. Verizon confirmed that they will not require any additional equipment in order to implement REANNZ diversity plans at Vector and it was agreed to share the detailed design with Verizon at the earliest opportunity.

Another issue highlighted by the Vector outage was that when the M10i came back up after the outage, the circuit to Sydney remained on the protected path. Patrick suggested raising a ticket to re-fail it over to the correct path but after discussion it was decided that a more thorough investigation of the issues would be appropriate. Patrick will do this and come back to REANNZ with the results. He will request outages for any remedial work required to do this.

As more members begin to use multicast there will be a need to re-architect the way international multicast is handled. This need will be brought about by the requirement to segment multicast domains for security and troubleshooting purposes. Most large networks implement a model that effectively places multicast gatekeepers at their traffic exchange points. Verizon have completed a design to implement this feature for REANNZ's consideration; this design does have capital procurement elements.

