Juniper Networks, Inc.

Submission on the Next Generation Network (NGN) Study Consultation Questionnaire

26 September, 2008

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Introduction

Juniper Networks has been working with Service Providers in New Zealand build and secure IP networks since 2000. It is hoped that this submission on the Commerce Commissions' Next Generation Network (NGN) Study Consultation Questionnaire will highlight several specific issues that will help with the deployment of NGNs in New Zealand, and also protect the wider outcomes of New Zealand's investment in next generation telecommunications infrastructure.

The key points made in this submission include:

- To support enhanced retail service offerings, wholesale capabilities will need to continue to evolve apace. This includes plans that better match the requirements of a variety of customers (residential vs small business to pick one example), as well as evolving content and applications.
- New Zealand is set to gain benefits from the post- "operational separation" market. At the same time it needs to ensure that in opening up competition across the access, wholesale and retail areas, New Zealand doesn't lose some of the capabilities that would traditionally be available in a single vertically integrated network.
- The predicted exhaustion of IPv4 address pools available for allocation is a concern that has gained significant international focus in the past 18 months. This poses a significant future risk to New Zealand's ability to harness maximum benefit from the changes that have taken place and from future plans. Other countries including China, Japan, the United States and Australia have already taken varying levels of action. This submission offers several suggestions along with links to (and an extract from) a recent OECD report into the "Economic Considerations in the Management of IPv4 and in the Deployment of IPv6".

This submission is relatively focused and specific in it's nature. Where wholesale services are concerned, improvements are suggested but the approach to achieving these outcomes is not addressed. A subset of questions are responded to.

While there has been much change in the New Zealand telecommunications marketplace in the last few years, the pace will continue over the next few years as New Zealanders take advantage of improving access to broadband and ICT infrastructure, and as future Governments look to action policies recently announced. Juniper Networks looks forward to continuing to contribute to this debate.

This paper was authored by Ian Quinn (Systems Engineering Manager). Juniper Networks would welcome any comments, questions or opportunities to elaborate on this paper further. Please feel free to contact Ian Quinn (+64 21 428408, iquinn@juniper.net).

A. Retail and Wholesale Services

A.6. Can you envisage any areas where significant barriers to entry are likely to emerge?

With the projected exhaustion of IPv4 addresses, one concern that is being discussed internationally is how this will affect competition. From "Interoperability and competition concerns" in the OCED report "Economic Considerations in the Management of IPv4 and in the Deployment of IPv6":

"IPv4 will not disappear; it is therefore essential that the transition strategy pursued is an integration and co-existence of IPv6 networks with IPv4. For network operators and other entities that rely on Internet numbering allocations, it will become increasingly difficult and expensive to obtain new IPv4 address space to expand their networks. A situation with anticipated scarcity of IPv4 addresses raises competition concerns in terms of barriers to new entry and strengthening incumbent positions. From a business standpoint, new or existing Internet users who need IPv4 addresses are likely to have to use private addresses with several levels of translation (NAT) and still need some quantity of public IPv4 addresses. Care must be exercised that the IPv6 transition and co-existence between IPv4 and IPv6 safeguard competition and a level playing field and do not lock in dominant positions."

There is a significant body of discussion on this topic available – too extensive to include here. A useful perspective however might be that the more widely IPv6 is deployed in the New Zealand environment at the time IPv4 addresses cease to be readily available, the less of a concern or problem competitive issues around this will be.

As a proactive measure to avoid or minimise future concerns around competitive issues due to IPv4 address space, the New Zealand market needs to build and ramp IPv6 deployment significantly. More comment on this is included in the response to question C.1.

B. Architecture

B.1. What technical issues need to be resolved to allow you to offer the services you would like to be able to offer today, and over the next 1-3 years?

Broadband access networks and NGNs can provide significant additional benefits to the New Zealand economy. Examples of services that are being or are likely to be delivered given the appropriate support include:

- VoIP-based voice services, with the pace of deployment picking up as services mature and as migration from legacy PSTN platforms takes place.
- Video-based communications, including video calling, video conferencing and newer high definition options. The Government has signalled through the Digital Strategy 2.0 and other recent announcements around sustainability, a desire to encourage remote working and video conferencing as options for reducing travel and carbon emissions.
- Increased remote working. Again the Government has signalled through the Digital Strategy 2.0 and sustainability announcements that remote working as an option for reducing travel is desirable. This could potentially also be driven as employers use this to address a tight labour/skills market.
- Improved IT productivity tools such as trends such as Software-as-a-Service and cloud computing grow with the market. These offer businesses the opportunity to benefit from hosted tools and infrastructure that they could not otherwise afford to deploy themselves (time, money and expertise all being limiting factors).
- Richer broadband residential services including more video options, utility monitoring, and the like

The deployment of NGNs is already underway in New Zealand, but the access options outside of fibre-served premises in the major metropolitan areas are a potential constraint. Aspects of wholesale broadband access services available today limit the ability of retailers to deliver some types of services, and for the overall country to realise the benefits of IP-based NGN investments. Some specific improvements are suggested below.

- Current wholesale access services specify a single option for best-efforts traffic (32Kbps throughput averaged over a period of time). A single option limits the ability of retailers to, for instance, offer plans that support the different requirements of an average residential user, someone using broadband to work remotely, and a SME office with say 5-10 users.

  A more developed market might offer say the existing option as an entry level residential plan, but also support a higher minimum throughput for more advanced plans, and higher bandwidth/less contended service options for use SME-oriented plans.
- The EUBA service provides two real-time options supporting 40Kbps and 90Kbps. Multiple higher throughput options will be required to provide Retailers with the option of supporting multiple VoIP calls, or any form of video calling or video conferencing.

  The Government has signalled through the Digital Strategy 2.0 and other recent announcements around sustainability, a desire to encourage remote working and video conferencing as options for reducing travel and carbon emissions. A wider range of real-time options within broadband services available in the market would support these objectives.
- In recent years, broadband access architectures and standards have evolved to provide edge routing platforms with richer information from the access network. Examples include the upstream and downstream access line speed and line id. The Broadband Forum has specified these for both PPPoE and

DHCP, enabling information to be passed back to either environment in the Retailer and other mechanisms exist in other environments (L2TP for example).

Passing this information to retail networks would aid in the deployment of assured experience services through improved QoS (eg able to shape to match and not exceed the line rate) and by enabling admission control for services using the learned line rate. It would also enable retailers to make service decisions based on the line id (rather than an authenticated userid/password), and improve troubleshooting capabilities lowering costs and reducing time to fix certain types of faults.

- There is a class of applications, such as some streaming video models, which require assurances around access to significant bandwidth in order to meet service requirements. These applications only require that bandwidth for limited periods of time, but permanently provisioning that bandwidth through the backhaul haul network for each customer is prohibitively expensive.

  An alternative option to enable these types of service is to enhance the wholesale-retail handoff to allow the retailer to request a particular service offering (6Mbps of assured bandwidth for example) to a specific customer. This permits the wholesale network to perform admission control and to provide the service if it is able to supply the service.

  This capability would allow retailers to deploy services that would otherwise be cost-prohibitive, and for wholesale providers with a more economic model for high bandwidth applications.

Finally the requirement for flexible wholesale offerings extends not only to existing wholesale service offerings, but also those currently building out access networks under LLU, and any future network infrastructure (public, private or public-private partnership based).

B.4. Do you envisage any issues in NGN interconnect or in relation to current peering arrangements?

The response to question C.1 outlines the need to migrate to IPv6 as IPv4 address exhaustion approaches. Supporting IPv6 across peering and interconnection points is an important part of enabling this migration for Internet, voice and VPN services.

B.5. Do you envisage any issues in NGAN to NGN interconnect?

The response to question B.1 outlines some of the additional functionality or options required from access services to fully support NGN deployment.

The response to question C.1 outlines the need to migrate to IPv6 as IPv4 address exhaustion approaches. IPv6 has implications for some access network scenario's and this is touched on in the response to question C.1. Addressing these implications as soon as is feasible removes a potential hindrance to IPv6 deployment.

B.6. Do you envisage any issues around NGN to service, content and application provider interconnect?

The response to question B.1 outlines some of the additional functionality or options required from access services to fully support NGN deployment. Availability of these facilities in the access network would serve to support the deployment of content and applications not well supported today.

B.7. Do you envisage any issues around agreement on appropriate parameters and values relating to Quality of Service in the NGN environment?

The response to question B.1 outlines some of the additional functionality or options required from access services, including additional options for best-efforts throughput, real-time service support, and the dynamic provision of access network information to retailers.

B.8. Do you envisage any issues around the integration with the developing open access fibre networks?

The increased interest in FTTH is a world-wide trend. There is significant interest in ensuring that the benefits from the architectures deployed to support DSL today can also be leveraged in other environments. It is worth noting that the DSL Forum recently renamed itself to the Broadband Forum to reflect this, and that there is active work underway in the Broadband Forum to adapt and extend existing network and service architectures to support alternative technologies including GPON and WiMax. It is expected that this will reduce the cost and time taken to deploy these networks, as well as better support services in a mixed access environment. Monitoring this work would likely provide useful technical background as FTTH deployment picks up in New Zealand.

C. Transition

C.1. Can you comment on the need or timing to migrate from IPv4 to IPv6 and any role you see for government in this transition?

Today's broadband services are almost exclusively based on the IPv4 (Internet Protocol). While this has served the Internet and more recently broadband and mobile networks for two or more decades, recent modelling of the use of the IPv4 address space suggests that spare IPv4 addresses will cease to be available for allocation by IANA (Internet Assigned Numbers Authority) in 2010 and the Regional Internet Registries in 2011.

With the pool exhausted, service providers will not be able to acquire additional address space for new networks or growth using the existing address allocation models. A recent OECD report ("Economic Considerations in the Management of IPv4 and in the Deployment of IPv6") makes the following comments:

"An intersection of economic, technical and public policy factors will determine the strategies adopted by various stakeholders who can pursue three broad paths: i) an even denser deployment of IPv4 Network Address Translation (NAT), whereby more devices are connected with fewer public IPv4 addresses by using private networks; ii) trying to obtain previously allocated but unused IPv4 addresses, and; iii) the deployment of IPv6. It is likely that all three of these options will be pursued by various actors in parallel, according to their business requirements. As an immediate solution, many are expected to pursue denser deployments of NAT. If Internet addressing groups were to liberalise address transfers, some actors would acquire previously allocated IPv4 addresses. Some actors will also implement IPv6. For policy makers, the most important point is that the first two strategies, which extend the life of IPv4, may be useful but are shortterm. The only sustainable solution to deliver expected economic and social opportunities for the future of the Internet economy is the deployment of IPv6.

In terms of public policy, IPv6 plays an important role in innovation and scalability of the Internet. In addition, security, interoperability and competition issues are involved with the depletion of IPv4. Transitioning to IPv6 represents a fundamental change in the Internet Protocol layer, which is necessary to foster an environment for long-term growth and competition across existing players and new entrants. In turn, such an environment is expected to enable the expanded use of the Internet and the development of new networking environments and services."

IPv4 address exhaustion poses risks to New Zealand realising the benefits sought through increased investment in broadband and related infrastructure, as well as wider programs such as the Digital Strategy 2.0. These risks include:

- Impediments to supporting the growth of broadband network connections. This includes today's residential and business services, but will also future uses of IP connectivity which might include utility monitoring, alarm monitoring, and other intelligent devices in the household or business.
- New market entrants could conceivably have difficulty launching services due to the lack of IPv4 address space. The more advanced IPv6 deployment in New Zealand is (with availability of content and services), the less of an impediment this would be.

If New Zealand was at the trailing edge of IPv6 deployment and these impacts were felt, our relative position in the global economy could be impacted as relative productivity and competitiveness gains from broadband dropped off.

At a global level IPv6 has gained momentum in countries such as Japan and China due to various reasons which include government initiatives to encourage deployment and historically smaller IPv4 address space allocations. Examples of initiatives driving IPv6 deployment include:

- Various initiatives in Japan including the eJapan (2001) and eJapan II Initiatives (2003).

- Taiwan's National IPv6 Deployment and Development Program (October 2001).
- The United States Department of Defence has required networking products to be IPv6 capable since 2003. The Australian Department of Defence released a transition policy in 2005 and has mandated migration to IPv6 by 2013.
- On August 2, 2005, the United States Government OMB Office of E-Gov and IT issued OMB Memorandum 05-22[3], "Transition Planning for Internet Protocol Version 6 (IPv6)," directing all Federal government agencies to transition their network backbones to the next generation of the Internet Protocol Version 6 (IPv6), by June 30, 2008. In addition, the National Institute of Standards and Technology (NIST) was recently tasked with evaluating additional standards and testing infrastructure that is required to support these plans.
- In December 2006, the Australian Government's Chief Information Officer Committee (CIOC) tasked the Australian Government Information Management Office (AGIMO) with the development of a whole-of-government strategy for a transition to Internet Protocol version 6 (IPv6)[4]. The strategy was endorsed by the CIOC in December 2007, and a Community of Expertise (CoE) was formed to acts as the central point for policy advice and information regarding whole-of-government issues in the transition to an IPv6 environment.
- The EU announced at the end of May, that "Twenty-five per cent of all European users should have the opportunity to use IPv6 by the end of 2010, and should be able to access most of their normal services and content with it.".

Taking significant steps to encourage IPv6 deployment will bring New Zealand back into line with initiatives that are already underway in other markets, ensuring that local broadband and Internet infrastructure continues to be adopted without impediment, and that the local ICT industry is aligned with changing global markets.

Accelerating IPv6 deployment also ensures we make the most of the opportunity to migrate in an optimised, orderly and relatively non-disruptive manner. From an economic standpoint, ensuring investments being made support IPv6 avoid expensive rework and disruption later. Delaying IPv6 deployment increases risk and impacts the benefits of broadband deployment in later years.

It is worth noting that the OECD report has a more comprehensive list of steps that it recommends Governments specifically should consider. This is cover in the Main Points section of this report, and the suggestions are organised along under the following headings:

1) Working with the private sector and other stakeholders to increase education and awareness and reduce bottlenecks.
2) Demonstrating government commitment to adoption of IPv6.
3) Pursuing international co-operation and monitoring IPv6 deployment.

To focus on several points more specific to the New Zealand environment:

- The availability of content and services on IPv6 has traditionally been raised as a "chicken-and-egg" situation – people could elect to migrate to IPv6 but historically the content and services have not been available over IPv6. The projected exhaustion of IPv4 addresses should increases the efforts being made around migration which will help break this deadlock, but encouraging the availability of content and services on IPv6 should be encouraged as an additional driver to accelerate deployment.

  The Government has noted the need to move to IPv6 within the final Digital Strategy 2.0 as a shared challenge. With it's coverage of content, recognition with DS2 is an ideal starting point, although the challenge is now to move to more specific actions to implement this aspect. An encouraging step would be to see the Government content sites listed within DS2 accessible via IPv6 within a reasonable timeframe.
- Incorporation of IPv6 into retail services is a step that service providers will undertake according to their own priorities, typically driven by business opportunities and competitive marketplace pressure. Internationally a number of Government organisations have encouraged steps towards commercial IPv6 deployment and the OECD report "Economic Considerations in the Management of IPv4 and in the

Deployment of IPv6" has also made recommendations on steps that Governments should consider including "adoption of IPv6 for governments' internal use and for public services".

- To ensure that Retailers are free to commence IPv6 deployment as soon as they are ready, any regulated access service specifications should not discriminate the delivery of IPv6 based services in comparison to IPv4 services.

  IPv6 can by deployed by Retailers across some existing wholesale access service specifications. For example, IPv6 is carried across BUBA transparently (inside PPP/L2TP), and other relevant factors such as the incorporation of line speed information can be carried (if the service supports it) independently of the protocols inside the connection.

  It is quite possible that there can be impediments to the delivery of IPv6 based services with some wholesale access such as EUBA. Even though the access is Layer 2 based, there can be functions in the network that rely upon certain IPv4 upper layer protocols, such as DHCP(v4) that may not be present should IPv6 be used. This could impact not just the relay of useful data such as access line information but the overall operation of an IPv6 service.

- All new interconnection standards and work should incorporate support for IPv6. This is not to say that service providers should be forced in any way to deploy IPv6 across interconnects – just to ensure that any specifications include support for IPv6 to ensure that it is not a barrier to deployment when service providers are ready.

The Broadband Forum (formally known as the DSL Forum) has adopted a stance that all new work must support IPv4 and IPv6 on a non-discriminatory basis, for example any new technical reports must include provision for both protocols before they are adopted. This might be a useful stance to adopt within the New Zealand environment to avoid barriers to IPv6 deployment.

D. Environment

D.3. Do you have a view of the role of the regulator and other industry bodies (e.g. TCF) in the evolving NGN environment?

NGNs and the wider telecommunications market is a rapidly evolving market. Against this backdrop, the overall New Zealand industry is collectively undertaking a significant program of work and change over the next 2-3 years, challenging the resource and expertise of all parties. Open consultation processes provide the opportunity to collect all relevant perspectives and experience, and the greatest opportunity to incorporate these and benefit from them early. More informed decisions lead to greater surety around the outcomes and less risk that the industry will invest valuable time and effort pursuing less optimal paths or revisiting work already undertaken.