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Guide to Roadmap Preparation

The Opportunities, Process and Considerations for Transitioning to

IPv6

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What we will cover…

- Where are we with IPv6
- The Road Mapping Process
  - IPv6 Benefits
  - Transitioning Options
- Making the Business Case
- How Gen-i can help
- Summary

Where are we with IPv6

- Peering IPv6 across our international links.
- First IPv6 wholesale customer connected.
- Active IPv6 steering group assessing customer requirements.
- Working with Government, InternetNZ and other industry players.
- Core network migration planning underway.
- IPv6 enabling public facing services such as DNS, Web, Email & NTP later this year.
- Teredo and 6to4 relays being built shortly.

The Road Mapping Process

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1. Work out what the business drivers are including address exhaustion, but not limited to that.
   - ✓ Do we have enough public IPv4 addresses for our future requirements?
   - ✓ Will you need to communicate with other businesses who are going to move to IPv6 or access applications / information that they will make available using IPv6?
   - ✓ Given the benefits of IPv6, what opportunities does that create for your business?

IPv6 Benefits

- Scalability: IPv6 has 128-bit addresses versus 32-bit IPv4 addresses. With IPv4, the theoretical number of available IP addresses is $2^{32} \sim 10^{10}$. IPv6 offers a 2^{128} space. Hence, the number of available unique node addressees is $2^{128} \sim 10^{39}$.
- Security: IPv6 includes security features, such as payload encryption and authentication of the source of the communication, in its specifications.

IPv6 Benefits

- Real-time applications: To provide better support for real-time traffic (e.g., VoIP), IPv6 includes “labeled flows” in its specifications. By means of this mechanism, routers can recognize the end-to-end flow to which transmitted packets belong. This is similar to the service offered by Multi-Protocol Label Switching (MPLS), but it is intrinsic with the IP mechanism rather than an add-on.

IPv6 Benefits

- Plug-and-play: IPv6 includes a plug-and-play mechanism that facilitates the connection of equipment to the network. The requisite configuration is automatic.
- Mobility: IPv6 includes more efficient and enhanced mobility mechanisms, particularly important for mobile networks.
- LTE - Long Term Evolution circa 2010-11 will likely be IPv6 only!

IPv6 Benefits

- Optimized protocol: IPv6 embodies IPv4 best practices but removes unused or obsolete IPv4 characteristics. This results in a better-optimized Internet Protocol.
- Addressing and routing: IPv6 improves the addressing and routing hierarchy.
- Extensibility: IPv6 has been designed to be extensible and offers support for new options and extensions.

The Road Mapping Process

2. What transitioning option(s) best meet the needs of your business drivers, now and in the future...
   - ✓ Can we operate with both IPv4 / IPv6 addresses and will our infrastructure / applications support that?
   - ✓ Shall we rapidly transition our internal network to IPv6 and then use a pool of IPv4 addresses to enable translation to and from the IPv4 world?
   - ✓ Are we best to tunnel either IPv6 across our IPv4 infrastructure or vice versa?

Transitioning Options – Dual Stack

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- Dual Stack (RFC2893): The principal building block for transitioning is the dual-stack approach. Dual-stack nodes, as the name suggests, maintain two protocol stacks that operate in parallel and thus allow the end system or router to operate via either protocol. In end systems, they enable both IPv4- and IPv6- capable applications to operate on the same node.

Transitioning Options - Translation

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- Translation: Refers to the direct conversion of protocols and may include transformation of both the protocol header and the protocol payload.
- Translation can occur at several layers in the protocol stack, including IP, transport, and application layers.
- Note that protocol translation can result in feature loss when there is no clear mapping between the features provided by translated protocols. For instance, translation of an IPv6 header into an IPv4 header will lead to the loss of the IPv6 flow label and its accompanying functionality.

Transitioning Options - Translation

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- Translation options...
  - Stateless Internet Protocol/Internet Control Messaging Protocol Translation (SIIT – RFC2765)
  - Bump in the Stack (BIS – RFC2767)
  - Bump in the API (BIA – RFC3338)
  - Network Address Translation–Protocol Translation (NAT-PT – RFC2766)
  - Transport Relay Translator (TRT - RFC3142)

Transitioning Options - Tunneling

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- Tunneling (or encapsulation): Tunneling is used to interconnect compatible networking nodes or domains across incompatible networks.
- It can be viewed technically as the transfer of a payload protocol data unit by an encapsulating carrier protocol.
- For IPv6 transition, the IPv6 protocol data unit is generally carried as the payload of an IPv4 packet.
- Encapsulation of the payload protocol data unit is performed at the tunnel entrance, and decapsulation is performed at the tunnel exit point.

Transitioning Options - Tunneling

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- Tunneling options...
  - Static Tunneling
  - Automatic Tunneling using IPv4 compatible addresses (RFC2893)
  - 6over4 Transition Mechanism (RFC2529)
  - 6to4 Transition Mechanism (RFC3056)
  - Intrasite Automatic Tunnel Addressing Protocol (ISATAP - RFC4214)
  - Teredo (RFC1631)

The Road Mapping Process

3. Inventory and Audit your current environment – hardware, software, processes and knowledge base to identify potential issues for the transitioning option(s) you have chosen.
   - ✓ Hardware – routers, switches, adapters, printers, sensors, probes...?
   - ✓ Ensure they have sufficient memory, correct firmware, what form their support takes – in hardware / software...?
   - ✓ Applications – especially support / provisioning?
   - ✓ Training and processes?

4. Build the business case

The Road Mapping Process

3. Build the business case
   - ✓ Understand the business drivers and the opportunities and risks that they create.
     - ✓ Look at the other players in your industry – what are they doing and why?
   - ✓ Remember its not a case of whether or not you need to do it, but when and how!
   - ✓ The most basic business case driver for IPv6 is address exhaustion – what is your drop dead date?
     - ✓ Note: It is unlikely that any NZ carrier will get further IPv4 allocations beyond mid 2010!

The Road Mapping Process

3. Build the business case
   - ✓ If you are an exporter, you should be planning to support IPv6 ASAP as there are an increasing number of IPv6 only customers in major markets such as China and India!
   - ✓ In summary – what do you need to do, when do you need to do it, how much will it cost and what are the benefits.

How can Gen-i help?

- Gen-i has a leading team of IPv6 experts and can provide a range of consultancy, planning, transitioning and deployment services to make your journey to IPv6 easy.
- Come and talk to us about your business drivers and how to apply this road mapping process.

In summary...

- IPv6 is the next generation plumbing for the global internet.
- It offers many benefits...
  - Better scalability
  - Better security
  - Better real-time application support (labelled flows)
  - Plug and Play automated configuration
  - Improved mobility support (LTE will be IPv6 only!)
  - An optimised Internet protocol that takes all the learning's from IPv4

...in summary

- Your business case will probably be a combination of factors relating to your specific business drivers – start thinking about that now!
- Talk to your Gen-i account manager about how we can help you evaluate your options for transitioning to IPv6.
- Do these things sooner rather than later, no body likes to be queuing for a ticket when the train is about to leave the station!

...thanks for your time!

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