Stoking the IPv6 debate

Australia lags behind in IPv6 adoption, but its prospects are gaining heat

By Tony Hill

DEBATE ABOUT a next generation Internet Protocol began early in the 1990s, even before the massive worldwide uptake of the Internet. Internet Protocol version 4 (IPv4) is the current protocol and Internet Protocol version 6 (IPv6) has been developed to succeed it. Over the last decade the value of IPv6 has been debated in the Internet community.

Since 2005 Australia has begun to discuss seriously the value of IPv6 and related transition issues. The discussion was prompted by the establishment of an IPv6 Special Interest Group within the Internet Society of Australia, that has taken on the activities of the IPv6 Forum in Australia.

The major elements of this national discussion are a new project focused on "IPv6 for e-business", and national discussion of IPv6 opportunities endorsed by the National ICT Industry Alliance. The discussion has come about particularly through a series of Australian IPv6 summits that were initiated in 2005. The next summit, to be held in December 2006, will focus on the business case, IPv6 transition planning and will allow further detailed planning and discussion of IPv6 benefits and transition issues.

ITOL IPv6 for e-Business

The ITOL IPv6 for e-Business project will enable Australian businesses to take advantage of opportunities based on IPv6, even in advance of the availability of extensive native IPv6 infrastructure. A consortium of organisations has joined forces to make sure that all Australian businesses are not disadvantaged in being able to take up the benefits of IPv6.

The project has been funded by the Australian Government through the Department of Communications, Information Technology and the Arts. The project sponsors are the Internet Society of Australia, .au Domain Administration, the Australian Electrical and Electronic Manufacturers Association, through the Australian Defence Information and Electronic System Association, and BuildersNet.

The IPv6 for e-Business project will seek to map the status of IPv6 in Australia. It has established a Web site — http://www.ipv6.org.au/ — to provide information on IPv6 for Australia, and will develop additional elements of essential infrastructure. It will provide business tools for the uptake of IPv6, including business case planning tools, transition checklists and a multifunction IPv6 connectivity terminator (tunnel broker), as well as undertaking awareness building activities. The project activities will focus on initial uptake sectors including defence industries and the building sector.

International developments

In 2005, ISOC-AU reported that there were significant international developments occurring in relation to IPv6 that Australia needed to position itself to consider. North Asian countries continue to press ahead with implementation plans for IPv6 over the next few years. The IPv6 Promotion Council of Japan says that "the e-Japan Priority Policy Program which was established in March 2001 … will realize an Internet environment

equipped with IPv6 by 2005 where everyone can receive, share and transmit diverse information securely, promptly and easily regardless of location."

In South Korea, the Ministry of Information and Communication's IT839 policy mandates adoption of IPv6 by 2010. In China, the research and education sector through CERNET are currently working to establish four native IPv6 networks, and IPv6 demonstration projects are being established for the 2008 Olympic Games.

In North America, the US Department of Defense has nominated that all its equipment should be IPv6 enabled by 2008. The US Office of Management and Budget has mandated that by June 30, 2008, the Internet backbone for every federal agency must be able to run Internet Protocol Version 6.

These international market developments are highly relevant to Australia's strategic positioning for take-up of IPv6 because they include Australia's major trading and strategic partners. In order to gain maximum value from its online relationships, Australia needs to be in a position to implement similar capabilities.

Australian IPv6 summits

The National ICT Industry Alliance considered the submission from the Internet Society of Australia early in 2005 and endorsed the concept of a national discussion on IPv6 and related opportunities. As a result, the first Australian IPv6 summit held in 2005 presented Australia with a snapshot of international market developments. In particular, it highlighted the market developments that were happening worldwide in relation to IPv6 standards.

Traditionally, standards have only been of significance when the market begins to respond and identify their importance. The summit speakers confirmed the assessment of the international developments compiled by ISOC-AU. They identified that by the end of 2010 there was a potential international shortfall of IPv4 addresses.

While Australia's Internet is comparatively well supplied with IPv4 addresses, growing international uptake of the IPv6 in the lead-up to 2010 would have implications for network planning in Australia.

A key statement by the Australian Department of Defence at the 2005 summit was that transition to IPv6 would be carried out by 2013.

Strengths of IPv6

As the next generation of Internet technology, IPv6 extends key principles established with the IPv4 Internet. These principles include the relatively simple and scalable nature of Internet technology, making it easy to implement. It is a means of communication able to piggyback on many physical layer connection technologies. Other essential principles of the Internet carried over into IPv6 include: the efficiency of packet networks, the importance of interoperability, and the value of giving customers (CPE) access to the transport protocol.

However, limitations have emerged in respect of the existing Internet, such as on the allocation of address space. At the APNIC 22 meeting, held in September 2006, there were suggestions that address allocations from IANA could run out by 2011.

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Even so, innovation and delivery of Internet services has continued with the advent of network address translation (NAT) devices, used to reduce the impact of limitations of IPv4 address space.

IPv6 will generate additional opportunities for innovation while extending the key principles established with the operation of the IPv4 Internet. The undisputed element of IPv6 is a massively increased address space from around 4 billion addresses for IPv4 to 3.4 times 10 to the 38 addresses for IPv6.

This increase in address space in itself is a substantial change because it will massively increase the potential scale of the network and the number of nodes that can be addressed, thus creating a further enhanced platform for innovation and interoperability.

In addition, increased address space will provide the opportunity to reassert an end-to-end network structure for the Internet, dispensing with the need for NAT and enhancing the potential for peer-to-peer architectures — every user and every device will be a generator of information.

Further potential advantages of IPv6 are possible, but continue to be debated in terms of implementation. Such potential advantages include network layer security with potential for header authentication and payload encryption at the packet layer, as well as auto-configuration to reduce the complexity of network administration. Expectations are strong that there will be capacity also for creation of mobile ad hoc networks. The IPv6 Forum has identified the core set of IPv6 standards as a solid foundation for implementation of IPv6.

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IPv6 Forum

The IPv6 Forum was created by the members of the Internet Engineering Task Force (IETF) IPv6 Working Group. The Forum is the only body which has an endorsement from the IAB (Internet Architecture Board), the IETF IPv6 WG, and the Internet Society (ISOC) to promote IPv6 worldwide.

The IPv6 Forum defines the IPv6 core specifications as generally consisting of:

- [RFC 1981] Path MTU Discovery
- [RFC 2460] IPv6 Protocol
- [RFC 2461] IPv6 Neighbor Discovery
- [RFC 2462] IPv6 Stateless Auto-Configuration
- [RFC 2463] Internet Control Message Protocol for IPv6 (ICMPv6)
- [RFC 4291] IPv6 Address Architecture
- [RFC 4301] Security Architecture for IP (IPsec)
- IPv6 over "XYZ" Link Layer (Ethernet, ATM, PPP, etc)

Readiness for change

Australia's readiness to take up the opportunities of IPv6 remains at a low level. The mapping exercise conducted as part of the IPv6 for e-Business project shows that lack of local IPv6 connectivity is the key barrier to take-up for small and medium businesses (SMEs) and small office home office (SOHO) businesses.

The mapping project has made assessments of three levels of IPv6 readiness: core, nets and user levels.

For all sizes of businesses, the mapping exercise demonstrates that the standards, the DNS and root servers are capable of supporting IPv6 implementation now; however, address allocation may be a problem for smaller businesses. At the user level computers, applications and devices are available for implementation of IPv6. However, network connectivity remains a challenge in terms of hardware and service providers for all but larger businesses.

Debate about the "killer app" for IPv6 continues. Nevertheless, there are emerging potential areas of applicability for IPv6 that include:

Potential e-business advantages — with security and easier administration

Likely importance of communications with many devices, beyond desktop internet — beginning with 3G mobile phones and PDAs — potential to address many appliances and components

Links to other types of technologies — eg RFID, sensor nets

Platform for widely applicable peer-to-peer applications eg VoIP

Opportunities for secure mobile ad hoc networks

Australian leaders in IPv6

The leading adoption sectors in Australia are the research and education sector and defence industries. Many of the campuses of Australian universities have substantial implementations of IPv6 supported by AARNet and established through its participation in the Grangenet consortium up to this year. AARNet currently provides an Australian IPv6 broking service. The Australian Department of Defence is committed to implementation of IPv6 by 2013. Defence has developed a strong understanding of user needs for interoperability and is continuing its discussions with industry and planning its IPv6 transition.

Australian IPv6 Summit 2006

The Australian IPv6 Summit 2006 will explore in more detail many aspects of the business case for IPv6 and transition issues. The Summit will be held in Canberra from December 4 to 6, 2006 and the program will include leading international and Australian speakers.

It will provide the opportunity for deeper consideration of issues related to the implementation of IPv6. The program will include a launch of more detailed results from the ITOL IPv6 for e-Business project, as well as demonstrations of IPv6 capabilities.

Links

Internet Society of Australia — http://www.isoc-au.org.au/
IPv6 Forum — http://www.ipv6forum.org/
IPv6 Forum Downunder — http://www.ipv6forum.org.au/
ITOL IPv6 for e-Business — http://www.ipv6.org.au/
National ICT Industry Alliance — http://www.nictia.org.au/
Australian IPv6 Summit 2006 — http://www.isoc-au.org.au/ipv6summit/
First Australian IPv6 Summit 2005 — http://www.isoc-au.org.au/ipv6summit05/
.au Domain Administration — http://www.auda.org.au/
Australian Electrical and Electronic Manufacturers Association — http://www.aeema.asn.au/
Australian Defence Information and Electronic Systems Association — http://www.adiesa.aeema.asn.au/
Asia Pacific Network Information Center — http://www.apnic.org/
Internet Engineering Task Force — http://www.ietf.org/
AARNet — http://www.aarnet.edu.au/
Grangenet — http://www.grangenet.net/

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