IPv6 Management Briefing Document

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About this paper

This document is aimed at senior managers who are involved in planning institutional IT strategies, and who want to gain some understanding behind the rationale of implementing IPv6 services alongside their IPv4 infrastructure.

A corresponding JANET IPv6 Technical Guide providing a more detailed account is available at:
http://www.ja.net/documents/publications/technical-guides/ipv6-tech-guide-for-web.pdf
This includes technical information aimed at those responsible for implementation and practice.

What is IPv6?

IPv6 is the new version of the Internet Protocol (IP), the common protocol underpinning all Internet communications. It was developed by the IETF during the 1990s to offer 3.4×10^{38} globally unique IP addresses, in contrast to the four billion offered by IPv4.

As such, IPv6 will ultimately supersede the current version, IPv4, in order to accommodate the continued growth of the Internet.
The transition from IPv4 to IPv6 will take some years, but in the meantime the two protocols will need to co-exist.

IPv4 Address Space Depletion

In 2007 the size of the unassigned IPv4 address space pool fell to such a level as to trigger warnings of IPv4 address space exhaustion from the IP address registry community. By 2010, only 5% of the unused IPv4 pool remained with address space being depleted during 2011.   This does not mean that no more IPv4 address space will be available, but ISPs seeking to obtain additional IPv4 address space for their customers will possibly need to engage in some form of trading activity to obtain it.

As no new IPv4 address space is currently available, many universities and some FE sites already have sufficient IPv4 address space assigned to them for the foreseeable future. JANET(UK) also holds a small 'buffer' of address space allocated to it by RIPE-NCC from which some further allocations can be made, but that supply will also become exhausted, probably at some point in 2011.

Why IPv6?

Before the early 1990s the Internet was almost entirely the preserve of government funded bodies, such as education, R&D and defence. Once the market for Internet connectivity extended into the commercial sector it fast became clear that IPv4's addressing limitations would ultimately prove inadequate. New networks (in emerging Internet countries such as China), devices (e.g. iPhones and Android handhelds) and application areas (such as logistics and utility/sensor networks) are continuously driving the demand for more IP addresses

IPv4's lifetime has been extended by more efficient use of the existing IPv4 space (through policy controls and classless prefix allocations) and most notably Network Address Translation (NAT). While NAT is simple to deploy, it causes a number of architectural problems, particularly in adding complexity to end-to-end applications (especially where both ends

reside behind a NAT) and real-time media services, such as VoIP (voice over IP).

The lack of new IPv4 address space for network growth will cause additional complexity in network operations where more use is then made of Network Address Translation (NAT) - and possibly multiple layers of NAT - in UK HE/FE sites. With growing deployment of IPv6 elsewhere, a point in time will come about where using IPv6 greatly simplifies network design and operation, rather than trying to sustain and manage a more complex architecture around a limited number of IPv4 addresses.

Strategies for IPv6 Deployment

The most common approach for IPv6 deployment is 'dual-stack' whereby networks, hosts and applications support both IPv4 and IPv6 protocols and can use either when appropriate. It should be noted that deploying IPv6 need not mean sacrificing existing IPv4 functionality – IPv4 communications can continue to be used, but you can also use IPv6 when required, for example to communicate with emerging new IPv6-only networks or services most efficiently.

At the very least, organisations should be procuring IPv6-capable equipment and software, to be ready to enable IPv6 when required. To be best informed for this process, organisations should seek appropriate training for both management and technical staff, and begin formulating appropriate policies for IPv6 operations. Starting the process now positions an organisation for a smooth transition to IPv6. The JANET Service Desk has already made over 100 allocations to sites that are at some stage in their deployment planning.

Since all common host and router platforms now ship with IPv6 support, and OSes such as Windows 7, Linux and MacOSX enable IPv6 by default, you should at the very least have a strategy to manage that capability within your organisation for security purposes.

The JANET backbone and many of the Regional networks are capable of transporting both IPv4 and IPv6 network traffic natively. Other Regional networks are obliged by their SLAs to enable IPv6 on demand for their customer sites. Many JANET network services are already available via IPv6 and a programme of work is underway to enable IPv6 access to all remaining services as soon as is practical, e.g. at the time re-procurement of a service or equipment happens, such procurements should mandate IPv6 support.

The IPv6 World Today

UK Government – Current Position

The UK government has defined an e-GIF (e- Government Interoperability Framework) policy outlining the gradual migration to IPv6, while maintaining its co-existence with IPv4. Their advice for new IT infrastructure procurements is to support the co-existence of IPv4 and IPv6 networks and to procure dual IPv4 and IPv6-enabled products when it is cost effective to do so. Further details can be found at:
http://www.govtalk.gov.uk/schemasstandards/egif_document.asp?docnum=949

European Commission (EC) – Current Position

The EC has funded a number of IPv6 related activities over the past few years. To raise awareness the EC has provided significant funding to initiatives such as the IPv6 Task Force and technical validation projects such as 6NET. Further details about the EC's action plan on IPv6 are available through the JANET website:
http://www.ja.net/ipv6

Commercial Sector

It is acknowledged that within the commercial sector most vendors are now building IPv6 support as standard within new

equipment. Google and Facebook both have pilot IPv6 versions of their content currently available.   Some smaller UK ISPs are now offering IPv6 services to ADSL subscribers.

Around The World

Asia is perhaps the most advanced area in the large scale deployment of IPv6, with both academic and commercial networks now IPv6 capable. IPv6 deployment within the academic sector worldwide has been underway over the past few years, and deployments in commercial Internet Service Provider networks are now becoming more common.

JANET Connected Organisations – Example Plan of Action

IPv6 unicast was introduced into the JANET Service Level Agreement (SLA) 07/08 and entered the contracts that JANET(UK) has with its Regional Network Operators in 08/09. With IPv6 now available natively to JANET connected organisations, or available on request to Regional Networks yet to deploy it, it is timely for such organisations to begin IPv6 deployment planning (if not already in progress!).

A possible outline plan might be:
- Apply via the JANET Service Desk for an IPv6 address assignment.
    - º IPv6 addresses are assigned in large chunks. For the first /32 size assignment, no detailed justification is required.
- Undertake appropriate training for management and technical staff
    - º JANET Training is now offering courses on IPv6.
- Conduct an evaluation of your existing infrastructure and identify the equipment/software that does not support IPv6.
    - º Ensure that IPv6 support is included as a mandatory requirement in future procurements
    - º Assess requirements for porting existing software/tools to support IPv6
- Gain early experience by enabling IPv6 within a development environment.
    - º Run pilot IPv6 services, e.g. in an isolated dual-stack DMZ network.
- Form a deployment plan, which may include factors such as:
    - º Identify funding to upgrade, port or replace equipment and software that does not support IPv6.
    - º Plan when to enable IPv6 on the connection to JANET/Regional Network.
    - º Incorporate IPv6 into the organisational management, monitoring and security architecture.
    - º Rollout IPv4 and IPv6 dual-stack operation 'on the wire' across the network.
    - º Enable IPv6 on key network services (e.g. DNS) and selected server networks and (public-facing) services
    - º Enable IPv6 on user networks

To understand the steps required to deploy IPv6, we would advise you to refer to the JANET IPv6 Technical Guide and attend other JANET IPv6 events, such as workshops or training courses. Further details can be found on the JANET website at: http://www.ja.net JANET Training has information on the IPv6 course at http://www.ja.net/training

Sources of Information

- JANET IPv6 website
  http://www.ja.net/ipv6
- The JANET IPv6 Technical Guide
  http://www.ja.net/documents/publications/technical-guides/ipv6-tech-guide-for-web.pdf
- Applying for a JANET IPv6 address range (towards the end of):
  http://www.ja.net/services/connections/ip-address-application.html
- IPv6 summary for Technical Managers
  http://www.ja.net/documents/development/network-engineering/ipv6-technical-summary-web.pdf