DNS and IPv6

While IPv6 provides many improvements in network management, one of the major driving forces behind its design was to greatly increase address space. An IPv4 address uses 32 bits whereas an IPv6 address uses 128 bits. Thus, IPv6 is theoretically capable of providing many millions of IP addresses for every human on the planet!

The original IETF specifications for IPv6 date from 1995 but the Classless Inter-Domain Routing and Network Address Translation (see the “IPv4 Addresses and CIDR” sidebar in Chapter 3) initiatives of the mid-90s effectively postponed the urgent need for additional address space. IPv6 usage until 2006 was largely confined to experimental networks such as the IETF’s 6bone (www.6bone.net) and large-scale deployment was limited to academic institutions.

There are a number of significant developments that have given urgent impetus to IPv6 and have significantly increased its deployment:

- **Mobile communications:** The emerging 4G standards (primarily LTE and WiMax) will use packet switching (IP) technologies for all communications (voice and data), thus requiring every mobile device to have an IP address at all times. The 3rd Generation Partnership Project (www.3gpp.org), consisting of mobile wireless equipment suppliers and operators, has proposed standards that allow for both IPv4 and IPv6 but Release 8 (March 2009) defined a new, more efficient, dual-stack mechanism (IPv4v6). Since 4G networks will likely be deployed at a time when IPv4 address depletion (see below) will be reaching critical levels, it’s reasonable to assume that IPv6 will be the preferred, if not the only viable, IP address technology for 4G networks. The first IPv6 mobile usage was publicly demonstrated in late 2004.

- **DNS support:** IPv6 addresses are already published by 8 of the 13 root-servers.

- **Address allocation:** IPv6 address block assignments may be obtained from all the regional Internet registries (RIRs), which comprise ARIN (www.arin.net covering North America and Southern Africa), RIPE (www.ripe.net covering Europe, North Africa, and the Middle East), APNIC (www.apnic.net covering Asia Pacific), LACNIC (www.lacnic.net covering South America), and AFRINIC (www.afrinic.net covering Africa).

- **Software availability:** IPv6 stacks and dual (IPv6/IPv4) stacks are provided with Windows (from Server 2003 and XP), Linux, UNIX, and the BSDs (FreeBSD, NetBSD, and OpenBSD).

- **Mainstream technology:** The IETF wrapped up its 6bone experimental and testbed network and transferred its special IPv6 addresses range to IANA in June 2006. In essence, this endorsed the production-ready status of IPv6.
- **IPv4 address depletion:** Increasingly dire warnings are being heard from all the RIRs that the remaining IPv4 address stock will, for all practical purposes, be exhausted shortly—perhaps even as soon as the end of 2011.

Probably the most significant push for IPv6, however, is coming from the changing nature of Internet-based applications. Classic Internet applications such as those providing web access, e-mail, and FTP use a traditional client-server model and can handle mapping private addresses to a limited range of IPv4 public IP addresses using network address translation (NAT) strategies with some help from application-level gateways (ALGs). However, the new generation of Internet applications—such as Instant Messaging (IM) and Voice over IP (VoIP) among others—use a peer-to-peer model and increasingly require *always-on* capabilities (permanent connection to the Internet) and need end-user address transparency (any given user’s equipment IP address must be publicly visible and fixed (*static*) over a reasonable period of time). The current IPv4 address scheme is incapable of providing all peer-to-peer users with end-user address transparency; there simply are not enough addresses. Figure 5–1 illustrates the difference between the client-server model with NAT and peer-to-peer applications.

**Figure 5–1. IP Address Transparency**

The huge investment in IPv4 together with the size of the current installed base means IPv4 will not disappear overnight. IPv6 and IPv4 will have to coexist for some considerable period of time, and serious attention has been paid to IPv4 transition and interworking schemes in the various IPv6 RFCs. There are significant implications for DNS in both IPv6 and mixed IPv6/IPv4 environments.

Now that you have a better general understanding for why IPv6 will soon become a particularly important part of the network environment, let’s take a moment to introduce IPv6 before delving into the implications it will have on DNS implementations.