6sense Generating New Possibilities in the New Internet. Produced by: IPv6 SUMMIT INC.

Reading The IPv6 Thermometer

By Arvind Krishnamoorthy, Ph.D.
Architect/Consulting Engineer
Enterasys Networks

enterasys Networks that Know

This article presents a personal perspective on where IPv6 seems to be headed, and is based on impressions gathered at the recent IPv6 Coalition Summit held at Reston,VA.

HIGH LEVELS OF INTEREST AMONG STAKEHOLDERS

The Summit attracted some of the most important movers and shakers capable of influencing the prospects for this technology, including a Congressman, several high ranking generals and key IT decision makers in the US Government and Armed Forces, senior officials from foreign countries with active IPv6 initiatives, and senior representatives from the Networking industry and Internet-related bodies. If the rank and range of the participants could be used as a rough gauge of interest and commitment, then there seems to be a high level of interest in and commitment to IPv6, among the various stakeholders in the technology.

IPv6 CAN'T BE IGNORED

IPv6 is a key, emerging technology that no serious player in the network business can really afford to ignore. There are doubters and nay-sayers whose predictions seem to be based on short-term and local perspectives, and on "big bang"-like arrival expectations that are inappropriate for a technology that has the wide deployment scope of IPv6. However, there are powerful stakeholder communities with deep pockets who see a strong need for IPv6, who are committed to it, and who are proceeding at a steady pace that is appropriate for them. While the pace at which they deploy IPv6 may be driven by budgetary, tactical, and practical considerations, their procurement mandates are real and immediate.

There are very real market drivers for IPv6, and IPv6 is beginning to be deployed in many important markets all over the world. There are industry behemoths, including Microsoft and Panasonic who seem to see strong value in IPv6, and appear to be actively working with the technology. Every major equipment manufacturer seems to have IPv6 offerings (even though many of them apparently support only a subset of the full IPv6 feature set today), and IPv6 is becoming an important differentiator and is a mandatory check-off item in many RFPs.

THE CHICKEN MAY ARRIVE WITHOUT AN EGG

Many of us who have encountered buzz about IPv6 technology, and who don't see much immediate evidence of its deployment, would readily agree with the flippant quote that "IPv6 has a great future – it'll probably have a great future for a long time." However, lack of speed does not imply lack of momentum – one has to consider the magnitude of the mass (inertia) involved also. IPv6 is not a small, nimble technology that is carving out a new niche for itself. It is a technology that is meant to displace IPv4, a powerful and entrenched incumbent whose tentacles reach out into every nook and corner of the world economy today. Brian Haberman, Co-Chair of the IETF IPv6 working group, noted in his talk that when the ARPANET transitioned from NCP to IPv4 a couple of years after the publication of RFC 791, it was possible to declare a flag day (1/1/1983) and be done with the transition. However, there were only a few hundred nodes then, and a centralized group was responsible for the transition.

About a quarter of a century later, today's IPv4 Internet is vastly different not only in the number of nodes (by six orders of magnitude), but also in how tightly it is intertwined with the world economy, and in its borderless and ownerless nature. It is absurd and unrealistic to expect IPv6 to take over the world tomorrow or the day after – the doubters just have to recalibrate their expectations to be more realistic. However, IPv6 meets real needs of important entities, and has committed and powerful early adopters and champions who are beginning to prime the pump. Procurement requirements that mandate IPv6 capability, coupled with natural technology refresh cycles, will automatically ensure that IPv6 is integrated into the network infrastructure landscape in the near term. The chicken may arrive even without an egg and start laying its own eggs.

DEATH, TAXES, and IPv6

Lt. Gen Tom Hobbins, (acting) CIO of the US Air Force, in one of his slides, included IPv6 among the three things

that are certain in life, “Death, Taxes, and IPv6.” This seems to illustrate the US Department of Defense’s continued deep interest in and commitment to IPv6. The DoD’s interest in this technology is driven by the inability of IPv4 to support the required future capabilities of ubiquity, mobility, and operability (security, QoS, policies, etc.), which are considered essential for fully realizing its vision of network-centric warfare. The DoD views IPv6 as the vehicle to realize this vision, in which every soldier, weapon, sensor, and pair of socks ? will be IP addressable. IPv6 is also expected to enable a number of new applications in the areas of geospatial addressing (“area codes” that span regions from interplanetary nets to subsurface nets), homeland security, logistics (e.g., inventory tracking), and biometric monitoring.

Dr. Linton Wells, the DoD’s CIO, announced that the DoD is working toward establishing IPv6 implementation strategies and schedules by September 2005, while acknowledging the challenges relating to IPv6 transition, and cautioning that completing the transition will be event-driven (e.g., satisfaction of operational criteria, deployment of sufficient IPv6-capable infrastructure and applications). Various roadmaps presented at the conference seemed to point to a 2015 timeframe for 100% completion of the IPv6 transition, at which point IPv4 would have been relegated to legacy status. All of this seems to point to a clear interest in adopting IPv6, and strong commitment toward transitioning to IPv6, while acknowledging the reality that a transition of this magnitude comes with its own challenges. The overall strategy appears to be to make all systems IPv6-capable via the normal technology refresh cycle, start activating IPv6 capabilities gradually, and eventually retire IPv4.

MICROSOFT ADOPTS IPv6

Microsoft rules the enterprise desktops of the world. When Microsoft sees potential in a technology, it would make sense for others to take serious notice. Microsoft seems to be strongly interested in IPv6, because its vast address space enables a new class of peer-to-peer applications that can run without the problems created by NAT and private address spaces. Microsoft announced that IPv6 will be a key technology in the upcoming Windows Longhorn operating system. Jawad Khaki, the Corporate Vice President of Microsoft responsible for Windows Networking and Device Technologies, announced that the Longhorn operating system is fully IPv6 capable -- in fact, IPv6 is on by default, and is the preferred transport. An “IPv6-only” mode is also supported. Mr. Khaki asserted that IPv6 is real and not a fantasy. He also noted that Microsoft’s internal network is the world’s largest IPv6 enterprise network, with 40K+ potential users and 150K+ potential nodes.

Microsoft’s seemingly strong endorsement of IPv6 and high-profile integration of IPv6 in Longhorn could spur the development of new peer-to-peer applications, and the adoption of IPv6 by enterprises. Could Windows Longhorn do to IPv6 what Windows 95 did to IPv4 in 1995, in terms of widespread adoption?

UNCLE SAM IS WAKING UP

President Bush’s 2003 National Strategy to Secure Cyberspace stated that, “The United States must understand the merits of, and the obstacles to, moving to IPv6, and based on that understanding, identify a process for moving to an IPv6-based infrastructure.” However, civilian agencies in the US Government have not made anywhere near the extent of progress in IPv6 transition efforts that the Department of Defense has made, as a GAO report released by Congressman Tom Davis, Chairman of the Government Reforms Committee, indicates. A study by Juniper Networks released at the conference confirms this also.

Rep. Davis in his keynote address called for a Federal transition to IPv6, and announced an initiative to push civilian agencies to adopt IPv6 by 2008, in parallel with the DoD. Rep. Davis plans to hold hearings on how to push the Federal Government toward the new protocol (a full committee hearing on the Internet and IPv6 scheduled for June 29, 2005, will already have taken place by the time you read this). He emphasized that, “It is vital that the US maintains strong leadership in the Internet and all of the enterprises touched by information technology. China is outspending the US 10 to 1 on the new technology.”

This clearly seems to indicate that the civilian side of the Government is beginning to get its act together on IPv6, while frankly acknowledging the current status. Clearly there is very strong interest at the highest levels of the administration in getting the IPv6 ball rolling inside the Government enterprise immediately.

MOMENTUM BUILDING UP GLOBALLY

Interest in IPv6 is gathering momentum in the rest of the world, both in the civilian sector as well as in the Armed Forces. The Armed Forces of many of the coalition partners of the US seem to be following the lead of the US in adopting IPv6. NATO is developing an IPv6 transition plan, the German Armed Forces has made the decision to go for IPv6 and initiated the migration process, and the Australian Department of Defense apparently signed off an IPv6

initiative two months ago with a transition deadline of 2012-2013.

IPv4 address space depletion is so distant a problem in the US that the biggest selling point touted for IPv6, viz., its virtually unlimited address space, has hardly any takers here. However, the scenario is quite different in other parts of the world. As one speaker calculated, China has an average of 0.06 IPv4 addresses per person, India 0.006, Europe one address per person, and the rest of the world 0.2 addresses per person, compared to nine addresses per person that the US has. IPv6 is seen as important in these regions of the world, since it is capable of addressing a problem that is looming in the visible horizon. In addition to the routine Internet needs of today, many countries of the world are concerned about the need for expanded address space as mobile networks start proliferating.

As a speaker from Cisco pointed out, even if only 30% of 3G nodes are IP-enabled, about 500 million addresses would be required. If 15% of the one billion cars that are expected to be on the road world-wide in 2009 are IP-enabled, we are talking about 15 million subnets. The need for and level of interest in IPv6 in many of these countries is so high that working groups involved with IPv6 transition are often associated with the highest levels of Government. There are national initiatives in many countries, especially in the Asia-Pacific region, to adopt IPv6.

Congressman Davis pointed out that China outspends the US 10 to 1 on the new technology. The Chinese Government has established a group led by eight ministers, which funds 50% of the cost to transition from IPv4 to IPv6. China has various IPv6 network projects in progress. The China Next Generation Internet (CNGI) is an initiative with a $169M budget to develop an IPv6-capable infrastructure in China. The China Education and Research Network is an IPv6-only network linking 25 Universities in 20 cities across China. There also seems to be a move to power the 2008 Olympics in Beijing with IPv6.

Japan considers IPv6 to be a key technology for the ubiquitous computing initiative called “u-Japan,” which is targeted for realization over the next five years. The Japanese Government has a funded initiative to promote the migration to the IPv6 Internet, and has ministerial level meetings with Korea and China on IPv6.

An effort by the Korean Government to promote IPv6 deployment has apparently been a huge success, with aggressive participation from vendors and ISPs, and the creation of a road map for nation-wide IPv6 adoption. Korea currently has various IPv6 networks, ranging from research and experimental through commercial (KOREAv6). Korea’s roadmap for IPv6 adoption calls for expanding IPv6 pilot networks and commercial services continuously toward the realization of all-IPv6 based services by 2010. Korea also has an IPv6 cooperation agreement with the European Union.

ISPs: GETTING READY AND WAITING

A number of ISPs offer IPv6 service. For example, NTT/Verio has been offering commercial grade services since 2001 in Japan, from 2003 in the US, and since 2005 globally. Global Crossing has announced general availability of IPv6 service from the third quarter of this year. SprintLink also offers IPv6 service. However, there were murmurs at the conference that the level of usage of IPv6 services is low. This is hardly surprising, as enterprise usage of IPv6 is insignificant today, except probably in Japan. However, the very fact that several ISPs have chosen to offer IPv6 service is encouraging and is a sign that they are starting to prepare for IPv6. The arrival of Longhorn next year would cause a significant automatic deployment in enterprises of readily-usable IPv6 capability, perhaps triggering more demand from ISPs for IPv6 services.

CONCLUSION: MOMENTUM IS MORE THAN JUST SPEED

Two of the O’Reilly books on IPv6 have a snail and a turtle on their respective covers. The logo associated with the IPv6 KAME project in Japan is a turtle. These are apt choices, since they seem to reflect well the current speed at which IPv6 is being deployed. However, speed does not equate to momentum. IPv6 is a key technology of the future that satisfies real needs of important market segments, and that has committed stakeholders with deep pockets all over the world, who have already started executing roadmaps for its deployment. The IPv6 countdown is definitely in progress.

AUTHOR: Dr. K. Arvind received his Ph.D. and Master’s in Computer Science from the University of Massachusetts at Amherst, and his B.Tech. in Electronics Engineering from the Indian Institute of Technology, Madras. In addition to active involvement in software R&D, he has published technical papers, participated in standards efforts, and spoken at a number of conferences. He has served in various companies in the Networking industry including Digital Equipment Corporation, 3Com, and Tenor Networks. He currently serves as an Architect/Consulting Engineer at Enterasys Networks, Andover, MA, and can be reached at karvind@enterasys.com.