

WHITE PAPER

In Anticipation of IPv6: Prepare, Don't Panic

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Executive Summary

The transition from IPv4 to IPv6 is on the horizon. There is no immediate crisis, but the fact is that IPv4 address blocks are no longer available through the Internet Assigned Numbers Authority (IANA) and in the next few years IPv4 and IPv6 addressing will exist in parallel. How much time this will take cannot be accurately projected. Federal agencies are under mandate to support IPv6 during 2012, but organizations that rely on the Internet to do business will embrace IPv6 based on what their customers demand. According to Frost & Sullivan, "Consumers don't understand the distinction between IPv4 and IPv6, but they do understand being able to surf the web at will. If IPv4 begins to limit that, then they will want whatever upgrades are necessary to ensure that happens."¹

The upside of the situation is that IPv6 could help set a foundation for a more powerful Internet, one that elevates business efficiencies and network performance. In addition, expanding machine-to-machine communication could transform energy use, make roadways safer, push audio and video communication to new levels and advance healthcare. These benefits underpin a strong argument for accelerating IPv6 implementation.

In this white paper, Level 3 will discuss the challenges and benefits that IPv6 should present to private citizens, small business, enterprises, federal agencies and ISPs. We also suggest how enterprises in particular can approach this technology transition and describe what Level 3 Communications has been doing to prepare for the change.

Introduction

On February 11, 2011 the Numbering Resource Organization (NRO) announced an important IPv4/IPv6 milestone: The last public block of IPv4 addresses was assigned and marked the depletion of the IPv4 address pool.² Since then, awareness has grown gradually in the enterprise and private sectors around the fact that the Internet and all the devices linked to it will by necessity transition to this new, essentially unlimited address scheme.

A government mandate specifying that all public-facing federal agency websites support IPv6 by September 2012 has also fostered a sense of urgency.³ Although the transition has not been readily embraced by all agencies, the Department of Defense has recognized the tactical advantages of fully networked Warfighters; sensors, drones, rockets and other weapons, and military mobile communications devices are either ready for, or already employing, IPv6.

¹Frost & Sullivan, *Stratecast Consumer Communication Services, IPv6 and the Consumer: Does it Matter?* CCS 4-15 – Jun. 3, 2010

²Frost & Sullivan, *Stratecast Perspectives & Insight for Executives SPIE 2011 #16 – April 22, 2011*

³Network World, *White House issues IPv6 directive*, September 28, 2010,

<http://www.networkworld.com/news/2010/092810-white-house-ipv6-directive.html>

The key question for enterprises is: are my customers ready for the switch?

Creation of a protocol that will accommodate the proliferation of networked devices into the foreseeable future — which promises to include smart appliances, smarter vehicles, and continued explosion in the number of smart phones and other IP-connected devices — is clearly the greatest advantage IPv6 offers. Conversely, capital investment to identify and upgrade legacy hardware and software, and the cost of training staff, will put pressure on medium-to-large enterprises. IPv6 adoption is also a double-edged sword for the general public. On the one hand, IPv6 better supports gamers, those interested in virtual worlds, and appliances communicating through the smart grid by leveraging the complete peer-to-peer model of TCP/IP; on the other hand, eventually every modem and in-house router may need to be replaced, which could be a fairly costly undertaking for an extensively connected home.

ISPs including Level 3 have been anticipating the shift to IPv6 by implementing dual-stack IPv4/IPv6 network architecture as well as participating in standards committees to help shape the global transition.

How much time will the transition take? While Level 3 and other organizations recommend that large enterprises in particular take steps to replace or reconfigure equipment sooner rather than later, the sky is not falling. The consensus among most providers is that it probably will be a five-year or longer transition. Nonetheless, a prudent approach to this inevitable shift in addressing should begin now.

Private Citizen & Small Business Challenges

Just as the Internet is virtually ubiquitous, so will be the impact of IPv6. As mentioned above, the average home Internet user will need IPv6 compatibility in their DSL modem, cable modem or private home router. That could entail software or firmware upgrades (at the expense of their provider, given that most equipment is leased), or hardware replacement. Coffee shops, restaurants, libraries, college campuses — everywhere Wi-Fi is offered — will also need to update their equipment. In both scenarios, there's high probability that ISPs will need to deploy technicians to get the upgrade accomplished. Who pays for that? Smart money is on the end user, not consumer broadband providers. Small businesses will also bear the burden of equipment replacement cost and deciding if they need provider resources to make the upgrade or if they can handle it on their own.

Federal Agency Challenges

Federal agencies are under mandate to ensure that public-facing websites are accessible through IPv6, but with ever-increasing pressure to trim operational expenses, they face the conundrum of getting the task accomplished while already being stretched for resources and funding. This segment, just like enterprises, also must be sensitive to how they connect with constituents (their customers) and so will run a dual-stack environment to enable both IPv4- and IPv6-based communication for several years. That implies the need to manage two networks, or at least two versions of a network. This requires that network engineers need to be trained for IPv6; and more resources to manage the networks will be needed.

Large Enterprise Challenges

Process change is a fact of business life for enterprises. The move to IPv6 is another such change. IPv6 promises improvements to business processes that should justify the time and expense associated with enterprise-wide deployment. For example, end-to-end connectivity and native support for mobility should improve communication and application performance inside and outside of the office. IPv6 can help accelerate adoption of cloud computing processes, thereby reducing capital expenditure for customer premise equipment (CPE). Auto-configuration could reduce costs by decreasing network management and administration demands. Of course, the level of tangible return on investment is yet to be discerned. However, other technology transitions, for example Y2K, forced enterprises to assess their business processes and in many cases find rewards.

The key question for enterprises is: are my customers ready for the switch? Companies with e-commerce based business models need to be sure that their customers can make transactions, regardless of whether customers are IPv4- or IPv6-enabled. Beyond the question of site access, website speed affects the online experience and influences brand perception, loyalty and competitive position. Regardless of their revenue model, companies must ensure that potential and existing customers using IPv4 have a positive experience when on their site.

Large enterprises with assets distributed not only throughout their headquarters but also in multiple remote offices will face a challenge locating and determining which of those assets should be involved in the transition.

It's important to keep in mind that although new IPv4 address blocks are no longer available for issue through IANA, addressing remains available through an ISP and enterprises are well supplied with private addresses. Nonetheless, the time to begin planning is now. Any further investment into equipment that only supports IPv4 eventually will increase capital expenditures when it requires replacement with IPv6-compatible gear.

ISPs & Cable Operator Challenges

ISPs have been anticipating the transition for a few years, and many (such as Level 3) have been participating in consortiums formed to set standards and formulate best practices. Level 3 and other ISPs also have been using a dual-stack IPv4/IPv6 architecture that accommodates voice, data and video over both IPv4 and IPv6 on the same network.

Replacing cable modem termination systems will create the most expense for cable operators. This capital expense is a necessary one for these organizations, whose business model has evolved to include services bundling video with VoIP and other Internet-dependent communication. The good news for cable operators is that IPv6 will help grow Internet broadcast of television shows and movies. Like ISPs, cable operators have been preparing their content delivery equipment for some time.

Checklist for Implementation

Practical transition to IPv6 in enterprises will best occur through a well-planned, staged initiative that allows the company to spread expenses over time. Level 3 recommends that enterprises look both internally and externally in their planning. Internally, we (and the organization IPv6actnow.org, the original source of the following list) recommend that following this simple checklist will help to get you started:

- Appoint a project manager
- Consult with your Internet Service Provider
- Identify the network components that will need to be changed or upgraded and prioritize the order of those changes
- Identify the training needs for team and project manager
- Determine costs of new hardware and software
- Select suppliers (possibly the same as you have today) and consultants
- Develop a project plan
- Present costs to the decision maker in the organization

The order in which you transform your business should be part of the implementation strategy. We suggest that you make your Internet-facing content first priority, which includes your website as well as customer service applications.

Following that, it will probably be best to focus on applications that your business operations rely on, including those hosted on your Intranet and in "the cloud." This will be especially important for organizations with a significant volume of resources that are mobile. Next, less business-critical legacy applications, such as email, can be converted.

Level 3's Efforts

Level 3 Communications welcomes the opportunity to advise or assist other businesses and organizations as they plan and execute migration to IPv6. The company has been intimately involved in developing the standards, procedures and specifications on which the Internet Protocol is built and we have been successfully transporting IPv6 since 2005.

Our early work and authorship in Layer 2 emulation over MPLS has led to a number of Internet Engineering Task Force (IETF) Request For Comment (RFC) documents related to MPLS pseudowire innovation. As a member of the North American IPv6 Task Force, Level 3 works to contribute to the advancement and propagation of the IP protocol. By working with organizations such as the IETF, the Alliance for Telecommunications, Industry Solutions (ATIS) and the TOPS Council's IPv6 Readiness Plan Study Group, Level 3 is taking a leadership role as IPv6 technology deployment is accelerated.

Conclusion

The IPv6 addressing protocol solves the problem of IP address exhaustion, but because IPv4 and IPv6 are incompatible, the general public, businesses of all size and federal agencies will eventually need to replace or upgrade every element in their communications scheme. The adoption of IPv6 will occur over several years; precisely how long remains unpredictable.

Making the transition will naturally incur some capital expenses. Personnel will need to be trained in IPv6 and dedicated to administering networks running each protocol simultaneously as the gradual transition is made. The investment should result in many benefits, however, such as enhanced business processes and greater machine-to-machine communications.

While there is no immediate crisis, Level 3 and others suggest that planning should begin now, especially for large enterprises. ISPs have been anticipating the shift by implementing dual-stack network architectures and helping shape standards and policies around IPv6 implementation worldwide. Level 3 is ready to support IPv6 and in fact has been capable of doing so for over five years.

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