IP Version 6 (IPv6)

INDUSTRY WHITE PAPER

The Impact & Adoption of the Latest Internet Protocol

Overview

On the Internet everyone wants to communicate. That globally common communication language is IP (Internet Protocol). Every Internet server must have an IP address in order to be accessed via the Internet. Every computer running a web browser must have or be translated to an IP address to access the Internet. The commonly used version of IP addresses is called IP Version 4 (IPv4). It was originally designed in 1980 as a means to interconnect mainframe computers. Of course this was well before the invention of personal computers and three decades before the privatization and commercialization of the Internet.

Each IP address is defined by 32 bits. This means there is a theoretical maximum of over four billion IPv4 addresses, which was more than adequate in 1980. IPv4 addresses are typically written as four groups of decimal numbers between 0 and 255 separated by a "dot" (Example: 192.168.0.1). Originally the Internet was accessible only by a select number of government organizations and Universities. Over time Internet routable (transmittable) IPv4 addresses were assigned to five continental registry organizations. They in turn assigned IPv4 numbers to service providers, companies, organizations and government entities. With the incredible growth of the Internet over the years, our global pool of unassigned space is running out. In fact, 98% of all available space from the global pool has already been assigned.

IPv6 Defined

The newest IP address scheme is called IP Version 6 (IPv6) and was developed in 1998. IPv6 IP addresses are defined in 128 bits, which is a theoretical 3.4 x 1038. There are enough IPs that each square millimeter of the earth could be assigned 3.9 quadrillion (3,900,000,000,000)1. At the current rate of growth of the Internet, only 1/8th of this IPv6 space is expected to be issued by the year 2158. This amount of new IP space should solve any IP address capacity issues for the foreseeable future. These IPv6 IP addresses are expressed in eight groups of four hexadecimal numbers separated by colons (Example: 2001:0DB8:0001:7AB5:0290:27FF:FE17:FC0F). IPv6 is not the same thing as "Internet 2".

Adoption

Google has publically stated that currently only 0.08% of traffic to Google's sites use IPv6. Comcast labs shows that only 0.1475% of the top 1 million web sites are IPv6 enabled, which means that 99.8% of the top 1 million web sites are only accessible via IPv4. Also according to Hurricane Electric, only 8% of all Internet accessible networks are IPv6 enabled.

Over the next decade, IPv6 adoption will continue to grow alongside IPv4, but for the foreseeable future IPv4 will continue to be the dominant protocol used on the Internet since you can't just "turn it off".

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The Challenges of Adoption

Traffic Volumes

Currently over 99% of Internet traffic is IPv4 traffic, yet only 8% of Internet accessible networks are IPv6 enabled. As a result there is a far greater emphasis on routing IPv4 optimally versus routing IPv6 traffic optimally. Therefore IPv6 traffic suffers less than optimal routes which can greatly increase latency and/or packet loss.

End to End Enablement

In order for IPv6 traffic to work from end user to webserver, the entire network must be IPv6 enabled. Basically everything that is done for IPv4 must also be done for IPv6. In other words, (1) the end user's computer operating system and local area network, including their broadband router needs to be IPv6 enabled, (2) the end user's ISP needs to resolve IPv6 DNS queries and route IPv6 traffic, (3) peering connections between ISPs need to route IPv6 traffic, (4) data center service providers need to route IPv6 packets all the way through the networks, the firewalls and to the web server's operating system and applications, and finally (5) the authoritative DNS would need to resolve IPv6 DNS queries.

Security

While IPv6 has a built-in capability for IPSEC to encrypt traffic, it is not mandatory. There is twice as much attack surface exposed when an IPv6 server is on an IPv6 enabled network since both the IPv4 and IPv6 protocols must be secured. If there is belief that the IPv6 is more secure there may be less emphasis on securing those IPv6 attack surfaces, which would actually decrease security for that server.

New Challenges

There are multiple levels of new challenges supporting IPv6. A hasty move to IPv6 could be costly to companies and organizations trying to support a second protocol. If implemented incorrectly, services can inadvertently become inaccessible to the majority of Internet end users who are still using IPv4.

ROI (Return On Investment)

There is little ROI in IPv6 Internet services in the short term since less than 1% of Internet end users are using IPv6 currently and almost 100% of end users can use IPv4. However, not planning for and moving to IPv6 within the near future could limit any company's growth or ability to stay competitive.

What's Next?

The Internet will continue to work even after the regional registries hand out the last IPv4 addresses. As adoption of IPv6 addresses grows across the Internet more and more networks, DNS servers, web sites and other Internet services will become IPv6 enabled. IPv6 routing optimization will improve and eventually reach or even surpass current IPv4 optimization.

ViaWest's Position

ViaWest will provide transition pathways to enable customers to use IPv6. However, we are taking a methodical approach in order to ensure customer stability. As with all technology evolutions, the real question is timing. At ViaWest our success criteria is ultimately customer satisfaction. Should your business immediately require IPv6, we're here to help. Otherwise, over the next several quarters, you'll see ViaWest begin with targeted areas where the introduction of IPv6 is prudent for our wide customer base.

About ViaWest

Headquartered in Denver, Colorado ViaWest provides colocation, hosting, and managed services to businesses nationwide. We own and operate 20 enterprise-class data center facilities in Colorado, Texas, Oregon, Utah, and Nevada serving thousands of customers including Frontier Airlines, Red Robin, Chipotle, and Northrop Grumman. Core Services include:

- Colocation
- Complex Hosting
- Managed Services
  - > Managed security services
  - > Managed storage
  - > Managed network services

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