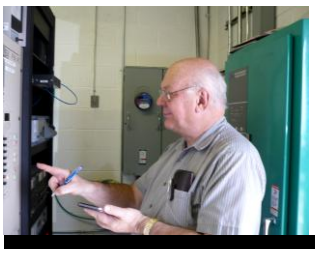

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Bits and Bytes

IPv6 - The Internet Gets a Lot Bigger

By Dana Puopolo

[January 2012] You may have heard about it, read about it, or seen the "IPv6 ready" markings on a box. But is IPv6 something to worry about now, or to just learn about and get ready. Dana Puopolo offers some clarity.

The original design of the Internet was for scientific and educational research. None of its creators could have possibly seen its true potential – a worldwide transit and communications service. Indeed, the Internet originally was just an experiment itself!

At first the designers used a system allowing for only a 256 node network. In 1981, a 32-bit (2 raised to the 32nd power) addressing system was devised, providing just over four billion unique IP (Internet Protocol) addresses. It was believed these would be enough to last forever. To the astonishment of all, the explosive growth of the Internet has resulted in all four billion addresses now being allotted, and it continues to grow.

A NEW SYSTEM

The original IP system is called IPv4 and is the xxx.xxx.xxx.xxx IP addressing system that is so familiar, with the x's being numbers.

What kept the Internet from running out of addresses even earlier was Network Address Translation (NAT), which allows for private (non-routable on the Internet) IP addresses like the 192.168.xxx.xxx that most of our home and station routers use.

Still, all public IP addresses have been exhausted and the Internet continues to grow. Fortunately, the guardians of the Internet saw this coming and have implemented a new addressing system called IPv6. With IPv6, there now are 2 raised to the 128th power (340 undecillion or 3.4×10^{38} addresses).

A LOT MORE

IPv6 has many advantages over IPv4, including:

- multicast (very important for audio and video streaming)
- enough IP addresses to make NAT (and home routers) unnecessary (though you can still use one if you want)
- automatic address assignment (that is far superior to DHCP, though DHCP will still work with IPv6)

- better speed (because of the way the packets are routed in IPv6)
- improved security (unlike IPv4, network security is designed into IPv6)
- far better/faster DNS
- much better mobile operation (where you move between different cell data sites).

The two protocols are designed to co-exist on the same Internet – essentially allowing the phase-out of IPv4 as equipment gets upgraded and/or wears out. IPv6 is being rolled out now.

Many large ISPs already support it, and it has been tested successfully several times this year on a large scale. Most (but not all) home routers that offer N speeds already have IPv6 functionality built into them.

TRANSITION ISSUES

The big problem is that as new sites come online with IPv6, users running the IPv4 protocol will not be able to natively access IPv6 site content.

During this transition period, IPv6 nodes are going to need to communicate with IPv4 nodes, and the isolated "islands" of IPv6 installations are going to continue to need to use the wider IPv4 network to connect to each other.

Dual IP stacks have been proposed to solve the first problem, and tunneling to solve the latter. In a way it is like the DTV transition worked: for a while you could use both NTSC and DTV sets as the TV stations broadcast both. But to get enhanced content you had to move to DTV.

However, unlike that transition, there is no government mandate to transition to IPv6 and the total transition could take a decade or more.

THE NEW ADDRESS FORMAT

We all are familiar with IPv4 addresses. For example, Yahoo's IPV4 address is:
209.91.122.70.

An IPv6 IP address looks completely different. As an example it could look like:
2002:2df9:e60q:ac10:ec95:292d:72fe:td92.

The most obvious difference is that IPv6 is hexadecimal and includes both letters and numbers. It uses four characters per group as opposed to three for IPv4; there are eight groups as opposed to four in IPv4; and colons are used instead of periods between groups.

There is one other part of the transition: IPv6 IP addresses will be issued in order as needed, and the end groups that are not used (unused groups will have all zeros in them) do not have to be used at all. In simpler terms:
2001:5db7:7fe9:9eh2:0000:0000:0000:0000
can be simplified to **2001:5db7:7fe9:9eh2**.

WHAT YOU SHOULD DO NOW

Nothing really. The IPv6 rollout is just starting. Most of the conversion will be done in the background by your ISP (and/or his upstream provider).

So, the next time you replace your personal or station router, you might want to buy one that is IPv6 compatible. IPv6 is already supported in every Windows release since XP (Service Pack 2 and higher), is natively supported in Vista and Windows 7, Apple (OS-X 10.2 and higher), Linux and Android.

It will likely be years before your ISP requires you to do anything to convert, and they will surely provide translation between the two protocols for some time (though without the advantages of IPv6).

Of course, we as broadcasters should hope that IPv6 gets adopted sooner rather then later, simply because the multicast protocol is built into IPv6. Multicast means just what it says: Instead of a streamer having to send one discrete stream to each user, multicast will allow them to originate *just one stream* and all users will "tune in" to that stream, much the way over the air broadcasting works.

CHANGES ARE COMING

Make no mistake about it though – the Internet of our children will be nothing like ours is now.

We already see inklings of it now: at the annual Consumer Electronic Show, all sorts of "connected home" applications are appearing, so you can remotely view webcams and control lights, for example.

Soon, each appliance will have its very own IP address. You will be able to turn your crock pot and coffee maker on from your computer before you leave work so your food is done when you get home. You will be able to see what the temperature in your refrigerator is (and adjust it) from work.

One thing is certain: I am sure there will be 1001 uses that none of us has even thought of that will be developed in the near future. But rest assured, they will happen – as IPv6 comes to a computer near you.

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