Product:
Active & Wireless

Family
Switches, Radios and Routers

Tech Tip 5

IPv4 vs IPv6 (part 2) Compatibility of IPv4 addresses with IPv6

The IPv4 address compatible with the IPv6 address is a special class of IPv6 address, it is a IPv6 address whose first 96 bits are zeroes, while the last 32 represent the IPv4 addresses.

Important Note: *It is important to highlight that the IPv6 address :: and the Loopback address: ::1) are not IPv4 compatible even though they are included in the IPv6 ::/96 address space.*

There are a series of mechanisms that will permit the coexistence and progressive migration of the networks and user equipment. In general, the transition mechanisms can be classified in three groups:

• *Dual Stack*

When configured as dual stack, each device on the network is configured with both an IPv4 address and an IPv6 address, the motus behind that is that once all the devices have implemented IPv6, the IPv4 part of the network will be discarded. This method is usual for businesses looking to progressively migrate their existing devices from IPv4 to IPv6. These businesses can configure their routing infrastructure to support both IPv4 and IPv6 but incorporate their other network devices to IPv6 at a slower pace.

• *Tunneling*

This concept is not new; many people use tunneling frequently, but just use it for other reasons. E.g.: many businesses use IPsec or Secure Sockets Layer (SSL) tunnels to secure information when it is being transmitted through an untrusted network.
There are many different tunneling methods available. The selection depends on the specific implementation details. Table 1 lists some commonly available tunneling methods and their suggested usage.

Tunneling Method	Suggested Application
Manual	Used to provide a point-to-point IPv6 link over an existing IPv4 network; only supports IPv6 traffic.
GRE	Used to provide a point-to-point IPv6 link over an existing IPV4 network; supports multiple protocols, including IPv6.
6to4	Used to provide a point-to-multipoint IPv6 link over an existing IPv4 network; sites must use IPv6 addresses from the 2002::/16 range.
6rd (or 6RD)	Used to provide a point-to-multipoint IPv6 link over an existing IPv4 network; sites can use IPv6 addresses from any range.
ISATAP	Used to provide point-to-multipoint IPv6 links over an existing IPv4 network. Designed to be used between devices inside the same site.

LANPRO
How Information Moves...

• Translation

This is not a new concept to most network engineers; this is because Network Address Translation (NAT) is implemented between different IPv4 networks in almost every residential household. The concept behind this type of NAT and the newer technologies that support address translation between IPv4 and IPv6 networks is similar. IPv6 translation technologies differ from IPv6 tunneling technologies; this is because the translation technologies enable IPv4-only devices to speak to IPv6-only devices, which is not possible with any of the tunneling methods.

However, IPv4/IPv6 translation and IPv4-only translation entail a certain amount of complexity. What happens when an IPv6-only device is attempting to communicate with a device on the public IPv4 Internet and only an IPv4 DNS record (A) exists? In these situations, a secondary technology is required to step in and provide additional services for the connection to work.

The first method to be introduced to provide IPv6 translation services was Network Address Translation - Protocol Translation (NAT-PT). NAT-PT defined a mechanism to not only translate between IPv4 to IPv6 addresses but also a built-in ability to provide protocol translation services for Internet Control Message Protocol (ICMP), File Transfer Protocol (FTP), and Domain Name System (DNS). The component that was responsible for these translation services is called the application layer gateway (ALG).

The ALG piece of the NAT-PT method raised a number of issues. With additional testing and real-life experience, a new method was introduced that separated the address translation functionality and the application layer translation functionalities: NAT64 and DNS64.

DNS64 can synthesize IPv6 address resource records (AAAA) from IPv4 resource records (A); it does this by encoding the returned IPv4 address into a IPv6 address format.

There are tools in Internet that ease the translation of these addresses like the following:

Some examples of online applications from IPv4 to IPv6 on address conversion,

http://www.subnetonline.com/pages/subnet-calculators/ipv4-to-ipv6-converter.php

https://www.ultratools.com/tools/ipv4toipv6

http://www.ipaddressguide.com/ipv4-to-ipv6

Some terminology may match with public articles found in Internet.