                 IPv6 Support Required for All IP-Capable Nodes

Abstract

   Given the global lack of available IPv4 space, and limitations in
   IPv4 extension and transition technologies, this document advises
   that IPv6 support is no longer considered optional. It also cautions
   that there are places in existing IETF documents where the term "IP"
   is used in a way that could be misunderstood by implementers as the
   term "IP" becomes a generic that can mean IPv4 + IPv6, IPv6-only, or
   IPv4-only, depending on context and application.

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Table of Contents

1. Introduction

   IP version 4 (IPv4) has served to connect public and private hosts
   all over the world for over 30 years. However, due to the success of
   the Internet in finding new and innovative uses for IP networking,
   billions of hosts are now connected via the Internet and require
   unique addressing. This demand has led to the exhaustion of the IANA
   global pool of unique IPv4 addresses [IANA-EXHAUST], and will be
   followed by the exhaustion of the free pools for each Regional
   Internet Registry (RIR), the first of which is APNIC [APNIC-EXHAUST].
   While transition technologies and other means to extend the lifespan
   of IPv4 do exist, nearly all of them come with trade-offs that
   prevent them from being optimal long-term solutions when compared
   with deployment of IP version 6 (IPv6) as a means to allow continued
   growth on the Internet. See [RFC6269] and [NAT444-IMPACTS] for some
   discussion on this topic.

   IPv6 [RFC1883] was proposed in 1995 as, among other things, a
   solution to the limitations on globally unique addressing that IPv4's
   32-bit addressing space represented, and has been under continuous
   refinement (e.g., [RFC2460]) and deployment ever since. The
   exhaustion of IPv4 and the continued growth of the Internet worldwide
   have created the driver for widespread IPv6 deployment.

However, the IPv6 deployment necessary to reduce reliance on IPv4 has
been hampered by a lack of ubiquitous hardware and software support
throughout the industry. Many vendors, especially in the consumer
space, have continued to view IPv6 support as optional. Even today,
they are still selling "IP-capable" or "Internet-Capable" devices
that are not IPv6-capable, which has continued to push out the point
at which the natural hardware refresh cycle will significantly
increase IPv6 support in the average home or enterprise network.
They are also choosing not to update existing software to enable IPv6
support on software-updatable devices, which is a problem because it
is not realistic to expect that the hardware refresh cycle will
single-handedly purge IPv4-only devices from the active network in a
reasonable amount of time. This is a significant problem, especially
in the consumer space, where the network operator often has no
control over the hardware the consumer chooses to use. For the same
reason that the average consumer is not making a purchasing decision
based on the presence of IPv6 support in their Internet-capable
devices and services, consumers are unlikely to replace their still-
functional Internet-capable devices simply to add IPv6 support --
they don't know or don't care about IPv6; they simply want their
devices to work as advertised.

This lack of support is making the eventual IPv6 transition
considerably more difficult, and drives the need for expensive and
complicated transition technologies to extend the life of IPv4-only
devices as well as to eventually interwork IPv4-only and IPv6-only
hosts. While IPv4 is expected to coexist on the Internet with IPv6
for many years, a transition from IPv4 as the dominant Internet
Protocol version towards IPv6 as the dominant Internet Protocol
version will need to occur. The sooner the majority of devices
support IPv6, the less protracted this transition period will be.

2. Clarifications and Recommendation

To ensure interoperability and proper function after IPv4 exhaustion,
support for IPv6 is virtually a requirement. Rather than update the
existing IPv4 protocol specification standards to include IPv6, the
IETF has defined a completely separate set of standalone documents
that cover IPv6. Therefore, implementers are cautioned that a
distinction must be made between IPv4 and IPv6 in some IETF documents
where the term "IP" is used generically. Current requirements for
IPv6 support can be found in [RFC6204] and [RFC6434]. Each of these
documents contains specific information, requirements, and references
to other Draft and Proposed Standards governing many aspects of IPv6
implementation.

Many of the IETF's early documents use the generic term "IP"
synonymously with the more specific "IPv4". Some examples of this
potential confusion can be found in [RFC1812], especially in
Sections 1, 2, and 4. Since RFC 1812 is an IPv4 router
specification, the generic use of IP in this standard may cause
confusion as the term "IP" can now be interpreted to mean
IPv4 + IPv6, IPv6-only, or IPv4-only. Additionally, [RFC1122] is no
longer a complete definition of "IP" or the Internet Protocol suite
by itself, because it does not include IPv6. For example,
Section 3.1 does not contain references to the equivalent standards
for IPv6 for the Internet layer, Section 3.2 is a protocol
walk-through for IPv4 only, and Section 3.2.1.1 explicitly requires
that an IP datagram whose version number is not 4 be discarded, which
would be detrimental to IPv6 forwarding. Additional instances of
this type of problem exist that are not discussed here. Since
existing RFCs say "IP" in places where they may mean IPv4,
implementers are cautioned to ensure that they know whether a given
standard is inclusive or exclusive of IPv6. To ensure
interoperability, implementers building IP nodes will need to support
both IPv4 and IPv6. If the standard does not include an integral
definition of both IPv4 and IPv6, implementers need to use the other
informative references in this document as companion guidelines for
proper IPv6 implementations.

To ensure interoperability and flexibility, the best practices are as
follows:

o New IP implementations must support IPv6.

o Updates to current IP implementations should support IPv6.

o IPv6 support must be equivalent or better in quality and
   functionality when compared to IPv4 support in a new or updated IP
   implementation.

o New and updated IP networking implementations should support IPv4
   and IPv6 coexistence (dual-stack), but must not require IPv4 for
   proper and complete function.

o Implementers are encouraged to update existing hardware and
   software to enable IPv6 wherever technically feasible.

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4. Security Considerations

   There are no direct security considerations generated by this
   document, but existing documented security considerations for
   implementing IPv6 will apply.

5. Informative References

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