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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.

Status of This Memo

This memo documents an Internet Best Current Practice.

This document is a product of the Internet Engineering Task Force (IETF). It represents the consensus of the IETF community. It has received public review and has been approved for publication by the Internet Engineering Steering Group (IESG). Further information on BCPs is available in Section 2 of RFC 5741.

Information about the current status of this document, any errata, and how to provide feedback on it may be obtained at http://www.rfc-editor.org/info/rfc6540.

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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:

- New IP implementations must support IPv6.

- Updates to current IP implementations should support IPv6.

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

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

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

3. Acknowledgements

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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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