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IPv6 Support Within IETF work
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Abstract

This document recommends that the IETF formally require its standards work to be IP version agnostic or to explicitly include support for IPv6, with some exceptions, to ensure that it is possible to operate without dependencies on IPv4.

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1. Introduction

[RFC6540] gives guidance to implementers that in order to ensure interoperability and proper function after IPv4 exhaustion, IP-capable devices need to support IPv6, and cannot be reliant on IPv4, because global IPv4 exhaustion creates many circumstances where the use of IPv6 will no longer be optional. Since this is an IETF Best Current Practice recommendation, it is imperative that the results of IETF efforts enable implementers to follow that recommendation. This document provides recommendations and guidance as to how IETF itself should handle future work as it relates to Internet Protocol versions.

When considering support for IPv4 vs IPv6 within IETF work, the general goal is to provide tools that enable networks and applications to operate seamlessly in any combination of IPv4-only, dual-stack, or IPv6-only as their needs dictate. However, as the IPv4 to IPv6 transition continues, it will become increasingly difficult to ensure interoperability and backward compatibility with IPv4-only networks and applications. As IPv6 deployment grows, IETF will naturally focus on features and protocols that enhance and extend IPv6, along with continuing work on items that are IP version agnostic. New features and protocols will not typically be introduced for use as IPv4-only. However, as of this document's writing, there is no formal requirement for all IETF work to support IPv6, either implicitly by being network-layer agnostic or explicitly by having an IPv6-specific implementation.

1.1. Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC 2119 [RFC2119].

2. IPv6-only operation

At this document's writing, IPv6 has seen significant deployment. Most of these deployments are dual-stack, with IPv4 and IPv6 coexisting on the same networks. However, dual-stack is a waypoint in the transition from IPv4 to IPv6. The eventual end state is networks and end points that are IPv6-only. Some operators may take a long time to turn off IPv4, if they ever do, but the IETF MUST ensure that its standards can be deployed by even the first operators to turn off IPv4. Problems (and solutions) need to be identified before they are encountered by the earliest adopters.

2.1. Functional Parity with IPv4

In order for IPv6-only operation to be realistic, IPv6 MUST have at least functional parity with IPv4. "Functional parity" means that any function that IPv4 enables MUST also be enabled by IPv6. This does not mean that every feature that exists in IPv4 will exist in IPv6; different features may enable the same function. For instance, IPv4 supports some features that are no longer in use. In some cases it has not been practical to remove them in IPv4, or even to declare them historic, but it is unnecessary to carry them forward into IPv6. IPv6 also eliminates the need for some features that exist in IPv4; no effort to create unneeded features is required. Functional parity does not mean that all functions in IPv6 must also be possible in IPv4. Indeed, with IPv6 becoming the predominant protocol, new functionality should be developed in IPv6, and IETF effort SHOULD NOT be spent retrofitting features into the legacy protocol.

2.2. IPv4 Sunset

Somewhat distinct from identifying the needed features for IPv6-only functional parity is the effort to identify what is necessary to disable or sunset IPv4 in a given network. Since many of the protocols in use today were designed to be fault-tolerant and very robust, actually removing them from a network once they are no longer needed is sometimes complex. Many implementations may not even have "off switches" because the assumption was that they would never be switched off in a normal network implementation. The Sunset4 Working Group was chartered to address these issues:

"The Working Group will point out specific areas of concern, provide recommendations, and standardize protocols that facilitate the graceful "sunsetting" of the IPv4 Internet in areas where IPv6 has been deployed. This includes the act of shutting down IPv4 itself, as well as the ability of IPv6-only portions of the Internet to continue to connect with portions of the Internet that remain IPv4-only. ... Disabling IPv4 in applications, hosts, and networks is new territory for much of the Internet today, and it is expected that problems will be uncovered including those related to basic IPv4 functionality, interoperability, as well as potential security concerns. The working group will report on common issues, provide recommendations, and, when necessary, protocol extensions in order to facilitate disabling IPv4 in networks where IPv6 has been deployed."

3. Requirements and Recommendations

Ongoing focus is required to ensure that future IETF work is capable of IPv6-only operation. This attention may take the form of IESG evaluation, individual document reviews, or future WG charters. Due to the existing operational base of IPv4, it is not realistic to completely bar further work on IPv4 within the IETF at this time, nor to formally declare it historic. Until the time when IPv4 is no longer in wide use and/or declared historic, the IETF needs to continue to update IPv4-only protocols and features for vital operational or security issues. Similarly, the IETF needs to complete the work related to IPv4-to-IPv6 transition tools for migrating more traffic to IPv6. As the transition to IPv6-capable networks accelerates, it is also likely that some changes may be necessary in IPv4 protocols to facilitate decommissioning IPv4 in a way that does not create unacceptable impact to applications or users. These sorts of IPv4-focused activities, in support of security, transition, and decommissioning, should continue, accompanied by problem statements based on operational experience. Generally the focus should move away from IPv4-only work.

The IESG SHOULD review working group charters to ensure that work will be capable of operating without IPv4, except in cases of IPv4 security, transition, and decommissioning work.

IETF SHOULD make updates to IPv4 protocols and features to facilitate IPv4 decommissioning

IETF work SHOULD explicitly support IPv6 or SHOULD be IP version agnostic (because it is implemented above the network layer), except IPv4-specific transition or address-sharing technologies.

IETF SHOULD NOT initiate new IPv4 extension technology development.

IETF work SHOULD function completely on IPv6-only nodes and networks, unless consensus exists that it is unnecessary to use a given feature or protocol on IPv6-only networks.

IETF SHOULD identify and update IPv4-only protocols and applications to support IPv6 unless consensus exists that it is unnecessary for a given feature or protocol.

4. Acknowledgements

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5. IANA Considerations

This memo includes no request to IANA.

6. Security Considerations

This document generates no new security considerations because it is not defining a new protocol. As existing work is analyzed for its ability to operate properly on IPv6-only networks, new security issues may be identified.

7. References

7.1. Normative References

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, March 1997.

7.2. Informative References

[RFC6540] George, W., Donley, C., Liljenstolpe, C., and L. Howard, "IPv6 Support Required for All IP-Capable Nodes", BCP 177, RFC 6540, April 2012.

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