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An Internet Transition Plan

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Abstract

This memo provides one possible plan for transitioning the Internet from a predominantly IPv4-based connectivity model to a predominantly IPv6-based connectivity model.

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1. Introduction

This memo provides one possible plan for transitioning the Internet from a predominantly IPv4-based connectivity model to a predominantly IPv6-based connectivity model.

Other transition plans are possible and this purely informational document does not create an obligation on any party to undertake any of the actions specified herein, and the use of requirements language per RFC 2119 is only for the purpose of clearly describing the proposed transition plan in unambiguous terms.

The motivation for an Internet-wide transition plan is to facilitate coordination of expectations among innumerable, highly decentralized entities during a period of significant change, thus reducing risk to the defining Internet property of universal connectivity.

The purpose of specifying this particular transition plan is to allow for overall assessment of the challenges of accomplishing the desired transition and to continue the discussion of Internet-wide transition plans in general.

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]. RFC 2119 defines the use of these key words to help make the intent of Standards Track documents as clear as possible. While not a Standards Track document, the same key words are used in this document only for sake of clarity in describing the proposed transition plan.

2. A Phased Transition Model

It is not reasonable to specify the changes that each and every system connected to the Internet must undergo in order to achieve the desired transition, as the number of connected systems precludes creating one plan that contains such a level of detail. Further, while there are common scenarios that may be specified for transitioning individual networks (refer to [RFC3750] and [RFC4057] for examples), the specific timeline and mechanisms utilized for a given network will be unique. Despite these challenges, it is necessary to coordinate expectations on an overall basis so that Internet-wide connectivity is maintained throughout the transition.

This document specifies a three-phase transition plan that includes preparation, transition, and post-transition phases, and delineates the necessary activities within each phase based on the role that an organization plays in the provision and use of Internet services.

An important distinction made in this transition plan is identifying the explicit requirement for existing end-site organizations to add IPv6-based connectivity to their public-facing servers during a transition phase. An accelerated adoption of IPv6 for public-facing servers enables new organizations in the post-transition phase to be connected to the Internet only via IPv6 and still have access to a substantial representative base of publicly available servers.

For nearly every organization, the task of IPv6-enabling their public-facing servers is far easier than undertaking an organization-wide adoption of IPv6. Still, the requirement for existing Internet-connected organizations to add IPv6 connectivity (even to a small number of systems) will be a significant hurdle and require a level of effort that may not be achievable given the lack of compelling additional benefits to these organizations [RFC1669]. This transition plan presumes that "connectivity is its own reward" [RFC1958] and that there still exists a sufficient level of cooperation among Internet participants to make this evolution possible.

The three proposed phases are: Preparation Phase, Transition Phase, and Post-Transition Phase. The timeline for the phases has been set to allow entry to the Post-Transition Phase prior to the projected IPv4 address pool exhaustion date [IPUSAGE].

2.1. Preparation Phase - Present to December 2009

In the Preparation Phase, Service Providers pilot test their IPv6 network services, and end-site organizations prepare to provide Internet-facing services via IPv6-based connectivity while continuing to provide Internet-facing services via IPv4 connectivity.

During the Preparation Phase, the following principles apply:

PREP1: Service Providers SHOULD offer pilot IPv6-based Internet Service to their Internet customers. IPv6-based Internet Service MAY be provided via IPv6 transition mechanisms (such as those described in [RFC4213], for example) or via native IPv6 network service.

PREP2: Organizations SHOULD arrange for IPv6-based Internet connectivity for any Internet-facing servers (e.g., web, email, and domain name servers). Internet-facing IPv6 servers in this phase SHOULD use separate service names per [RFC4472] to avoid impact to production IPv4-based services unless the organization supports production IPv6 connectivity.

PREP3: Organizations MAY provide IPv6-based Internet connectivity to internal user communities.

2.2. Transition Phase - January 2010 to December 2011

In the Transition Phase, Service Providers offer production IPv6 and IPv4 services to their Internet customers. End-site organizations provide Internet-facing services in a production manner via IPv6-based connectivity in addition to IPv4-based connectivity.

During the Transition Phase, the following principles apply:

TRANS1: Service Providers MUST offer IPv6-based Internet Service to their Internet customers. IPv6-based Internet Service SHOULD be via native IPv6 network service but MAY be via IPv6 transition mechanisms if necessary.

TRANS2: Organizations MUST arrange for IPv6-based Internet connectivity for any Internet-facing servers (e.g., web, email, and domain name servers). Internet-facing IPv6 servers SHOULD be treated as production by the organization, and SHOULD be treated as production by other Internet organizations.

TRANS3: Organizations SHOULD provide IPv6-based Internet connectivity to their internal user communities, and provide IPv6 internal supporting servers (e.g., DNS, DHCP). IPv6-based Internet connectivity MAY be via native IPv6 network service or MAY be via IPv6 transition mechanisms.

2.3. Post-Transition Phase - January 2012 to the Future

In the Post-Transition Phase, end-site organizations provide all Internet-facing services via IPv6-based connectivity, thus allowing for new Internet customers connected solely by IPv6.

During the Post-Transition Phase, the following principles apply:

POST1: Service Providers MUST offer IPv6-based Internet Service to their Internet customers. IPv6-based Internet Service SHOULD be via native IPv6 network service.

POST2: Organizations MUST arrange for IPv6-based Internet connectivity for any Internet-facing servers (e.g., web, email, and domain name servers). Internet-facing IPv6 servers MUST be treated as production by the organization, and SHOULD be treated as production by other Internet organizations.

POST3: Organizations SHOULD provide IPv6-based Internet connectivity to internal user communities, and provide IPv6 internal supporting infrastructure (e.g., routers, DNS, DHCP, etc). IPv6-based Internet connectivity SHOULD be via native IPv6 network service or MAY be via IPv6 transition mechanisms.

POST4: Service Providers MAY continue to offer IPv4-based Internet connectivity to their Internet customers. Organizations MAY continue to use IPv4-based Internet connectivity.

3. Summary

In order to facilitate full Internet-wide connectivity during the transition from IPv4-based connectivity to IPv6-based connectivity, a transition plan which provides clear guidance to organizations regarding expectations is necessary. As the specific expectations change over time, and vary greatly by organization, a phased approach is specified in this document, with the timeline for each phase set with the intention of allowing enough time for the necessary planning and deployment steps which each organization much undertake. This Internet Transition Plan provides for transition to predominantly IPv6-connectivity by January 2012 which, with careful management, may meet the overall requirements of allowing the Internet to scale as specified in "The Recommendation for the IP Next Generation Protocol" [RFC1752].

4. Security Considerations

This memo describes the transition of the Internet from IPv4-based connectivity to predominantly IPv6-based connectivity. This change inherently has security implications due to the widespread deployment of a new version of the Internet Protocol but these are beyond the scope of this document and are covered in [RFC4942]. This document raises no new security issues itself.

5. IANA Considerations

While no new name or identifier space is created by this document, the policies for management of Internet Protocol version 4 (IPv4) address space may not provide for IPv4 availability through the Transition Phase as intended by this plan. The IANA should work with

all parties to develop policies per [RFC2050] which allow continued general availability of IPv4 address resources sufficiently long for any transition plan that receives widespread community support.

6. Acknowledgments

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