Internet Engineering Task Force (IETF)
Request for Comments: 7020
Obsoletes: 2050
Category: Informational
ISSN: 2070-1721

R. Housley
Vigil Security
J. Curran
ARIN
G. Huston
APNIC
D. Conrad
Virtualized, LLC

August 2013

The Internet Numbers Registry System

Abstract

This document provides information about the current Internet Numbers Registry System used in the distribution of globally unique Internet Protocol (IP) address space and autonomous system (AS) numbers.

This document also provides information about the processes for further evolution of the Internet Numbers Registry System.

This document replaces RFC 2050.

This document does not propose any changes to the current Internet Numbers Registry System. Rather, it documents the Internet Numbers Registry System as it works today.

Status of This Memo

This document is not an Internet Standards Track specification; it is published for informational purposes.

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). Not all documents approved by the IESG are a candidate for any level of Internet Standard; see 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/rfc7020.

Table of Contents

1. Introduction

The administrative structures of the Internet Numbers Registry System described in this document are largely the result of the interaction of operational practices, existing routing technology, number resource assignments that have occurred over time, and network architectural history. Further discussion and analysis of these interactions are outside the scope of this document.

This document provides information about the current Internet Numbers Registry System used in the distribution of globally unique Internet Protocol (IP) address space and autonomous system (AS) numbers. It also describes the processes used for further evolution of the Internet Numbers Registry System. This document does not propose any changes to the current operation of this system.

This document replaces RFC 2050. Since the publication of RFC 2050, the Internet Numbers Registry System has changed significantly. This document describes the present Internet Numbers Registry System.

2. Goals

Internet number resources are currently distributed according to the following (non-exclusive) goals:

1) Allocation Pool Management: Due to the fixed lengths of IP addresses and AS numbers, the pools from which these resources are allocated are finite. As such, allocations must be made in accordance with the operational needs of those running the networks that make use of these number resources and by taking into consideration pool limitations at the time of allocation.

2) Hierarchical Allocation: Given current routing technology, the distribution of IP addresses in a hierarchical manner increases the likelihood of continued scaling of the Internet's routing system. As such, it is currently a goal to allocate IP addresses in such a way that permits aggregation of these addresses into a minimum number of routing announcements. However, whether IP addresses are actually announced to the Internet and the manner of their advertisement into the Internet's routing system are operational considerations outside the scope of the Internet Numbers Registry System.

3) Registration Accuracy: A core requirement of the Internet Numbers Registry System is to maintain a registry of allocations to ensure uniqueness and to provide accurate registration information of those allocations in order to meet a variety of operational requirements. Uniqueness ensures that IP addresses and AS numbers are not allocated to more than one party at the same time.

These goals may sometimes conflict with each other or with the interests of individual end users, Internet service providers, or other number resource consumers. Careful analysis, judgment, and cooperation among registry system providers and consumers at all levels via community-developed policies are necessary to find appropriate compromises to facilitate Internet operations.

3. Internet Numbers Registry System Structure

The Internet Registry (IR) hierarchy was established to provide for the allocation of IP addresses and AS numbers with consideration to the above goals. This hierarchy is rooted in the Internet Assigned Numbers Authority (IANA) address allocation function, which serves a set of "Regional Internet Registries" (RIRs); the RIRs then serve a set of "Local Internet Registries" (LIRs) and other customers. LIRs in turn serve their respective number resource consumers (which may be themselves, their customers, "sub-LIRs", etc.)

IETF

The IETF specifies the underlying technical facilities and constraints of Internet numbers administered by the Internet Numbers Registry System. These specifications are aimed at enabling and protecting the long-term viability of the Internet, and adjustments to those specifications are made over time as circumstances warrant. The IETF has also reserved portions of the Internet number spaces and identifiers for future needs.

IANA

The Internet Assigned Numbers Authority (IANA) is a role, not an organization. For the Internet Numbers Registry System, the IANA role manages the top of the IP address and AS number allocation hierarchies. The Internet Corporation for Assigned Names and Numbers (ICANN) currently fulfills the IANA role in accordance with the IETF-ICANN "Memorandum of Understanding Concerning Technical Work of the Internet Assigned Numbers Authority", which was signed and ratified in March 2000 [RFC2860]. In addition, ICANN performs the IANA services related to the IP address space and AS numbers according to global number resource policies that have been developed by the community and formalized under a Memorandum of Understanding between ICANN and the Regional Internet Registries [ASOMOU] and documented in [ICANNv4], [ICANNv6], and [ICANNASN].

Regional IRs

In order to promote distribution of the Internet number resource registration function, RFC 1366 proposed delegating responsibility to regional bodies. (Note: RFC 1366 was replaced by RFC 1466, which was replaced by RFC 2050.) These bodies became known as the Regional Internet Registries (RIRs). The RIRs operate in continent-sized geopolitical regions. Currently, there are five RIRs: AfriNIC serving Africa, APNIC serving parts of Asia and the Pacific region, ARIN serving North America and parts of the Caribbean, LACNIC serving Latin America and parts of the Caribbean, and RIPE NCC serving Europe, parts of Asia and the Middle East. The RIRs were established in a bottom-up fashion via a global policy process that has been documented as the ICANN "Internet Consensus Policy 2" [ICP-2], which details the principles and criteria for establishment of Regional Internet Registries. The RIRs also conduct regional number policy development used in the administration of the number resources for which they are responsible.

Local IRs

Local Internet Registries (LIRs) are established through a relationship with the body from which they received their addresses, typically the RIR that serves the region in which they operate, a parent LIR, or other number-allocating entity. In cases where LIRs span multiple regions, those LIRs have established relationships with multiple RIRs. LIRs perform IP address allocation services for their customers, typically ISPs, end users, or child LIRs (also known as "sub-LIRs").

4. Internet Numbers Registry Technical Considerations

As a result of the system of technical standards and guidelines established by the IETF as well as historical and operational constraints, there have been technical considerations regarding the services provided by the Internet Numbers Registry System as it evolved. These technical considerations have included:

1) Reverse DNS: In situations where reverse DNS was used, the policies and practices of the Internet Numbers Registry System have included consideration of the technical and operational requirements posed by reverse DNS zone delegation [RFC5855].

2) Public WHOIS: The policies and practices of the Internet Numbers Registry System have included consideration of the technical and operational requirements for supporting WHOIS services [RFC3013] [RFC3912].

As the Internet and the Internet Numbers Registry System continue to evolve, it may be necessary for the Internet community to examine these and related technical and operational considerations and how best to meet them. This evolution is discussed in the next section.

5. Internet Numbers Registry Evolution

Over the years, the Internet Numbers Registry System has developed mechanisms by which the structures, policies, and processes of the Internet Numbers Registry System itself can evolve to meet the changing demands of the global Internet community. Further evolution of the Internet Numbers Registry System is expected to occur in an open, transparent, and broad multi-stakeholder manner.

Per the delineation of responsibility for Internet address policy issues specified in the IETF/IAB/ICANN MOU [RFC2860], discussions regarding the evolution of the Internet Numbers Registry System structure, policy, and processes are to take place within the ICANN framework and will respect ICANN’s core values [ICANNBL]. These core

values encourage broad, informed participation reflecting the functional, geographic, and cultural diversity of the Internet at all levels of policy development and decision making, as well as the delegation of coordination functions and recognition of the policy roles of other responsible entities that reflect the interests of affected parties. The discussions regarding Internet Numbers Registry evolution must also continue to consider the overall Internet address architecture and technical goals referenced in this document.

The foregoing does not alter the IETF's continued responsibility for the non-policy aspects of Internet addressing such as the architectural definition of IP address and AS number spaces and specification of associated technical goals and constraints in their application, assignment of specialized address blocks, and experimental technical assignments as documented in RFC 2860. In addition, in the cases where the IETF sets technical recommendations for protocols, practices, or services that are directly related to IP address space or AS numbers, such recommendations must be taken into consideration in Internet Numbers Registry System policy discussions regardless of venue.

6. Summary of Changes since RFC 2050

Since RFC 2050 was published, the Internet and the Internet Numbers Registry System have undergone significant change. This document describes the Internet Numbers Registry System as it presently exists and omits policy and operational procedures that have been superseded by ICANN and RIR policy since the publication of RFC 2050.

One particular change of note is that RFC 2050 defined an appeal process and included:

> If necessary, after exhausting all other avenues, the appeal may be forwarded to IANA for a final decision. Each registry must, as part of their policy, document and specify how to appeal a registry assignment decision.

The RIRs have developed consensus-based policies for appeals, and over time, they have become accepted by the respective RIR communities. As a result, the ability to further appeal to IANA is no longer appropriate.

7. Security Considerations

It is generally recognized that accuracy and public availability of Internet registry data is often an essential component in researching and resolving security and operational issues on the Internet.

8. Acknowledgements

Several people have made comments on draft versions of this document. The authors would like to thank Randy Bush, Brian Carpenter, Daniel Karrenberg, Olaf Kolkman, Scott Bradner, Leslie Daigle, Adiel Akplogan, Mark Kosters, Elise Gerich, and SM for their constructive feedback and comments. Additionally, we are indebted to the authors of RFC 1466 and RFC 2050 for their earlier contributions in this area.

9. References

9.1. Normative References

[ASOMOU] Published by ICANN, "ICANN Address Supporting Organization (ASO) MoU", October 2004, <http://archive.icann.org/en/aso/aso-mou-29oct04.htm>.

[ICANNASN] Ratified by ICANN, "Internet Assigned Numbers Authority (IANA) Policy for Allocation of ASN Blocks to Regional Internet Registries", September 2010, <http://www.icann.org/en/resources/policy/global-addressing/global-policy-asn-blocks-21sep10-en.htm>.

[ICANNBL] ICANN, "Bylaws for Internet Corporation for Assigned Names and Numbers", December 2012, <http://www.icann.org/en/about/governance/bylaws>.

[ICANNv4] Ratified by ICANN, "Global Policy for Post Exhaustion IPv4 Allocation Mechanisms by the IANA", May 2012, <http://www.icann.org/en/resources/policy/global-addressing/allocation-ipv4-post-exhaustion>.

[ICANNv6] Ratified by ICANN, "Internet Assigned Numbers Authority (IANA) Policy For Allocation of IPv6 Blocks to Regional Internet Registries", September 2006, <http://www.icann.org/en/resources/policy/global-addressing/allocation-ipv6-rirs>.

[ICP-2] ICANN, "ICP-2: Criteria for Establishment of New Regional Internet Registries", July 2001, <http://www.icann.org/icp/icp-2.htm>.

[RFC2860] Carpenter, B., Baker, F., and M. Roberts, "Memorandum of Understanding Concerning the Technical Work of the Internet Assigned Numbers Authority", RFC 2860, June 2000.

[RFC3013] Killalea, T., "Recommended Internet Service Provider Security Services and Procedures", BCP 46, RFC 3013, November 2000.

9.2. Informative References

[RFC3912] Daigle, L., "WHOIS Protocol Specification", RFC 3912, September 2004.

[RFC5855] Abley, J. and T. Manderson, "Nameservers for IPv4 and IPv6 Reverse Zones", BCP 155, RFC 5855, May 2010.

Authors' Addresses

Russ Housley
Vigil Security, LLC
918 Spring Knoll Drive
Herndon, VA 20170
USA

Phone: +1 703 435 1775
EMail: housley@vigilsec.com

John Curran
American Registry for Internet Numbers (ARIN)
3635 Concorde Parkway
Chantilly, VA 20151-1125
USA

Phone: +1 703 227 9845
EMail: jcurran@arin.net

Geoff Huston
Asia Pacific Network Information Centre (APNIC)
6 Cordelia St
South Brisbane, QLD 4101
Australia

Phone: +61 7 3858 3100
EMail: gih@apnic.net

David Conrad
Virtualized, LLC
2310 Homestead Road, C1#204
Los Altos, CA 94024
USA

Phone: +1 650 397 6102
EMail: drc@virtualized.org