The IANA Functions

Introduction

For the billions of devices and many thousands of networks that make up the Internet to connect with each other, they must agree upon a variety of standards, protocols, and associated protocol parameters (values or identifiers) which support that communication. For example, when you send an email with an attachment the servers used to transmit and receive the message each have an *Internet protocol (IP) address*. Your email address and the receiving email address each have a *domain name* (everything after the "@" symbol). And, a specific *protocol parameter* value indicates the kind of file attached so your email reader will know which program to use to open it. Behind the scenes, many other protocols and parameters ensure that email servers are located and reached, that services are mediated, and errors are detected; and, in general, that the transaction is successful.

IANA, the **Internet Assigned Numbers Authority**, is an administrative function of the Internet that keeps track of IP addresses, domain names, and protocol parameter identifiers that are used by Internet standards. Some of these identifiers are parameters, such as those used by Internet protocols (like TCP, ICMP or UDP) to specify functions and behaviour; some of them represent Internet addresses; and others represent domain names. Regardless of the type of identifier, the IANA function (IANA for short below) ensures that values are managed for uniqueness and made available in publicly-accessible registries so there is can be no confusion.

In short, IANA is about managing and ensuring the global uniqueness of three types of Internet identifiers:

   a. Protocol parameters
   b. Internet Protocol (IP) addresses
   c. Internet domain names

This document provides a brief and colloquial description of each of these activities and a real-world analogy to help explain it. In each case, we identify two important aspects of the activity: the source of policies, or rules, implemented by the IANA and the source of oversight of IANA's performance of that work.

IANA is currently operated by the Internet Corporation for Assigned Names and Numbers (ICANN).

Protocol Parameters

   • Policy role performed by the Internet Engineering Task Force (IETF)
   • Oversight provided by the Internet Architecture Board (IAB)
   • Maintenance and publications of the tables containing parameters and coordination of the requests for assignments of parameters by the IANA.

Description

In everyday life, *protocols* refer to a set of norms, principles, and customs that facilitate communication and determine human relationships. The term is also often used in the context of governmental foreign policy. In the context of computer networking, *protocol* has a similar meaning, only it is more specific. A protocol refers to a set of specific rules, sequences, message formats, and procedures that computer systems use and understand when they exchange data with each other. Protocols ensure that all machines in one network, no matter how different they are, 'speak' the same language.

Because protocols are used globally by independent implementations, there must be a place that can give an authoritative answer as to what value should be used in a particular situation. For instance, implementations that see the number 6 in a specific place in an IP packet know that those packets are being

used for TCP. **These sets of possible values for particular protocols, called protocol parameters, are kept in tables, or *registries*.**

When a new value is needed, for instance for a new functionality of an existing protocol, IANA takes an action to create a new row in the appropriate table and assign a value. When a new protocol is developed, IANA may be requested to create a new table – a new registry with certain rules about how values can be assigned in the registry defined by the developers of the protocol.

Implementation and maintenance of these protocol parameter registries is performed by IANA.

Real life analogy: Protocol for Greeting Royalty

There is certain protocol when meeting British royalty, which differs, for example, from that used when meeting heads of state. One should stand when royalty enters the room. One is not expected to genuflect, but men are expected to take a small bow from the neck, while women are expected to take a small curtsy. If anyone from the royal family offers his hand, one should not shake it but gently touch it. The first address to the Queen should be "Your Majesty". Other members of the royal family should be addressed as "Your Royal Highness".

A protocol for greeting royalty, therefore, includes some necessary steps as well as a set of invisible rules that govern how one should address royalty. Those greetings are "parameters" of the overall protocol. The registry would be the equivalent of a cheat sheet, which would contain the appropriate address for the various dignitaries, such as "Excellency" for Ministers.

Numbers

- Policies developed by the regional communities of the Regional Internet address Registries (RIRs), via the ICANN Address Supporting Organization (ASO) and global Policy Development Process
- Oversight provided by the ASO Address Council and the ICANN Board, in accordance with the ASO Memorandum of Understanding
- Maintenance of the registry and allocation to the RIRs by IANA

Description

Internet number resources include Internet Protocol addresses (including IPv4 and IPv6, sometimes referred to as IP addresses or IP numbers) and Autonomous System Numbers (ASNs). Every device connected to the Internet requires a globally unique IP address, which is used by protocols to exchange data with other devices; while each distinct, independent network requires a unique ASN.

There are two standards or "versions" of IP addresses:

- IPv4, or "IP version 4", which uses 32 binary bits, allowing a total of 4 billion unique IPv4 addresses
- IPv6, which uses 128 binary bits, allowing a vastly larger number, at least 4 billion times the size of the IPv4 address space

The IANA's role is to allocate Internet number resources from the pools of unallocated resources to the RIRs, in accordance with global Internet number policies[1]. RIRs then allocate these numbers to organizations, in accordance with community developed policies; and those organizations assign addresses to network infrastructure and customers.

Real life analogy: Telephone Numbers

In order to understand the function of an IP address, imagine a telephone number. In the same way that a telephone number is used to identify a telephone and allow it to call another, an IP address is used to

---

[1] https://www.icann.org/resources/pages/global-addressing-2012-02-25-en

identify a device (server, computer, device, or infrastructure component), and allow it to exchange data with other devices on the Internet.

Just like telephone numbers, IP addresses must be assigned *uniquely,* and *hierarchically*, in successively smaller blocks. However, while telephone numbers are organized according to national borders, telephone companies, telephone exchanges, and subscribers, IP addresses are organized according to large geographic regions, Internet Service Providers, smaller operators, and individual Internet devices and users. The borders of the telephone infrastructure are national and static; but the borders of the Internet exist between network operators, and are extremely diverse and dynamic.

Names

- Policy performed by the Internet Corporation for Assigned Names and Numbers (ICANN) community through supporting organizations: Generic Name Supporting Organization (GNSO) and Country Code Names Supporting Organization (ccNSO);
- Oversight performed by board of the Internet Corporation for Assigned Names and Numbers (ICANN)
- Maintenance of and coordination of changes to the root zone by IANA.

Description:

Domain names are the alphanumeric strings each one of us types in to the address bar of any Web browser (Safari, Internet Explorer, Firefox, Opera, etc.). Domain names are mapped into IPv4 or IPv6 addresses using a global Domain Name System (DNS). Because IP addresses are difficult to remember, easy-to-remember, user-friendly alphanumeric domain names were introduced as mnemonics. As soon as a user types a domain name into her browser, the device "asks" the DNS to translate the domain name into the corresponding IP address needed to establish communication with the desired server.

Domain names are hierarchical. For instance, the domain name www.example.com consists of three levels: 1) the root domain that contains "com", 2) the "com" domain contains "example", and 3) the "example.com" domain that contains "www". Every level of the domain name hierarchy can itself contain multiple domains. In particular, the root domain contains two categories of top-level domain names:

- Generic Top-Level Domain Names (gTLDs) like .info or .org
- Country Code Top-Level Domain Names (ccTLDs) like .uk (for United Kingdom) or .gr (for Greece).

IANA is responsible for coordination of changes to the DNS root zone. This role means processing the requests for changes from operators of top-level domains, such as .uk and .com, and maintaining their technical and administrative details, as well as corresponding records in the root zone.

Real life analogy: Street Addresses

In order to understand the role of domain names, imagine postal addresses. The same way a postal address describes the location of someone's house in the offline world, a domain name describes where to find information about the location of a particular resource such as a website. A domain name must be unique, and the hierarchical structure of a name makes this task easier. Much as a city administration ensures that street names are unique in a city, and street numbers do not repeat themselves, the administrator of a domain, say .com, or .gr, ensures that names within its domain are unique. And, similar to postal addresses, a full domain name is unique: There is only one Athens in Greece, one Dionysiou Areopagitou Street in Athens and only one house with number 15 on this street. Likewise, there is only one .gr top-level domain, and only one theacropolismuseum name in this domain; together they ensure that theacropolismuseum.gr name is globally unique.

Additional Resources

Internet Architecture Board (IAB): https://www.iab.org

Internet Assigned Numbers Authority (IANA): https://www.iana.org

Internet Corporation for Assigned Names and Numbers (ICANN): https://www.icann.org

Internet Engineering Task Force (IETF): https://www.ietf.org

Number Resource Organization (representing the RIRs): http://www.nro.net

Internet Society IANA Transition Webpage: http://www.internetsociety.org/ianaxfer

The Internet Ecosystem and Shared Internet Resources: http://www.internetsociety.org/ecosystem

Shared Internet Resources

Learn more at: www.internetsociety.org/resources

Smooth operation of the Internet depends upon a **global, coordinated, community-driven** approach to managing key shared resources

ROLES

Policy >
Policies are the agreed upon rules developed through community-based processes by which shared Internet resources are managed.
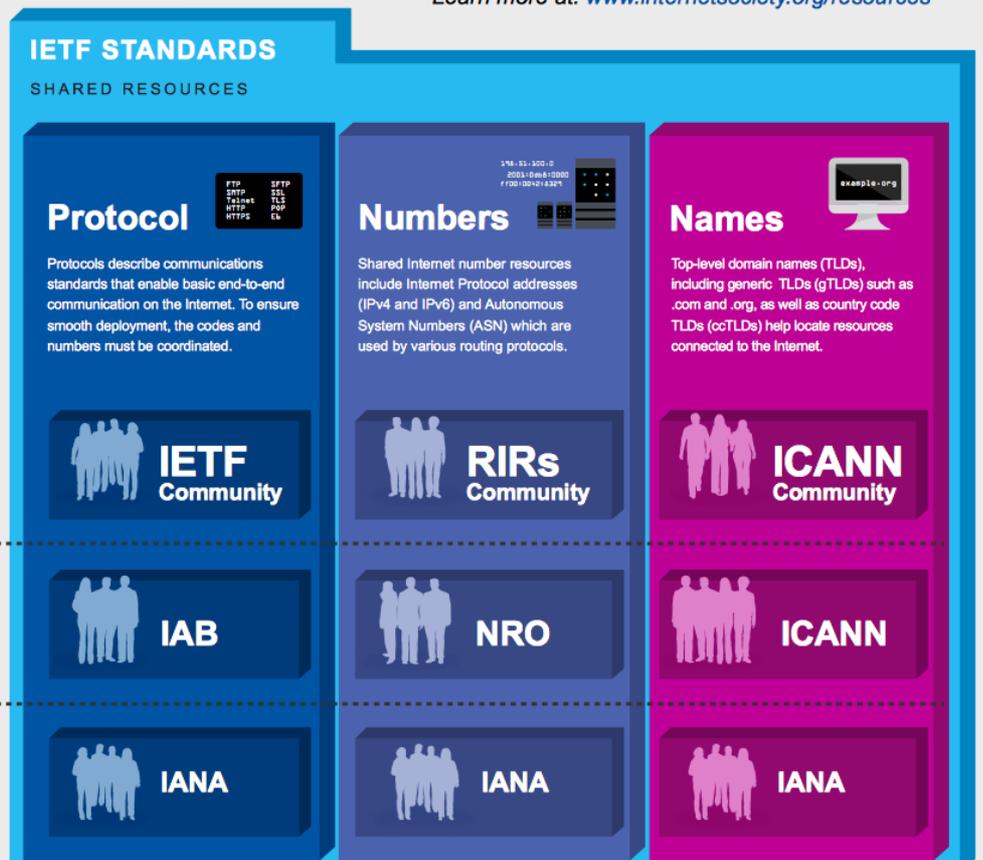
Oversight >
Oversight to ensure policies and implementation are aligned promotes the coherent long-term development and use of shared Internet resources.

Implementation >
Implementation of shared Internet resources in a neutral and responsible manner guided by the relevant policy and oversight processes.

Source: Internet community leaders' meeting in Miami, Florida, USA in February 2011

IETF STANDARDS
SHARED RESOURCES

Protocol
Protocols describe communications standards that enable basic end-to-end communication on the Internet. To ensure smooth deployment, the codes and numbers must be coordinated.

| IETF Community | IAB | IANA |

Numbers
Shared Internet number resources include Internet Protocol addresses (IPv4 and IPv6) and Autonomous System Numbers (ASN) which are used by various routing protocols.

| RIRs Community | NRO | IANA |

Names
Top-level domain names (TLDs), including generic TLDs (gTLDs) such as .com and .org, as well as country code TLDs (ccTLDs) help locate resources connected to the Internet.

| ICANN Community | ICANN | IANA |

This version of the document was published on 12 August 2014. Your input will improve this material. The Internet Society appreciates your questions and feedback to this document and may update this document accordingly. Please contact us at isoc@isoc.org.

gen-IANAexplained-201400812-en

Internet Society