       Internet Assigned Numbers Authority (IANA) Procedures for the Management
          of the Service Name and Transport Protocol Port Number Registry

Abstract

   This document defines the procedures that the Internet Assigned
   Numbers Authority (IANA) uses when handling assignment and other
   requests related to the Service Name and Transport Protocol Port
   Number registry. It also discusses the rationale and principles
   behind these procedures and how they facilitate the long-term
   sustainability of the registry.

   This document updates IANA's procedures by obsoleting the previous
   UDP and TCP port assignment procedures defined in Sections 8 and 9.1
   of the IANA Allocation Guidelines, and it updates the IANA service
   name and port assignment procedures for UDP-Lite, the Datagram
   Congestion Control Protocol (DCCP), and the Stream Control
   Transmission Protocol (SCTP). It also updates the DNS SRV
   specification to clarify what a service name is and how it is
   registered.

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/rfc6335.

Table of Contents

1. Introduction

   For many years, the assignment of new service names and port number
   values for use with the Transmission Control Protocol (TCP) [RFC0793]
   and the User Datagram Protocol (UDP) [RFC0768] has had less than
   clear guidelines. New transport protocols have been added -- the
   Stream Control Transmission Protocol (SCTP) [RFC4960] and the
   Datagram Congestion Control Protocol (DCCP) [RFC4342] -- and new
   mechanisms like DNS SRV records [RFC2782] have been developed, each
   with separate registries and separate guidelines. The community also
   recognized the need for additional procedures beyond just assignment;
   notably modification, revocation, and release.

   A key element of the procedural streamlining specified in this
   document is to establish identical assignment procedures for all IETF
   transport protocols. This document brings the IANA procedures for
   TCP and UDP in line with those for SCTP and DCCP, resulting in a
   single process that requesters and IANA follow for all requests for
   all transport protocols, including future protocols not yet defined.

   In addition to detailing the IANA procedures for the initial
   assignment of service names and port numbers, this document also
   specifies post-assignment procedures that until now have been handled
   in an ad hoc manner. These include procedures to de-assign a port
   number that is no longer in use, to take a port number assigned for
   one service that is no longer in use and reuse it for another
   service, and the procedure by which IANA can unilaterally revoke a
   prior port number assignment. Section 8 discusses the specifics of
   these procedures and processes that requesters and IANA follow for
   all requests for all current and future transport protocols.

   IANA is the authority for assigning service names and port numbers.
   The registries that are created to store these assignments are
   maintained by IANA. For protocols developed by IETF working groups,
   IANA now also offers a method for the "early assignment" [RFC4020] of
   service names and port numbers, as described in Section 8.1.

   This document updates IANA's procedures for UDP and TCP port numbers
   by obsoleting Sections 8 and 9.1 of the IANA Allocation Guidelines
   [RFC2780]. (Note that other sections of the IANA Allocation
   Guidelines, relating to the protocol field values in IPv4 headers,
   were also updated in February 2008 [RFC5237].) This document also
   updates the IANA assignment procedures for DCCP [RFC4340] [RFC5595]
   and SCTP [RFC4960].

The Lightweight User Datagram Protocol (UDP-Lite) shares the port
space with UDP. The UDP-Lite specification [RFC3828] says: "UDP-Lite
uses the same set of port number values assigned by the IANA for use
by UDP". An update of the UDP procedures therefore also results in a
corresponding update of the UDP-Lite procedures.

This document also clarifies what a service name is and how it is
assigned. This will impact the DNS SRV specification [RFC2782],
because that specification merely makes a brief mention that the
symbolic names of services are defined in "Assigned Numbers"
[RFC1700], without stating to which section it refers within that
230-page document. The DNS SRV specification may have been referring
to the list of Port Assignments (known as /etc/services on Unix), or
to the "Protocol And Service Names" section, or to both, or to some
other section. Furthermore, "Assigned Numbers" [RFC1700] has been
obsoleted [RFC3232] and has been replaced by on-line registries
[PORTREG] [PROTSERVREG].

The development of new transport protocols is a major effort that the
IETF does not undertake very often. If a new transport protocol is
standardized in the future, it is expected to follow these guidelines
and practices around using service names and port numbers as much as
possible, for consistency.

At the time of writing of this document, the internal procedures of
"Expert Review" teams, including that of IANA's port review team, are
not documented in any RFC and this document doesn't change that.

2. Motivation

Information about the assignment procedures for the port registry has
existed in three locations: the forms for requesting port number
assignments on the IANA web site [SYSFORM] [USRFORM], an introductory
text section in the file listing the port number assignments
themselves (known as the port numbers registry) [PORTREG], and two
brief sections of the IANA Allocation Guidelines [RFC2780].

Similarly, the procedures surrounding service names have been
historically unclear. Service names were originally created as
mnemonic identifiers for port numbers without a well-defined syntax,
apart from the 14-character limit mentioned on the IANA website
[SYSFORM] [USRFORM]. Even that length limit has not been
consistently applied, and some assigned service names are 15
characters long. When service identification via DNS SRV Resource
Records (RRs) was introduced [RFC2782], it became useful to start
assigning service names alone, and because IANA had no procedure for
assigning a service name without an associated port number, this led

   to the creation of an informal temporary service name registry
   outside of the control of IANA, which now contains roughly 500
   service names [SRVREG].

   This document aggregates all this scattered information into a single
   reference that aligns and clearly defines the management procedures
   for both service names and port numbers. It gives more detailed
   guidance to prospective requesters of service names and ports than
   the existing documentation, and it streamlines the IANA procedures
   for the management of the registry, so that requests can be completed
   in a timely manner.

   This document defines rules for assignment of service names without
   associated port numbers, for such usages as DNS SRV records
   [RFC2782], which was not possible under the previous IANA procedures.
   The document also merges service name assignments from the non-IANA
   ad hoc registry [SRVREG] and from the IANA Protocol and Service Names
   registry [PROTSERVREG] into the IANA Service Name and Transport
   Protocol Port Number registry [PORTREG], which from here on is the
   single authoritative registry for service names and port numbers.

   An additional purpose of this document is to describe the principles
   that guide the IETF and IANA in their role as the long-term joint
   stewards of the service name and port number registry. TCP and UDP
   have had remarkable success over the last decades. Thousands of
   applications and application-level protocols have service names and
   port numbers assigned for their use, and there is every reason to
   believe that this trend will continue into the future. It is hence
   extremely important that management of the registry follow principles
   that ensure its long-term usefulness as a shared resource. Section 7
   discusses these principles in detail.

3. Background

   The Transmission Control Protocol (TCP) [RFC0793] and the User
   Datagram Protocol (UDP) [RFC0768] have enjoyed a remarkable success
   over the decades as the two most widely used transport protocols on
   the Internet. They have relied on the concept of "ports" as logical
   entities for Internet communication. Ports serve two purposes:
   first, they provide a demultiplexing identifier to differentiate
   transport sessions between the same pair of endpoints, and second,
   they may also identify the application protocol and associated
   service to which processes connect. Newer transport protocols, such
   as the Stream Control Transmission Protocol (SCTP) [RFC4960] and the
   Datagram Congestion Control Protocol (DCCP) [RFC4342], have also
   adopted the concept of ports for their communication sessions and use
   16-bit port numbers in the same way as TCP and UDP (and UDP-Lite
   [RFC3828], a variant of UDP).

Port numbers are the original and most widely used means for
application and service identification on the Internet. Ports are
16-bit numbers, and the combination of source and destination port
numbers together with the IP addresses of the communicating end
systems uniquely identifies a session of a given transport protocol.
Port numbers are also known by their associated service names such as
"telnet" for port number 23 and "http" (as well as "www" and
"www-http") for port number 80.

All involved parties -- hosts running services, hosts accessing
services on other hosts, and intermediate devices (such as firewalls
and NATs) that restrict services -- need to agree on which service
corresponds to a particular destination port. Although this is
ultimately a local decision with meaning only between the endpoints
of a connection, it is common for many services to have a default
port upon which those servers usually listen, when possible, and
these ports are recorded by the Internet Assigned Numbers Authority
(IANA) through the service name and port number registry [PORTREG].

Over time, the assumption that a particular port number necessarily
implies a particular service may become less true. For example,
multiple instances of the same service on the same host cannot
generally listen on the same port, and multiple hosts behind the same
NAT gateway cannot all have a mapping for the same port on the
external side of the NAT gateway, whether using static port mappings
configured by hand by the user, or dynamic port mappings configured
automatically using a port mapping protocol like the NAT Port Mapping
Protocol [NAT-PMP] or Internet Gateway Device [IGD].

Applications may use port numbers directly, look up port numbers
based on service names via system calls such as getservbyname() on
UNIX, look up port numbers by performing queries for DNS SRV records
[RFC2782] [DNS-SD], or determine port numbers in a variety of other
ways like the TCP Port Service Multiplexer (TCPMUX) [RFC1078].

Designers of applications and application-level protocols may apply
to IANA for an assigned service name and port number for a specific
application, and may -- after assignment -- assume that no other
application will use that service name or port number for its
communication sessions. Application designers also have the option
of requesting only an assigned service name without a corresponding
fixed port number if their application does not require one, such as
applications that use DNS SRV records to look up port numbers
dynamically at run-time. Because the port number space is finite
(and therefore conservation is an important goal), the alternative of
using service names instead of port numbers is RECOMMENDED whenever
possible.

4. Conventions Used in This Document

   The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT",
   "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and
   "OPTIONAL" in this document are to be interpreted as described in
   "Key words for use in RFCs to Indicate Requirement Levels" [RFC2119].

   This document uses the term "assignment" to refer to the procedure by
   which IANA provides service names and/or port numbers to requesting
   parties; other RFCs refer to this as "allocation" or "registration".
   This document assumes that all these terms have the same meaning, and
   will use terms other than "assignment" only when quoting from or
   referring to text in these other documents.

5. Service Names

   Service names are the unique key in the Service Name and Transport
   Protocol Port Number registry. This unique symbolic name for a
   service may also be used for other purposes, such as in DNS SRV
   records [RFC2782]. Within the registry, this unique key ensures that
   different services can be unambiguously distinguished, thus
   preventing name collisions and avoiding confusion about who is the
   Assignee for a particular entry.

   There may be more than one service name associated with a particular
   transport protocol and port. There are three ways that such port
   number overloading can occur:

   o Overloading occurs when one service is an extension of another
      service, and an in-band mechanism exists for determining if the
      extension is present or not. One example is port 3478, which has
      the service name aliases "stun" and "turn". Traversal Using
      Relays around NAT (TURN) [RFC5766] is an extension to the Session
      Traversal Utilities for NAT (STUN) [RFC5389] service. TURN-
      enabled clients wishing to locate TURN servers could attempt to
      discover "stun" services and then check in-band if the server also
      supports TURN, but this would be inefficient. Enabling them to
      directly query for "turn" servers by name is a better approach.
      (Note that TURN servers in this case should also be locatable via
      a "stun" discovery, because every TURN server is also a STUN
      server.)

   o By historical accident, the service name "http" has two synonyms
      "www" and "www-http". When used in SRV records [RFC2782] and
      similar service discovery mechanisms, only the service name "http"
      should be used, not these additional names. If a server were to
      advertise "www", it would not be discovered by clients browsing
      for "http". Advertising or browsing for the aliases as well as

the primary service name is inefficient, and achieves nothing that
is not already achieved by using the service name "http"
exclusively.

o As indicated in this document in Section 10.1, overloading has
   been used to create replacement names that are consistent with the
   syntax this document prescribes for legacy names that do not
   conform to this syntax already. For such cases, only the new name
   should be used in SRV records, to avoid the same issues as with
   historical cases of multiple names, and also because the legacy
   names are incompatible with SRV record use.

Assignment requests for new names for existing registered services
will be rejected, as a result. Implementers are requested to inform
IANA if they discover other cases where a single service has multiple
names, so that one name may be recorded as the primary name for
service discovery purposes.

Service names are assigned on a "first come, first served" basis, as
described in Section 8.1. Names should be brief and informative,
avoiding words or abbreviations that are redundant in the context of
the registry (e.g., "port", "service", "protocol", etc.) Names
referring to discovery services, e.g., using multicast or broadcast
to identify endpoints capable of a given service, SHOULD use an
easily identifiable suffix (e.g., "-disc").

5.1. Service Name Syntax

Valid service names are hereby normatively defined as follows:

o MUST be at least 1 character and no more than 15 characters long

o MUST contain only US-ASCII [ANSI.X3.4-1986] letters 'A' - 'Z' and
   'a' - 'z', digits '0' - '9', and hyphens ('-', ASCII 0x2D or
   decimal 45)

o MUST contain at least one letter ('A' - 'Z' or 'a' - 'z')

o MUST NOT begin or end with a hyphen

o hyphens MUST NOT be adjacent to other hyphens

The reason for requiring at least one letter is to avoid service
names like "23" (could be confused with a numeric port) or "6000-
6063" (could be confused with a numeric port range). Although
service names may contain both upper-case and lower-case letters,
case is ignored for comparison purposes, so both "http" and "HTTP"
denote the same service.

Service names are purely opaque identifiers, and no semantics are
implied by any superficial structure that a given service name may
appear to have. For example, a company called "Example" may choose
to register service names "Example-Foo" and "Example-Bar" for its
"Foo" and "Bar" products, but the "Example" company cannot claim to
"own" all service names beginning with "Example-"; they cannot
prevent someone else from registering "Example-Baz" for a different
service, and they cannot prevent other developers from using the
"Example-Foo" and "Example-Bar" service types in order to
interoperate with the "Foo" and "Bar" products. Technically
speaking, in service discovery protocols, service names are merely a
series of byte values on the wire; for the mnemonic convenience of
human developers, it can be convenient to interpret those byte values
as human-readable ASCII characters, but software should treat them as
purely opaque identifiers and not attempt to parse them for any
additional embedded meaning.

As of August 5, 2009, approximately 98% of the so-called "Short
Names" [SYSFORM] [USRFORM] for existing port number assignments
[PORTREG] already met the rules for legal service names stated in
Section 8.1, and hence for these services their service name is
exactly the same as their historical "Short Name". In approximately
2% of cases, the new "service name" is derived based on the old
"Short Name" as described below in Section 10.1.

The rules for valid service names, excepting the limit of 15
characters maximum, are also expressed below (as a non-normative
convenience) using ABNF [RFC5234].

```
SRVNAME = *(1*DIGIT [HYPHEN]) ALPHA *([HYPHEN] ALNUM)
ALNUM   = ALPHA / DIGIT      ; A-Z, a-z, 0-9
HYPHEN  = %x2D               ; "-"
ALPHA   = %x41-5A / %x61-7A ; A-Z / a-z [RFC5234]
DIGIT   = %x30-39            ; 0-9       [RFC5234]
```

5.2. Service Name Usage in DNS SRV Records

The DNS SRV specification [RFC2782] states that the Service Label
part of the owner name of a DNS SRV record includes a "Service"
element, described as "the symbolic name of the desired service", but
as discussed above, it is not clear precisely what this means.

This document clarifies that the Service Label MUST be a service name
as defined herein with an underscore prepended. The service name
SHOULD be registered with IANA and recorded in the Service Name and
Transport Protocol Port Number registry [PORTREG].

   The details of using Service Names in SRV Service Labels are
   specified in the DNS SRV specification [RFC2782].

6. Port Number Ranges

   TCP, UDP, UDP-Lite, SCTP, and DCCP use 16-bit namespaces for their
   port number registries. The port registries for all of these
   transport protocols are subdivided into three ranges of numbers
   [RFC1340], and Section 8.1.2 describes the IANA procedures for each
   range in detail:

   o the System Ports, also known as the Well Known Ports, from 0-1023
      (assigned by IANA)

   o the User Ports, also known as the Registered Ports, from 1024-
      49151 (assigned by IANA)

   o the Dynamic Ports, also known as the Private or Ephemeral Ports,
      from 49152-65535 (never assigned)

   Of the assignable port ranges (System Ports and User Ports, i.e.,
   port numbers 0-49151), individual port numbers are in one of three
   states at any given time:

   o Assigned: Assigned port numbers are currently assigned to the
      service indicated in the registry.

   o Unassigned: Unassigned port numbers are currently available for
      assignment upon request, as per the procedures outlined in this
      document.

   o Reserved: Reserved port numbers are not available for regular
      assignment; they are "assigned to IANA" for special purposes.
      Reserved port numbers include values at the edges of each range,
      e.g., 0, 1023, 1024, etc., which may be used to extend these
      ranges or the overall port number space in the future.

   In order to keep the size of the registry manageable, IANA typically
   only records the Assigned and Reserved service names and port numbers
   in the registry. Unassigned values are typically not explicitly
   listed. (There are very many Unassigned service names and
   enumerating them all would not be practical.)

   As a data point, when this document was written, approximately 76% of
   the TCP and UDP System Ports were assigned, and approximately 9% of
   the User Ports were assigned. (As noted, Dynamic Ports are never
   assigned.)

6.1. Service Names and Port Numbers for Experimentation

   Of the System Ports, two TCP and UDP port numbers (1021 and 1022),
   together with their respective service names ("exp1" and "exp2"),
   have been assigned for experimentation with new applications and
   application-layer protocols that require a port number in the
   assigned ports range [RFC4727].

   Please refer to Sections 1 and 1.1 of "Assigning Experimental and
   Testing Numbers Considered Useful" [RFC3692] for how these
   experimental port numbers are to be used.

   This document assigns the same two service names and port numbers for
   experimentation with new application-layer protocols over SCTP and
   DCCP in Section 10.2.

   Unfortunately, it can be difficult to limit access to these ports.
   Users SHOULD take measures to ensure that experimental ports are
   connecting to the intended process. For example, users of these
   experimental ports might include a 64-bit nonce, once on each segment
   of a message-oriented channel (e.g., UDP), or once at the beginning
   of a byte-stream (e.g., TCP), which is used to confirm that the port
   is being used as intended. Such confirmation of intended use is
   especially important when these ports are associated with privileged
   (e.g., system or administrator) processes.

7. Principles for Service Name and Transport Protocol Port Number
     Registry Management

   Management procedures for the Service Name and Transport Protocol
   Port Number registry include assignment of service names and port
   numbers upon request, as well as management of information about
   existing assignments. The latter includes maintaining contact and
   description information about assignments, revoking abandoned
   assignments, and redefining assignments when needed. Of these
   procedures, careful port number assignment is most critical, in order
   to continue to conserve the remaining port numbers.

   As noted earlier, only about 9% of the User Port space is currently
   assigned. The current rate of assignment is approximately 400 ports
   per year, and has remained steady for the past 8 years. At that
   rate, if similar conservation continues, this resource will sustain
   another 85 years of assignment - without the need to resort to
   reassignment of released values or revocation. The namespace
   available for service names is much larger, which allows for simpler
   management procedures.

7.1. Past Principles

   The principles for service name and port number management are based
   on the recommendations of the IANA "Expert Review" team. Until
   recently, that team followed a set of informal guidelines developed
   based on the review experience from previous assignment requests.
   These original guidelines, although informal, had never been publicly
   documented. They are recorded here for historical purposes only; the
   current guidelines are described in Section 7.2. These guidelines
   previously were:

   o TCP and UDP ports were simultaneously assigned when either was
      requested

   o Port numbers were the primary assignment; service names were
      informative only, and did not have a well-defined syntax

   o Port numbers were conserved informally, and sometimes
      inconsistently (e.g., some services were assigned ranges of many
      port numbers even where not strictly necessary)

   o SCTP and DCCP service name and port number registries were managed
      separately from the TCP/UDP registries

   o Service names could not be assigned in the old ports registry
      without assigning an associated port number at the same time

7.2. Updated Principles

   This section summarizes the current principles by which IANA both
   handles the Service Name and Transport Protocol Port Number registry
   and attempts to conserve the port number space. This description is
   intended to inform applicants requesting service names and port
   numbers. IANA has flexibility beyond these principles when handling
   assignment requests; other factors may come into play, and exceptions
   may be made to best serve the needs of the Internet. Applicants
   should be aware that IANA decisions are not required to be bound to
   these principles. These principles and general advice to users on
   port use are expected to change over time.

   IANA strives to assign service names that do not request an
   associated port number assignment under a simple "First Come First
   Served" policy [RFC5226]. IANA MAY, at its discretion, refer service
   name requests to "Expert Review" in cases of mass assignment requests
   or other situations where IANA believes "Expert Review" is advisable
   [RFC5226]; use of the "Expert Review" helps advise IANA informally in
   cases where "IETF Review" or "IESG Approval" is used, as with most
   IETF protocols.

The basic principle of service name and port number registry
management is to conserve use of the port space where possible.
Extensions to support larger port number spaces would require
changing many core protocols of the current Internet in a way that
would not be backward compatible and interfere with both current and
legacy applications.

Conservation of the port number space is required because this space
is a limited resource, so applications are expected to participate in
the traffic demultiplexing process where feasible. The port numbers
are expected to encode as little information as possible that will
still enable an application to perform further demultiplexing by
itself. In particular, the principles form a goal that IANA strives
to achieve for new applications (with exceptions as deemed
appropriate, especially as for extensions to legacy services) as
follows:

o IANA strives to assign only one assigned port number per service
   or application.

   Note: At the time of writing of this document, there is no IETF
   consensus on when it is appropriate to use a second port for an
   insecure version of a protocol.

o IANA strives to assign only one assigned port number for all
   variants of a service (e.g., for updated versions of a service).

o IANA strives to encourage the deployment of secure protocols.

o IANA strives to assign only one assigned port number for all
   different types of devices using or participating in the same
   service.

o IANA strives to assign port numbers only for the transport
   protocol(s) explicitly named in an assignment request.

o IANA may recover unused port numbers, via the new procedures of
   de-assignment, revocation, and transfer.

Where possible, a given service is expected to demultiplex messages
if necessary. For example, applications and protocols are expected
to include in-band version information, so that future versions of
the application or protocol can share the same assigned port.
Applications and protocols are also expected to be able to
efficiently use a single assigned port for multiple sessions, either
by demultiplexing multiple streams within one port or by using the
assigned port to coordinate using dynamic ports for subsequent
exchanges (e.g., in the spirit of FTP [RFC0959]).

Ports are used in various ways, notably:

o as endpoint process identifiers

o as application protocol identifiers

o for firewall-filtering purposes

Both the process-identifier and the protocol-identifier uses suggest
that anything a single process can demultiplex, or that can be
encoded into a single protocol, should be. The firewall-filtering
use suggests that some uses that could be multiplexed or encoded
could instead be separated to allow for easier firewall management.
Note that this latter use is much less sound, because port numbers
have meaning only for the two endpoints involved in a connection, and
drawing conclusions about the service that generated a given flow
based on observed port numbers is not always reliable.

Effective with the publication of this document, IANA will begin
assigning port numbers for only those transport protocols explicitly
included in an assignment request. This ends the long-standing
practice of automatically assigning a port number to an application
for both TCP and UDP, even if the request is for only one of these
transport protocols. The new assignment procedure conserves
resources by assigning a port number to an application for only those
transport protocols (TCP, UDP, SCTP, and/or DCCP) it actually uses.
The port number will be marked as Reserved -- instead of Assigned --
in the port number registries of the other transport protocols. When
applications start supporting the use of some of those additional
transport protocols, the Assignee for the assignment MUST request
that IANA convert these reserved ports into assignments. An
application MUST NOT assume that it can use a port number assigned to
it for use with one transport protocol with another transport
protocol without IANA converting the reservation into an assignment.

When the available pool of unassigned numbers has run out in a port
range, it will be necessary for IANA to consider the Reserved ports
for assignment. This is part of the motivation for not automatically
assigning ports for transport protocols other than the requested
one(s). This will allow more ports to be available for assignment at
that point. To help conserve ports, application developers SHOULD
request assignment of only those transport protocols that their
application currently uses.

Conservation of port numbers is improved by procedures that allow
previously assigned port numbers to become Unassigned, either through
de-assignment or through revocation, and by a procedure that lets
application designers transfer an assigned but unused port number to

a new application. Section 8 describes these procedures, which until
now were undocumented. Port number conservation is also improved by
recommending that applications that do not require an assigned port
should register only a service name without an associated port
number.

8. IANA Procedures for Managing the Service Name and Transport Protocol
    Port Number Registry

   This section describes the process for handling requests associated
   with IANA's management of the Service Name and Transport Protocol
   Port Number registry. Such requests include initial assignment, de-
   assignment, reuse, and updates to the contact information or
   description associated with an assignment. Revocation is an
   additional process, initiated by IANA.

8.1. Service Name and Port Number Assignment

   Assignment refers to the process of providing service names or port
   numbers to applicants. All such assignments are made from service
   names or port numbers that are Unassigned or Reserved at the time of
   the assignment.

   o Unassigned names and numbers are assigned according to the rules
      described in Section 8.1.2 below.

   o Reserved numbers and names are generally only assigned by a
      "Standards Action" or "IESG Approval", and MUST be accompanied by
      a statement explaining the reason a Reserved number or name is
      appropriate for this action. The only exception to this rule is
      that the current Assignee of a port number MAY request the
      assignment of the corresponding Reserved port number for other
      transport protocols when needed. IANA will initiate an "Expert
      Review" [RFC5226] for such requests.

   When an assignment for one or more transport protocols is approved,
   the port number for any non-requested transport protocol(s) will be
   marked as Reserved. IANA SHOULD NOT assign that port number to any
   other application or service until no other port numbers remain
   Unassigned in the requested range. It is anticipated that at such
   time a new document will be published specifying IANA procedures for
   assignment of such ports.

8.1.1. General Assignment Procedure

   A service name or port number assignment request contains the
   following information. The service name is the unique identifier of
   a given service:

      Service Name (REQUIRED)
      Transport Protocol(s) (REQUIRED)
      Assignee (REQUIRED)
      Contact (REQUIRED)
      Description (REQUIRED)
      Reference (REQUIRED)
      Port Number (OPTIONAL)
      Service Code (REQUIRED for DCCP only)
      Known Unauthorized Uses (OPTIONAL)
      Assignment Notes (OPTIONAL)

   o Service Name: A desired unique service name for the service
      associated with the assignment request MUST be provided. This
      name may be used with various service selection and discovery
      mechanisms (including, but not limited to, DNS SRV records
      [RFC2782]). The name MUST be compliant with the syntax defined in
      Section 5.1. In order to be unique, they MUST NOT be identical to
      any currently assigned service name in the IANA registry
      [PORTREG]. Service names are case-insensitive; they may be
      provided and entered into the registry with mixed case for
      clarity, but case is ignored otherwise.

   o Transport Protocol(s): The transport protocol(s) for which an
      assignment is requested MUST be provided. This field is currently
      limited to one or more of TCP, UDP, SCTP, and DCCP. Requests
      without any port assignment and only a service name are still
      required to indicate which protocol the service uses.

   o Assignee: Name and email address of the party to whom the
      assignment is made. This is REQUIRED. The Assignee is the
      organization, company or individual person responsible for the
      initial assignment. For assignments done through RFCs published
      via the "IETF Document Stream" [RFC4844], the Assignee will be the
      IESG <iesg@ietf.org>.

   o Contact: Name and email address of the Contact person for the
      assignment. This is REQUIRED. The Contact person is the
      responsible person for the Internet community to send questions
      to. This person is also authorized to submit changes on behalf of
      the Assignee; in cases of conflict between the Assignee and the
      Contact, the Assignee decisions take precedence. Additional

address information MAY be provided. For assignments done through
RFCs published via the "IETF Document Stream" [RFC4844], the
Contact will be the IETF Chair <chair@ietf.org>.

o Description: A short description of the service associated with
   the assignment request is REQUIRED. It should avoid all but the
   most well-known acronyms.

o Reference: A description of (or a reference to a document
   describing) the protocol or application using this port. This is
   REQUIRED. The description must state whether the protocol uses
   IP-layer broadcast, multicast, or anycast communication.

   For assignments requesting only a Service Name, or a Service Name
   and User Port, a statement that the protocol is proprietary and
   not publicly documented is also acceptable, provided that the
   required information regarding the use of IP broadcast, multicast,
   or anycast is given.

   For any assignment request that includes a User Port, the
   assignment request MUST explain why a port number in the Dynamic
   Ports range (discovered by clients dynamically at run-time) is
   unsuitable for the given application.

   For any assignment request that includes a System Port, the
   assignment request MUST explain why a port number in the User
   Ports or Dynamic Ports ranges is unsuitable, and a reference to a
   stable protocol specification document MUST be provided.

   IANA MAY accept early assignment [RFC4020] requests (known as
   "early allocation" therein) from IETF working groups that
   reference a sufficiently stable Internet-Draft instead of a
   published Standards-Track RFC.

o Port Number: If assignment of a port number is desired, either the
   port number the requester suggests for assignment or indication of
   port range (user or system) MUST be provided. If only a service
   name is to be assigned, this field is left empty. If a specific
   port number is requested, IANA is encouraged to assign the
   requested number. If a range is specified, IANA will choose a
   suitable number from the User or System Ports ranges. Note that
   the applicant MUST NOT use the requested port in implementations
   deployed for use on the public Internet prior to the completion of
   the assignment, because there is no guarantee that IANA will
   assign the requested port.

   o Service Code: If the assignment request includes DCCP as a
      transport protocol, then the request MUST include a desired unique
      DCCP service code [RFC5595], and MUST NOT include a requested DCCP
      service code otherwise. Section 19.8 of the DCCP specification
      [RFC4340] defines requirements and rules for assignment, updated
      by this document. Note that, as per the DCCP Service Codes
      document [RFC5595], some service codes are not assigned; zero
      (absence of a meaningful service code) and 4294967295 (0xFFFFFFFF;
      invalid service code) are permanently reserved, and the Private
      service codes 1056964608-1073741823 (0x3F000000-0x3FFFFFFF; i.e.,
      32-bit values with the high-order byte equal to a value of 63
      (0x3F), corresponding to the ASCII character '?') are not
      centrally assigned.

   o Known Unauthorized Uses: A list of uses by applications or
      organizations who are not the Assignee. This is OPTIONAL. This
      list may be augmented by IANA after assignment when unauthorized
      uses are reported.

   o Assignment Notes: Indications of owner/name change, or any other
      assignment process issue. This is OPTIONAL. This list may be
      updated by IANA after assignment to help track changes to an
      assignment, e.g., de-assignment, owner/name changes, etc.

   If the assignment request is for the addition of a new transport
   protocol to a previously assigned service name and the requester is
   not the Assignee or Contact for the previously assigned service name,
   IANA needs to confirm with the Assignee for the existing assignment
   whether this addition is appropriate.

   If the assignment request is for a new service name sharing the same
   port as a previously assigned service name (see port number
   overloading in Section 5), IANA needs to confirm with the Assignee
   for the existing service name and other appropriate experts whether
   the overloading is appropriate.

   When IANA receives an assignment request -- containing the above
   information -- that is requesting a port number, IANA SHALL initiate
   an "Expert Review" [RFC5226] in order to determine whether an
   assignment should be made. For requests that are not seeking a port
   number, IANA SHOULD assign the service name under a simple "First
   Come First Served" policy [RFC5226].

8.1.2. Variances for Specific Port Number Ranges

   Section 6 describes the different port number ranges. It is
   important to note that IANA applies slightly different procedures
   when managing the different port ranges of the service name and port
   number registry:

   o Ports in the Dynamic Ports range (49152-65535) have been
      specifically set aside for local and dynamic use and cannot be
      assigned through IANA. Application software may simply use any
      dynamic port that is available on the local host, without any sort
      of assignment. On the other hand, application software MUST NOT
      assume that a specific port number in the Dynamic Ports range will
      always be available for communication at all times, and a port
      number in that range hence MUST NOT be used as a service
      identifier.

   o Ports in the User Ports range (1024-49151) are available for
      assignment through IANA, and MAY be used as service identifiers
      upon successful assignment. Because assigning a port number for a
      specific application consumes a fraction of the shared resource
      that is the port number registry, IANA will require the requester
      to document the intended use of the port number. For most IETF
      protocols, ports in the User Ports range will be assigned under
      the "IETF Review" or "IESG Approval" procedures [RFC5226] and no
      further documentation is required. Where these procedures do not
      apply, then the requester must input the documentation to the
      "Expert Review" procedure [RFC5226], by which IANA will have a
      technical expert review the request to determine whether to grant
      the assignment. Regardless of the path ("IETF Review", "IESG
      Approval", or "Expert Review"), the submitted documentation is
      expected to be the same, as described in this section, and MUST
      explain why using a port number in the Dynamic Ports range is
      unsuitable for the given application. Further, IANA MAY utilize
      the "Expert Review" process informally to inform their position in
      participating in "IETF Review" and "IESG Approval".

   o Ports in the System Ports range (0-1023) are also available for
      assignment through IANA. Because the System Ports range is both
      the smallest and the most densely assigned, the requirements for
      new assignments are more strict than those for the User Ports
      range, and will only be granted under the "IETF Review" or "IESG
      Approval" procedures [RFC5226]. A request for a System Port
      number MUST document *both* why using a port number from the
      Dynamic Ports range is unsuitable *and* why using a port number
      from the User Ports range is unsuitable for that application.

8.2. Service Name and Port Number De-Assignment

   The Assignee of a granted port number assignment can return the port
   number to IANA at any time if they no longer have a need for it. The
   port number will be de-assigned and will be marked as Reserved. IANA
   should not reassign port numbers that have been de-assigned until all
   unassigned port numbers in the specific range have been assigned.

   Before proceeding with a port number de-assignment, IANA needs to
   reasonably establish that the value is actually no longer in use.

   Because there is much less danger of exhausting the service name
   space compared to the port number space, it is RECOMMENDED that a
   given service name remain assigned even after all associated port
   number assignments have become de-assigned. Under this policy, it
   will appear in the registry as if it had been created through a
   service name assignment request that did not include any port
   numbers.

   On rare occasions, it may still be useful to de-assign a service
   name. In such cases, IANA will mark the service name as Reserved.
   IANA will involve their IESG-appointed expert in such cases.

   IANA will include a comment in the registry when de-assignment
   happens to indicate its historic usage.

8.3. Service Name and Port Number Reuse

   If the Assignee of a granted port number assignment no longer has a
   need for the assigned number, but would like to reuse it for a
   different application, they can submit a request to IANA to do so.

   Logically, port number reuse is to be thought of as a de-assignment
   (Section 8.2) followed by an immediate (re-)assignment (Section 8.1)
   of the same port number for a new application. Consequently, the
   information that needs to be provided about the proposed new use of
   the port number is identical to what would need to be provided for a
   new port number assignment for the specific ports range.

   Because there is much less danger of exhausting the service name
   space compared to the port number space, it is RECOMMENDED that the
   original service name associated with the prior use of the port
   number remains assigned, and a new service name be created and
   associated with the port number. This is again consistent with
   viewing a reuse request as a de-assignment followed by an immediate
   (re-)assignment. Reusing an assigned service name for a different
   application is NOT RECOMMENDED.

IANA needs to carefully review such requests before approving them.
In some instances, the Expert Reviewer will determine that the
application the port number was assigned to has found usage beyond
the original Assignee, or that there is a concern that it may have
such users. This determination MUST be made quickly. A community
call concerning revocation of a port number (see below) MAY be
considered, if a broader use of the port number is suspected.

8.4. Service Name and Port Number Revocation

   A port number revocation can be thought of as an IANA-initiated de-
   assignment (Section 8.2), and has exactly the same effect on the
   registry.

   Sometimes, it will be clear that a specific port number is no longer
   in use and that IANA can revoke it and mark it as Reserved. At other
   times, it may be unclear whether a given assigned port number is
   still in use somewhere in the Internet. In those cases, IANA must
   carefully consider the consequences of revoking the port number, and
   SHOULD only do so if there is an overwhelming need.

   With the help of their IESG-appointed Expert Reviewer, IANA SHALL
   formulate a request to the IESG to issue a four-week community call
   concerning the pending port number revocation. The IESG and IANA,
   with the Expert Reviewer's support, SHALL determine promptly after
   the end of the community call whether revocation should proceed, and
   then communicate their decision to the community. This procedure
   typically involves similar steps to de-assignment except that it is
   initiated by IANA.

   Because there is much less danger of exhausting the service name
   space compared to the port number space, revoking service names is
   NOT RECOMMENDED.

8.5. Service Name and Port Number Transfers

   The value of service names and port numbers is defined by their
   careful management as a shared Internet resource, whereas enabling
   transfer allows the potential for associated monetary exchanges. As
   a result, the IETF does not permit service name or port number
   assignments to be transferred between parties, even when they are
   mutually consenting.

   The appropriate alternate procedure is a coordinated de-assignment
   and assignment: The new party requests the service name or port
   number via an assignment and the previous party releases its
   assignment via the de-assignment procedure outlined above.

   With the help of their IESG-appointed Expert Reviewer, IANA SHALL
   carefully determine if there is a valid technical, operational, or
   managerial reason to grant the requested new assignment.

8.6. Maintenance Issues

   In addition to the formal procedures described above, updates to the
   Description and Contact information are coordinated by IANA in an
   informal manner, and may be initiated by either the Assignee or by
   IANA, e.g., by the latter requesting an update to current Contact
   information. (Note that the Assignee cannot be changed as a separate
   procedure; see instead Section 8.5 above.)

8.7. Disagreements

   In the case of disagreements around any request, there is the
   possibility of appeal following the normal appeals process for IANA
   assignments as defined by Section 7 of "Guidelines for Writing an
   IANA Considerations Section in RFCs" [RFC5226].

9. Security Considerations

   The IANA guidelines described in this document do not change the
   security properties of UDP, TCP, SCTP, or DCCP.

   Assignment of a service name or port number does not in any way imply
   an endorsement of an application or product, and the fact that
   network traffic is flowing to or from an assigned port number does
   not mean that it is "good" traffic, or even that it is used by the
   assigned service. Firewall and system administrators should choose
   how to configure their systems based on their knowledge of the
   traffic in question, not based on whether or not there is an assigned
   service name or port number.

   Services are expected to include support for security, either as
   default or dynamically negotiated in-band. The use of separate
   service name or port number assignments for secure and insecure
   variants of the same service is to be avoided in order to discourage
   the deployment of insecure services.

10. IANA Considerations

   This document obsoletes Sections 8 and 9.1 of the March 2000 IANA
   Allocation Guidelines [RFC2780].

   Upon approval of this document for publication as an RFC, IANA worked
   with Stuart Cheshire, maintainer of the independent service name
   registry [SRVREG], to merge the contents of that private registry
   into the official IANA registry. The independent registry web page
   has been updated with pointers to the IANA registry and to this RFC.

   IANA created a new service name entry in the service name and port
   number registry [PORTREG] for all entries in the Protocol and Service
   Names registry [PROTSERVREG] that did not already have one assigned.

   IANA also indicates in the Assignment Notes for "www" and "www-http"
   that they are duplicate terms that refer to the "http" service, and
   should not be used for discovery purposes. For this conceptual
   service (human-readable web pages served over HTTP), the correct
   service name to use for service discovery purposes is "http" (see
   Section 5).

10.1. Service Name Consistency

   Section 8.1 defines which character strings are well-formed service
   names, which until now had not been clearly defined. The definition
   in Section 8.1 was chosen to allow maximum compatibility of service
   names with current and future service discovery mechanisms.

   As of August 5, 2009, approximately 98% of the so-called "Short
   Names" from existing port number assignments [PORTREG] met the rules
   for legal service names stated in Section 8.1, and hence for these
   services their service name is exactly the same as their "Short
   Name".

   The remaining approximately 2% of the existing "Short Names" are not
   suitable to be used directly as well-formed service names because
   they contain illegal characters such as asterisks, dots, pluses,
   slashes, or underscores. All existing "Short Names" conform to the
   length requirement of 15 characters or fewer. For these 96
   unsuitable "Short Names", listed in the table below, the service name
   is the Short Name with any illegal characters replaced by hyphens.
   IANA added an entry to the registry that uses the new well-formed
   primary service name for the existing service and that otherwise
   duplicates the original assignment information. In the description
   field of this new entry giving the primary service name, IANA
   recorded that it has assigned a well-formed service name for the
   previous service and references the original assignment. In the

   Assignment Notes field of the original assignment, IANA added a note
   that this entry is an alias to the new well-formed service name, and
   that the old service name is historic, not usable for use with many
   common service discovery mechanisms.

   96 names containing illegal characters to be replaced by hyphens:

```
+----------------+----------------+----------------+
| 914c/g         | acmaint_dbd    | acmaint_transd |
| atex_elmd      | avanti_cdp     | badm_priv      |
| badm_pub       | bdir_priv      | bdir_pub       |
| bmc_ctd_ldap   | bmc_patroldb   | boks_clntd     |
| boks_servc     | boks_servm     | broker_service |
| bues_service   | canit_store    | cedros_fds     |
| cl/1           | contamac_icm   | corel_vncadmin |
| csc_proxy      | cvc_hostd      | dbcontrol_agent|
| dec_dlm        | dl_agent       | documentum_s   |
| dsmeter_iatc   | dsx_monitor    | elpro_tunnel   |
| elvin_client   | elvin_server   | encrypted_admin|
| erunbook_agent | erunbook_server| esri_sde       |
| EtherNet/IP-1  | EtherNet/IP-2  | event_listener |
| flr_agent      | gds_db         | ibm_wrless_lan |
| iceedcp_rx     | iceedcp_tx     | iclcnet_svinfo |
| idig_mux       | ife_icorp      | instl_bootc    |
| instl_boots    | intel_rci      | interhdl_elmd  |
| lan900_remote  | LiebDevMgmt_A  | LiebDevMgmt_C  |
| LiebDevMgmt_DM | mapper-ws_ethd | matrix_vnet    |
| mdbs_daemon    | menandmice_noh | msl_lmd        |
| nburn_id       | ncr_ccl        | nds_sso        |
| netmap_lm      | nms_topo_serv  | notify_srvr    |
| novell-lu6.2   | nuts_bootp     | nuts_dem       |
| ocs_amu        | ocs_cmu        | pipe_server    |
| pra_elmd       | printer_agent  | redstorm_diag  |
| redstorm_find  | redstorm_info  | redstorm_join  |
| resource_mgr   | rmonitor_secure| rsvp_tunnel    |
| sai_sentlm     | sge_execd      | sge_qmaster    |
| shiva_confsrvr | sql*net        | srvc_registry  |
| stm_pproc      | subntbcst_tftp | udt_os         |
| universe_suite | veritas_pbx    | vision_elmd    |
| vision_server  | wrs_registry   | z39.50         |
+----------------+----------------+----------------+
```

   In addition to the 96 names listed above, the service name for
   "whois++" is "whoispp", following the example set by the
   "application/whoispp-query" MIME Content-Type [RFC2957].

There were four names recorded in IANA's Port Number Registry
[PORTREG] that conflicted with names previously recorded in the ad
hoc SRV name registry [SRVREG]: esp, hydra, recipe, and xmp.

The name conflicts were resolved amicably:

The IANA Port Number Registry Short Name "esp" had been registered by
Andrew Chernow, and he informed the authors that the port was no
longer in use and the registration was no longer required. The SRV
registry entry for "esp" remains in effect.

The SRV name "hydra" for SubEthaEdit had already been retired in
favor of the new SRV name "see". The IANA Port Number Registry entry
for "hydra" remains in effect.

The SRV name "recipe" was in use in an open source project that had
not yet been packaged for distribution, and the registrant Daniel
Taylor was willing to change to a different service name. Thanks to
Daniel Taylor for accommodating this change. The IANA Port Number
Registry entry for "recipe" remains in effect.

The IANA Port Number Registry Short Name "xmp" had been registered by
Bobby Krupczak, but since his registration included an assigned port
number (which is still in use and remains unaffected by this change),
he was willing to switch to a different service name. Thanks to
Bobby Krupczak for accommodating this change. The SRV registry entry
for "xmp" remains in effect.

10.2. Port Numbers for SCTP and DCCP Experimentation

Two System UDP and TCP ports, 1021 and 1022, have been reserved for
experimental use [RFC4727]. This document assigns the same port
numbers for SCTP and DCCP, updates the TCP and UDP assignments, and
also instructs IANA to automatically assign these two port numbers
for any future transport protocol with a similar 16-bit port number
namespace.

Note that these port numbers are meant for temporary experimentation
and development in controlled environments. Before using these port
numbers, carefully consider the advice in Section 6.1 in this
document, as well as in Sections 1 and 1.1 of "Assigning Experimental
and Testing Numbers Considered Useful" [RFC3692]. Most importantly,
application developers must request a permanent port number
assignment from IANA as described in Section 8.1 before any kind of
non-experimental deployment.

```
+-------------------+----------------------------+
| Service Name      | exp1                       |
| Transport Protocol | DCCP, SCTP, TCP, UDP      |
| Assignee          | IESG <iesg@ietf.org>       |
| Contact           | IETF Chair <chair@ietf.org> |
| Description       | RFC3692-style Experiment 1 |
| Reference         | [RFC4727] [RFC6335]        |
| Port Number       | 1021                       |
+-------------------+----------------------------+


+-------------------+----------------------------+
| Service Name      | exp2                       |
| Transport Protocol | DCCP, SCTP, TCP, UDP      |
| Assignee          | IESG <iesg@ietf.org>       |
| Contact           | IETF Chair <chair@ietf.org> |
| Description       | RFC3692-style Experiment 2 |
| Reference         | [RFC4727] [RFC6335]        |
| Port Number       | 1022                       |
+-------------------+----------------------------+
```

10.3. Updates to DCCP Registries

   This document updates the IANA assignment procedures for the DCCP
   Port Number and DCCP Service Codes Registries [RFC4340].

10.3.1. DCCP Service Code Registry

   Service codes are assigned on a "first come, first served" basis
   according to Section 19.8 of the DCCP specification [RFC4340]. This
   document updates that section by extending the guidelines given there
   in the following ways:

   o IANA MAY assign new service codes without seeking "Expert Review"
      using their discretion, but SHOULD seek "Expert Review" if a
      request asks for more than five service codes.

   o IANA should feel free to contact the DCCP Expert Reviewer with any
      questions related to requests for DCCP-related codepoints.

10.3.2. DCCP Port Numbers Registry

   The DCCP ports registry is defined by Section 19.9 of the DCCP
   specification [RFC4340]. Assignments in this registry require prior
   assignment of a service code. Not all service codes require IANA-
   assigned ports. This document updates that section by extending the
   guidelines given there in the following way:

   o IANA should normally assign a value in the range 1024-49151 to a
      DCCP server port. IANA requests to assign port numbers in the
      System Ports range (0 through 1023) require an "IETF Review"
      [RFC5226] prior to assignment by IANA [RFC4340].

   o IANA MUST NOT assign more than one DCCP server port to a single
      service code value.

   o The assignment of multiple service codes to the same DCCP port is
      allowed, but subject to "Expert Review".

   o The set of service code values associated with a DCCP server port
      should be recorded in the service name and port number registry.

   o A request for additional service codes to be associated with an
      already assigned port number requires "Expert Review". These
      requests will normally be accepted when they originate from the
      contact associated with the port assignment. In other cases,
      these applications will be expected to use an unassigned port,
      when this is available.

   The DCCP specification [RFC4340] notes that a short port name MUST be
   associated with each DCCP server port that has been assigned. This
   document clarifies that this short port name is the service name as
   defined here, and this name MUST be unique.

11. Contributors

   Alfred Hoenes (ah@tr-sys.de) and Allison Mankin (mankin@psg.com) have
   contributed text and ideas to this document.

12. Acknowledgments

   The text in Section 10.3 is based on a suggestion originally proposed
   as a part of the DCCP Service Codes document [RFC5595] by Gorry
   Fairhurst.

   Lars Eggert is partly funded by the Trilogy Project [TRILOGY], a
   research project supported by the European Commission under its
   Seventh Framework Program.

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