     Guidelines for Writing an IANA Considerations Section in RFCs

Abstract

   Many protocols make use of points of extensibility that use constants
   to identify various protocol parameters. To ensure that the values
   in these fields do not have conflicting uses and to promote
   interoperability, their allocations are often coordinated by a
   central record keeper. For IETF protocols, that role is filled by
   the Internet Assigned Numbers Authority (IANA).

   To make assignments in a given registry prudently, guidance
   describing the conditions under which new values should be assigned,
   as well as when and how modifications to existing values can be made,
   is needed. This document defines a framework for the documentation
   of these guidelines by specification authors, in order to assure that
   the provided guidance for the IANA Considerations is clear and
   addresses the various issues that are likely in the operation of a
   registry.

   This is the third edition of this document; it obsoletes RFC 5226.

Status of This Memo

Copyright Notice

Table of Contents

1. Introduction

   Many protocols make use of points of extensibility that use constants
   to identify various protocol parameters. To ensure that the values
   in these fields do not have conflicting uses and to promote
   interoperability, their allocations are often coordinated by a
   central record keeper. The Protocol field in the IP header [RFC791]
   and MIME media types [RFC6838] are two examples of such
   coordinations.

   The IETF selects an IANA Functions Operator (IFO) for protocol
   parameters defined by the IETF. In the contract between the IETF and
   the current IFO (ICANN), that entity is referred to as the IANA
   PROTOCOL PARAMETER SERVICES Operator, or IPPSO. For consistency with
   past practice, the IFO or IPPSO is referred to in this document as
   "IANA" [RFC2860].

   In this document, we call the range of possible values for such a
   field a "namespace". The binding or association of a specific value
   with a particular purpose within a namespace is called an assignment
   (or, variously: an assigned number, assigned value, code point,
   protocol constant, or protocol parameter). The act of assignment is
   called a registration, and it takes place in the context of a
   registry. The terms "assignment" and "registration" are used
   interchangeably throughout this document.

   To make assignments in a given namespace prudently, guidance
   describing the conditions under which new values should be assigned,
   as well as when and how modifications to existing values can be made,
   is needed. This document defines a framework for the documentation
   of these guidelines by specification authors, in order to assure that
   the guidance for the IANA Considerations is clear and addresses the
   various issues that are likely in the operation of a registry.

   Typically, this information is recorded in a dedicated section of the
   specification with the title "IANA Considerations".

1.1. Keep IANA Considerations for IANA

   The purpose of having a dedicated IANA Considerations section is to
   provide a single place to collect clear and concise information and
   instructions for IANA. Technical documentation should reside in
   other parts of the document; the IANA Considerations should refer to
   these other sections by reference only (as needed). Using the IANA
   Considerations section as primary technical documentation both hides
   it from the target audience of the document and interferes with
   IANA's review of the actions they need to take.

An ideal IANA Considerations section clearly enumerates and specifies
each requested IANA action; includes all information IANA needs, such
as the full names of all applicable registries; and includes clear
references to elsewhere in the document for other information.

The IANA actions are normally phrased as requests for IANA (such as,
"IANA is asked to assign the value TBD1 from the Frobozz
Registry..."); the RFC Editor will change those sentences to reflect
the actions taken ("IANA has assigned the value 83 from the Frobozz
Registry...").

1.2. For Updated Information

IANA maintains a web page that includes additional clarification
information beyond what is provided here, such as minor updates and
summary guidance. Document authors should check that page. Any
significant updates to the best current practice will have to feed
into updates to BCP 26 (this document), which is definitive.

   <https://iana.org/help/protocol-registration>

1.3. A Quick Checklist Upfront

It's useful to be familiar with this document as a whole. But when
you return for quick reference, here are checklists for the most
common things you'll need to do and references to help with the less
common ones.

In general...

1. Put all the information that IANA will need to know into the
    "IANA Considerations" section of your document (see Section 1.1).

2. Try to keep that section only for information to IANA and to
    designated expert reviewers; put significant technical
    information in the appropriate technical sections of the document
    (see Section 1.1).

3. Note that the IESG has the authority to resolve issues with IANA
    registrations. If you have any questions or problems, you should
    consult your document shepherd and/or working group chair, who
    may ultimately involve an Area Director (see Section 3.3).

If you are creating a new registry...

1. Give the registry a descriptive name and provide a brief
    description of its use (see Section 2.2).

2. Identify any registry grouping that it should be part of (see
    Section 2.1).

3. Clearly specify what information is required in order to register
    new items (see Section 2.2). Be sure to specify data types,
    lengths, and valid ranges for fields.

4. Specify the initial set of items for the registry, if applicable
    (see Section 2.2).

5. Make sure the change control policy for the registry is clear to
    IANA, in case changes to the format or policies need to be made
    later (see Sections 2.3 and 9.5).

6. Select a registration policy -- or a set of policies -- to use
    for future registrations (see Section 4, and especially note
    Sections 4.11 and 4.12).

7. If you're using a policy that requires a designated expert
    (Expert Review or Specification Required), understand Section 5
    and provide review guidance to the designated expert (see
    Section 5.3).

8. If any items or ranges in your registry need to be reserved for
    special use or are otherwise unavailable for assignment, see
    Section 6.

If you are registering into an existing registry...

1. Clearly identify the registry by its exact name and optionally by
    its URL (see Section 3.1).

2. If the registry has multiple ranges from which assignments can be
    made, make it clear which range is requested (see Section 3.1).

3. Avoid using specific values for numeric or bit assignments, and
    let IANA pick a suitable value at registration time (see
    Section 3.1). This will avoid registration conflicts among
    multiple documents.

4. For "reference" fields, use the document that provides the best
    and most current documentation for the item being registered.
    Include section numbers to make it easier for readers to locate
    the relevant documentation (see Sections 3.1 and 7).

5. Look up (in the registry's reference document) what information
    is required for the registry and accurately provide all the
    necessary information (see Section 3.1).

6. Look up (in the registry's reference document) any special rules
    or processes there may be for the registry, such as posting to a
    particular mailing list for comment, and be sure to follow the
    process (see Section 3.1).

7. If the registration policy for the registry does not already
    dictate the change control policy, make sure it's clear to IANA
    what the change control policy is for the item, in case changes
    to the registration need to be made later (see Section 9.5).

If you're writing a "bis" document or otherwise making older
documents obsolete, see Section 8.

If you need to make an early registration, such as for supporting
test implementations during document development, rather than waiting
for your document to be finished and approved, see [RFC7120].

If you need to change the format/contents or policies for an existing
registry, see Section 2.4.

If you need to update an existing registration, see Section 3.2.

If you need to close down a registry because it is no longer needed,
see Section 9.6.

2. Creating and Revising Registries

   Defining a registry involves describing the namespaces to be created,
   listing an initial set of assignments (if applicable), and
   documenting guidelines on how future assignments are to be made.

   When defining a registry, consider structuring the namespace in such
   a way that only top-level assignments need to be made with central
   coordination, and those assignments can delegate lower-level
   assignments so coordination for them can be distributed. This
   lessens the burden on IANA for dealing with assignments, and is
   particularly useful in situations where distributed coordinators have
   better knowledge of their portion of the namespace and are better
   suited to handling those assignments.

2.1. Organization of Registries

   All registries are anchored from the IANA "Protocol Registries" page:

      <https://www.iana.org/protocols>

   That page lists registries in protocol category groups, placing
   related registries together and making it easier for users of the
   registries to find the necessary information. Clicking on the title
   of one of the registries on the IANA Protocol Registries page will
   take the reader to the details page for that registry.

   Unfortunately, we have been inconsistent in how we refer to these
   entities. The group names, as they are referred to here, have been
   variously called "protocol category groups", "groups", "top-level
   registries", or just "registries". The registries under them have
   been called "registries" or "sub-registries".

   Regardless of the terminology used, document authors should pay
   attention to the registry groupings, should request that related
   registries be grouped together to make related registries easier to
   find, and, when creating a new registry, should check whether that
   registry might best be included in an existing group. That grouping
   information should be clearly communicated to IANA in the registry
   creation request.

2.2. Documentation Requirements for Registries

   Documents that create a new namespace (or modify the definition of an
   existing space) and that expect IANA to play a role in maintaining
   that space (serving as a repository for registered values) must
   provide clear instructions on details of the namespace, either in the
   IANA Considerations section or referenced from it.

   In particular, such instructions must include:

   The name of the registry

      This name will appear on the IANA web page and will be referred to
      in future documents that need to allocate a value from the new
      space. The full name (and abbreviation, if appropriate) should be
      provided. It is highly desirable that the chosen name not be
      easily confused with the name of another registry.

      When creating a registry, the group that it is a part of must be
      identified using its full name, exactly as it appears in the
      Protocol Registries list.

   Providing a URL to precisely identify the registry helps IANA
   understand the request. Such URLs can be removed from the RFC
   prior to final publication or left in the document for reference.
   If you include iana.org URLs, IANA will provide corrections, if
   necessary, during their review.

Required information for registrations

   This tells registrants what information they have to include in
   their registration requests. Some registries require only the
   requested value and a reference to a document where use of the
   value is defined. Other registries require a more detailed
   registration template that describes relevant security
   considerations, internationalization considerations, and other
   such information.

Applicable registration policy

   The policy that will apply to all future requests for
   registration. See Section 4.

Size, format, and syntax of registry entries

   What fields to record in the registry, any technical requirements
   on registry entries (valid ranges for integers, length limitations
   on strings, and such), and the exact format in which registry
   values should be displayed. For numeric assignments, one should
   specify whether values are to be recorded in decimal, in
   hexadecimal, or in some other format.

   Strings are expected to be ASCII, and it should be clearly
   specified whether case matters, and whether, for example, strings
   should be shown in the registry in uppercase or lowercase.

   Strings that represent protocol parameters will rarely, if ever,
   need to contain non-ASCII characters. If non-ASCII characters are
   really necessary, instructions should make it very clear that they
   are allowed and that the non-ASCII characters should be
   represented as Unicode characters using the "(U+XXXX)" convention.
   Anyone creating such a registry should think carefully about this
   and consider internationalization advice such as that in
   [RFC7564], Section 10.

   Initial assignments and reservations

      Any initial assignments or registrations to be included. In
      addition, any ranges that are to be reserved for "Private Use",
      "Reserved", "Unassigned", etc. (see Section 6) should be
      indicated.

   For example, a document might specify a new registry by including:

      X. IANA Considerations

      This document defines a new DHCP option, entitled "FooBar" (see
      Section y), and assigns a value of TBD1 from the DHCP Option space
      <https://www.iana.org/assignments/bootp-dhcp-parameters>
      [RFC2132] [RFC2939]:
                                  Data
            Tag   Name   Length   Meaning
            ----   ----   ------   -------
            TBD1   FooBar   N   FooBar server

   The FooBar option also defines an 8-bit FooType field, for which
   IANA is to create and maintain a new registry entitled
   "FooType values" used by the FooBar option. Initial values for the
   DHCP FooBar FooType registry are given below; future assignments
   are to be made through Expert Review [BCP26]. Assignments consist
   of a DHCP FooBar FooType name and its associated value.

            Value   DHCP FooBar FooType Name   Definition
            ----   -----------------------   ----------
            0   Reserved
            1   Frobnitz   RFCXXXX, Section y.1
            2   NitzFrob   RFCXXXX, Section y.2
            3-254   Unassigned
            255   Reserved

   For examples of documents that establish registries, consult
   [RFC3575], [RFC3968], and [RFC4520].

   Any time IANA includes names and contact information in the public
   registry, some individuals might prefer that their contact
   information not be made public. In such cases, arrangements can be
   made with IANA to keep the contact information private.

2.3. Specifying Change Control for a Registry

   Registry definitions and registrations within registries often need
   to be changed after they are created. The process of making such
   changes is complicated when it is unclear who is authorized to make
   the changes. For registries created by RFCs in the IETF stream,
   change control for the registry lies by default with the IETF, via
   the IESG. The same is true for value registrations made in IETF-
   stream RFCs.

   Because registries can be created and registrations can be made
   outside the IETF stream, it can sometimes be desirable to have change
   control outside the IETF and IESG, and clear specification of change
   control policies is always helpful.

   It is advised, therefore, that all registries that are created
   clearly specify a change control policy and a change controller. It
   is also advised that registries that allow registrations from outside
   the IETF stream include, for each value, the designation of a change
   controller for that value. If the definition or reference for a
   registered value ever needs to change, or if a registered value needs
   to be deprecated, it is critical that IANA know who is authorized to
   make the change. For example, the Media Types registry [RFC6838]
   includes a "Change Controller" in its registration template. See
   also Section 9.5.

2.4. Revising Existing Registries

   Updating the registration process or making changes to the format of
   an already existing (previously created) registry (whether created
   explicitly or implicitly) follows a process similar to that used when
   creating a new registry. That is, a document is produced that makes
   reference to the existing namespace and then provides detailed
   guidance for handling assignments in the registry or detailed
   instructions about the changes required.

   If a change requires a new column in the registry, the instructions
   need to be clear about how to populate that column for the existing
   entries. Other changes may require similar clarity.

   Such documents are normally processed with the same document status
   as the document that created the registry. Under some circumstances,
   such as with a straightforward change that is clearly needed (such as
   adding a "status" column), or when an earlier error needs to be
   corrected, the IESG may approve an update to a registry without
   requiring a new document.

Example documents that updated the guidelines for assignments in
pre-existing registries include: [RFC6895], [RFC3228], and [RFC3575].

3. Registering New Values in an Existing Registry

3.1. Documentation Requirements for Registrations

Often, documents request an assignment in an existing registry (one
created by a previously published document).

Such documents should clearly identify the registry into which each
value is to be registered. Use the exact registry name as listed on
the IANA web page, and cite the RFC where the registry is defined.
When referring to an existing registry, providing a URL to precisely
identify the registry is helpful (see Section 2.2).

There is no need to mention what the assignment policy is when making
new assignments in existing registries, as that should be clear from
the references. However, if multiple assignment policies might
apply, as in registries with different ranges that have different
policies, it is important to make it clear which range is being
requested, so that IANA will know which policy applies and can assign
a value in the correct range.

Be sure to provide all the information required for a registration,
and follow any special processes that are set out for the registry.
Registries sometimes require the completion of a registration
template for registration or ask registrants to post their request to
a particular mailing list for discussion prior to registration. Look
up the registry's reference document: the required information and
special processes should be documented there.

Normally, numeric values to be used are chosen by IANA when the
document is approved; drafts should not specify final values.
Instead, placeholders such as "TBD1" and "TBD2" should be used
consistently throughout the document, giving each item to be
registered a different placeholder. The IANA Considerations should
ask the RFC Editor to replace the placeholder names with the IANA-
assigned values. When drafts need to specify numeric values for
testing or early implementations, they will either request early
allocation (see Section 3.4) or use values that have already been set
aside for testing or experimentation (if the registry in question
allows that without explicit assignment). It is important that
drafts not choose their own values, lest IANA assign one of those
values to another document in the meantime. A draft can request a
specific value in the IANA Considerations section, and IANA will

accommodate such requests when possible, but the proposed number
might have been assigned to some other use by the time the draft is
approved.

Normally, text-string values to be used are specified in the
document, as collisions are less likely with text strings. IANA will
consult with the authors if there is, in fact, a collision, and a
different value has to be used. When drafts need to specify string
values for testing or early implementations, they sometimes use the
expected final value. But it is often useful to use a draft value
instead, possibly including the draft version number. This allows
the early implementations to be distinguished from those implementing
the final version. A document that intends to use "foobar" in the
final version might use "foobar-testing-draft-05" for the -05 version
of the draft, for example.

For some registries, there is a long-standing policy prohibiting
assignment of names or codes on a vanity or organization-name basis.
For example, codes might always be assigned sequentially unless there
is a strong reason for making an exception. Nothing in this document
is intended to change those policies or prevent their future
application.

As an example, the following text could be used to request assignment
of a DHCPv6 option number:

    IANA is asked to assign an option code value of TBD1 to the DNS
    Recursive Name Server option and an option code value of TBD2 to
    the Domain Search List option from the DHCP option code space
    defined in Section 24.3 of RFC 3315.

The IANA Considerations section should summarize all of the IANA
actions, with pointers to the relevant sections elsewhere in the
document as appropriate. Including section numbers is especially
useful when the reference document is large; the section numbers will
make it easier for those searching the reference document to find the
relevant information.

When multiple values are requested, it is generally helpful to
include a summary table of the additions/changes. It is also helpful
for this table to be in the same format as it appears or will appear
on the IANA web site. For example:

    Value   Description   Reference
    --------   ------------------- ---------
    TBD1   Foobar   this RFC, Section 3.2
    TBD2   Gumbo   this RFC, Section 3.3
    TBD3   Banana   this RFC, Section 3.4

Note: In cases where authors feel that including the full table of
changes is too verbose or repetitive, authors should still include
the table in the draft, but may include a note asking that the table
be removed prior to publication of the final RFC.

3.2. Updating Existing Registrations

Even after a number has been assigned, some types of registrations
contain additional information that may need to be updated over time.

For example, MIME media types, character sets, and language tags
typically include more information than just the registered value
itself, and may need updates to items such as point-of-contact
information, security issues, pointers to updates, and literature
references.

In such cases, the document defining the namespace must clearly state
who is responsible for maintaining and updating a registration.
Depending on the registry, it may be appropriate to specify one or
more of:

o Letting registrants and/or nominated change controllers update
   their own registrations, subject to the same constraints and
   review as with new registrations.

o Allowing attachment of comments to the registration. This can be
   useful in cases where others have significant objections to a
   registration, but the author does not agree to change the
   registration.

o Designating the IESG, a designated expert, or another entity as
   having the right to change the registrant associated with a
   registration and any requirements or conditions on doing so. This
   is mainly to get around the problem when a registrant cannot be
   reached in order to make necessary updates.

3.3. Overriding Registration Procedures

Experience has shown that the documented IANA considerations for
individual protocols do not always adequately cover the reality of
registry operation or are not sufficiently clear. In addition,
documented IANA considerations are sometimes found to be too
stringent to allow even working group documents (for which there is
strong consensus) to perform a registration in advance of actual RFC
publication.

In order to allow assignments in such cases, the IESG is granted
authority to override registration procedures and approve assignments
on a case-by-case basis.

The intention here is not to overrule properly documented procedures
or to obviate the need for protocols to properly document their IANA
considerations. Rather, it is to permit assignments in specific
cases where it is obvious that the assignment should just be made,
but updating the IANA process beforehand is too onerous.

When the IESG is required to take action as described above, it is a
strong indicator that the applicable registration procedures should
be updated, possibly in parallel with the work that instigated it.

IANA always has the discretion to ask the IESG for advice or
intervention when they feel it is needed, such as in cases where
policies or procedures are unclear to them, where they encounter
issues or questions they are unable to resolve, or where registration
requests or patterns of requests appear to be unusual or abusive.

3.4. Early Allocations

IANA normally takes its actions when a document is approved for
publication. There are times, though, when early allocation of a
value is important for the development of a technology, for example,
when early implementations are created while the document is still
under development.

IANA has a mechanism for handling such early allocations in some
cases. See [RFC7120] for details. It is usually not necessary to
explicitly mark a registry as allowing early allocation, because the
general rules will apply.

4. Choosing a Registration Policy and Well-Known Policies

A registration policy is the policy that controls how new assignments
in a registry are accepted. There are several issues to consider
when defining the registration policy.

If the registry's namespace is limited, assignments will need to be
made carefully to prevent exhaustion.

Even when the space is essentially unlimited, it is still often
desirable to have at least a minimal review prior to assignment in
order to:

o prevent the hoarding of or unnecessary wasting of values. For
   example, if the space consists of text strings, it may be
   desirable to prevent entities from obtaining large sets of strings
   that correspond to desirable names (existing company names, for
   example).

o provide a sanity check that the request actually makes sense and
   is necessary. Experience has shown that some level of minimal
   review from a subject matter expert is useful to prevent
   assignments in cases where the request is malformed or not
   actually needed (for example, an existing assignment for an
   essentially equivalent service already exists).

Perhaps most importantly, unreviewed extensions can impact
interoperability and security. See [RFC6709].

When the namespace is essentially unlimited and there are no
potential interoperability or security issues, assigned numbers can
usually be given out to anyone without any subjective review. In
such cases, IANA can make assignments directly, provided that IANA is
given detailed instructions on what types of requests it should
grant, and it is able to do so without exercising subjective
judgment.

When this is not the case, some level of review is required.
However, it's important to balance adequate review and ease of
registration. In many cases, those making registrations will not be
IETF participants; requests often come from other standards
organizations, from organizations not directly involved in standards,
from ad-hoc community work (from an open-source project, for
example), and so on. Registration must not be unnecessarily
difficult, unnecessarily costly (in terms of time and other
resources), nor unnecessarily subject to denial.

While it is sometimes necessary to restrict what gets registered
(e.g., for limited resources such as bits in a byte, or for items for
which unsupported values can be damaging to protocol operation), in
many cases having what's in use represented in the registry is more
important. Overly strict review criteria and excessive cost (in time
and effort) discourage people from even attempting to make a
registration. If a registry fails to reflect the protocol elements
actually in use, it can adversely affect deployment of protocols on
the Internet, and the registry itself is devalued.

Therefore, it is important to think specifically about the
registration policy, and not just pick one arbitrarily nor copy text
from another document. Working groups and other document developers
should use care in selecting appropriate registration policies when
their documents create registries. They should select the least
strict policy that suits a registry's needs, and look for specific
justification for policies that require significant community
involvement (those stricter than Expert Review or Specification
Required, in terms of the well-known policies). The needs here will
vary from registry to registry, and, indeed, over time, and this BCP
will not be the last word on the subject.

The following policies are defined for common usage. These cover a
range of typical policies that have been used to describe the
procedures for assigning new values in a namespace. It is not
strictly required that documents use these terms; the actual
requirement is that the instructions to IANA be clear and
unambiguous. However, use of these terms is strongly recommended
because their meanings are widely understood. Newly minted policies,
including ones that combine the elements of procedures associated
with these terms in novel ways, may be used if none of these policies
are suitable; it will help the review process if an explanation is
included as to why that is the case. The terms are fully explained
in the following subsections.

    1.   Private Use
    2.   Experimental Use
    3.   Hierarchical Allocation
    4.   First Come First Served
    5.   Expert Review
    6.   Specification Required
    7.   RFC Required
    8.   IETF Review
    9.   Standards Action
    10. IESG Approval

It should be noted that it often makes sense to partition a namespace
into multiple categories, with assignments within each category
handled differently. Many protocols now partition namespaces into
two or more parts, with one range reserved for Private or
Experimental Use while other ranges are reserved for globally unique
assignments assigned following some review process. Dividing a
namespace into ranges makes it possible to have different policies in
place for different ranges and different use cases.

Similarly, it will often be useful to specify multiple policies in
parallel, with each policy being used under different circumstances.
For more discussion of that topic, see Section 4.12.

   Examples of RFCs that specify multiple policies in parallel:

      LDAP [RFC4520]
      TLS ClientCertificateType Identifiers [RFC5246] (as detailed in
      the subsections below)
      MPLS Pseudowire Types Registry [RFC4446]

4.1. Private Use

   Private Use is for private or local use only, with the type and
   purpose defined by the local site. No attempt is made to prevent
   multiple sites from using the same value in different (and
   incompatible) ways. IANA does not record assignments from registries
   or ranges with this policy (and therefore there is no need for IANA
   to review them) and assignments are not generally useful for broad
   interoperability. It is the responsibility of the sites making use
   of the Private Use range to ensure that no conflicts occur (within
   the intended scope of use).

   Examples:

      Site-specific options in DHCP [RFC2939]
      Fibre Channel Port Type Registry [RFC4044]
      TLS ClientCertificateType Identifiers 224-255 [RFC5246]

4.2. Experimental Use

   Experimental Use is similar to Private Use, but with the purpose
   being to facilitate experimentation. See [RFC3692] for details.
   IANA does not record assignments from registries or ranges with this
   policy (and therefore there is no need for IANA to review them) and
   assignments are not generally useful for broad interoperability.
   Unless the registry explicitly allows it, it is not appropriate for
   documents to select explicit values from registries or ranges with
   this policy. Specific experiments will select a value to use during
   the experiment.

   When code points are set aside for Experimental Use, it's important
   to make clear any expected restrictions on experimental scope. For
   example, say whether it's acceptable to run experiments using those
   code points over the open Internet or whether such experiments should
   be confined to more closed environments. See [RFC6994] for an
   example of such considerations.

   Example:

      Experimental Values in IPv4, IPv6, ICMPv4, ICMPv6, UDP, and TCP
      Headers [RFC4727]

4.3. Hierarchical Allocation

   With Hierarchical Allocation, delegated administrators are given
   control over part of the namespace and can assign values in that part
   of the namespace. IANA makes allocations in the higher levels of the
   namespace according to one of the other policies.

   Examples:

   o DNS names - IANA manages the top-level domains (TLDs), and, as
      [RFC1591] says:

         Under each TLD may be created a hierarchy of names. Generally,
         under the generic TLDs the structure is very flat. That is,
         many organizations are registered directly under the TLD, and
         any further structure is up to the individual organizations.

   o Object Identifiers - defined by ITU-T recommendation X.208.
      According to <http://www.alvestrand.no/objectid/>, some registries
      include

      * IANA, which hands out OIDs under the "Private Enterprises"
         branch,
      * ANSI, which hands out OIDs under the "US Organizations" branch,
         and
      * BSI, which hands out OIDs under the "UK Organizations" branch.

   o URN namespaces - IANA registers URN Namespace IDs (NIDs
      [RFC8141]), and the organization registering an NID is responsible
      for allocations of URNs within that namespace.

4.4. First Come First Served

   For the First Come First Served policy, assignments are made to
   anyone on a first come, first served basis. There is no substantive
   review of the request, other than to ensure that it is well-formed
   and doesn't duplicate an existing assignment. However, requests must
   include a minimal amount of clerical information, such as a point of
   contact (including an email address, and sometimes a postal address)
   and a brief description of how the value will be used. Additional
   information specific to the type of value requested may also need to
   be provided, as defined by the namespace. For numbers, IANA
   generally assigns the next in-sequence unallocated value, but other
   values may be requested and assigned if an extenuating circumstance
   exists. With names, specific text strings can usually be requested.

When creating a new registry with First Come First Served as the
registration policy, in addition to the contact person field or
reference, the registry should contain a field for change controller.
Having a change controller for each entry for these types of
registrations makes authorization of future modifications more clear.
See Section 2.3.

It is important that changes to the registration of a First Come
First Served code point retain compatibility with the current usage
of that code point, so changes need to be made with care. The change
controller should not, in most cases, be requesting incompatible
changes nor repurposing a registered code point. See also Sections
9.4 and 9.5.

A working group or any other entity that is developing a protocol
based on a First Come First Served code point has to be extremely
careful that the protocol retains wire compatibility with current use
of the code point. Once that is no longer true, the new work needs
to change to a different code point (and register that use at the
appropriate time).

It is also important to understand that First Come First Served
really has no filtering. Essentially, any well-formed request is
accepted.

Examples:

    SASL mechanism names [RFC4422]
    LDAP Protocol Mechanisms and LDAP Syntax [RFC4520]

4.5. Expert Review

For the Expert Review policy, review and approval by a designated
expert (see Section 5) is required. While this does not necessarily
require formal documentation, information needs to be provided with
the request for the designated expert to evaluate. The registry's
definition needs to make clear to registrants what information is
necessary. The actual process for requesting registrations is
administered by IANA (see Section 1.2 for details).

(This policy was also called "Designated Expert" in earlier editions
of this document. The current term is "Expert Review".)

The required documentation and review criteria, giving clear guidance
to the designated expert, should be provided when defining the
registry. It is particularly important to lay out what should be
considered when performing an evaluation and reasons for rejecting a
request. It is also a good idea to include, when possible, a sense

of whether many registrations are expected over time, or if the
registry is expected to be updated infrequently or in exceptional
circumstances only.

Thorough understanding of Section 5 is important when deciding on an
Expert Review policy and designing the guidance to the designated
expert.

Good examples of guidance to designated experts:

      Extensible Authentication Protocol (EAP) [RFC3748], Sections 6 and
      7.2
      North-Bound Distribution of Link-State and TE Information Using
      BGP [RFC7752], Section 5.1

When creating a new registry with Expert Review as the registration
policy, in addition to the contact person field or reference, the
registry should contain a field for change controller. Having a
change controller for each entry for these types of registrations
makes authorization of future modifications more clear. See
Section 2.3.

Examples:

      EAP Method Types [RFC3748]
      HTTP Digest AKA algorithm versions [RFC4169]
      URI schemes [RFC7595]
      GEOPRIV Location Types [RFC4589]

4.6. Specification Required

   For the Specification Required policy, review and approval by a
   designated expert (see Section 5) is required, and the values and
   their meanings must be documented in a permanent and readily
   available public specification, in sufficient detail so that
   interoperability between independent implementations is possible.
   This policy is the same as Expert Review, with the additional
   requirement of a formal public specification. In addition to the
   normal review of such a request, the designated expert will review
   the public specification and evaluate whether it is sufficiently
   stable and permanent, and sufficiently clear and technically sound to
   allow interoperable implementations.

   The intention behind "permanent and readily available" is that a
   document can reasonably be expected to be findable and retrievable
   long after IANA assignment of the requested value. Publication of an
   RFC is an ideal means of achieving this requirement, but
   Specification Required is intended to also cover the case of a

document published outside of the RFC path, including informal
documentation.

For RFC publication, formal review by the designated expert is still
requested, but the normal RFC review process is expected to provide
the necessary review for interoperability. The designated expert's
review is still important, but it's equally important to note that
when there is IETF consensus, the expert can sometimes be "in the
rough" (see also the last paragraph of Section 5.4).

As with Expert Review (Section 4.5), clear guidance to the designated
expert should be provided when defining the registry, and thorough
understanding of Section 5 is important.

When specifying this policy, just use the term "Specification
Required". Some specifications have chosen to refer to it as "Expert
Review with Specification Required", and that only causes confusion.

Examples:

    Diffserv-aware TE Bandwidth Constraints Model Identifiers
    [RFC4124]
    TLS ClientCertificateType Identifiers 64-223 [RFC5246]
    ROHC Profile Identifiers [RFC5795]

4.7. RFC Required

With the RFC Required policy, the registration request, along with
associated documentation, must be published in an RFC. The RFC need
not be in the IETF stream, but may be in any RFC stream (currently an
RFC may be in the IETF, IRTF, IAB, or Independent Submission streams
[RFC5742]).

Unless otherwise specified, any type of RFC is sufficient (currently
Standards Track, BCP, Informational, Experimental, or Historic).

Examples:

    DNSSEC DNS Security Algorithm Numbers [RFC6014]
    Media Control Channel Framework registries [RFC6230]
    DANE TLSA Certificate Usages [RFC6698]

4.8. IETF Review

(Formerly called "IETF Consensus" in the first edition of this
document.) With the IETF Review policy, new values are assigned only
through RFCs in the IETF Stream -- those that have been shepherded
through the IESG as AD-Sponsored or IETF working group documents

[RFC2026] [RFC5378], have gone through IETF Last Call, and have been approved by the IESG as having IETF consensus.

The intent is that the document and proposed assignment will be reviewed by the IETF community (including appropriate IETF working groups, directorates, and other experts) and by the IESG, to ensure that the proposed assignment will not negatively affect interoperability or otherwise extend IETF protocols in an inappropriate or damaging manner.

Unless otherwise specified, any type of RFC is sufficient (currently Standards Track, BCP, Informational, Experimental, or Historic).

Examples:

    IPSECKEY Algorithm Types [RFC4025]
    TLS Extension Types [RFC5246]

4.9. Standards Action

   For the Standards Action policy, values are assigned only through Standards Track or Best Current Practice RFCs in the IETF Stream.

   Examples:

    BGP message types [RFC4271]
    Mobile Node Identifier option types [RFC4283]
    TLS ClientCertificateType Identifiers 0-63 [RFC5246]
    DCCP Packet Types [RFC4340]

4.10. IESG Approval

   New assignments may be approved by the IESG. Although there is no requirement that the request be documented in an RFC, the IESG has the discretion to request documents or other supporting materials on a case-by-case basis.

   IESG Approval is not intended to be used often or as a "common case"; indeed, it has seldom been used in practice. Rather, it is intended to be available in conjunction with other policies as a fall-back mechanism in the case where one of the other allowable approval mechanisms cannot be employed in a timely fashion or for some other compelling reason. IESG Approval is not intended to circumvent the public review processes implied by other policies that could have been employed for a particular assignment. IESG Approval would be appropriate, however, in cases where expediency is desired and there is strong consensus (such as from a working group) for making the assignment.

   Before approving a request, the IESG might consider consulting the
   community, via a "call for comments" that provides as much
   information as is reasonably possible about the request.

   Examples:

      IPv4 Multicast address assignments [RFC5771]
      IPv4 IGMP Type and Code values [RFC3228]
      Mobile IPv6 Mobility Header Type and Option values [RFC6275]

4.11. Using the Well-Known Registration Policies

   Because the well-known policies benefit from both community
   experience and wide understanding, their use is encouraged, and the
   creation of new policies needs to be accompanied by reasonable
   justification.

   It is also acceptable to cite one or more well-known policies and
   include additional guidelines for what kind of considerations should
   be taken into account by the review process.

   For example, for media-type registrations [RFC6838], a number of
   different situations are covered that involve the use of IETF Review
   and Specification Required, while also including specific additional
   criteria the designated expert should follow. This is not meant to
   represent a registration procedure, but to show an example of what
   can be done when special circumstances need to be covered.

   The well-known policies from "First Come First Served" to "Standards
   Action" specify a range of policies in increasing order of strictness
   (using the numbering from the full list in Section 4):

   4. First Come First Served
      No review, minimal documentation.

   5 and 6 (of equal strictness).

      5. Expert Review
         Expert review with sufficient documentation for review.

      6. Specification Required
         Significant stable public documentation sufficient for
         interoperability.

   7. RFC Required
      Any RFC publication, IETF or a non-IETF Stream.

   8. IETF Review

   RFC publication, IETF Stream only, but need not be Standards
   Track.

   9. Standards Action
      RFC publication, IETF Stream, Standards Track or BCP only.

   Examples of situations that might merit IETF Review or Standards
   Action include the following:

   o When a resource is limited, such as bits in a byte (or in two
      bytes, or four), or numbers in a limited range. In these cases,
      allowing registrations that haven't been carefully reviewed and
      agreed to by community consensus could too quickly deplete the
      allowable values.

   o When thorough community review is necessary to avoid extending or
      modifying the protocol in ways that could be damaging. One
      example is in defining new command codes, as opposed to options
      that use existing command codes: the former might require a strict
      policy, where a more relaxed policy could be adequate for the
      latter. Another example is in defining protocol elements that
      change the semantics of existing operations.

   o When there are security implications with respect to the resource,
      and thorough review is needed to ensure that the new usage is
      sound. Examples of this include lists of acceptable hashing and
      cryptographic algorithms, and assignment of transport ports in the
      system range.

   When reviewing a document that asks IANA to create a new registry or
   change a registration policy to any policy more stringent than Expert
   Review or Specification Required, the IESG should ask for
   justification to ensure that more relaxed policies have been
   considered and that the more strict policy is the right one.

   Accordingly, document developers need to anticipate this and document
   their considerations for selecting the specified policy (ideally, in
   the document itself; failing that, in the shepherd writeup).
   Likewise, the document shepherd should ensure that the selected
   policies have been justified before sending the document to the IESG.

   When specifications are revised, registration policies should be
   reviewed in light of experience since the policies were set.

4.12. Using Multiple Policies in Combination

   In some situations, it is necessary to define multiple registration
   policies. For example, registrations through the normal IETF process

might use one policy, while registrations from outside the process
would have a different policy applied.

Thus, a particular registry might want to use a policy such as "RFC
Required" or "IETF Review" sometimes, with a designated expert
checking a "Specification Required" policy at other times.

The alternative to using a combination requires either that all
requests come through RFCs or that requests in RFCs go through review
by the designated expert, even though they already have IETF review
and consensus.

This can be documented in the IANA Considerations section when the
registry is created, for example:

> IANA is asked to create the registry "Fruit Access Flags" under
> the "Fruit Parameters" group. New registrations will be permitted
> through either the IETF Review policy or the Specification
> Required policy [BCP26]. The latter should be used only for
> registrations requested by SDOs outside the IETF. Registrations
> requested in IETF documents will be subject to IETF review.

Such combinations will commonly use one of {Standards Action, IETF
Review, RFC Required} in combination with one of {Specification
Required, Expert Review}. Guidance should be provided about when
each policy is appropriate, as in the example above.

4.13. Provisional Registrations

Some existing registries have policies that allow provisional
registration: see URI Schemes [RFC7595] and Email Header Fields
[RFC3864]. Registrations that are designated as provisional are
usually defined as being more readily created, changed, reassigned,
moved to another status, or removed entirely. URI Schemes, for
example, allow provisional registrations to be made with incomplete
information.

Allowing provisional registration ensures that the primary goal of
maintaining a registry -- avoiding collisions between incompatible
semantics -- is achieved without the side effect of "endorsing" the
protocol mechanism the provisional value is used for. Provisional
registrations for codepoints that are ultimately standardized can be
promoted to permanent status. The criteria that are defined for
converting a provisional registration to permanent will likely be
more strict than those that allowed the provisional registration.

If your registry does not have a practical limit on codepoints,
perhaps adding the option for provisional registrations might be

   right for that registry as well.

5. Designated Experts

5.1. The Motivation for Designated Experts

   Discussion on a mailing list can provide valuable technical feedback,
   but opinions often vary and discussions may continue for some time
   without clear resolution. In addition, IANA cannot participate in
   all of these mailing lists and cannot determine if or when such
   discussions reach consensus. Therefore, IANA relies on a "designated
   expert" for advice regarding the specific question of whether an
   assignment should be made. The designated expert is an individual
   who is responsible for carrying out an appropriate evaluation and
   returning a recommendation to IANA.

   It should be noted that a key motivation for having designated
   experts is for the IETF to provide IANA with a subject matter expert
   to whom the evaluation process can be delegated. IANA forwards
   requests for an assignment to the expert for evaluation, and the
   expert (after performing the evaluation) informs IANA as to whether
   or not to make the assignment or registration. In most cases, the
   registrants do not work directly with the designated experts. The
   list of designated experts for a registry is listed in the registry.

   It will often be useful to use a designated expert only some of the
   time, as a supplement to other processes. For more discussion of
   that topic, see Section 4.12.

5.2. The Role of the Designated Expert

   The designated expert is responsible for coordinating the appropriate
   review of an assignment request. The review may be wide or narrow,
   depending on the situation and the judgment of the designated expert.
   This may involve consultation with a set of technology experts,
   discussion on a public mailing list, consultation with a working
   group (or its mailing list if the working group has disbanded), etc.
   Ideally, the designated expert follows specific review criteria as
   documented with the protocol that creates or uses the namespace. See
   the IANA Considerations sections of [RFC3748] and [RFC3575] for
   specific examples.

   Designated experts are expected to be able to defend their decisions
   to the IETF community, and the evaluation process is not intended to
   be secretive or bestow unquestioned power on the expert. Experts are
   expected to apply applicable documented review or vetting procedures,
   or in the absence of documented criteria, follow generally accepted
   norms such as those in Section 5.3. Designated experts are generally

not expected to be "gatekeepers", setting out to make registrations
difficult to obtain, unless the guidance in the defining document
specifies that they should act as such. Absent stronger guidance,
the experts should be evaluating registration requests for
completeness, interoperability, and conflicts with existing protocols
and options.

It has proven useful to have multiple designated experts for some
registries. Sometimes those experts work together in evaluating a
request, while in other cases additional experts serve as backups,
acting only when the primary expert is unavailable. In registries
with a pool of experts, the pool often has a single chair responsible
for defining how requests are to be assigned to and reviewed by
experts. In other cases, IANA might assign requests to individual
members in sequential or approximate random order. The document
defining the registry can, if it's appropriate for the situation,
specify how the group should work -- for example, it might be
appropriate to specify rough consensus on a mailing list, within a
related working group or among a pool of designated experts.

In cases of disagreement among multiple experts, it is the
responsibility of those experts to make a single clear recommendation
to IANA. It is not appropriate for IANA to resolve disputes among
experts. In extreme situations, such as deadlock, the designating
body may need to step in to resolve the problem.

If a designated expert has a conflict of interest for a particular
review (is, for example, an author or significant proponent of a
specification related to the registration under review), that expert
should recuse himself. In the event that all the designated experts
are conflicted, they should ask that a temporary expert be designated
for the conflicted review. The responsible AD may then appoint
someone or the AD may handle the review.

This document defines the designated expert mechanism with respect to
documents in the IETF stream only. If other streams want to use
registration policies that require designated experts, it is up to
those streams (or those documents) to specify how those designated
experts are appointed and managed. What is described below, with
management by the IESG, is only appropriate for the IETF stream.

5.2.1. Managing Designated Experts in the IETF

Designated experts for registries created by the IETF are appointed
by the IESG, normally upon recommendation by the relevant Area
Director. They may be appointed at the time a document creating or
updating a namespace is approved by the IESG, or subsequently, when
the first registration request is received. Because experts

   originally appointed may later become unavailable, the IESG will
   appoint replacements as necessary. The IESG may remove any
   designated expert that it appointed, at its discretion.

   The normal appeals process, as described in [RFC2026], Section 6.5.1,
   applies to issues that arise with the designated expert team. For
   this purpose, the designated expert team takes the place of the
   working group in that description.

5.3. Designated Expert Reviews

   In the years since [RFC2434] was published and put to use, experience
   has led to the following observations:

   o A designated expert must respond in a timely fashion, normally
      within a week for simple requests to a few weeks for more complex
      ones. Unreasonable delays can cause significant problems for
      those needing assignments, such as when products need code points
      to ship. This is not to say that all reviews can be completed
      under a firm deadline, but they must be started, and the requester
      and IANA should have some transparency into the process if an
      answer cannot be given quickly.

   o If a designated expert does not respond to IANA's requests within
      a reasonable period of time, either with a response or with a
      reasonable explanation for the delay (some requests may be
      particularly complex), and if this is a recurring event, IANA must
      raise the issue with the IESG. Because of the problems caused by
      delayed evaluations and assignments, the IESG should take
      appropriate actions to ensure that the expert understands and
      accepts his or her responsibilities, or appoint a new expert.

   o The designated expert is not required to personally bear the
      burden of evaluating and deciding all requests, but acts as a
      shepherd for the request, enlisting the help of others as
      appropriate. In the case that a request is denied, and rejecting
      the request is likely to be controversial, the expert should have
      the support of other subject matter experts. That is, the expert
      must be able to defend a decision to the community as a whole.

   When a designated expert is used, the documentation should give clear
   guidance to the designated expert, laying out criteria for performing
   an evaluation and reasons for rejecting a request. In the case where
   there are no specific documented criteria, the presumption should be
   that a code point should be granted unless there is a compelling
   reason to the contrary (and see also Section 5.4). Reasons that have
   been used to deny requests have included these:

o Scarcity of code points, where the finite remaining code points
   should be prudently managed, or where a request for a large number
   of code points is made and a single code point is the norm.

o Documentation is not of sufficient clarity to evaluate or ensure
   interoperability.

o The code point is needed for a protocol extension, but the
   extension is not consistent with the documented (or generally
   understood) architecture of the base protocol being extended and
   would be harmful to the protocol if widely deployed. It is not
   the intent that "inconsistencies" refer to minor differences "of a
   personal preference nature". Instead, they refer to significant
   differences such as inconsistencies with the underlying security
   model, implying a change to the semantics of an existing message
   type or operation, requiring unwarranted changes in deployed
   systems (compared with alternate ways of achieving a similar
   result), etc.

o The extension would cause problems with existing deployed systems.

o The extension would conflict with one under active development by
   the IETF, and having both would harm rather than foster
   interoperability.

Documents must not name the designated expert(s) in the document
itself; instead, any suggested names should be relayed to the
appropriate Area Director at the time the document is sent to the
IESG for approval. This is usually done in the document shepherd
writeup.

If the request should also be reviewed on a specific public mailing
list, its address should be specified.

5.4. Expert Reviews and the Document Lifecycle

   Review by the designated expert is necessarily done at a particular
   point in time and represents review of a particular version of the
   document. While reviews are generally done around the time of IETF
   Last Call, deciding when the review should take place is a question
   of good judgment. And while rereviews might be done when it's
   acknowledged that the documentation of the registered item has
   changed substantially, making sure that rereview happens requires
   attention and care.

   It is possible, through carelessness, accident, inattentiveness, or
   even willful disregard, that changes might be made after the
   designated expert's review and approval that would, if the document
   were rereviewed, cause the expert not to approve the registration.
   It is up to the IESG, with the token held by the responsible Area
   Director, to be alert to such situations and to recognize that such
   changes need to be checked.

   For registrations made from documents on the Standards Track, there
   is often expert review required (by the registration policy) in
   addition to IETF consensus (for approval as a Standards Track RFC).
   In such cases, the review by the designated expert needs to be
   timely, submitted before the IESG evaluates the document. The IESG
   should generally not hold the document up waiting for a late review.
   It is also not intended for the expert review to override IETF
   consensus: the IESG should consider the review in its own evaluation,
   as it would do for other Last Call reviews.

6. Well-Known Registration Status Terminology

   The following labels describe the status of an assignment or range of
   assignments:

      Private Use: Private use only (not assigned), as described in
           Section 4.1.

      Experimental: Available for general experimental use as described
           in [RFC3692]. IANA does not record specific assignments for
           any particular use.

      Unassigned: Not currently assigned, and available for assignment
           via documented procedures. While it's generally clear that
           any values that are not registered are unassigned and
           available for assignment, it is sometimes useful to
           explicitly specify that situation. Note that this is
           distinctly different from "Reserved".

   Reserved: Not assigned and not available for assignment.
        Reserved values are held for special uses, such as to extend
        the namespace when it becomes exhausted. "Reserved" is also
        sometimes used to designate values that had been assigned
        but are no longer in use, keeping them set aside as long as
        other unassigned values are available. Note that this is
        distinctly different from "Unassigned".

        Reserved values can be released for assignment by the change
        controller for the registry (this is often the IESG, for
        registries created by RFCs in the IETF stream).

   Known Unregistered Use: It's known that the assignment or range
        is in use without having been defined in accordance with
        reasonable practice. Documentation for use of the
        assignment or range may be unavailable, inadequate, or
        conflicting. This is a warning against use, as well as an
        alert to network operators who might see these values in use
        on their networks.

7. Documentation References in IANA Registries

   Usually, registries and registry entries include references to
   documentation (RFCs or other documents). The purpose of these
   references is to provide pointers for implementors to find details
   necessary for implementation, NOT to simply note what document
   created the registry or entry. Therefore:

   o If a document registers an item that is defined and explained
      elsewhere, the registered reference should be to the document
      containing the definition, not to the document that is merely
      performing the registration.

   o If the registered item is defined and explained in the current
      document, it is important to include sufficient information to
      enable implementors to understand the item and to create a proper
      implementation.

   o If the registered item is explained primarily in a specific
      section of the reference document, it is useful to include a
      section reference. For example, "[RFC4637], Section 3.2", rather
      than just "[RFC4637]".

   o For documentation of a new registry, the reference should provide
      information about the registry itself, not just a pointer to the
      creation of it. Useful information includes the purpose of the
      registry, a rationale for its creation, documentation of the
      process and policy for new registrations, guidelines for new

   registrants or designated experts, and other such related
   information. But note that, while it's important to include this
   information in the document, it needn't all be in the IANA
   Considerations section. See Section 1.1.

8. What to Do in "bis" Documents

   On occasion, an RFC is issued that obsoletes a previous edition of
   the same document. We sometimes call these "bis" documents, such as
   when RFC 4637 is to be obsoleted by draft-ietf-foo-rfc4637bis. When
   the original document created registries and/or registered entries,
   there is a question of how to handle the IANA Considerations section
   in the "bis" document.

   If the registrations specify the original document as a reference,
   those registrations should be updated to point to the current (not
   obsolete) documentation for those items. Usually, that will mean
   changing the reference to be the "bis" document.

   There will, though, be times when a document updates another, but
   does not make it obsolete, and the definitive reference is changed
   for some items but not for others. Be sure that the references
   always point to the correct, current documentation for each item.

   For example, suppose RFC 4637 registered the "BANANA" flag in the
   "Fruit Access Flags" registry, and the documentation for that flag is
   in Section 3.2.

   The current registry might look, in part, like this:

      Name   Description   Reference
      --------   ------------------- ---------
      BANANA   Flag for bananas   [RFC4637], Section 3.2

   If draft-ietf-foo-rfc4637bis obsoletes RFC 4637 and, because of some
   rearrangement, now documents the flag in Section 4.1.2, the IANA
   Considerations of the bis document might contain text such as this:

      IANA is asked to change the registration information for the
      BANANA flag in the "Fruit Access Flags" registry to the
      following:

      Name   Description   Reference
      --------   ------------------- ---------
      BANANA   Flag for bananas   [[this RFC]], Section 4.2.1

In many cases, if there are a number of registered references to the
original RFC and the document organization has not changed the
registered section numbering much, it may simply be reasonable to do
this:

    Because this document obsoletes RFC 4637, IANA is asked to change
    all registration information that references [RFC4637] to instead
    reference [[this RFC]].

If information for registered items has been or is being moved to
other documents, then the registration information should be changed
to point to those other documents. In most cases, documentation
references should not be left pointing to the obsoleted document for
registries or registered items that are still in current use. For
registries or registered items that are no longer in current use, it
will usually make sense to leave the references pointing to the old
document -- the last current reference for the obsolete items. The
main point is to make sure that the reference pointers are as useful
and current as is reasonable, and authors should consider that as
they write the IANA Considerations for the new document. As always:
do the right thing, and there is flexibility to allow for that.

It is extremely important to be clear in your instructions regarding
updating references, especially in cases where some references need
to be updated and others do not.

9. Miscellaneous Issues

9.1. When There Are No IANA Actions

Before an Internet-Draft can be published as an RFC, IANA needs to
know what actions (if any) it needs to perform. Experience has shown
that it is not always immediately obvious whether a document has no
IANA actions, without reviewing the document in some detail. In
order to make it clear to IANA that it has no actions to perform (and
that the author has consciously made such a determination), such
documents should, after the authors confirm that this is the case,
include an IANA Considerations section that states:

    This document has no IANA actions.

IANA prefers that these "empty" IANA Considerations sections be left
in the document for the record: it makes it clear later on that the
document explicitly said that no IANA actions were needed (and that
it wasn't just omitted). This is a change from the prior practice of
requesting that such sections be removed by the RFC Editor, and
authors are asked to accommodate this change.

9.2. Namespaces Lacking Documented Guidance

   For all existing RFCs that either explicitly or implicitly rely on
   IANA to make assignments without specifying a precise assignment
   policy, IANA will work with the IESG to decide what policy is
   appropriate. Changes to existing policies can always be initiated
   through the normal IETF consensus process, or through the IESG when
   appropriate.

   All future RFCs that either explicitly or implicitly rely on IANA to
   register or otherwise administer namespace assignments must provide
   guidelines for administration of the namespace.

9.3. After-the-Fact Registrations

   Occasionally, the IETF becomes aware that an unassigned value from a
   namespace is in use on the Internet or that an assigned value is
   being used for a different purpose than it was registered for. The
   IETF does not condone such misuse; procedures of the type described
   in this document need to be applied to such cases, and it might not
   always be possible to formally assign the desired value. In the
   absence of specifications to the contrary, values may only be
   reassigned for a different purpose with the consent of the original
   assignee (when possible) and with due consideration of the impact of
   such a reassignment. In cases of likely controversy, consultation
   with the IESG is advised.

   This is part of the reason for the advice in Section 3.1 about using
   placeholder values, such as "TBD1", during document development:
   problems are often caused by the open use of unregistered values
   after results from well-meant, early implementations, where the
   implementations retained the use of developmental code points that
   never proceeded to a final IANA assignment.

9.4. Reclaiming Assigned Values

   Reclaiming previously assigned values for reuse is tricky, because
   doing so can lead to interoperability problems with deployed systems
   still using the assigned values. Moreover, it can be extremely
   difficult to determine the extent of deployment of systems making use
   of a particular value. However, in cases where the namespace is
   running out of unassigned values and additional ones are needed, it
   may be desirable to attempt to reclaim unused values. When
   reclaiming unused values, the following (at a minimum) should be
   considered:

   o Attempts should be made to contact the original party to which a
      value is assigned, to determine if the value was ever used, and if
      so, the extent of deployment. (In some cases, products were never
      shipped or have long ceased being used. In other cases, it may be
      known that a value was never actually used at all.)

   o Reassignments should not normally be made without the concurrence
      of the original requester. Reclamation under such conditions
      should only take place where there is strong evidence that a value
      is not widely used, and the need to reclaim the value outweighs
      the cost of a hostile reclamation. IESG Approval is needed in
      this case.

   o It may be appropriate to write up the proposed action and solicit
      comments from relevant user communities. In some cases, it may be
      appropriate to write an RFC that goes through a formal IETF
      process (including IETF Last Call) as was done when DHCP reclaimed
      some of its "Private Use" options [RFC3942].

   o It may be useful to differentiate between revocation, release, and
      transfer. Revocation occurs when IANA removes an assignment,
      release occurs when the assignee initiates that removal, and
      transfer occurs when either revocation or release is coupled with
      immediate reassignment. It may be useful to specify procedures
      for each of these or to explicitly prohibit combinations that are
      not desired.

9.5. Contact Person vs Assignee or Owner

   Many registries include designation of a technical or administrative
   contact associated with each entry. Often, this is recorded as
   contact information for an individual. It is unclear, though, what
   role the individual has with respect to the registration: is this
   item registered on behalf of the individual, the company the
   individual worked for, or perhaps another organization the individual
   was acting for?

   This matters because some time later, when the individual has changed
   jobs or roles, and perhaps can no longer be contacted, someone might
   want to update the registration. IANA has no way to know what
   company, organization, or individual should be allowed to take the
   registration over. For registrations rooted in RFCs, the stream
   owner (such as the IESG or the IAB) can make an overriding decision.
   But in other cases, there is no recourse.

   Registries can include, in addition to a "Contact" field, an
   "Assignee" or "Owner" field (also referred to as "Change Controller")
   that can be used to address this situation, giving IANA clear

guidance as to the actual owner of the registration. This is
strongly advised, especially for registries that do not require RFCs
to manage their information (e.g., registries with policies such as
First Come First Served (Section 4.4), Expert Review (Section 4.5),
and Specification Required (Section 4.6)). Alternatively,
organizations can put an organizational role into the "Contact" field
in order to make their ownership clear.

9.6. Closing or Obsoleting a Registry/Registrations

Sometimes there is a request to "close" a registry to further
registrations. When a registry is closed, no further registrations
will be accepted. The information in the registry will still be
valid and registrations already in the registry can still be updated.

A closed registry can also be marked as "obsolete", as an indication
that the information in the registry is no longer in current use.

Specific entries in a registry can be marked as "obsolete" (no longer
in use) or "deprecated" (use is not recommended).

Such changes to registries and registered values are subject to
normal change controls (see Section 2.3). Any closure, obsolescence,
or deprecation serves to annotate the registry involved; the
information in the registry remains there for informational and
historic purposes.

10. Appeals

Appeals of protocol parameter registration decisions can be made
using the normal IETF appeals process as described in [RFC2026],
Section 6.5. That is, an initial appeal should be directed to the
IESG, followed (if necessary) by an appeal to the IAB.

11. Mailing Lists

All IETF mailing lists associated with evaluating or discussing
assignment requests as described in this document are subject to
whatever rules of conduct and methods of list management are
currently defined by best current practices or by IESG decision.

12. Security Considerations

Information that creates or updates a registration needs to be
authenticated and authorized. IANA updates registries according to
instructions in published RFCs and from the IESG. It may also accept
clarifications from document authors, relevant working group chairs,
designated experts, and mail list participants.

Information concerning possible security vulnerabilities of a
protocol may change over time. Likewise, security vulnerabilities
related to how an assigned number is used may change as well. As new
vulnerabilities are discovered, information about such
vulnerabilities may need to be attached to existing registrations so
that users are not misled as to the true security issues surrounding
the use of a registered number.

Security needs to be considered as part of the selection of a
registration policy. For some protocols, registration of certain
parameters will have security implications, and registration policies
for the relevant registries must ensure that requests get appropriate
review with those security implications in mind.

An analysis of security issues is generally required for all
protocols that make use of parameters (data types, operation codes,
keywords, etc.) documented in IETF protocols or registered by IANA.
Such security considerations are usually included in the protocol
document [BCP72]. It is the responsibility of the IANA
considerations associated with a particular registry to specify
whether value-specific security considerations must be provided when
assigning new values and the process for reviewing such claims.

13. IANA Considerations

Sitewide, IANA has replaced references to RFC 5226 with references to
this document.

14. Changes Relative to Earlier Editions of BCP 26

14.1. 2016: Changes in This Document Relative to RFC 5226

Significant additions:

o Removed RFC 2119 key words, boilerplate, and reference, preferring
   plain English -- this is not a protocol specification.

o Added Section 1.1, Keep IANA Considerations for IANA

o Added Section 1.2, For Updated Information

o Added Section 2.1, Organization of Registries

o Added best practice for selecting an appropriate policy into
   Section 4.

o Added Section 4.12, Using Multiple Policies in Combination

o Added Section 2.3, Specifying Change Control for a Registry

o Added Section 3.4, Early Allocations

o Moved each well-known policy into a separate subsection of
   Section 4.

o Added Section 5.4, Expert Reviews and the Document Lifecycle

o Added Section 7, Documentation References in IANA Registries

o Added Section 8, What to Do in "bis" Documents

o Added Section 9.5, Contact Person vs Assignee or Owner

o Added Section 9.6, Closing or Obsoleting a Registry/Registrations

Clarifications and such:

o Some reorganization -- moved text around for clarity and easier
   reading.

o Made clarifications about identification of IANA registries and
   use of URLs for them.

o Clarified the distinction between "Unassigned" and "Reserved".

o Made some clarifications in "Expert Review" about instructions to
   the designated expert.

o Made some clarifications in "Specification Required" about how to
   declare this policy.

o Assorted minor clarifications and editorial changes throughout.

14.2. 2008: Changes in RFC 5226 Relative to RFC 2434

Changes include:

o Major reordering of text to expand descriptions and to better
   group topics such as "updating registries" vs. "creating new
   registries", in order to make it easier for authors to find the
   text most applicable to their needs.

o Numerous editorial changes to improve readability.

   o Changed the term "IETF Consensus" to "IETF Review" and added more
      clarifications. History has shown that people see the words "IETF
      Consensus" (without consulting the actual definition) and are
      quick to make incorrect assumptions about what the term means in
      the context of IANA Considerations.

   o Added "RFC Required" to list of defined policies.

   o Much more explicit directions and examples of "what to put in
      RFCs".

   o "Specification Required" now implies use of a designated expert to
      evaluate specs for sufficient clarity.

   o Added a section describing provisional registrations.

   o Significantly changed the wording in the "Designated Experts"
      section. Main purpose is to make clear that Expert Reviewers are
      accountable to the community, and to provide some guidance for
      review criteria in the default case.

   o Changed wording to remove any special appeals path. The normal
      RFC 2026 appeals path is used.

   o Added a section about reclaiming unused values.

   o Added a section on after-the-fact registrations.

   o Added a section indicating that mailing lists used to evaluate
      possible assignments (such as by a designated expert) are subject
      to normal IETF rules.

15. References

15.1. Normative References

   [RFC2026] Bradner, S., "The Internet Standards Process -- Revision
              3", BCP 9, RFC 2026, DOI 10.17487/RFC2026, October 1996,
              <http://www.rfc-editor.org/info/rfc2026>.

15.2. Informative References

   [BCP72]   Rescorla, E. and B. Korver, "Guidelines for Writing RFC
              Text on Security Considerations", BCP 72, RFC 3552, July
              2003, <http://www.rfc-editor.org/info/bcp72>.

   [RFC791]   Postel, J., "Internet Protocol", STD 5, RFC 791,
               DOI 10.17487/RFC0791, September 1981,
               <http://www.rfc-editor.org/info/rfc791>.

   [RFC1591]   Postel, J., "Domain Name System Structure and Delegation",
               RFC 1591, DOI 10.17487/RFC1591, March 1994,
               <http://www.rfc-editor.org/info/rfc1591>.

   [RFC2434]   Narten, T. and H. Alvestrand, "Guidelines for Writing an
               IANA Considerations Section in RFCs", RFC 2434,
               DOI 10.17487/RFC2434, October 1998,
               <http://www.rfc-editor.org/info/rfc2434>.

   [RFC2860]   Carpenter, B., Baker, F., and M. Roberts, "Memorandum of
               Understanding Concerning the Technical Work of the
               Internet Assigned Numbers Authority", RFC 2860,
               DOI 10.17487/RFC2860, June 2000,
               <http://www.rfc-editor.org/info/rfc2860>.

   [RFC2939]   Droms, R., "Procedures and IANA Guidelines for Definition
               of New DHCP Options and Message Types", BCP 43, RFC 2939,
               DOI 10.17487/RFC2939, September 2000,
               <http://www.rfc-editor.org/info/rfc2939>.

   [RFC3228]   Fenner, B., "IANA Considerations for IPv4 Internet Group
               Management Protocol (IGMP)", BCP 57, RFC 3228,
               DOI 10.17487/RFC3228, February 2002,
               <http://www.rfc-editor.org/info/rfc3228>.

   [RFC3575]   Aboba, B., "IANA Considerations for RADIUS (Remote
               Authentication Dial In User Service)", RFC 3575,
               DOI 10.17487/RFC3575, July 2003,
               <http://www.rfc-editor.org/info/rfc3575>.

   [RFC3692]   Narten, T., "Assigning Experimental and Testing Numbers
               Considered Useful", BCP 82, RFC 3692,
               DOI 10.17487/RFC3692, January 2004,
               <http://www.rfc-editor.org/info/rfc3692>.

   [RFC3748]   Aboba, B., Blunk, L., Vollbrecht, J., Carlson, J., and H.
               Levkowetz, Ed., "Extensible Authentication Protocol
               (EAP)", RFC 3748, DOI 10.17487/RFC3748, June 2004,
               <http://www.rfc-editor.org/info/rfc3748>.

   [RFC3864]   Klyne, G., Nottingham, M., and J. Mogul, "Registration
               Procedures for Message Header Fields", BCP 90, RFC 3864,
               DOI 10.17487/RFC3864, September 2004,
               <http://www.rfc-editor.org/info/rfc3864>.

   [RFC3942] Volz, B., "Reclassifying Dynamic Host Configuration
              Protocol version 4 (DHCPv4) Options", RFC 3942,
              DOI 10.17487/RFC3942, November 2004,
              <http://www.rfc-editor.org/info/rfc3942>.

   [RFC3968] Camarillo, G., "The Internet Assigned Number Authority
              (IANA) Header Field Parameter Registry for the Session
              Initiation Protocol (SIP)", BCP 98, RFC 3968,
              DOI 10.17487/RFC3968, December 2004,
              <http://www.rfc-editor.org/info/rfc3968>.

   [RFC4025] Richardson, M., "A Method for Storing IPsec Keying
              Material in DNS", RFC 4025, DOI 10.17487/RFC4025, March
              2005, <http://www.rfc-editor.org/info/rfc4025>.

   [RFC4044] McCloghrie, K., "Fibre Channel Management MIB", RFC 4044,
              DOI 10.17487/RFC4044, May 2005,
              <http://www.rfc-editor.org/info/rfc4044>.

   [RFC4124] Le Faucheur, F., Ed., "Protocol Extensions for Support of
              Diffserv-aware MPLS Traffic Engineering", RFC 4124,
              DOI 10.17487/RFC4124, June 2005,
              <http://www.rfc-editor.org/info/rfc4124>.

   [RFC4169] Torvinen, V., Arkko, J., and M. Naslund, "Hypertext
              Transfer Protocol (HTTP) Digest Authentication Using
              Authentication and Key Agreement (AKA) Version-2",
              RFC 4169, DOI 10.17487/RFC4169, November 2005,
              <http://www.rfc-editor.org/info/rfc4169>.

   [RFC4271] Rekhter, Y., Ed., Li, T., Ed., and S. Hares, Ed., "A
              Border Gateway Protocol 4 (BGP-4)", RFC 4271,
              DOI 10.17487/RFC4271, January 2006,
              <http://www.rfc-editor.org/info/rfc4271>.

   [RFC4283] Patel, A., Leung, K., Khalil, M., Akhtar, H., and K.
              Chowdhury, "Mobile Node Identifier Option for Mobile IPv6
              (MIPv6)", RFC 4283, DOI 10.17487/RFC4283, November 2005,
              <http://www.rfc-editor.org/info/rfc4283>.

   [RFC4340] Kohler, E., Handley, M., and S. Floyd, "Datagram
              Congestion Control Protocol (DCCP)", RFC 4340,
              DOI 10.17487/RFC4340, March 2006,
              <http://www.rfc-editor.org/info/rfc4340>.

   [RFC4422] Melnikov, A., Ed. and K. Zeilenga, Ed., "Simple
              Authentication and Security Layer (SASL)", RFC 4422,
              DOI 10.17487/RFC4422, June 2006,
              <http://www.rfc-editor.org/info/rfc4422>.

   [RFC4446] Martini, L., "IANA Allocations for Pseudowire Edge to Edge
              Emulation (PWE3)", BCP 116, RFC 4446,
              DOI 10.17487/RFC4446, April 2006,
              <http://www.rfc-editor.org/info/rfc4446>.

   [RFC4520] Zeilenga, K., "Internet Assigned Numbers Authority (IANA)
              Considerations for the Lightweight Directory Access
              Protocol (LDAP)", BCP 64, RFC 4520, DOI 10.17487/RFC4520,
              June 2006, <http://www.rfc-editor.org/info/rfc4520>.

   [RFC4589] Schulzrinne, H. and H. Tschofenig, "Location Types
              Registry", RFC 4589, DOI 10.17487/RFC4589, July 2006,
              <http://www.rfc-editor.org/info/rfc4589>.

   [RFC4727] Fenner, B., "Experimental Values In IPv4, IPv6, ICMPv4,
              ICMPv6, UDP, and TCP Headers", RFC 4727,
              DOI 10.17487/RFC4727, November 2006,
              <http://www.rfc-editor.org/info/rfc4727>.

   [RFC5246] Dierks, T. and E. Rescorla, "The Transport Layer Security
              (TLS) Protocol Version 1.2", RFC 5246,
              DOI 10.17487/RFC5246, August 2008,
              <http://www.rfc-editor.org/info/rfc5246>.

   [RFC5378] Bradner, S., Ed. and J. Contreras, Ed., "Rights
              Contributors Provide to the IETF Trust", BCP 78, RFC 5378,
              DOI 10.17487/RFC5378, November 2008,
              <http://www.rfc-editor.org/info/rfc5378>.

   [RFC5742] Alvestrand, H. and R. Housley, "IESG Procedures for
              Handling of Independent and IRTF Stream Submissions",
              BCP 92, RFC 5742, DOI 10.17487/RFC5742, December 2009,
              <http://www.rfc-editor.org/info/rfc5742>.

   [RFC5771] Cotton, M., Vegoda, L., and D. Meyer, "IANA Guidelines for
              IPv4 Multicast Address Assignments", BCP 51, RFC 5771,
              DOI 10.17487/RFC5771, March 2010,
              <http://www.rfc-editor.org/info/rfc5771>.

   [RFC5795] Sandlund, K., Pelletier, G., and L-E. Jonsson, "The RObust
              Header Compression (ROHC) Framework", RFC 5795,
              DOI 10.17487/RFC5795, March 2010,
              <http://www.rfc-editor.org/info/rfc5795>.

   [RFC6014]   Hoffman, P., "Cryptographic Algorithm Identifier
               Allocation for DNSSEC", RFC 6014, DOI 10.17487/RFC6014,
               November 2010, <http://www.rfc-editor.org/info/rfc6014>.

   [RFC6230]   Boulton, C., Melanchuk, T., and S. McGlashan, "Media
               Control Channel Framework", RFC 6230,
               DOI 10.17487/RFC6230, May 2011,
               <http://www.rfc-editor.org/info/rfc6230>.

   [RFC6275]   Perkins, C., Ed., Johnson, D., and J. Arkko, "Mobility
               Support in IPv6", RFC 6275, DOI 10.17487/RFC6275, July
               2011, <http://www.rfc-editor.org/info/rfc6275>.

   [RFC6698]   Hoffman, P. and J. Schlyter, "The DNS-Based Authentication
               of Named Entities (DANE) Transport Layer Security (TLS)
               Protocol: TLSA", RFC 6698, DOI 10.17487/RFC6698, August
               2012, <http://www.rfc-editor.org/info/rfc6698>.

   [RFC6709]   Carpenter, B., Aboba, B., Ed., and S. Cheshire, "Design
               Considerations for Protocol Extensions", RFC 6709,
               DOI 10.17487/RFC6709, September 2012,
               <http://www.rfc-editor.org/info/rfc6709>.

   [RFC6838]   Freed, N., Klensin, J., and T. Hansen, "Media Type
               Specifications and Registration Procedures", BCP 13,
               RFC 6838, DOI 10.17487/RFC6838, January 2013,
               <http://www.rfc-editor.org/info/rfc6838>.

   [RFC6895]   Eastlake 3rd, D., "Domain Name System (DNS) IANA
               Considerations", BCP 42, RFC 6895, DOI 10.17487/RFC6895,
               April 2013, <http://www.rfc-editor.org/info/rfc6895>.

   [RFC6994]   Touch, J., "Shared Use of Experimental TCP Options",
               RFC 6994, DOI 10.17487/RFC6994, August 2013,
               <http://www.rfc-editor.org/info/rfc6994>.

   [RFC7120]   Cotton, M., "Early IANA Allocation of Standards Track Code
               Points", BCP 100, RFC 7120, DOI 10.17487/RFC7120, January
               2014, <http://www.rfc-editor.org/info/rfc7120>.

   [RFC7564]   Saint-Andre, P. and M. Blanchet, "PRECIS Framework:
               Preparation, Enforcement, and Comparison of
               Internationalized Strings in Application Protocols",
               RFC 7564, DOI 10.17487/RFC7564, May 2015,
               <http://www.rfc-editor.org/info/rfc7564>.

   [RFC7595] Thaler, D., Ed., Hansen, T., and T. Hardie, "Guidelines
              and Registration Procedures for URI Schemes", BCP 35,
              RFC 7595, DOI 10.17487/RFC7595, June 2015,
              <http://www.rfc-editor.org/info/rfc7595>.

   [RFC7752] Gredler, H., Ed., Medved, J., Previdi, S., Farrel, A., and
              S. Ray, "North-Bound Distribution of Link-State and
              Traffic Engineering (TE) Information Using BGP", RFC 7752,
              DOI 10.17487/RFC7752, March 2016,
              <http://www.rfc-editor.org/info/rfc7752>.

   [RFC8141] Saint-Andre, P. and J. Klensin, "Uniform Resource Names
              (URNs)", RFC 8141, DOI 10.17487/RFC8141, April 2017,
              <http://www.rfc-editor.org/info/rfc8141>.

Acknowledgments for This Document (2017)

    Thomas Narten and Harald Tveit Alvestrand edited the two earlier
    editions of this document (RFCs 2434 and 5226), and Thomas continues
    his role in this third edition. Much of the text from RFC 5226
    remains in this edition.

    Thank you to Amanda Baber and Pearl Liang for their multiple reviews
    and suggestions for making this document as thorough as possible.

    This document has benefited from thorough review and comments by many
    people, including Benoit Claise, Alissa Cooper, Adrian Farrel,
    Stephen Farrell, Tony Hansen, John Klensin, Kathleen Moriarty, Mark
    Nottingham, Pete Resnick, and Joe Touch.

    Special thanks to Mark Nottingham for reorganizing some of the text
    for better organization and readability, to Tony Hansen for acting as
    document shepherd, and to Brian Haberman and Terry Manderson for
    acting as sponsoring ADs.

Acknowledgments from the Second Edition (2008)

    The original acknowledgments section in RFC 5226 was:

    This document has benefited from specific feedback from Jari Arkko,
    Marcelo Bagnulo Braun, Brian Carpenter, Michelle Cotton, Spencer
    Dawkins, Barbara Denny, Miguel Garcia, Paul Hoffman, Russ Housley,
    John Klensin, Allison Mankin, Blake Ramsdell, Mark Townsley, Magnus
    Westerlund, and Bert Wijnen.

Acknowledgments from the First Edition (1998)

    The original acknowledgments section in RFC 2434 was:

    Jon Postel and Joyce Reynolds provided a detailed explanation on what
    IANA needs in order to manage assignments efficiently, and patiently
    provided comments on multiple versions of this document. Brian
    Carpenter provided helpful comments on earlier versions of the
    document. One paragraph in the Security Considerations section was
    borrowed from RFC 4288.

Authors' Addresses

    Michelle Cotton
    PTI, an affiliate of ICANN
    12025 Waterfront Drive, Suite 300
    Los Angeles, CA 90094-2536
    United States of America

    Phone: +1-424-254-5300
    Email: michelle.cotton@iana.org
    URI: https://www.iana.org/

    Barry Leiba
    Huawei Technologies

    Phone: +1 646 827 0648
    Email: barryleiba@computer.org
    URI: http://internetmessagingtechnology.org/

    Thomas Narten
    IBM Corporation
    3039 Cornwallis Ave., PO Box 12195 - BRQA/502
    Research Triangle Park, NC 27709-2195
    United States of America

    Phone: +1 919 254 7798
    Email: narten@us.ibm.com