

Internet Engineering Task Force (IETF)
Request for Comments: 8126
BCP: 26
Obsoletes: 5226
Category: Best Current Practice
ISSN: 2070-1721

M. Cotton
PTI
B. Leiba
Huawei Technologies
T. Narten
IBM Corporation
June 2017

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

This memo documents an Internet Best Current Practice.

This document is a product of the Internet Engineering Task Force (IETF). It represents the consensus of the IETF community. It has received public review and has been approved for publication by the Internet Engineering Steering Group (IESG). Further information on BCPs is available in Section 2 of RFC 7841.

Information about the current status of this document, any errata, and how to provide feedback on it may be obtained at <http://www.rfc-editor.org/info/rfc8126>.

Copyright Notice

Copyright (c) 2017 IETF Trust and the persons identified as the document authors. All rights reserved.

This document is subject to BCP 78 and the IETF Trust's Legal Provisions Relating to IETF Documents (<http://trustee.ietf.org/license-info>) in effect on the date of publication of this document. Please review these documents carefully, as they describe your rights and restrictions with respect to this document. Code Components extracted from this document must include Simplified BSD License text as described in Section 4.e of the Trust Legal Provisions and are provided without warranty as described in the Simplified BSD License.

Table of Contents

1. Introduction	4
1.1. Keep IANA Considerations for IANA	4
1.2. For Updated Information	5
1.3. A Quick Checklist Upfront	5
2. Creating and Revising Registries	7
2.1. Organization of Registries	8
2.2. Documentation Requirements for Registries	8
2.3. Specifying Change Control for a Registry	11
2.4. Revising Existing Registries	11
3. Registering New Values in an Existing Registry	12
3.1. Documentation Requirements for Registrations	12
3.2. Updating Existing Registrations	14
3.3. Overriding Registration Procedures	14
3.4. Early Allocations	15
4. Choosing a Registration Policy and Well-Known Policies	15
4.1. Private Use	18
4.2. Experimental Use	18
4.3. Hierarchical Allocation	19
4.4. First Come First Served	19
4.5. Expert Review	20
4.6. Specification Required	21
4.7. RFC Required	22
4.8. IETF Review	22
4.9. Standards Action	23
4.10. IESG Approval	23
4.11. Using the Well-Known Registration Policies	24
4.12. Using Multiple Policies in Combination	26
4.13. Provisional Registrations	26

5. Designated Experts	27
5.1. The Motivation for Designated Experts	27
5.2. The Role of the Designated Expert	27
5.2.1. Managing Designated Experts in the IETF	29
5.3. Designated Expert Reviews	29
5.4. Expert Reviews and the Document Lifecycle	31
6. Well-Known Registration Status Terminology	31
7. Documentation References in IANA Registries	32
8. What to Do in "bis" Documents	33
9. Miscellaneous Issues	34
9.1. When There Are No IANA Actions	34
9.2. Namespaces Lacking Documented Guidance	35
9.3. After-the-Fact Registrations	35
9.4. Reclaiming Assigned Values	35
9.5. Contact Person vs Assignee or Owner	36
9.6. Closing or Obsoleting a Registry/Registrations	37
10. Appeals	37
11. Mailing Lists	37
12. Security Considerations	37
13. IANA Considerations	38
14. Changes Relative to Earlier Editions of BCP 26	38
14.1. 2016: Changes in This Document Relative to RFC 5226	38
14.2. 2008: Changes in RFC 5226 Relative to RFC 2434	39
15. References	40
15.1. Normative References	40
15.2. Informative References	40
Acknowledgments for This Document (2017)	46
Acknowledgments from the Second Edition (2008)	46
Acknowledgments from the First Edition (1998)	46
Authors' Addresses	47

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]:

Tag	Name	Data 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

