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M. Cotton
ICANN
B. Leiba
Huawei Technologies
T. Narten
IBM Corporation
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Guidelines for Writing an IANA Considerations Section in RFCs
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Abstract

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

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

This is the third edition, and obsoletes [RFC 5226](#).

Status of this Memo

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[1.](#) Introduction

Many protocols make use of points of extensibility that use constants to identify various protocol parameters. To ensure that the values used in these fields do not have conflicting uses, and to promote interoperability, their allocation is often coordinated by a central authority. For IETF protocols, that role is filled by the Internet Assigned Numbers Authority (IANA) [[RFC2860](#)]. IANA services are currently provided by the International Corporation for Assigned Names and Numbers (ICANN).

The Protocol field in the IP header [[RFC0791](#)] and MIME media types [[RFC4288](#)] are two examples of such coordinations.

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, IANA needs guidance describing the conditions under which new values should be assigned, as well as when and how modifications to existing values can be made. This document defines a framework for the documentation of these guidelines by specification authors, in order to assure that the guidance given to IANA 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, and should be included by reference only. 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.

If, for example, the registration of an item in a registry includes a short description of the item being registered, that should be placed in the IANA Considerations directly. But if it's necessary to include a longer technical explanation of the purpose and use of the item, the IANA Considerations should refer to a technical section of the document where that information resides. Similarly, if the document is pointing out the use of an existing assignment in a registry, but makes no modification to the registration, that should be in a technical section of the document, reserving the IANA Considerations section for instructions to IANA.

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.

1.2. For More Information

IANA maintains a web page that includes current important information from IANA. Document authors should check that page for additional information, beyond what is provided here.

<<http://www.iana.org/important-information>>.

[[***** The URI above is not yet ready. IANA is setting it up.
*****]]

1.3. Terminology Used In This Document

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [RFC 2119](#) [RFC2119]. For this document, "the specification" as used by [RFC 2119](#) refers to the processing of protocol documents within the IETF standards process.

2. Creating and Revising Registries

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

Before defining a registry, however, consider delegating the namespace in some manner. This route should be pursued when appropriate, as it lessens the burden on IANA for dealing with assignments.

In particular, not all namespaces require a registry; in some cases, assignments can be made independently and with no further (central) coordination. In the Domain Name System, for example, IANA only deals with assignments at the higher levels, while subdomains are administered by the organization to which the space has been delegated. When a namespace is delegated in this manner, the scope of IANA is limited to the parts of the namespace where IANA has authority.

2.1. Hierarchical Registry Structure

It's important to start with a word on the IANA registry structure. All registries are anchored from the IANA "Protocol Registries" page:

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

That page lists registries in protocol category groups, like this:

Author Domain Signing Practices (ADSP) Parameters

ADSP Outbound Signing Practices	RFC 5617 IETF Review
---------------------------------	---

ADSP Specification Tags	RFC 5617 IETF Review
-------------------------	---

Automatic Responses to Electronic Mail Parameters

Auto-Submitted Header Field Keywords	RFC 5436 Specification Required
---	--

Auto-Submitted header field optional parameters	RFC 3834 IETF Consensus
--	--

Autonomous System (AS) Numbers

16-bit Autonomous System Numbers	RFC 1930 , RFC 5398 , RFC 6996 RIR request to the IANA or IETF Review
----------------------------------	---

32-bit Autonomous System Numbers	RFC 1930 , RFC 5398 , RFC 6793 , RFC 6996 RIR request to the IANA
----------------------------------	---

or IETF Review

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The grouping allows related registries to be placed together, making it easier for users of the registries to find the necessary information. In the example section above, there are two registries related to the ADSP protocol, and they are both placed in the "ADSP Parameters" group.

Within the "ADSP Parameters" group are two registries: "ADSP Outbound Signing Practices" and "ADSP Specification Tags". Clicking on the title of one of these registries on the IANA Protocol Registries page will take the reader to the details page for that registry. Often, multiple registries are shown on the same details page.

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". And when new registries are created, the documents that define them often don't specify the grouping at all, but only name the new registry. This results in questions from IANA and delays in processing, or, worse, in related registries that should have been grouped together, but that are instead scattered about and hard to find and correlate.

Regardless of the terminology used, document authors should pay attention to the registry groupings, should request that related registries be grouped together, 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 (or sub-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 sub-registry, the registry that it is a part of **MUST** be identified using its full name, exactly as it appears in

the IANA registry 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. If they are to be left in, it is important that they be permanent links. IANA intends to include the permalink for each registry in the registry header. Until that is done, IANA can answer questions about the correct URLs to use.

For example, a document could contain something like this:

This registration should be made in the Foobar Operational Parameters registry, located at <<http://www.iana.org/assignments/foobar-registry>>.

It might be tempting to use the URL that appears in your web browser's address bar, which might look something like this for the example above:

<http://www.iana.org/assignments/foobar-registry/foobar-registry.xml>

...but that is not the permanent link to the registry.

Required information for registrations

This information may include the need to document relevant Security Considerations, if any.

Applicable review process

The review process that will apply to all future requests for registration. See [Section 2.3](#).

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. For strings, the encoding format should be specified (ASCII, UTF8, etc.).

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:

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X. IANA Considerations

This document defines a new DHCP option, entitled "FooBar" (see Section y), assigned a value of TBD1 from the DHCP Option space [to be removed upon publication:
<http://www.iana.org/assignments/bootp-dhcp-parameters>]
[\[RFC2132\]](#) [\[RFC2939\]](#):

Tag	Name	Data	Meaning
		Length	
----	----	-----	-----
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 sub-registry entitled "FooType values" under 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	See Section y.1
2	NitzFrob	See Section y.2
3-254	Unassigned	
255	Reserved	

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

2.3. Defining an Appropriate Registry Policy

There are several issues to consider when defining the policy for the new assignments in a registry.

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

Even when the space is essentially unlimited, however, it is usually 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 judgement.

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.

In particular, when a registry policy that requires involvement of Working Groups, directorates, or other bodies to be actively involved and to support the effort, requests frequently run into concerns that "it's not worth doing a Standards-Track RFC for something this trivial," when, in fact, that requirement was created by the Working Group in the first place, by placing the bar that high.

Indeed, publishing any RFC is costly, and a Standards Track RFC is

especially so, requiring a great deal of community time for review and discussion, IETF-wide last call, involvement of the entire IESG as well as concentrated time and review from the sponsoring AD,

review and action by IANA, and RFC-Editor processing.

Therefore, 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 (Specification Required, in terms of the well-known policies).

2.3.1. Using the Well-Known Registration Policies

This document defines a number of registration policies in [Section 4](#). Because they benefit from both community experience and wide understanding, their use is encouraged when appropriate.

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

For example, RADIUS [[RFC3575](#)] specifies the use of a Designated Expert, but includes specific additional criteria the Designated Expert should follow.

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. Expert Review
Expert review, sufficient documentation for review.
6. Specification Required
Expert review, significant, stable public documentation.
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 only.

Examples of situations that might merit RFC Required, 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 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.

The description in [Section 4.10](#) of "IESG Approval" suggests that the IESG "can (and should) reject a request if another path for registration is available that is more appropriate and there is no compelling reason not to use that path." The IESG should give similar consideration to any registration policy more stringent than Specification Required, asking for justification and ensuring that more relaxed policies have been considered, and the 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.

Note that the well-known policies are not exclusive; there are situations where a different policy might be more appropriate.

[2.3.2.](#) 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:

IANA is asked to create the registry "Fruit Access Flags" as a sub-registry of "Fruit Parameters". New registrations will be permitted through either the IETF Review policy or the Specification Required policy [BCP26].

Such combinations will commonly use one of {Standards Action, IETF Review, RFC Required} in combination with one of {Specification Required, Expert Review}.

2.3.3. 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 desired 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. 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. Remember to check this, and give clear instructions to IANA.

Such documents are normally processed with the same document status as the document that created the registry, or as Best Current Practices (BCPs) [[RFC2026](#)].

Example documents that updated the guidelines for assignments in pre-existing registries include: [[RFC6195](#)], [[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 namespace (one created by a previously published document).

Such documents should clearly identify the namespace into which each value is to be registered. If the registration goes into a sub-registry, the author should clearly explain that. Use the exact namespace name as listed on the IANA web page, and cite the RFC where the namespace is defined.

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.

When referring to an existing registry, providing a URL to precisely identify the registry is helpful. See [Section 2.2](#) for details on specifying the correct URL.

For example, a document could contain something like this:

This registration should be made in the Foobar Operational Parameters registry, located at <http://www.iana.org/assignments/foobar-registry>.

Normally, numeric values to be used are chosen by IANA when the document is approved, and 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. 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 that's 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, IANA has 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.

The IANA Considerations section should summarize all of the IANA actions, with pointers to the relevant sections elsewhere in the document as appropriate. When multiple values are requested, it is generally helpful to include a summary table. 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]]

Note: In cases where authors feel that including the full table 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.

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

IANA has assigned 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](#).

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 in this section, it is a strong indicator that the applicable registration procedures should be updated, possibly in parallel with the work that

instigated it.

3.4. Early Allocations

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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.

4. Well-Known Registration Policies

The following are some defined policies, most of which are in use today. These cover a range of typical policies that have been used to describe the procedure 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. 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 2.3.2](#).

Examples of RFCs that specify multiple policies in parallel:

LDAP [[RFC4520](#)]

TLS ClientCertificateType Identifiers [[RFC5246](#)] (as detailed in the subsections below)

Pseudowire Edge to Edge Emulation (PWE3) [[RFC4446](#)]

[4.1.](#) Private Use

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. There is no need for IANA to review such assignments (since IANA does not record 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 only, but with the purpose being to facilitate experimentation. See [[RFC3692](#)] for details.

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:

DNS names

Object Identifiers

IP addresses

[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, the exact value is generally assigned by IANA; 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 2.3.3](#)

Examples:

SASL mechanism names [[RFC4422](#)]

LDAP Protocol Mechanisms and LDAP Syntax [[RFC4520](#)]

[4.5.](#) Expert Review

(Also called "Designated Expert" in earlier editions of this document.) For the Expert Review policy, review and approval by a designated expert (see [Section 5](#)) is required. The required documentation and review criteria for use by the designated expert should be provided when defining the registry. For example, see Sections [6](#) and [7.2](#) in [[RFC3748](#)].

It is particularly important, when using a designated expert, to give clear guidance to the expert, laying out criteria for performing an evaluation and reasons for rejecting a request. When specifying a policy that involves a designated expert, the IANA Considerations SHOULD contain such guidance. 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.

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 2.3.3](#)

Examples:

EAP Method Types [[RFC3748](#)]

HTTP Digest AKA algorithm versions [[RFC4169](#)]

URI schemes [[RFC4395](#)]

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. The designated expert will review the public specification and evaluate whether it is sufficiently clear 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. For RFC publication, the normal RFC review process is expected to provide the necessary review for interoperability, though the designated expert may be a particularly well-qualified person to perform such a review.

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, or IAB stream, or an RFC Editor Independent Submission [[RFC5742](#)]). Unless otherwise specified, any type of RFC is sufficient (currently Standards Track, BCP, Informational, Experimental, or Historic).

[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](#)].

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. To ensure adequate community review, such documents will always undergo an IETF Last Call.

Examples:

IPSECKEY Algorithm Types [[RFC4025](#)]

Accounting-Auth-Method AVP values in DIAMETER [[RFC4005](#)]

TLS Extension Types [[RFC5246](#)]

4.9. Standards Action

For the Standards Action policy, values are assigned only through Standards Track RFCs approved by the IESG.

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 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 during the period [RFC 2434](#) was in effect. 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.

The following guidelines are suggested for any evaluation under IESG Approval:

- o The IESG can (and should) reject a request if another path for registration is available that is more appropriate and there is no compelling reason not to use that path.
- o Before approving a request, the community should be consulted, 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](#)]

5. Designated Experts

5.1. The Motivation for Designated Experts

IANA does not define registry policy itself; rather, it carries out policies that have been defined by others and published in RFCs. As part of that process, review of proposed registrations is often appropriate.

A common way to ensure such review is for a proposed registration to be published as an RFC, as this ensures that the specification is publicly and permanently available. It is particularly important if any potential interoperability issues might arise. For example, some assignments are not just assignments, but also involve an element of protocol specification. A new option may define fields that need to be parsed and acted on, which (if specified poorly) may not fit cleanly with the architecture of other options or the base protocols on which they are built.

In some cases, however, the burden of publishing an RFC in order to register a protocol element is excessive.

However, it is generally still useful (and sometimes necessary) to discuss proposed registrations within the community, on a mailing list. Such a mailing list provides opportunity for public review prior to assignment, and allows for a consultative process when registrants want help in understanding what a proper registration should contain.

While discussion on a mailing list can provide valuable technical feedback, opinions may 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.

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 2.3.2](#).

[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](#).

In registries where a pool of experts evaluates requests, the pool should have a single chair responsible for defining how requests are to be assigned to and reviewed by experts. In some cases, the expert pool may consist of a primary and backups, with the backups involved only when the primary expert is unavailable. In other cases, IANA might assign requests to individual members in sequential or approximate random order. In the event that IANA finds itself having received conflicting advice from its experts, it is the responsibility of the pool's chair to resolve the issue and provide IANA with clear instructions.

If a designated expert is conflicted 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.

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. In cases of disagreement among those 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.

This document defines the designated expert mechanism with respect to documents in the IETF stream only. Documents in other streams may only use a registration policy that requires a designated expert if those streams (or those documents) specify how 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 [RFC 2434](#) was published and has been 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. Possible reasons to deny a request include 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.

When a designated expert is used, documents MUST NOT name the designated expert 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. Deciding when the review should take place is a question of good judgment. And while re-reviews might be done when it's acknowledged that the documentation of the registered item has changed substantially, making sure that re-review 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 re-reviewed, 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.

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. 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).

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 that document, and 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, "[\[RFC9876\], Section 3.2](#)", rather than just "[\[RFC9876\]](#)".
- 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 (and shouldn'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 9876](#) is updated by [draft-ietf-foo-rfc9876bis](#). 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, and changes the definitive reference for some items, but not for others. Be sure that the references are always set to point to the correct, current documentation for each item.

For example, suppose [RFC 9876](#) 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	[RFC9876] , Section 3.2

If [draft-ietf-foo-rfc9876bis](#) obsoletes [RFC 9876](#) 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 9876](#), IANA is asked to change all registration information that references [\[RFC9876\]](#) to instead reference [\[\[this RFC\]\]](#).

If information for registered items has been or is being moved to other documents, then, of course, the registration information should be changed to point to those other documents. In no case is it reasonable to leave documentation pointers to the obsoleted document for any registries or registered items that are still in current use.

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

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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 include an IANA Considerations section that states:

This document has no IANA actions.

This statement, or an equivalent, must only be inserted after the working group or individual submitter has carefully verified it to be true. Using such wording as a matter of "boilerplate" or without careful consideration can lead to incomplete or incorrect IANA actions being performed.

If a specification makes use of values from a namespace in which assignments are not made by IANA, it may be useful to note this fact, with wording such as this:

The values of the Foofoo parameter are assigned by the Barfoo registry on behalf of the Rabfoo Forum. Therefore, this document has no IANA actions.

IANA prefers that these "empty" IANA Considerations sections be left in the document for the record. 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 (in consultation with the IESG) will continue 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 **MUST** be applied to such cases. 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.

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. In any case, 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](#)].

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 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 (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](#)

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 2.3.3](#)). 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 also may accept clarifications from document authors, relevant working group chairs, Designated Experts, and mail list participants, too.

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.

An analysis of security issues is generally required for all protocols that make use of parameters (data types, operation codes, keywords, etc.) used in IETF protocols or registered by IANA. Such security considerations are usually included in the protocol document [[RFC3552](#)]. It is the responsibility of the IANA considerations associated with a particular registry to specify what (if any) security considerations must be provided when assigning new values, and the process for reviewing such claims.

13. Changes Relative to Earlier Editions of [BCP 26](#)

13.1. 2014: Changes in This Document Relative to [RFC 5226](#)

Significant additions:

- o Added [Section 1.1](#), Keep IANA Considerations for IANA
- o Added [Section 1.2](#), For More Information
- o Added [Section 2.1](#), Hierarchical Registry Structure
- o Added [Section 2.3](#), Best Practice for Selecting an Appropriate Policy.
- o Added [Section 2.3.2](#), Using Multiple Policies in Combination.
- o Added [Section 2.3.3](#), Specifying Change Control for a Registry
- o Added [Section 3.4](#), Early Allocations
- o Moved well-known policies into a separate section for each, subsections 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

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.

[13.2.](#) 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 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.

14. Acknowledgments

14.1. Acknowledgments for This Document (2014)

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 Tony Hansen, John Klensin, and Mark Nottingham.

Special thanks to Mark Nottingham for reorganizing some of the text for better organization and readability, and to Tony Hansen for acting as document shepherd.

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Authors' Addresses

Michelle Cotton
Internet Corporation for Assigned Names and Numbers
12025 Waterfront Drive, Suite 300
Los Angeles, CA 90094-2536
US

Phone: +1 310 823 9358
Email: michelle.cotton@icann.org
URI: <http://www.icann.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
US

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

