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A Framework for Describing the Internet Assigned Numbers Authority(IANA)
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Abstract

This document provides a framework for describing the management of Internet registries managed by the Internet Assigned Numbers Authority. It defines terminology describing the various roles and responsibilities associated with management of Internet registry functions.

[Note: This is a work in progress and documents the thoughts developed by the IAB in its IAB iana-evolution program (<http://www.iab.org/activities/programs/iana-evolution-program/>) InternetGovtech@iab.org is the list which the IAB will be monitoring for the discussion of this draft. See <http://www.iab.org/mailman/listinfo/internetgovtech> for subscription details.]

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[1](#). Introduction

[1.1](#). Internet Registries and Interoperability on the Internet

Internet registries are critical to the operation of the Internet, since they provide a definitive record of the value and meaning of identifiers that protocols use when communicating with each other. Almost every Internet protocol makes use of registries in some form. At the time of writing, the Internet Assigned Numbers Authority (IANA) maintains over one thousand protocol parameter registries.

Management of Internet registries must be predictable, stable and secure, in order to ensure that protocol identifiers have consistent meanings and interpretations across all implementations and deployments. For example, TCP port number 80 is globally understood to denote the "http" service.

Internet registries hold identifiers consisting of constants and other well-known values used by Internet protocols. These values can be numbers, strings, addresses, etc. They are uniquely assigned for one particular purpose or use. Identifiers can be maintained in within a central list (e.g. a list of cryptographic algorithms for use in a particular protocol) or they can be hierarchically allocated and assigned by separate entities at different points in the hierarchy (such as for IP addresses and domain names).

Stable and predictable assignment and registration of protocol identifiers for Internet protocols is of great importance to many stakeholders, including developers, vendors, and customers, as well as users of devices, software, and services on the Internet. These stakeholders use and depend on registries and implicitly trust the registry system to be stable and predictable. The registry system is built on trust and mutual cooperation; the use of the registries is voluntary and is not enforced by mandates or certification policies. While the use of registries is voluntary, it is noted that the success of the Internet (e.g. as an enabler of social and economic

development) does create enormous pressure to utilize Internet protocols, and hence the protocol registries and their associated policies should be developed in a transparent manner which is open to all interested parties.

Stability and consistency of Internet registries is achieved through the definition of appropriate and clear policies for making additions to or updating existing entries. Such policies must take into account the technical and operational properties of the technology that makes use of the registries. At the same time, it must be possible to evolve the systems and policies for managing registry contents as the Internet itself evolves. This description of responsibilities, entities, and functions within the scope of IANA serves as an aid for a structured approach to the potential evolution of the Internet Registries model.

1.2. The IANA function and Internet Registries

The Internet Engineering Task Force (IETF) and its predecessors have traditionally separated the publication mechanism of its protocol specifications, published in immutable Request for Comments (RFCs), from the registries containing protocol parameters. The latter is maintained by a set of functions traditionally known collectively as the Internet Assigned Numbers Authority (IANA). Dating back to the somewhat before the earliest days of the Internet, the specification publication function and the registry maintenance functions were tightly coupled: Jon Postel of the Information Sciences Institute (ISI) of the University of Southern California (USC) was responsible for both the RFC publications and the IANA function. However, this tight coupling was never a requirement. Indeed, today the RFC Editor and IANA function are contracted to different entities. (The RFC publication process and the IANA protocol parameter policy development process and oversight remain closely coupled. For example, the Internet Architecture Board (IAB) has oversight responsibilities over the both RFC Series and IANA [[RFC2850](#)].)

One way to approach Internet Registry Management is to examine the what, why, who and how. Internet Registries are tables with assignments and allocations of values (the 'what'), established by explicit directions contained within RFC documents (the 'why'). The framework described in this document applies to individual registries. These registries are colloquially grouped into 3 classes: Names, Numbers, and IETF Protocol Parameters. The framework applies, with some nuance, to all registries, regardless of their class. Within the context of this document the term "Internet registries" is used for those the registries that are currently organized as Domain Names, Number Resources, and IETF Protocol Parameter registries.

One of the nuances that come into play is that some protocol parameters within these classes are "general use", and registry values assigned upon request to specific parties in accordance with the registry policy. Such assignments are generally unique in nature, i.e. only one party is associated with each general-purpose registry entry. Coordination (or automation) is necessary to provide uniqueness of assignments in each registry, but it is particularly important in the general purpose registries given the large number of assignments involved. Several of the general purpose registries (DNS, IPv4, IPv6, ASNs) have been delegated to parties which are believed to be reasonably representative of the communities dependent upon those registries (e.g. ccTLD, and Regional Internet Registries).

In this framework we identify major four roles: The Policy, The Oversight, the Evaluation Coordination, and Maintenance/Publication Roles (the latter two are both both implementation aspects). The entities that perform each of these roles can be interpreted as 'the who' while the ways in which they carry out their roles determine 'the how'.

Within the IETF, the term "IANA" is often used to describe functions belonging to the Evaluation Coordination and Maintenance/Publication roles (as described below). In this document we use the term IANA or IANA function(s) independent of the entities that implement those functions (the 'who'). Currently, according to the Memorandum of Understanding[RFC2860], the maintenance, implementation and publication of most of the IETF protocol parameter registries are performed by the Internet Corporation for Assigned Names and Numbers (ICANN).

1.3. Framework for Internet Registries

This document provides a framework for describing the management of Internet Registries as they are currently implemented. In [Section 2](#) it defines terminology describing the various roles and responsibilities associated with those roles. In [Section 3](#) we enumerate a few key principles for the implementation of the framework. In [Section 4](#) we discuss the existing context for these principles and other features of the framework. Finally, in [Section 5](#) we provide a number of examples on how the framework applies today. The examples demonstrate how the framework is applied to the situation today and its utility going forward.

This document may be read independent of [[RFC6220](#)] and [[RFC7020](#)]. Those documents identify the specific requirements for the IETF Protocol Parameter registries and the Internet Numbers Registry System. As such, they provide context and examples for some of the subject matter of this document. Those requirements apply only to

those subsets of the current collection of IANA function Internet registries.

The authors are aware that this framework uses fewer, slightly different, and more generic terms to describe the various roles than [\[RFC6220\]](#). [\[RFC6220\]](#) is a document that specifically pertains to the IETF protocol parameter registries.

For instance, [\[RFC6220\] section 2.1](#) "Protocol Parameter Registry Operator Role" describes the full set of responsibilities for the operator(s) of the IETF Protocol Parameter registries. These responsibilities map to the Implementor aspects in [Section 2.2](#) and [Section 2.3](#) below. [\[RFC6220\]](#) also describes the role of the IETF Administrative Oversight Committee (IAOC) and IETF Trust. These bodies have specific responsibilities in the wider IETF and are responsible for contracting and IPR respectively. Within this framework they should be considered part of the 'oversight role'.

The words must, should, shall, required, may and such should not be interpreted as normative language as defined in [\[RFC2119\]](#), but in their plain English meaning.

[2.](#) Roles in Relation to Internet Registries

In this section we discuss the roles relevant to Internet Registries in terms of an abstract registry that is defined as part of an arbitrary technical specification.

Registry management involves 4 roles. First, a policy development role that defines the purpose of the registry and the process and requirements for making additions or updates. Second, roles that refer to the operational process for processing change requests to a registry and for publishing its contents, both implementation aspects. Finally, an oversight role that refers to a high-level responsibility for ensuring that the other two roles are operating satisfactorily and stepping in if significant changes are needed in the policies or implementation of a registry. Each of these roles is described in more detail in the following subsections.

[2.1.](#) The Policy Role

Description:

Registries may need to have additional values added, or an existing entry may need to be removed, clarified, or updated in some manner. The Policy Role creates the registry and defines the policies that describes who can make updates or additions, what sort of review (if any) is needed, the conditions under which update requests would

normally be granted or when they might not, the security requirements of these interactions, etc. The entity performing this role may delegate its policy responsibilities for part or all of the parameters within the registry. Consequently, in this document the word "policy" is used to refer to a specific course or principle of action for administration of a technical resource maintained within specific registries.

Key Responsibilities:

The Policy Role refers to the creation of the governing policies that define how and when a registry can be updated or modified.

Primary Output:

A set of policies by which registries can be populated.

2.2. Evaluation Coordination Role

The Evaluation Coordination Role and the Maintenance/Publication Role (below) comprise the actual day-to-day operation of a registry in terms of servicing requests for registry additions or updates and publishing the contents of the registry. These roles implement processes that abide by the policies as defined by the Policy Role.

Key Responsibility:

Coordinate, operate, and process the timely evaluation of registration requests based on policies set by the Policy Role.

Primary Output:

A smoothly functioning system in which requests for registry updates are submitted and are evaluated and processed in a manner consistent with the policy guidance with the results recorded and published as appropriate. In some cases, the evaluation of requests is a straightforward task requiring little subjective evaluation, whereas in other cases evaluation is more complex and requires subject matter experts as defined by the relevant policy guidance.

Relation to other roles and activities:

The output of the evaluations is input to the process of assignment, delegation, and/or population of the registries as performed by the entity in the Maintenance/Publication Role ([Section 2.3](#)). The evaluations are performed based on the policies as defined by the Policy Role. The coordination of the evaluation is different from the evaluation of a request itself: the Evaluation Coordination Role

handles the request for allocation or maintenance of a record and may, under guidance of and in coordination with the entity fulfilling the Policy Role, delegate the actual evaluation to a third party.

2.3. Maintenance/Publication Role

Key Responsibility:

The maintenance of the registries' content: allocating or assigning parameters after positive evaluation and based on established policies, keeping appropriate record of transactions, and making the registries widely and freely available to the extent possible, to encourage protocol usage in conformance with the specifications.

Primary Output:

Easy and convenient access to registry contents, with additions and updates appearing in a timely manner.

Note:

Registry maintenance and publication are strictly mechanical functions. In practice the entity that performs those functions will often perform some or all of the responsibilities of the Evaluation Coordination Role. For instance, verification that an application/registration request is correct is an Evaluation Coordination responsibility that can reasonably be explicitly assigned to the entity performing the Maintenance/Publication Role by the entity that performs the Policy Development Role while evaluation of technical content is usually delegated to technical experts.

2.4. The Oversight Role

Description:

The oversight role refers to a high-level responsibility for ensuring that the other three roles are operating satisfactorily. Oversight involves stepping in if significant changes are needed in the policies, evaluation coordination, maintenance, or publication of a registry.

Key Responsibility:

Ensure that policies and the implementation of registries are aligned in a way that supports the coherent long-term development and use of shared Internet resources. Coordinate with entities with similar roles for other registries.

The oversight role is normally isolated from policy development. That said, the entity performing the Oversight Role may serve to resolve appeals related to policies or ratify developed policies.

3. Key principles of the IANA framework

The following key principles underscore the successful functioning of the framework:

Separation of Roles: The Policy, Evaluation Coordination, Maintenance/Publication, and Oversight roles should be separate or separable. A clear distinction between the roles enhances the transparency and makes it clearer who is accountable to whom.

Delegation: It should be possible to delegate any of the roles for registries or parts thereof.

Accountability and transparency: The entities fulfilling the roles are accountable to the materially concerned parties and the wider community. The entities fulfilling the Oversight Role are directly accountable to the wider community, although not all of the entities fulfilling the other roles must be. By implication, the entities fulfilling Oversight Role must maintain the highest possible standards of transparency and be open to input and review.

Stable and Predictable: Stable and predictable implementation of the Internet registries function is important for establishing global trust.

4. Discussion

4.1. On Separation of the roles

For many registries there is a de-facto separation of the Policy Role and the Evaluation Coordination Role that takes place at implementation. While this has never been an explicit requirement, it seems that splitting those roles can expose instances where policies lack of clarity, which provides helpful feedback to allow those policies to be improved. In addition, having the Policy, Oversight and the Evaluation Coordination Roles separated prevents the risks of the Evaluation Coordination Role from being burdened with (perceptions of) favoritism and unfairness.

4.2. On Delegation

Most, if not all, protocol parameter registries were created by the IETF or its predecessors. Today, most IETF protocols parameters registries are maintained by the IANA at ICANN. However, nothing in this framework prohibits the delegation of the Oversight, Policy, Evaluation Coordination, or Maintenance/Publication role (or any combination of these) of specific protocol parameter registries to other organizations. In some circumstances, that may be desirable and allow improved registry management for the good of the global Internet community.

Delegation of an IANA registry may be desirable for several reasons, including support for more inclusive registry policy development, distributing registry operations globally, and accommodating public policy considerations in registry management. While delegation of an IANA registry in these situations can improve the registry service received by the global Internet community, it is not guaranteed to do so and hence it is incumbent upon the IAB to have clear guidelines for successful IANA registry delegation. Such guidelines are out of scope for this document.

Examples for registries where the responsibility for developing policy has been delegated in whole or in part include the assignment of domain names and the assignment of Internet Protocol (IP) address blocks (both considered policy issues by [\[RFC2860\]](#)), and the autonomous system (AS) number registry [\[RFC7020\]](#). [\[RFC2860\]](#) demonstrates that that delegation can be very specifically bounded: "Note that (a) assignments of domain names for technical uses (such as domain names for inverse DNS lookup), (b) assignments of specialised address blocks (such as multicast or anycast blocks), and (c) experimental assignments are not considered to be policy issues [...]". These special-purpose names and addresses are assigned in the same manner as protocol parameters except that coordination is needed during policy setting and actual assignment of the values. The oversight bodies may facilitate the coordination. Also see Policy Examples 2 and 3 in [Section 5.1](#).

4.3. Accountability

Any entity performing one of the roles defined in this framework is to be held accountable for its responsibilities. Accountability of each entity needs to be expressed in terms of 'who' and 'how'; to who is the entity accountable and by which mechanisms is the entity being held accountable. In other words registry policy development and registry operations need to be "accountable" to the affected community.

In practice accountability mechanisms may be defined by memoranda of understanding or through contractual service level agreements (SLA) between implementing entities and the oversight body while the oversight bodies are being held accountable through community review mechanisms, for instance through recall and appeal processes.

For example: For protocol parameters the general oversight over the IANA function is performed by the IAB as a chartered responsibility from [RFC2850] (also see [Section 5.4](#)). In addition the IAOC, a body responsible for IETF administrative and financial matters, [RFC4071] maintains an SLA with ICANN, thereby specifying the operational requirements with respect to the coordination of evaluation, and the maintenance and publication of the registries. Both the IAB and the IAOC are accountable to the larger Internet community and are being held accountable through the IETF Nomcom process [BCP10].

Accountability mechanisms can vary depending upon the actual distribution of responsibilities (i.e.: how much is separated, how much is delegated).

[4.4.](#) On the Ability to create Internet Registries

As with the IETF and the corresponding IANA Protocol registries, other standards bodies (and other institutions) have long histories of defining and creating registries and the parameters, tables, and other values that make them up. Those normal practices may obviously extend to registries and their contents for use on the Internet. This document does not prescribe how those registries are governed.

The (wider) IETF has the authority to create new IETF Protocol Parameter registries as described in [RFC6220]. The IETF also has the authority to create registries that pertain to the Domain Name System, but only for specify technical use [RFC6761]. Finally the IETF has the (exclusive) authority to make technical assignment for Number Resources out of the currently reserved address space ([RFC2860] and [RFC4291]).

[5.](#) Examples

[5.1.](#) Policy Examples

Not coincidentally, the following 3 examples map to how the IANA registration functions are currently organized: IETF Protocol Parameter Registries, Number Resources and Domain Names.

5.1.1. IETF Protocol Parameter Registries

The IETF, through the IESG (see [\[RFC6220\] section 2.3](#)), acts in this role when in the "IANA Considerations" sections of its RFCs it specifies the creation of a new registry, specifies initial entries, and specifies a policy for adding additional entries to the registry in the future. [\[RFC5226\]](#) provides guidance and terminology that has proven useful within the IETF for describing common policies for managing its registries. Those terms include "Private Use", "Hierarchical allocation", "First Come First Served", "Expert Review", "Specification Required", "IESG Approval", "IETF Consensus", and "Standards Action". The IETF uses these and, if needed, other templates to define the policy through which registries are populated.

5.1.2. Number Resources

IP address allocation and the associated policy development is distributed too. For instance, the IETF has defined an IPv6 address range called unicast addresses. For a fraction of that address range ICANN has been delegated change control (see [\[RFC3513\] section 4](#) for details and [\[GlobAddrPol\]](#) for examples). The change control is further delegated to the Regional Internet Registries (RIRs) which, guided by policies set by the regional communities, delegate change control even further e.g., to Local Internet Registries.

5.1.3. Domain Names

The Domain Name System (DNS) protocol allows for hierarchical maintenance of the domain name registries, and publication thereof. ICANN is currently responsible for change control at the root zone which includes setting and maintaining policies for that zone. Change control, policy control, and publication authority follows the DNS hierarchy; although ICANN is the authoritative entity in the policy role for the root zone, it is not authoritative for all domains below the root. For example the IETF sets the policy for determining which names are allocated in the ietf.org zone. For country code top-level domains (ccTLD) the policies are set by the ccTLD registry in coordination with local community, local regulator(s), and/or other national bodies. Even the policy for assignment of names within the root is subject to nuances. For instance, ICANN has reserved two letter top-level domains for the use as country and territory code Top Level Domains (ccTLDs). The assignment of two-letter codes themselves (that may consecutively be used as DNS top-level domains) is done by ISO TC46/WG2 and are maintained by the ISO 3166 maintenance agency [\[ISO.3166.2013\]](#). The selection of the operator of a ccTLD is currently governed by [\[RFC1591\]](#), also see [Section 5.4.4](#).

[5.2.](#) Evaluation Coordination Role Examples

[5.2.1.](#) IETF Protocol Parameters

As mentioned above, [[RFC5226](#)] provides terminology to define common policies used by IETF registries associated with IETF protocols. One of the policies that the Policy Role can impose for allocation from a registry is "Expert Review". In this case a subject matter expert will evaluate the allocation request and determine whether an allocation will be made.

An alternative policy for allocation is the requirement for IETF Consensus. This is where the IETF has first, in its Policy Role, sets the policy to use its (policy) process to determine consensus for a particular registry modification.

The IANA functions operator (currently operated by ICANN) is the entity that, for the IETF, coordinates the evaluation of registration requests against policies as set by the IETF.

[5.2.2.](#) Nubmer Resources

IP address allocation policy is developed bottom-up through the Regional Internet Registry (RIR) communities. The RIR communities perform the Policy Role while at the RIRs the Policy Evaluation Role is performed by IP-Resource Analysts (or similar) that assess allocation requests against the policies developed in the Region.

RIR staff often support or even initiate the policy development process.

[5.2.3.](#) Domain Names

Generic TLD delegation policy is today developed bottom-up through ICANN policy processes. As specified in ICANN's bylaws [[ADDREF](#)], the ICANN Board of Trustees (BoT) oversees those process to perform the Policy Role. The Policy Evaluation Role is performed under the responsibility of the ICANN BoT; staff and various panels evaluate applications for new generic top-level domains against the policies developed via the ICANN Policy Development Processes. In addition, ICANN staff often support these policy development processes.

[5.3.](#) Maintenance and Publication of Registry Content

[5.3.1.](#) IETF Protocol Parameters

ICANN, as the current IANA functions operator, publishes the protocol parameters registries on the IANA website. Recently the plain-text tables on that website have been augmented with tables in a structured machine-readable format. The coordination of the requirements for publication and the implementation of the technical systems is part of the publication and maintenance responsibility.

[5.3.2.](#) Alternative publication mechanisms

[EDITORIAL NOTE: Add Reverse DNS and WHOIS content as examples of publication and maintenance]

[5.4.](#) Oversight Examples

[5.4.1.](#) IETF Protocol Parameters

The Internet Architecture Board (IAB) is responsible for overseeing the process used to create Internet Standards and coordinates with the other entities that have the oversight role for Internet Registries.

[5.4.2.](#) Nubmer Resources

Collectively, the communities served by the Regional Internet Registries oversee the policy development for global Internet address allocation policies.

[5.4.3.](#) Coordination - gTLDs vs special domain names

Collectively, the stakeholders involved in the ICANN policy development processes serve to oversee the policy development for generic TLD allocation processes.

Other examples of oversight around IETF protocols include the coordination between the IAB and the ITU-T when the ENUM protocol started to use E.164 identifiers (telephone numbers)[[RFC3245](#)]. Another example is the facilitation of coordination between the IETF protocol development process and reservations of labels at the top-level of the domain name space with [RFC6761](#) as a recent example.

[5.4.4.](#) Coordination - ccTLD Administration

Some readers might have noticed that in the Policy Example in [Section 5.1.3](#) the policy by which ccTLD operators are selected refers to [RFC1591](#). [RFC1591](#) was specified and published by the IANA, while Internet was still an ARPA project and before ICANN and the IETF

existed. The IAB at the time maintained loose oversight of IANA but had a different set of responsibilities. Should an update of [RFC1591](#) or a declaration of the historic nature of that document be needed then such action would most likely involve stewardship and coordination by the IAB and ICANN.

6. Security Considerations

As discussed in Section [Section 1.1](#) Internet Registries and the model discussed in this document are critical to elements of Internet security. However, this document simply discusses that model rather than changing it and consequently does not directly affect the security of the Internet.

7. Contributors and Acknowledgements

This text has been [is being] developed within the IAB IANA evolution program. The ideas and many, if not most, text fragments, and corrections came from or were inspired on comments from: Bernard Aboba, Jaap Akkerhuis, Jari Arkko, Marcelo Bagnulo, Mark Blanchet, Brian Carpenter, David Conrad, Steve Crocker, John Curran, Alissa Cooper, Leslie Daigle, Elise Gerich, Russ Housley, John Klensin, Bertrand de La Chapelle, Danny McPherson, George Michaelson, Thomas Narten, Andrei Robachevsky, and Greg Wood. Further inspiration and input was drawn from various meetings with IETF and other Internet community (RIRs, ISOC, W3C, IETF & IAB) leadership.

It should not be assumed that those acknowledged endorse the text.

8. IANA Considerations

This memo does not contain any specific instruction to any entity in the Implementer Role.

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- [RFC7020] Housley, R., Curran, J., Huston, G., and D. Conrad, "The Internet Numbers Registry System", [RFC 7020](#), August 2013.

[Appendix A](#). Document Editing Details

[Text between square brackets starting with initials are editor notes. Any other text between square brackets assumes an action by the RFC editor prior to publication as an RFC. In most cases this will be removal, sometimes a stylistic or editorial choices ore question is indicated] [This section and its subsections should be removed at publication as RFC]

[A.1](#). Version Information

[A.1.1](#). [draft-iab-iana-framework-01](#) -> [draft-iab-iana-framework-02](#)

Reordered paragraphs in the Discussion to align them with the order in the Key Principles. Also changed the order because Accountability mechanisms may depend on the kinds of separation and delegation applied.

Renamed the section titles for the examples from numbers to more descriptive titles.

Significant rewording to improve readability based on feedback by Alissa Cooper.

Added the paragraph talking about general use in [Section 1.2](#) based on feedback from John Curran.

[A.1.2](#). [draft-iab-iana-framework-00](#) -> [draft-iab-iana-framework-01](#)

Significantly reordered the document by pulling the examples out of the descriptions of the roles and moving those to section [Section 5](#).

Split the "Implementation Role" into two different roles explicitly: Evaluation and Maintenance. Both those roles can be headed under Implementation aspects.

Refined text about te "what, who and why" and gave an overview in section [Section 1.2](#)

Reworded the text in [Section 4.2](#) to highlight that only the name assignment is the policy aspect that has been delegated. Similarly, in section [Section 5.1](#) I tried to illustrate that even within the domain name assignment in the root there are delegated policies by introducing the IS03166 reference.

Added Oversight Example 4 in [Section 5.4](#) as an example of policy that exists for over a few decades and for which an update would need coordination

Nits and minor edits.

[A.1.3.](#) [draft-kolkman-iana-framework-00](#) -> [draft-iab-iana-framework-00](#)

Added section "On Accountability" and "On Delegation".

Refined some of the phrasing based on a thorough review by David Conrad"

Added a reference to [[RFC7020](#)] in [Section 1.3](#) and clarified the informative rather than normative nature of the examples.

Added section [Section 3](#) and changed the name of section [Section 4](#).

Nits and minor edits.

[A.1.4.](#) [draft-kolkman-iana-framework-00](#)

This draft is the result of a set of brainstorms in the IAB IANA program, it does not claim to reflect any consensus.

[A.1.5.](#) **TODO**

- o [RFC EDITOR: [BCP10](#) reference [[BCP10](#)] needs to be formatted correctly. The annotation hack used to list multiple RFCs that make up [BCP10](#) does not seem to work.]

[A.2.](#) **Subversion information**

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