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T. Lemon
Nominum, Inc.
R. Droms

W. Kumari
Google

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Special-Use Domain Names Problem Statement
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Abstract

The Special-Use Domain Names IANA registry policy defined in RFC 6761 has been shown through experience to present unanticipated challenges. This memo presents a list, intended to be comprehensive, of the problems that have been identified. In addition it reviews the history of Domain Names and summarizes current IETF publications and some publications from other organizations relating to Special-Use Domain Names.

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1. Introduction

One of the key services required to use the Internet is name resolution. Name resolution is the process of translating a symbolic name into some object or set of objects to which the name refers, most typically one or more IP addresses. These names are often referred to as Domain Names. When reading this document, care must be taken to not assume that the term Domain Name implies the use of the Domain Name System [RFC1034] for resolving these names. An excellent presentation on this topic can be found in Domain Names [I-D.lewis-domain-names].

Special-Use Domain Names [RFC6761] created an IANA registry for Special-Use Domain Names [SDO-IANA-SUDR], defined policies for adding to the registry, and made some suggestions about how those policies might be implemented. Since the publication of RFC 6761, the IETF has been asked to designate several new Special-Use Domain Names in this registry. During the evaluation process for these Special-Use Domain Names, the IETF encountered several different sorts of issues. Because of this, the IETF has decided to investigate the problem and decide if and how the RFC 6761 process can be improved, or whether it should be deprecated. The IETF DSNOP working group charter was extended to include conducting a review of the process for adding names to the registry that is defined in RFC 6761. This document is a product of that review.

Based on current ICANN and IETF practice, including RFC 6761, there are several different types of names in the root of the Domain Namespace:

- Reserved by the IETF for technical purposes

- Assigned by ICANN to the public DNS root; some names reserved by the IETF for technical purposes may appear in the Global DNS root for reasons pertaining to the operation of the DNS

- ICANN Reserved Names; names that may not be applied for as TLDs (see [SDO-ICANN-DAG], Section 2.2.1.2.1, Reserved Names, Section 2.2.1.4.1, Treatment of Country or Territory Names, et al.)

- Used by other organizations without following established processes

- Names that are unused and are available for assignment to one of the previous categories

This document presents a list, believed to be complete, of the problems associated with the assignment of Special-Use Domain Names. In support of its analysis of the particular set of issues described here, the document also includes descriptions of existing practice as it relates to the use of domain names, a brief history of domain names, and some observations by various IETF participants who have experience with various aspects of the current situation.

2. Terminology

This document uses the terminology from RFC 7719 [RFC7719]. Other terms used in this document are defined here:

Domain Name This document uses the term "Domain Name" as defined in section 2 of RFC 7719 [RFC7719].

Domain Namespace The set of all possible Domain Names.

Special-Use Domain Name A Domain Name listed in the Special-Use Domain Names registry.

For the sake of brevity this document uses some abbreviations, which are expanded here:

IANA Internet Assigned Numbers Authority

ICANN Internet Corporation for Assigned Names and Numbers

TLD Top-Level Domain, as defined in in section 2 of RFC 7719 [RFC7719]

gTLD Generic Top-Level Domain, as defined in in section 2 of RFC 7719 [RFC7719]

3. Problems associated with Special-Use Domain Names

This section presents a list of problems that have been identified with respect to the assignment of Special-Use Domain Names. Solutions to these problems, including their costs or tradeoffs, are out of scope for this document. They will be covered in a separate document. New problems that might be created in the process of solving problems described in this document are also out of scope: these problems are expected to be addressed in the process of evaluating potential solutions.

Special-Use Domain Names exist to solve a variety of problems. This document has two goals: enumerate all of the problems that have been identified to which Special-Use Domain Names are a solution and enumerate all of the problems that have been raised in the process of trying to use RFC 6761 as it was intended. As some of those problems may fall into both categories, this document makes no attempt to categorize the problems.

There is a broad diversity of opinion about this set of problems. Not every participant agrees that each of the problems enumerated in this document is actually a problem. This document takes no position on the relative validity of the various problems that have been enumerated. The sole purposes of the document are to enumerate those problems, provide the reader with context for thinking about them and provide a context for future discussion of solutions.

This is the list of problems:

- o No formal coordination process exists between the IETF and ICANN as they follow their respective name assignment processes (see Section 4.1.3). The lack of coordination complicates the management of the root of the Domain Namespace and could lead to conflicts in name assignments [SDO-ICANN-SAC090].

- o There is no explicit scoping as to what can constitute a "technical use" [RFC2860] and what cannot, and there is also no consensus within the IETF as to what this term means.

- o Not all developers of protocols on the internet agree that authority over the entire Domain Namespace should reside solely with the IETF and ICANN.

- o Although IETF and ICANN nominally have authority over this namespace, neither organization can enforce that authority over any third party who wants to just start using a subset of the namespace. Such parties may observe that the IETF has never asserted control or authority over what protocols are "allowed" on the internet, and that the principle of "permissionless innovation" suggests there should be a way for people to include new uses of domain names in new protocols and applications.

- o Organizations do in fact sometimes use subsets of the Domain Namespace without following established processes. Reasons a third party might do this include:

  - * Unaware that a process exists for assigning such names

  - * Intended use is covered by gTLD process [SDO-ICANN-DAG], but no gTLD process is ongoing

  - * Intended use is covered by gTLD process, but the third party doesn't want to pay a fee

  - * Intended use is covered by some IETF process, but the third party doesn't want to follow the process

  - * Intended use is covered by ICANN or IETF process, but third party expects that the outcome will be refusal or non-action

  - * Unaware that a name intended to be used only locally may nevertheless leak

  * Unaware that a name used locally with informal allocation may subsequently be allocated formally, creating operational problems

- There is demand for more than one name resolution protocol for Domain Names. Domain Names contain no metadata to indicate which protocol to use to resolve them. Domain name resolution APIs do not provide a way to specify which protocol to use.

- When a Special-Use Domain Name is added to the Special-Use Domain Names registry, not all software that processes such names will understand the special use of that name. In many cases, name resolution software will use the Domain Name System for resolution of names not known to have a special use. Consequently, any such use will result in queries for Special-Use Domain Names being sent to Domain Name System authoritative servers. These queries may constitute an operational problem for operators of root zone authoritative name servers. These queries may also inadvertently reveal private information through the contents of the query, which is a privacy consideration.

- The RFC 6761 process is sufficiently uncertain that some protocol developers have assumed they could not get a name assigned; the process of assigning the first new name ('.local') using the RFC 6761 process took more than ten years from beginning to end: longer by a factor of ten than any other part of the protocol development process (largely because this ten years included time to develop the process as well as use it). Other uses of the process have proceeded more smoothly, but there is a reasonably justified perception that using this process is likely to be slow and difficult, with an uncertain outcome.

- There is strong resistance within the IETF to assigning Domain Names to resolution systems outside of the DNS, for a variety of reasons:

  * Requires a mechanism for identifying which of a set of resolution processes is required in order to resolve a particular name.

  * Assertion of authority: there is a sense that the Domain Namespace is "owned" by the IETF or by ICANN, and so, if a name is claimed outside of that process, the person or entity that claimed that name should suffer some consequence that would, presumably, deter future circumvention of the official process.

  * More than one name resolution protocol is bad, in the sense that a single protocol is less complicated to implement and deploy.

  * The semantics of alternative resolution protocols may differ from the DNS protocol; DNS has the concept of RRtypes; other protocols may not support RRtypes, or may support some entirely different data structuring mechanism.

  * If there is an IETF process through which a TLD can be assigned at zero cost other than time, this process will be used as an alternative to the more costly process of getting the name registered through ICANN.

  * A name might be assigned for a particular purpose when a more general use of the name would be more beneficial.

  * If the IETF assigns a name that some third party or parties believes belongs to them in some way, the IETF could become embroiled in an expensive dispute with those parties.

- If there were no process for assigning names for technical use through the IETF, there is a concern that protocols that require such names would not be able to get them.

- In some cases where the IETF has made assignments through the RFC 6761 process, technical mistakes have been made due to misunderstandings as to the actual process that RFC 6761 specifies (e.g., treating the list of suggested considerations for assigning a name as a set of requirements all of which must be met). In other cases, the IETF has made de facto assignments of Special-Use Domain Names without following the RFC 6761 process.

- There are several Domain Name TLDs that are in use without due process for a variety of purposes [SDO-ICANN-COLL]. The status of these names need to be clarified and recorded to avoid future disputes about their use.

- In principle, the RFC 6761 process could be used to document the existence of Domain Names that are not safe to assign, and provide information on how those names are used in practice. However, attempts to use RFC 6761 to accomplish this documentation have not been successful (for example, see "Additional Reserved Top Level Domains [I-D.chapin-additional-reserved-tlds] and Section 4.2.7). One side effect of the lack of documentation is that any mitigation effect on the root name servers or on privacy considerations has been missed.

- o A Domain Name can be identified as either a DNS name by placing it in the DNS zone(s) or as a Special-Use Domain Name by adding it to the IANA registry. Some names are in both places; for example, some locally served zone names are in DNS zones and documented in the Special-Use Domain Names registry. At present, the only way a Domain Name can be added to the Special-Use Domain Name registry is for the IETF to take responsibility for the name and designate it for "technical use". There are other potential uses for Domain Names that should be recorded in the registry, but for which the IETF should not take responsibility.

- o The IETF may in some cases see the need to document that a name is in use without claiming that the use of the name is the IETF's use of the name. No mechanism exists in the current registry to mark names in this way.

- o There is no formal process during any of the review stages for a document in which a check is made to ensure that the document does not unintentionally violate IETF process for adding special-use domain names to the registry, as was the case, for example, in RFC 7788 [RFC7788].

- o Use of the registry is inconsistent -- some Special-Use Domain Name RFCs specify registry entries, some don't; some specify delegation, some don't.

- o There exists no safe, non-process-violating mechanism for ad-hoc assignment of Special-Use Domain Names.

- o It is generally assumed that protocols that need a Special-Use Domain Name need a mnemonic, single-label, human-readable Special-Use Domain Name, for use in user interfaces such as command lines or URL entry fields. While this assumption is correct in some cases, it is likely not correct in all cases; for example, in applications where the DNS name is never visible to a user.

- o RFC 6761 uses the term "Domain Name" to describe the thing for which special uses are registered. This creates a great deal of confusion because some readers take "Domain Name" to imply the use of the DNS protocol.

- o The use of DNSSEC with Special-Use Domain Names is an open issue. There is no consensus or guidance about how to use DNSSEC with various classes of Special-Use Domain Names. Considerations in the use of DNSSEC with Special-Use Domain Names include:

  * What class of Special-Use Domain Name is under consideration: non-DNS, locally served zone, other?

* Does the Special-Use Domain Name require a delegation in the root zone; if so, should that delegation be signed or not? If there is no delegation, then this will be treated by validating resolvers as a secure denial of existence for that zone. This would not be appropriate for a name being resolved using the DNS protocol.

* A process would be required through which the IETF can cause a delegation in the root zone to be instantiated.

* What are the recommended practices for using DNS with the specific Special-Use Domain Name?

The problems we have stated here represent the current understanding of the authors of the document as to the complete set of problems that have been identified during discussion by the working group on this topic. The remainder of this document provides additional context that will be needed for reasoning about these problems.

4. Existing Practice Regarding Special-Use Domain Names

There are three primary (see Section 4.1) and numerous secondary (Section 4.2) documents to consider when thinking about the Special-Use Domain Names process.

How names are resolved is ambiguous, in the sense that some names are Special-Use Domain names that require special handling, and some names can be resolved using the DNS protocol with no special handling.

The assignment of Internet Names is not under the sole control of any one organization. IETF has authority in some cases, but only with respect to "technical uses." ICANN at present is the designated administrator of the root zone, but generally not of zones other than the root zone. Neither of these authorities can in any practical sense exclude the practice of ad-hoc use of names. Unauthorized use of domain names can be accomplished by any entity that has control over one or more name servers or resolvers, in the context of any hosts and services that that entity operates. It can also be accomplished by authors of software who decide that a Special-Use Domain Name is the right way to indicate the use of an alternate resolution mechanism.

4.1. Primary Special-Use Domain Name Documents

The primary documents are considered primary because they directly address the IETF's past thoughts on this topic in a general way, and

also because they describe what the IETF does in practice. Only one of these documents is an IETF consensus document.

4.1.1. IAB Technical Comment on the Unique DNS Root

This document [RFC2826] is not an IETF consensus document, and appears to have been written to address a different problem than the Special-Use Domain Name problem. However, it speaks directly to several of the key issues that must be considered, and, coming as it does from the IAB, it is rightly treated as having significant authority despite not being an IETF consensus document.

This document should be considered required reading for IETF participants who wish to express an informed opinion on the topic of Special-Use Domain Names. The main points that appear relevant to the Special-Use Domain Names problem are:

- The Internet requires a globally unique namespace

- Private networks may operate private namespaces, but still require that names in the public namespace be globally unique.

- The Domain Name System [RFC1035] is not the only protocol that may be used for resolving domain names.

- Users cannot be assumed to know how to distinguish between symbolic references that have local meaning and references that have global meaning. Users may therefore share references that incorporate Domain Names with no global meaning (for example, a URL of 'http://mysite.example.corp', where 'example.corp' is a domain used privately and informally as described in [SDO-ICANN-COLL]).

- Such references might refer to the object the user intends to share within that user's context, but either refer to some other object any recipient's context, or might not refer to any object at all in a recipient's context. The effect of this reference escaping the context in which it is valid is that the user's intended communication will not be able to be understood by the recipients of the communication.

- This same problem can also occur when a single user copies a name from one context in which it has one meaning, into a different context in which it has a different meaning -- for example copying a '.onion' Domain Name out of a Tor Browser [TOR], where it has meaning, and pasting this name into an ssh client that doesn't support connecting over the Tor network.

We can summarize the advice in this document as follows:

- o Domain Names with unambiguous global meaning are preferable to Domain Names with local meaning which will be ambiguous. Nevertheless both globally-meaningful and locally-special names are in use and must be supported.

- o At the time of the writing of this document the IAB was of the opinion that there might well be more than one name resolution protocol used to resolve Domain Names.

4.1.2. Special-Use Domain Names

The second important document is "Special-Use Domain Names" [RFC6761]. RFC 6761 represents the current IETF consensus on designating and recording Special-Use Domain Names. The IETF has experienced problems with the designation process described in RFC 6761; these concerns motivate this document. Familiarity with RFC 6761 is a prerequisite for having an informed opinion on the topic of Special-Use Domain Names.

RFC 6761 defines two aspects of Special-Use Domain Names: designating a Domain Name to have a special purpose and registering that special use in the Special-Use Domain Names registry. The designation process is defined in a single sentence (RFC 6761, section 4):

> If it is determined that special handling of a name is required in order to implement some desired new functionality, then an IETF "Standards Action" or "IESG Approval" specification [RFC5226] MUST be published describing the new functionality.

This sentence requires that any designation of a Special-Use Domain Name is subject to the same open review and consensus process as used to produce and publish all other IETF specifications.

The registration process is a purely mechanical process, in which the existence of the newly designated Special-Use Domain Name is recorded, with a pointer to a section in the relevant specification document that defines the ways in which special handling is to be applied to the name.

RFC 6761 provided the process whereby Multicast DNS [RFC6762] designated ".local" as a Special-Use Domain Name and included it in the Special-Use Domain Names registry. It itself also enumerated a set of names that had been previously used or defined to have special uses prior to the publication of RFC 6761. Since there had been no registry for these names prior to the publication of RFC 6761, the

documents defining these names could not have added them to the registry.

There are at least several important points to think of with respect to the RFC 6761:

- o A Special-Use Domain Name may be a name that should be resolved using the DNS protocol with no special handling. An example of this is 'IN-ADDR.ARPA.' (which is an example of a Special-Use Domain Name that is not a TLD).

- o A Special-Use Domain Name may be a name that is resolved using the DNS protocol, requires no special handling in the stub resolver, but requires special handling in the recursive resolver. An example of this would be "10.in-addr.arpa."

- o A Special-Use Domain Name may be a name that requires special handling in the stub resolver. An example would be a Special-Use Top-Level Domain Name like '.local' which acts as a signal to indicate that the local stub resolver should use a non-DNS protocol for name resolution.

- o The current IETF consensus (from a process perspective, not necessarily from the perspective of what would be consensus if the IETF were to attempt to produce a new consensus document) is that all of these purposes for Special-Use Domain Names are valid.

The term "stub resolver" in this case does not mean "DNS protocol stub resolver." The stub resolver is the entity within a particular software stack that takes a question about a Domain Name and answers it. One way a stub resolver can answer such a question is using the DNS protocol, but it is in the stub resolver, as we are using the term here, that the decision as to whether to use a protocol, and if so which protocol, or whether to use a local database of some sort, is made.

RFC 6761 does not limit Special-Use Domain Names to TLDs. However, at present, all Special-Use Domain Names registered in the IANA Special-Use Domain Names registry [SDO-IANA-SUDR] are either intended to be resolved using the DNS protocol, or are TLDs, or both. That is, at present there exist no Special-Use Domain Names which require special handling by stub resolvers and which are not at the top level of the naming hierarchy.

One point to take from this is that there is already a requirement in RFC 6762 that when stub resolvers encounter the special label, '.LOCAL' at the top level of a domain name, they can only use the mDNS protocol be used for resolving that Domain Name.

4.1.3. MoU Concerning the Technical Work of the IANA

There exists a Memorandum of Understanding [RFC2860] between the IETF and ICANN (Internet Corporation for Assigned Names and Numbers) which discusses how names and numbers will be managed through the IANA (Internet Assigned Numbers Authority). This document is important to the discussion of Special-Use Domain Names because, while it delegates authority for managing the Domain Name System Namespace generally to ICANN, it reserves to the IETF the authority that RFC 6761 formalizes:

> 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, and shall remain subject to the provisions of this Section 4.

The above text is an addendum to the following:

> Two particular assigned spaces present policy issues in addition to the technical considerations specified by the IETF: the assignment of Domain Names, and the assignment of IP address blocks. These policy issues are outside the scope of this MOU.

In general, then, the assignment of names in the DNS root zone, and the management of the DNS namespace, is a function that is performed by ICANN. However, the MoU specifically exempts domain names assigned for technical use, and uses the example of domains used for inverse DNS lookup. Both 'IN-ADDR.ARPA' and 'IP6.ARPA' are in the Special-Use Domain Names registry.

Implicit in the MoU is the fact that the IETF and ICANN retain, between them, sole authority for assigning any names from the Domain Namespace. Both the IETF and ICANN have internal processes for making such assignments.

The point here is not to say what the implications of this statement in the MoU are, but rather to call the reader's attention to the existence of this statement.

4.1.4. Liaison Statement on Technical Use of Domain Names

As a result of processing requests to add names to the Special-Use Domain Name registry, as documented in [I-D.chapin-additional-reserved-tlds] and [I-D.grothoff-iesg-special-use-p2p-names], a review was chartered of the process defined in RFC 6761 for adding names to the registry (as

explained earlier). The Liaison Statement [SDO-IAB-ICANN-LS] notified ICANN of the review, affirmed that the discussion would be "open and transparent to participation by interested parties" and explicitly invited members of the ICANN community to participate.

4.2. Secondary documents relating to the Special-Use Domain Name question

In addition to these documents, there are several others with which participants in this discussion should be familiar.

4.2.1. Multicast DNS

Multicast DNS [RFC6762] defines the Multicast DNS protocol, which uses the '.LOCAL' Special-Use Top-Level Domain Name. Section 3 describes the semantics of "multicast DNS names." It is of considerable historical importance to note that the -00 version of this document, an individual submission, was published in July of 2001. This version contains substantially the same text in section 3, and was discussed in the DNSEXT working group at IETF 51 in August of 2001[IETF-PRO-51]. The first version of this document designated '.LOCAL.ARPA' as the Special-Use Domain Name. This idea was strongly opposed by DNSEXT working group participants, and as a result the author eventually switched to using '.LOCAL'.

The history of RFC 6762 is documented in substantial detail in Appendix H; some notable milestones include the initial proposal to replace Appletalk's NBP in July 1997, the chartering of the Zeroconf working group in September 1999, assignment of a multicast address for link-local name discovery in April of 2000. A companion requirements document, eventually published as [RFC6760] was first published in September of 2001.

The point of mentioning these dates is so that discussions involving the time when the '.LOCAL' domain was first deployed, and the context in which it was deployed, may be properly informed.

4.2.2. The .onion Special-Use Top-Level Domain Name

The .onion Special-Use Top-Level Domain Name [RFC7686] is important because it is the most recent IETF action on the topic of Special-Use Domain Names; although it does not set new policy, the mere fact of its publication is worth thinking about.

Two important points to consider about this document are that:

o The IETF gained consensus to publish it

- o The situation was somewhat forced, both by the fact of its unilateral use by The Tor Project without following the RFC 6761 process, and because a deadline had been set by the CA/Browser Forum [SDO-CABF-INT] after which all .onion PKI certificates would expire and no new certificates would be issued, unless the .onion Special-Use Top-Level Domain Name were to be recognized by the IETF.

4.2.3. Locally Served DNS Zones

Locally Served DNS Zones [RFC6303] describes a particular use case for zones that exist by definition, and that are resolved using the DNS protocol, but that cannot have a global meaning, because the host IP addresses they reference are not unique. This applies to a variety of addresses, including Private IPv4 addresses [RFC1918], Unique Local IPv6 Unicast Addresses [RFC4193] (in which this practice was first described) and IANA-Reserved IPv4 Prefix for Shared Address Space [RFC6598].

This use case is distinct from the use-case for Special-Use Domain Names like '.local' and '.onion' in that the names are resolved using the DNS protocol (but do require extensions or exceptions to the usual DNS resolution to enforce resolution in a local context rather than the global DNS context). But it shares the problem that such names cannot be assumed either to be unique or to be functional in all contexts for all Internet-connected hosts.

4.2.4. Name Collision in the DNS

Name Collision in the DNS [SDO-ICANN-COLL] is a study commissioned by ICANN that attempts to characterize the potential risk to the Internet of adding global DNS delegations for names that were not previously delegated in the DNS, not reserved under any RFC, but also known to be (.home) or surmised to be (.corp) in significant use for Special-Use-type reasons (local scope DNS, or other resolution protocols altogether).

4.2.5. SSAC Advisory on the Stability of the Domain Namespace

SSAC Advisory on the Stability of the Domain Namespace [SDO-ICANN-SAC090] reports on some issues surrounding the conflicting uses, interested parties and processes related to the Domain Namespace. The document recommends the development of collaborative processes among the various interested parties to coordinate their activities related to the Domain Namespace.

4.2.6. Discovery of the IPv6 Prefix Used for IPv6 Address Synthesis

Discovery of the IPv6 Prefix Used for IPv6 Address Synthesis [RFC7050] is an example of a document that successfully used the RFC 6761 process to designate '.ipv4only.arpa' as a Special-Use Domain Name; in this case the process worked smoothly and without controversy.

Unfortunately, while the IETF process worked smoothly, in the sense that there was little controversy or delay in approving the new use, it did not work correctly: the name "ipv4only.arpa" was never added to the Special-Use Domain Names registry. This appears to have happened because the document did not explicitly request the addition of an entry for "ipv4only.arpa" in the SUDN registry. This is an illustration of one of the problems that we have with the 6761 process: it is apparently fairly easy to miss the step of adding the name to the registry.

4.2.7. Additional Reserved Top Level Domains

Additional Reserved Top Level Domains [I-D.chapin-additional-reserved-tlds] is an example of a document that attempted to reserve several TLDs identified by ICANN as particularly at risk for collision as Special-Use Domain Names with no documented use. This attempt did not advance in the IETF process.

Although this document failed to gain consensus to publish, the need it was intended to fill still exists. Unfortunately, although a fair amount is known about the use of these names, no RFC documents how they are used, and why it would be a problem to delegate them. Additionally, to the extent that the uses being made of these names are valid, no document exists indicating when it might make sense to use them, and when it would not make sense to use them.

RFC 7788 [RFC7788] defines the Domain Name TLD ".home" for use as the default name for name resolution relative to a home network context. Although, as defined in RFC 7788, ".home" is a Special-Use Domain Name, RFC 7788 did not follow the process in RFC 6761 and request the addition of ".home" to the IANA Special-Use Domain Name registry. Additionally, ".home" is an example of an attempt to reuse a Domain Name that has already been put into use for other purposes without following established processes[SDO-ICANN-COLL], which further complicates the situation. At the time this document was written, the IETF was developing a solution to this problem.

5. History

Newcomers to the problem of resolving Domain Names may be under the mistaken impression that the DNS sprang, as in the Greek legend of Athena, directly from Paul Mockapetris' forehead. This is not the case. At the time of the writing of the IAB technical document, memories would have been fresh of the evolutionary process that led to the DNS' dominance as a protocol for Domain Name resolution.

In fact, in the early days of the Internet, hostnames were resolved using a text file, HOSTS.TXT, which was maintained by a central authority, the Network Information Center, and distributed to all hosts on the Internet using the File Transfer Protocol (FTP) [RFC0959]. The inefficiency of this process is cited as a reason for the development of the DNS [RFC0882] [RFC0883] in 1983.

However, the transition from HOSTS.TXT to the DNS was not smooth. For example, Sun Microsystems's Network Information System [CORP-SUN-NIS], at the time known as Yellow Pages, was an active competitor to the DNS, although it failed to provide a complete solution to the global naming problem.

Another example was NetBIOS Name Service, also known as WINS [RFC1002]. This protocol was used mostly by Microsoft Windows machines, but also by open source BSD and Linux operating systems to do name resolution using Microsoft's own name resolution protocol.

Most modern operating systems can still use the '/etc/hosts' file for name resolution. Many still have a name service switch that can be configured on the host to resolve some domains using NIS or WINS. Most have the capability to resolve names using mDNS by recognizing the special meaning of the '.local' Special-Use Top Level Domain Name.

The Sun Microsystems model of having private domains within a corporate site, while supporting the global Domain Name system for off-site, persisted even after the NIS protocol fell into disuse. Microsoft used to recommend that site administrators use a "private" TLD for internal use, and this practice was very much a part of the zeitgeist at the time (see section 5.1 of [SDO-ICANN-COLL] and Appendix G of [RFC6762]). This attitude is at the root of the widespread practice of simply picking an unused TLD and using it for experimental purposes, which persists even at the time of writing of this memo.

This history is being presented because discussions about Special-Use Domain Names in the IETF often come down to the question of why users of new name resolution protocols choose to use Domain Names, rather

than using some other naming concept that doesn't overlap with the namespace that, in modern times is, by default, resolved using the DNS.

The answer is that as a consequence of this long history of resolving Domain Names using a wide variety of name resolution systems, Domain Names are required in a large variety of contexts in user interfaces and applications programming interfaces. Any name that appears in such a context is a Domain Name. So developers of new name resolution systems that must work in existing contexts actually have no choice: they must use a Special-Use Domain Name to segregate a portion of the namespace for use with their system.

6. Security Considerations

This document mentions various security and privacy considerations in the text. However, this document creates no new security or privacy concerns.

7. IANA considerations

This document has no actions for IANA.

8. Contributors

This document came about as a result of conversations that occurred in the conference hotel lobby, the weekend before IETF 95, when the original author, Ted Lemon, was trying to come up with a better problem statement. Stuart Cheshire, Mark Andrews, David Conrad, Paul Ebersman and Aaron Falk all made helpful and insightful observations or patiently answered questions. This should not be taken as an indication that any of these folks actually agree with what the document says, but their generosity with time and thought are appreciated in any case.

Ralph started out as an innocent bystander, but discussion with him was the key motivating factor in the writing of this document, and he agreed to co-author it without too much arm-twisting. Warren spent a lot of time working with us on this document after it was first published, and joined as an author in order to make sure that the work got finished; without him the -01 and -02 versions might not have happened.

This document also owes a great deal to Ed Lewis' excellent work on what a "Domain Name" is [I-D.lewis-domain-names].

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Appendix A. Change Log.

-03 to -04:

- Issue #72: Corrected original text to reflect that RFC 7050 neglected to request an SUDN registry entry for "ipv4only.arpa", but any inference about the cause for the oversight would be speculation.

- Issue #69: Edited Joel's suggested text.

- Issue #67: Minor change to Joel's suggested text.

- Issue #66: Edited second text update suggested by Joel and reverted third change back to the original text.

- Issue #64: Minor changes to text suggested by Joel.

- Issue #61: Minor edit based on authors' consensus in response to Joel's comment.

- Addressed Joel / Benoit's AD comments. See GH issues

-02 to -03 (in Github):

Passes idnits except for errors resulting from a reference to an RFC 2119 keyword and a citation of RFC 5226 with no matching reference in quoted text at line 493.

Issue #60: Add new section "6. Summary" -- Petr Spacek
https://github.com/Abhayakara/draft-tldr-sutld-ps/issues/60

Issue #57: Document needs an "Security Considerations" section
https://github.com/Abhayakara/draft-tldr-sutld-ps/issues/57

Numerous editorial changes for consistency; e.g. use "Special-Use Domain Names" throughout.

Issue #58: Document needs an "IANA Considerations" section https://github.com/Abhayakara/draft-tldr-sutld-ps/issues/58

Issue #39: Overlapping bullets in Section 3, with proposed restructuring -- Russ Housley https://github.com/Abhayakara/draft-tldr-sutld-ps/issues/39

Issue #55: Editorial improvement to Section 3 (4) -- John Dickinson https://github.com/Abhayakara/draft-tldr-sutld-ps/issues/55

Issue #34: Separate two problems in paragraph that begins "No mechanism exists for adding a name to the registry...." (2 issues) -- Suzanne Woolf https://github.com/Abhayakara/draft-tldr-sutld-ps/issues/34

Issue #52: Editorial improvement to Section 3 (1) -- John Dickinson https://github.com/Abhayakara/draft-tldr-sutld-ps/issues/52

Issue #51: Clarification in Introduction -- John Dickinson https://github.com/Abhayakara/draft-tldr-sutld-ps/issues/51

Issue #49: Should cite https://datatracker.ietf.org/liaison/1351 -- George Michaelson https://github.com/Abhayakara/draft-tldr-sutld-ps/issues/49

Issue #50: IETF precedence in Special-Use names registry -- Ted Lemon https://github.com/Abhayakara/draft-tldr-sutld-ps/issues/50

Issue #48: 4.1.2 cites sub-domains of .ARPA arguing for special use TLD -- George Michaelson https://github.com/Abhayakara/draft-tldr-sutld-ps/issues/48

Issue #47: 4.3 should be made more prominent -- George Michaelson https://github.com/Abhayakara/draft-tldr-sutld-ps/issues/47

Issue #43: Spell out SUDN and SUTLDN rather than use acronyms -- Russ Housley https://github.com/Abhayakara/draft-tldr-sutld-ps/issues/43

Issue #41: Reword bullet in Section 3 regarding Domain Name TLDs that have been commandeered, as reported in SDO-ICANN-COLL -- Russ Housley https://github.com/Abhayakara/draft-tldr-sutld-ps/issues/41

Issue #40: Note that time to publish spec for .local included inventing SUDN registry -- Russ Housley https://github.com/Abhayakara/draft-tldr-sutld-ps/issues/41

Issue #37: Title should be "Special-Use Domain Names Problem Statement" -- Russ Housley https://github.com/Abhayakara/draft-tldr-sutld-ps/issues/37

Issue #36: Expand on desire for Special-Use names to be human-readable -- Suzanne Woolf https://github.com/Abhayakara/draft-tldr-sutld-ps/issues/36

Issue #35: Clarify "No process exists [...]" to include both IETF process and other process -- Suzanne Woolf https://github.com/Abhayakara/draft-tldr-sutld-ps/issues/35

Issue #31: Add justification for concern about IETF's ability to assign names for technical use -- Suzanne Woolf https://github.com/Abhayakara/draft-tldr-sutld-ps/issues/31

Issue #12: Add DNSSEC to text -- John Levine https://github.com/Abhayakara/draft-tldr-sutld-ps/issues/12

Issue #6: Without a process, we just have chaos -- Stuart Cheshire https://github.com/Abhayakara/draft-tldr-sutld-ps/issues/6

Issue #32: Have assignments through RFC 6761 really had "technical mistakes"? -- Suzanne Wolff https://github.com/Abhayakara/draft-tldr-sutld-ps/issues/32

Issue #29: Add a reason to bypass external process: expectation for use of new name to be restricted to local scope -- Suzanne Wolff https://github.com/Abhayakara/draft-tldr-sutld-ps/issues/29

Issue #27: Is "technical use" really ambiguous; too inclusive for some people and too limited for others -- Suzanne Wolff https://github.com/Abhayakara/draft-tldr-sutld-ps/issues/27

Issue #24: Replacement for "commandeer" (2 issues)-- Suzanne Wolff https://github.com/Abhayakara/draft-tldr-sutld-ps/issues/24

Issue #22: Clarify importance of the "root of the Domain Namespace" -- Suzanne Wolff https://github.com/Abhayakara/draft-tldr-sutld-ps/issues/22

Issue #21: Section 3 - clarify paragraphs 2 and 3 -- Suzanne Wolff https://github.com/Abhayakara/draft-tldr-sutld-ps/issues/21

Issue #20: Section 3: Clarify sentences beginning "Solutions to these problems..." -- Suzanne Wolff https://github.com/Abhayakara/draft-tldr-sutld-ps/issues/20

Issue #19: Define "default" or "assumed" use of domain names to be within DNS -- Suzanne Wolff https://github.com/Abhayakara/draft-tldr-sutld-ps/issues/19

Issue #18: Cite definition of RFC 7719 and domain names draft in definition of "domain name" -- Suzanne Wolff https://github.com/Abhayakara/draft-tldr-sutld-ps/issues/18

Issue #45: Correct usages of Tor Browser and Tor -- Russ Housley (https://github.com/Abhayakara/draft-tldr-sutld-ps/issues/45)

Issue #46: Reformat citation of RFC 2860 -- Russ Housley (https://github.com/Abhayakara/draft-tldr-sutld-ps/issues/46)

Issue #44: Clean up reference to SDO-ICANN-DAG in first bullet in section 3 -- Russ Housley (https://github.com/Abhayakara/draft-tldr-sutld-ps/issues/44)

Issue #42: Add reference to SDO-ICANN-SAC090 in section 4.2.5 -- Russ Housley (https://github.com/Abhayakara/draft-tldr-sutld-ps/issues/42)

Issue #30: Leaked queries aren't an operational problem in practice -- Suzanne Wolf (https://github.com/Abhayakara/draft-tldr-sutld-ps/issues/30)

Address some of the simpler issues, including:

Issue #13: Spelling of Tor -- Jeremy Rand (https://github.com/Abhayakara/draft-tldr-sutld-ps/issues/13)

Issue #14: Change SDO to "organizations" -- Suzanne Woolf (https://github.com/Abhayakara/draft-tldr-sutld-ps/issues/14)

Issue #16: Match number of "policies" and "that policy" -- Suzanne (https://github.com/Abhayakara/draft-tldr-sutld-ps/issues/16)

Issue #17: Clarify sentence beginning with "In support of the particular set of problems described here...." -- Suzanne. (https://github.com/Abhayakara/draft-tldr-sutld-ps/issues/14)

Issue #23: Match number of "names" and "a TLD" -- Suzanne. (https://github.com/Abhayakara/draft-tldr-sutld-ps/issues/23)

-01 to -02:

Language cleanup from Ted.

-00 to -01:

Improved the terminology.

Included reference to SAC090.

Added ICANN Reserved Names (e.g .icann, .iesg, .arin) to types of names.

Improved background.

Noted that semantics may differ between resolution contexts.

Pointer to .home / .corp / .mail, other "toxic" names

Readability fixes.

-04 to ietf-00

Document adopted by WG.

Significant changes from CfA integrated, please refer to diff.

-03 to -04:

o Replaced 'Internet Names' with 'Domain Names' - suggestion by John Levine.

-02 to -03:

o Readability fixes, small grammar updates.

-01 to -02:

o Cleaned up the abstract.

o Fixed the case of Internet

o Reference to Ed Lewis' "Domain Names"

o Fleshed out the problems, primarily the coordination, collisions ones.

-00 to -01:

- o Large refactoring, basically a rewrite. Incorporated comments, removed a bunch of unneeded text, etc.

Authors' Addresses

Ted Lemon
Nominum, Inc.
800 Bridge Parkway
Redwood City, California 94065
United States of America

Phone: +1 650 381 6000
Email: ted.lemon@nominum.com

Ralph Droms

Email: rdroms.ietf@gmail.com

Warren Kumari
Google
1600 Amphitheatre Parkway
Mountain View, CA 94043
US

Email: warren@kumari.net