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Special-Use Domain Names

Abstract

This document describes what it means to say that a Domain Name (DNS name) is reserved for special use, when reserving such a name is appropriate, and the procedure for doing so. It establishes an IANA registry for such domain names, and seeds it with entries for some of the already established special domain names.

Status of This Memo

This is an Internet Standards Track document.

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1. Introduction

Certain individual IP addresses and IP address ranges are treated specially by network implementations and, consequently, are not suitable for use as unicast addresses. For example, IPv4 addresses 224.0.0.0 to 239.255.255.255 are multicast addresses [RFC5735], with 224.0.0.1 being the "all hosts" multicast address [RFC1112] [RFC5771]. Another example is 127.0.0.1, the IPv4 "local host" address [RFC5735].

Analogous to Special-Use IPv4 Addresses [RFC5735], the Domain Name System (DNS) [RFC1034][RFC1035] has its own concept of reserved names, such as "example.com.", "example.net.", and "example.org.", or any name falling under the top-level pseudo-domain "invalid." [RFC2606]. However, "Reserved Top Level DNS Names" [RFC2606] does not state whether implementations are expected to treat such names differently, and if so, in what way.

This document specifies under what circumstances special treatment is appropriate, and in what ways.

2. Terminology

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 "Key words for use in RFCs to Indicate Requirement Levels" [RFC2119].

3. Applicability

When IP multicast was created [RFC1112], implementations had to be updated to understand what an IP multicast address means and what to do with it. Adding IP multicast to a networking stack entailed more than merely adding the right routing table entries for those addresses. Moreover, supporting IP multicast entails some level of commonality that is consistent across all conformant hosts, independent of what networks those hosts may be connected to. While it is possible to build a private isolated network using whatever valid unicast IP addresses and routing topology one chooses (regardless of whether those unicast IP addresses are already in use by other hosts on the public Internet), the IPv4 multicast address 224.0.0.1 is always the "all hosts" multicast address, and that’s not a local decision.

Similarly, if a domain name has special properties that affect the way hardware and software implementations handle the name, that apply universally regardless of what network the implementation may be connected to, then that domain name may be a candidate for having the

IETF declare it to be a Special-Use Domain Name and specify what special treatment implementations should give to that name. On the other hand, if declaring a given name to be special would result in no change to any implementations, then that suggests that the name may not be special in any material way, and it may be more appropriate to use the existing DNS mechanisms [RFC1034] to provide the desired delegation, data, or lack-of-data, for the name in question. Where the desired behaviour can be achieved via the existing domain name registration processes, that process should be used. Reservation of a Special-Use Domain Name is not a mechanism for circumventing normal domain name registration processes.

As an example, suppose there were to be an IETF document specifying that a particular name (or set of names) is guaranteed to produce an NXDOMAIN ("Name Error" [RFC1035]) result. Such a document falls within the responsibilities of the IETF. The IETF is responsible for protocol rules. The IETF defines name character set, length limits, syntax, the fact that in DNS "A" is equivalent to "a", etc. [RFC1034] [RFC1035]. Portions of the namespace created by those rules are given to ICANN to manage, but, due to established DNS protocol rules, ICANN is not free to allocate "COM" and "com" to two different name servers. The IETF has responsibility for specifying how the DNS protocol works, and ICANN is responsible for allocating the names made possible by that DNS protocol. Now, suppose a developer were to use this special "guaranteed nonexistent" name, "knowing" that it’s guaranteed to return NXDOMAIN, and suppose also that the user’s DNS server fails to return NXDOMAIN for this name. The developer’s software then fails. Who do the user and/or developer complain to? ICANN? The IETF? The DNS server operator? If the developer can’t depend on the special "guaranteed nonexistent" name to always return NXDOMAIN, then the special name is worthless, because it can’t be relied on to do what it is supposed to. For this special "guaranteed nonexistent" name to have any use, it has to be defined to return NXDOMAIN, BY PROTOCOL, for all installations, not just by ICANN allocation on the public Internet. ICANN has no jurisdiction over how users choose to configure their own private DNS servers on their own private networks, but developers need a protocol specification that states that returning positive answers for the special "guaranteed nonexistent" name is a protocol violation on *all* networks, not just the public Internet. Hence, the act of defining such a special name creates a higher-level protocol rule, above ICANN’s management of allocable names on the public Internet.

4. Procedure

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.

The specification MUST state how implementations determine that the special handling is required for any given name. This is typically done by stating that any fully qualified domain name ending in a certain suffix (i.e., falling within a specified parent pseudo-domain) will receive the special behaviour. In effect, this carves off a sub-tree of the DNS namespace in which the modified name treatment rules apply, analogous to how IP multicast [RFC1112] or IP link-local addresses [RFC3927] [RFC4862] carve off chunks of the IP address space in which their respective modified address treatment rules apply.

The specification also MUST state, in each of the seven "Domain Name Reservation Considerations" categories below, what special treatment, if any, is to be applied. If in all seven categories the answer is "none", then possibly no special treatment is required and requesting reservation of a Special-Use Domain Name may not be appropriate.

5. Domain Name Reservation Considerations

An IETF "Standards Action" or "IESG Approval" document specifying some new naming behaviour, which requires a Special-Use Domain Name be reserved to implement this desired new behaviour, needs to contain a subsection of the "IANA Considerations" section titled "Domain Name Reservation Considerations" giving answers in the seven categories listed below. In the case of algorithmically generated DNS names, the specifying document needs to clearly identify the set of names generated by the algorithm that would require the proposed special treatment.

1. Users:

   Are human users expected to recognize these names as special and use them differently? In what way?

2. Application Software:

   Are writers of application software expected to make their software recognize these names as special and treat them differently? In what way? (For example, if a human user enters such a name, should the application software reject it with an error message?)

3. Name Resolution APIs and Libraries:

   Are writers of name resolution APIs and libraries expected to make their software recognize these names as special and treat them differently? If so, how?

4. Caching DNS Servers:

   Are developers of caching domain name servers expected to make their implementations recognize these names as special and treat them differently? If so, how?

5. Authoritative DNS Servers:

   Are developers of authoritative domain name servers expected to make their implementations recognize these names as special and treat them differently? If so, how?

6. DNS Server Operators:

   Does this reserved Special-Use Domain Name have any potential impact on DNS server operators? If they try to configure their authoritative DNS server as authoritative for this reserved name, will compliant name server software reject it as invalid? Do DNS server operators need to know about that and understand why? Even if the name server software doesn't prevent them from using this reserved name, are there other ways that it may not work as expected, of which the DNS server operator should be aware?

7. DNS Registries/Registrars:

   How should DNS Registries/Registrars treat requests to register this reserved domain name? Should such requests be denied? Should such requests be allowed, but only to a specially-designated entity? (For example, the name "www.example.org" is reserved for documentation examples and is not available for registration; however, the name is in fact registered; and there is even a web site at that name, which states circularly that the name is reserved for use in documentation and cannot be registered!)

6. Initial Registry

The initial IANA "Special-Use Domain Names" registry shall contain entries for the private-address [RFC1918] reverse-mapping domains and for the existing Reserved Top Level DNS Names [RFC2606].

6.1. Domain Name Reservation Considerations for Private Addresses

The private-address [RFC1918] reverse-mapping domains listed below, and any names falling within those domains, are Special-Use Domain Names:

10.in-addr.arpa.	21.172.in-addr.arpa.	26.172.in-addr.arpa.
16.172.in-addr.arpa.	22.172.in-addr.arpa.	27.172.in-addr.arpa.
17.172.in-addr.arpa.	30.172.in-addr.arpa.	28.172.in-addr.arpa.
18.172.in-addr.arpa.	23.172.in-addr.arpa.	29.172.in-addr.arpa.
19.172.in-addr.arpa.	24.172.in-addr.arpa.	31.172.in-addr.arpa.
20.172.in-addr.arpa.	25.172.in-addr.arpa.	168.192.in-addr.arpa.

These domains, and any names falling within these domains, are special in the following ways:

1. Users are free to use these names as they would any other reverse-mapping names. However, since there is no central authority responsible for use of private addresses, users SHOULD be aware that these names are likely to yield different results on different networks.

2. Application software SHOULD NOT recognize these names as special, and SHOULD use these names as they would other reverse-mapping names.

3. Name resolution APIs and libraries SHOULD NOT recognize these names as special and SHOULD NOT treat them differently. Name resolution APIs SHOULD send queries for these names to their configured caching DNS server(s).

4. Caching DNS servers SHOULD recognize these names as special and SHOULD NOT, by default, attempt to look up NS records for them, or otherwise query authoritative DNS servers in an attempt to resolve these names. Instead, caching DNS servers SHOULD, by default, generate immediate (positive or negative) responses for all such queries. This is to avoid unnecessary load on the root name servers and other name servers. Caching DNS servers SHOULD offer a configuration option (disabled by default) to enable upstream resolution of such names, for use in private networks where private-address reverse-mapping names are known to be handled by an authoritative DNS server in said private network.

5. Authoritative DNS servers SHOULD recognize these names as special and SHOULD, by default, generate immediate negative responses for all such queries, unless explicitly configured by the administrator to give positive answers for private-address reverse-mapping names.

6. DNS server operators SHOULD, if they are using private addresses, configure their authoritative DNS servers to act as authoritative for these names.

7. DNS Registries/Registrars MUST NOT grant requests to register any of these names in the normal way to any person or entity. These names are reserved for use in private networks, and fall outside the set of names available for allocation by registries/registrars. Attempting to allocate one of these names as if it were a normal DNS domain name will probably not work as desired, for reasons 4, 5 and 6 above.

6.2. Domain Name Reservation Considerations for "test."

The domain "test.", and any names falling within ".test.", are special in the following ways:

1. Users are free to use these test names as they would any other domain names. However, since there is no central authority responsible for use of test names, users SHOULD be aware that these names are likely to yield different results on different networks.

2. Application software SHOULD NOT recognize test names as special, and SHOULD use test names as they would other domain names.

3. Name resolution APIs and libraries SHOULD NOT recognize test names as special and SHOULD NOT treat them differently. Name resolution APIs SHOULD send queries for test names to their configured caching DNS server(s).

4. Caching DNS servers SHOULD recognize test names as special and SHOULD NOT, by default, attempt to look up NS records for them, or otherwise query authoritative DNS servers in an attempt to resolve test names. Instead, caching DNS servers SHOULD, by default, generate immediate negative responses for all such queries. This is to avoid unnecessary load on the root name servers and other name servers. Caching DNS servers SHOULD offer a configuration option (disabled by default) to enable upstream resolving of test names, for use in networks where test names are known to be handled by an authoritative DNS server in said private network.

5. Authoritative DNS servers SHOULD recognize test names as special and SHOULD, by default, generate immediate negative responses for all such queries, unless explicitly configured by the administrator to give positive answers for test names.

6. DNS server operators SHOULD, if they are using test names, configure their authoritative DNS servers to act as authoritative for test names.

7. DNS Registries/Registrars MUST NOT grant requests to register test names in the normal way to any person or entity. Test names are reserved for use in private networks and fall outside the set of names available for allocation by registries/registrars. Attempting to allocate a test name as if it were a normal DNS domain name will probably not work as desired, for reasons 4, 5, and 6 above.

6.3. Domain Name Reservation Considerations for "localhost."

The domain "localhost." and any names falling within ".localhost." are special in the following ways:

1. Users are free to use localhost names as they would any other domain names. Users may assume that IPv4 and IPv6 address queries for localhost names will always resolve to the respective IP loopback address.

2. Application software MAY recognize localhost names as special, or MAY pass them to name resolution APIs as they would for other domain names.

3. Name resolution APIs and libraries SHOULD recognize localhost names as special and SHOULD always return the IP loopback address for address queries and negative responses for all other query types. Name resolution APIs SHOULD NOT send queries for localhost names to their configured caching DNS server(s).

4. Caching DNS servers SHOULD recognize localhost names as special and SHOULD NOT attempt to look up NS records for them, or otherwise query authoritative DNS servers in an attempt to resolve localhost names. Instead, caching DNS servers SHOULD, for all such address queries, generate an immediate positive response giving the IP loopback address, and for all other query types, generate an immediate negative response. This is to avoid unnecessary load on the root name servers and other name servers.

5. Authoritative DNS servers SHOULD recognize localhost names as special and handle them as described above for caching DNS servers.

6. DNS server operators SHOULD be aware that the effective RDATA for localhost names is defined by protocol specification and cannot be modified by local configuration.

7. DNS Registries/Registrars MUST NOT grant requests to register localhost names in the normal way to any person or entity. Localhost names are defined by protocol specification and fall outside the set of names available for allocation by registries/ registrars. Attempting to allocate a localhost name as if it were a normal DNS domain name will probably not work as desired, for reasons 2, 3, 4, and 5 above.

6.4. Domain Name Reservation Considerations for "invalid."

The domain "invalid." and any names falling within ".invalid." are special in the ways listed below. In the text below, the term "invalid" is used in quotes to signify such names, as opposed to names that may be invalid for other reasons (e.g., being too long).

1. Users are free to use "invalid" names as they would any other domain names. Users MAY assume that queries for "invalid" names will always return NXDOMAIN responses.

2. Application software MAY recognize "invalid" names as special or MAY pass them to name resolution APIs as they would for other domain names.

3. Name resolution APIs and libraries SHOULD recognize "invalid" names as special and SHOULD always return immediate negative responses. Name resolution APIs SHOULD NOT send queries for "invalid" names to their configured caching DNS server(s).

4. Caching DNS servers SHOULD recognize "invalid" names as special and SHOULD NOT attempt to look up NS records for them, or otherwise query authoritative DNS servers in an attempt to resolve "invalid" names. Instead, caching DNS servers SHOULD generate immediate NXDOMAIN responses for all such queries. This is to avoid unnecessary load on the root name servers and other name servers.

5. Authoritative DNS servers SHOULD recognize "invalid" names as special and handle them as described above for caching DNS servers.

6. DNS server operators SHOULD be aware that the effective RDATA for "invalid" names is defined by protocol specification to be nonexistent and cannot be modified by local configuration.

7. DNS Registries/Registrars MUST NOT grant requests to register "invalid" names in the normal way to any person or entity. These "invalid" names are defined by protocol specification to be nonexistent, and they fall outside the set of names available for allocation by registries/registrars. Attempting to allocate a "invalid" name as if it were a normal DNS domain name will probably not work as desired, for reasons 2, 3, 4, and 5 above.

6.5. Domain Name Reservation Considerations for Example Domains

The domains "example.", "example.com.", "example.net.", "example.org.", and any names falling within those domains, are special in the following ways:

1. Users SHOULD understand that example names are reserved for use in documentation.

2. Application software SHOULD NOT recognize example names as special and SHOULD use example names as they would other domain names.

3. Name resolution APIs and libraries SHOULD NOT recognize example names as special and SHOULD NOT treat them differently. Name resolution APIs SHOULD send queries for example names to their configured caching DNS server(s).

4. Caching DNS servers SHOULD NOT recognize example names as special and SHOULD resolve them normally.

5. Authoritative DNS servers SHOULD NOT recognize example names as special.

6. DNS server operators SHOULD be aware that example names are reserved for use in documentation.

7. DNS Registries/Registrars MUST NOT grant requests to register example names in the normal way to any person or entity. All example names are registered in perpetuity to IANA:

```
Domain Name: EXAMPLE.COM
Registrar: RESERVED-INTERNET ASSIGNED NUMBERS AUTHORITY
Whois Server: whois.iana.org
Referral URL: http://res-dom.iana.org
Name Server: A.IANA-SERVERS.NET
Name Server: B.IANA-SERVERS.NET
Status: clientDeleteProhibited
Status: clientTransferProhibited
Status: clientUpdateProhibited
Updated Date: 26-mar-2004
Creation Date: 14-aug-1995
Expiration Date: 13-aug-2011
```

IANA currently maintains a web server providing a web page explaining the purpose of example domains.

7. Security Considerations

This document outlines the circumstances in which reserving a domain name for special use is appropriate, and the procedure for having that Special-Use Domain Name recorded by IANA. Any document requesting such a Special-Use Domain Name needs to contain an appropriate "Security Considerations" section which describes any security issues relevant to that special use.

8. IANA Considerations

IANA has created a new registry of Special-Use Domain Names, initially populated with the private-address reverse-mapping domains and the Reserved Top Level DNS Names outlined above in Section 6.

When IANA receives a request to record a new "Special-Use Domain Name", it should verify, in consultation with the IESG, that the IETF "Standards Action" or "IESG Approval" document [RFC5226] includes the required "Domain Name Reservation Considerations" section stating how the special meaning of this name affects the behavior of hardware, software, and humans in the seven categories. If IANA and the IESG determine that special handling of this "Special-Use Domain Name" is appropriate, IANA should record the Special-Use Domain Name, and a reference to the specification that documents it, in the registry.

9. References

9.1. Normative References

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9.2. Informative References

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