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Locally-served DNS Zones
draft-ietf-dnsop-default-local-zones-14

Abstract

Experience with the Domain Name System (DNS) has shown that there are a number of DNS zones all iterative resolvers and recursive nameservers should automatically serve, unless configured otherwise. [RFC 4193](#) specifies that this should occur for D.F.IP6.ARPA. This document extends the practice to cover the IN-ADDR.ARPA zones for [RFC 1918](#) address space and other well known zones with similar characteristics.

Status of this Memo

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[1.](#) Introduction

Experience with the Domain Name System (DNS, [[RFC1034](#)] and [[RFC1035](#)]) has shown that there are a number of DNS zones that all iterative resolvers and recursive nameservers SHOULD automatically serve, unless intentionally configured otherwise. These zones include, but are not limited to, the IN-ADDR.ARPA zones for the address space allocated by [[RFC1918](#)] and the IP6.ARPA zones for locally assigned unique local IPv6 addresses defined in [[RFC4193](#)].

This recommendation is made because data has shown that significant leakage of queries for these name spaces is occurring, despite instructions to restrict them, and because it has therefore become necessary to deploy sacrificial name servers to protect the immediate parent name servers for these zones from excessive, unintentional, query load [[AS112](#)] [I-D.[draft-ietf-dnsop-as112-ops](#)] [I-D.[draft-ietf-dnsop-as112-under-attack-help-help](#)]. There is every expectation that the query load will continue to increase unless steps are taken as outlined here.

Additionally, queries from clients behind badly configured firewalls that allow outgoing queries for these name spaces but drop the responses, put a significant load on the root servers (forward but no reverse zones configured). They also cause operational load for the root server operators as they have to reply to enquiries about why the root servers are "attacking" these clients. Changing the default configuration will address all these issues for the zones listed in [Section 4](#).

[RFC4193] recommends that queries for D.F.IP6.ARPA be handled locally. This document extends the recommendation to cover the IN-ADDR.ARPA zones for [RFC1918] and other well known IN-ADDR.ARPA and IP6.ARPA zones for which queries should not appear on the public Internet.

It is hoped that by doing this the number of sacrificial servers [AS112] will not have to be increased, and may in time be reduced.

This recommendation should also help DNS responsiveness for sites which are using [RFC1918] addresses but do not follow the last paragraph in [Section 3 of \[RFC1918\]](#).

[1.1.](#) Reserved Words

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 [RFC2119].

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[2.](#) Effects on sites using [RFC 1918](#) addresses.

For most sites using [RFC1918] addresses, the changes here will have little or no detrimental effect. If the site does not already have the reverse tree populated the only effect will be that the name error responses will be generated locally rather than remotely.

For sites that do have the reverse tree populated, most will either have a local copy of the zones or will be forwarding the queries to servers which have local copies of the zone. Therefore this recommendation will not be relevant.

The most significant impact will be felt at sites that make use of delegations for [RFC1918] addresses and have populated these zones. These sites will need to override the default configuration expressed in this document to allow resolution to continue. Typically, such sites will be fully disconnected from the Internet and have their own root servers for their own non-Internet DNS tree.

[3.](#) Changes to Iterative Resolver Behaviour.

Unless configured otherwise, an iterative resolver will now return authoritatively (aa=1) name errors (RCODE=3) for queries within the zones in [Section 4](#), with the obvious exception of queries for the zone name itself where SOA, NS and "no data" responses will be returned as appropriate to the query type. One common way to do this all at once is to serve empty (SOA and NS only) zones.

An implementation of this recommendation MUST provide a mechanism to disable this new behaviour, and SHOULD allow this decision on a zone by zone basis.

If using empty zones one SHOULD NOT use the same NS and SOA records as used on the public Internet servers as that will make it harder to detect the origin of the responses and thus any leakage to the public Internet servers. This document recommends that the NS record defaults to the name of the zone and the SOA MNAME defaults to the name of the only NS RR's target. The SOA RNAME should default to "nobody.invalid." [[RFC2606](#)]. Implementations SHOULD provide a mechanism to set these values. No address records need to be provided for the name server.

Below is an example of a generic empty zone in master file format. It will produce a negative cache TTL of 3 hours.

```
@ 10800 IN SOA @ nobody.invalid. 1 3600 1200 604800 10800
@ 10800 IN NS @
```

The SOA RR is needed to support negative caching [[RFC2308](#)] of name error responses and to point clients to the primary master for DNS dynamic updates.

SOA values of particular importance are the MNAME, the SOA RR's TTL and the negTTL value. Both TTL values SHOULD match. The rest of the SOA timer values MAY be chosen arbitrarily since they are not intended to control any zone transfer activity.

The NS RR is needed as some UPDATE [[RFC2136](#)] clients use NS queries to discover the zone to be updated. Having no address records for the name server is expected to abort UPDATE processing in the client.

[4.](#) Lists Of Zones Covered

The following subsections are intended to seed the IANA registry as requested in the IANA Considerations Section. Following the caveat in that section, the list contains only reverse zones corresponding to permanently assigned address space. The zone name is the entity to be registered.

[4.1.](#) [RFC1918](#) Zones

The following zones correspond to the IPv4 address space reserved in [\[RFC1918\]](#).

+-----+	
Zone	
+-----+	
10.IN-ADDR.ARPA	
16.172.IN-ADDR.ARPA	
17.172.IN-ADDR.ARPA	
18.172.IN-ADDR.ARPA	
19.172.IN-ADDR.ARPA	
20.172.IN-ADDR.ARPA	
21.172.IN-ADDR.ARPA	
22.172.IN-ADDR.ARPA	
23.172.IN-ADDR.ARPA	
24.172.IN-ADDR.ARPA	
25.172.IN-ADDR.ARPA	
26.172.IN-ADDR.ARPA	
27.172.IN-ADDR.ARPA	
28.172.IN-ADDR.ARPA	
29.172.IN-ADDR.ARPA	
30.172.IN-ADDR.ARPA	
31.172.IN-ADDR.ARPA	

168.192.IN-ADDR.ARPA	
+-----+	

[4.2.](#) [RFC5735](#) and [RFC5737](#) Zones

The following zones correspond to those address ranges from [\[RFC5735\]](#) and [\[RFC5737\]](#) that are not expected to appear as source or destination addresses on the public Internet and to not have a unique

name to associate with.

The recommendation to serve an empty zone 127.IN-ADDR.ARPA is not an attempt to discourage any practice to provide a PTR RR for 1.0.0.127.IN-ADDR.ARPA locally. In fact, a meaningful reverse mapping should exist, but the exact setup is out of the scope of this document. Similar logic applies to the reverse mapping for ::1 ([Section 4.3](#)). The recommendations made here simply assume no other coverage for these domains exists.

Zone	Description
0.IN-ADDR.ARPA	IPv4 "THIS" NETWORK
127.IN-ADDR.ARPA	IPv4 LOOP-BACK NETWORK
254.169.IN-ADDR.ARPA	IPv4 LINK LOCAL
2.0.192.IN-ADDR.ARPA	IPv4 TEST NET 1
100.51.198.IN-ADDR.ARPA	IPv4 TEST NET 2
113.0.203.IN-ADDR.ARPA	IPv4 TEST NET 3
255.255.255.255.IN-ADDR.ARPA	IPv4 BROADCAST

4.3. Local IPv6 Unicast Addresses

The reverse mappings ([\[RFC3596\]](#), [Section 2.5](#) IP6.ARPA Domain) for the IPv6 Unspecified (::) and Loopback (::1) addresses ([\[RFC4291\]](#), [Sections 2.4](#), [2.5.2](#) and [2.5.3](#)) are covered by these two zones:

```
+-----+
| Zone                                     |
+-----+
| 0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.\ |
|      0.0.0.0.0.0.0.0.0.0.0.0.0.0.IP6.ARPA      |
| 1.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0.\ |
|      0.0.0.0.0.0.0.0.0.0.0.0.0.0.IP6.ARPA      |
+-----+
```

Note: Line breaks and a escapes '\n' have been inserted above for readability and to adhere to line width constraints. They are not parts of the zone names.

4.4. IPv6 Locally Assigned Local Addresses

[Section 4.4 of \[RFC4193\]](#) already required special treatment of:

```
+-----+
| Zone   |
+-----+
| D.F.IP6.ARPA |
+-----+
```

[4.5.](#) IPv6 Link Local Addresses

IPv6 Link-Local Addresses as of [\[RFC4291\]](#), [Section 2.5.6](#) are covered by four distinct reverse DNS zones:

```
+-----+
| Zone   |
+-----+
| 8.E.F.IP6.ARPA |
| 9.E.F.IP6.ARPA |
| A.E.F.IP6.ARPA |
| B.E.F.IP6.ARPA |
+-----+
```

[4.6.](#) IPv6 Example Prefix

IPv6 example prefix [\[RFC3849\]](#).

```
+-----+
| Zone   |
+-----+
| 8.B.D.0.1.0.0.2.IP6.ARPA |
+-----+
```

Note: 8.B.D.0.1.0.0.2.IP6.ARPA is not being used as an example here.

[5.](#) Zones that are Out-Of-Scope

IPv6 site-local addresses (deprecated, see [\[RFC4291\]](#) Sections [2.4](#) and [2.5.7](#)), and IPv6 Non-Locally Assigned Local addresses ([\[RFC4193\]](#)) are not covered here.

It is expected that IPv6 site-local addresses will be self correcting as IPv6 implementations remove support for site-local addresses. However, sacrificial servers for the zones C.E.F.IP6.ARPA through F.E.F.IP6.ARPA may still need to be deployed in the short term if the traffic becomes excessive.

For IPv6 Non-Locally Assigned Local addresses ($L = 0$) [[RFC4193](#)], there has been no decision made about whether the Regional Internet Registries (RIRs) will provide delegations in this space or not. If they don't, then C.F.IP6.ARPA will need to be added to the list in [Section 4.4](#). If they do, then registries will need to take steps to ensure that name servers are provided for these addresses.

IP6.INT was once used to provide reverse mapping for IPv6. IP6.INT was deprecated in [[RFC4159](#)] and the delegation removed from the INT zone in June 2006. While it is possible that legacy software continues to send queries for names under the IP6.INT domain, this document does not specify that IP6.INT be considered a local zone.

This document has also deliberately ignored names immediately under the root domain. While there is a subset of queries to the root name servers which could be addressed using the techniques described here (e.g. .local, .workgroup and IPv4 addresses), there is also a vast amount of traffic that requires a different strategy (e.g. lookups for unqualified hostnames, IPv6 addresses).

[6.](#) IANA Considerations

This document requests that IANA establish a registry of zones which require this default behaviour. The initial contents of this registry are defined in [Section 4](#). Implementors are encouraged to periodically check this registry and adjust their implementations to reflect changes therein.

This registry can be amended through "IETF Review" as per [[RFC5226](#)]. As part of this review process it should be noted that once a zone is added it is effectively added permanently; once an address range starts being configured as a local zone in systems on the Internet, it will be impossible to reverse those changes.

IANA should co-ordinate with the RIRs to ensure that, as DNSSEC is deployed in the reverse tree, delegations for these zones are made in the manner described in [Section 7](#).

[7.](#) Security Considerations

During the initial deployment phase, particularly where [[RFC1918](#)] addresses are in use, there may be some clients that unexpectedly receive a name error rather than a PTR record. This may cause some service disruption until their recursive name server(s) have been re-

configured.

As DNSSEC is deployed within the IN-ADDR.ARPA and IP6.ARPA namespaces, the zones listed above will need to be delegated as insecure delegations, or be within insecure zones. This will allow DNSSEC validation to succeed for queries in these spaces despite not being answered from the delegated servers.

It is recommended that sites actively using these namespaces secure them using DNSSEC [[RFC4035](#)] by publishing and using DNSSEC trust anchors. This will protect the clients from accidental import of unsigned responses from the Internet.

[8.](#) Acknowledgements

This work was supported by the US National Science Foundation (research grant SCI-0427144) and DNS-OARC.

[9.](#) References

[9.1.](#) Normative References

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[9.2](#). Informative References

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Abley, J. and W. Maton, "I'm Being Attacked by PRISONER.IANA.ORG!", [draft-ietf-dnsop-as112-under-attack-help-help-04](#) (work in progress), July 2010.

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[Appendix A](#). Change History [To Be Removed on Publication]

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[A.1. draft-ietf-dnsop-default-local-zones-14.txt](#)

Removed ORCHID prefix.

[A.2. draft-ietf-dnsop-default-local-zones-13.txt](#)

Inclusion of ORCHID prefix.

reference updates.

[A.3. draft-ietf-dnsop-default-local-zones-12.txt](#)

Update IP6.INT's non inclusion rational.

Removed [Appendix B](#), which requested BCP status, as it was redundant.

[A.4. draft-ietf-dnsop-default-local-zones-11.txt](#)

Change [RFC 3330](#) to [RFC 5735](#)

[A.5. draft-ietf-dnsop-default-local-zones-10.txt](#)

added [RFC 5737](#) zones

[A.6. draft-ietf-dnsop-default-local-zones-09.txt](#)

refresh awaiting writeup

[A.7. draft-ietf-dnsop-default-local-zones-08.txt](#)

editorial, reference updates

[A.8. draft-ietf-dnsop-default-local-zones-07.txt](#)

none, expiry prevention

[A.9. draft-ietf-dnsop-default-local-zones-06.txt](#)

add IPv6 example prefix

[A.10. draft-ietf-dnsop-default-local-zones-05.txt](#)

none, expiry prevention

[A.11. draft-ietf-dnsop-default-local-zones-04.txt](#)

Centrally Assigned Local addresses -> Non-Locally Assigned Local address

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[A.12. draft-ietf-dnsop-default-local-zones-03.txt](#)

expanded [section 4](#) descriptions

Added references [[RFC2136](#)], [[RFC3596](#)],
[I-D.[draft-ietf-dnsop-as112-ops](#)] and
[I-D.[draft-ietf-dnsop-as112-under-attack-help-help](#)].

Revised language.

[A.13. draft-ietf-dnsop-default-local-zones-02.txt](#)

RNAME now "nobody.invalid."

Revised language.

[A.14. draft-ietf-dnsop-default-local-zones-01.txt](#)

Revised impact description.

Updated to reflect change in IP6.INT status.

[A.15. draft-ietf-dnsop-default-local-zones-00.txt](#)

Adopted by DNSOP.

"Author's Note" re-titled "Zones that are Out-Of-Scope"

Add note that these zone are expected to seed the IANA registry.

Title changed.

[A.16. draft-andrews-full-service-resolvers-03.txt](#)

Added "Proposed Status".

[A.17. draft-andrews-full-service-resolvers-02.txt](#)

Added 0.IN-ADDR.ARPA.

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