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DNS IPv6 transport operational guidelines
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Status of this Memo

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Abstract

This memo provides guidelines and Best Current Practice for operating DNS in a world where queries and responses are carried in a mixed environment of IPv4 and IPv6 networks.

Acknowledgment

This document is the result of many conversations that happened in the DNS community at IETF and elsewhere since 2001. During that

period of time, a number of Internet drafts have been published to clarify various aspects of the issues at stake. This document focuses on the conclusion of those discussions.

The authors would like to acknowledge the role of Pekka Savola in his thorough review of the document.

1. Terminology

The phrase "IPv4 name server" indicates a name server available over IPv4 transport. It does not imply anything about what DNS [1,2] data is served. Likewise, "IPv6 [5,6,7] name server" indicates a name server available over IPv6 transport. The phrase "dual-stack name server" indicates a name server that is actually configured to run both protocols, IPv4 and IPv6, and not merely a server running on a system capable of running both but actually configured to run only one.

2. Introduction to the Problem of Name Space Fragmentation: following the referral chain

A resolver that tries to look up a name starts out at the root, and follows referrals until it is referred to a name server that is authoritative for the name. If somewhere down the chain of referrals it is referred to a name server that is only accessible over a transport which the resolver cannot use, the resolver is unable to finish the task.

When the Internet moves from IPv4 to a mixture of IPv4 and IPv6 it is only a matter of time until this starts to happen. The complete DNS hierarchy then starts to fragment into a graph where authoritative name servers for certain nodes are only accessible over a certain transport. The concern is that a resolver using only a particular version of IP, querying information about another node using the same version of IP can not do it because, somewhere in the chain of servers accessed during the resolution process, one or more of them will only be accessible with the other version of IP.

With all DNS data only available over IPv4 transport everything is simple. IPv4 resolvers can use the intended mechanism of following referrals from the root and down while IPv6 resolvers have to work through a "translator", i.e. they have to use a recursive name server on a so-called "dual stack" host as a "forwarder" since they cannot access the DNS data directly.

With all DNS data only available over IPv6 transport everything would be equally simple, with the exception of IPv4 recursive name servers having to switch to a forwarding configuration.

However, the second situation will not arise in the foreseeable future. Instead, the transition will be from IPv4 only to a mixture of IPv4 and IPv6, with three categories of DNS data depending on whether the information is available only over IPv4 transport, only over IPv6 or both.

Having DNS data available on both transports is the best situation. The major question is how to ensure that it as quickly as possible becomes the norm. However, while it is obvious that some DNS data will only be available over v4 transport for a long time it is also obvious that it is important to avoid fragmenting the name space available to IPv4 only hosts. I.e. during transition it is not acceptable to break the name space that we presently have available for IPv4-only hosts.

3. Policy Based Avoidance of Name Space Fragmentation

Today there are only a few DNS "zones" on the public Internet that are available over IPv6 transport, and most of them can be regarded as "experimental". However, as soon as the root and top level domains are available over IPv6 transport, it is reasonable to expect that it will become more common to have zones served by IPv6 servers.

Having those zones served only by IPv6-only name server would not be a good development, since this will fragment the previously unfragmented IPv4 name space and there are strong reasons to find a mechanism to avoid it.

The recommended approach to maintain name space continuity is to use administrative policies, as described in the next section.

4. DNS IPv6 Transport recommended Guidelines

In order to preserve name space continuity, the following administrative policies are recommended:

- every recursive name server SHOULD be either IPv4-only or dual stack,

  This rules out IPv6-only recursive servers. However, one might well design configurations where a chain of IPv6-only name server forward queries to a set of dual stack recursive name server actually performing those recursive queries.

- every DNS zone SHOULD be served by at least one IPv4-reachable authoritative name server.

  This rules out DNS zones served only by IPv6-only authoritative name servers.

Note: zone validation processes SHOULD ensure that there is at least one IPv4 address record available for the name servers of any child delegations within the zone.

5. Security Considerations

The guidelines described in this memo introduce no new security considerations into the DNS protocol or associated operational scenarios.

6. IANA considerations

This memo creates no new requirements on IANA namespaces [4].

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8. Normative References

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