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Alain Durand  
SUN Microsystems, inc.  
Johan Ihren  
Autonomica

DNS IPv6 transport operational guidelines  
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## Abstract

This memo provides guidelines and best common practice to operate DNS in a mixed world of IPv4 and IPv6 transport.

## [1](#). Terminology

The phrase "IPv4 name server" indicates a name server available over IPv4 transport. It does not imply anything about what DNS data is served. Likewise, "IPv6 name server" indicates a name server available over IPv6 transport.

## [2](#). Introduction to the problem of name space fragmentation: following the referral chain

The caching resolver that tries to lookup a name starts out at the root, and follows referrals until it is referred to a nameserver that is authoritative for the name. If somewhere down the chain of referrals it is referred to a nameserver that is only accessible over a type of transport that is unavailable, a traditional nameserver 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 and the complete DNS hierarchy starts to fragment into a graph where authoritative nameservers for certain nodes are only accessible over a certain transport. What is feared is that a node 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 second 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 old legacy IPv4 name servers having to switch to a forwarding configuration.

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

The latter is the best situation, and a 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 they can mostly be regarded as "experimental". However, as soon as there is a root name server available over IPv6 transport it is reasonable to expect that it will become more common to have zones served by IPv6 servers over time.

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.

#### 4. DNS IPv6 transport RECOMMENDED guidelines:

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

- every recursive DNS server SHOULD be either IPv4-only or dual stack,
- every single DNS zone SHOULD be served by at least one IPv4 reachable DNS server.

This rules out IPv6-only DNS servers performing full recursion and DNS zones served only by IPv6-only DNS servers. This approach could be revisited if/when translation techniques between IPv4 and IPv6 were to be widely deployed.

In order to enforce the second point, the zone validation process 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

Being a critical piece of the Internet infrastructure, the DNS is a potential value target and thus should be protected. Great care should be taken not to weaken the security of DNS while introducing IPv6 operation.

The RECOMMENDED guidelines are compatible with the operation of DNSsec and do not introduce any new security issues.

#### 6. Author addresses

Alain Durand  
SUN Microsystems, Inc  
17 Network circle UMPK17-202  
Menlo Park, CA, 94025  
USA  
Mail: Alain.Durand@sun.com

Johan Ihren  
Autonomica  
Bellmansgatan 30  
SE-118 47 Stockholm, Sweden  
Mail: johani@autonomica.se

## 7. References

[2119] Bradner, S., "Key Words for Use in RFCs to Indicate Requirement Levels", [BCP 14](#), [RFC 2119](#), March 1997.

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