

Pre-Delegation Testing

DNS Test Plan

Version D

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1. Introduction

This Level Test Plan focuses on the DNS service of the new gTLDs.

1.1 Scope

The Pre-Delegation Testing Provider will test the DNS infrastructure.

1.2 References

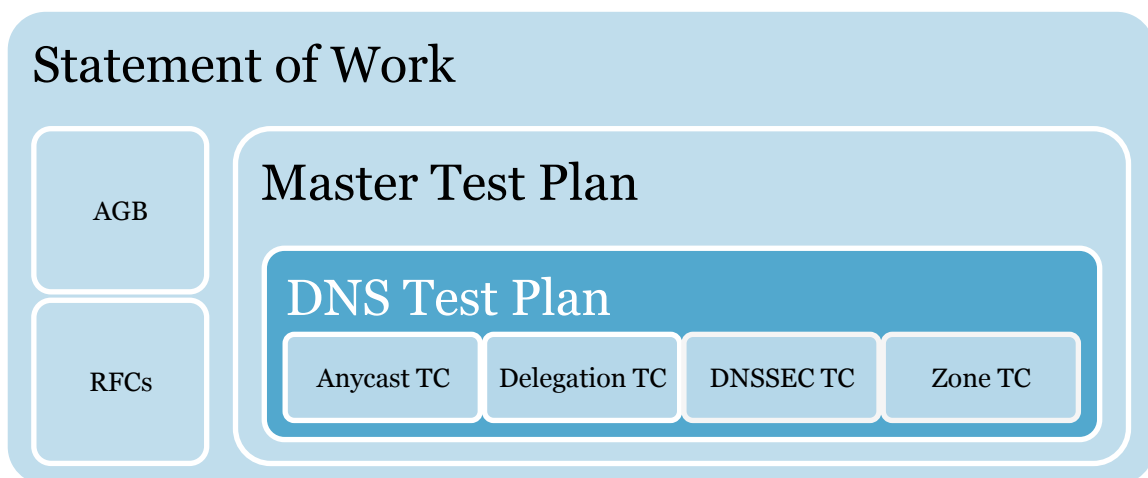
1.2.1 External

- IEEE 829-2008
- ICANN gTLD Applicant Guidebook, Version 2012-06-04

1.2.2 Internal

- Pre-Delegation Testing, Statement of Work
- Pre-Delegation Testing, Master Test Plan
- Pre-Delegation Testing, DNS Delegation Test Cases
- Pre-Delegation Testing, DNS DNSSEC Test Cases
- Pre-Delegation Testing, DNS Anycast Test Cases
- Pre-Delegation Testing, DNS Zone Test Cases

1.2.3 Document Hierarchy



1.3 Level in the overall sequence

The DNS test plan can be executed independently of other tests.

1.4 Test classes and overall test conditions

The DNS service for the gTLD is available over IPv4 and IPv6 via UDP and TCP on port 53. The DNS infrastructure must be open and available for testing, and be configured with the designated zone for authoritative answers. The applicant provides valid test data.

2. Details for this level of test plan

2.1 Test items and their identifiers

2.1.1 Statement of Work

The main requirements for testing the DNS infrastructure are found in the Statement of Work:

- [R9]** Test the applicant's DNS infrastructure for compliance with the requirements described in section 5.2 of the AGB.
- [R25]** Verify that the provided DNSSEC trust anchor can be used to validate DNSSEC signatures in the test zone.
- [R27]** Verify that all authoritative name servers complies with the IANA Technical Requirements – <http://www.iana.org/procedures/nameserver-requirements.html>
- [R27b]** The tests from R27 must also be performed for all unicast locations of an anycast cluster where applicable.
- [R28]** Verify that the submitted DNSSEC Trust Anchors (DS records) complies with the IANA Technical Requirements – <http://www.iana.org/procedures/root-dnssec-records.html>

2.1.2 Additions to Statement of Work

- [ADD1]** Check invalid syntax for SOA RNAME
- [ADD2]** SOA Minimum must be more than 300 seconds
- [ADD3]** Check for too many (150) NSEC3 iterations
- [ADD4]** Check for too short (12 hours) or too long (180 days) RRSIG lifetimes
- [ADD5]** Check for invalid DNSKEY algorithms
- [ADD6]** Check for Too long (>172800) TTL for DS records
- [ADD7]** Wildcards must not exist in the TLD zone ("site finder")
- [ADD8]** Check for use of zone as "dotless domain"
- [ADD9]** nic.<TLD> or whois.nic.<TLD> must be delegated
- [ADD10]** Maximum timeout for connectivity on anycast nodes

2.1.3 Technical requirements for authoritative name servers

These requirements are derived from the tests that IANA performs for all name server changes to the root zone. The test cases are mostly collected in the Delegation test case document. This is an overview of the described requirements:

- [DEL1]** Minimum number of name servers
- [DEL2]** Valid hostnames
- [DEL3]** Name server reachability
- [DEL4]** Answer authoritatively
- [DEL5]** Network diversity
- [DEL6]** Consistency between glue and authoritative data
- [DEL7]** Consistency between delegation and zone
- [DEL8a]** SOA record consistency between authoritative name servers
- [DEL8b]** Name server consistency between authoritative name servers
- [DEL9]** No truncation of referrals
- [DEL10]** Prohibited networks

[DEL11] No open recursive name service

[DEL12] Same source address

2.1.4 Placing TLD delegation signer information in the root zone

This IANA document is describing the IANA requirements for publishing a DS record in the root zone. This is an overview of the described requirements:

[DS1] Valid digest algorithm for the DS hash digest

[DS2] A DS record must match a DNSKEY that is present in the child zone

2.1.5 Applicant Guidebook

Section 5.2 of the AGB states the following requirements:

UDP Support -- The DNS infrastructure to which these tests apply comprises the complete set of servers and network infrastructure to be used by the chosen providers to deliver DNS service for the new gTLD to the Internet.

TCP support -- TCP transport service for DNS queries and responses must be enabled and provisioned for expected load. ICANN will review the capacity self-certification documentation provided by the applicant and will perform TCP reachability and transaction capability tests across a randomly selected subset of the name servers within the applicant's DNS infrastructure. In case of use of anycast, each individual server in each anycast set will be tested.

DNSSEC support -- Applicant must demonstrate support for EDNS(o) in its server infrastructure, the ability to return correct DNSSEC-related resource records such as DNSKEY, RRSIG, and NSEC/NSEC3 for the signed zone, and the ability to accept and publish DS resource records from second-level domain administrators. In particular, the applicant must demonstrate its ability to support the full life cycle of KSK and ZSK keys. ICANN will review the self-certification materials as well as test the reachability, response sizes, and DNS transaction capacity for DNS queries using the EDNS(o) protocol extension with the "DNSSEC OK" bit set for a randomly selected subset of all name servers within the applicant's DNS infrastructure. In case of use of anycast, each individual server in each anycast set will be tested.

The test cases described in the Applicant Guidebook section 5.2 are also covered by R27 and R28. So there will be a minimal set of requirements derived from the Applicant Guidebook. Name server reachability over UDP and TCP, DNSSEC and EDNS(o) and anycast support will be covered by these requirements:

[AGB1] Name server reachability

[AGB2] Return correct DNSKEY

[AGB3] Return NSEC/NSEC3 records

[AGB4] Each individual unicast node in an anycast node must be tested for TCP

[AGB5] Each individual unicast node in an anycast node must be tested for DNSSEC support

2.2 Test Traceability Matrix

Test ID	Description	Requirement Point
DNS01 Minimum number of name servers	There must be at least two NS records listed in a delegation, and the hosts must not resolve to the same IP address.	R27, DEL1, DEL2
DNS02 Name server reachability	The name servers must answer DNS queries over both the UDP and TCP protocols on port 53.	R27, DEL3
DNS03 Answer authoritatively	The name servers must answer authoritatively for the designated zone. Responses to queries to the name servers for the designated zone must have the "AA"-bit set.	R27, DEL4
DNS04 Network diversity	The name servers must be in at least two topologically separate networks.	R27, DEL5
DNS05 Consistency between glue and authoritative data	For name servers that have IP addresses listed as glue, the IP addresses must match the authoritative A and AAAA records for that host.	R27, DEL6
DNS06 Consistency between delegation and zone	The set of NS records served by the authoritative name servers must match those proposed for the delegation in the parent zone.	R27, DEL7
DNS07 SOA record consistency between authoritative name servers	The data served by the authoritative name servers for the designated zone must be consistent. [...] All authoritative name servers must serve the same SOA record for the designated domain.	R27, DEL8a
DNS08 NS record consistency between authoritative name servers	The data served by the authoritative name servers for the designated zone must be consistent. All authoritative name servers must serve the same NS record set for the designated domain.	R27, DEL8b
DNS09 No truncation of referrals	Referrals from the parent zone's name servers must fit into a non-EDNS0 UDP DNS packet and therefore the DNS payload must not exceed 512 octets.	R27, DEL9
DNS10 Prohibited networks	The authoritative name server IP addresses must not be in specially designated networks that are either not globally routable, or are otherwise unsuited for authoritative name service.	R27, DEL10
DNS11 No open recursive name service	The authoritative name servers must not provide recursive name service.	R27, DEL11
DNS12 Same source address	Responses from the authoritative name servers must contain the same source IP address as the destination IP address of the initial query.	R27, DEL12
DNS13 Anycast, test of individual unicast nodes	If using anycast, each individual server in each anycast set will be tested. All individual servers must be authoritative for the designated zone	R9, AGB4, ADD10

	over UDP and TCP.	
DNS14 Legal values for the DS hash digest algorithm	For the hash digest, ICANN supports two types — SHA1 (value 1), and SHA256 (value 2). The DnsKeyDigestType for the supplied DS records must match those type values.	R25, R28, DS1
DNS15 DS must match a DNSKEY in the designated zone	There must be a DNSKEY that matches the DS record present in the child zone.	R25, R28, DS2, AGB2, AGB5
DNS16 Signatures in the designated zone must validate	Verify that the provided DNSSEC trust anchor can be used to validate DNSSEC signatures (RRSIG) in the test zone.	R25, R28, AGB2, AGB5
DNS17 Zone contains NSEC or NSEC3 records	The zone must contain NSEC or NSEC3 records with valid signatures.	R9, AGB3, AGB5
DNS18 (Anycast) Consistency between glue and authoritative data	For name servers that have IP addresses listed as glue, the IP addresses must match the authoritative A and AAAA records for that host.	R27, R27b, DEL6
DNS19 (Anycast) SOA record consistency between authoritative name servers	The data served by the authoritative name servers for the designated zone must be consistent. [...] All authoritative name servers must serve the same SOA record for the designated domain.	R27, R27b, DEL8a
DNS20 (Anycast) NS record consistency between authoritative name servers	The data served by the authoritative name servers for the designated zone must be consistent. All authoritative name servers must serve the same NS record set for the designated domain.	R27, R27b, DEL8b
DNS21 (Anycast) No open recursive name service	The authoritative name servers must not provide recursive name service.	R27, R27b, DEL11
DNS22 (Anycast) Same source address	Responses from the authoritative name servers must contain the same source IP address as the destination IP address of the initial query.	R27, R27b, DEL12
DNS23 Syntax for SOA RNAME	Check invalid syntax for SOA RNAME	ADD1
DNS24 SOA Minimum	SOA Minimum must be more than 300 seconds	ADD2
DNS25 NSEC3 Iterations	Check for too many (150) NSEC3 iterations	ADD3
DNS26 RRSIG Lifetimes	Check for too short (12 hours) or too long (180 days) RRSIG lifetimes	ADD4
DNS27 DNSKEY Algorithms	Check for invalid DNSKEY algorithms	ADD5
DNS28 DS TTL	Check for Too long (>172800) TTL for DS records	ADD6
DNS29 Wildcards	Wildcards must not exist in the TLD zone ("site finder")	ADD7
DNS30 Dotless domain	Check for use of zone as "dotless domain"	ADD8
DNS31 nic.<TLD> or whois.nic.<TLD> must be delegated	nic.<TLD> or whois.nic.<TLD> must be delegated	ADD9

The requirement ADD10 is added to section 2.6 in this document, and is applied to all DNS queries on anycast nodes.

2.3 Features to be tested

- DNS infrastructure
- A sub-set of records present in the zone
- Reachability and connectivity to all specified name servers
- UDP and TCP support
- IPv4 and IPv6 connectivity
- DNSSEC with DNSKEY, NSEC/NSEC3 and valid RRSIGs
- Network diversity
- No open resolvers
- DNSKEY algorithms and signature lifetimes
- Legal or correct values in the SOA record

2.4 Features not to be tested

- Load capacity
- PTR records
- DNSKEY key lengths
- AXFR availability

2.5 Approach

The overall input parameters for the different DNS test cases we consider to be the same set of parameters as those sent to IANA for publication in the root. We follow the same structure as the web form and the e-mail form that is used for communication with IANA.¹ There are however additional input parameters needed for testing unicast addresses in anycast nodes, and some other information about the zone distribution that is needed for testing.

All DNS tests that are performed using the DNS protocol on the applicants DNS infrastructure is done from all five Internet locations over IPv4 and IPv6. Some tests are not dependent on network connectivity but only applied using rules using the input parameters.

In case of any temporary network failures, all DNS test cases can be repeated if necessary without any external interaction needed.

2.6 Item pass/fail criteria

The test will pass if an expected response was received from the DNS service. It will however fail if it is not following the requirements.

There are some special procedural requirements that give a “notify” message in the report. The result of the test is ok, but there is some information about the tests result that ICANN should be aware of.

The Service Level Requirement in Specification 10 of the registry agreement states that “If the RTT is 5 times greater than the time specified in the relevant SLR, the RTT will be considered undefined”. The requirement for UDP is 500ms and TCP is 1500ms. A test can thus be failed if it takes longer than 2.5 seconds to get an answer over UDP or longer than 7.5 seconds for TCP. This fulfills the requirement ADD10.

2.7 Suspension criteria and resumption requirements

The only suspension criteria for the test would be if there are external network problems outside the control of the applicant or the PDT tester.

2.8 Test deliverables

The DNS test level will produce:

- Level Test Logs (LTL)
- Anomaly Report (AR) in case of error
- Level Test Report (LTR)

¹ <http://www.iana.org/domains/root/tld-change-template.txt>

3. Test management

The goal of these documents is to describe the test cases and how the new gTLDs are tested. This is just a part of a larger project and defining test management is not part of this subproject. However, some information can be found in the Master Test Plan.

4. General

4.1 Glossary

The glossary is available in the Master Test Plan.

4.2 Document change procedures

Document change procedures are documented in the Master Test Plan.