

# Pre-Delegation Testing

## DNS Distributed

Version B

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## Document control

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## 1. Introduction

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### 1.1 Scope

The Pre-Delegation Testing Provider will test the DNS service for the designated zone and verify the resulting answers. The test cases described in this document are performed using many measurement nodes distributed globally, as an alternative approach as ICANN dropped the requirement from the Applicant Guidebook stating that each unicast node in an Anycast cluster must be tested.

### 1.2 References

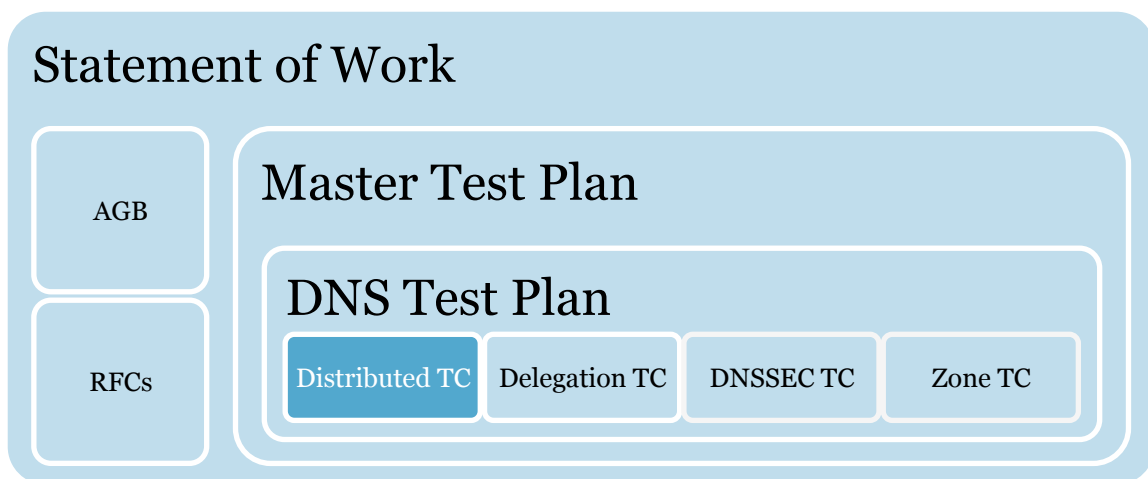
#### 1.2.1 External

- IEEE 829-2008
- ICANN gTLD Applicant Guidebook, Version 2012-06-04
- Placing TLD delegation signer information in the root zone<sup>1</sup>

#### 1.2.2 Internal

- Pre-Delegation Testing, Statement of Work
- Pre-Delegation Testing, Master Test Plan
- Pre-Delegation Testing, DNS Test Plan

#### 1.2.3 Document Hierarchy



### 1.3 Context

All tests are to be performed over IPv4 and IPv6 from many nodes widely distributed over the Internet. “Many” is a lot more than the five nodes in the five different ICANN regions as required in the other test cases. Each test case has the exact detail on how many nodes are required for the test cases described in this document that must be functioning in order for the tests to be performed.

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<sup>1</sup> <http://www.iana.org/procedures/root-dnssec-records.html>

The purpose of using many measurement nodes is to measure the largest amount of individual anycast locations as possible, in order to conclude that the Anycast DNS function is operational.

#### 1.4 Notation for description

Each test case for the DNS service is described in their own section. The test procedures are described directly in the test case.

#### 1.5 Measurement criteria for all test cases in this document

The available nodes to the PDT tests system are variable over time. The current number of nodes that the PDT can access for these tests as of the date of this specification is approximately 150, widely distributed globally.

All test cases in this document are performed on these nodes using the timeouts and threshold values described in this section. Availability of a node is based on if The PDT Service Provider can connect to the node using SSH, and if it can run the test program without returning any error from the system.

1. If a node does not return answers for all requested queries within **7.5 seconds times the number of queries** (timeout = 7.5s x queries), all data from the node is ignored and the node is disconnected. The node is considered to be **non-available**.
2. The number of nodes that must be available to the test master system for testing must be **at least 20 nodes**.
3. **51% of the available nodes must have a complete set of answers for each query made via the available nodes**. The set of answers from a node is considered complete when **at least 99%** of the queries have **valid DNS responses**.

If the number of available nodes are below the threshold described in 2), a PDT test cannot be performed, and the problem must be fixed by the PDT Service Provider.

If the number of DNS nodes that have returned a complete set of DNS answers are below the threshold described in 3), all test cases in this document fails.

## 2. (Distributed) Signatures in the designated zone must validate

### 2.1 Test case identifier

DNS16 Signatures in the designated zone must validate

### 2.2 Objective

Verify that the provided DNSSEC trust anchor can be used to validate DNSSEC signatures (RRSIG) in the test zone.

This test case fulfills the DNSSEC validation requirement R25 from the Statement of Work.

### 2.3 Inputs

The following information will be needed as input for this test case:

| Id                      | Description                                                         | Type   |
|-------------------------|---------------------------------------------------------------------|--------|
| TLD                     | The ASCII compatible name of the TLD                                | String |
| DnsKeyDigest-[1..n]     | The digest (DS) of the DNSKEY                                       | String |
| DnsKeyTag-[1..n]        | The key tag of the DNSKEY                                           | Number |
| DnsKeyAlgorithm-[1..n]  | The algorithm number of the DNSKEY                                  | Number |
| DnsKeyDigestType-[1..n] | The digest type number of the DS                                    | Number |
| DnsNameServer-[1..n]    | FQDN of authoritative name server                                   | String |
| DnsGlueRecord-[1..n]    | All IPv4 or IPv6 addresses for auth NS                              | String |
| SubDomain               | A delegated domain with NS and DS records published in the TLD zone | String |

The above input is also considered to be the exact same information that is sent to IANA for inclusion in the root zone, except for the SubDomain. IANA will only publish the subordinate host glue records in the root zone.

### 2.4 Outcome(s)

After the measurement criteria in section 1.5 has been passed, the following outcome must be true for all DNS answers, or this test case fails:

The signatures covering the DNSKEY record must be validated following the DNSSEC chain from the given DS records.

The signatures covering the SOA record must be validated following the DNSSEC chain from the given DS records.

### 2.5 Environmental needs

All authoritative name servers listed in the inputs section 2.3 should be authoritative for the designated zone.

The node availability criteria described in section 1.5 in this document also apply to this test.

## 2.6 Special procedural requirements

This test has no special procedural requirements.

## 2.7 Intercase dependencies

This test has no intercase dependencies.

## 2.8 Ordered description of steps to be taken to execute the test case

The test program is executed with all of the input parameters described in section 2.3.

For each name server, a query is sent to all the name servers for the DNSKEY record. The answers must contain DNSKEY records and an RRSIG record(s). The signature is validated with the DNSKEYs found, and then matched with the DS record from the input.

For each unique DNSKEY algorithm found in the, there must be an RRSIG matching each algorithm.



### 3. (Distributed) Zone contains NSEC or NSEC3 records

---

#### 3.1 Test case identifier

DNS17 Distributed, Zone contains NSEC or NSEC3 records

#### 3.2 Objective

Verify that there are NSEC or NSEC3 records present in the zones with valid signatures.

This test case fulfills the DNSSEC validation requirement AGB3 from the Applicant Guidebook.

#### 3.3 Inputs

See section 2.3 for all input parameters.

#### 3.4 Outcome(s)

After the measurement criteria in section 1.5 has been passed, the following outcome must be true for all DNS answers, or this test case fails:

The signatures covering the NSEC or NSEC3 record must be validated following the DNSSEC chain from the given DS records. If the records are not present, or if they show an invalid RRSIG, this test fails.

#### 3.5 Environmental needs

All authoritative name servers listed in the inputs section 2.3 should be authoritative for the designated zone.

The node availability criteria described in section 1.5 in this document also apply to this test.

#### 3.6 Special procedural requirements

This test has no special procedural requirements.

#### 3.7 Intercase dependencies

This test has no intercase dependencies.

#### 3.8 Ordered description of steps to be taken to execute the test case

The test program is executed with all of the input parameters described in section 2.3.

A query is made for the SOA record on xx—example.[TLD], a label that should never occur because of the prefix. The answer should contain NSEC or NSEC3 records with valid signatures.

## 4. (Distributed) Consistency between glue and authoritative data

---

### 4.1 Test case identifier

DNS18 Distributed, Consistency between glue and authoritative data

### 4.2 Objective

For name servers that have IP addresses listed as glue, the IP addresses must match the authoritative A and AAAA records for that host.

### 4.3 Inputs

See section 2.3 for all input parameters.

### 4.4 Outcome(s)

After the measurement criteria in section 1.5 has been passed, the following outcome must be true for all DNS answers, or this test case fails:

This test fails if there is a glue record (A or AAAA) in the delegation that does not exist in the delegated zone, i.e. the owner name and IP address of the record must be the same.

### 4.5 Environmental needs

All authoritative name servers listed in the inputs section 2.3 must be authoritative for the designated zone.

The node availability criteria described in section 1.5 in this document also apply to this test.

### 4.6 Special procedural requirements

This test case is dependent on the availability of all unicast addresses, however we cannot verify that all unicast addresses has been made available for testing.

### 4.7 Intercase dependencies

This test has no intercase dependencies.

### 4.8 Ordered description of steps to be taken to execute the test case

For each name server in the input parameter (DnsNameServer) send a DNS query for each glue record. Compare the RR set in the response with the glue record. If there is no record in the answer with the same owner name and IP address as the glue record, the entire test fails. The RR set may contain additional records.”

## 5. (Distributed) SOA record consistency between authoritative name servers

---

### 5.1 Test case identifier

DNS19 Distributed, SOA record consistency between authoritative name servers

### 5.2 Objective

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 zone.

### 5.3 Inputs

See section 2.3 in this document.

### 5.4 Outcome(s)

After the measurement criteria in section 1.5 has been passed, the following outcome must be true for all DNS answers, or this test case fails:

If there is an inconsistency between any SOA records retrieved for the designated zone, the test fails.

If there are occurrences of different SOA Serial numbers, we manually inspect the Serial numbers in the logs. See the requirement in 2.8.3.1 in the "Technical requirements for authoritative name servers" document.

### 5.5 Environmental needs

All authoritative name servers listed in the inputs section 2.3 must be authoritative for the designated zone.

The node availability criteria described in section 1.5 in this document also apply to this test.

### 5.6 Special procedural requirements

If for operational reasons the zone content fluctuates rapidly, the serial numbers need only be loosely coherent. Manual inspection of the logs is performed in case of the occurrence of different SOA Serial numbers.

There are several different methods to set the SOA Serial number. The most popular are "unix time" where the Serial is a second counter based on unix time, "date" where the Serial is a date and a serial number counter at the end, and "counter" where the Serial value is just any type of counter. The most common use is probably "unix time". In both "date" and "unix time" it should be easy to note that the name servers do not differ any more than a few serial number updates. A manual inspection of the SOA serial should be enough to make a decision on whether the name server updates work properly or not, and if the serial values are within a reasonable range the test is ok.

## 5.7 Intercase dependencies

This test has no intercase dependencies.

## 5.8 Ordered description of steps to be taken to execute the test case

A SOA query for the designated zone is made for each name server in the input data described in section 2.3. If the answers are not consistent this test fails.

## 6. (Distributed) NS record consistency between authoritative name servers

---

### 6.1 Test case identifier

DNS20 Distributed, NS record consistency between authoritative name servers

### 6.2 Objective

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.

### 6.3 Inputs

See section 2.3 in this document.

### 6.4 Outcome(s)

After the measurement criteria in section 1.5 has been passed, the following outcome must be true for all DNS answers, or this test case fails:

If there is an inconsistency between any set of NS records retrieved for the designated zone, the test fails.

### 6.5 Environmental needs

All authoritative name servers listed in the inputs section 2.3 must be authoritative for the designated zone.

The node availability criteria described in section 1.5 in this document also apply to this test.

### 6.6 Special procedural requirements

This test case is dependent on the availability of all unicast addresses, however we cannot verify that all unicast addresses has been made available for testing.

### 6.7 Intercase dependencies

This test has no intercase dependencies.

### 6.8 Ordered description of steps to be taken to execute the test case

An NS query for the designated zone is made for each name server in the input data described in section 2.3. If the answers are not consistent this test fails.

## 7. (Distributed) No open recursive name service

---

### 7.1 Test case identifier

DNS21 Distributed, No open recursive name service

### 7.2 Objective

The authoritative name servers must not provide recursive name service.

### 7.3 Inputs

See section 2.3 in this document.

### 7.4 Outcome(s)

After the measurement criteria in section 1.5 has been passed, the following outcome must be true for all DNS answers, or this test case fails:

If any of the name servers returns with an RCODE other than SERVFAIL or REFUSED, this test case fails.

### 7.5 Environmental needs

All authoritative name servers listed in the inputs section 2.3 must be authoritative for the designated zone.

The node availability criteria described in section 1.5 in this document also apply to this test.

### 7.6 Special procedural requirements

This test case is dependent on the availability of all unicast addresses, however we cannot verify that all unicast addresses has been made available for testing.

### 7.7 Intercase dependencies

This test has no intercase dependencies.

### 7.8 Ordered description of steps to be taken to execute the test case

A SOA query for an almost certainly nonexistent name (e.g., example.com) is sent to the list of name servers, with the recursion request and DNSSEC flags set, resulting in a response with the recursion available flag set, an RCODE other than SERVFAIL or REFUSED and not referring to other servers. If the response is a possible referral, a failure message is emitted from the test of the name server.

## 8. (Distributed) Name server reachability

---

### 8.1 Test case identifier

DNS32 Distributed, Name server reachability

### 8.2 Objective

The name servers must answer DNS queries over both the UDP and TCP protocols on port 53.

This test case fulfills the requirements 2.3.1 in the “Technical requirements for authoritative name servers” document, and the requirements on TCP and UDP of section 5.2 in the Applicant Guidebook.

### 8.3 Inputs

See section 2.3 in this document.

### 8.4 Outcome(s)

After the measurement criteria in section 1.5 has been passed, the following outcome must be true for all DNS answers, or this test case fails:

All name servers gives answers over UDP and TCP. If any of the listed name servers in section 2.3 does not answer below the threshold level described below this paragraph, this test case fail.

### 8.5 Environmental needs

All authoritative name servers listed in the inputs section 2.3 must be authoritative for the designated zone.

The node availability criteria described in section 1.5 in this document also apply to this test.

### 8.6 Special procedural requirements

This test has no procedural requirements.

### 8.7 Intercase dependencies

This test has no intercase dependencies.

### 8.8 Ordered description of steps to be taken to execute the test case

A SOA query over UDP and TCP for the designated zone is made for each name server in the input data described in section 2.3. If there are no answers, this test case fails (based on the outcome criteria in 8.4).

## 9. (Distributed) Answer authoritatively

---

### 9.1 Test case identifier

DNS33 Distributed, Answer authoritatively

### 9.2 Objective

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.

This test case fulfills the requirements 2.4.1 and 2.4.2 in the “Technical requirements for authoritative name servers” document.

### 9.3 Inputs

See section 2.3 in this document.

### 9.4 Outcome(s)

After the measurement criteria in section 1.5 has been passed, the following outcome must be true for all DNS answers, or this test case fails:

All name servers gives authoritative answers over UDP and TCP. If any of the listed name servers in section 2.3 does not answer authoritatively, this test case fail.

### 9.5 Environmental needs

All authoritative name servers listed in the inputs section 2.3 should be authoritative for the designated zone.

The node availability criteria described in section 1.5 in this document also apply to this test.

### 9.6 Special procedural requirements

This test has no procedural requirements.

### 9.7 Intercase dependencies

This test has no intercase dependencies.

### 9.8 Ordered description of steps to be taken to execute the test case

A SOA query over UDP and TCP for the designated zone is made for each name server in the input data described in section 2.3. If any of the name servers fail to give an authoritative answer (“AA-bit” is set in the answer), the test case fails.



## 10. (Distributed) Consistency between delegation and zone

---

### 10.1 Test case identifier

DNS34 Distributed, Consistency between delegation and zone

### 10.2 Objective

The set of NS records served by the authoritative name servers must match those proposed for the delegation in the parent zone.

This test case fulfills the requirements 2.7.1 in the “Technical requirements for authoritative name servers” document.

### 10.3 Inputs

See section 2.3 in this document.

### 10.4 Outcome(s)

After the measurement criteria in section 1.5 has been passed, the following outcome must be true for all DNS answers, or this test case fails:

If any extraneous name server is present in the parent data or in the delegated child zone, this test case fails.

### 10.5 Environmental needs

All authoritative name servers listed in the inputs section 2.3 should be authoritative for the designated zone.

The node availability criteria described in section 1.5 in this document also apply to this test.

### 10.6 Special procedural requirements

This test has no procedural requirements.

### 10.7 Intercase dependencies

This test has no intercase dependencies.

### 10.8 Ordered description of steps to be taken to execute the test case

The name server data on the input parameters side is compared to the content of the answers for all the name servers. If there is an inconsistency between the NS record sets, this test fails.

## 11. (Distributed) Name server must be able to provide referral to known subdomains

---

### 11.1 Test case identifier

DNS35 Distributed, Name server must be able to provide referral to known subdomains

### 11.2 Objective

All name servers must provide a referral with NS, DS and optional glue for the delegated subdomain.

### 11.3 Inputs

See section 2.3 in this document.

### 11.4 Outcome(s)

After the measurement criteria in section 1.5 has been passed, the following outcome must be true for all DNS answers, or this test case fails:

If the result of the query does not contain NS and DS records in the authority section, this test fails.

### 11.5 Environmental needs

All authoritative name servers listed in the inputs section 2.3 should be authoritative for the designated zone.

The node availability criteria described in section 1.5 in this document also apply to this test.

### 11.6 Special procedural requirements

This test has no procedural requirements.

### 11.7 Intercase dependencies

This test has no intercase dependencies.

### 11.8 Ordered description of steps to be taken to execute the test case

A SOA query for SubDomain from the input parameters is made to all the name servers. The result must contain a DS and NS set for the next link in the delegation chain.

## 12. Global

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### 12.1 Glossary

The glossary is available in the Master Test Plan.

### 12.2 Document change procedures

Document change procedures are documented in the Master Test Plan.