

# Pre-Delegation Testing

## DNS Delegation Test Cases

Version F

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# Document control

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## LIST OF CONTENTS

<b>1. INTRODUCTION .....</b>	<b>6</b>
1.1 SCOPE .....	6
1.2 REFERENCES .....	6
1.2.1 External .....	6
1.2.2 Internal .....	6
1.2.3 Document Hierarchy .....	6
1.3 CONTEXT .....	6
1.4 NOTATION FOR DESCRIPTION .....	6
<b>2. MINIMUM NUMBER OF NAME SERVERS .....</b>	<b>8</b>
2.1 TEST CASE IDENTIFIER .....	8
2.2 OBJECTIVE .....	8
2.3 INPUTS .....	8
2.4 OUTCOME(S) .....	8
2.5 ENVIRONMENTAL NEEDS .....	8
2.6 SPECIAL PROCEDURAL REQUIREMENTS .....	8
2.7 INTERCASE DEPENDENCIES .....	8
2.8 ORDERED DESCRIPTION OF STEPS TO BE TAKEN TO EXECUTE THE TEST CASE .....	9
<b>3. NAME SERVER REACHABILITY .....</b>	<b>10</b>
3.1 TEST CASE IDENTIFIER .....	10
3.2 OBJECTIVE .....	10
3.3 INPUTS .....	10
3.4 OUTCOME(S) .....	10
3.5 ENVIRONMENTAL NEEDS .....	10
3.6 SPECIAL PROCEDURAL REQUIREMENTS .....	10
3.7 INTERCASE DEPENDENCIES .....	10
3.8 ORDERED DESCRIPTION OF STEPS TO BE TAKEN TO EXECUTE THE TEST CASE .....	10
<b>4. ANSWER AUTHORITATIVELY .....</b>	<b>11</b>
4.1 TEST CASE IDENTIFIER .....	11
4.2 OBJECTIVE .....	11
4.3 INPUTS .....	11
4.4 OUTCOME(S) .....	11
4.5 ENVIRONMENTAL NEEDS .....	11
4.6 SPECIAL PROCEDURAL REQUIREMENTS .....	11
4.7 INTERCASE DEPENDENCIES .....	11
4.8 ORDERED DESCRIPTION OF STEPS TO BE TAKEN TO EXECUTE THE TEST CASE .....	11
<b>5. NETWORK DIVERSITY .....</b>	<b>12</b>
5.1 TEST CASE IDENTIFIER .....	12
5.2 OBJECTIVE .....	12
5.3 INPUTS .....	12
5.4 OUTCOME(S) .....	12
5.5 ENVIRONMENTAL NEEDS .....	12
5.6 SPECIAL PROCEDURAL REQUIREMENTS .....	12
5.7 INTERCASE DEPENDENCIES .....	12
5.8 ORDERED DESCRIPTION OF STEPS TO BE TAKEN TO EXECUTE THE TEST CASE .....	12
<b>6. CONSISTENCY BETWEEN GLUE AND AUTHORITATIVE DATA .....</b>	<b>13</b>
6.1 TEST CASE IDENTIFIER .....	13
6.2 OBJECTIVE .....	13
6.3 INPUTS .....	13
6.4 OUTCOME(S) .....	13
6.5 ENVIRONMENTAL NEEDS .....	13
6.6 SPECIAL PROCEDURAL REQUIREMENTS .....	13

6.7	INTERCASE DEPENDENCIES .....	13
6.8	ORDERED DESCRIPTION OF STEPS TO BE TAKEN TO EXECUTE THE TEST CASE .....	13
<b>7.</b>	<b>CONSISTENCY BETWEEN DELEGATION AND ZONE .....</b>	<b>14</b>
7.1	TEST CASE IDENTIFIER .....	14
7.2	OBJECTIVE .....	14
7.3	INPUTS .....	14
7.4	OUTCOME(S) .....	14
7.5	ENVIRONMENTAL NEEDS .....	14
7.6	SPECIAL PROCEDURAL REQUIREMENTS.....	14
7.7	INTERCASE DEPENDENCIES .....	14
7.8	ORDERED DESCRIPTION OF STEPS TO BE TAKEN TO EXECUTE THE TEST CASE .....	14
<b>8.</b>	<b>SOA RECORD CONSISTENCY BETWEEN AUTHORITATIVE NAME SERVERS .....</b>	<b>15</b>
8.1	TEST CASE IDENTIFIER .....	15
8.2	OBJECTIVE .....	15
8.3	INPUTS .....	15
8.4	OUTCOME(S) .....	15
8.5	ENVIRONMENTAL NEEDS .....	15
8.6	SPECIAL PROCEDURAL REQUIREMENTS.....	15
8.7	INTERCASE DEPENDENCIES .....	16
8.8	ORDERED DESCRIPTION OF STEPS TO BE TAKEN TO EXECUTE THE TEST CASE .....	16
<b>9.</b>	<b>NS RECORD CONSISTENCY BETWEEN AUTHORITATIVE NAME SERVERS .....</b>	<b>17</b>
9.1	TEST CASE IDENTIFIER .....	17
9.2	OBJECTIVE .....	17
9.3	INPUTS .....	17
9.4	OUTCOME(S) .....	17
9.5	ENVIRONMENTAL NEEDS .....	17
9.6	SPECIAL PROCEDURAL REQUIREMENTS.....	17
9.7	INTERCASE DEPENDENCIES .....	17
9.8	ORDERED DESCRIPTION OF STEPS TO BE TAKEN TO EXECUTE THE TEST CASE .....	17
<b>10.</b>	<b>NO TRUNCATION OF REFERRALS .....</b>	<b>18</b>
10.1	TEST CASE IDENTIFIER .....	18
10.2	OBJECTIVE .....	18
10.3	INPUTS .....	18
10.4	OUTCOME(S) .....	18
10.5	ENVIRONMENTAL NEEDS .....	18
10.6	SPECIAL PROCEDURAL REQUIREMENTS.....	18
10.7	INTERCASE DEPENDENCIES .....	18
10.8	ORDERED DESCRIPTION OF STEPS TO BE TAKEN TO EXECUTE THE TEST CASE .....	18
<b>11.</b>	<b>PROHIBITED NETWORKS .....</b>	<b>19</b>
11.1	TEST CASE IDENTIFIER .....	19
11.2	OBJECTIVE .....	19
11.3	INPUTS .....	19
11.4	OUTCOME(S) .....	19
11.5	ENVIRONMENTAL NEEDS .....	19
11.6	SPECIAL PROCEDURAL REQUIREMENTS.....	19
11.7	INTERCASE DEPENDENCIES .....	19
11.8	ORDERED DESCRIPTION OF STEPS TO BE TAKEN TO EXECUTE THE TEST CASE .....	19
<b>12.</b>	<b>NO OPEN RECURSIVE NAME SERVICE .....</b>	<b>21</b>
12.1	TEST CASE IDENTIFIER .....	21
12.2	OBJECTIVE .....	21
12.3	INPUTS .....	21
12.4	OUTCOME(S) .....	21
12.5	ENVIRONMENTAL NEEDS .....	21
12.6	SPECIAL PROCEDURAL REQUIREMENTS.....	21

12.7	INTERCASE DEPENDENCIES .....	21
12.8	ORDERED DESCRIPTION OF STEPS TO BE TAKEN TO EXECUTE THE TEST CASE .....	21
<b>13.</b>	<b>SAME SOURCE ADDRESS .....</b>	<b>22</b>
13.1	TEST CASE IDENTIFIER .....	22
13.2	OBJECTIVE .....	22
13.3	INPUTS .....	22
13.4	OUTCOME(S) .....	22
13.5	ENVIRONMENTAL NEEDS .....	22
13.6	SPECIAL PROCEDURAL REQUIREMENTS.....	22
13.7	INTERCASE DEPENDENCIES .....	22
13.8	ORDERED DESCRIPTION OF STEPS TO BE TAKEN TO EXECUTE THE TEST CASE .....	22
<b>14.</b>	<b>CHECK INVALID SYNTAX FOR SOA RNAME.....</b>	<b>23</b>
14.1	TEST CASE IDENTIFIER .....	23
14.2	OBJECTIVE .....	23
14.3	INPUTS .....	23
14.4	OUTCOME(S) .....	23
14.5	ENVIRONMENTAL NEEDS .....	23
14.6	SPECIAL PROCEDURAL REQUIREMENTS.....	23
14.7	INTERCASE DEPENDENCIES .....	23
14.8	ORDERED DESCRIPTION OF STEPS TO BE TAKEN TO EXECUTE THE TEST CASE .....	23
<b>15.</b>	<b>CHECK SOA MINIMUM VALUE .....</b>	<b>24</b>
15.1	TEST CASE IDENTIFIER .....	24
15.2	OBJECTIVE .....	24
15.3	INPUTS .....	24
15.4	OUTCOME(S) .....	24
15.5	ENVIRONMENTAL NEEDS .....	24
15.6	SPECIAL PROCEDURAL REQUIREMENTS.....	24
15.7	INTERCASE DEPENDENCIES .....	24
15.8	ORDERED DESCRIPTION OF STEPS TO BE TAKEN TO EXECUTE THE TEST CASE .....	24
<b>16.</b>	<b>GLOBAL .....</b>	<b>25</b>
16.1	GLOSSARY .....	25
16.2	DOCUMENT CHANGE PROCEDURES .....	25

## 1. Introduction

---

### 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 all done using DNSCheck with the same set of input parameters.

### 1.2 References

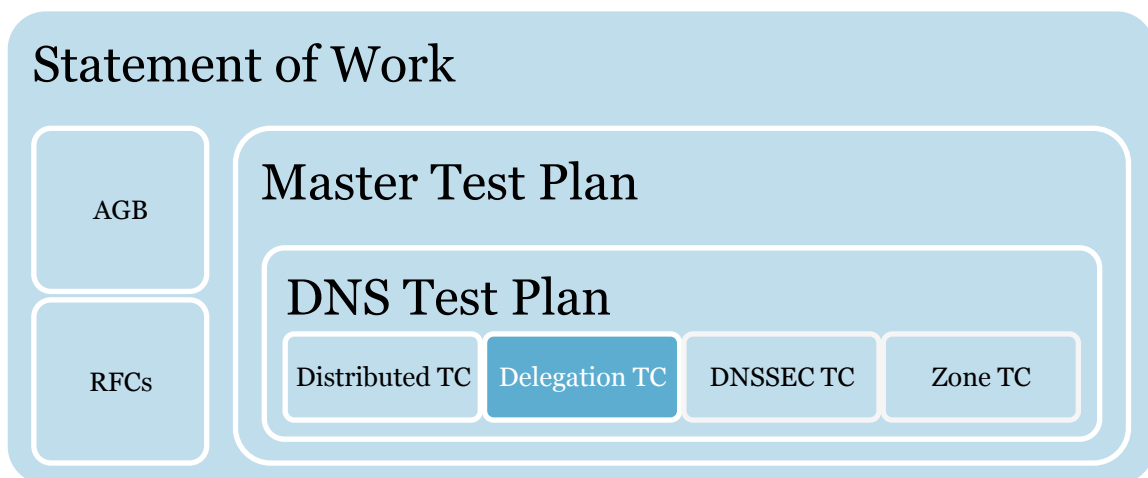
#### 1.2.1 External

- IEEE 829-2008
- ICANN gTLD Applicant Guidebook, Version 2012-06-04
- IANA document “Technical requirements for authoritative name servers”.<sup>1</sup>
- IANA document “Placing TLD delegation signer information in the root zone”.<sup>2</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 at least five points on the Internet. At least one probe node should be located in every ICANN region.

### 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.

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<sup>1</sup> <http://www.iana.org/procedures/nameserver-requirements.html> per 2012-12-18

<sup>2</sup> <http://www.iana.org/procedures/root-dnssec-records.html> per 2012-12-18



## 2. Minimum number of name servers

---

### 2.1 Test case identifier

DNS01 Minimum number of name servers

### 2.2 Objective

There must be at least two NS records listed in a delegation, and the hosts must not resolve to the same IP address.

This test case fulfills the requirement 2.1.1 in the “Technical requirements for authoritative name servers” document.

### 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
DnsNameServer-[1..n]	FQDN of authoritative name server	String
DnsGlueRecord-[1..n]	All IPv4 or IPv6 addresses for auth NS	String

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

### 2.4 Outcome(s)

No error message DELEGATION:TOO\_FEW\_NS, TOO\_FEW\_NS\_IPV4 or TOO\_FEW\_NS\_IPV6 is generated by DNSCheck. If there is an error, this test case fails.

### 2.5 Environmental needs

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

### 2.6 Special procedural requirements

This test has no 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

DNSCheck is run with all the input parameters

A query is made to all listed name servers for the NS records for the designated zone. The NS records in the answer are compared with the parent zone. If the total number of common NS records between parent and zone is less than two the DELEGATION:TOO\_FEW\_NS message is generated.

The IP addresses of all NS records are collected. If the total count of distinct IPv4 addresses is below 2 the message TOO\_FEW\_NS\_IPV4 is generated. If the total count of distinct IPv6 addresses is below 2 the message TOO\_FEW\_NS\_IPV6 is generated.

### 3. Name server reachability

---

#### 3.1 Test case identifier

DNS02 Name server reachability

#### 3.2 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.

#### 3.3 Inputs

See section 2.3 in this document.

#### 3.4 Outcome(s)

No error message NAMESERVER:NO\_UDP and NAMESERVER:NO\_TCP is generated by DNSCheck. If there is an error, this test case fails.

#### 3.5 Environmental needs

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

#### 3.6 Special procedural requirements

This test has no 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

DNSCheck is run with all the input parameters.

All listed name servers are queried over both UDP and TCP. If any query fails to give an answer, either the message NAMESERVER:NO\_UDP or NAMESERVER:NO\_TCP is emitted by DNSCheck.

## 4. Answer authoritatively

---

### 4.1 Test case identifier

DNS03 Answer authoritatively

### 4.2 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.

### 4.3 Inputs

See section 2.3 in this document.

### 4.4 Outcome(s)

No error message NAMESERVER:NOT\_AUTH is generated by DNSCheck. If there is an error, this test case fails.

### 4.5 Environmental needs

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

### 4.6 Special procedural requirements

This test has no procedural requirements.

### 4.7 Intercase dependencies

This test has no intercase dependencies.

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

DNSCheck is run with all the input parameters.

All listed name servers are queried for the SOA record. If any of the name servers fail to give an authoritative answer (“AA-bit” is set in the answer), DNSCheck generates the message NAMESERVER:NOT\_AUTH.

## 5. Network diversity

---

### 5.1 Test case identifier

DNS04 Network diversity

### 5.2 Objective

The name servers must be in at least two topologically separate networks.

This test case fulfills the requirements 2.5.2 in the “Technical requirements for authoritative name servers” document.

### 5.3 Inputs

See section 2.3 in this document. In addition to this we use the “IP to ASN mapping” feed from Team Cymru.<sup>3</sup>

### 5.4 Outcome(s)

No error message CONNECTIVITY:TOO\_FEW\_ASN or CONNECTIVITY:V6\_TOO\_FEW\_ASN is generated by DNSCheck. If there is an error, this test case pass with a warning.

### 5.5 Environmental needs

There must be an updated “IP to ASN mapping” from Team Cymru in place for the IP address mapping to AS numbers.

### 5.6 Special procedural requirements

This test has no procedural requirements.

### 5.7 Intercase dependencies

This test has no intercase dependencies.

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

DNSCheck is run with all the input parameters.

All NS records and their IP addresses are looked up for the designated zone. For every IP address, its routing prefix is looked up. If any prefixes found are fully contained within another prefix in the list, they are removed. It is then verified that the intersection of all AS sets for all remaining prefixes is empty (that is, that they form at least two disjoint sets).

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<sup>3</sup> <http://www.team-cymru.org/Services/ip-to-asn.html>

## 6. Consistency between glue and authoritative data

---

### 6.1 Test case identifier

DNS05 Consistency between glue and authoritative data

### 6.2 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.

This test case fulfills the requirements 2.6.1 in the “Technical requirements for authoritative name servers” document.

### 6.3 Inputs

See section 2.3 in this document.

### 6.4 Outcome(s)

No error message DELEGATION:INCONSISTENT\_GLUE is generated by DNSCheck. If there is an error, this test case fails.

### 6.5 Environmental needs

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

### 6.6 Special procedural requirements

This test has no procedural requirements.

### 6.7 Intercase dependencies

This test has no intercase dependencies.

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

DNSCheck is run with all the input parameters.

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 sets of IP-addresses the message DELEGATION:INCONSISTENT\_GLUE is generated by DNSCheck.

## 7. Consistency between delegation and zone

---

### 7.1 Test case identifier

DNS06 Consistency between delegation and zone

### 7.2 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.

### 7.3 Inputs

See section 2.3 in this document.

### 7.4 Outcome(s)

No error message DELEGATION:EXTRA\_NS\_PARENT or DELEGATION:EXTRA\_NS\_CHILD is generated by DNSCheck. If there is an error, this test case fails.

### 7.5 Environmental needs

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

### 7.6 Special procedural requirements

This test has no procedural requirements.

### 7.7 Intercase dependencies

This test has no intercase dependencies.

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

DNSCheck is run with all the input parameters.

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 the message DELEGATION:EXTRA\_NS\_PARENT or DELEGATION:EXTRA\_NS\_CHILD is generated by DNSCheck.

## 8. SOA record consistency between authoritative name servers

---

### 8.1 Test case identifier

DNS07 SOA record consistency between authoritative name servers

### 8.2 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 domain.

This test case fulfills the requirements 2.8.1 and 2.8.3 in the “Technical requirements for authoritative name servers” document.

### 8.3 Inputs

See section 2.3 in this document.

### 8.4 Outcome(s)

No error message CONSISTENCY:SOA\_SERIAL\_DIFFERENT or CONSISTENCY:SOA\_DIGEST\_DIFFERENT is generated by DNSCheck. If there is an error, this test case fails in this first step.

If there are occurrences of the error CONSISTENCY:SOA\_SERIAL\_DIFFERENT, we manually inspect the SOA Serial numbers in the logs. See the requirement in 2.8.3.1 in the “Technical requirements for authoritative name servers” document.

### 8.5 Environmental needs

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

### 8.6 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 in case of the occurrence of CONSISTENCY:SOA\_SERIAL\_DIFFERENT.

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.

## 8.7 Intercase dependencies

This test has no intercase dependencies.

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

DNSCheck is run with all the input parameters.

The SOA record is queried for all the name servers found in the input parameters, and also in the zone itself. If the SOA serial number is not all the same for all the answers, the message CONSISTENCY:SOA\_SERIAL\_DIFFERENT is generated by DNSCheck. A digest is calculated from the SOA records as well, and if the digest is not all the same for all the answers the message CONSISTENCY:SOA\_DIGEST\_DIFFERENT is generated by DNSCheck.



## 9. NS record consistency between authoritative name servers

---

### 9.1 Test case identifier

DNS08 NS record consistency between authoritative name servers

### 9.2 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.

This test case fulfills the requirements 2.8.1 and 2.8.2 in the “Technical requirements for authoritative name servers” document.

### 9.3 Inputs

See section 2.3 in this document.

### 9.4 Outcome(s)

No error message CONSISTENCY:MULTIPLE\_NS\_SETS is generated by DNSCheck. If there is an error, this test case fails in this first step.

### 9.5 Environmental needs

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

### 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

DNSCheck is run with all the input parameters.

The NS record is queried for all the name servers found in the input parameters. If any of the NS records in an authoritative answer is not consistent with any of the other answers, the message CONSISTENCY:MULTIPLE\_NS\_SETS is generated.

## 10. No truncation of referrals

---

### 10.1 Test case identifier

DNS09 No truncation of referrals

### 10.2 Objective

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.

This test case fulfills the requirements 2.9.1 and 2.9.2 in the “Technical requirements for authoritative name servers” document.

### 10.3 Inputs

See section 2.3 in this document.

### 10.4 Outcome(s)

No error message DELEGATION:MIN\_REFERRAL\_SIZE\_TOO\_BIG is generated by DNSCheck. If there is an error, this test case fails.

### 10.5 Environmental needs

This test has no environmental requirements.

### 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

DNSCheck is run with all the input parameters.

An algorithm calculates the size of a referral answer based on the input parameters and decides if the message DELEGATION:MIN\_REFERRAL\_SIZE\_TOO\_BIG is generated.

## 11. Prohibited networks

---

### 11.1 Test case identifier

DNS10 Prohibited networks

### 11.2 Objective

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.

This test case fulfills the requirements in 2.10 of the “Technical requirements for authoritative name servers” document.

### 11.3 Inputs

See section 2.3 in this document.

### 11.4 Outcome(s)

No error message ADDRESS:RESERVED\_IPV4, ADDRESS:RESERVED\_IPV6, ADDRESS:UNSUITABLE\_IPV4, ADDRESS:UNSUITABLE\_IPV6, ADDRESS:INVALID or ADDRESS:PRIVATE\_IPV4 is generated by DNSCheck. If there is an error, this test case fails.

### 11.5 Environmental needs

This test has no environmental requirements.

### 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

DNSCheck is run with all the input parameters.

All IP addresses derived from all listed name servers in the input parameters and found in the zone for any name servers listed there, is compared to a list containing blocks of reserved IPv4 addresses not suitable for global routing, blocks of reserved IPv6 addresses not suitable for global routing, and Teredo and 6to4 IPv6 tunnel addresses. This is a table of the message and the message generated if the IP address is within the disallowed address range:

Address blocks	Description	DNSCheck message
192.0.0.0/24, 23.255.255.0/24, 224.0.0.0/4, 240.0.0.0/4	Reserved IPv4 address blocks from RFC 3330. RFC 5735 and RFC 5771 (Multicast)	ADDRESS:RESERVED_IPV4
::1/128, ::/128, ::FFFF:0:0/96, fe80::/10, fc00::/7, 2001:db8::/32, 2002::/16, 2001::/32, 5f00::/8, 3ffe::/16, 2001:10::/28, ::/0, ff00::/8	Special use IPv6 address blocks from RFC 5156	ADDRESS:RESERVED_IPV6
192.88.99.0/24	6to4 IPv4 anycast address	ADDRESS:UNSUITABLE_IPV4
2001::/32, 2002::/16	Teredo and 6to4	ADDRESS:UNSUITABLE_IPV6
::<ipv4-address>/96, Syntactically incorrect IP- address	IPv4 mapped IPv6 address and syntactically incorrect addresses	ADDRESS:INVALID
10/8, 172.16/12, 192.168/16, 100.64/10	Private or Shared IPv4 addresses from RFC1918 and RFC 6598	ADDRESS:PRIVATE_IPV4

## 12. No open recursive name service

---

### 12.1 Test case identifier

DNS11 No open recursive name service

### 12.2 Objective

The authoritative name servers must not provide recursive name service.

This test case fulfills the requirements 2.11.1 in the “Technical requirements for authoritative name servers” document.

### 12.3 Inputs

See section 2.3 in this document.

### 12.4 Outcome(s)

No error message NAMESERVER:RECURSIVE is generated by DNSCheck. If there is an error, this test case fails.

### 12.5 Environmental needs

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

### 12.6 Special procedural requirements

This test has no procedural requirements.

### 12.7 Intercase dependencies

This test has no intercase dependencies.

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

DNSCheck is run with all the input parameters.

A SOA query for an almost certainly nonexistent name 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, the message NAMESERVER:RECURSIVE is generated by DNSCheck.

## 13. Same source address

---

### 13.1 Test case identifier

DNS12 Same source address

### 13.2 Objective

Responses from the authoritative name servers must contain the same source IP address as the destination IP address of the initial query.

This test case fulfills the requirements 2.12.1 in the “Technical requirements for authoritative name servers” document.

### 13.3 Inputs

See section 2.3 in this document.

### 13.4 Outcome(s)

No error message NAMESERVER:NOT\_SAME\_SOURCE is generated by DNSCheck. If there is an error, this test case fails.

### 13.5 Environmental needs

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

### 13.6 Special procedural requirements

This test has no procedural requirements.

### 13.7 Intercase dependencies

This test has no intercase dependencies.

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

DNSCheck is run with all the input parameters.

One query per name server IP address is made, and the answer is verified to come from the same IP address. If there is a mismatch between these IP addresses, the message NAMESERVER:NOT\_SAME\_SOURCE is generated.

## 14. Check invalid syntax for SOA RNAME

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### 14.1 Test case identifier

DNS23 Syntax for SOA RNAME

### 14.2 Objective

The SOA RNAME field must be valid in accordance with section 3.3.13 in RFC 1035 and section 3.4 in RFC 2822.

This test case is an addition to the Statement of Work; see section 2.1.2 in the DNS Test Plan document.

### 14.3 Inputs

See section 2.3 in this document.

### 14.4 Outcome(s)

No error message MAIL:ADDRESS\_SYNTAX is generated by DNSCheck. If there is an error, this test case fails.

### 14.5 Environmental needs

This test has no environmental requirements.

### 14.6 Special procedural requirements

This test has no procedural requirements.

### 14.7 Intercase dependencies

This test has no intercase dependencies.

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

DNSCheck is run with all the input parameters.

An algorithm in the Perl module Mail::RFC2822::Address is called from DNSCheck that checks the value of the RNAME field of the SOA record. If the RNAME field does not validate, the message MAIL:ADDRESS\_SYNTAX is generated.

## 15. Check SOA Minimum value

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### 15.1 Test case identifier

DNS24 SOA Minimum

### 15.2 Objective

The SOA Minimum field must be set to 300 seconds or more.

This test case is an addition to the Statement of Work; see section 2.1.2 in the DNS Test Plan document.

### 15.3 Inputs

See section 2.3 in this document.

### 15.4 Outcome(s)

No error message SOA:MINIMUM\_SMALL is generated by DNSCheck. If there is an error, this test case emits a warning.

### 15.5 Environmental needs

This test has no environmental requirements.

### 15.6 Special procedural requirements

This test has no procedural requirements.

### 15.7 Intercase dependencies

This test has no intercase dependencies.

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

DNSCheck is run with all the input parameters.

The value from the SOA Minimum field is retrieved. If the value is less than 300 the DNSCheck message SOA:MINIMUM\_SMALL is generated.



## 16. Global

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### 16.1 Glossary

The glossary is available in the Master Test Plan.

### 16.2 Document change procedures

Document change procedures are documented in the Master Test Plan.