DNS Conformance

Test Specification For Client

Revision 1.0

Yokogawa Electric Corporation

References

This test specification focus on following DNS related RFCs.

RFC 1034	DOMAIN NAMES - CONCEPTS AND FACILITIES
RFC 1035	DOMAIN NAMES - IMPLEMENTATION AND SPECIFICATION
RFC 1123	Requirements for Internet Hosts -- Application and Support
RFC 1995	Incremental Zone Transfer in DNS
RFC 1996	A Mechanism for Prompt Notification of Zone Changes (DNS NOTIFY)
RFC 2181	Clarifications to the DNS Specification
RFC 2308	Negative Caching of DNS Queries (DNS NCACHE)
RFC 2671	Extension Mechanisms for DNS (EDNS0)
RFC 2782	A DNS RR for specifying the location of services (DNS SRV)
RFC 3401	Dynamic Delegation Discovery System (DDDS) Part One: The Comprehensive DDDS
RFC 3402	Dynamic Delegation Discovery System (DDDS) Part Two: The Algorithm
RFC 3403	Dynamic Delegation Discovery System (DDDS) Part Three: The Domain Name System (DNS) Database
RFC 3404	Dynamic Delegation Discovery System (DDDS) Part Four: The Uniform Resource Identifiers (URI) Resolution Application
RFC 3405	Dynamic Delegation Discovery System (DDDS) Part Five: URI.ARPA Assignment Procedures
RFC 3425	Obsoleting IQUERY
RFC 3596	DNS Extensions to Support IP Version 6

---TOC---

1. Introduction

These DNS conformance test specifications have aimed to evaluate the client's behavior described in RFC1034 which defines domain names concepts and facilities.

These specifications evaluate DNS message. And the following points are also evaluated:

- The DNS client can exchange DNS messages over IPv6 transport satisfying the DNS specifications.
- The DNS client can exchange DNS messages over IPv4 transport satisfying the DNS specifications.

2. Common Topology

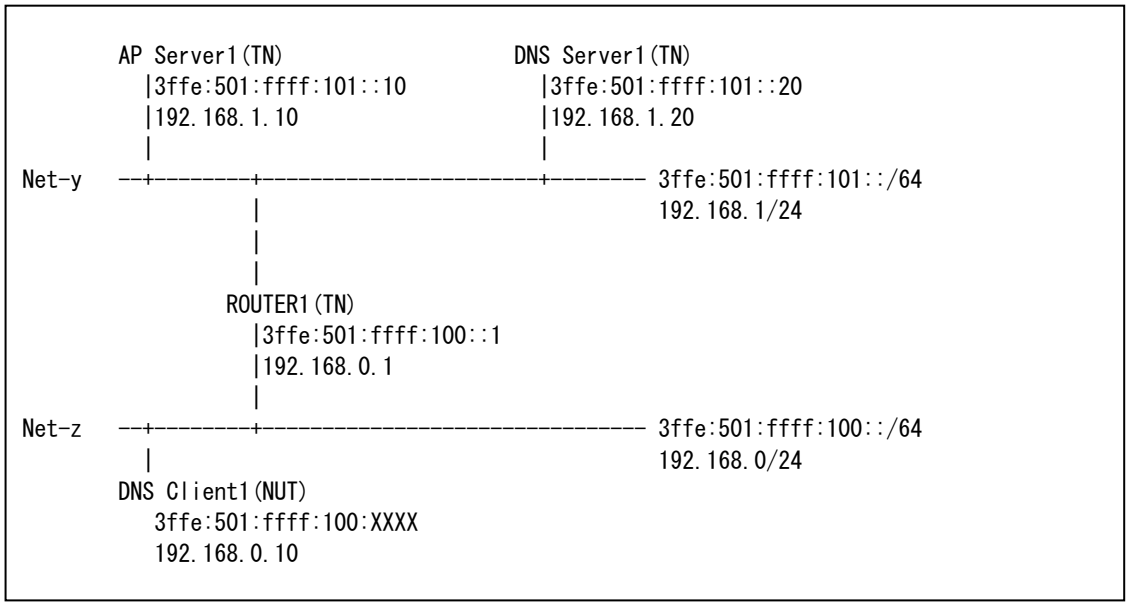


Fig. 1 Topology No.1

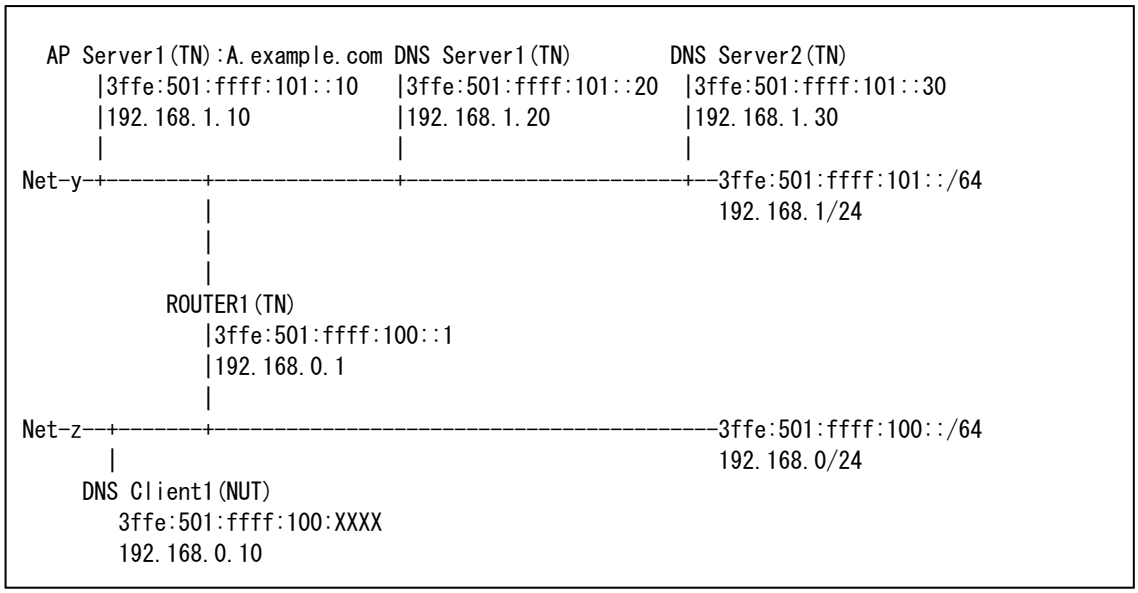


Fig. 2 Toplogy No.2

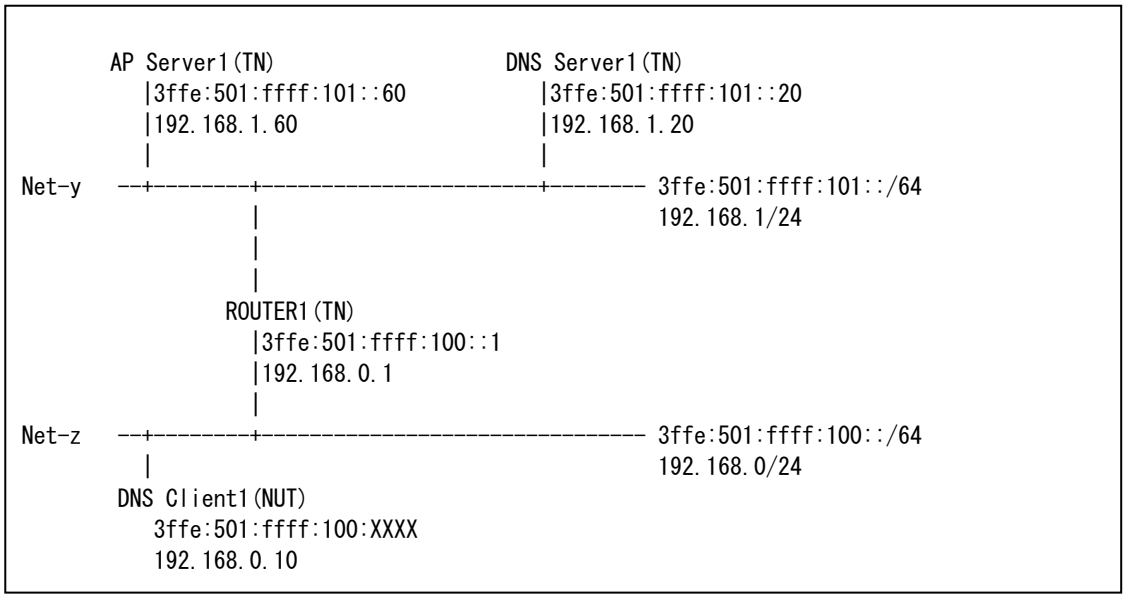


Fig. 3 Topology No.3

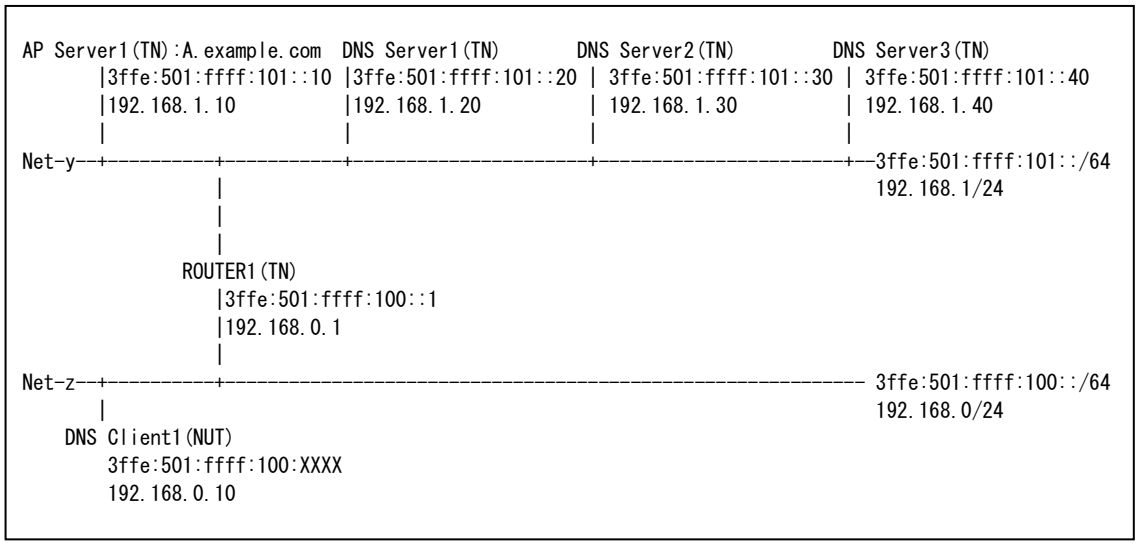


Fig. 4 Topology No.4

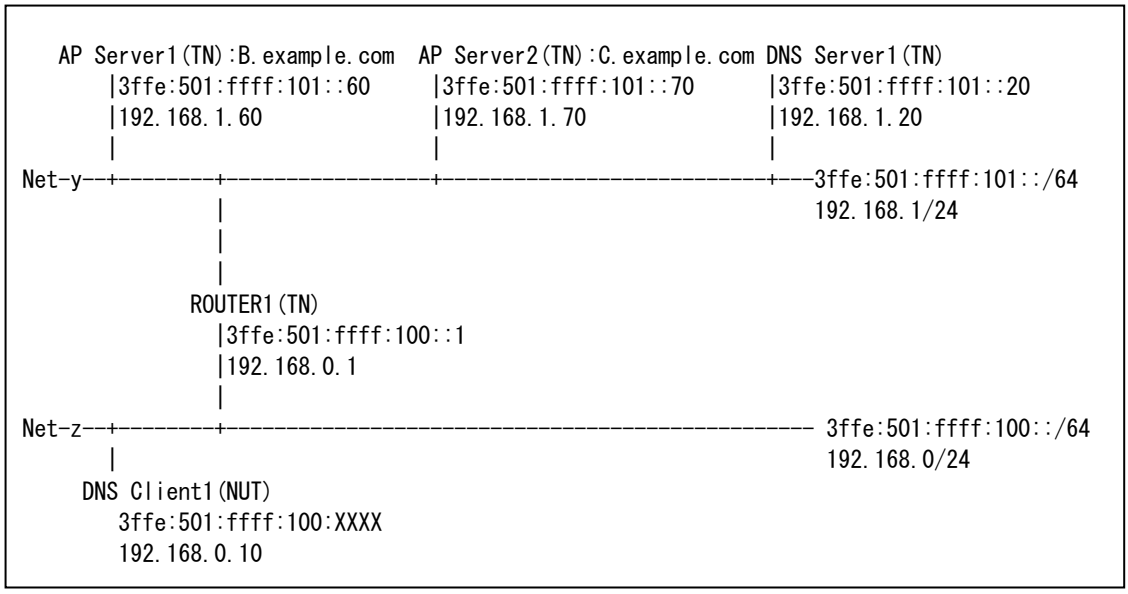


Fig. 5 Topology No.5

XXXX: EUI64 address

3. Terminology

NUT_NETZ	DNS Client1(NUT)'s address
SV1_NETY	DNS Server1(TN)'s address
SV2_NETY	DNS Server2(TN)'s address
SV3_NETY	DNS Server3(TN)'s address
AP1_NETY	AP Server1(TN)'s address
BRO_MULTI	Broadcast(for IPv4) or multicast(for IPv6) address

4. Description

Each test specification consists of following parts.

Purpose: The Purpose is the short statement describing what the test attempts to achieve. It is usually phrased as a simple assertion of the future or capability to be tested.

Category: The Category shows what classification of device must satisfy the test.

Initialization: The Initialization describes how to initialize and configure the NUT before starting each test. If a value is not provided, then the protocol's default value is used.

Procedure: The Procedure describes step-by-step instructions for carrying out the test.

Judgment: The Judgment describes expected result. If we can observe as same result as the description of Judgment, the NUT passes the test.

References: The References section contains some parts of specification

5. Client Test

5.1. Label length

Purpose

Verify that a NUT transmits messages name space specifications

- Each node has a label, which is zero to 63 octets in length Labels must be 63 characters or less.

Category

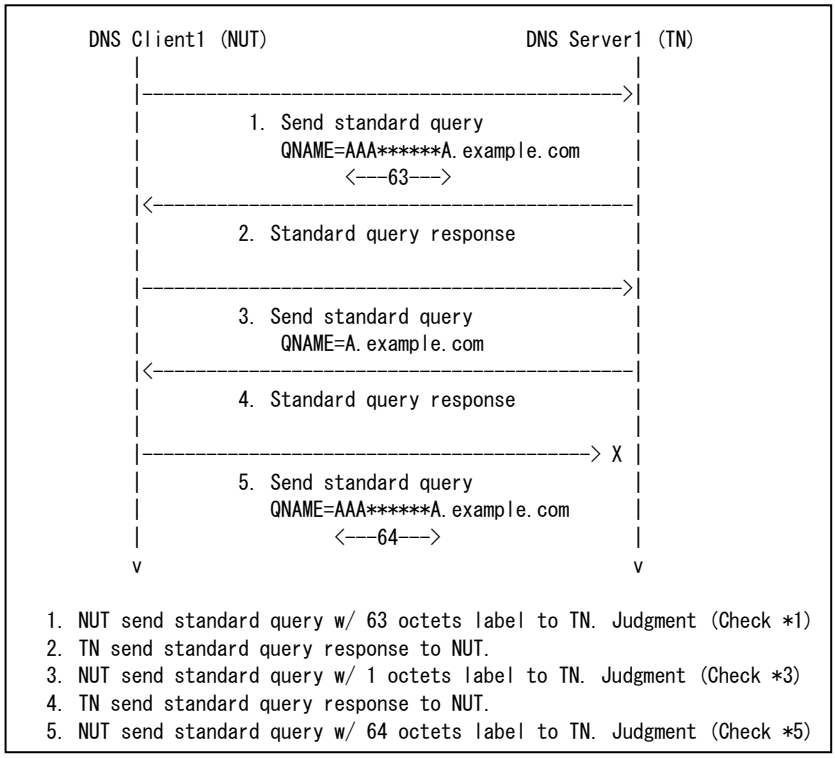
Client

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
- **Setup**
  Set the DNS Server1(TN)' s address to NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for A type of AP Server1(TN):
  AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA.example.com
  to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1st Packet

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA.example.com
	QTYPE	A (0x0001)
	QCLASS	*any*

2nd packet.

2. Standard query response from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Same as 1st Packet's Src Port
DNS Header	ID	Same as 1st Packet's ID
	QR	1
	OPCODE	0
	AA	1
	TC	0
	RD	Same as 1st Packet's RD
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	1
	NSCOUNT	1

	ARCOUNT	1
DNS Question section	QNAME	AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)
DNS Answer section	NAME	AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA.example.com (Pointer 0xC00C)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	4
	ADDRESS	192.168.1.10
DNS Authority section	NAME	example.com (Pointer 0xC04C)
	TYPE	NS (0x0002)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	6
	NSDNAME	NS1.example.com (NS1 + Pointer 0xC04C)
DNS Additional section	NAME	NS1.example.com (Pointer 0xC079)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	4
	ADDRESS	192.168.1.20

3rd Packet

2. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0

	ARCOUNT	any
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	*any*

4th Packet

2. Standard query response from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Same as 4th Packet's Src Port
DNS Header	ID	Same as 4th Packet's ID
	QR	1
	OPCODE	0
	AA	1
	TC	0
	RD	Same as 4th Packet's RD
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	1
	NSCOUNT	1
	ARCOUNT	1
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)
DNS Answer section	NAME	A.example.com (Pointer 0xC00C)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	4
	ADDRESS	192.168.1.10
DNS Authority section	NAME	example.com (Pointer 0xC00E)
	TYPE	NS (0x0002)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	6
	NSDNAME	NS1.example.com (NS1 + Pointer 0xC00E)
DNS Additional section	NAME	NS1.example.com (Pointer 0xC03B)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	1 day (86400)

	RDLENGTH	4
	ADDRESS	192.168.1.20

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Received standard query w/ label length 63 from NUT.
3. Received standard query w/ label length 1 from NUT.
5. Not received standard query w/ label length 64 from NUT.

References

RFC1034 : DOMAIN NAMES - CONCEPTS AND FACILITIES
  3.1. Name space specifications and terminology
  3.5. Preferred name syntax
RFC1035 DOMAIN NAMES - IMPLEMENTATION AND SPECIFICATION
  2.3.1 Preferred name syntax
RFC1123 Requirements for internet Hosts -- Application and Support
  2.1 Host Names and Numbers

5.2. Domain name length

Purpose

Verify that a NUT transmits messages name space specifications

- To simplify implementations, the total number of octets that represent a domain name (i.e., the sum of all label octets and label lengths) is limited to 255.

Category

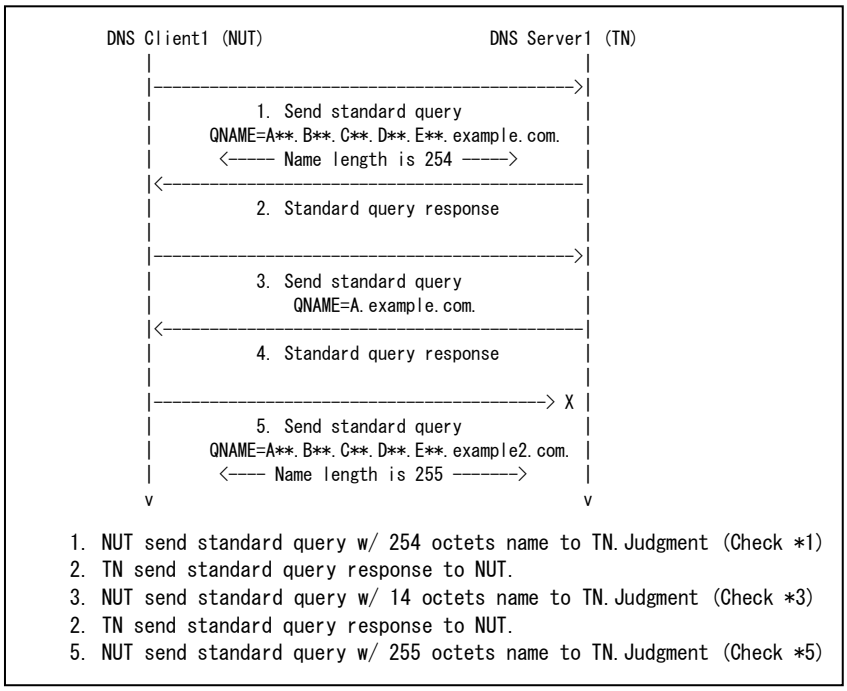
Client

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
- **Setup**
  Set the DNS Server1(TN)' s address to NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for A type of AP Server1(TN):
  AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA.
  BBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBB.
  CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC.
  DDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDD.
  EEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEE.example.com.
  to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



1. NUT send standard query w/ 254 octets name to TN. Judgment (Check *1)
2. TN send standard query response to NUT.
3. NUT send standard query w/ 14 octets name to TN. Judgment (Check *3)
2. TN send standard query response to NUT.
5. NUT send standard query w/ 255 octets name to TN. Judgment (Check *5)

Packet Description

1st Packet

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA. BBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBB. CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC. DDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDD. EEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEE.example.com.
	QTYPE	A (0x0001)
	QCLASS	*any*

2nd packet.

2. Standard query response from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Same as 1st Packet's Src Port
DNS Header	ID	Same as 1st Packet's ID
	QR	1
	OPCODE	0
	AA	1
	TC	0
	RD	Same as 1st Packet's RD
	RA	0
	Z	0

	RCODE	0
	QDCOUNT	1
	ANCOUNT	1
	NSCOUNT	1
	ARCOUNT	1
DNS Question section	QNAME	AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA. BBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBB. CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC. DDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDD. EEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEE.example.com.
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)
DNS Answer section	NAME	AAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA. BBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBB. CCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCCC. DDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDDD. EEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEE.example.com. (Pointer 0xC00C)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	4
	ADDRESS	192.168.1.10
DNS Authority section	NAME	example.com (Pointer 0xC0FE)
	TYPE	NS (0x0002)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	6
	NSDNAME	NS1.example.com (NS1 + Pointer 0xC0FE)
DNS Additional section	NAME	NS1.example.com (Pointer 0xC11F)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	4
	ADDRESS	192.168.1.20

3rd Packet

2. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*

	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	*any*

4th Packet

2. Standard query response from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Same as 4th Packet's Src Port
DNS Header	ID	Same as 4th Packet's ID
	QR	1
	OPCODE	0
	AA	1
	TC	0
	RD	Same as 4th Packet's RD
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	1
	NSCOUNT	1
	ARCOUNT	1
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)
DNS Answer section	NAME	A.example.com (Pointer 0xC00C)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	4
	ADDRESS	192.168.1.10
DNS Authority section	NAME	example.com (Pointer 0xC00E)
	TYPE	NS (0x0002)

	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	6
	NSDNAME	NS1.example.com (NS1 + Pointer 0xC00E)
DNS Additional section	NAME	NS1.example.com (Pointer 0xC03B)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	4
	ADDRESS	192.168.1.20

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Received standard query w/ domain name length 255 from NUT.
3. Received standard query w/ domain name length 15 from NUT.
5. Not received standard query w/ domain name length 256 from NUT.

References

RFC1034 DOMAIN NAMES - CONCEPTS AND FACILITIES
  3.1. Name space specifications and terminology
RFC1035 DOMAIN NAMES - IMPLEMENTATION AND SPECIFICATION
  2.3.4. Size limits
  3.1. Name space definitions
RFC1123 Requirements for internet Hosts -- Application and Support
  2.1. Host Names and Numbers
  11. Name syntax

5.3. Rule for label

Purpose

Verify that a NUT transmits messages as follow as rule for label

- The syntax of a legal Internet host name was specified in RFC-952.
  One aspect of host name syntax is hereby changed: the restriction on the first character is relaxed to allow either a letter or a digit.
  Host software MUST support this more liberal syntax.

Category

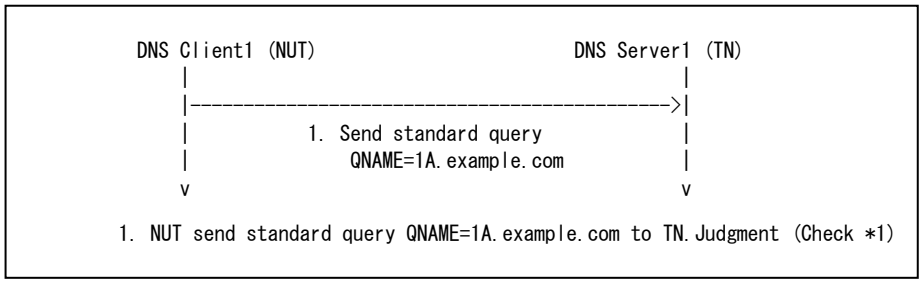
Client

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
- **Setup**
  Set the DNS Server1(TN)'s address to NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for A type of AP Server1(TN):
  1A.example.com to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*

	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	1A.example.com
	QTYPE	A (0x0001)
	QCLASS	*any*

- **Termination**

  If NUT has cache function, clear the cache.

Judgment

1. Received standard query QNAME=1A.example.com from NUT.

References

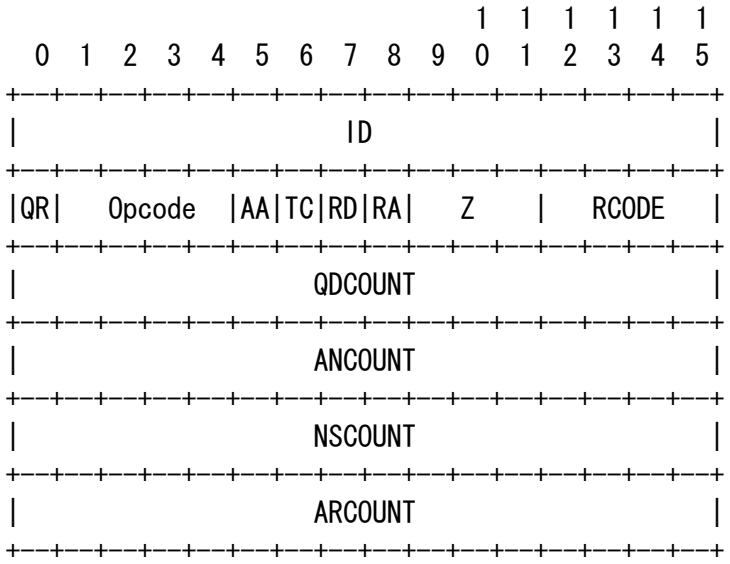
RFC1034 DOMAIN NAMES - CONCEPTS AND FACILITIES
  3.1. Name space specifications and terminology
  3.5. Preferred name syntax
RFC1035 DOMAIN NAMES - IMPLEMENTATION AND SPECIFICATION
  2.3.1 Preferred name syntax
RFC1123 Requirements for internet Hosts -- Application and Support
  2.1 Host Names and Numbers

5.4.A type in standard query

Purpose

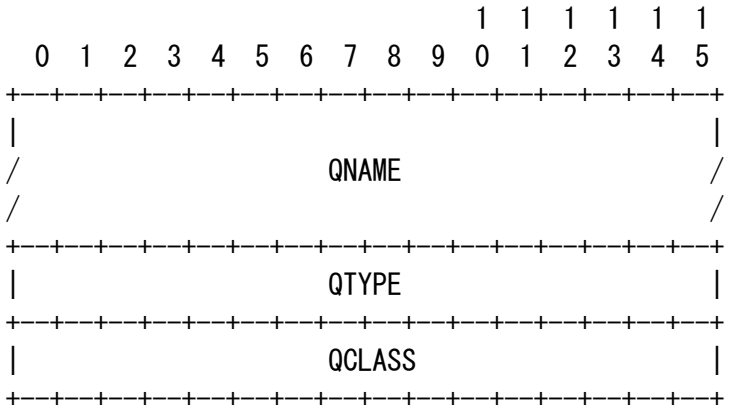
Verify that a NUT transmits correct standard query format for A type

- Header section format



QR	**Query (0)**
Opcode	**A standard query(QUERY) (0)**
Z	**Must be zero**
QDCOUNT	**1**
ANCOUNT	**0**
NSCOUNT	**0**
ARCOUNT	**0**

- Question section format



QNAME	**A.example.com**
QTYPE	**A type (1)**

- Answer section format
  Must be empty
- Authority section format
  Must be empty
- Additional section format
  Must be empty

Category

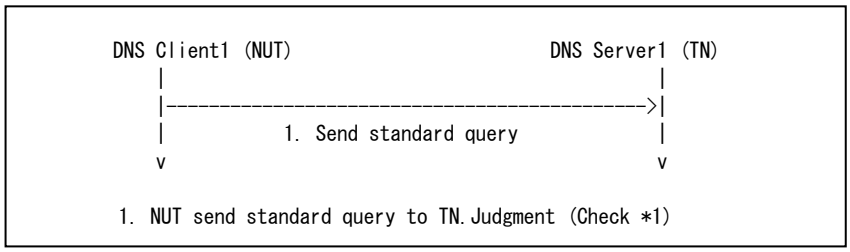
Client

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "A.example.com".
- **Setup**
  Set the DNS Server1(TN)'s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for A type of AP Server1(TN): A.example.com to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*

	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	*any*

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Standard query for A type must be base on above Verification Points.

References

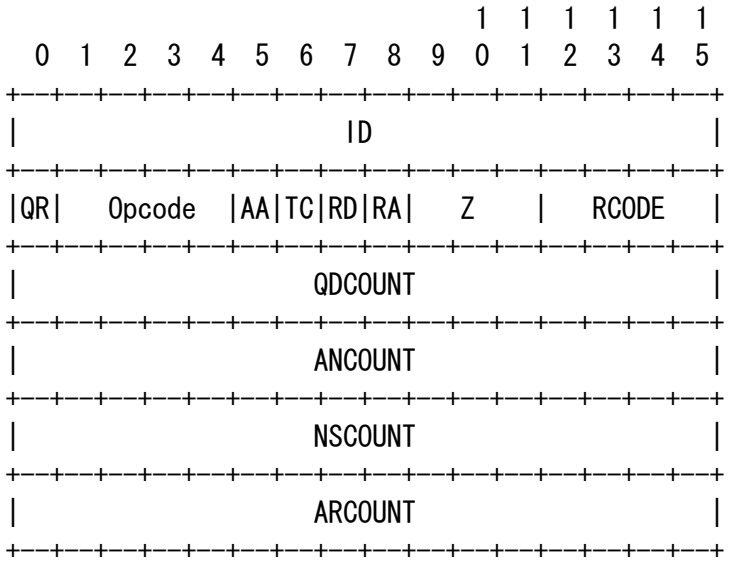
RFC1034 DOMAIN NAMES - CONCEPTS AND FACILITIES
3.6. Resource Records
RFC1035 DOMAIN NAMES - IMPLEMENTATION AND SPECIFICATION
3.2.2. TYPE values

5.5.CNAME type in standard query

Purpose

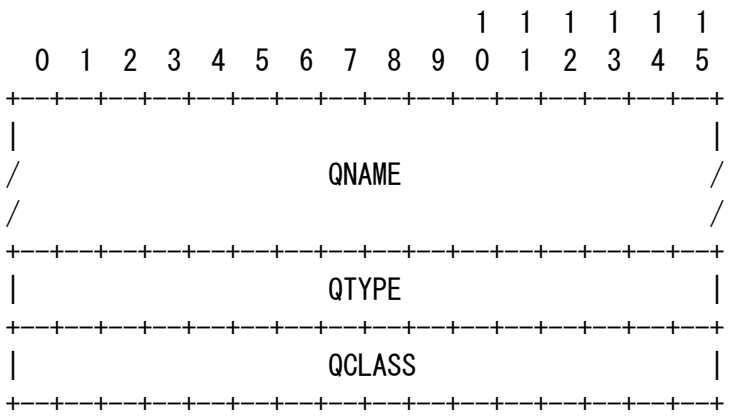
Verify that a NUT transmits correct standard query format for CNAME type

- Header section format



QR	**Query (0)**
Opcode	**A standard query(QUERY) (0)**
Z	**Must be zero**
QDCOUNT	**1**
ANCOUNT	**0**
NSCOUNT	**0**
ARCOUNT	**0**

- Question section format



QNAME	**A.example.com**
QTYPE	**CNAME type (5)**

- Answer section format
  Must be empty
- Authority section format
  Must be empty
- Additional section format
  Must be empty

Category

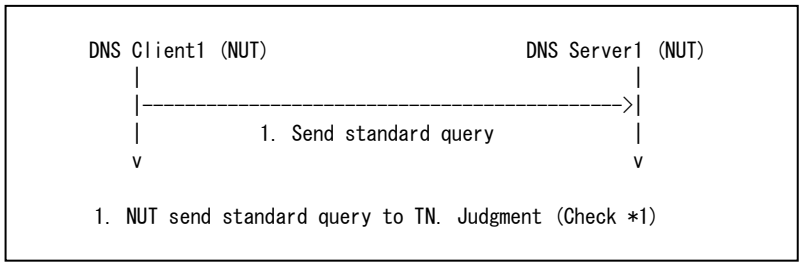
Client

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "A.example.com".
- **Setup**
  Set the DNS Server1(TN)'s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for CNAME type of AP Server1(TN): A.example.com to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*

	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	A.example.com
	QTYPE	CNAME (0x0005)
	QCLASS	*any*

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Standard query for CNAME type must be base on above Verification Points.

References

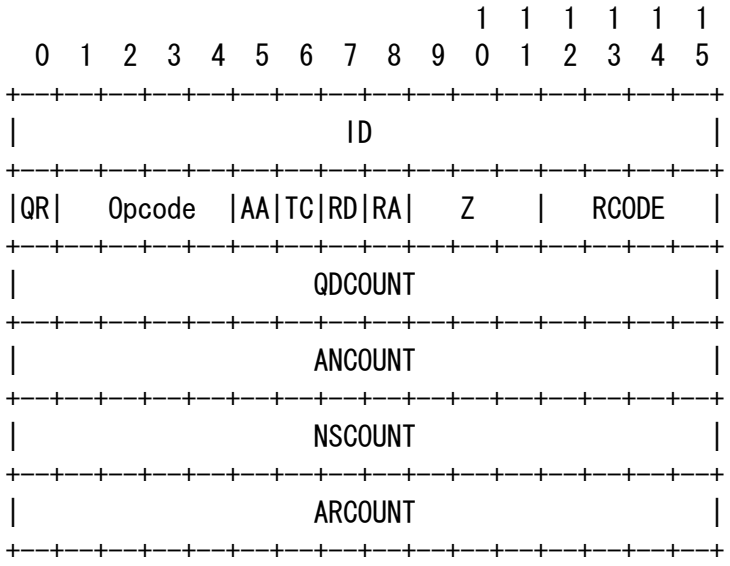
RFC1034 DOMAIN NAMES - CONCEPTS AND FACILITIES
3.6. Resource Records
RFC1035 DOMAIN NAMES - IMPLEMENTATION AND SPECIFICATION
3.2.2. TYPE values

5.6.HINFO type in standard query

Purpose

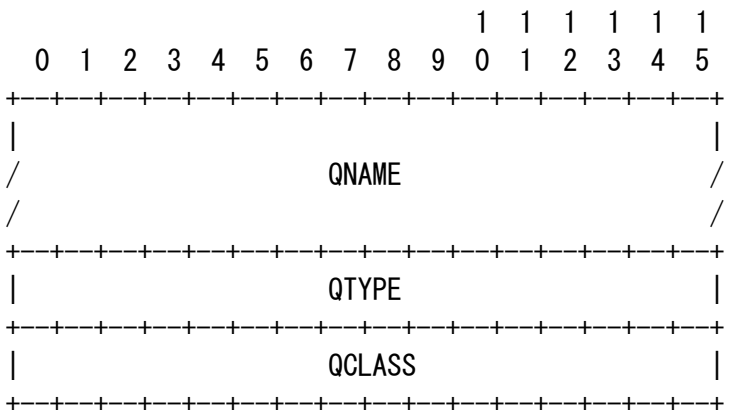
Verify that a NUT transmits correct standard query format for HINFO type

- Header section format



QR	**Query (0)**
Opcode	**A standard query(QUERY) (0)**
Z	**Must be zero**
QDCOUNT	**1**
ANCOUNT	**0**
NSCOUNT	**0**
ARCOUNT	**0**

- Question section format



QNAME	**A.example.com**
QTYPE	**HINFO type (13)**

- Answer section format
  Must be empty
- Authority section format
  Must be empty
- Additional section format
  Must be empty

Category

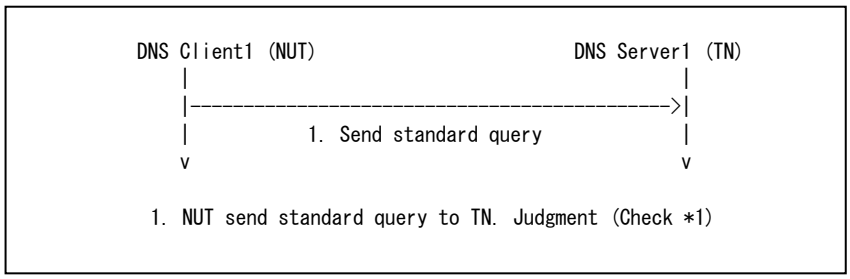
Client

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "A.example.com".
- **Setup**
  Set the DNS Server1(TN)'s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for HINFO type of AP Server1(TN): A.example.com to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*

	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	A.example.com
	QTYPE	HINFO (0x000d)
	QCLASS	*any*

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Standard query for HINFO type must be base on above Verification Points.

References

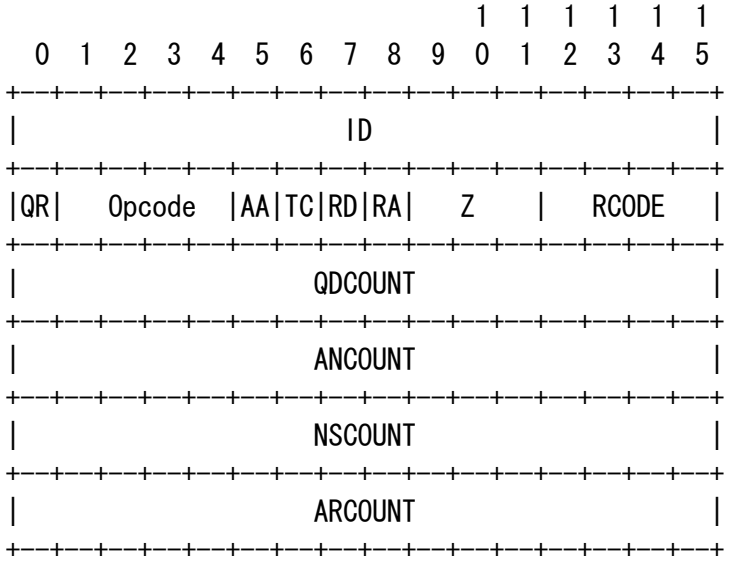
RFC1034 DOMAIN NAMES - CONCEPTS AND FACILITIES
3.6. Resource Records
RFC1035 DOMAIN NAMES - IMPLEMENTATION AND SPECIFICATION
3.2.2. TYPE values

5.7.MX type in standard query

Purpose

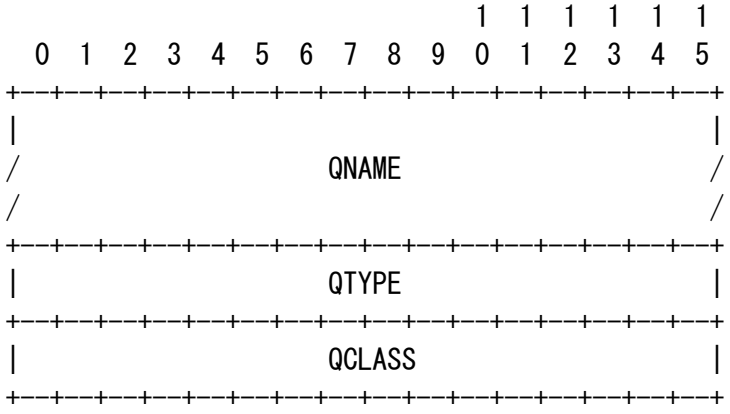
Verify that a NUT transmits correct standard query format for MX type Header section format

- Header section format



QR	**Query (0)**
Opcode	**A standard query(QUERY) (0)**
Z	**Must be zero**
QDCOUNT	**1**
ANCOUNT	**0**
NSCOUNT	**0**
ARCOUNT	**0**

- Question section format



QNAME	**example.com**
QTYPE	**MX type (15)**

- Answer section format
  Must be empty
- Authority section format
  Must be empty
- Additional section format
  Must be empty

Category

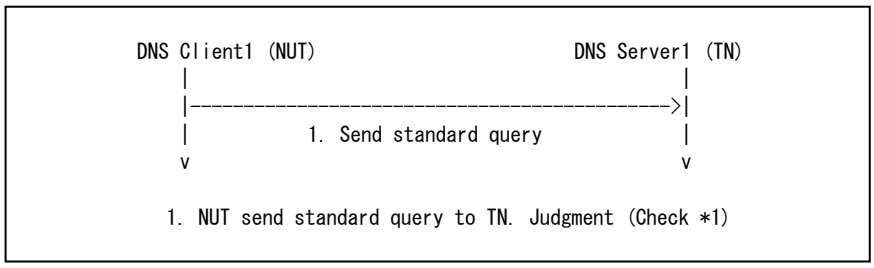
Client

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "mail.example.com".
- **Setup**
  Set the DNS Server1(TN)'s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for MX type of example.com to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*

	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	example.com
	QTYPE	MX (0x000f)
	QCLASS	*any*

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Standard query for MX type must be base on above Verification Points.

References

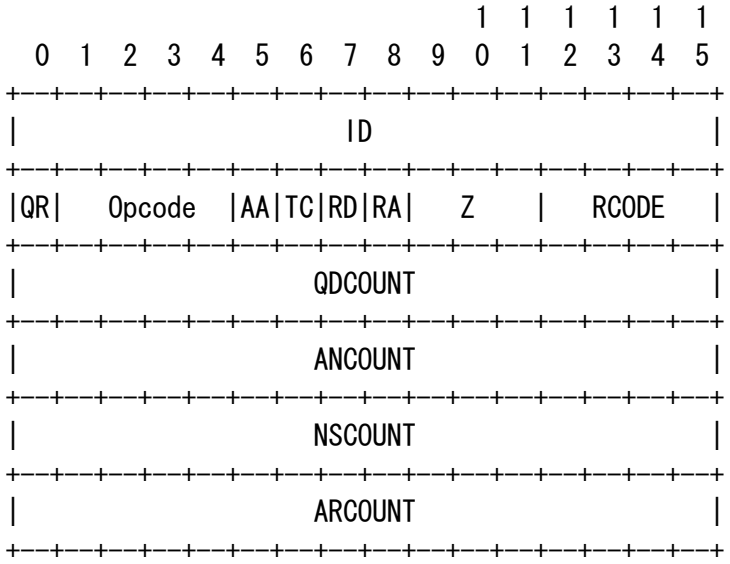
RFC1034 DOMAIN NAMES - CONCEPTS AND FACILITIES
  3.6. Resource Records
RFC1035 DOMAIN NAMES - IMPLEMENTATION AND SPECIFICATION
  3.2.2. TYPE values

5.8.NS type in standard query

Purpose

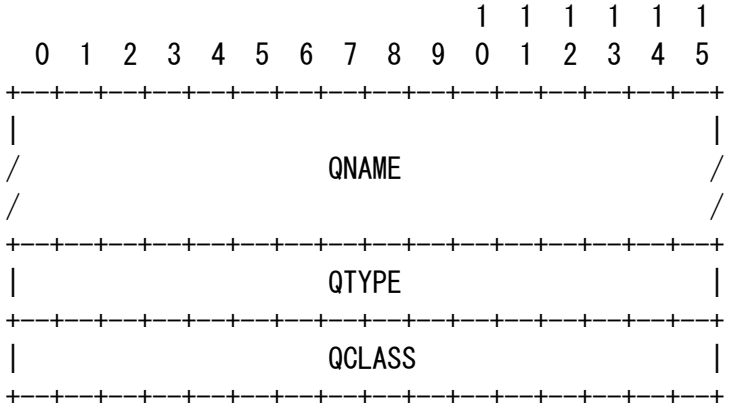
Verify that a NUT transmits correct standard query format for NS type Header section format

- Header section format



QR	**Query (0)**
Opcode	**A standard query(QUERY) (0)**
Z	**Must be zero**
QDCOUNT	**1**
ANCOUNT	**0**
NSCOUNT	**0**
ARCOUNT	**0**

- Question section format



QNAME	**example.com**
QTYPE	**NS type (2)**

- Answer section format
  Must be empty
- Authority section format
  Must be empty
- Additional section format
  Must be empty

Category

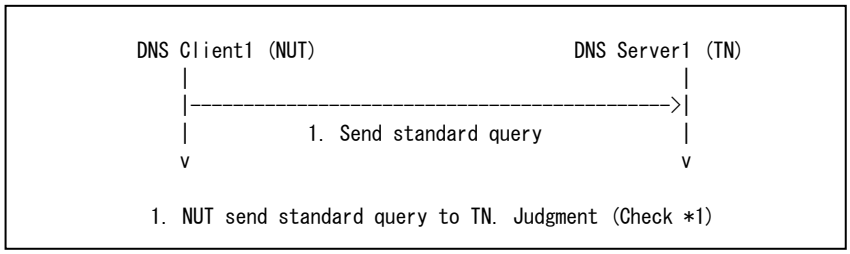
Client

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "ns example.com".
- **Setup**
  Set the DNS Server1(TN)' s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for NS type of example.com to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*

	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	example.com
	QTYPE	NS (0x0002)
	QCLASS	*any*

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Standard query for NS type must be base on above Verification Points.

References

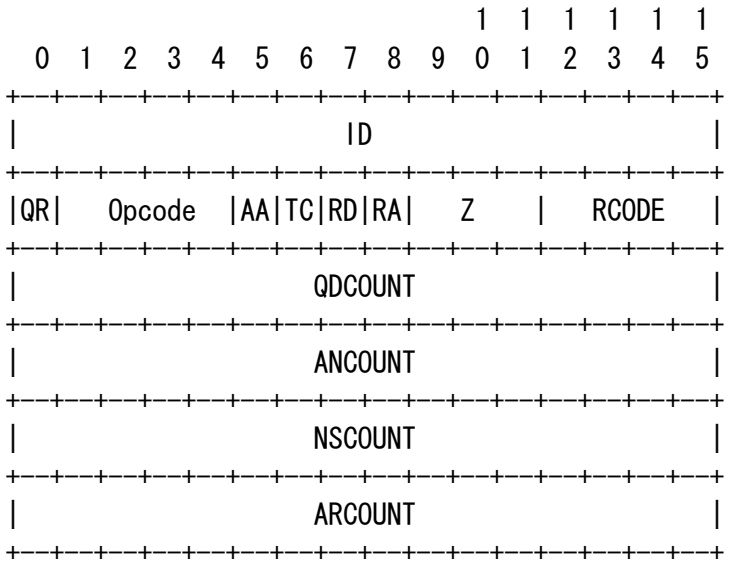
RFC1034 DOMAIN NAMES - CONCEPTS AND FACILITIES
  3.6. Resource Records
RFC1035 DOMAIN NAMES - IMPLEMENTATION AND SPECIFICATION
  3.2.2. TYPE values

5.9.PTR type in standard query (A)

Purpose

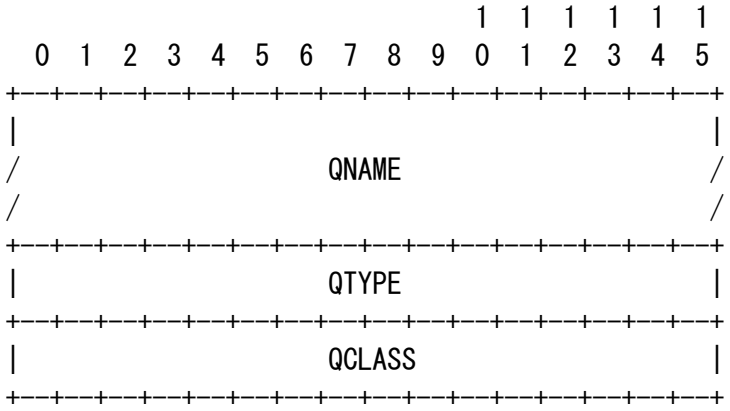
Verify that a NUT transmits correct standard query format for PTR type

- Header section format



QR	Query (0)
Opcode	A standard query(QUERY) (0)
Z	Must be zero
QDCOUNT	1
ANCOUNT	0
NSCOUNT	0
ARCOUNT	0

- Question section format



QNAME	10.1.168.192.in-addr.arpa.
QTYPE	PTR type (12)

- Answer section format
  Must be empty
- Authority section format
  Must be empty
- Additional section format
  Must be empty

Category

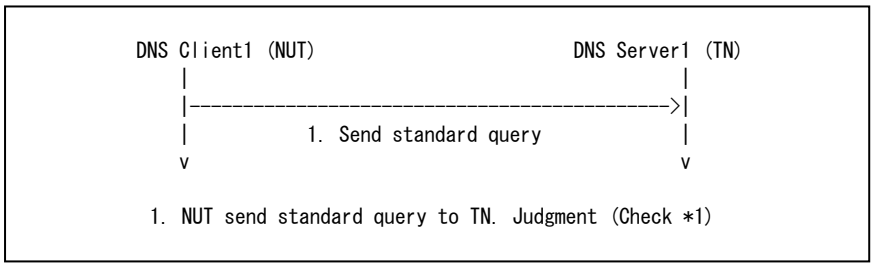
Client

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "A.example.com".
- **Setup**
  Set the DNS Server1(TN)'s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for PTR type of AP Server1(TN):
  A.example.com (A) to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*

	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	10.1.168.192.in-addr.arpa.
	QTYPE	PTR (0x000c)
	QCLASS	*any*

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Standard query for PTR type must be base on above Verification Points.

References

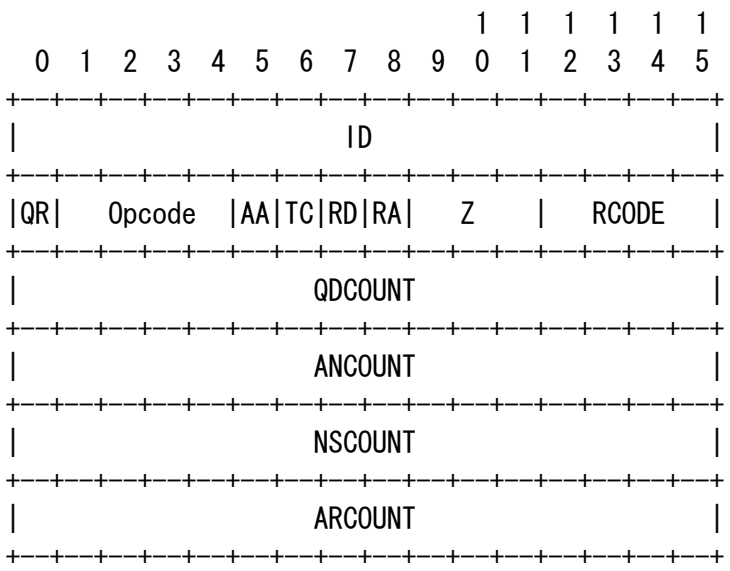
RFC1034 DOMAIN NAMES - CONCEPTS AND FACILITIES
  3.6. Resource Records
RFC1035 DOMAIN NAMES - IMPLEMENTATION AND SPECIFICATION
  3.2.2. TYPE values
  3.5. IN-ADDR.ARPA domain

5.10. PTR type in standard query (AAAA)

Purpose

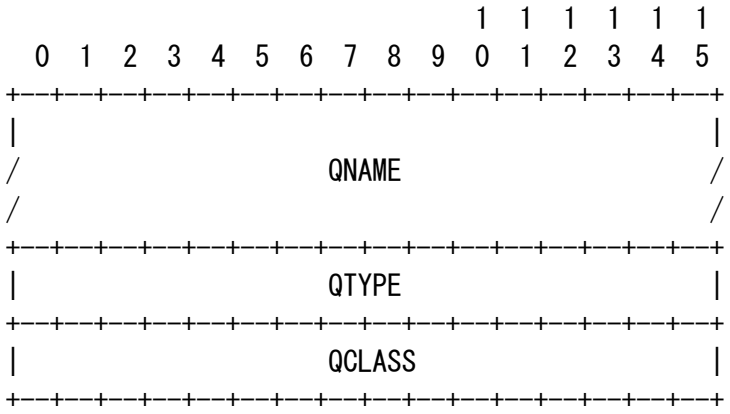
Verify that a NUT transmits correct standard query format for PTR type

- Header section format



QR	Query (0)
Opcode	A standard query(QUERY) (0)
Z	Must be zero
QDCOUNT	1
ANCOUNT	0
NSCOUNT	0
ARCOUNT	0

- Question section format



QNAME	0.1.0.0.0.0.0.0.0.0.0.0.0.0.1.0.1.0.f.f.f.f.1.0.5.0.e.f.f.3.ip6.arpa.
QTYPE	PTR type (12)

- Answer section format
  Must be empty
- Authority section format
  Must be empty
- Additional section format
  Must be empty

Category

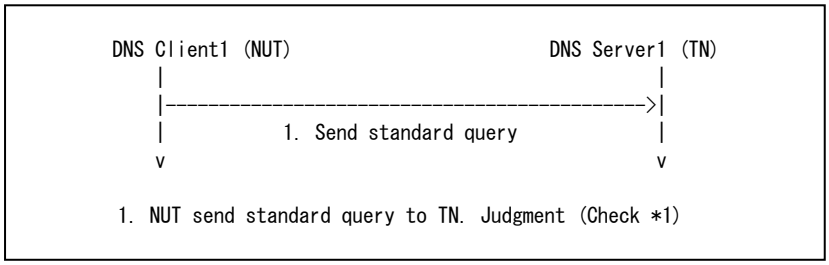
Client

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "A.example.com".
- **Setup**
  Set the DNS Server1(TN)' s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for PTR type of AP Server1(TN):
  A.example.com (AAAA) to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*

	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	0.1.0.0.0.0.0.0.0.0.0.0.0.0.0.0.1.0.1.0.f.f.f.f.1.0.5.0.e.f.f.3.ip6.arpa.
	QTYPE	PTR (0x000c)
	QCLASS	*any*

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Standard query for PTR type must be base on above Verification Points.

References

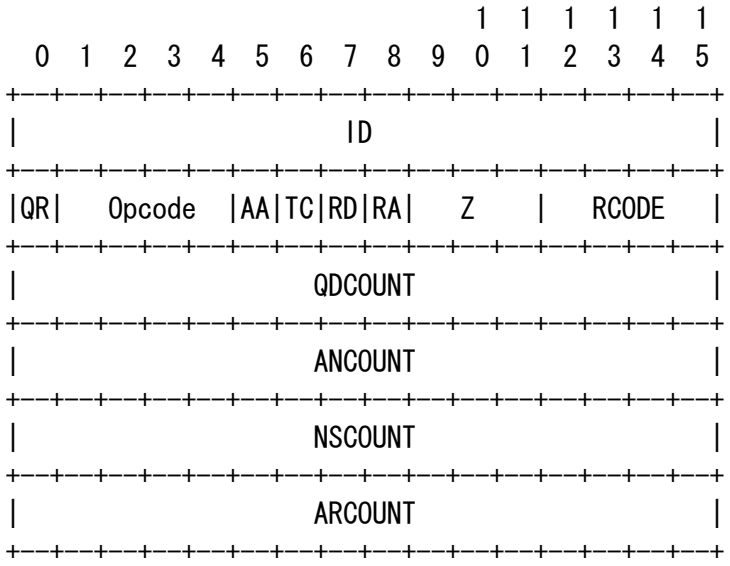
RFC1034 DOMAIN NAMES - CONCEPTS AND FACILITIES
  3.6. Resource Records
RFC1035 DOMAIN NAMES - IMPLEMENTATION AND SPECIFICATION
  3.2.2. TYPE values
RFC3596 DNS Extensions to Support IP Version 6
  2.5 IP6.ARPA Domain

5.11. SOA type in standard query

Purpose

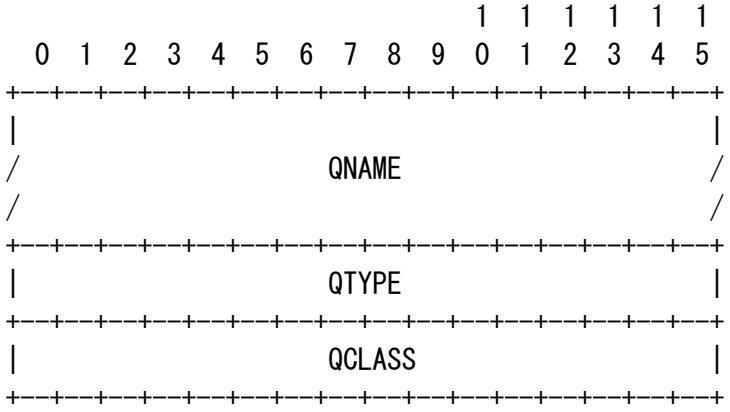
Verify that a NUT transmits correct standard query format for SOA type

- Header section format



QR	Query (0)
Opcode	A standard query(QUERY) (0)
Z	Must be zero
QDCOUNT	1
ANCOUNT	0
NSCOUNT	0
ARCOUNT	0

- Question section format



QNAME	example.com
QTYPE	SOA type (6)

- Answer section format
  Must be empty
- Authority section format
  Must be empty
- Additional section format
  Must be empty

Category

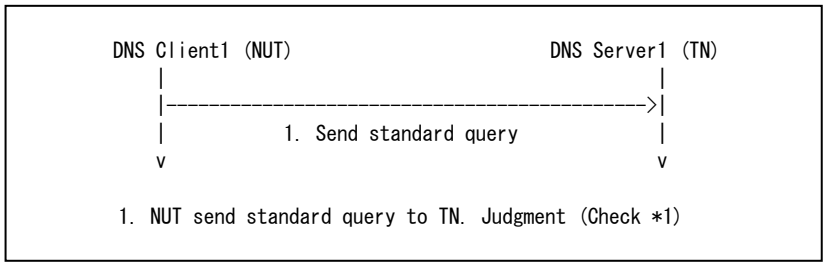
Client

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "A.example.com".
- **Setup**
  Set the DNS Server1(TN)'s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for SOA type of example.com to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*

	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	example.com
	QTYPE	SOA (0x0006)
	QCLASS	*any*

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Standard query for SOA type must be base on above Verification Points.

References

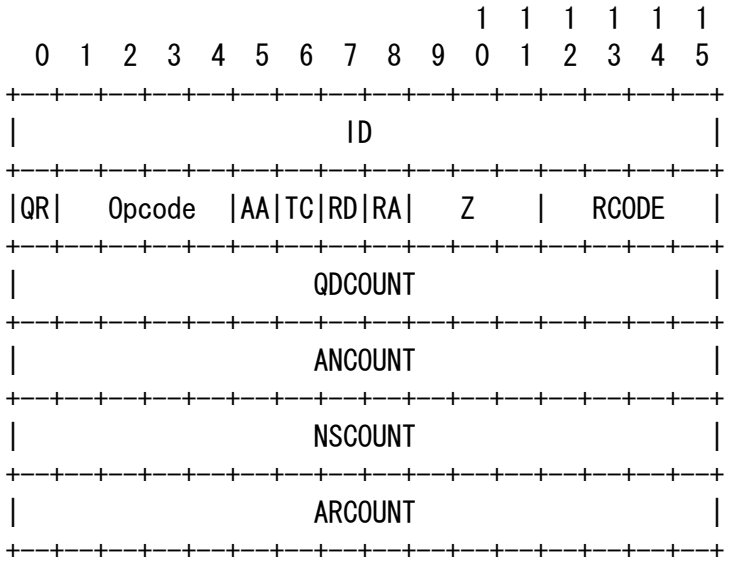
RFC1034 DOMAIN NAMES - CONCEPTS AND FACILITIES
3.6. Resource Records
RFC1035 DOMAIN NAMES - IMPLEMENTATION AND SPECIFICATION
3.2.2. TYPE values

5.12. IN class in standard query

Purpose

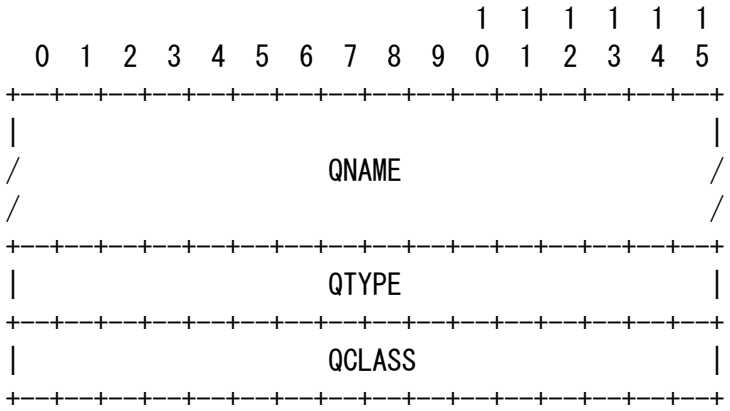
Verify that a NUT transmits correct standard query format for IN class

- Header section format



QR	Query (0)
Opcode	A standard query(QUERY) (0)
Z	Must be zero
QDCOUNT	1
ANCOUNT	0
NSCOUNT	0
ARCOUNT	0

- Question section format



QNAME	A.example.com
QCLASS	IN class (1)

- Answer section format
  Must be empty
- Authority section format
  Must be empty
- Additional section format
  Must be empty

Category

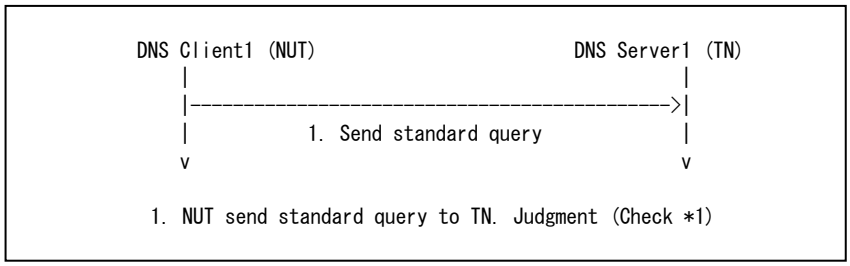
Client

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "A.example.com".
- **Setup**
  Set the DNS Server1(TN)'s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for IN class of AP Server1(TN): A.example.com to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*

	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	A.example.com
	QTYPE	*any*
	QCLASS	IN (0x0001)

- Termination
  If NUT has cache function, clear the cache.

Judgment

1. Standard query for IN class must be base on above Verification Points.

References

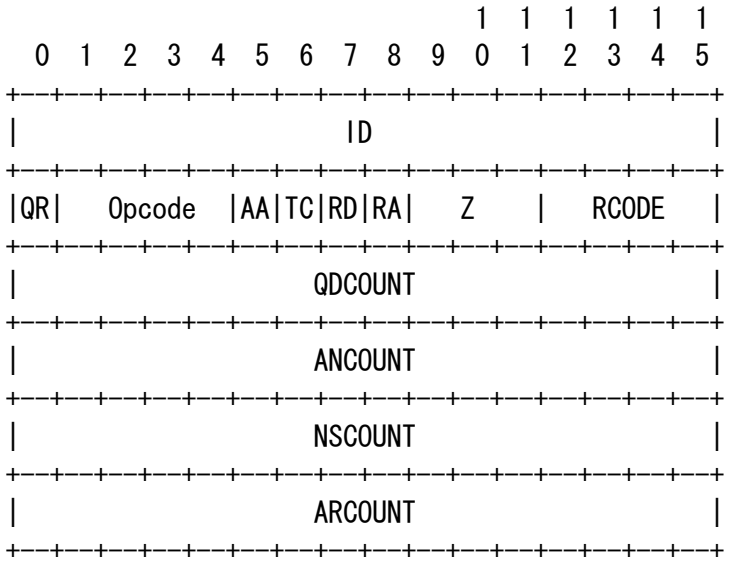
RFC1034 DOMAIN NAMES - CONCEPTS AND FACILITIES
  3.6. Resource Records
RFC1035 DOMAIN NAMES - IMPLEMENTATION AND SPECIFICATION
  3.2.4. CLASS values

5.13. CH class in standard query

Purpose

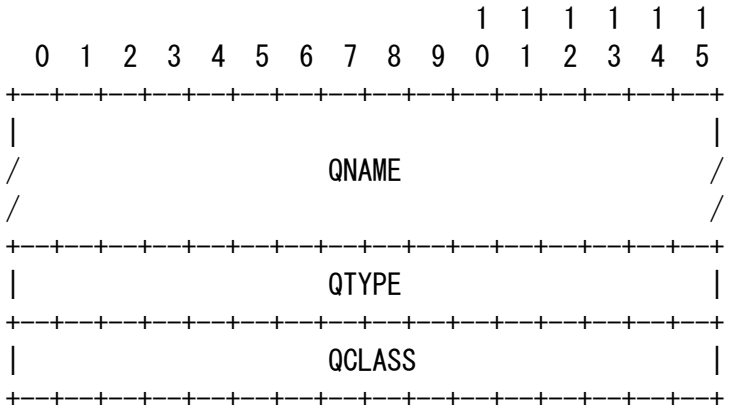
Verify that a NUT transmits correct standard query format for CH class

- Header section format



QR	Query (0)
Opcode	A standard query(QUERY) (0)
Z	Must be zero
QDCOUNT	1
ANCOUNT	0
NSCOUNT	0
ARCOUNT	0

- Question section format



QNAME	A.example.com
QCLASS	CH class (3)

- Answer section format
  Must be empty
- Authority section format
  Must be empty
- Additional section format
  Must be empty

Category

Client

Initialization

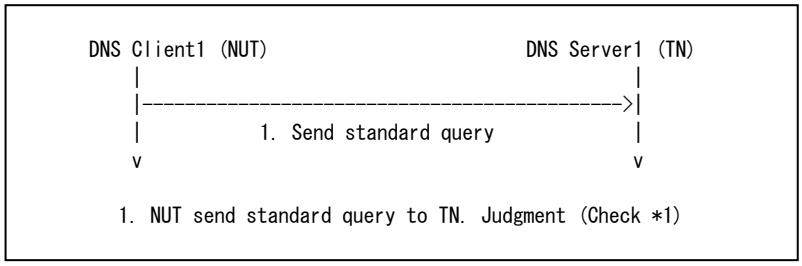
- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "A.example.com".

- **Setup**
  Set the DNS Server1(TN)'s address on NUT as above mentioned Network Topology.

- **Pre-Sequence**
  In order to send the query for CH class of AP Server1(TN):
  A.example.com to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0

	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	A.example.com
	QTYPE	*any*
	QCLASS	CH (0x0003)

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Standard query for CH class must be base on above Verification Points.

References

RFC1034 DOMAIN NAMES - CONCEPTS AND FACILITIES
3.6. Resource Records
RFC1035 DOMAIN NAMES - IMPLEMENTATION AND SPECIFICATION
3.2.4. CLASS values

5.14. Zero TTL prohibits caching

Purpose

Verify that a NUT prohibits caching with zero TTL

- While short TTLs can be used to minimize caching, and a zero TTL prohibits caching, the realities of Internet performance suggest that these times should be on the order of days for the typical host.
- All DNS name servers and resolvers MUST properly handle RRs with a zero TTL: return the RR to the client but do not cache it.

Category

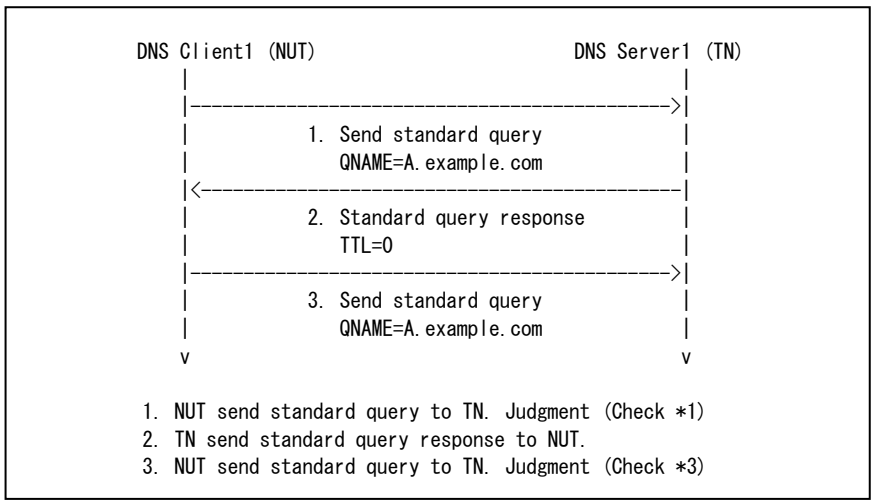
Client (with Caching function)

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "A.example.com".
- **Setup**
  Set the DNS Server1(TN)' s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for A type(IN class) of AP Server1 (TN): A.example.com to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1st Packet

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)

2nd packet.

2. Standard query response from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Same as 1st Packet's Src Port
DNS Header	ID	Same as 1st Packet's ID
	QR	1
	OPCODE	0
	AA	1
	TC	0
	RD	Same as 1st Packet's RD
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	1
	NSCOUNT	1
	ARCOUNT	1

DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)
DNS Answer section	NAME	A.example.com (Pointer 0xC00C)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	0
	RDLENGTH	4
	ADDRESS	192.168.1.10
DNS Authority section	NAME	example.com (Pointer 0xC00E)
	TYPE	NS (0x0002)
	CLASS	IN (0x0001)
	TTL	0
	RDLENGTH	6
	NSDNAME	NS1.example.com (NS1 + Pointer 0xC00E)
DNS Additional section	NAME	NS1.example.com (Pointer 0xC03B)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	0
	RDLENGTH	4
	ADDRESS	192.168.1.20

3rd Packet

3. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)

	QCLASS	IN (0x0001)

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Received standard query QNAME=A.example.com from NUT.
3. Received standard query QNAME=A.example.com from NUT.

References

RFC1034 DOMAIN NAMES - CONCEPTS AND FACILITIES
  3.6. Resource Records
RFC1123 Requirements for Internet Hosts -- Application and Support
  6.1.2.1 Resource Records with Zero TTL: RFC-1035 Section 3.2.1

5.15. Carried in TCP

Purpose

Verify that a NUT transmits messages in TCP

- In the Internet, queries are carried in UDP datagrams or over TCP connections
- DNS resolvers and recursive servers MUST support UDP, and SHOULD support TCP, for sending (non-zone-transfer) queries. Specifically, a DNS resolver or server that is sending a non-zone-transfer query MUST send a UDP query first. If the Answer section of the response is truncated and if the requester supports TCP, it SHOULD try the query again using TCP.
- The Internet supports name server access using TCP [RFC-793] on server port 53 (decimal).
- Messages sent over TCP connections use server port 53 (decimal).The message is prefixed with a two byte length field which gives the message length, excluding the two byte length field.
- If the Answer section of the response is truncated and if the requester supports TCP, it SHOULD try the query again using TCP.

Category

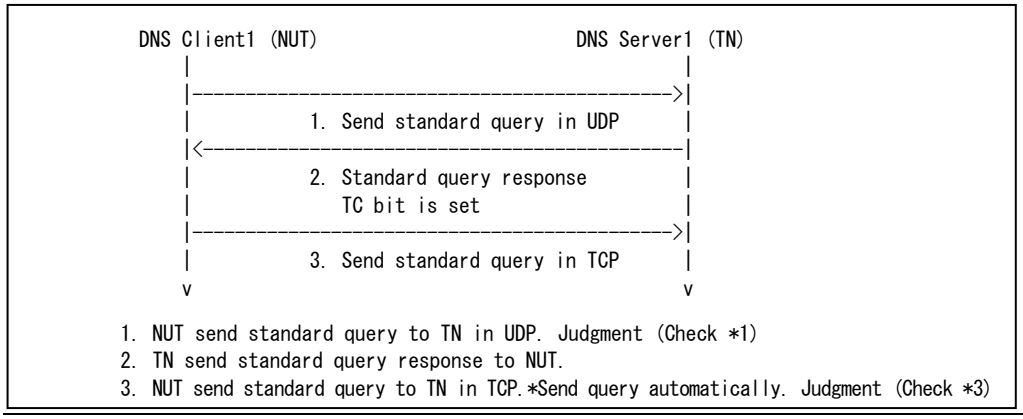
Client

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "A.example.com".
- **Setup**
  Set the DNS Server1(TN)'s address to NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for A type of AP Server1(TN):
  A.example.com to the DNS Server1(TN) in TCP, NUT is configured.

Procedure

This test sequence is following.



1. NUT send standard query to TN in UDP. Judgment (Check *1)
2. TN send standard query response to NUT.
3. NUT send standard query to TN in TCP.*Send query automatically. Judgment (Check *3)

Packet Description

1st Packet

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN) in UDP		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	*any*

2nd packet.

2. Standard query response from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Same as 1st Packet's Src Port
DNS Header	ID	Same as 1st Packet's ID
	QR	1
	OPCODE	0
	AA	1
	TC	1
	RD	Same as 1st Packet's RD
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	30
	NSCOUNT	0
	ARCOUNT	0

DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)
DNS Answer section	NAME	A.example.com (Pointer 0xC00C)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	4
	ADDRESS	192.168.1.100
DNS Answer section X 28 ADDRESS 192.168.1.101 - 192.168.1.128	NAME	A.example.com (Pointer 0xC00C)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	4
	ADDRESS	****
DNS Answer section	NAME	A.example.com (Pointer 0xC00C)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	4
	ADDRESS	192.168.1.129

1st session

3. Standard query from DNS Client1 (NUT) to DNS Server1 (TN) in TCP		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
TCP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)

	QCLASS	*any*

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Received standard query from NUT in UDP.
3. Received standard query from NUT in TCP.

References

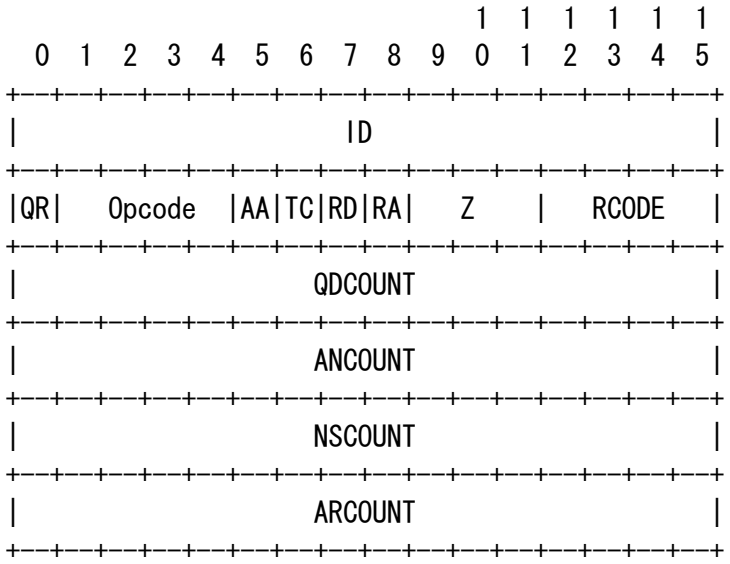
RFC1034 DOMAIN NAMES - CONCEPTS AND FACILITIES
  3.7. Queries
  4.2. Transport
RFC1035 DOMAIN NAMES - IMPLEMENTATION AND SPECIFICATION
  4.2. Transport
  4.2.2. TCP usage
RFC1123 Requirements for internet Hosts -- Application and Support
  6.1.3.2 Transport Protocols

5.16. Standard message format

Purpose

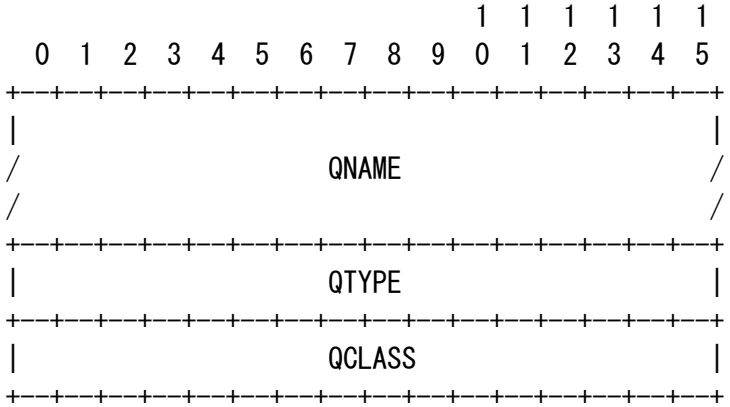
Verify that a NUT transmits correct standard message format

- Header section format



QR	**Query (0)**
Opcode	**A standard query(QUERY) (0)**
Z	**Must be zero**
QDCOUNT	**1**
ANCOUNT	**0**
NSCOUNT	**0**
ARCOUNT	**0**

- Question section format



QNAME	A.example.com
QTYPE	A type (1)
QCLASS	IN class (1)

- Answer section format
  Must be empty
- Authority section format
  Must be empty
- Additional section format
  Must be empty

Category

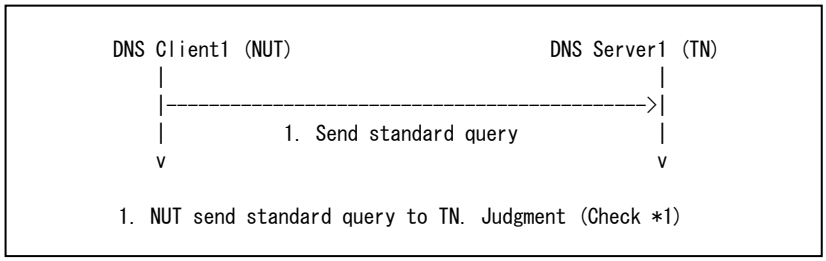
Client

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "A.example.com".
- **Setup**
  Set the DNS Server1(TN)' s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for A type(IN class) of AP Server1(TN): A.example.com to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0

	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Standard query must be base on above Verification Points.

References

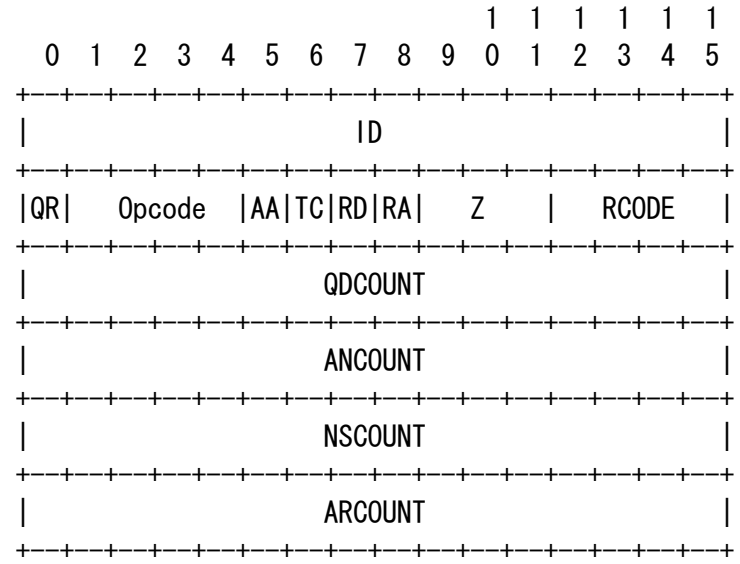
RFC1034 DOMAIN NAMES - CONCEPTS AND FACILITIES
3.7. Queries
RFC1035 DOMAIN NAMES - IMPLEMENTATION AND SPECIFICATION
4.1. Format

5.17. Opcode (standard query)

Purpose

Verify that a NUT transmits correct Opcode in standard query

- Header section format



Opcode	**A standard query (QUERY) (0)**

Category

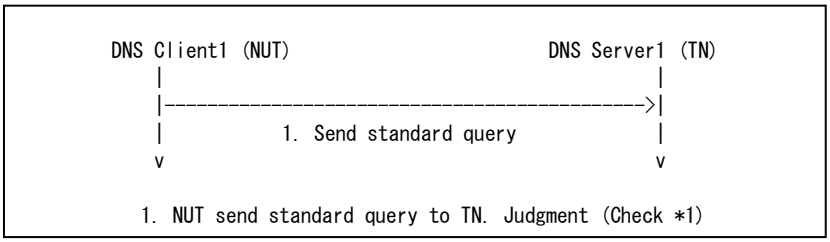
Client

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "A.example.com".
- **Setup**
  Set the DNS Server1(TN)' s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the standard query for AP Server1(TN): A.example.com to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	*any*
	OPCODE	0
	AA	*any*
	TC	*any*
	RD	*any*
	RA	*any*
	Z	*any*
	RCODE	*any*
	QDCOUNT	*any*
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	*any*
	QTYPE	*any*
	QCLASS	*any*

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Standard query must be base on above Verification Points.

References

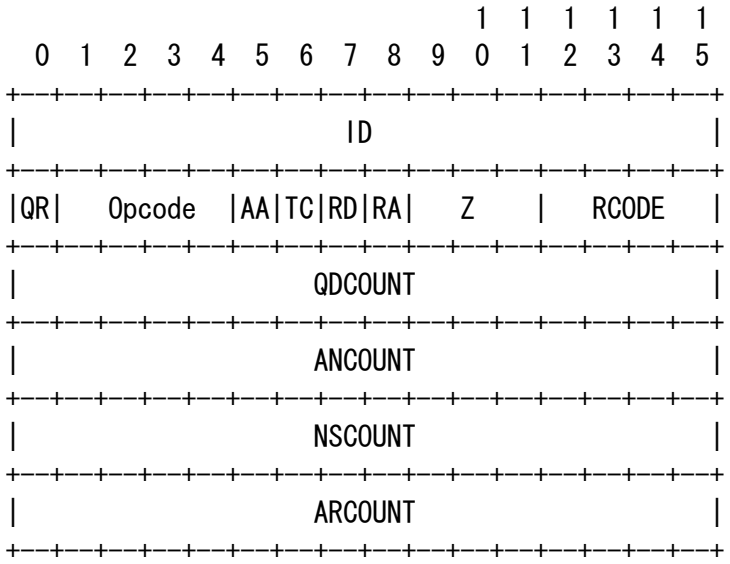
RFC1034 DOMAIN NAMES - CONCEPTS AND FACILITIES
  3.7. Queries
RFC1035 DOMAIN NAMES - IMPLEMENTATION AND SPECIFICATION
  4.1.1. Header section format

5.18. Opcode (status query)

Purpose

Verify that a NUT transmits correct Opcode in status query

- Header section format



Opcode	**a server status request(STATUS) (2)**

Category

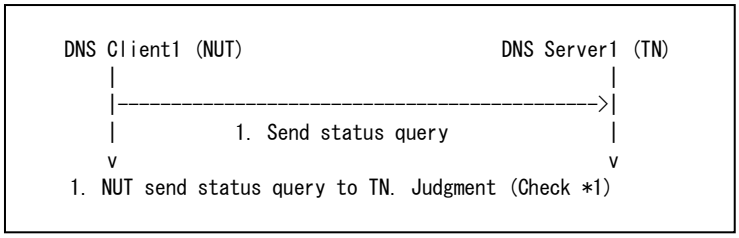
Client

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "A.example.com".
- **Setup**
  Set the DNS Server1(TN)' s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the status query to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	*any*
	OPCODE	2
	AA	*any*
	TC	*any*
	RD	*any*
	RA	*any*
	Z	*any*
	RCODE	*any*
	QDCOUNT	*any*
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	*any*
	QTYPE	*any*
	QCLASS	*any*

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Standard query must be base on above Verification Points.

References

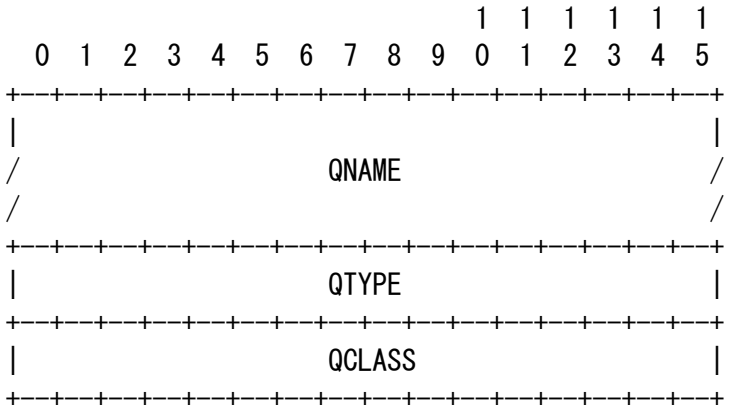
RFC1034 DOMAIN NAMES - CONCEPTS AND FACILITIES
  3.7. Queries
RFC1035 DOMAIN NAMES - IMPLEMENTATION AND SPECIFICATION
  4.1.1. Header section format

5.19. Question section format

Purpose

Verify that a NUT transmits correct question section format

- Question section format



QNAME	A.example.com
QTYPE	A type (1)
QCLASS	IN class (1)

Category

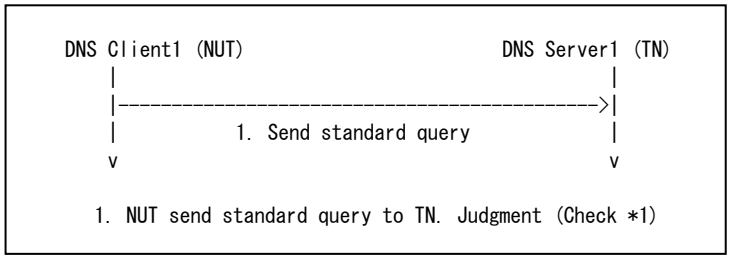
Client

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "A.example.com".
- **Setup**
  Set the DNS Server1(TN)' s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for A type(IN class) of AP Server1 (TN): A.example.com to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	*any*
	OPCODE	*any*
	AA	*any*
	TC	*any*
	RD	*any*
	RA	*any*
	Z	*any*
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	*any*
	NSCOUNT	*any*
	ARCOUNT	*any*
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Standard query must be base on above Verification Points.

References

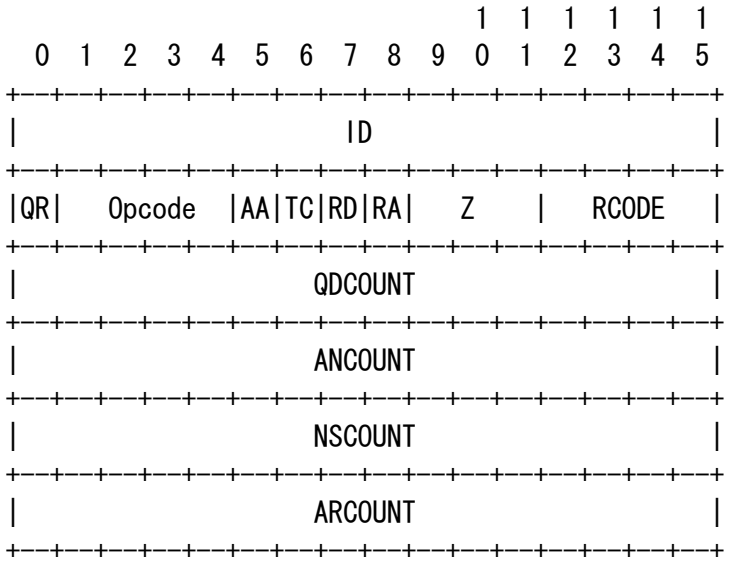
RFC1034 DOMAIN NAMES - CONCEPTS AND FACILITIES
  3.7.1. Standard queries
RFC1035 DOMAIN NAMES - IMPLEMENTATION AND SPECIFICATION
  4.1. Format
  4.1.2. Question section format

5.20. AXFR qtype in standard query

Purpose

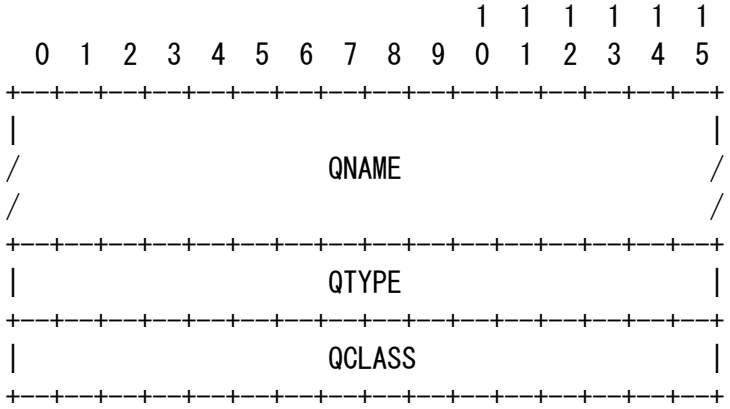
Verify that a NUT transmits correct standard query format for AXFR qtype

- Header section format



QR	**Query (0)**
Opcode	**A standard query(QUERY) (0)**
Z	**Must be zero**
QDCOUNT	**1**
ANCOUNT	**0**
NSCOUNT	**0**
ARCOUNT	**0**

- Question section format



QNAME	**example.com**
QTYPE	**AXFR qtype (252)**

- Answer section format
  Must be empty
- Authority section format
  Must be empty
- Additional section format
  Must be empty

Category

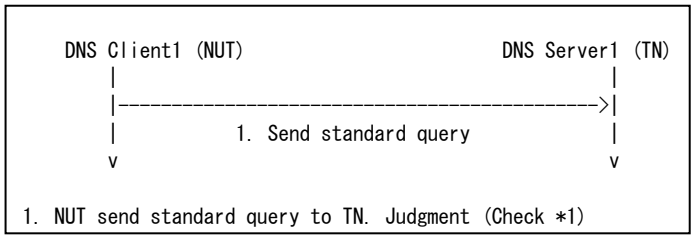
Client

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
- **Setup**
  Set the DNS Server1(TN)' s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for AXFR qtype of example.com to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
TCP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any

	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	example.com
	QTYPE	AXFR (0x00fc)
	QCLASS	*any*

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Standard query for AXFR qtype must be base on above Verification Points.

References

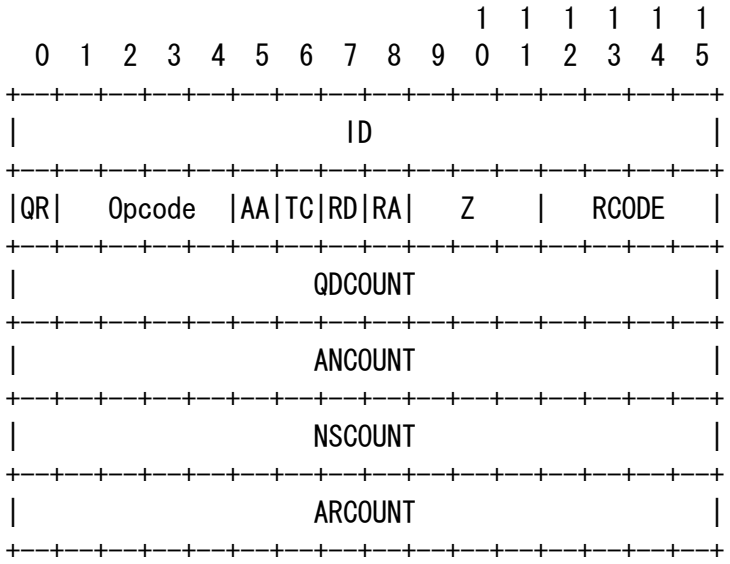
RFC1034 DOMAIN NAMES - CONCEPTS AND FACILITIES
  3.7.1. Standard queries
RFC1035 DOMAIN NAMES - IMPLEMENTATION AND SPECIFICATION
  3.2.3. QTYPE values

5.21. * qtype in standard query

Purpose

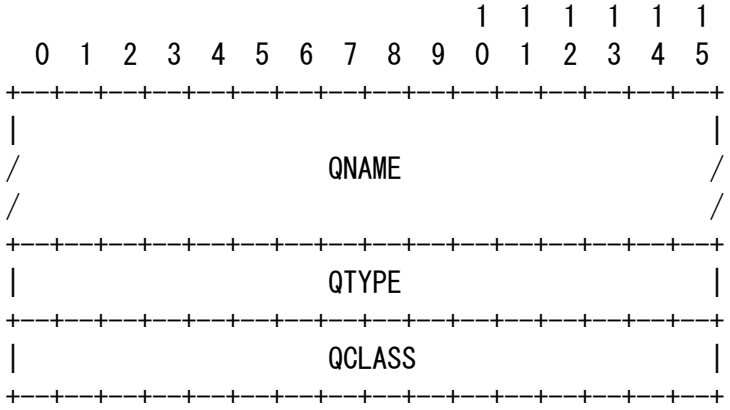
Verify that a NUT transmits correct standard query format for * qtype

- Header section format



QR	**Query (0)**
Opcode	**A standard query(QUERY) (0)**
Z	**Must be zero**
QDCOUNT	**1**
ANCOUNT	**0**
NSCOUNT	**0**
ARCOUNT	**0**

- Question section format



QNAME	**A.example.com**
QTYPE	*** qtype (255)**

- Answer section format
  Must be empty
- Authority section format
  Must be empty
- Additional section format
  Must be empty

Category

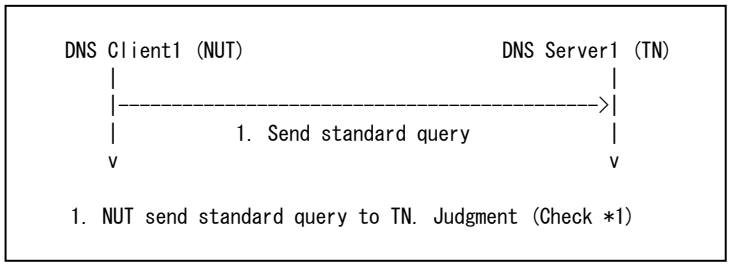
Client

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "A.example.com".
- **Setup**
  Set the DNS Server1(TN)'s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for * qtype of AP Server1(TN):
  A.example.com to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*

	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	A.example.com
	QTYPE	* (0x00ff)
	QCLASS	*any*

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Standard query for A type must be base on above Verification Points.

References

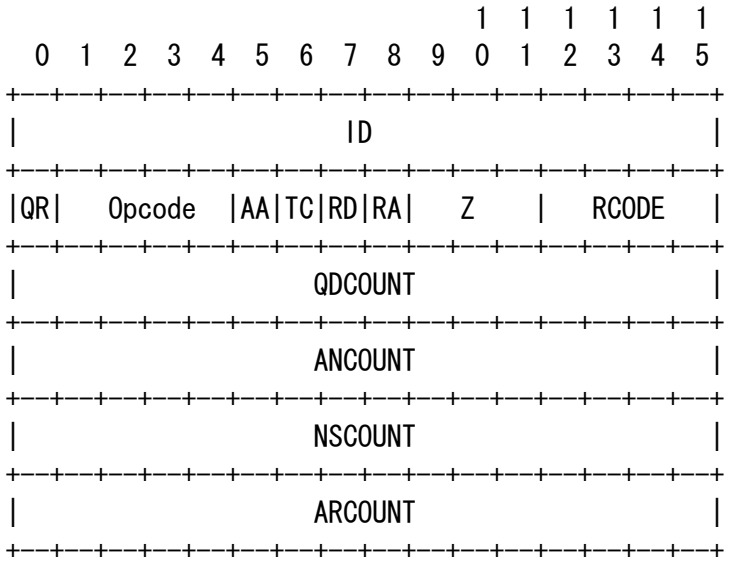
RFC1034 DOMAIN NAMES - CONCEPTS AND FACILITIES
  3.7.1. Standard queries
RFC1035 DOMAIN NAMES - IMPLEMENTATION AND SPECIFICATION
  3.2.3. QTYPE values

5.22. * qclass in standard query

Purpose

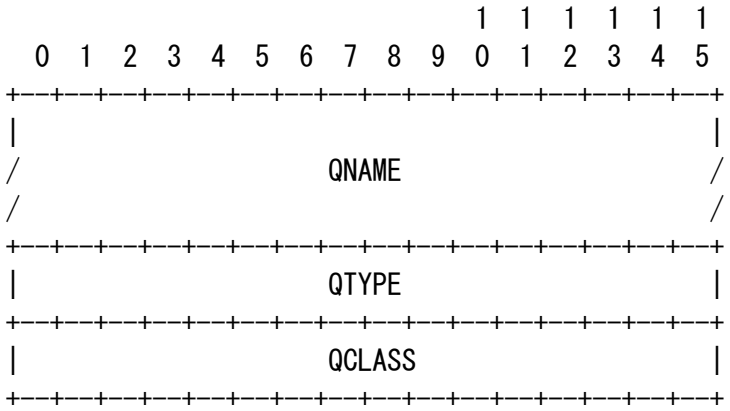
Verify that a NUT transmits correct standard query format for * qclass

- Header section format



QR	**Query (0)**
Opcode	**A standard query(QUERY) (0)**
Z	**Must be zero**
QDCOUNT	**1**
ANCOUNT	**0**
NSCOUNT	**0**
ARCOUNT	**0**

- Question section format



QNAME	**A.example.com**
QCLASS	*** qclass (255)**

- Answer section format
  Must be empty
- Authority section format
  Must be empty
- Additional section format
  Must be empty

Category

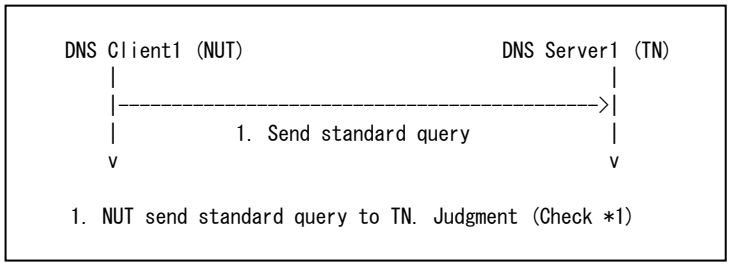
Client

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "A.example.com".
- **Setup**
  Set the DNS Server1(TN)' s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for * class of AP Server1(TN):
  A.example.com to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*

	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	A.example.com
	QTYPE	*any*
	QCLASS	* (0x00ff)

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Standard query for * qclass must be base on above Verification Points.

References

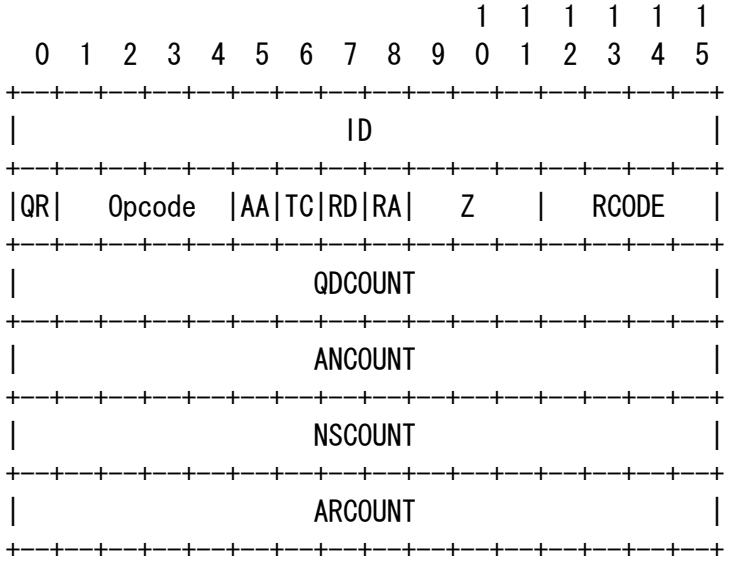
RFC1034 DOMAIN NAMES - CONCEPTS AND FACILITIES
  3.7.1. Standard queries
RFC1035 DOMAIN NAMES - IMPLEMENTATION AND SPECIFICATION
  3.2.5. QCLASS values

5.23. Recursion desired (RD) in standard query

Purpose

Verify that a NUT transmits correct standard query format for Recursion desired(RD)

- Header section format



QR	Query (0)
Opcode	A standard query(QUERY) (0)
RD	1
Z	Must be zero
QDCOUNT	1
ANCOUNT	0
NSCOUNT	0
ARCOUNT	0

Category

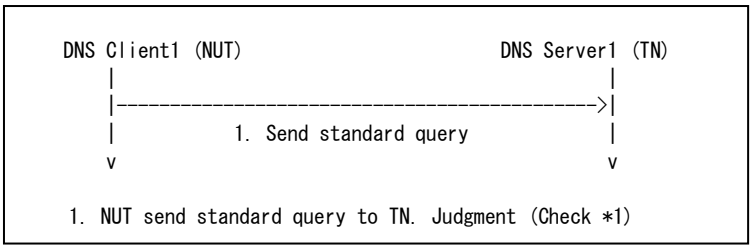
Client

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "A.example.com".
- **Setup**
  Set the DNS Server1(TN)' s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the recursive query to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



1. NUT send standard query to TN. Judgment (Check *1)

Packet Description

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	1
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	*any*
	QTYPE	*any*
	QCLASS	*any*

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Standard query for recursion desired must be base on above Verification Points.

References

RFC1034 DOMAIN NAMES - CONCEPTS AND FACILITIES
  4.3.1. Queries and responses
RFC1035 DOMAIN NAMES - IMPLEMENTATION AND SPECIFICATION
  4.1.1. Header section format

5.24. Caching wildcards response

Purpose

Verify that a NUT prohibits caching wildcards response

- A * label appearing in a query name has no special effect, but can be used to test for wildcards in an authoritative zone; such a query is the only way to get a response containing RRs with an owner name with * in it. The result of such a query should not be cached.

Category

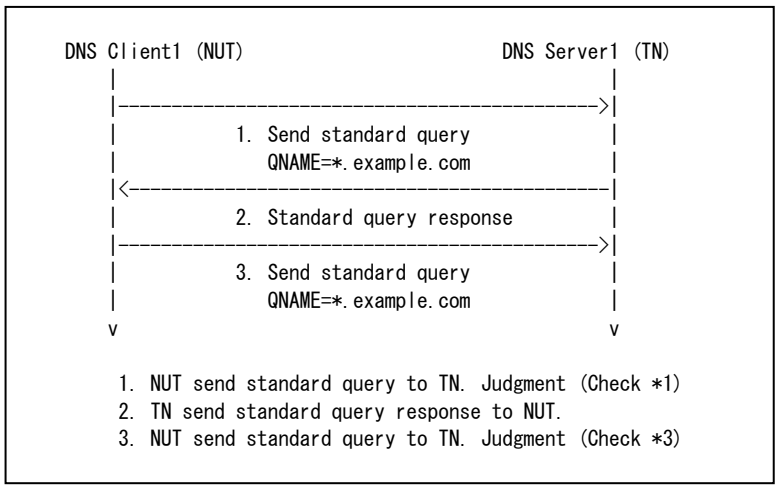
Client (with Caching function)

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "mail.example.com".
- **Setup**
  Set the DNS Server1(TN)' s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for A type(IN class) of *.example.com to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1st Packet

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	*.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)

2nd packet.

2. Standard query response from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Same as 1st Packet's Src Port
DNS Header	ID	Same as 1st Packet's ID
	QR	1
	OPCODE	0
	AA	1
	TC	0
	RD	Same as 1st Packet's RD
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	1
	NSCOUNT	1
	ARCOUNT	1

DNS Question section	QNAME	*.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)
DNS Answer section	NAME	*.example.com (Pointer 0xC00C)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	4
	ADDRESS	192.168.1.10
DNS Authority section	NAME	example.com (Pointer 0xC00E)
	TYPE	NS (0x0002)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	6
	NSDNAME	NS1.example.com (NS1 + Pointer 0xC00E)
DNS Additional section	NAME	NS1.example.com (Pointer 0xC03B)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	4
	ADDRESS	192.168.1.20

3rd Packet

3. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	*.example.com
	QTYPE	A (0x0001)

	QCLASS	IN (0x0001)

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Received standard query QNAME=*.example.com from NUT.
3. Received standard query QNAME=*.example.com from NUT.

References

RFC1034 DOMAIN NAMES - CONCEPTS AND FACILITIES
4.3.3. Wildcards
RFC1035 DOMAIN NAMES - IMPLEMENTATION AND SPECIFICATION
7.4. Using the cache

5.25. Returning of answer

Purpose

Verify that a NUT uses the returned RR

- When the resolver performs the indicated function, it usually has one of the following results to pass back to the client:
  - ✧ One or more RRs giving the requested data

Category

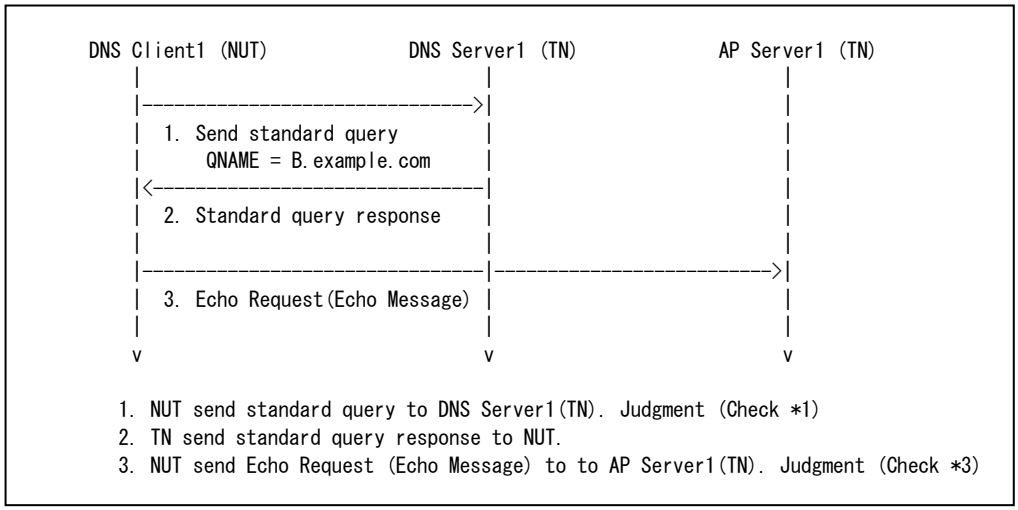
Client

Initialization

- **Network Topology**
  Refer the topology "Fig. 3 Topology No.3".
  AP server1 has a domain name "B.example.com".
- **Setup**
  Set the DNS Server1(TN)'s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for A type(IN class) of AP Server1 (TN):B.example.com to the DNS Server1(TN), NUT send Echo Request(Echo Message) to AP Server1(TN):B.example.com.

Procedure

This test sequence is following.



Packet Description

1st Packet

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	B.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)

2nd packet.

2. Standard query response from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Same as 1st Packet's Src Port
DNS Header	ID	Same as 1st Packet's ID
	QR	1
	OPCODE	0
	AA	1
	TC	0
	RD	Same as 1st Packet's RD
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	1
	NSCOUNT	0
	ARCOUNT	0

DNS Question section	QNAME	B.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)
DNS Answer section	NAME	B.example.com (Pointer 0xC00C)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	4
	ADDRESS	192.168.1.60

3rd Packet

3. Standard Echo Request(Echo Message) from DNS Client1 (NUT) to AP Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	AP1_NETY
ICMP	Type	8(Echo Message for IPv4)/128(Echo Request for IPv6)

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Received standard query QNAME=B.example.com from NUT.
3. Received Echo Request(Echo Message) from NUT.

References

RFC1035 DOMAIN NAMES - CONCEPTS AND FACILITIES
5.2.1. Typical functions

5.26. Returning of name error (NXDOMAIN)

Purpose

Verify that a NUT correctly treats the name error (NXDOMAIN)

- When the resolver performs the indicated function, it usually has one of the following results to pass back to the client:
  ✧ A name error (NXDOMAIN)

Category

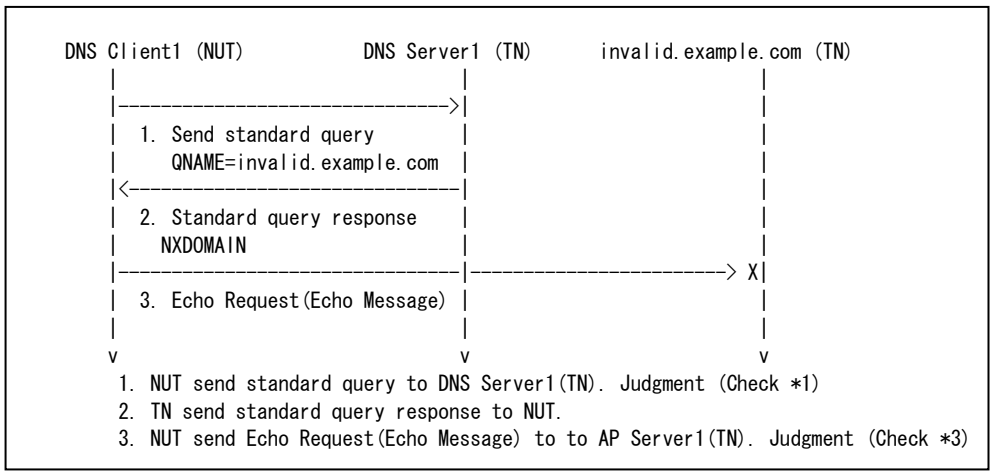
Client

Initialization

- **Network Topology**
  Refer the topology "Fig. 3 Topology No.3".
  AP server1 has a domain name "invalid.example.com".
- **Setup**
  Set the DNS Server1(TN)' s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for A type(IN class) of invalid.example.com to the DNS Server1(TN), NUT send Echo Request(Echo Message) to invalid.example.com.

Procedure

This test sequence is following.



Packet Description

1st Packet

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ

	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	invalid.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)

2nd packet.

2. Standard query response from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Same as 1st Packet's Src Port
DNS Header	ID	Same as 1st Packet's ID
	QR	1
	OPCODE	0
	AA	1
	TC	0
	RD	Same as 1st Packet's RD
	RA	0
	Z	0
	RCODE	3
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	1
	ARCOUNT	0
DNS Question section	QNAME	invalid.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)
DNS Authority	NAME	example.com (Pointer 0xC014)

section	TYPE	SOA (0x0006)
	CLASS	IN (0x0001)
	TTL	1 hour
	RDLENGTH	33
	MNAME	NS1.example.com (NS1 + Pointer 0xC014)
	RNAME	root.example.com (root + Pointer 0xC014)
	SERIAL	2005080300
	REFRESH	1 hour
	RETRY	15 minutes
	EXPIRE	1 week
	MINIMUM	1 hour

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Received standard query QNAME=invalid.example.com from NUT.
3. Not received Echo Request(Echo Message) from NUT.

References

RFC1035 DOMAIN NAMES - CONCEPTS AND FACILITIES
5.2.1. Typical functions

5.27. Returning of data not found error (NODATA)

Purpose

Verify that a NUT correctly treats the data not found error (NODATA)

- When the resolver performs the indicated function, it usually has one of the following results to pass back to the client:
  - ✧ A data not found error (NODATA)

Category

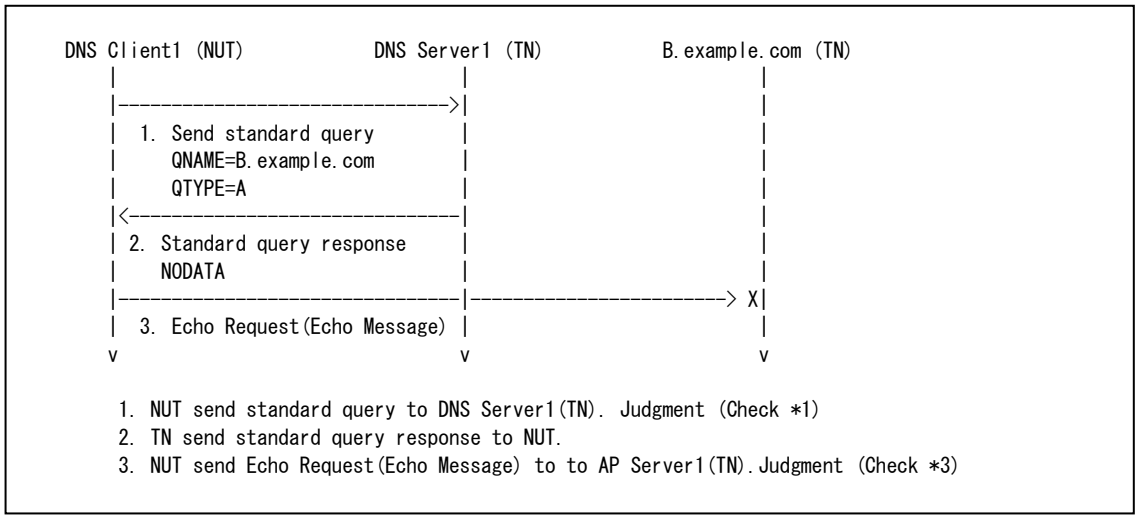
Client

Initialization

- **Network Topology**
  Refer the topology "Fig. 3 Topology No.3".
  AP server1 has a domain name "B.example.com".
- **Setup**
  Set the DNS Server1(TN)' s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for A type(IN class) of B.example.com to the DNS Server1(TN), NUT send Echo Request(Echo Message) to invalid.example.com.

Procedure

This test sequence is following.



1. NUT send standard query to DNS Server1(TN). Judgment (Check *1)
2. TN send standard query response to NUT.
3. NUT send Echo Request(Echo Message) to to AP Server1(TN).Judgment (Check *3)

Packet Description

1st Packet

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ

	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	B.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)

2nd packet.

2. Standard query response from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Same as 1st Packet's Src Port
DNS Header	ID	Same as 1st Packet's ID
	QR	1
	OPCODE	0
	AA	1
	TC	0
	RD	Same as 1st Packet's RD
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	1
	ARCOUNT	0
DNS Question section	QNAME	B.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)
DNS Authority	NAME	example.com (Pointer 0xC00E)

section	TYPE	SOA (0x0006)
	CLASS	IN (0x0001)
	TTL	1 hour
	RDLENGTH	33
	MNAME	NS1.example.com (NS1 + Pointer 0xC00E)
	RNAME	root.example.com (root + Pointer 0xC00E)
	SERIAL	2005080300
	REFRESH	1 hour
	RETRY	15 minutes
	EXPIRE	1 week
	MINIMUM	1 hour

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Received standard query QNAME=B.example.com from NUT.
3. Not received Echo Request(Echo Message) from NUT.

References

RFC1035 DOMAIN NAMES - CONCEPTS AND FACILITIES
5.2.1. Typical functions

5.28. Encounters a CNAME

Purpose

Verify that a NUT restarts the query when it encounters a CNAME

- In most cases a resolver simply restarts the query at the new name when it encounters a CNAME.
- If the response contains a CNAME, the search is restarted at the CNAME unless the response has the data for the canonical name or if the CNAME is the answer itself.

Category

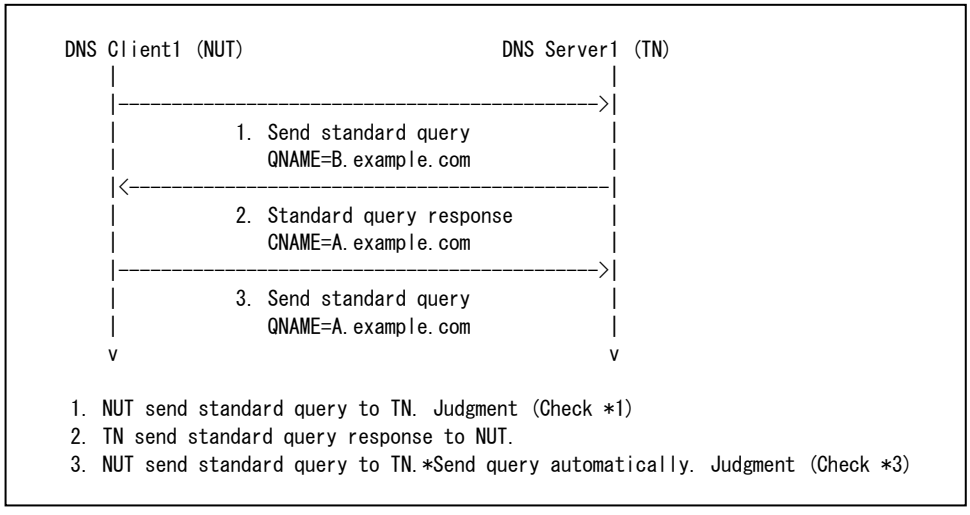
Client (with recursive function)

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
- **Setup**
  Set the DNS Server1(TN)' s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for A type (IN class) of AP Server1 (TN): B.example.com(CNAME) with RD=0 to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1st Packet

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	0
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	B.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)

2nd packet.

2. Standard query response from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Same as 1st Packet's Src Port
DNS Header	ID	Same as 1st Packet's ID
	QR	1
	OPCODE	0
	AA	1
	TC	0
	RD	Same as 1st Packet's RD
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	1
	NSCOUNT	1
	ARCOUNT	1

DNS Question section	QNAME	B.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)
DNS Answer section	NAME	B.example.com (Pointer 0xC00C)
	TYPE	CNAME (0x0005)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	4
	CNAME	A.example.com (A + Pointer 0xC00E)
DNS Authority section	NAME	example.com (Pointer 0xC00E)
	TYPE	NS (0x0002)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	6
	NSDNAME	NS1.example.com (NS1 + Pointer 0xC00E)
DNS Additional section	NAME	NS1.example.com (Pointer 0xC03B)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	0
	RDLENGTH	4
	ADDRESS	192.168.1.20

3rd Packet

3. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)

	QCLASS	IN (0x0001)

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Received standard query QNAME=B.example.com from NUT.
3. Received standard query QNAME=A.example.com from NUT.

References

RFC1034 DOMAIN NAMES - CONCEPTS AND FACILITIES
  5.2.2. Aliases
  5.3.3. Algorithm
RFC2308 Negative Caching of DNS Queries (DNS NCACHE)
  2.2.1 Special Handling of No Data

5.29. Cache data vs authoritative data

Purpose

Verify that a NUT uses the authoritative data in preference to cached data

- If the resolver has direct access to a name server's zones, it should check to see if the desired data is present in authoritative form, and if so, use the authoritative data in preference to cached data.

Category

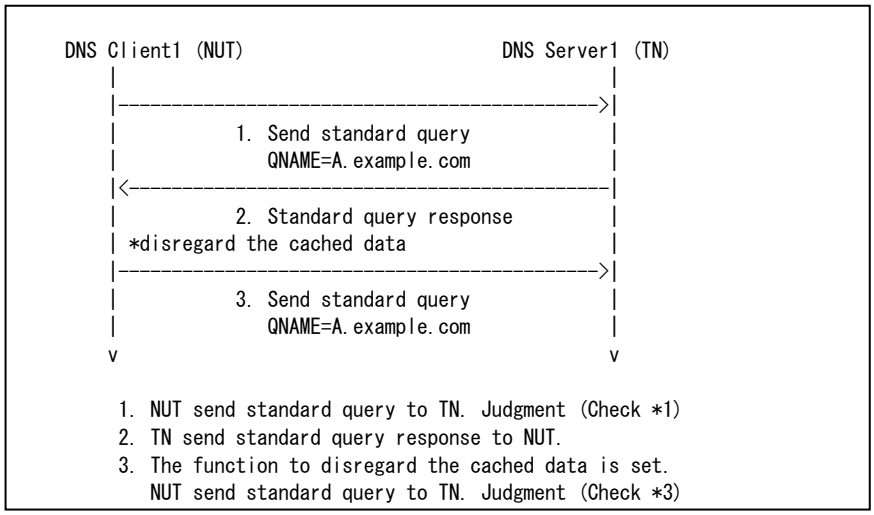
Client (with Caching function)

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "A.example.com".
- **Setup**
  Set the DNS Server1(TN)' s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for A type(IN class) of AP Server1(TN): A.example.com to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1st Packet

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)

2nd packet.

2. Standard query response from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Same as 1st Packet's Src Port
DNS Header	ID	Same as 1st Packet's ID
	QR	1
	OPCODE	0
	AA	1
	TC	0
	RD	Same as 1st Packet's RD
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	1
	NSCOUNT	1
	ARCOUNT	1

DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)
DNS Answer section	NAME	A.example.com (Pointer 0xC00C)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	4
	ADDRESS	192.168.1.10
DNS Authority section	NAME	example.com (Pointer 0xC00E)
	TYPE	NS (0x0002)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	6
	NSDNAME	NS1.example.com (NS1 + Pointer 0xC00E)
DNS Additional section	NAME	NS1.example.com (Pointer 0xC03B)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	4
	ADDRESS	192.168.1.20

3rd Packet

3. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)

	QCLASS	IN (0x0001)

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Received standard query QNAME=A.example.com from NUT.
3. Received standard query QNAME=A.example.com from NUT.

References

RFC1034 DOMAIN NAMES - CONCEPTS AND FACILITIES
  5.3.2. Resouces
  5.3.3. Algorithm
RFC1035 DOMAIN NAMES - IMPLEMENTATION AND SPECIFICATION
  7.4. Using the cache

5.30. Answer in local information

Purpose

Verify that a NUT uses the cached data

- Searches the cache for the desired data. If the data is in the cache, it is assumed to be good enough for normal use.
- The resolver MUST implement a local caching function to avoid repeated remote access for identical requests.

Category

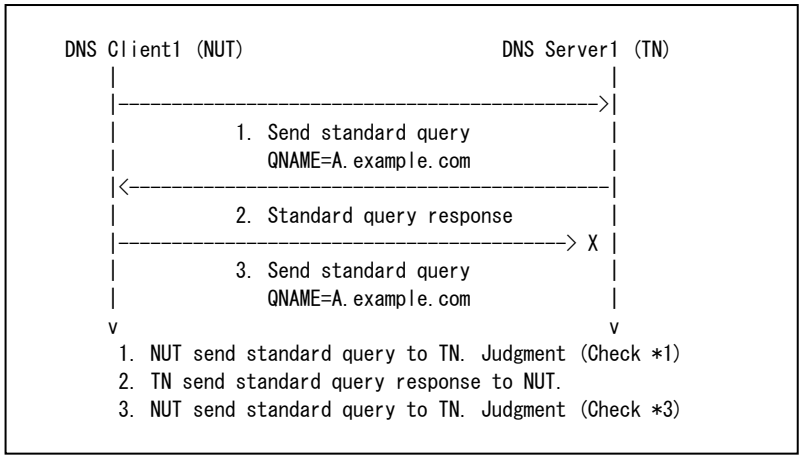
Client (with Caching function)

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "A.example.com".
- **Setup**
  Set the DNS Server1(TN)' s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for A type(IN class) of AP Server1(TN): A.example.com to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1st Packet

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)

2nd packet.

2. Standard query response from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Same as 1st Packet's Src Port
DNS Header	ID	Same as 1st Packet's ID
	QR	1
	OPCODE	0
	AA	1
	TC	0
	RD	Same as 1st Packet's RD
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	1
	NSCOUNT	1
	ARCOUNT	1

DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)
DNS Answer section	NAME	A.example.com (Pointer 0xC00C)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	4
	ADDRESS	192.168.1.10
DNS Authority section	NAME	example.com (Pointer 0xC00E)
	TYPE	NS (0x0002)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	6
	NSDNAME	NS1.example.com (NS1 + Pointer 0xC00E)
DNS Additional section	NAME	NS1.example.com (Pointer 0xC03B)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	4
	ADDRESS	192.168.1.20

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Received standard query QNAME=A.example.com from NUT.
3. Not received standard query QNAME=A.example.com from NUT.

References

RFC1034 DOMAIN NAMES - CONCEPTS AND FACILITIES
  5.3.3. Algorithm
RFC1123 Requirements for Internet Hosts -- Application and Support
  6.1.3.1 Resolver Implementation

5.31. Sending query to servers

Purpose

Verify that a NUT transmits standard query to multiple servers.

- Send out queries until a response is received. The strategy is to cycle around all of the addresses for all of the servers with a timeout between each transmission. Searches the cache for the desired data.
- The client should try other servers and server addresses before repeating a query to a specific address of a server.
- At a minimum, the stub resolver MUST be capable of directing its requests to redundant recursive name servers.

Category

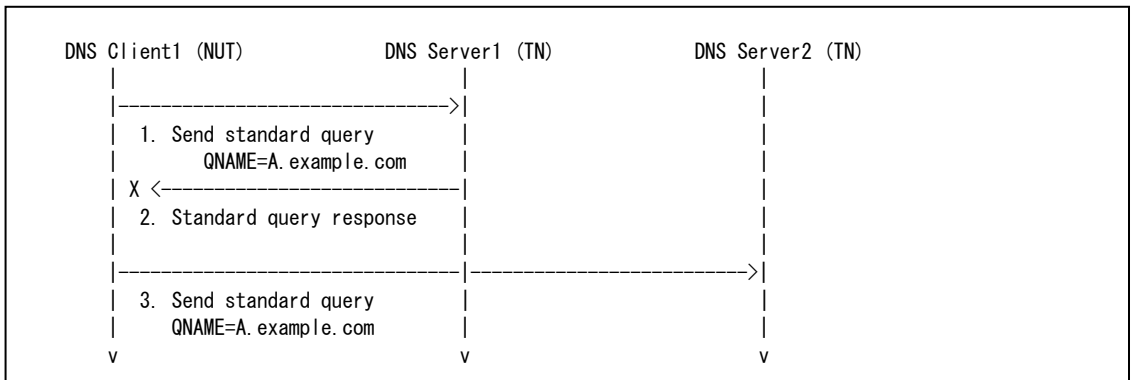
Client

Initialization

- **Network Topology**
  Refer the topology "Fig. 2 Toplogy No.2".
- **Setup**
  Set the DNS Server1(TN) and DNS Server2's address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for A type(IN class) of AP Server1(TN): A.example.com to the DNS Server1(TN) and DNS Server2(TN), NUT is configured.

Procedure

This test sequence is following.



1. NUT send standard query to DNS Server1(TN). Judgment (Check *1)
2. TN doesn't send standard query response to NUT.
3. NUT send standard query to DNS Server2(TN).*Don't specify the DNS Server2. *Send query automatically. Judgment (Check *3)

   *The order of 1. and 3. might become opposite.

Packet Description

1st Packet

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)

3rd Packet

3. Standard query from DNS Client1 (NUT) to DNS Server2 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV2_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any

DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Received standard query QNAME=A.example.com from NUT to Server1(TN).
3. Received standard query QNAME=A.example.com from NUT to Server2(TN)
 *The order of 1. and 3. might become opposite.

References

RFC1034 DOMAIN NAMES - CONCEPTS AND FACILITIES
  5.3.3. Algorithm
RFC1035 DOMAIN NAMES - IMPLEMENTATION AND SPECIFICATION
  4.2.1. UDP usage
RFC1123 Requirements for Internet Hosts -- Application and Support
  6.1.3.1 Resolver Implementa

5.32. Analyze the response (delegation)

Purpose

Verify that a NUT uses better delegation servers

- If the delegation is valid the NS delegation RRs and any address RRs for the servers should be cached.

Category

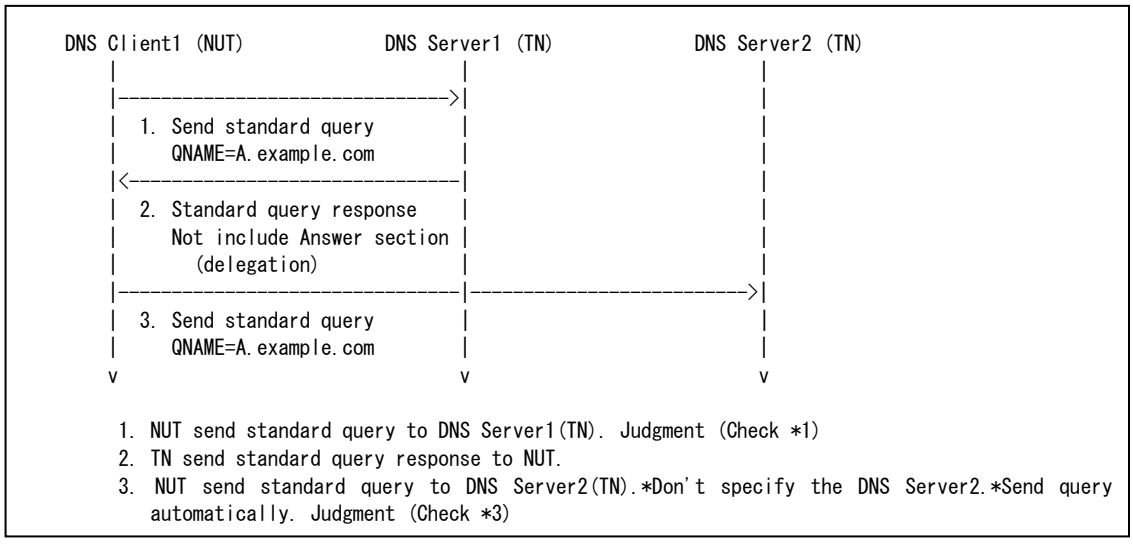
Client (with recursive function)

Initialization

- **Network Topology**
  Refer the topology "Fig. 2 Toplogy No.2".
- **Setup**
  Set the DNS Server1(TN) address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for A type(IN class) of AP Server1(TN): A.example.com to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



1. NUT send standard query to DNS Server1(TN). Judgment (Check *1)
2. TN send standard query response to NUT.
3. NUT send standard query to DNS Server2(TN).*Don't specify the DNS Server2.*Send query automatically. Judgment (Check *3)

Packet Description

1st Packet

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*

	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)

2nd packet.

2. Standard query response from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Same as 1st Packet's Src Port
DNS Header	ID	Same as 1st Packet's ID
	QR	1
	OPCODE	0
	AA	0
	TC	0
	RD	Same as 1st Packet's RD
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	1
	ARCOUNT	1
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)
DNS Authority section	NAME	example.com (Pointer 0xC00E)
	TYPE	NS (0x0002)
	CLASS	IN (0x0001)

	TTL	1 day (86400)
	RDLENGTH	6
	NSDNAME	NS2.example.com (NS2 + Pointer 0xC00E)
DNS Additional section	NAME	NS2.example.com (Pointer 0xC02B)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	4
	ADDRESS	192.168.1.30

3rd Packet

3. Standard query from DNS Client1 (NUT) to DNS Server2 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV2_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Received standard query QNAME=A.example.com from NUT to Server1(TN).
3. Received standard query QNAME=A.example.com from NUT to Server2(TN)

References

RFC1034 DOMAIN NAMES - CONCEPTS AND FACILITIES
5.3.3. Algorithm

5.33. Analyze the response (caching delegation)

Purpose

Verify that a NUT caches better delegation servers

- If the delegation is valid the NS delegation RRs and any address RRs for the servers should be cached.

Category

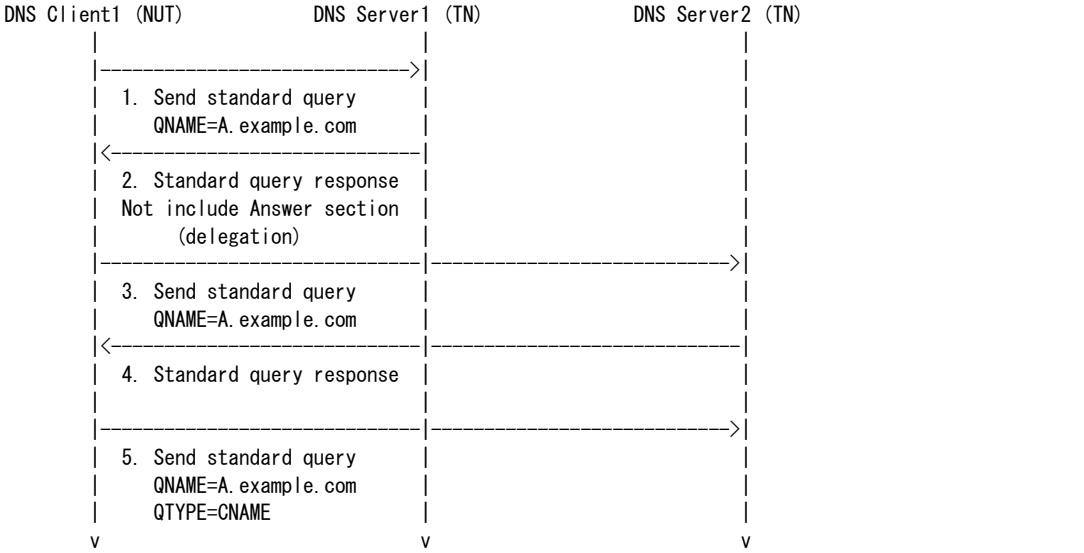
Client (with Caching function and recursive function)

Initialization

- **Network Topology**
  Refer the topology "Fig. 2 Toplogy No.2".
- **Setup**
  Set the DNS Server1(TN) address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for A type(IN class) of AP Server1(TN): A.example.com to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



1. NUT send standard query to DNS Server1(TN). Judgment (Check *1)
2. TN send standard query response to NUT.
3. NUT send standard query to DNS Server2(TN).*Don't specify the DNS Server2.*Send query automatically. Judgment (Check *3)
4. TN send standard query response to NUT.
5. NUT send standard query to DNS Server2(TN).*Don't specify the DNS Server2. Judgment (Check *5)

Packet Description

1st Packet

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)

2nd packet.

2. Standard query response from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Same as 1st Packet's Src Port
DNS Header	ID	Same as 1st Packet's ID
	QR	1
	OPCODE	0
	AA	0
	TC	0
	RD	Same as 1st Packet's RD
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	1
	ARCOUNT	1

DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)
DNS Authority section	NAME	example.com (Pointer 0xC00E)
	TYPE	NS (0x0002)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	6
	NSDNAME	NS2.example.com (NS2 + Pointer 0xC00E)
DNS Additional section	NAME	NS2.example.com (Pointer 0xC02B)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	4
	ADDRESS	192.168.1.30

3rd Packet

3. Standard query from DNS Client1 (NUT) to DNS Server2 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV2_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)

4th packet.

4. Standard query response from DNS Server2 (TN) to Client1 (NUT)		
IP Header	Source Address	SV2_NETY
	Destination Address	NUT_NETZ

UDP Header	Src Port	53
	Dst Port	Same as 3rd Packet's Src Port
DNS Header	ID	Same as 3rd Packet's ID
	QR	1
	OPCODE	0
	AA	1
	TC	0
	RD	Same as 3rd Packet's RD
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	1
	NSCOUNT	1
	ARCOUNT	1
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)
DNS Answer section	NAME	A.example.com (Pointer 0xC00C)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	4
	ADDRESS	192.168.1.10
DNS Authority section	NAME	example.com (Pointer 0xC00E)
	TYPE	NS (0x0002)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	6
	NSDNAME	NS2.example.com (NS2 + Pointer 0xC00E)
DNS Additional section	NAME	NS2.example.com (Pointer 0xC03B)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	4
	ADDRESS	192.168.1.30

5th Packet

5. Standard query from DNS Client1 (NUT) to DNS Server2 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV2_NETY
UDP Header	Src Port	*any*
	Dst Port	53

DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	A.example.com
	QTYPE	CNAME (0x0005)
	QCLASS	IN (0x0001)

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Received standard query QNAME=A.example.com from NUT to Server1(TN).
3. Received standard query QNAME=A.example.com from NUT to Server2(TN).
5. Received standard query QNAME=A.example.com QTYPE=CNAME from NUT to Server2(TN).

References

RFC1034 DOMAIN NAMES - CONCEPTS AND FACILITIES
5.3.3. Algorithm

5.34. Analyze the response (caching CNAME)

Purpose

Verify that a NUT caches the query when it encounters a CNAME

- If the response shows a CNAME and that is not the answer itself, cache the CNAME.

Category

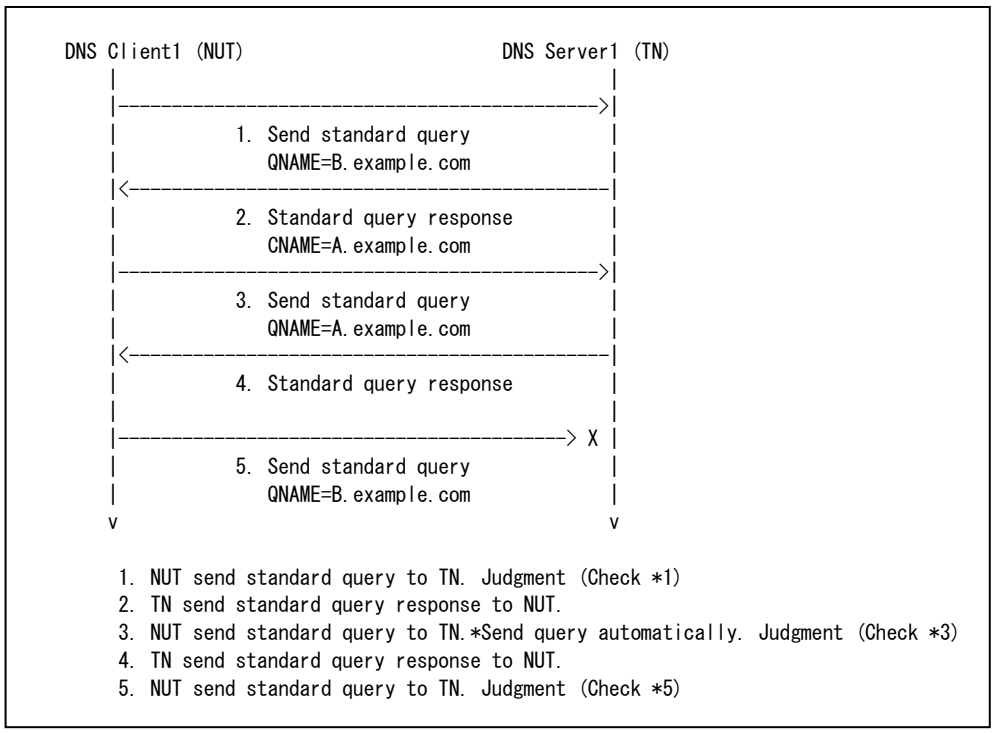
Client (with Caching function and recursive function)

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
- **Setup**
  Set the DNS Server1(TN)' s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for A type(IN class) of AP Server1(TN): B.example.com(CNAME) with RD=0 to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1st Packet

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	0
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	B.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)

2nd packet.

2. Standard query response from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Same as 1st Packet's Src Port
DNS Header	ID	Same as 1st Packet's ID
	QR	1
	OPCODE	0
	AA	1
	TC	0
	RD	Same as 1st Packet's RD
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	1
	NSCOUNT	1
	ARCOUNT	1

DNS Question section	QNAME	B.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)
DNS Answer section	NAME	B.example.com (Pointer 0xC00C)
	TYPE	CNAME (0x0005)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	4
	CNAME	A.example.com (A + Pointer 0xC00E)
DNS Authority section	NAME	example.com (Pointer 0xC00E)
	TYPE	NS (0x0002)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	6
	NSDNAME	NS1.example.com (NS1 + Pointer 0xC00E)
DNS Additional section	NAME	NS1.example.com (Pointer 0xC03B)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	0
	RDLENGTH	4
	ADDRESS	192.168.1.20

3rd Packet

3. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)

	QCLASS	IN (0x0001)

4th packet.

4. Standard query response from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Same as 3rd Packet's Src Port
DNS Header	ID	Same as 3rd Packet's ID
	QR	1
	OPCODE	0
	AA	1
	TC	0
	RD	Same as 3rd Packet's RD
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	1
	NSCOUNT	1
	ARCOUNT	1
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)
DNS Answer section	NAME	A.example.com (Pointer 0xC00C)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	4
	ADDRESS	192.168.1.10
DNS Authority section	NAME	example.com (Pointer 0xC00E)
	TYPE	NS (0x0002)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	6
	NSDNAME	NS1.example.com (NS1 + Pointer 0xC00E)
DNS Additional section	NAME	NS1.example.com (Pointer 0xC03B)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	0
	RDLENGTH	4
	ADDRESS	192.168.1.20

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Received standard query QNAME=B.example.com from NUT.
3. Received standard query QNAME=A.example.com from NUT.
5. Not Received standard query QNAME=B.example.com from NUT.

References

RFC1034 DOMAIN NAMES - CONCEPTS AND FACILITIES
5.3.3. Algorithm

5.35. Analyze the response (answer is invalid for recursive)

Purpose

Verify that a NUT checks the query which has invalid ID field.

- The resolver should be highly paranoid in its parsing of responses. It should also check that the response matches the query it sent using the ID field in the response.

Category

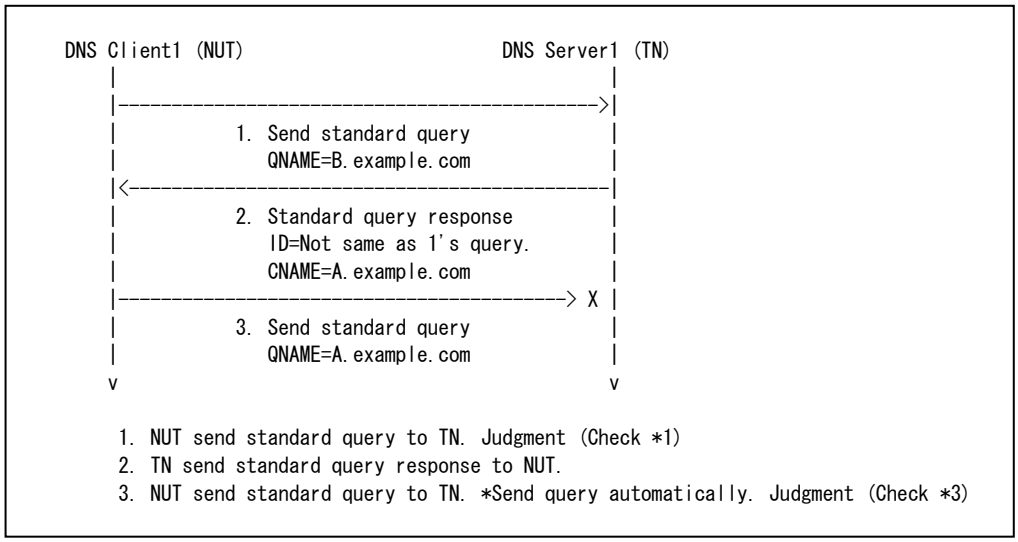
Client (with recursive function)

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
- **Setup**
  Set the DNS Server1(TN)' s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for A type(IN class) of AP Server1(TN): B.example.com(CNAME) with RD=0 to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1st Packet

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	0
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	B.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)

2nd packet.

2. Standard query response from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Same as 1st Packet's Src Port
DNS Header	ID	0xffff (Not same as 1st Packet's ID)
	QR	1
	OPCODE	0
	AA	1
	TC	0
	RD	Same as 1st Packet's RD
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	1
	NSCOUNT	1
	ARCOUNT	1

DNS Question section	QNAME	B.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)
DNS Answer section	NAME	B.example.com (Pointer 0xC00C)
	TYPE	CNAME (0x0005)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	4
	CNAME	A.example.com (A + Pointer 0xC00E)
DNS Authority section	NAME	example.com (Pointer 0xC00E)
	TYPE	NS (0x0002)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	6
	NSDNAME	NS1.example.com (NS1 + Pointer 0xC00E)
DNS Additional section	NAME	NS1.example.com (Pointer 0xC03B)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	0
	RDLENGTH	4
	ADDRESS	192.168.1.20

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Received standard query QNAME=B.example.com from NUT.
3. Not received standard query QNAME=A.example.com from NUT.

References

RFC1034 DOMAIN NAMES - CONCEPTS AND FACILITIES
5.3.3. Algorithm

5.36. Analyze the response (answer is invalid for caching)

Purpose

Verify that a NUT checks the query which has invalid ID field.

- The resolver should be highly paranoid in its parsing of responses. It should also check that the response matches the query it sent using the ID field in the response.

Category

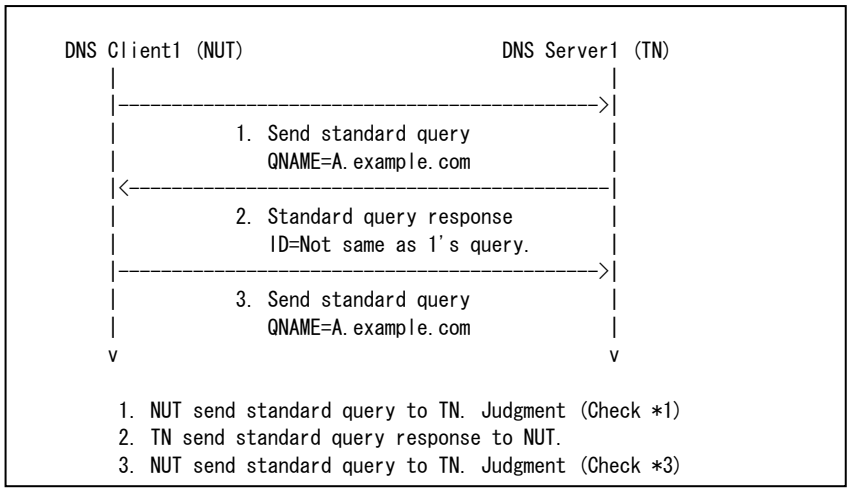
Client (with Caching function)

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
- **Setup**
  Set the DNS Server1(TN)' s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for A type(IN class) of AP Server1(TN): A.example.com to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1st Packet

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*

	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	any
	NSCOUNT	0
	ARCOUNT	0
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)

2nd packet.

2. Standard query response from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Same as 1st Packet's Src Port
DNS Header	ID	0xffff (Not same as 1st Packet's ID)
	QR	1
	OPCODE	0
	AA	1
	TC	0
	RD	Same as 1st Packet's RD
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	1
	NSCOUNT	1
	ARCOUNT	1
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)
DNS Answer section	NAME	A.example.com (Pointer 0xC00C)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)

	TTL	1 day (86400)
	RDLENGTH	4
	ADDRESS	192.168.1.10
DNS Authority section	NAME	example.com (Pointer 0xC00E)
	TYPE	NS (0x0002)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	6
	NSDNAME	NS1.example.com (NS1 + Pointer 0xC00E)
DNS Additional section	NAME	NS1.example.com (Pointer 0xC03B)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	4
	ADDRESS	192.168.1.20

3rd Packet

3. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Received standard query from NUT.
3. Received standard query from NUT.

References

RFC1034 DOMAIN NAMES - CONCEPTS AND FACILITIES
5.3.3. Algorithm

5.37. Analyze the response (delegation is invalid)

Purpose

Verify that a NUT checks the query which has invalid delegation.

- If the response shows a delegation, the resolver should check to see that the delegation is "closer" to the answer than the servers in SLIST are.

Category

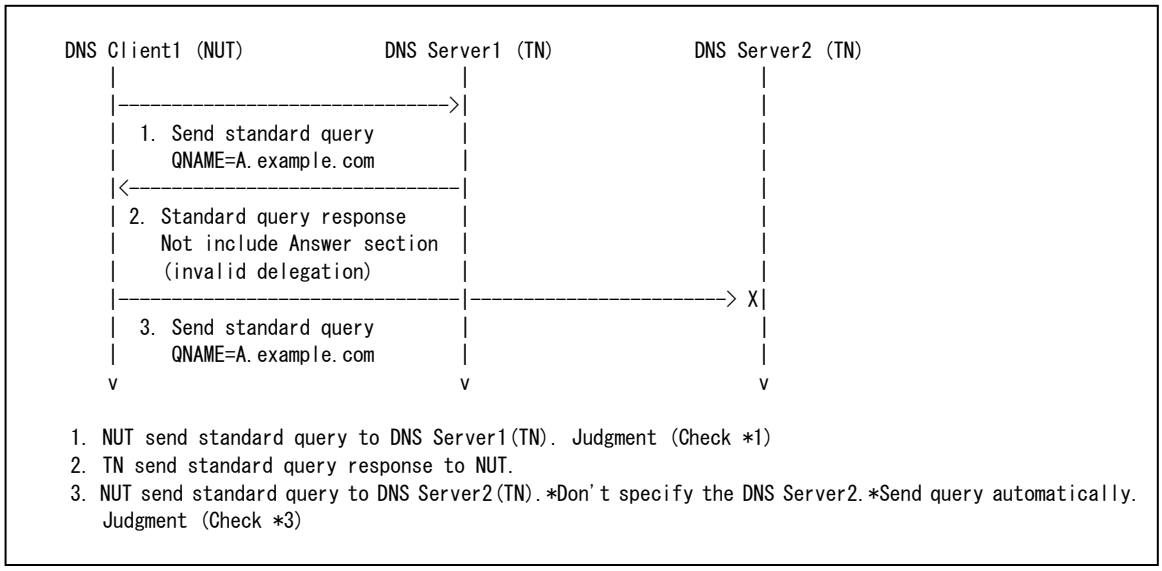
Client (with recursive function)

Initialization

- **Network Topology**
  Refer the topology "Fig. 2 Toplogy No.2".
- **Setup**
  Set the DNS Server1(TN) address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for A type(IN class) of AP Server1(TN): A.example.com to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



1. NUT send standard query to DNS Server1(TN). Judgment (Check *1)
2. TN send standard query response to NUT.
3. NUT send standard query to DNS Server2(TN).*Don't specify the DNS Server2.*Send query automatically. Judgment (Check *3)

Packet Description

1st Packet

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ

	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)

2nd packet.

2. Standard query response from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Same as 1st Packet's Src Port
DNS Header	ID	Same as 1st Packet's ID
	QR	1
	OPCODE	0
	AA	0
	TC	0
	RD	Same as 1st Packet's RD
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	1
	ARCOUNT	1
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)
DNS Authority	NAME	invalid.com (invalid + Pointer 0xC016)

section	TYPE	NS (0x0002)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	6
	NSDNAME	NS2.invalid.com (NS2 + Pointer 0xC01F)
DNS Additional section	NAME	NS2.invalid.com (Pointer 0xC033)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	4
	ADDRESS	192.168.1.30

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Received standard query QNAME=A.example.com from NUT to Server1(TN).
3. Not received standard query QNAME=A.example.com from NUT to Server2(TN)

References

RFC1034 DOMAIN NAMES - CONCEPTS AND FACILITIES
5.3.3. Algorithm

5.38. Order of transmission of octets and bits

Purpose

Verify that a NUT transmits correct order of transmission of octets and bits

- The order of transmission of the header and data is resolved to the octet level. The order of transmission of octets is the normal order in which they are read in English.
- Whenever an octet represents a numeric quantity, the left most bit in the diagram is the high order or most significant bit.
- Similarly, whenever a multi-octet field represents a numeric quantity the left most bit of the whole field is the most significant bit. When a multi-octet quantity is transmitted the most significant octet is transmitted first.

Category

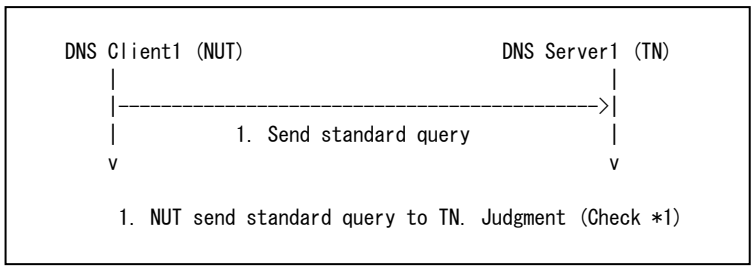
Client

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "A.example.com".
- **Setup**
  Set the DNS Server1(TN)' s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for A type of AP Server1(TN): A.example.com to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*

	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	*any*

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Standard query must be base on above Verification Points.
   *Order of transmission of octets is the normal in which they are read in English.
   *Check order of transmission of octets in DNS header.
   *The left most bit in the octets is most significant bit.
   *Check numeric quantity of OPCODE, Z fields in DNS header.
   *The left most bit in the multi-octets field is most significant bit.
   *Check numeric quantity of QDCOUNT, ANCOUNT, NSCOUNT, ARCOUNT fields in DNS header.

References

RFC1035 DOMAIN NAMES - IMPLEMENTATION AND SPECIFICATION
2.3.2. Data Transmission Order

5.39. Label format

Purpose

Verify that a NUT transmits correct standard query for label format

- Domain names in messages are expressed in terms of a sequence of labels. Each label is represented as a one octet length field followed by that number of octets.
- The high order two bits of every length octet must be zero, and the remaining six bits of the length field limit the label to 63 octets or less.

Category

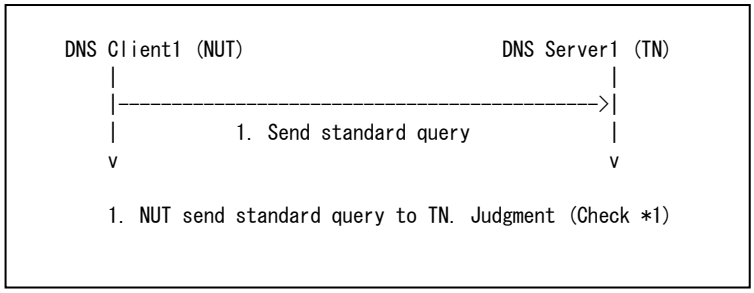
Client

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "A.example.com".
- **Setup**
  Set the DNS Server1(TN)' s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for A type of AP Server1(TN):
  A.example.com to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1st Packet

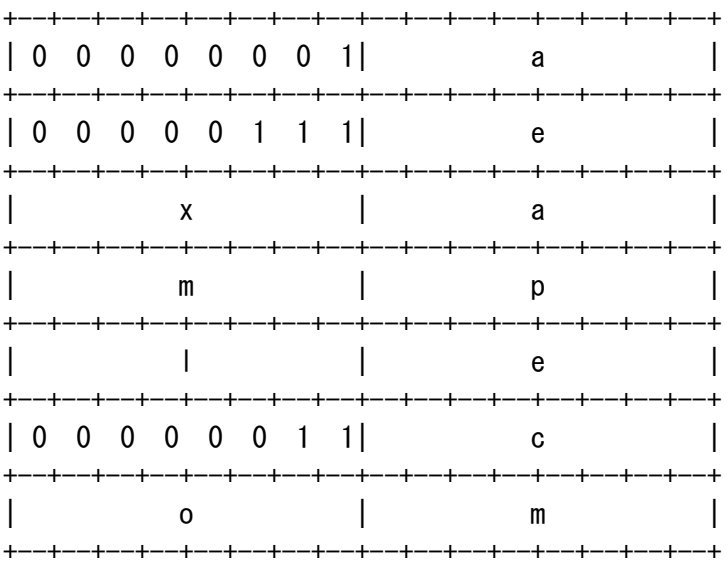
1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*

	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	*any*

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Standard query must be base on above Verification Points.
   *In DNS Question section, QNAME field must include following data.



References

RFC1035 DOMAIN NAMES - IMPLEMENTATION AND SPECIFICATION
3.1. Name space definitions

5.40. Label of root

Purpose

Verify that a NUT transmits correct standard query for label of root

- Since every domain name ends with the null label of the root, a domain name is terminated by a length byte of zero.

Category

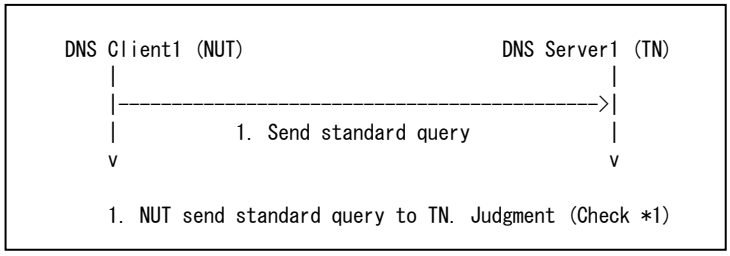
Client

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "A.example.com".
- **Setup**
  Set the DNS Server1(TN)' s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for A type of AP Server1(TN):
  A.example.com to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1st Packet

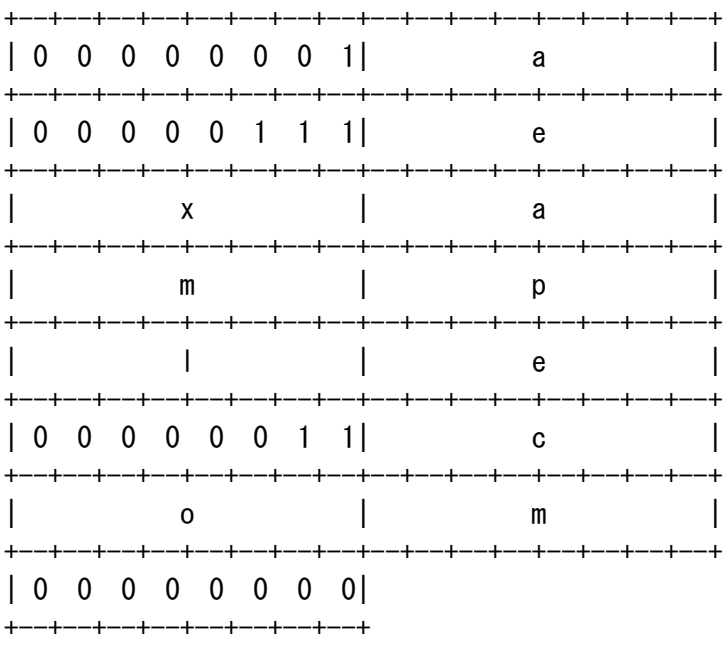
1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*

	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	*any*

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Standard query must be base on above Verification Points.
   *In DNS Question section, QNAME field must include following data.



References

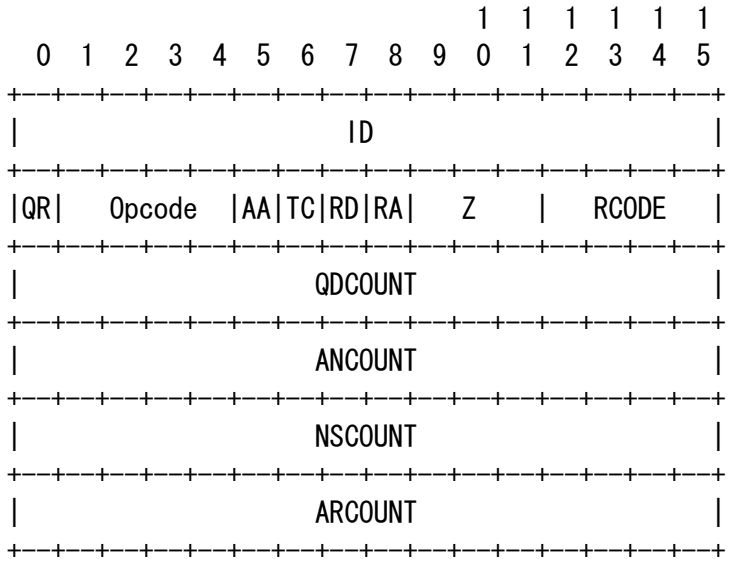
RFC1035 DOMAIN NAMES - IMPLEMENTATION AND SPECIFICATION
3.1. Name space definitions

5.41. MB type in standard query

Purpose

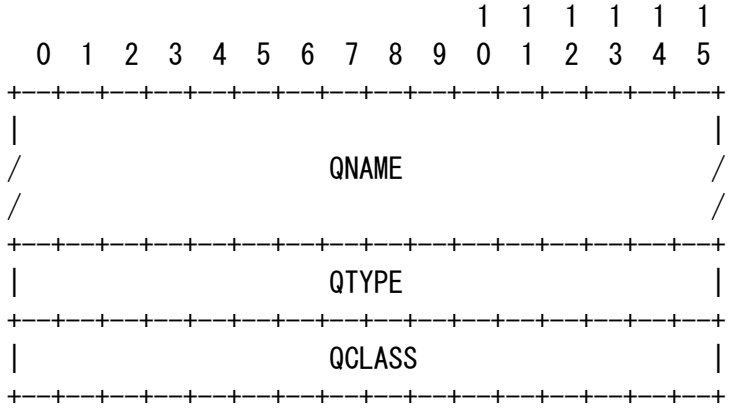
Verify that a NUT transmits correct standard query format for MB type

- Header section format



QR	**Query (0)**
Opcode	**A standard query(QUERY) (0)**
Z	**Must be zero**
QDCOUNT	**1**
ANCOUNT	**0**
NSCOUNT	**0**
ARCOUNT	**0**

- Question section format



QNAME	**mb.example.com**
QTYPE	**MB type (7)**

- Answer section format
  Must be empty
- Authority section format
  Must be empty
- Additional section format
  Must be empty

Category

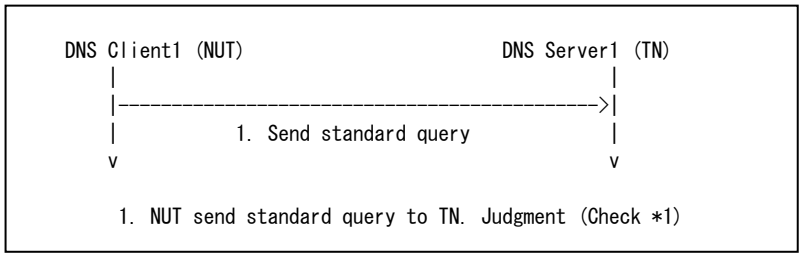
Client

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "mb.example.com".
- **Setup**
  Set the DNS Server1(TN)'s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for MB type of mb.example.com to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*

	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	mb.example.com
	QTYPE	MB (0x0007)
	QCLASS	*any*

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Standard query for MB type must be base on above Verification Points.

References

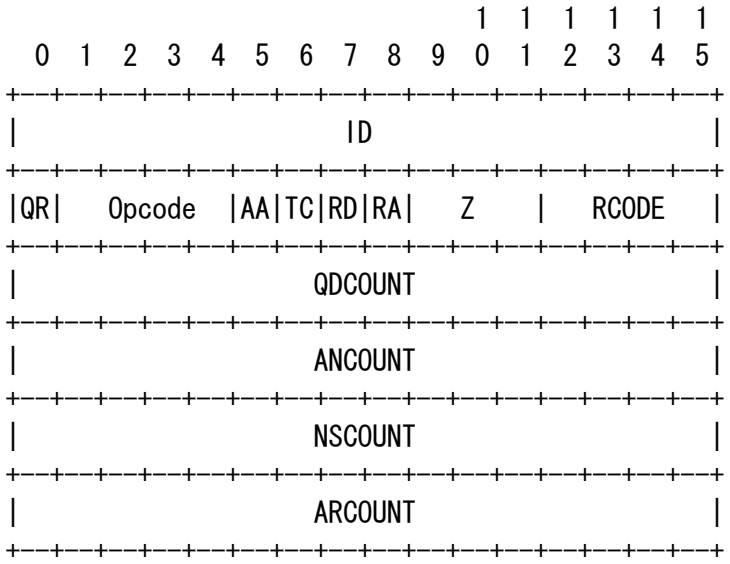
RFC1035 DOMAIN NAMES - IMPLEMENTATION AND SPECIFICATION
3.2.2. TYPE values

5.42. MG type in standard query

Purpose

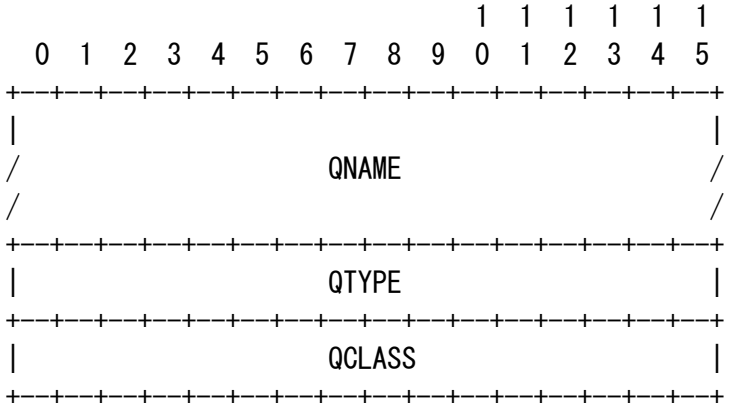
Verify that a NUT transmits correct standard query format for MG type

- Header section format



QR	**Query (0)**
Opcode	**A standard query(QUERY) (0)**
Z	**Must be zero**
QDCOUNT	**1**
ANCOUNT	**0**
NSCOUNT	**0**
ARCOUNT	**0**

- Question section format



QNAME	**mg.example.com**
QTYPE	**MG type (8)**

- Answer section format
  Must be empty
- Authority section format
  Must be empty
- Additional section format
  Must be empty

Category

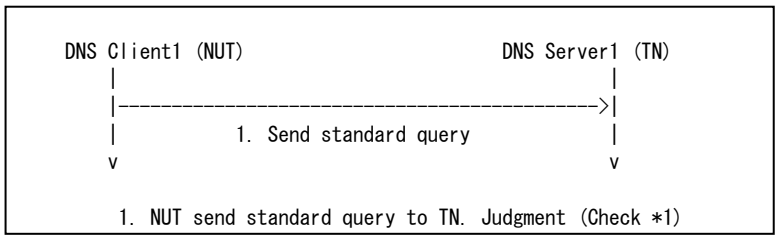
Client

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "mg.example.com".
- **Setup**
  Set the DNS Server1(TN)'s address to NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for MG type of mg.example.com to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*

	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	mg.example.com
	QTYPE	MG (0x0008)
	QCLASS	*any*

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Standard query for MG type must be base on above Verification Points.

References

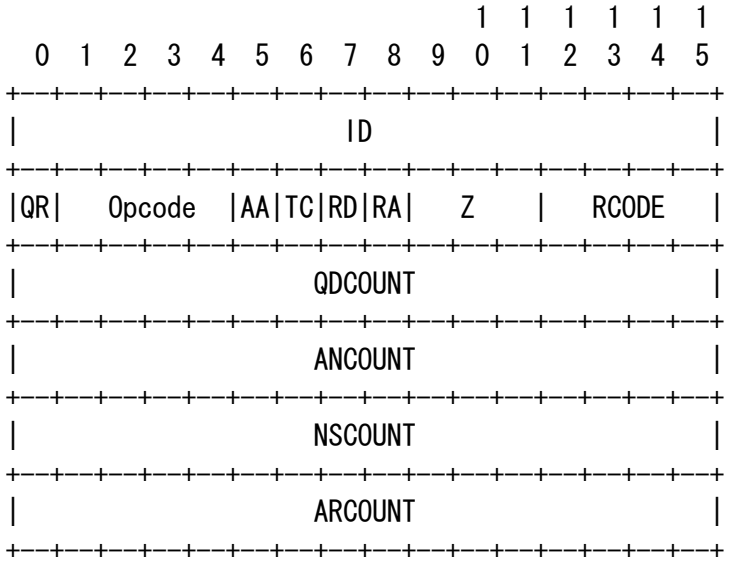
RFC1035 DOMAIN NAMES - IMPLEMENTATION AND SPECIFICATION
3.2.2. TYPE values

5.43. MR type in standard query

Purpose

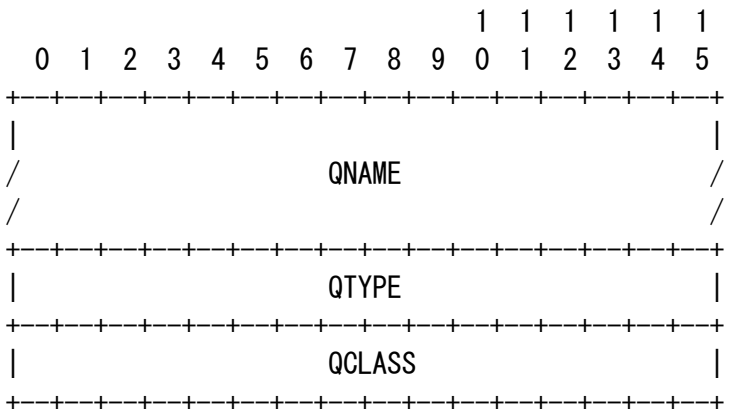
Verify that a NUT transmits correct standard query format for MR type

- Header section format



QR	**Query (0)**
Opcode	**A standard query(QUERY) (0)**
Z	**Must be zero**
QDCOUNT	**1**
ANCOUNT	**0**
NSCOUNT	**0**
ARCOUNT	**0**

- Question section format



QNAME	**mr.example.com**
QTYPE	**MR type (9)**

- Answer section format
  Must be empty
- Authority section format
  Must be empty
- Additional section format
  Must be empty

Category

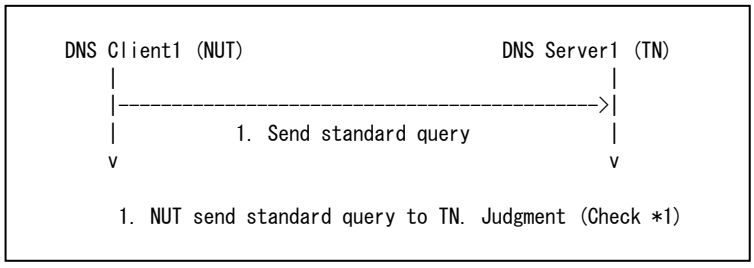
Client

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "mr.example.com".
- **Setup**
  Set the DNS Server1(TN)'s address to NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for MR type of mr.example.com to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*

	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	mr.example.com
	QTYPE	MR (0x0009)
	QCLASS	*any*

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Standard query for MR type must be base on above Verification Points.

References

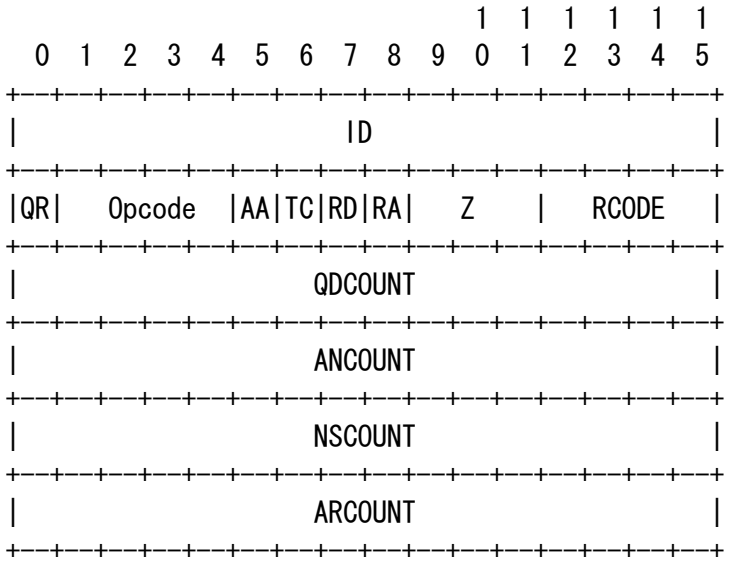
RFC1035 DOMAIN NAMES - IMPLEMENTATION AND SPECIFICATION
3.2.2. TYPE values

5.44. NULL type in standard query

Purpose

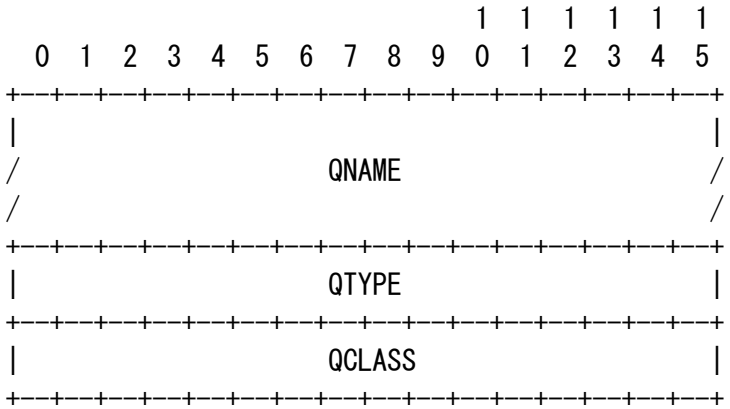
Verify that a NUT transmits correct standard query format for NULL type

- Header section format



QR	**Query (0)**
Opcode	**A standard query(QUERY) (0)**
Z	**Must be zero**
QDCOUNT	**1**
ANCOUNT	**0**
NSCOUNT	**0**
ARCOUNT	**0**

- Question section format



QNAME	**A.example.com**
QTYPE	**NULL type (10)**

- Answer section format
  Must be empty
- Authority section format
  Must be empty
- Additional section format
  Must be empty

Category

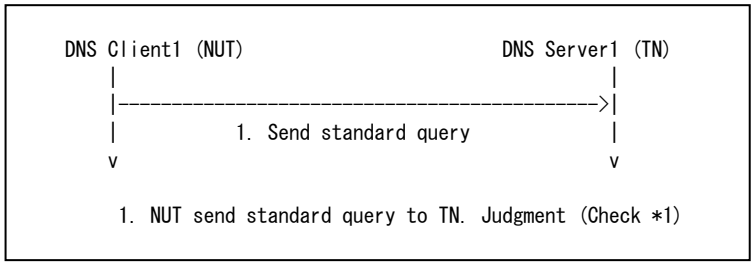
Client

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "A.example.com".
- **Setup**
  Set the DNS Server1(TN)'s address to NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for NULL type of A.example.com to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*

	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	A.example.com
	QTYPE	NULL (0x000a)
	QCLASS	*any*

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Standard query for A type must be base on above Verification Points.

References

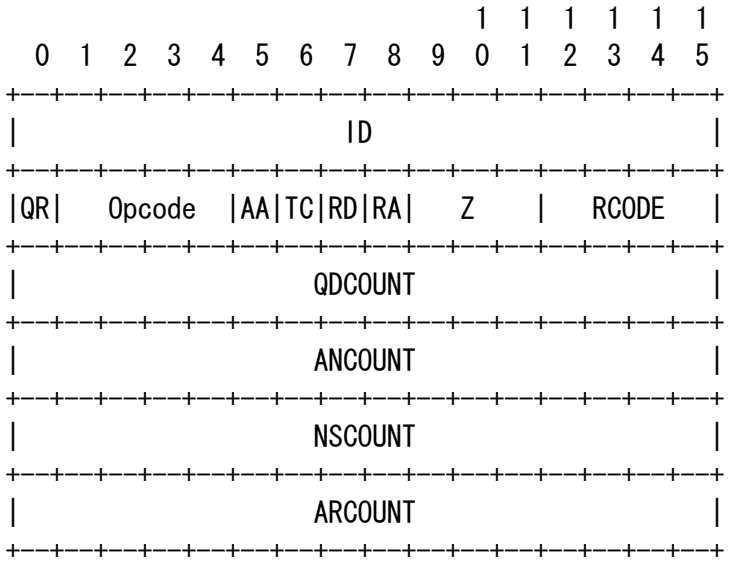
RFC1035 DOMAIN NAMES - IMPLEMENTATION AND SPECIFICATION
3.2.2. TYPE values

5.45. WKS type in standard query

Purpose

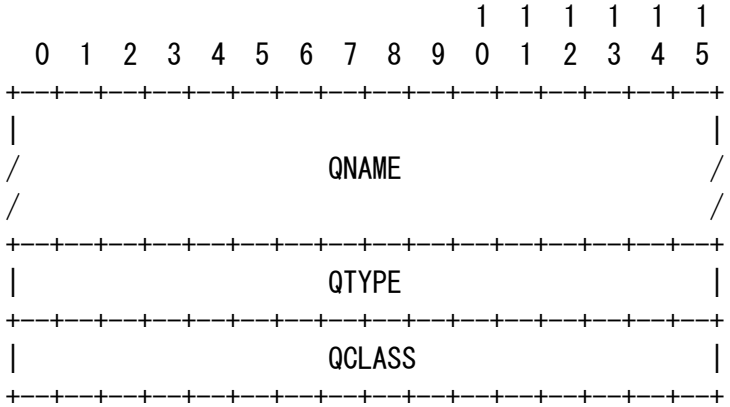
Verify that a NUT transmits correct standard query format for WKS type

- Header section format



QR	**Query (0)**
Opcode	**A standard query(QUERY) (0)**
Z	**Must be zero**
QDCOUNT	**1**
ANCOUNT	**0**
NSCOUNT	**0**
ARCOUNT	**0**

- Question section format



QNAME	**A.example.com**
QTYPE	**WKS type (11)**

- Answer section format
  Must be empty
- Authority section format
  Must be empty
- Additional section format
  Must be empty

Category

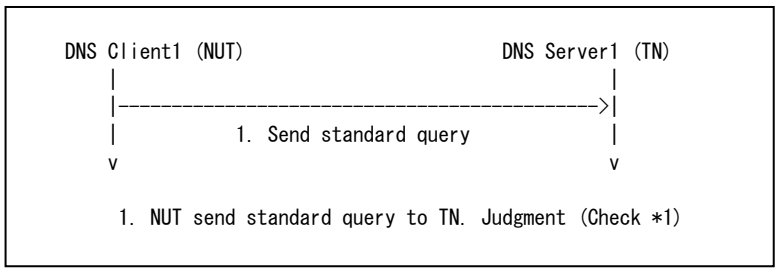
Client

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "A.example.com".
- **Setup**
  Set the DNS Server1(TN)'s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for WKS type of AP Server1(TN): A.example.com to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*

	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	A.example.com
	QTYPE	WKS (0x000b)
	QCLASS	*any*

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Standard query for WKS type must be base on above Verification Points.

References

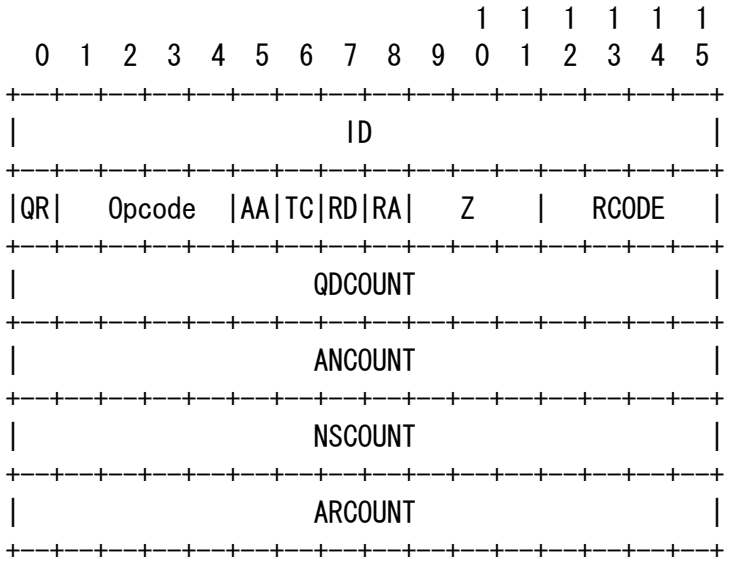
RFC1035 DOMAIN NAMES - IMPLEMENTATION AND SPECIFICATION
3.2.2. TYPE values

5.46. MINFO type in standard query

Purpose

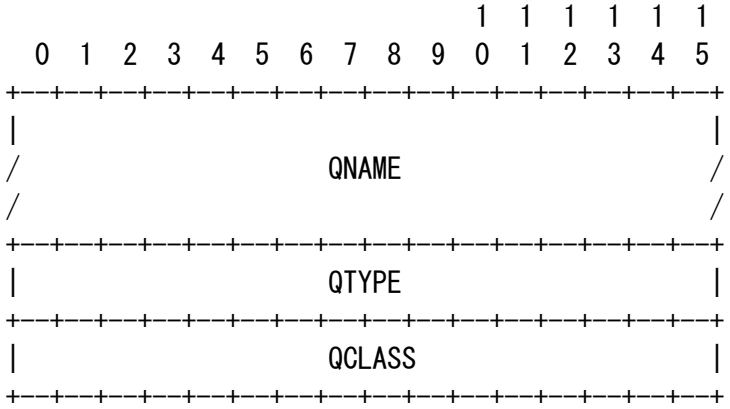
Verify that a NUT transmits correct standard query format for MINFO type

- Header section format



QR	**Query (0)**
Opcode	**A standard query(QUERY) (0)**
Z	**Must be zero**
QDCOUNT	**1**
ANCOUNT	**0**
NSCOUNT	**0**
ARCOUNT	**0**

- Question section format



QNAME	**minfo.example.com**
QTYPE	**MINFO type (14)**

- Answer section format
  Must be empty
- Authority section format
  Must be empty
- Additional section format
  Must be empty

Category

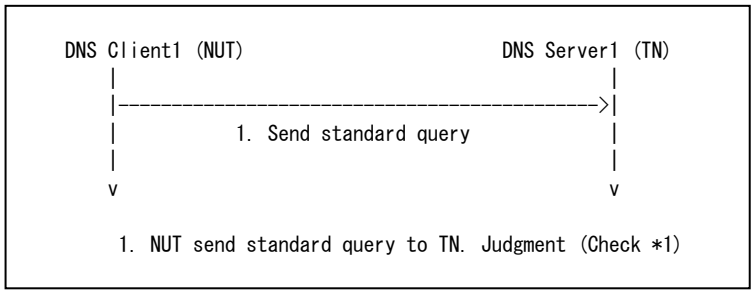
Client

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "minfo.example.com".
- **Setup**
  Set the DNS Server1(TN)' s address to NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for MINFO type of minfo.example.com to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0

	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	minfo.example.com
	QTYPE	MINFO (0x000e)
	QCLASS	*any*

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Standard query for MINFO type must be base on above Verification Points.

References

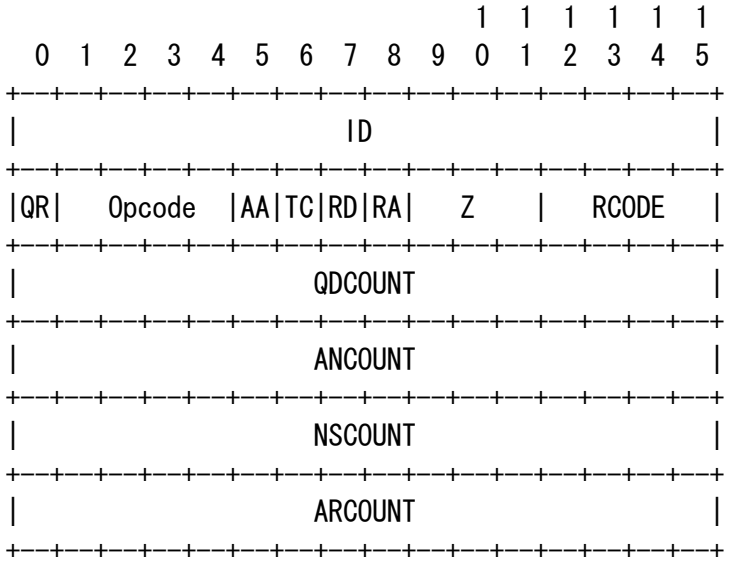
RFC1035 DOMAIN NAMES - IMPLEMENTATION AND SPECIFICATION
3.2.2. TYPE values

5.47. TXT type in standard query

Purpose

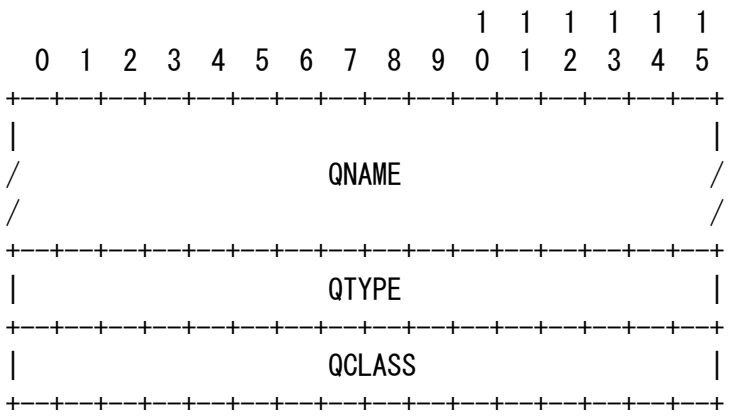
Verify that a NUT transmits correct standard query format for TXT type

- Header section format



QR	Query (0)
Opcode	A standard query(QUERY) (0)
Z	Must be zero
QDCOUNT	1
ANCOUNT	0
NSCOUNT	0
ARCOUNT	0

- Question section format



QNAME	A.example.com
QTYPE	TXT type (16)

- Answer section format
  Must be empty
- Authority section format
  Must be empty
- Additional section format
  Must be empty

Category

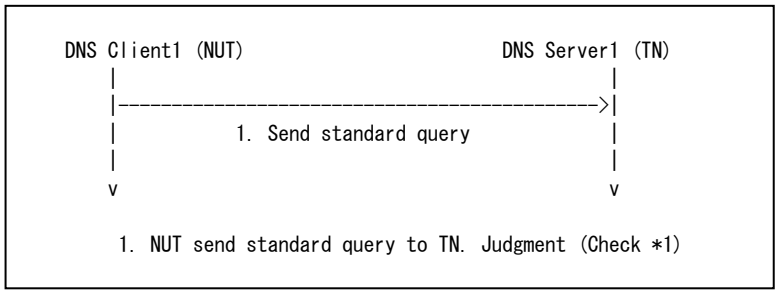
Client

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "A.example.com".
- **Setup**
  Set the DNS Server1(TN)'s address to NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for TXT type of AP Server1(TN):A.example.com to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0

	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	A.example.com
	QTYPE	TXT (0x0010)
	QCLASS	*any*

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Standard query for TXT type must be base on above Verification Points.

References

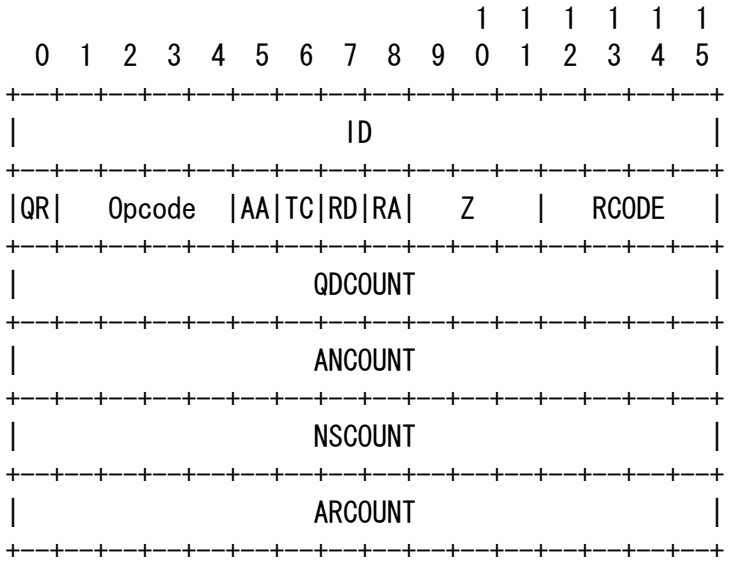
RFC1035 DOMAIN NAMES - IMPLEMENTATION AND SPECIFICATION
3.2.2. TYPE values

5.48. MAILB qtype in standard query

Purpose

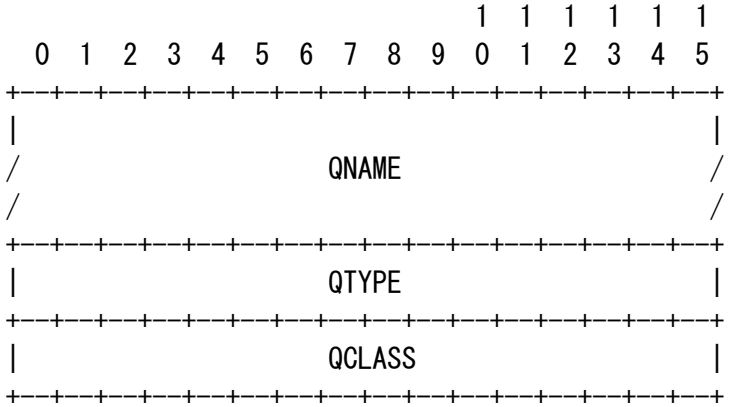
Verify that a NUT transmits correct standard query format for MAILB qtype

- Header section format



QR	**Query (0)**
Opcode	**A standard query(QUERY) (0)**
Z	**Must be zero**
QDCOUNT	**1**
ANCOUNT	**0**
NSCOUNT	**0**
ARCOUNT	**0**

- Question section format



QNAME	**mb.example.com**
QTYPE	**MAILB qtype (253)**

- Answer section format
  Must be empty
- Authority section format
  Must be empty
- Additional section format
  Must be empty

Category

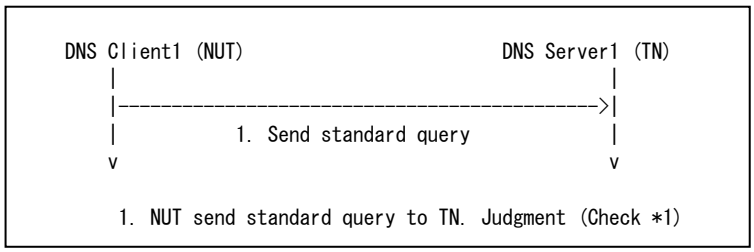
Client

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "mb.example.com".
- **Setup**
  Set the DNS Server1(TN)'s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for MALIB qtype of example.com to the DNS Server1 (TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*

	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	mb.example.com
	QTYPE	MAILB (0x00fd)
	QCLASS	*any*

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Standard query for MAILB qtype must be base on above Verification Points.

References

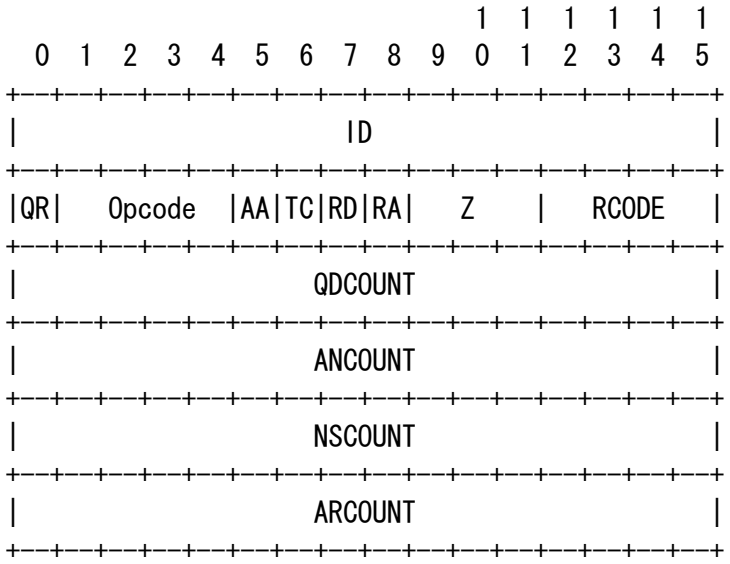
RFC1035 DOMAIN NAMES - IMPLEMENTATION AND SPECIFICATION
3.2.3 QTYPE values

5.49. HS class in standard query

Purpose

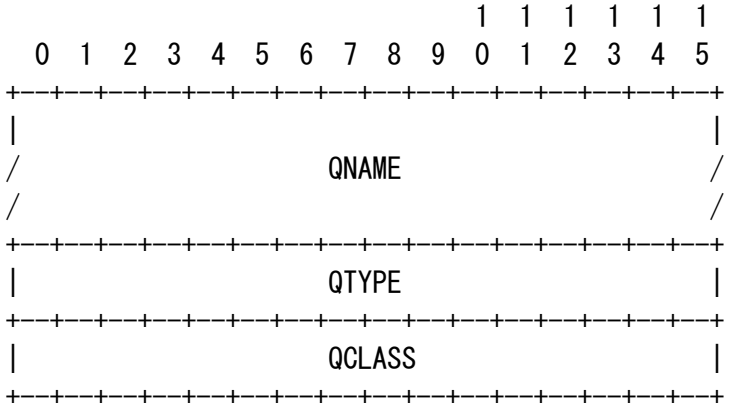
Verify that a NUT transmits correct standard query format for HS class

- Header section format



QR	**Query (0)**
Opcode	**A standard query(QUERY) (0)**
Z	**Must be zero**
QDCOUNT	**1**
ANCOUNT	**0**
NSCOUNT	**0**
ARCOUNT	**0**

- Question section format



QNAME	**A.example.com**
QCLASS	**HS class (4)**

- Answer section format
  Must be empty
- Authority section format
  Must be empty
- Additional section format
  Must be empty

Category

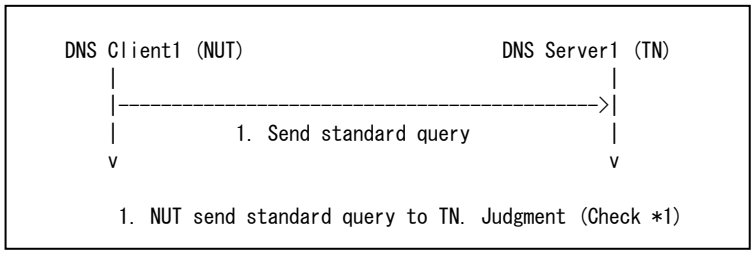
Client

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "A.example.com".
- **Setup**
  Set the DNS Server1(TN)'s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for HS class of AP Server1(TN):A.example.com to the DNS Server1(TN),NUT is configured.

Procedure

This test sequence is following.



Packet Description

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*

	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	A.example.com
	QTYPE	*any*
	QCLASS	HS (0x0004)

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Standard query for HS class must be base on above Verification Points.

References

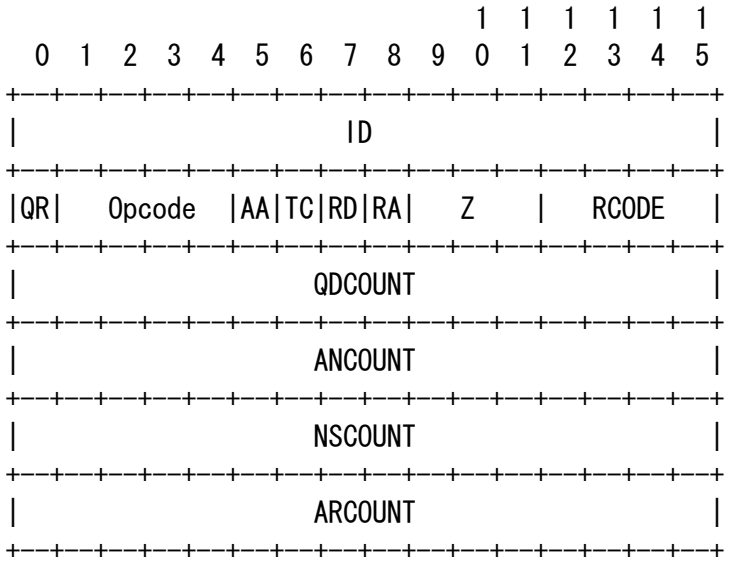
RFC1035 DOMAIN NAMES - IMPLEMENTATION AND SPECIFICATION
3.2.4. CLASS values

5.50. Header section format

Purpose

Verify that a NUT transmits correct Header section format

- Header section format



QR	**Query (0)**
Opcode	**A standard query(QUERY) (0)**
QDCOUNT	**1**
ANCOUNT	**0**
NSCOUNT	**0**

Category

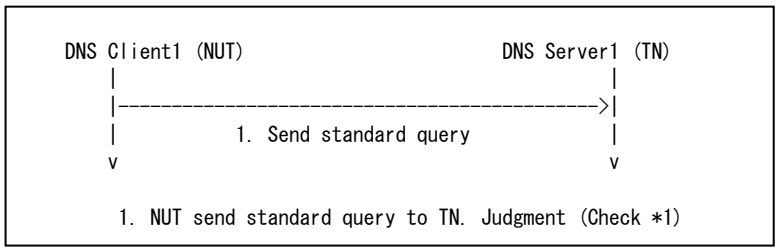
Client

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "A.example.com".
- **Setup**
  Set the DNS Server1(TN)' s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for A type of AP Server1(TN): A.example.com to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	*any*
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	*any*
DNS Question section	QNAME	*any*
	QTYPE	*any*
	QCLASS	*any*

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Standard query must be base on above Verification Points.

References

RFC1035 DOMAIN NAMES - IMPLEMENTATION AND SPECIFICATION
4.1.1. Header section format

5.51. Message compression

Purpose

Verify that a NUT understands receiving message that contain compression

- All programs are required to understand arriving messages that contain pointers.

Category

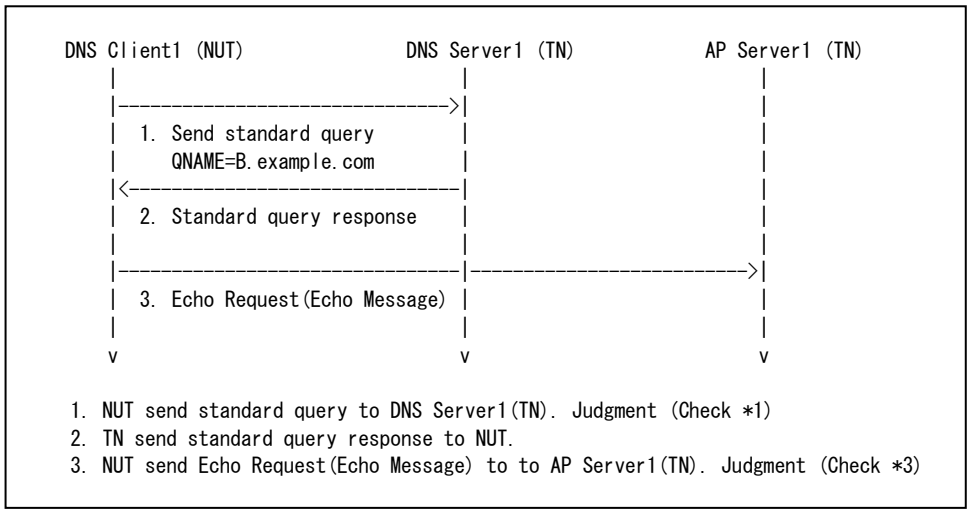
Client

Initialization

- **Network Topology**
  Refer the topology "Fig. 3 Topology No.3".
  AP server1 has a domain name "B.example.com".
- **Setup**
  Set the DNS Server1(TN)'s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for A type(IN class) of AP Server1(TN):B.example.com to the DNS Server1(TN), NUT send Echo Request(Echo Message) to AP Server1(TN):B.example.com.

Procedure

This test sequence is following.



Packet Description

1st Packet

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ

	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	B.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)

2nd packet.

2. Standard query response from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Same as 1st Packet's Src Port
DNS Header	ID	Same as 1st Packet's ID
	QR	1
	OPCODE	0
	AA	1
	TC	0
	RD	Same as 1st Packet's RD
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	1
	NSCOUNT	1
	ARCOUNT	1
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)
DNS Answer section	NAME	B.example.com (Pointer 0xC00C)

	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	4
	ADDRESS	192.168.1.60
DNS Authority section	NAME	example.com (Pointer 0xC00E)
	TYPE	NS (0x0002)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	6
	NSDNAME	NS1.example.com (NS1 + Pointer 0xC00E)
DNS Additional section	NAME	NS1.example.com (Pointer 0xC03B)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	4
	ADDRESS	192.168.1.20

3rd Packet

3. Standard Echo Request(Echo Message) from DNS Client1 (NUT) to AP Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	AP1_NETY
ICMP	Type	8(Echo Message for IPv4)/128(Echo Request for IPv6)

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Received standard query QNAME=B.example.com from NUT.
3. Received Echo Request(Echo Message) from NUT.

References

RFC1035 DOMAIN NAMES - IMPLEMENTATION AND SPECIFICATION
4.1.4. Message compression

5.52. Not depend on response in order

Purpose

Verify that a NUT doesn't depend on response in order

- Queries or their responses may be reordered by the network, or by processing in name servers, so resolvers should not depend on them being returned in order.

Category

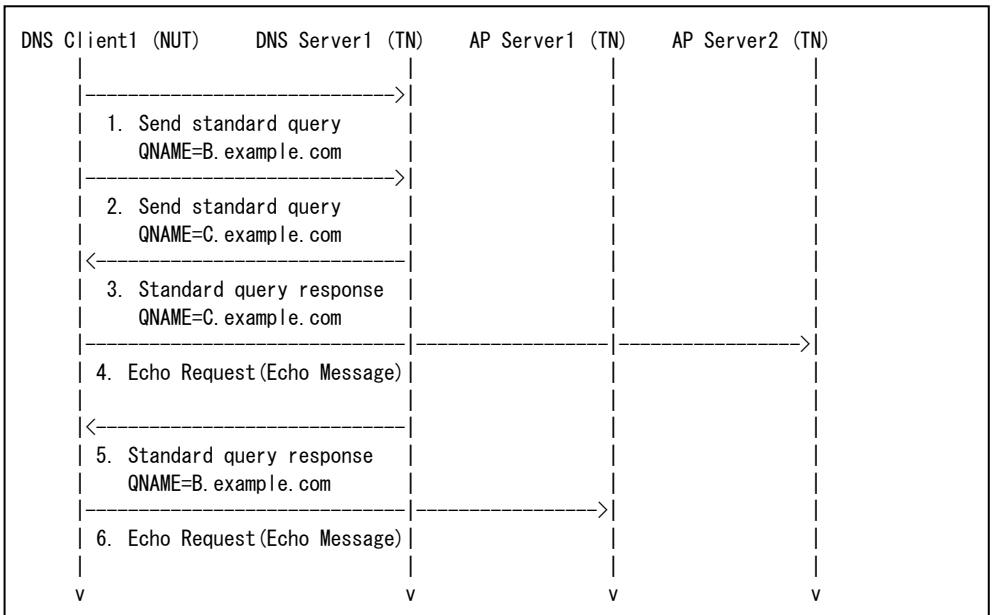
Client

Initialization

- **Network Topology**
  Refer the topology "Fig. 5 Topology No.5".
- **Setup**
  Set the DNS Server1(TN)'s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  1. In order to send the query for A type(IN class) of AP Server1 (TN):B.example.com to the DNS Server1(TN), NUT send Echo Request(Echo Message) to AP Server1(TN):B.example.com.
  2. In order to send the query for A type(IN class) of AP Server2 (TN):C.example.com to the DNS Server1(TN), NUT send Echo Request(Echo Message) to AP Server2(TN):C.example.com.

Procedure

This test sequence is following.



1. NUT send standard query QNAME=B.example.com to DNS Server1(TN). Judgment (Check *1)
2. NUT send standard query QNAME=C.example.com to DNS Server1(TN). Judgment (Check *2)
3. TN send standard query response QNAME=C.example.com to NUT.
4. NUT send Echo Request(Echo Message) to to AP Server2(TN). Judgment (Check *4)
5. TN send standard query response QNAME=B.example.com to NUT.
6. NUT send Echo Request(Echo Message) to to AP Server1(TN). Judgment (Check *6)

Packet Description

1st Packet

1. Standard query QNAME=B.example.com from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	B.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)

2nd packet.

2. Standard query QNAME=C.example.com from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any

DNS Question section	QNAME	C.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)

3rd packet.

3. Standard query response QNAME=C.example.com from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Same as 2nd Packet's Src Port
DNS Header	ID	Same as 2nd Packet's ID
	QR	1
	OPCODE	0
	AA	1
	TC	0
	RD	Same as 2nd Packet's RD
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	1
	NSCOUNT	1
	ARCOUNT	1
DNS Question section	QNAME	C.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)
DNS Answer section	NAME	B.example.com (Pointer 0xC00C)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	4
	ADDRESS	192.168.1.70
DNS Authority section	NAME	example.com (Pointer 0xC00E)
	TYPE	NS (0x0002)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	6
	NSDNAME	NS1.example.com (NS1 + Pointer 0xC00E)
DNS Additional section	NAME	NS1.example.com (Pointer 0xC03B)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	4

	ADDRESS	192.168.1.20

4th Packet

4. Standard Echo Request(Echo Message) from DNS Client1 (NUT) to AP Server2 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	AP2_NETY
ICMP	Type	8(Echo Message for IPv4)/128(Echo Request for IPv6)

5th packet.

5. Standard query response QNAME=B.example.com from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Same as 1st Packet's Src Port
DNS Header	ID	Same as 1st Packet's ID
	QR	1
	OPCODE	0
	AA	1
	TC	0
	RD	Same as 1st Packet's RD
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	1
	NSCOUNT	1
	ARCOUNT	1
DNS Question section	QNAME	B.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)
DNS Answer section	NAME	B.example.com (Pointer 0xC00C)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	4
	ADDRESS	192.168.1.60
DNS Authority section	NAME	example.com (Pointer 0xC00E)
	TYPE	NS (0x0002)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	6
	NSDNAME	NS1.example.com (NS1 + Pointer 0xC00E)
DNS Additional section	NAME	NS1.example.com (Pointer 0xC03B)

	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	4
	ADDRESS	192.168.1.20

6th Packet

6. Standard Echo Request(Echo Message) from DNS Client1 (NUT) to AP Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	AP1_NETY
ICMP	Type	8(Echo Message for IPv4)/128(Echo Request for IPv6

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Received standard query QNAME=B.example.com from NUT.
2. Received standard query QNAME=C.example.com from NUT.
4. Received Echo Request(Echo Message) from NUT.
6. Received Echo Request(Echo Message) from NUT.

References

RFC1035 DOMAIN NAMES - IMPLEMENTATION AND SPECIFICATION
4.2.1. UDP usage

5.53. Invalid response (query is returned)

Purpose

Verify that a NUT checks the header of response

- Check the header for reasonableness. Discard datagrams which are queries when responses are expected.

Category

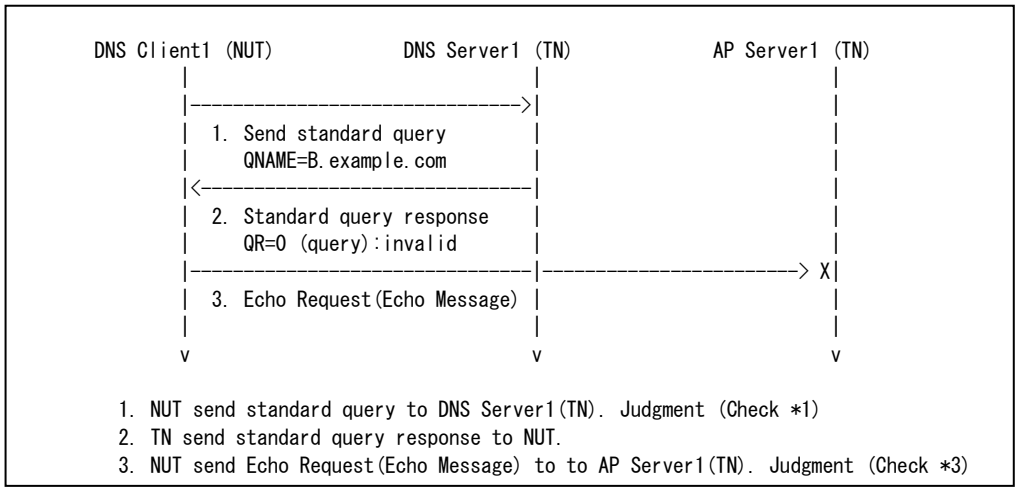
Client

Initialization

- **Network Topology**
  Refer the topology "Fig. 3 Topology No.3".
  AP server1 has a domain name "B.example.com".
- **Setup**
  Set the DNS Server1(TN)'s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for A type(IN class) of AP Server1 (TN):B.example.com to the DNS Server1(TN), NUT send Echo Request(Echo Message) to AP Server1(TN):B.example.com.

Procedure

This test sequence is following.



1. NUT send standard query to DNS Server1(TN). Judgment (Check *1)
2. TN send standard query response to NUT.
3. NUT send Echo Request(Echo Message) to to AP Server1(TN). Judgment (Check *3)

Packet Description

1st Packet

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	B.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)

2nd packet.

2. Standard query response from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Same as 1st Packet's Src Port
DNS Header	ID	Same as 1st Packet's ID
	QR	0
	OPCODE	0
	AA	1
	TC	0
	RD	Same as 1st Packet's RD
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	1
	NSCOUNT	1
	ARCOUNT	1

DNS Question section	QNAME	B.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)
DNS Answer section	NAME	B.example.com (Pointer 0xC00C)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	4
	ADDRESS	192.168.1.60
DNS Authority section	NAME	example.com (Pointer 0xC00E)
	TYPE	NS (0x0002)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	6
	NSDNAME	NS1.example.com (NS1 + Pointer 0xC00E)
DNS Additional section	NAME	NS1.example.com (Pointer 0xC03B)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	4
	ADDRESS	192.168.1.20

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Received standard query QNAME=B.example.com from NUT.
3. Not received Echo Request(Echo Message) from NUT.

References

RFC1035 DOMAIN NAMES - IMPLEMENTATION AND SPECIFICATION
7.3. Processing responses

5.54. Invalid response (RRs are incorrectly formatted)

Purpose

Verify that a NUT checks the RRs of response

- Parse the sections of the message, and insure that all RRs are correctly formatted.

Category

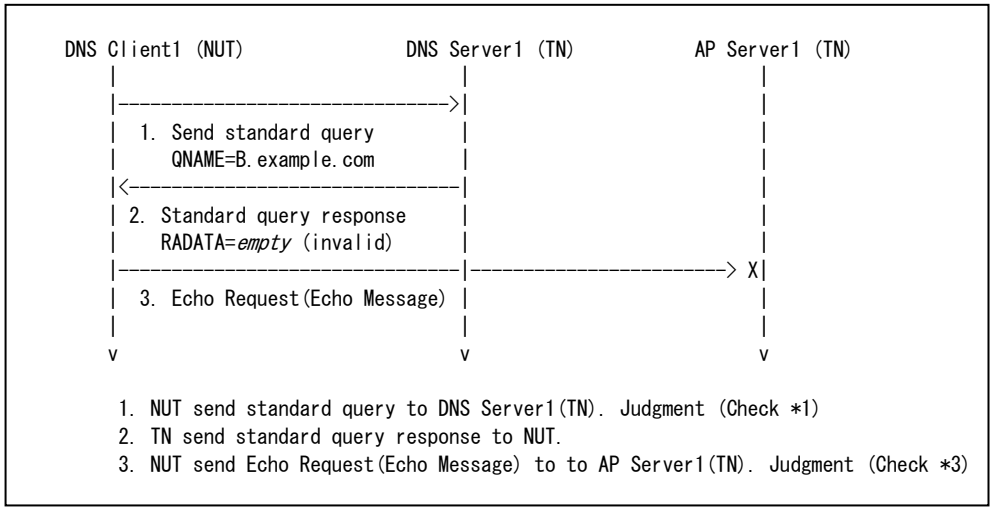
Client

Initialization

- **Network Topology**
  Refer the topology "Fig. 3 Topology No.3".
  AP server1 has a domain name "B.example.com".
- **Setup**
  Set the DNS Server1(TN)'s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for A type(IN class) of AP Server1 (TN):B.example.com to the DNS Server1(TN), NUT send Echo Request(Echo Message) to AP Server1(TN):B.example.com.

Procedure

This test sequence is following.



Packet Description

1st Packet

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	B.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)

2nd packet.

2. Standard query response from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Same as 1st Packet's Src Port
DNS Header	ID	Same as 1st Packet's ID
	QR	1
	OPCODE	0
	AA	1
	TC	0
	RD	Same as 1st Packet's RD
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	1
	NSCOUNT	1
	ARCOUNT	1

DNS Question section	QNAME	B.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)
DNS Answer section	NAME	B.example.com (Pointer 0xC00C)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	0
	ADDRESS	*empty*
DNS Authority section	NAME	example.com (Pointer 0xC00E)
	TYPE	NS (0x0002)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	6
	NSDNAME	NS1.example.com (NS1 + Pointer 0xC00E)
DNS Additional section	NAME	NS1.example.com (Pointer 0xC037)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	4
	ADDRESS	192.168.1.20

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Received standard query QNAME=B.example.com from NUT.
3. Not received Echo Request(Echo Message) from NUT.

References

RFC1035 DOMAIN NAMES - IMPLEMENTATION AND SPECIFICATION
7.3. Processing responses

5.55. Invalid response (Long TTL) (optional)

Purpose

Verify that a NUT checks the TTL of response

- As an optional step, check the TTLs of arriving data looking for RRs with excessively long TTLs. If a RR has an excessively long TTL, say greater than 1 week, either discard the whole response, or limit all TTLs in the response to 1 week.

Category

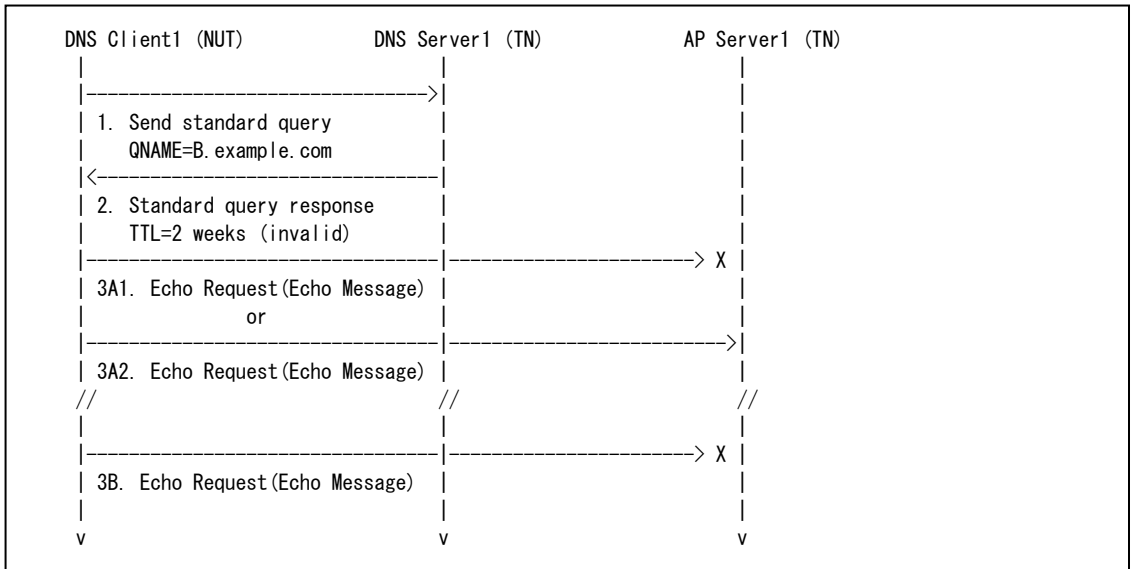
Client (Caching function might be necessary)

Initialization

- **Network Topology**
  Refer the topology "Fig. 3 Topology No.3".
  AP server1 has a domain name "B.example.com".
- **Setup**
  Set the DNS Server1(TN)'s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for A type(IN class) of AP Server1 (TN):B.example.com to the DNS Server1(TN), NUT send Echo Request(Echo Message) to AP Server1(TN):B.example.com.

Procedure

This test sequence is following.



1. NUT send standard query to DNS Server1(TN). Judgment (Check *1)
2. TN send standard query response to NUT.
3A1,3A2. NUT send Echo Request(Echo Message) to to AP Server1(TN). Judgment (Check *3A)
3B. *If TN receive Echo Request(Echo Message) from NUT at 3A(3A2), this sequence is run.
NUT send Echo Request(Echo Message) to to AP Server1(TN) after 1 week from 3A1 or 3A2. Judgment (Check *3B)

Packet Description

1st Packet

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	B.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)

2nd packet.

2. Standard query response from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Same as 1st Packet's Src Port
DNS Header	ID	Same as 1st Packet's ID
	QR	1
	OPCODE	0
	AA	1
	TC	0
	RD	Same as 1st Packet's RD
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	1
	NSCOUNT	1
	ARCOUNT	1

DNS Question section	QNAME	B.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)
DNS Answer section	NAME	B.example.com (Pointer 0xC00C)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	2 weeks (1209600)
	RDLENGTH	4
	ADDRESS	192.168.1.60
DNS Authority section	NAME	example.com (Pointer 0xC00E)
	TYPE	NS (0x0002)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	6
	NSDNAME	NS1.example.com (NS1 + Pointer 0xC00E)
DNS Additional section	NAME	NS1.example.com (Pointer 0xC03B)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	4
	ADDRESS	192.168.1.20

3rd Packet(3A2)

3. Standard Echo Request(Echo Message) from DNS Client1 (NUT) to AP Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	AP1_NETY
ICMP	Type	8(Echo Message for IPv4)/128(Echo Request for IPv6)

- **Termination**

  If NUT has cache function, clear the cache.

Judgment

1. Received standard query QNAME=B.example.com from NUT.
3A1. Not received Echo Request(Echo Message) from NUT.
3A2. Received Echo Request(Echo Message) from NUT.
*3A1 or 3A2 is judged. If 3A2 is observed, 3B is judged.
3B. Not received Echo Request(Echo Message) from NUT.

References

RFC1035 DOMAIN NAMES - IMPLEMENTATION AND SPECIFICATION
7.3. Processing responses

5.56. Invalid response (ID does not match)

Purpose

Verify that a NUT checks the ID of response

- The recommended strategy is to do a preliminary matching using the ID field in the domain header, and then to verify that the question section corresponds to the information currently desired.

Category

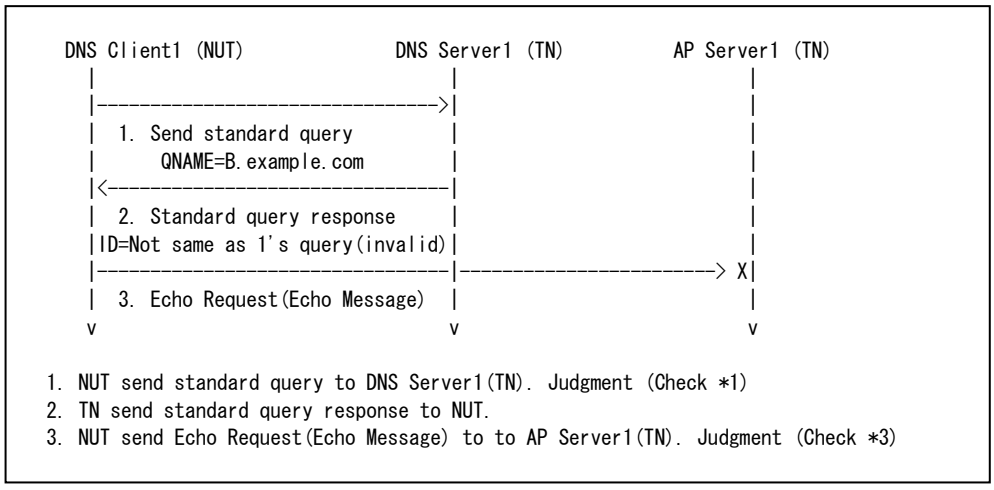
Client

Initialization

- **Network Topology**
  Refer the topology "Fig. 3 Topology No.3".
  AP server1 has a domain name "B.example.com".
- **Setup**
  Set the DNS Server1(TN)' s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for A type(IN class) of AP Server1(TN): B.example.com to the DNS Server1(TN), NUT send Echo Request(Echo Message) to AP Server1(TN):B.example.com.

Procedure

This test sequence is following.



1. NUT send standard query to DNS Server1(TN). Judgment (Check *1)
2. TN send standard query response to NUT.
3. NUT send Echo Request(Echo Message) to to AP Server1(TN). Judgment (Check *3)

Packet Description

1st Packet

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	B.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)

2nd packet.

2. Standard query response from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Same as 1st Packet's Src Port
DNS Header	ID	0xffff (Not same as 1st Packet's ID)
	QR	1
	OPCODE	0
	AA	1
	TC	0
	RD	Same as 1st Packet's RD
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	1
	NSCOUNT	1
	ARCOUNT	1

DNS Question section	QNAME	B.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)
DNS Answer section	NAME	B.example.com (Pointer 0xC00C)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	4
	ADDRESS	192.168.1.60
DNS Authority section	NAME	example.com (Pointer 0xC00E)
	TYPE	NS (0x0002)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	6
	NSDNAME	NS1.example.com (NS1 + Pointer 0xC00E)
DNS Additional section	NAME	NS1.example.com (Pointer 0xC03B)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	4
	ADDRESS	192.168.1.20

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Received standard query QNAME=B.example.com from NUT.
3. Not received Echo Request(Echo Message) from NUT.

References

RFC1035 DOMAIN NAMES - IMPLEMENTATION AND SPECIFICATION
7.3. Processing responses

5.57. Invalid response (invalid question section)

Purpose

Verify that a NUT checks the Question section of response

- The recommended strategy is to do a preliminary matching using the ID field in the domain header, and then to verify that the question section corresponds to the information currently desired.

Category

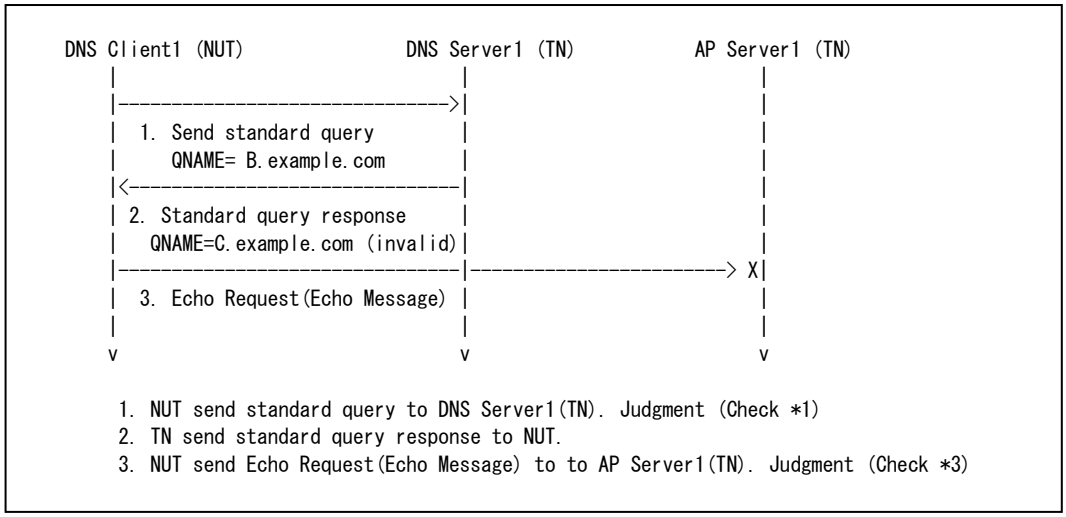
Client

Initialization

- **Network Topology**
  Refer the topology "Fig. 3 Topology No.3".
  AP server1 has a domain name "B.example.com".
- **Setup**
  Set the DNS Server1(TN)' s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for A type(IN class) of AP Server1 (TN): B.example.com to the DNS Server1(TN), NUT send Echo Request(Echo Message) to AP Server1(TN):B.example.com.

Procedure

This test sequence is following.



Packet Description

1st Packet

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	B.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)

2nd packet.

2. Standard query response from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Same as 1st Packet's Src Port
DNS Header	ID	Same as 1st Packet's ID
	QR	1
	OPCODE	0
	AA	1
	TC	0
	RD	Same as 1st Packet's RD
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	1
	NSCOUNT	1
	ARCOUNT	1

DNS Question section	QNAME	C.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)
DNS Answer section	NAME	C.example.com (Pointer 0xC00C)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	4
	ADDRESS	192.168.1.60
DNS Authority section	NAME	example.com (Pointer 0xC00E)
	TYPE	NS (0x0002)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	6
	NSDNAME	NS1.example.com (NS1 + Pointer 0xC00E)
DNS Additional section	NAME	NS1.example.com (Pointer 0xC03B)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	4
	ADDRESS	192.168.1.20

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Received standard query QNAME=B.example.com from NUT.
3. Not received Echo Request(Echo Message) from NUT.

References

RFC1035 DOMAIN NAMES - IMPLEMENTATION AND SPECIFICATION
7.3. Processing responses

5.58. Caching several RRs of same type

Purpose

Verify that a NUT uses the cached data

- When several RRs of the same type are available for a particular owner name, the resolver should either cache them all or none at all.

Category

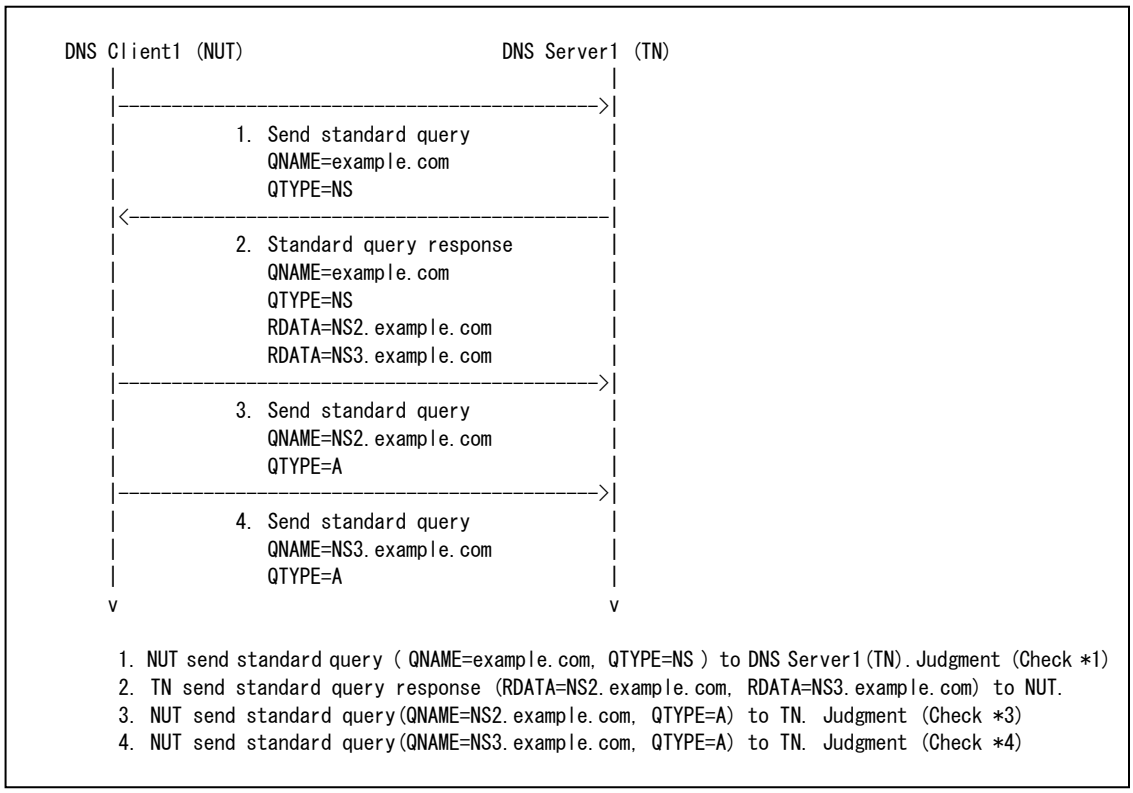
Client (with Caching function)

Initialization

- **Network Topology**
  Refer the topology "Fig. 4 Topology No.4".
- **Setup**
  Set the DNS Server1(TN)' s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for NS type(IN class) of example.com to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1st Packet

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	example.com
	QTYPE	NS (0x0002)
	QCLASS	IN (0x0001)

2nd packet.

2. Standard query response from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Same as 1st Packet's Src Port
DNS Header	ID	Same as 1st Packet's ID
	QR	1
	OPCODE	0
	AA	1
	TC	0
	RD	Same as 1st Packet's RD
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	2
	NSCOUNT	2
	ARCOUNT	2

DNS Question section	QNAME	example.com
	QTYPE	NS (0x0002)
	QCLASS	IN (0x0001)
DNS Answer section	NAME	example.com (Pointer 0xC00C)
	TYPE	NS (0x0002)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	6
	NSDNAME	NS2.example.com (NS2 + Pointer 0xC00C)
DNS Answer section	NAME	example.com (Pointer 0xC00C)
	TYPE	NS (0x0002)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	6
	NSDNAME	NS3.example.com (NS3 + Pointer 0xC00C)
DNS Authority section	NAME	example.com (Pointer 0xC00C)
	TYPE	NS (0x0002)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	6
	NSDNAME	NS2.example.com (Pointer 0xC029)
DNS Authority section	NAME	example.com (Pointer 0xC00C)
	TYPE	NS (0x0002)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	6
	NSDNAME	NS3.example.com (Pointer 0xC03B)
DNS Additional section	NAME	NS2.example.com (Pointer 0xC029)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	4
	ADDRESS	192.168.1.30
DNS Additional section	NAME	NS3.example.com (Pointer 0xC03B)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	4
	ADDRESS	192.168.1.40

3rd Packet

3. Standard query from DNS Client1 (NUT) to TN		
IP Header	Source Address	NUT_NETZ

	Destination Address	SV1_NETY or SV2_NETY or SV3_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	NS2.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)

4th Packet

4. Standard query from DNS Client1 (NUT) to TN		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY or SV2_NETY or SV3_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	NS3.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Received standard query QNAME=example.com from NUT.
3. Received standard query QNAME=NS2.example.com from NUT.
4. Received standard query QNAME=NS3.example.com from NUT.

or

3. Not received standard query QNAME=NS2.example.com from NUT.
4. Not received standard query QNAME=NS3.example.com from NUT.

References

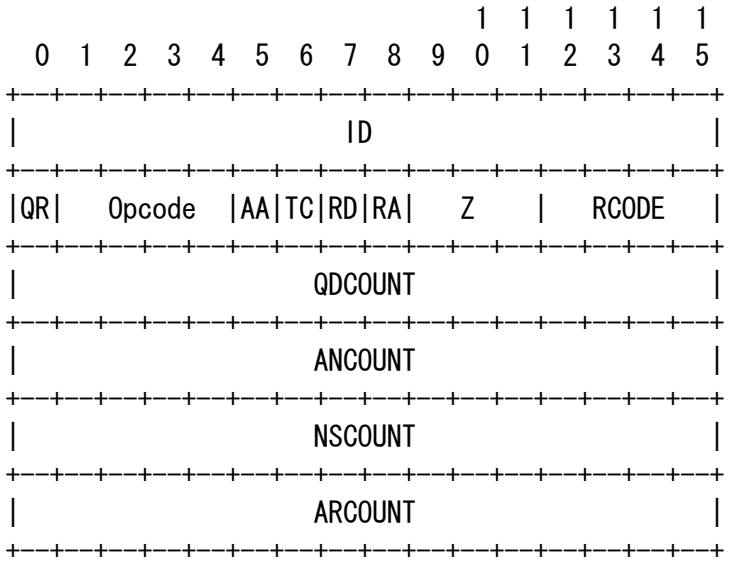
RFC1035 DOMAIN NAMES - IMPLEMENTATION AND SPECIFICATION
7.4. Using the cache

5.59. Unused fields in a query

Purpose

Verify that a NUT transmits correct standard query format for unused fields

- Header section format



AA	Must be zero (0)
RA	Must be zero (0)
Z	Must be zero (0)
RCODE	Must be zero (0)

Category

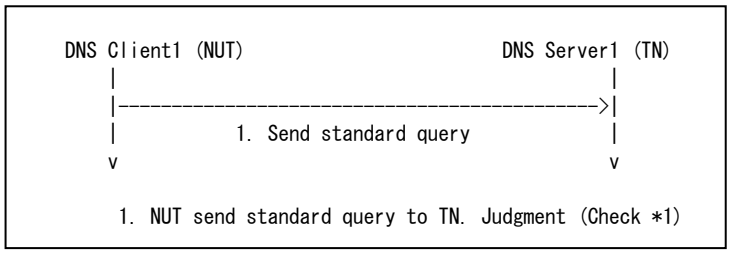
Client

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "A.example.com".
- **Setup**
  Set the DNS Server1(TN)' s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for A type of AP Server1(TN):
  A.example.com to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	*any*
	OPCODE	*any*
	AA	0
	TC	*any*
	RD	*any*
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	*any*
	ANCOUNT	*any*
	NSCOUNT	*any*
	ARCOUNT	*any*
DNS Question section	QNAME	*any*
	QTYPE	*any*
	QCLASS	*any*

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Standard query for A type must be base on above Verification Points.

References

RFC1123 Requirements for Internet Hosts -- Application and Support
6.1.2.3 Unused Fields: RFC-1035 Section 4.1.1

5.60. Multiplex concurrent requests

Purpose

Verify that a NUT supports multiplex concurrent requests

- A name resolver SHOULD be able to multiplex concurrent requests if the host supports concurrent processes.

Category

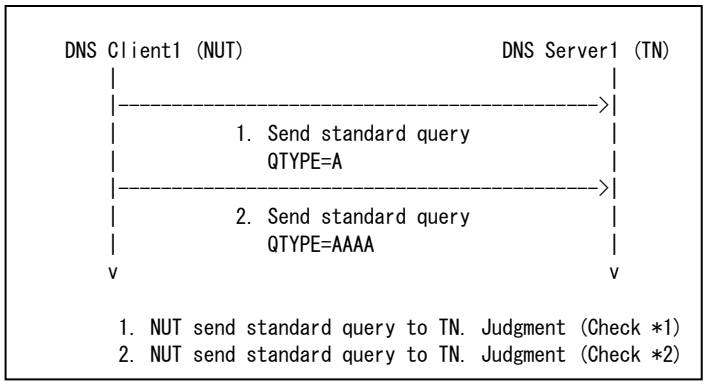
Client

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "A.example.com".
- **Setup**
  Set the DNS Server1(TN)' s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for A type of AP Server1(TN): A.example.com to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1st Packet

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*

	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	*any*

2nd Packet

2. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	A.example.com
	QTYPE	AAAA (0x001C)
	QCLASS	*any*

- **Termination**

  If NUT has cache function, clear the cache.

Judgment

1. Received standard query QNAME=A.example.com QTYPE=A from NUT.
2. Received standard query QNAME=A.example.com QTYPE=AAAA from NUT.

References

RFC1123 Requirements for Internet Hosts -- Application and Support
6.1.3.1 Resolver Implementation

5.61. Time out of cache

Purpose

Verify that a NUT has time out information in the cache

- The resolver MUST implement a local caching function to avoid repeated remote access for identical requests, and MUST time out information in the cache.

Category

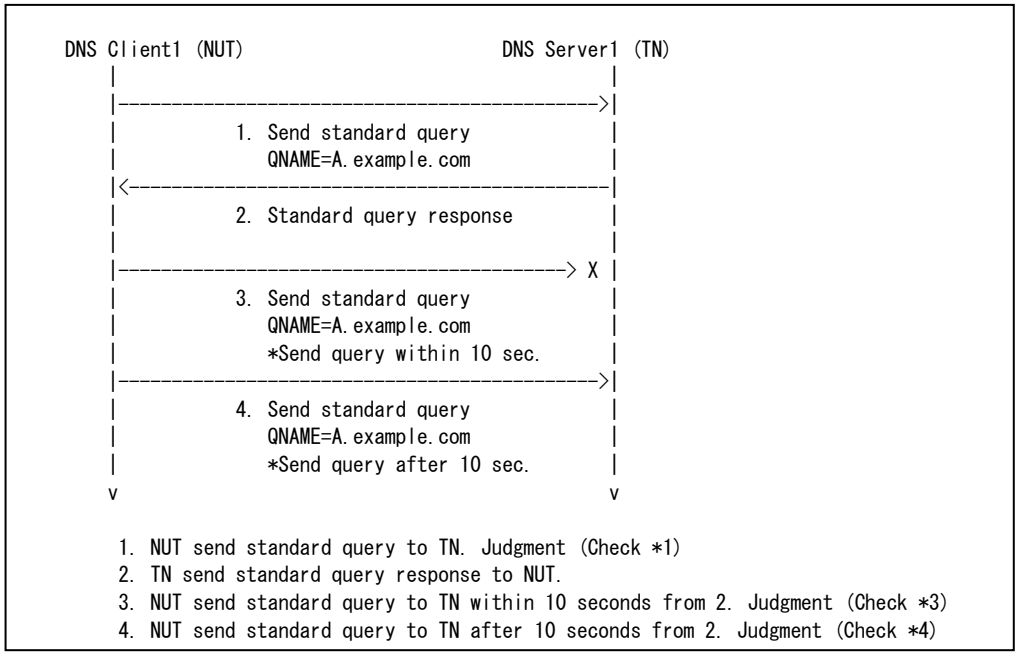
Client (with Caching function)

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "A.example.com".
- **Setup**
  Set the DNS Server1(TN)' s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for A type(IN class) of AP Server1(TN): A.example.com to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1st Packet

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)

2nd packet.

2. Standard query response from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Same as 1st Packet's Src Port
DNS Header	ID	Same as 1st Packet's ID
	QR	1
	OPCODE	0
	AA	1
	TC	0
	RD	Same as 1st Packet's RD
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	1
	NSCOUNT	1
	ARCOUNT	1

DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)
DNS Answer section	NAME	A.example.com (Pointer 0xC00C)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	10 seconds (10)
	RDLENGTH	4
	ADDRESS	192.168.1.10
DNS Authority section	NAME	example.com (Pointer 0xC00E)
	TYPE	NS (0x0002)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	6
	NSDNAME	NS1.example.com (NS1 + Pointer 0xC00E)
DNS Additional section	NAME	NS1.example.com (Pointer 0xC03B)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	4
	ADDRESS	192.168.1.20

4th Packet

4. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)

	QCLASS	IN (0x0001)

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Received standard query QNAME=A.example.com from NUT.
3. Not received standard query QNAME=A.example.com from NUT.
4. Received standard query QNAME=A.example.com from NUT.

References

RFC1123 Requirements for Internet Hosts - Application and Support
6.2.3.1 Resolver Implementation

5.62. Caching truncated responses

Purpose

Verify that a NUT must not cache truncated response

- Truncated responses MUST NOT be saved (cached) and later used in such a way that the fact that they are truncated is lost.
- When a response is truncated, and a resolver doesn't know whether it has a complete set, it should not cache a possibly partial set of RRs.

Category

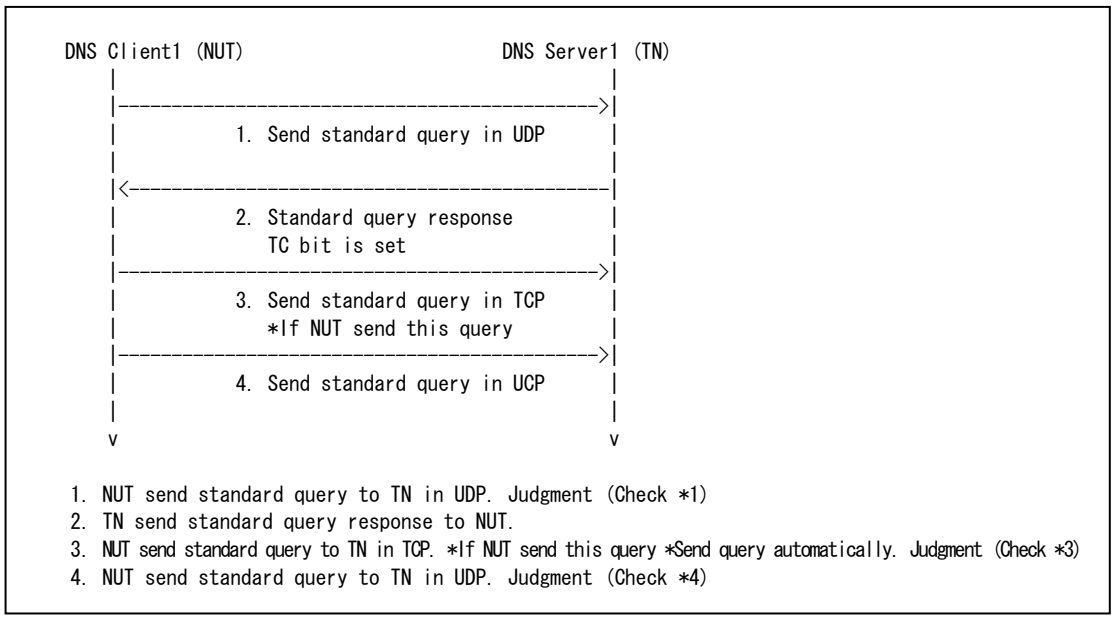
Client (with Caching function)

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "A.example.com".
- **Setup**
  Set the DNS Server1(TN)' s address to NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for A type of AP Server1(TN):
  A.example.com to the DNS Server1(TN) in TCP, NUT is configured.

Procedure

This test sequence is following.



Packet Description

1st Packet

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN) in UDP		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	*any*

2nd packet.

2. Standard query response from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Same as 1st Packet's Src Port
DNS Header	ID	Same as 1st Packet's ID
	QR	1
	OPCODE	0
	AA	1
	TC	1
	RD	Same as 1st Packet's RD
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	27
	NSCOUNT	0
	ARCOUNT	0

DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)
DNS Answer section	NAME	A.example.com (Pointer 0xC00C)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	4
	ADDRESS	192.168.1.100
DNS Answer section X 25 ADDRESS 192.168.1.101 - 192.168.1.125	NAME	A.example.com (Pointer 0xC00C)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	4
	ADDRESS	****
DNS Answer section	NAME	A.example.com (Pointer 0xC00C)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	4
	ADDRESS	192.168.1.126

1st session

3. Standard query from DNS Client1 (NUT) to DNS Server1 (TN) in TCP		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
TCP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)

	QCLASS	*any*

4th Packet

4. Standard query from DNS Client1 (NUT) to DNS Server1 (TN) in UDP		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	*any*

- **Termination**

  If NUT has cache function, clear the cache.

Judgment

1. Received standard query from NUT in UDP.
3. Received standard query from NUT in TCP. *If NUT send this query.
5. Received standard query from NUT in TCP.

References

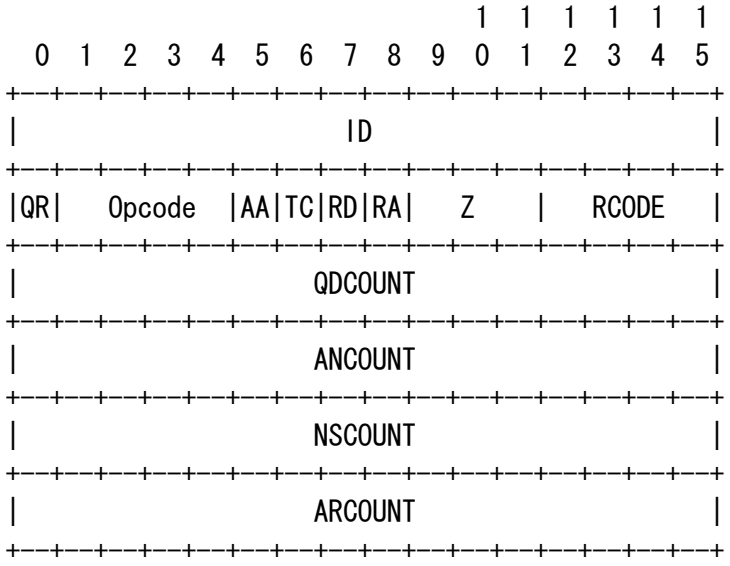
RFC1035 DOMAIN NAMES - CONCEPTS AND FACILITIES
  7.4 Using the cache
RFC1123 Requirements for internet Hosts -- Application and Support
  6.1.3.2 Transport Protocols

5.63. Multicast query

Purpose

Verify that a NUT transmits correct UDP query with broadcast or multicast address

- A server MAY support a UDP query that is delivered using an IP broadcast or multicast address. However, the Recursion Desired bit MUST NOT be set in a query that is multicast, and MUST be ignored by name servers receiving queries via a broadcast or multicast address. A host that sends broadcast or multicast DNS queries SHOULD send them only as occasional probes, caching the IP address(es) it obtains from the response(s) so it can normally send unicast queries.
- Header section format



QR	query (0)
Opcode	a standard query(QUERY) (0)
RD	Must be zero
QDCOUNT	1
ANCOUNT	0
NSCOUNT	0

Category

Client

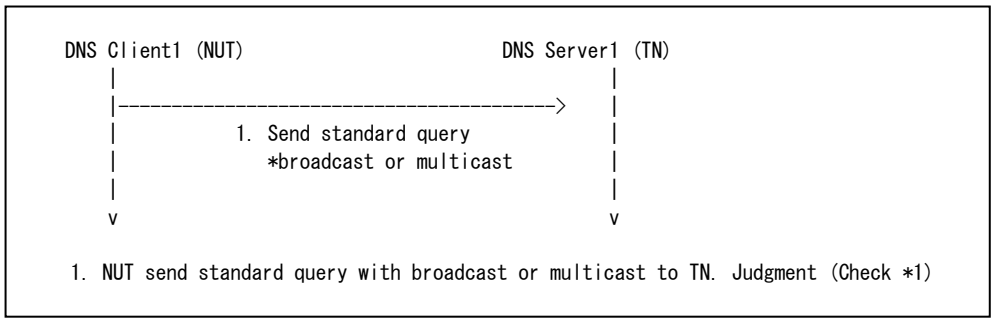
Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "A.example.com".
- **Setup**
  Set the DNS Server1(TN)' s address on NUT as above mentioned Network Topology.

- **Pre-Sequence**
  In order to send the query for A type of AP Server1(TN): A.example.com to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	BRO_MULTI
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	0
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	*any*

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Standard query for broadcast or multicast must be base on above Verification Points.

References

RFC1123 Requirements for internet Hosts -- Application and Support
6.1.3.2 Transport Protocols

5.64. Retransmission control

Purpose

Verify that a NUT implements retransmission controls

- The resolver MUST implement retransmission controls to insure that it does not waste communication bandwidth, and MUST impose finite bounds on the resources consumed to respond to a single request.
- While local limits on the number of times a resolver will retransmit a particular query to a particular name server address are essential, the resolver should have a global per-request counter to limit work on a single request.

Category

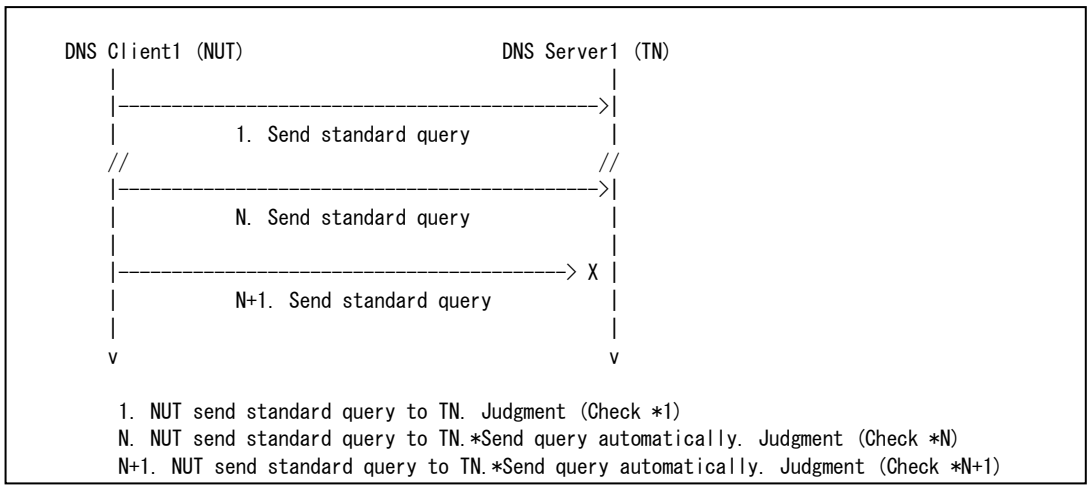
Client

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "A.example.com".
- **Setup**
  Set the DNS Server1(TN)' s address on NUT as above mentioned Network Topology.
  Set the limit of retransmission query on NUT(This limitation is assumed to be "N").
- **Pre-Sequence**
  In order to send the query for A type of AP Server1(TN):
  A.example.com to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1st to N th Packet

Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	BRO_MULTI
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	0
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	*any*

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Received standard query from NUT.
N. Received standard query from NUT.
N+1. Not received standard query from NUT.

References

RFC1035 DOMAIN NAMES - IMPLEMENTATION AND SPECIFICATION
  7.1. Transforming a user request into a query
RFC1123 Requirements for internet Hosts -- Application and Support
  6.1.3.3 Efficient Resource Usage

5.65. Caching of temporary failure

Purpose

Verify that a NUT caches of temporary failure

- All DNS name servers and resolvers SHOULD cache temporary failures, with a timeout period of the order of minutes.

Category

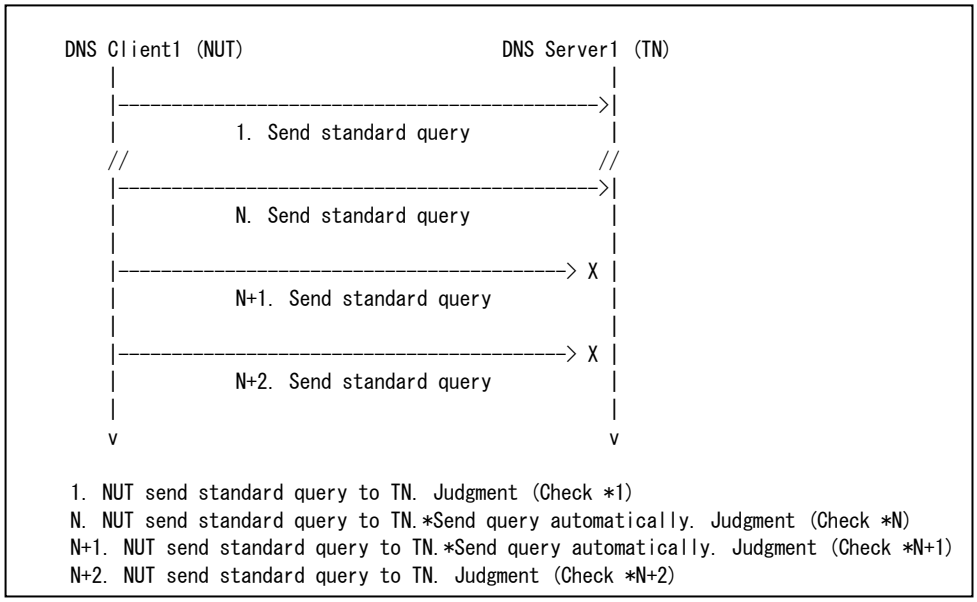
Client (with caching function)

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "A.example.com".
- **Setup**
  Set the DNS Server1(TN)' s address on NUT as above mentioned Network Topology.
  Set the limit of retransmission query on NUT (This limitation is assumed to be "N").
- **Pre-Sequence**
  In order to send the query for A type of AP Server1(TN):
  A.example.com to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1st to N th Packet

Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	BRO_MULTI
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	0
	RA	*any*
	Z	0
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	0
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	*any*

- **Termination**

  If NUT has cache function, clear the cache.

Judgment

1. Received standard query from NUT.
2. Received standard query from NUT.

N. Received standard query from NUT.

N+1. Not received standard query from NUT.

N+2. Not received standard query from NUT.

References

RFC1123 Requirements for internet Hosts -- Application and Support
6.1.3.3 Efficient Resource Usage

5.66. Differing TTLs from non-authoritative source

Purpose

Verify that a NUT treats as an error, when receive response containing RRs from an RRSet with differing TTLs from a non-authoritative source.

- Should a client receive a response containing RRs from an RRSet with differing TTLs, it should treat this as an error. If the RRSet concerned is from a non-authoritative source for this data, the client should simply ignore the RRSet, and if the values were required, seek to acquire them from an authoritative source. Clients that are configured to send all queries to one, or more, particular servers should treat those servers as authoritative for this purpose.

Category

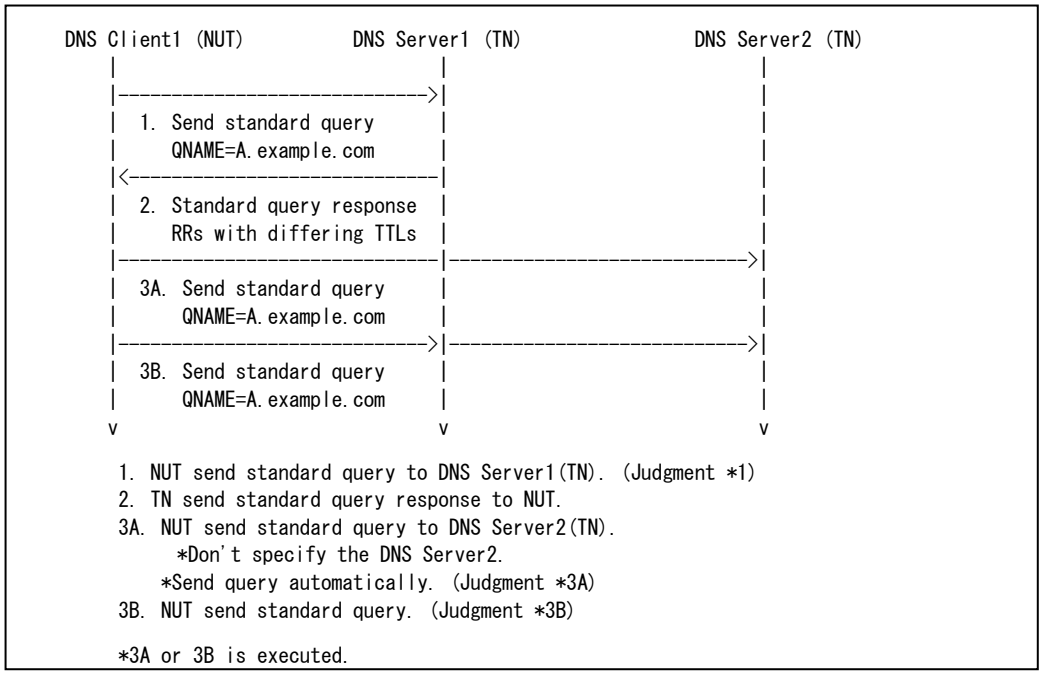
Client (with Caching function)

Initialization

- **Network Topology**
  Refer the topology "Fig. 2 Toplogy No.2".
- **Setup**
  Set the DNS Server1(TN) address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for A type(IN class) of AP Server1(TN): A.example.com to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1st Packet

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)

2nd packet.

2. Standard query response from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Same as 1st Packet's Src Port
DNS Header	ID	Same as 1st Packet's ID
	QR	1
	OPCODE	0
	AA	0
	TC	0
	RD	Same as 1st Packet's RD
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	2
	NSCOUNT	1
	ARCOUNT	1

DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)
DNS Answer section	NAME	A.example.com (Pointer 0xC00C)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	4
	ADDRESS	192.168.1.10
DNS Answer section	NAME	A.example.com (Pointer 0xC00C)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	2 day (172800)
	RDLENGTH	4
	ADDRESS	192.168.1.11
DNS Authority section	NAME	example.com (Pointer 0xC00E)
	TYPE	NS (0x0002)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	6
	NSDNAME	NS2.example.com (NS2 + Pointer 0xC00E)
DNS Additional section	NAME	NS2.example.com (Pointer 0xC04B)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	4
	ADDRESS	192.168.1.30

3rd packet.

3A. Standard query from DNS Client1 (NUT) to DNS Server2 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV2_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*

	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Received standard query QNAME=A.example.com from NUT to Server1(TN).
3A. Received standard query QNAME=A.example.com from NUT to Server2(TN).
3B. Received standard query QNAME=A.example.com from NUT to Server1(TN) or Server2(TN).
*3A or 3B is judged.

References

RFC2181 Clarifications to the DNS Specification
5.2. TTLs of RRs in an RRSet

5.67. Differing TTLs from authoritative source

Purpose

Verify that a NUT uses the value of the lowest TTL in the RRSet, when receive response containing RRs from an RRSet with differing TTLs from a authoritative source.

- Should an authoritative source send such a malformed RRSet, the client should treat the RRs for all purposes as if all TTLs in the RRSet had been set to the value of the lowest TTL in the RRSet.

Category

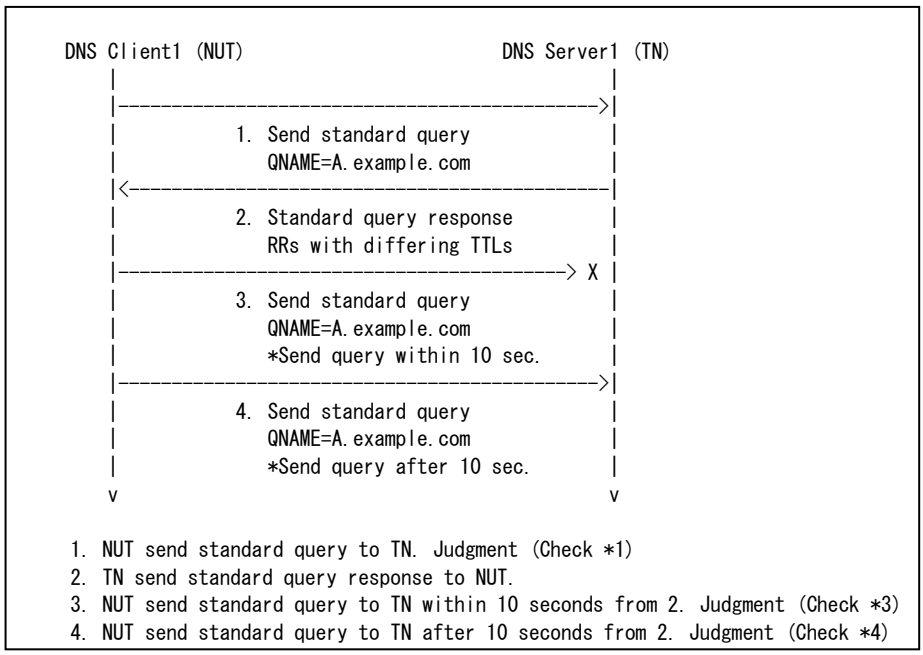
Client (with Caching function)

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "A.example.com".
- **Setup**
  Set the DNS Server1(TN)' s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for A type(IN class) of AP Server1(TN): A.example.com to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1st Packet

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)

2nd packet.

2. Standard query response from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Same as 1st Packet's Src Port
DNS Header	ID	Same as 1st Packet's ID
	QR	1
	OPCODE	0
	AA	1
	TC	0
	RD	Same as 1st Packet's RD
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	1
	NSCOUNT	1
	ARCOUNT	1

DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)
DNS Answer section	NAME	A.example.com (Pointer 0xC00C)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	10 seconds (10)
	RDLENGTH	4
	ADDRESS	192.168.1.10
DNS Answer section	NAME	A.example.com (Pointer 0xC00C)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	4
	ADDRESS	192.168.1.11
DNS Authority section	NAME	example.com (Pointer 0xC00E)
	TYPE	NS (0x0002)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	6
	NSDNAME	NS1.example.com (NS1 + Pointer 0xC00E)
DNS Additional section	NAME	NS1.example.com (Pointer 0xC04B)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	4
	ADDRESS	192.168.1.20

4th Packet

4. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*

	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Received standard query QNAME=A.example.com from NUT.
3. Not received standard query QNAME=A.example.com from NUT.
4. Received standard query QNAME=A.example.com from NUT.

References

RFC2181 Clarifications to the DNS Specification
5.2. TTLs of RRs in an RRSet

5.68. Received with most significant bit is set

Purpose

Verify that a NUT treats TTL value with most significant bit is set as zero

- Implementations should treat TTL values received with the most significant bit set as if the entire value received was zero.

Category

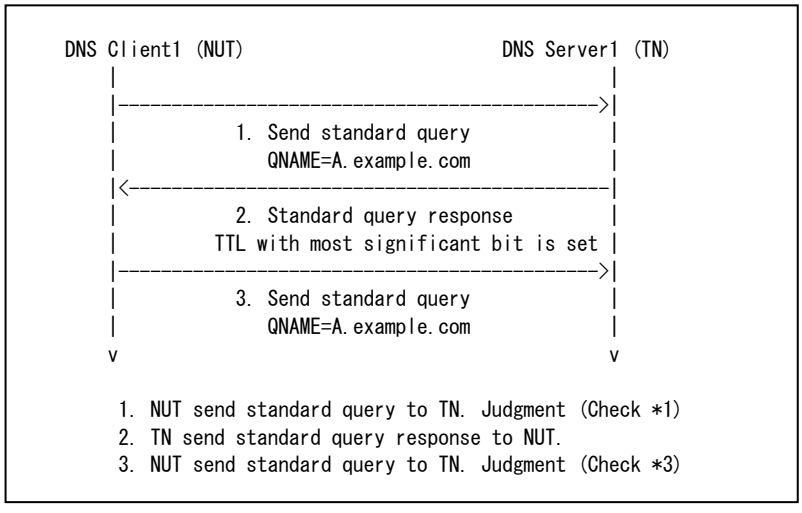
Client (with Caching function)

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "A.example.com".
- **Setup**
  Set the DNS Server1(TN)' s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for A type(IN class) of AP Server1(TN): A.example.com to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1st Packet

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY

UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)

2nd packet

2. Standard query response from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Same as 1st Packet's Src Port
DNS Header	ID	Same as 1st Packet's ID
	QR	1
	OPCODE	0
	AA	1
	TC	0
	RD	Same as 1st Packet's RD
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	1
	NSCOUNT	1
	ARCOUNT	1
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)
DNS Answer section	NAME	A.example.com (Pointer 0xC00C)
	TYPE	A (0x0001)

	CLASS	IN (0x0001)
	TTL	0x80015180
	RDLENGTH	4
	ADDRESS	192.168.1.10
DNS Authority section	NAME	example.com (Pointer 0xC00E)
	TYPE	NS (0x0002)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	6
	NSDNAME	NS1.example.com (NS1 + Pointer 0xC00E)
DNS Additional section	NAME	NS1.example.com (Pointer 0xC03B)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	4
	ADDRESS	192.168.1.20

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Received standard query QNAME=A.example.com from NUT.
3. Received standard query QNAME=A.example.com from NUT.

References

RFC2181 Clarifications to the DNS Specification
8. Time to Live(TTL)

5.69. Caching of name error (NXDOMAIN)

Purpose

Verify that a NUT caches negative answer that resulted from a name error (NXDOMAIN)

- A negative answer that resulted from a name error (NXDOMAIN) should be cached such that it can be retrieved and returned in response to another query for the same "QNAME, QCLASS" that resulted in the cached negative response.

Category

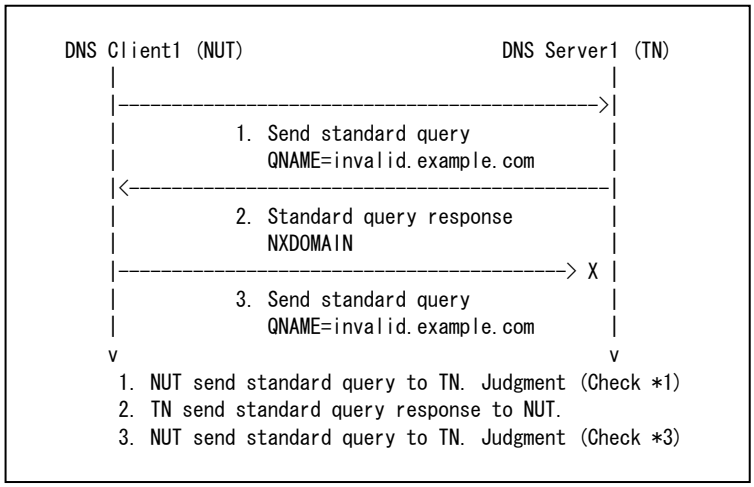
Client (with Caching function)

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "A.example.com".
- **Setup**
  Set the DNS Server1(TN)' s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for A type(IN class) of invalid.example.com to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1st Packet

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY

UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	invalid.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)

2nd packet.

2. Standard query response from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Same as 1st Packet's Src Port
DNS Header	ID	Same as 1st Packet's ID
	QR	1
	OPCODE	0
	AA	1
	TC	0
	RD	Same as 1st Packet's RD
	RA	0
	Z	0
	RCODE	3
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	1
	ARCOUNT	0
DNS Question section	QNAME	invalid.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)
DNS Authority section	NAME	example.com (Pointer 0xC014)
	TYPE	SOA (0x0006)

	CLASS	IN (0x0001)
	TTL	1 hour (3600)
	RDLENGTH	33
	MNAME	NS1.example.com (NS1 + Pointer 0xC014)
	RNAME	root.example.com (root + Pointer 0xC014)
	SERIAL	2005080300
	REFRESH	1 hour
	RETRY	15 minutes
	EXPIRE	1 week
	MINIMUM	1 hour (3600)

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Received standard query QNAME=invalid.example.com from NUT.
3. Not received standard query QNAME=invalid.example.com from NUT.

References

RFC2308 Negative Caching of DNS Queries (DNS NCACHE)
5 - Caching Negative Answers

5.70. TTL expired negative cache MUST NOT be used (NXDOMAIN)

Purpose

Verify that a NUT does not use the TTL expired negative cache.

- This TTL decrements in a similar manner to a normal cached answer and upon reaching zero (0) indicates the cached negative answer MUST NOT be used again.

Category

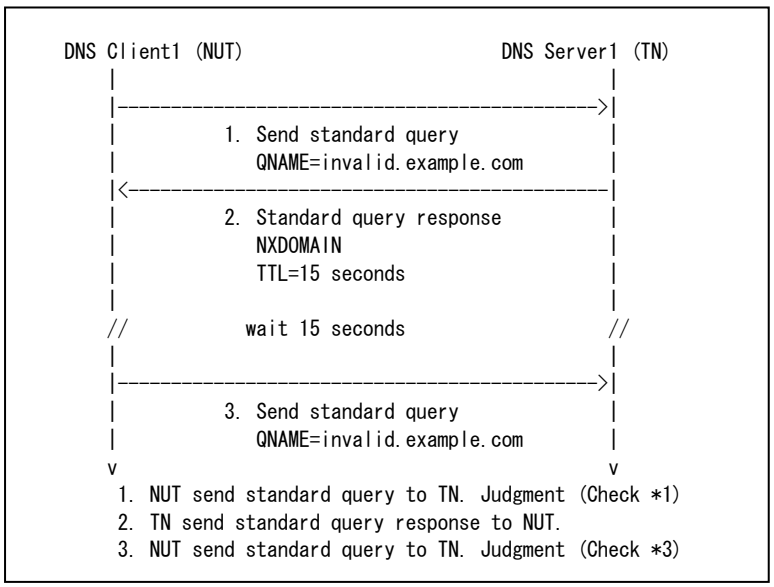
Client (with Caching function)

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "A.example.com".
- **Setup**
  Set the DNS Server1(TN)' s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for A type(IN class) of invalid.example.com to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1st Packet

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	invalid.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)

2nd packet.

2. Standard query response from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Same as 1st Packet's Src Port
DNS Header	ID	Same as 1st Packet's ID
	QR	1
	OPCODE	0
	AA	1
	TC	0
	RD	Same as 1st Packet's RD
	RA	0
	Z	0
	RCODE	3
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	1
	ARCOUNT	0

DNS Question section	QNAME	invalid.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)
DNS Authority section	NAME	example.com (Pointer 0xC014)
	TYPE	SOA (0x0006)
	CLASS	IN (0x0001)
	TTL	15
	RDLENGTH	33
	MNAME	NS1.example.com (NS1 + Pointer 0xC014)
	RNAME	root.example.com (root + Pointer 0xC014)
	SERIAL	2005080300
	REFRESH	1 hour
	RETRY	15 minutes
	EXPIRE	1 week
	MINIMUM	15

3rd Packet

4. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	*any*
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	*any*
DNS Question section	QNAME	invalid.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)

- **Termination**

  If NUT has cache function, clear the cache.

Judgment

1. Received standard query QNAME=invalid.example.com from NUT.
3. Received standard query QNAME=invalid.example.com from NUT.

References

RFC2308 Negative Caching of DNS Queries (DNS NCACHE)
5 - Caching Negative Answers

5.71. Caching of name error (NXDOMAIN) for query tuple

Purpose

Verify that a NUT caches negative answer that resulted from a name error (NXDOMAIN) for query tuple.

- A negative answer that resulted from a name error (NXDOMAIN) should be cached such that it can be retrieved and returned in response to another query for the same "QNAME, QCLASS" that resulted in the cached negative response.

Category

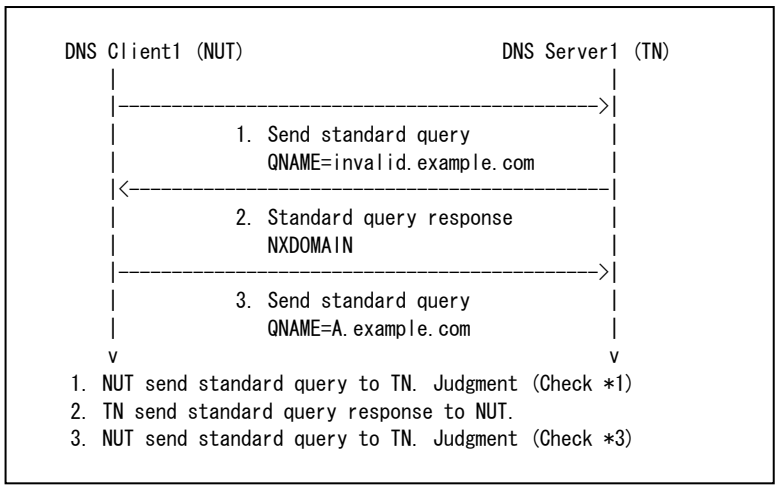
Client (with Caching function)

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "A.example.com".
- **Setup**
  Set the DNS Server1(TN)' s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for A type(IN class) of invalid.example.com to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1st Packet

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	invalid.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)

2nd packet.

2. Standard query response from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Same as 1st Packet's Src Port
DNS Header	ID	Same as 1st Packet's ID
	QR	1
	OPCODE	0
	AA	1
	TC	0
	RD	Same as 1st Packet's RD
	RA	0
	Z	0
	RCODE	3
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	1
	ARCOUNT	0

DNS Question section	QNAME	invalid.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)
DNS Authority section	NAME	example.com (Pointer 0xC014)
	TYPE	SOA (0x0006)
	CLASS	IN (0x0001)
	TTL	1 hour (3600)
	RDLENGTH	33
	MNAME	NS1.example.com (NS1 + Pointer 0xC014)
	RNAME	root.example.com (root + Pointer 0xC014)
	SERIAL	2005080300
	REFRESH	1 hour
	RETRY	15 minutes
	EXPIRE	1 week
	MINIMUM	1 hour (3600)

3rd Packet

4. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	*any*
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	*any*
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)

- **Termination**

  If NUT has cache function, clear the cache.

Judgment

1. Received standard query QNAME=invalid.example.com from NUT.
3. Received standard query QNAME=A.example.com from NUT.

References

RFC2308 Negative Caching of DNS Queries (DNS NCACHE)
5 - Caching Negative Answers

5.72. Caching of no data (NODATA)

Purpose

Verify that a NUT caches negative answer that resulted from a no data (NODATA)

- A negative answer that resulted from a no data (NODATA) should be cached such that it can be retrieved and returned in response to another query for the same "QNAME, QTYPE, QCLASS" that resulted in the cached negative response.

Category

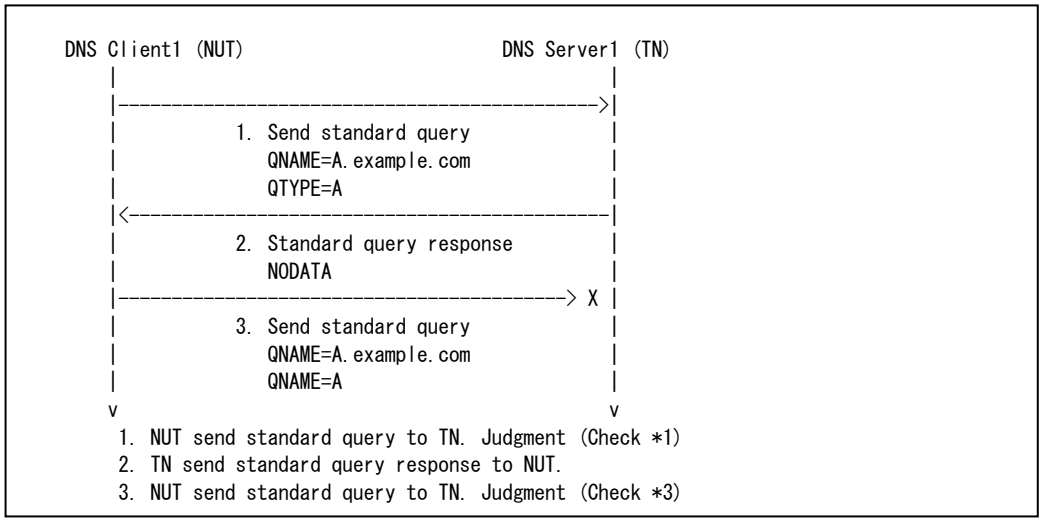
Client (with Caching function)

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "A.example.com".
- **Setup**
  Set the DNS Server1(TN)' s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for A type(IN class) of AP Server1(TN): A.example.com to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1st Packet

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)

2nd packet.

2. Standard query response from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Same as 1st Packet's Src Port
DNS Header	ID	Same as 1st Packet's ID
	QR	1
	OPCODE	0
	AA	1
	TC	0
	RD	Same as 1st Packet's RD
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	1
	ARCOUNT	0

DNS Question section	QNAME	A.example.com
	QTYPE	1 (0x0001)
	QCLASS	IN (0x0001)
DNS Authority section	NAME	example.com (Pointer 0xC00E)
	TYPE	SOA (0x0006)
	CLASS	IN (0x0001)
	TTL	1 hour (3600)
	RDLENGTH	33
	MNAME	NS1.example.com (NS1 + Pointer 0xC00E)
	RNAME	root.example.com (root + Pointer 0xC00E)
	SERIAL	2005080300
	REFRESH	1 hour
	RETRY	15 minutes
	EXPIRE	1 week
	MINIMUM	1 hour (3600)

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Received standard query QNAME=A.example.com from NUT.
3. Not received standard query QNAME=A.example.com from NUT.

References

RFC2308 Negative Caching of DNS Queries (DNS NCACHE)
5 - Caching Negative Answers

5.73. TTL expired negative cache MUST NOT be used (NODATA)

Purpose

Verify that a NUT does not use the TTL expired negative cache.

- This TTL decrements in a similar manner to a normal cached answer and upon reaching zero (0) indicates the cached negative answer MUST NOT be used again.

Category

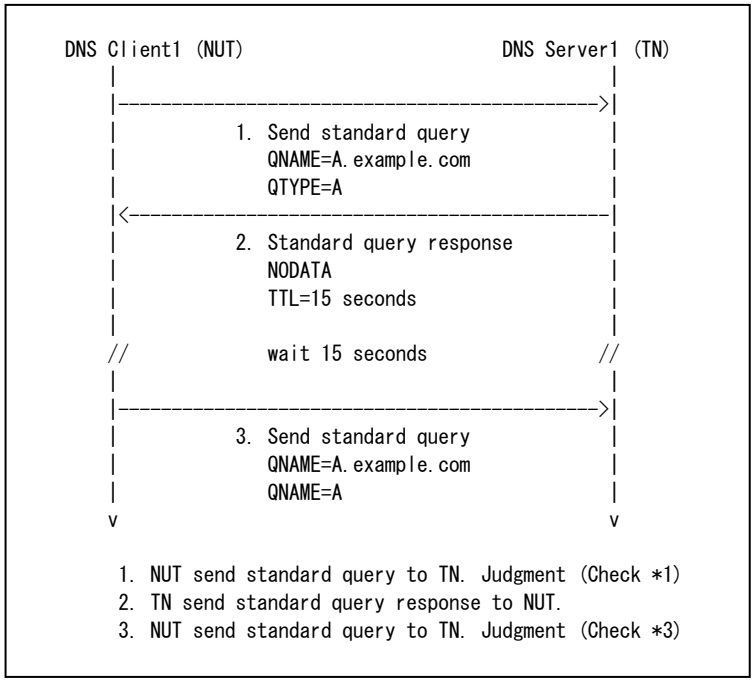
Client (with Caching function)

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "A.example.com".
- **Setup**
  Set the DNS Server1(TN)' s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for A type(IN class) of AP Server1(TN): A.example.com to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1st Packet

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)

2nd packet.

2. Standard query response from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Same as 1st Packet's Src Port
DNS Header	ID	Same as 1st Packet's ID
	QR	1
	OPCODE	0
	AA	1
	TC	0
	RD	Same as 1st Packet's RD
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	1
	ARCOUNT	0

DNS Question section	QNAME	A.example.com
	QTYPE	1 (0x0001)
	QCLASS	IN (0x0001)
DNS Authority section	NAME	example.com (Pointer 0xC00E)
	TYPE	SOA (0x0006)
	CLASS	IN (0x0001)
	TTL	15
	RDLENGTH	33
	MNAME	NS1.example.com (NS1 + Pointer 0xC00E)
	RNAME	root.example.com (root + Pointer 0xC00E)
	SERIAL	2005080300
	REFRESH	1 hour
	RETRY	15 minutes
	EXPIRE	1 week
	MINIMUM	15

3rd Packet

4. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	*any*
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	*any*
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)

- **Termination**

  If NUT has cache function, clear the cache.

Judgment

1. Received standard query QNAME=A.example.com from NUT.
3. Received standard query QNAME=A.example.com from NUT.

References

RFC2308 Negative Caching of DNS Queries (DNS NCACHE)
5 - Caching Negative Answers

5.74. Caching of no data (NODATA) for query tuple

Purpose

Verify that a NUT caches negative answer that resulted from a no data (NODATA) for query tuple.

- A negative answer that resulted from a no data (NODATA) should be cached such that it can be retrieved and returned in response to another query for the same "QNAME, QTYPE, QCLASS" that resulted in the cached negative response.

Category

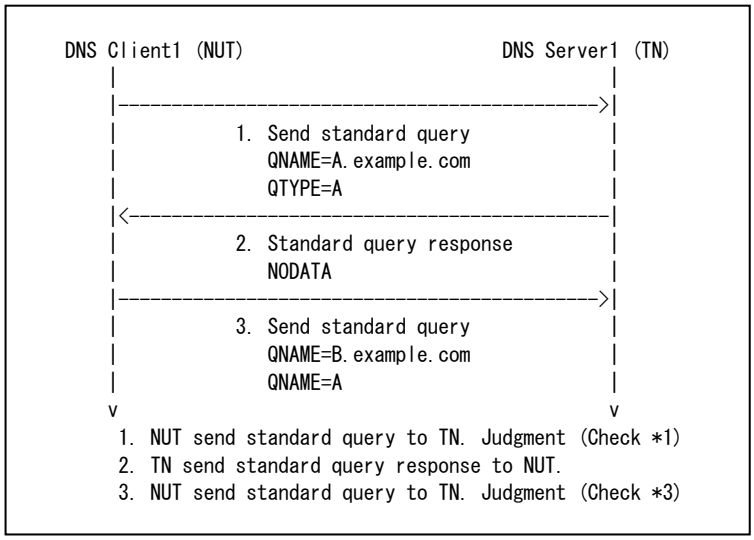
Client (with Caching function)

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "A.example.com".
- **Setup**
  Set the DNS Server1(TN)' s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for A type(IN class) of AP Server1(TN): A.example.com to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1st Packet

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	any
	Dst Port	53
DNS Header	ID	any
	QR	0
	OPCODE	0
	AA	any
	TC	0
	RD	any
	RA	any
	Z	any
	RCODE	any
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)

2nd packet.

2. Standard query response from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Same as 1st Packet's Src Port
DNS Header	ID	Same as 1st Packet's ID
	QR	1
	OPCODE	0
	AA	1
	TC	0
	RD	Same as 1st Packet's RD
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	1
	ARCOUNT	0

DNS Question section	QNAME	A.example.com
	QTYPE	1 (0x0001)
	QCLASS	IN (0x0001)
DNS Authority section	NAME	example.com (Pointer 0xC00E)
	TYPE	SOA (0x0006)
	CLASS	IN (0x0001)
	TTL	1 hour (3600)
	RDLENGTH	33
	MNAME	NS1.example.com (NS1 + Pointer 0xC00E)
	RNAME	root.example.com (root + Pointer 0xC00E)
	SERIAL	2005080300
	REFRESH	1 hour
	RETRY	15 minutes
	EXPIRE	1 week
	MINIMUM	1 hour (3600)

3rd Packet

4. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	any
	Dst Port	53
DNS Header	ID	any
	QR	0
	OPCODE	0
	AA	any
	TC	0
	RD	any
	RA	any
	Z	any
	RCODE	any
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	B.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)

- **Termination**

  If NUT has cache function, clear the cache.

Judgment

1. Received standard query QNAME=A.example.com from NUT.
3. Received standard query QNAME=B.example.com from NUT.

References

RFC2308 Negative Caching of DNS Queries (DNS NCACHE)
5 - Caching Negative Answers

5.75. Negative responses without SOA records

Purpose

Verify that a NUT does not cache negative responses without SOA records

- Negative responses without SOA records SHOULD NOT be cached as there is no way to prevent the negative responses looping forever between a pair of servers even with a short TTL.

Category

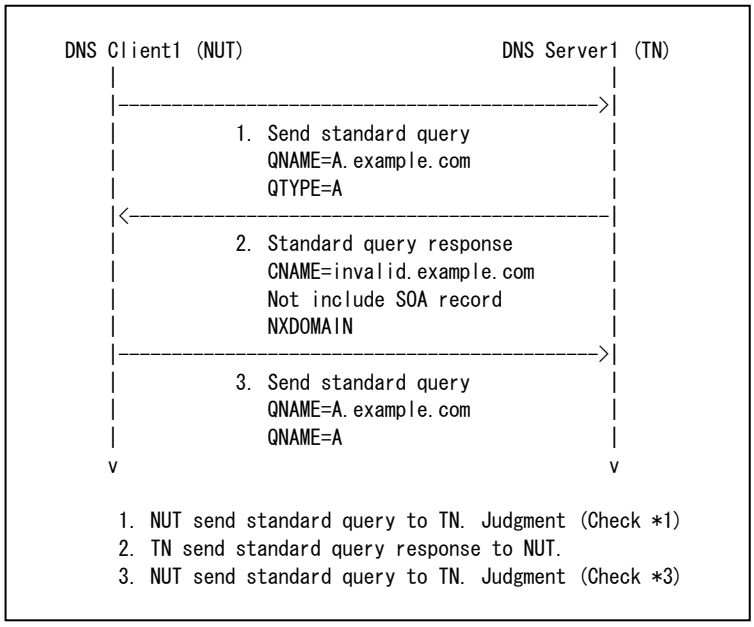
Client (with Caching function)

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "A.example.com".
- **Setup**
  Set the DNS Server1(TN)' s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for A type(IN class) of AP Server1(TN): A.example.com to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1st Packet

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)

2nd packet.

2. Standard query response from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Same as 1st Packet's Src Port
DNS Header	ID	Same as 1st Packet's ID
	QR	1
	OPCODE	0
	AA	1
	TC	0
	RD	Same as 1st Packet's RD
	RA	0
	Z	0
	RCODE	3
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	0

DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)
DNS Answer section	NAME	A.example.com (Pointer 0xC00C)
	TYPE	CNAME (0x0005)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	10
	CNAME	invalid.example.com (invalid + Pointer 0xC00E)

3rd Packet

4. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Received standard query QNAME=A.example.com from NUT.
3. Received standard query QNAME=A.example.com from NUT.

References

RFC2308 Negative Caching of DNS Queries (DNS NCACHE)
5 - Caching Negative Answers

5.76. Resolver cache a server failure response

Purpose

Verify that a NUT caches a server failure response

- Server failures fall into two major classes. The first is where a server can determine that it has been misconfigured for a zone. This may be where it has been listed as a server, but not configured to be a server for the zone, or where it has been configured to be a server for the zone, but cannot obtain the zone data for some reason. This can occur either because the zone file does not exist or contains errors, or because another server from which the zone should have been available either did not respond or was unable or unwilling to supply the zone.

  The second class is where the server needs to obtain an answer from elsewhere, but is unable to do so, due to network failures, other servers that don't reply, or return server failure errors, or similar.

  In either case a resolver MAY cache a server failure response. If it does so it MUST NOT cache it for longer than five (5) minutes, and it MUST be cached against the specific query tuple "query name, type, class, server IP address".

Category

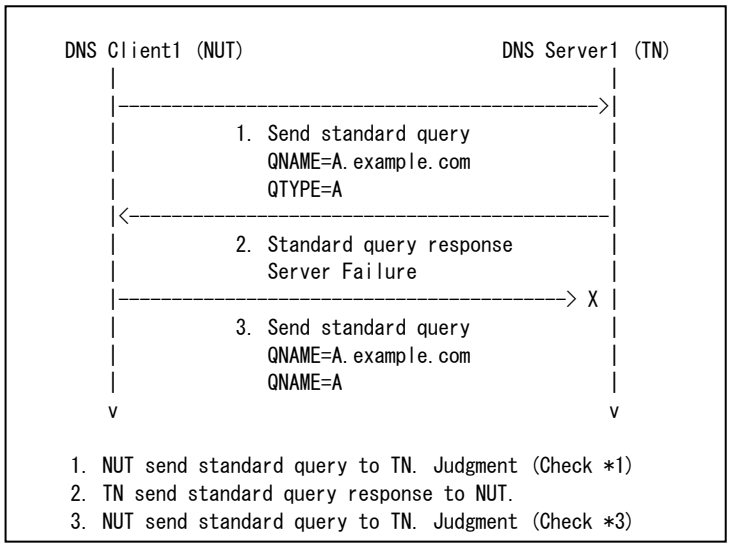
Client (with Caching function)

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "A.example.com".
- **Setup**
  Set the DNS Server1(TN)' s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for A type(IN class) of AP Server1(TN): A.example.com to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1st Packet

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)

2nd packet.

2. Standard query response from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Same as 1st Packet's Src Port
DNS Header	ID	Same as 1st Packet's ID
	QR	1
	OPCODE	0
	AA	0
	TC	0
	RD	Same as 1st Packet's RD
	RA	0
	Z	0
	RCODE	2
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	0
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Received standard query QNAME=A.example.com from NUT.
3. Not received standard query QNAME=A.example.com from NUT.

References

RFC2308 Negative Caching of DNS Queries (DNS NCACHE)
7.1 Server Failure (OPTIONAL)

5.77. Resolver cache a server failure response for query tuple

Purpose

Verify that a NUT caches a server failure response for the specific query tuple

- Server failures fall into two major classes. The first is where a server can determine that it has been misconfigured for a zone. This may be where it has been listed as a server, but not configured to be a server for the zone, or where it has been configured to be a server for the zone, but cannot obtain the zone data for some reason. This can occur either because the zone file does not exist or contains errors, or because another server from which the zone should have been available either did not respond or was unable or unwilling to supply the zone.

  The second class is where the server needs to obtain an answer from elsewhere, but is unable to do so, due to network failures, other servers that don't reply, or return server failure errors, or similar.

  In either case a resolver MAY cache a server failure response. If it does so it MUST NOT cache it for longer than five (5) minutes, and it MUST be cached against the specific query tuple "query name, type, class, server IP address".

Category

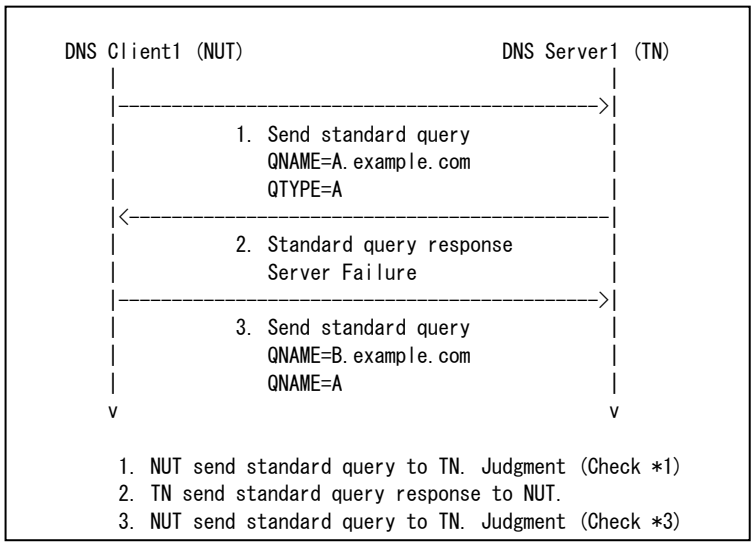
Client (with Caching function)

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "A.example.com".
- **Setup**
  Set the DNS Server1(TN)' s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for A type(IN class) of AP Server1(TN): A.example.com to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1st Packet

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)

2nd packet.

2. Standard query response from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Same as 1st Packet's Src Port
DNS Header	ID	Same as 1st Packet's ID
	QR	1
	OPCODE	0
	AA	0
	TC	0
	RD	Same as 1st Packet's RD
	RA	0
	Z	0
	RCODE	2
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	0
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)

3rd Packet

4. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	*any*
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	*any*
DNS Question section	QNAME	B.example.com

	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Received standard query QNAME=A.example.com from NUT.
3. Received standard query QNAME=B.example.com from NUT.

References

RFC2308 Negative Caching of DNS Queries (DNS NCACHE)
7.1 Server Failure (OPTIONAL)

5.78. Limit of time (5 minutes) for caching (Server Failure)

Purpose

Verify that a NUT must not cache a server failure response for longer than 5 minutes.

- Server failures fall into two major classes. The first is where a server can determine that it has been misconfigured for a zone. This may be where it has been listed as a server, but not configured to be a server for the zone, or where it has been configured to be a server for the zone, but cannot obtain the zone data for some reason. This can occur either because the zone file does not exist or contains errors, or because another server from which the zone should have been available either did not respond or was unable or unwilling to supply the zone.

  The second class is where the server needs to obtain an answer from elsewhere, but is unable to do so, due to network failures, other servers that don't reply, or return server failure errors, or similar.

  In either case a resolver MAY cache a server failure response. If it does so it MUST NOT cache it for longer than five (5) minutes, and it MUST be cached against the specific query tuple "query name, type, class, server IP address".

Category

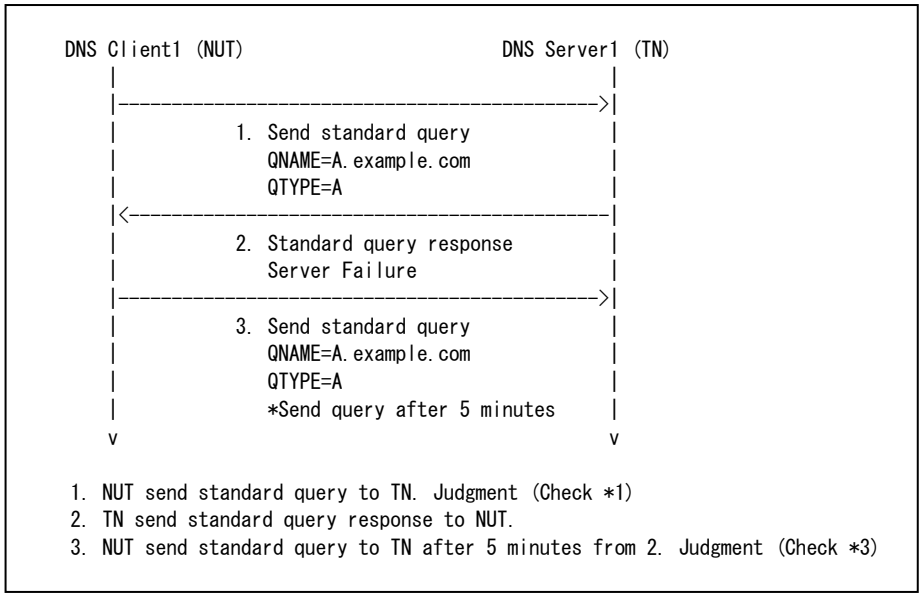
Client (with Caching function)

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "A.example.com".
- **Setup**
  Set the DNS Server1(TN)' s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for A type(IN class) of AP Server1(TN): A.example.com to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1st Packet

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)

2nd packet.

2. Standard query response from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Same as 1st Packet's Src Port
DNS Header	ID	Same as 1st Packet's ID
	QR	1
	OPCODE	0
	AA	0
	TC	0
	RD	Same as 1st Packet's RD
	RA	0
	Z	0
	RCODE	2
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	0
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)

3rd Packet

4. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	A.example.com

	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Received standard query QNAME=A.example.com from NUT.
3. Received standard query QNAME=A.example.com from NUT.

References

RFC2308 Negative Caching of DNS Queries (DNS NCACHE)
7.1 Server Failure (OPTIONAL)

5.79. Caching of dead server indication

Purpose

Verify that a NUT caches a dead server indication

- Dead / Unreachable servers are servers that fail to respond in any way to a query or where the transport layer has provided an indication that the server does not exist or is unreachable. A server may be deemed to be dead or unreachable if it has not responded to an outstanding query within 120 seconds.
- A server MAY cache a dead server indication. If it does so it MUST NOT be deemed dead for longer than five (5) minutes. The indication MUST be stored against query tuple "query name, type, class, server IP address" unless there was a transport layer indication that the server does not exist, in which case it applies to all queries to that specific IP address.

Category

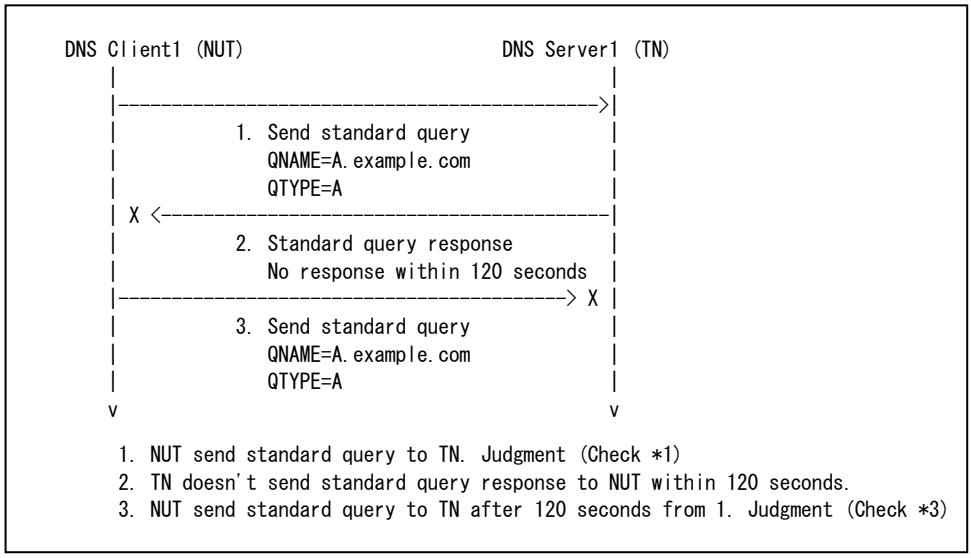
Client (with Caching function)

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "A.example.com".
- **Setup**
  Set the DNS Server1(TN)' s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for A type(IN class) of AP Server1(TN): A.example.com to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1st Packet

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Received standard query QNAME=A.example.com from NUT.
3. Not received standard query QNAME=A.example.com from NUT.

References

RFC2308 Negative Caching of DNS Queries (DNS NCACHE)
7.2 Dead / Unreachable Server (OPTIONAL)

5.80. Caching of dead server indication for query tuple

Purpose

Verify that a NUT caches a dead server indication for the specific query tuple

- Dead / Unreachable servers are servers that fail to respond in any way to a query or where the transport layer has provided an indication that the server does not exist or is unreachable. A server may be deemed to be dead or unreachable if it has not responded to an outstanding query within 120 seconds.
- A server MAY cache a dead server indication. If it does so it MUST NOT be deemed dead for longer than five (5) minutes. The indication MUST be stored against query tuple "query name, type, class, server IP address" unless there was a transport layer indication that the server does not exist, in which case it applies to all queries to that specific IP address.

Category

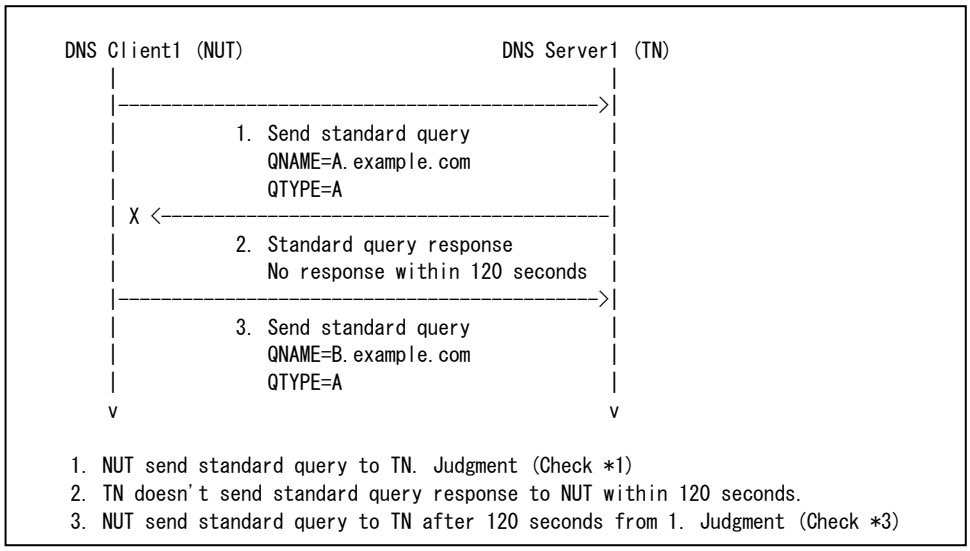
Client (with Caching function)

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "A.example.com".
- **Setup**
  Set the DNS Server1(TN)' s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for A type(IN class) of AP Server1(TN): A.example.com to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1st Packet

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)

3rd Packet

4. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	*any*
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	0

DNS Question section	QNAME	B.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Received standard query QNAME=A.example.com from NUT.
3. Received standard query QNAME=B.example.com from NUT.

References

RFC2308 Negative Caching of DNS Queries (DNS NCACHE)
7.2 Dead / Unreachable Server (OPTIONAL)

5.81. Limit of time (5 minutes) for caching (Dead/Unreachable Server)

Purpose

Verify that a NUT must not cache a dead server indication for longer than 5 minutes.

- Dead/Unreachable servers are servers that fail to respond in any way to a query or where the transport layer has provided an indication that the server does not exist or is unreachable. A server may be deemed to be dead or unreachable if it has not responded to an outstanding query within 120 seconds.
- A server MAY cache a dead server indication. If it does so it MUST NOT be deemed dead for longer than five(5) minutes. The indication MUST be stored against query tuple "query name, type, class, server IP address" unless there was a transport layer indication that the server does not exist, in which case it applies to all queries to that specific IP address.

Category

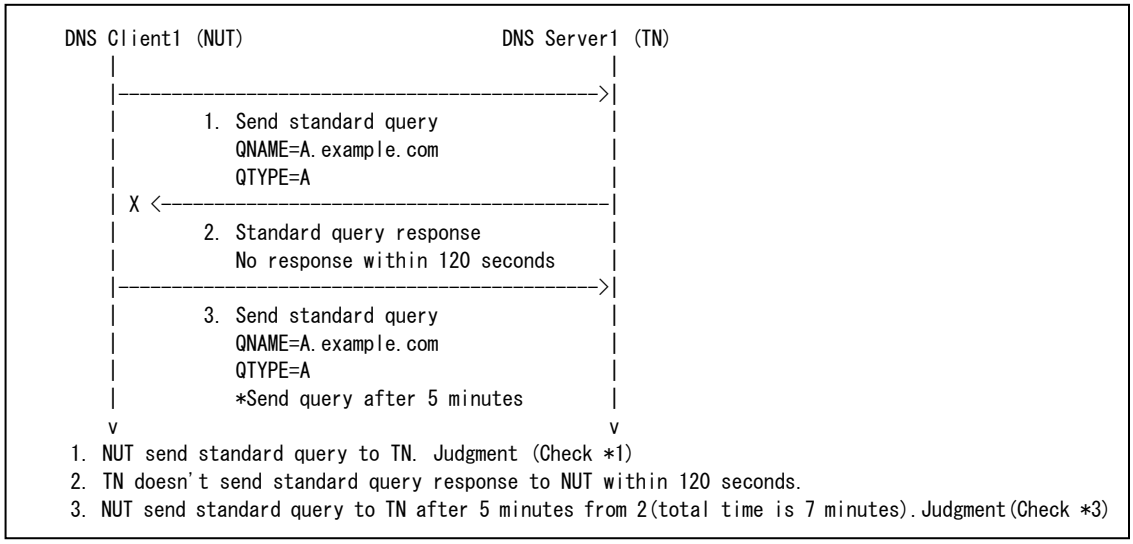
Client (with Caching function)

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "A.example.com".
- **Setup**
  Set the DNS Server1(TN)'s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for A type(IN class) of AP Server1(TN): A.example.com to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1st Packet

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)

3rd Packet

4. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any

DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Received standard query QNAME=A.example.com from NUT.
3. Received standard query QNAME=A.example.com from NUT.

References

RFC2308 Negative Caching of DNS Queries (DNS NCACHE)
7.2 Dead / Unreachable Server (OPTIONAL)

5.82. Caching of SOA record

Purpose

Verify that a NUT caches SOA record from the authority section for query tuple.

- The SOA record from the authority section MUST be cached. No data (NODATA) indications must be cached against "query name, QTYPE, QCLASS" tuple.

  A cached SOA record must be added to the response. This was explicitly not allowed because previously the distinction between a normal cached SOA record, and the SOA cached as a result of a negative response was not made, and simply extracting a normal cached SOA and adding that to a cached negative response causes problems.

Category

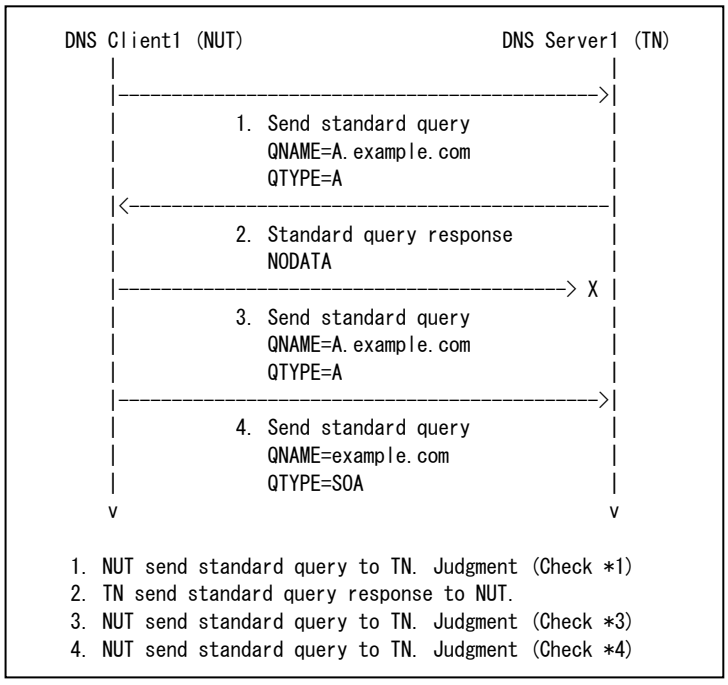
Client (with Caching function)

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "A.example.com".
- **Setup**
  Set the DNS Server1(TN)' s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for A type(IN class) of AP Server1(TN): A.example.com to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1st Packet

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)

2nd packet.

2. Standard query response from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Same as 1st Packet's Src Port
DNS Header	ID	Same as 1st Packet's ID
	QR	1
	OPCODE	0
	AA	1
	TC	0
	RD	Same as 1st Packet's RD
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	1
	ARCOUNT	0

DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)
DNS Authority section	NAME	example.com (Pointer 0xC00E)
	TYPE	SOA (0x0006)
	CLASS	IN (0x0001)
	TTL	1 hour (3600)
	RDLENGTH	33
	MNAME	NS1.example.com (NS1 + Pointer 0xC00E)
	RNAME	root.example.com (root + Pointer 0xC00E)
	SERIAL	2005080300
	REFRESH	1 hour
	RETRY	15 minutes
	EXPIRE	1 week
	MINIMUM	1 hour (3600)

4th Packet

4. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	example.com
	QTYPE	SOA (0x0006)
	QCLASS	IN (0x0001)

- **Termination**

  If NUT has cache function, clear the cache.

Judgment

1. Received standard query QNAME=A.example.com from NUT.
3. Not received standard query QNAME=A.example.com from NUT.
4. Received standard query QNAME=example.com from NUT.

References

RFC2308 Negative Caching of DNS Queries (DNS NCACHE)
8 - Changes from RFC 1034

5.83. OPT pseudo-RR

Purpose

Verify that a NUT transmits query that is correct position for OPT pseudo-RR

- OPT pseudo-RR can be added to the additional data section of either a request or a response.

Category

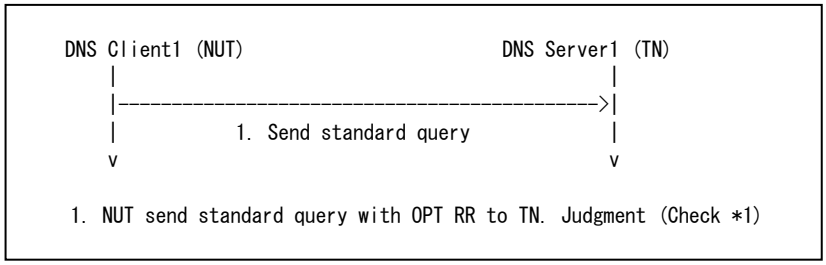
Client

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "A.example.com".
- **Setup**
  Set the DNS Server1(TN)' s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for A type of AP Server1(TN):
  A.example.com to the DNS Server1(TN) with OPT RR(1024 bytes), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0

	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	*any*
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	*any*
DNS Additional section	NAME(root)	*any*
	TYPE(OPT)	EDNS0 option(0x0029)
	CLASS(UDP payload size)	*any*
	TTL(EXTENDED-RCODE)	*any*
	TTL(VERSION)	*any*
	TTL(Z)	*any*
	RDLENGTH (describes RDATA)	*any*
	RDATA {attribute,value} pairs	*any*

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Received standard query QNAME=A.example.com from NUT.
3. Not received Echo Request(Echo Message) from NUT.

References

RFC2671 Extension Mechanisms for DNS (EDNS0)
4 - OPT pseudo-RR

5.84. The quantity of OPT pseudo-RRs

Purpose

Verify that a NUT transmits query that have correct number for OPT pseudo-RR

- The quantity of OPT pseudo-RRs per message shall be either zero or one, but not greater.

Category

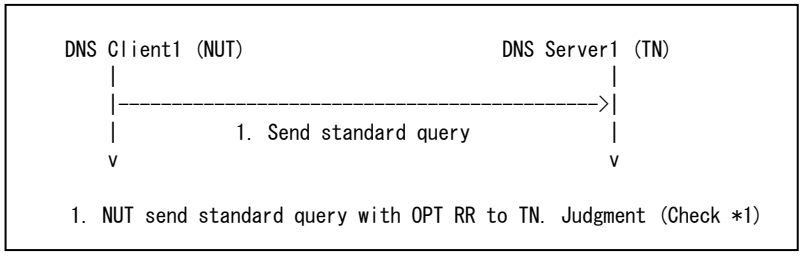
Client

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "A.example.com".
- **Setup**
  Set the DNS Server1(TN)'s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for A type of AP Server1(TN):
  A.example.com to the DNS Server1(TN) with OPT RR(1024 bytes), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0

	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	*any*
DNS Additional section	NAME(root)	*any*
	TYPE(OPT)	EDNS0 option(0x0029)
	CLASS(UDP payload size)	*any*
	TTL(EXTENDED-RCODE)	*any*
	TTL(VERSION)	*any*
	TTL(Z)	*any*
	RDLENGTH (describes RDATA)	*any*
	RDATA {attribute,value} pairs	*any*

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Standard query for A type with OPT RR must be base on above Verification Points.
   * OPT RR must be one.

References

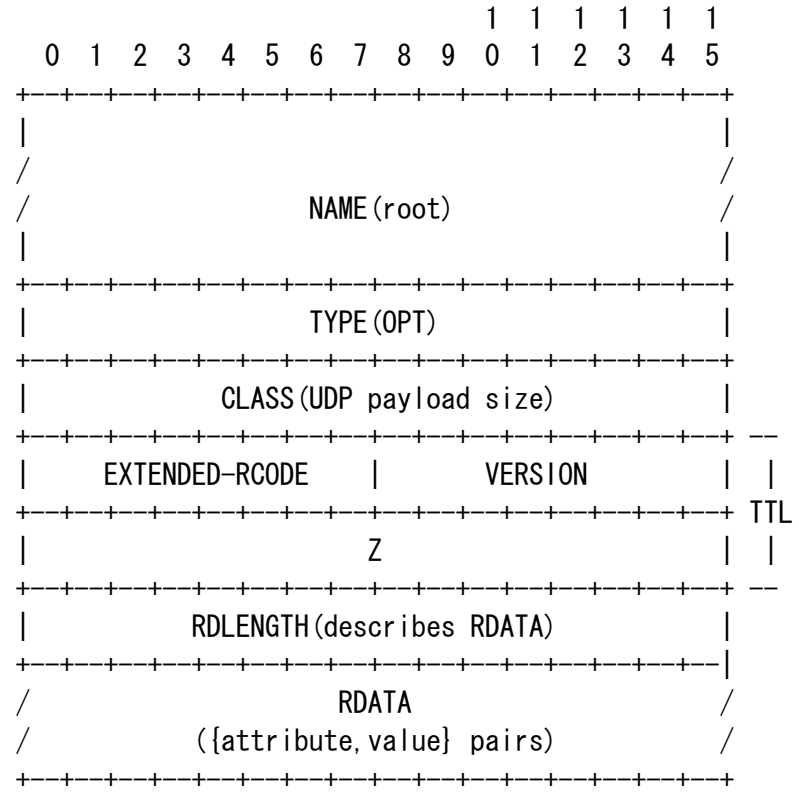
RFC2671 Extension Mechanisms for DNS (EDNS0)
4 - OPT pseudo-RR

5.85. Check OPT RR format

Purpose

Verify that a NUT transmits correct OPT pseudo-RR format

- OPT pseudo-RR format



NAME(root)	**root domain (0x00)**
TYPE(OPT)	**EDNS0 option(0x0029)**
CLASS(UDP payload size)	***any***
EXTENDED-RCODE	**0x00**
VERSION	**0x00**
Z	**0x0000**
RDLENGTH(describes RDATA)	**0x0**
RDATA({attribute,value} pairs)	***empty***

Category

Client

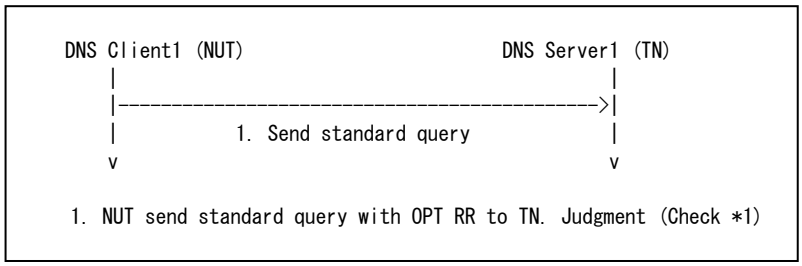
Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "A.example.com".

- **Setup**
  Set the DNS Server1(TN)' s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for A type of AP Server1(TN):
  A.example.com to the DNS Server1(TN) with OPT RR(1024 bytes), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	1
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	*any*
DNS Additional section	NAME(root)	empty (root domain 0x00)
	TYPE(OPT)	EDNS0 option(0x0029)
	CLASS(UDP payload size)	*any*

	TTL(EXTENDED-RCODE)	0x00
	TTL(VERSION)	0x00
	TTL(Z)	0x0000
	RDLENGTH (describes RDATA)	0x0
	RDATA {attribute,value} pairs	*empty*

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Standard query for A type with OPT RR must be base on above Verification Points.

References

RFC2671 Extension Mechanisms for DNS (EDNS0)
4 - OPT pseudo-RR

5.86. Check Sender's UDP payload size

Purpose

Verify that a NUT transmits correct UDP payload size

- The sender's UDP payload size (which OPT stores in the RR CLASS field) is the number of octets of the largest UDP payload that can be reassembled and delivered in the sender's network stack.

Category

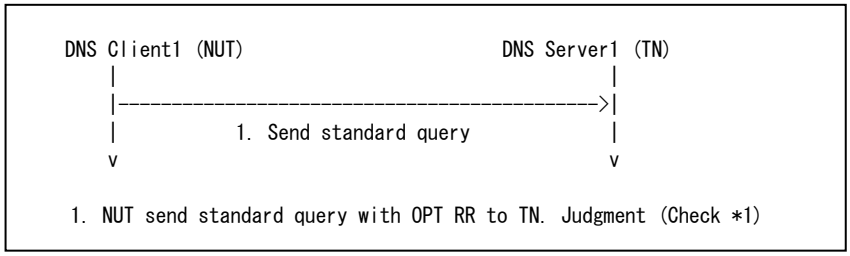
Client

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "A.example.com".
- **Setup**
  Set the DNS Server1(TN)' s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for A type of AP Server1(TN):
  A.example.com to the DNS Server1(TN) with OPT RR(1024 bytes), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*

	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	1
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	*any*
DNS Additional section	NAME(root)	empty (root domain 0x00)
	TYPE(OPT)	EDNS0 option(0x0029)
	CLASS(UDP payload size)	**0x0400**
	TTL(EXTENDED-RCODE)	0x00
	TTL(VERSION)	0x00
	TTL(Z)	0x0000
	RDLENGTH (describes RDATA)	0x0
	RDATA {attribute,value} pairs	*empty*

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Standard query for A type with OPT RR must be base on above Verification Points.
   * CLASS(UDP payload size) field must have 0x400.

References

RFC2671 Extension Mechanisms for DNS (EDNS0)
4 - OPT pseudo-RR

5.87. Responders don't understand OPT RR

Purpose

Verify that a NUT retransmits query when responders don't understand OPT RR

- Responders who do not understand these protocol extensions are expected to send a response with RCODE NOTIMPL, FORMERR, or SERVFAIL. Therefore use of extensions should be "probed" such that a responder who isn't known to support them be allowed a retry with no extensions if it responds with such an RCODE.

Category

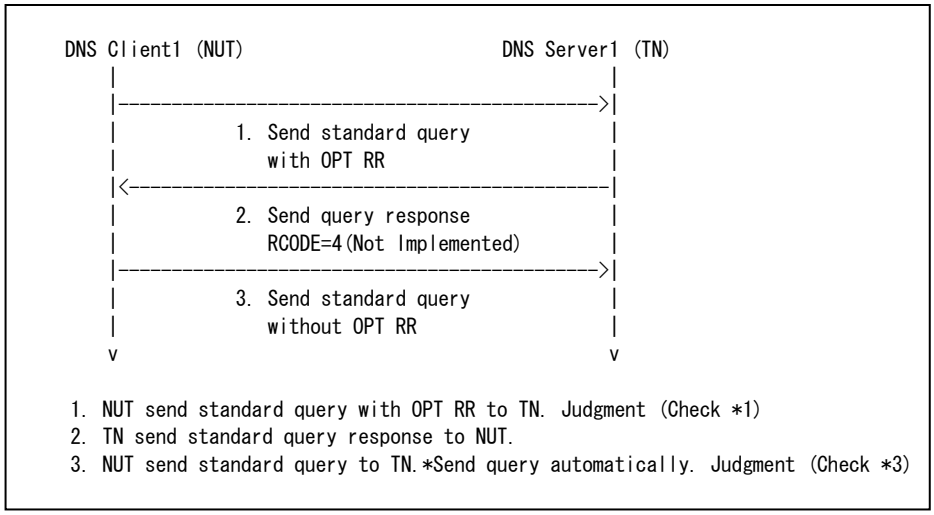
Client

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "A.example.com".
- **Setup**
  Set the DNS Server1(TN)' s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for A type of AP Server1(TN):
  A.example.com to the DNS Server1(TN) with OPT RR(1024 bytes), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1st Packet.

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	1
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	*any*
DNS Additional section	NAME(root)	empty (root domain 0x00)
	TYPE(OPT)	EDNS0 option(0x0029)
	CLASS(UDP payload size)	0x0400
	TTL(EXTENDED-RCODE)	0x00
	TTL(VERSION)	0x00
	TTL(Z)	0x0000
	RDLENGTH (describes RDATA)	0x0
	RDATA {attribute,value} pairs	*empty*

2nd packet.

2. Standard query response from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Same as 1st Packet's Src Port
DNS Header	ID	Same as 1st Packet's ID
	QR	1
	OPCODE	0
	AA	0
	TC	0

	RD	Same as 1st Packet's RD
	RA	0
	Z	0
	RCODE	4
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	1
	ARCOUNT	1
DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)
DNS Authority section	NAME	example.com (Pointer 0xC00E)
	TYPE	NS (0x0002)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	6
	NSDNAME	NS1.example.com (NS1 + Pointer 0xC00E)
DNS Additional section	NAME	NS1.example.com (Pointer 0xC02B)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	4
	ADDRESS	192.168.1.20

3rd Packet.

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any

DNS Question section	QNAME	A.example.com
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Received standard query QNAME=A.example.com with OPT RR from NUT to Server1 (TN).
3. Received standard query QNAME=A.example.com without OPT RR from NUT to Server1 (TN)

References

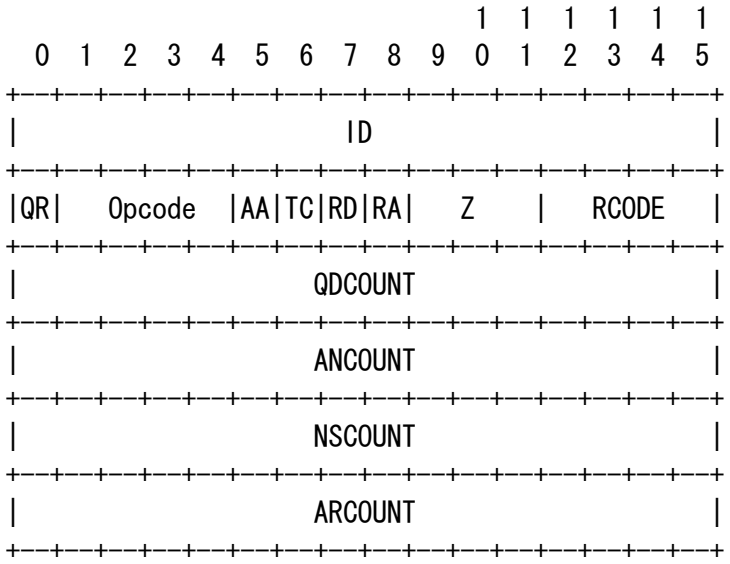
RFC2671 Extension Mechanisms for DNS (EDNS0)
4 - OPT pseudo-RR

5.88. SRV type in standard query

Purpose

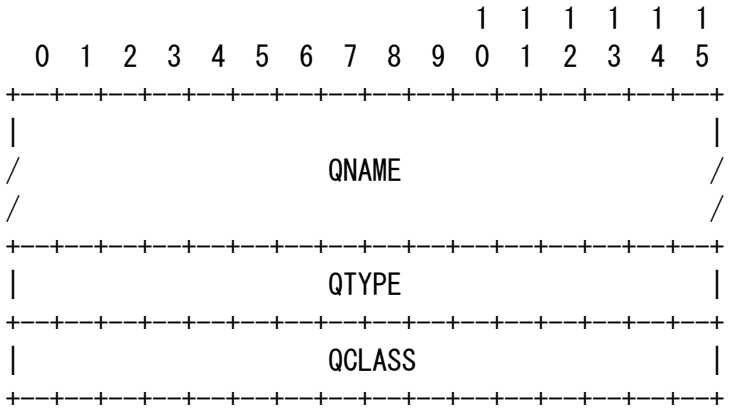
Verify that a NUT transmits correct standard query format for SRV type

- Header section format



QR	Query (0)
Opcode	A standard query(QUERY) (0)
Z	Must be zero
QDCOUNT	1
ANCOUNT	0
NSCOUNT	0
ARCOUNT	0

- Question section format



QNAME	_http._tcp.example.com
QTYPE	SRV type (33)

- Answer section format
  Must be empty
- Authority section format
  Must be empty
- Additional section format
  Must be empty

Category

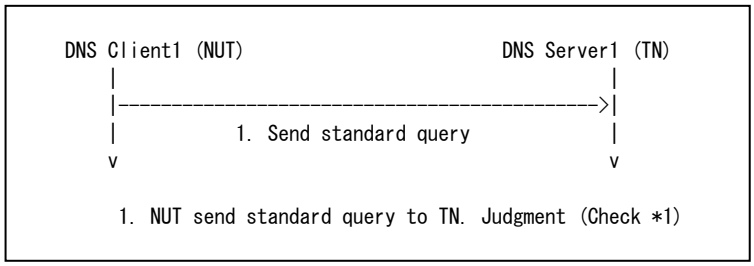
Client

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "A.example.com".
- **Setup**
  Set the DNS Server1(TN)'s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for SRV type of _http._tcp.example.com. to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*

	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	_http._tcp.example.com.
	QTYPE	SRV (0x0021)
	QCLASS	*any*

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Standard query for SRV type must be base on above Verification Points.

References

RFC2782 DNS SRV RR

5.89. Returning of answer

Purpose

Verify that a NUT uses the returned RR

- When the resolver performs the indicated function, it usually has one of the following results to pass back to the client:
  - ✧ One or more RRs giving the requested data

Category

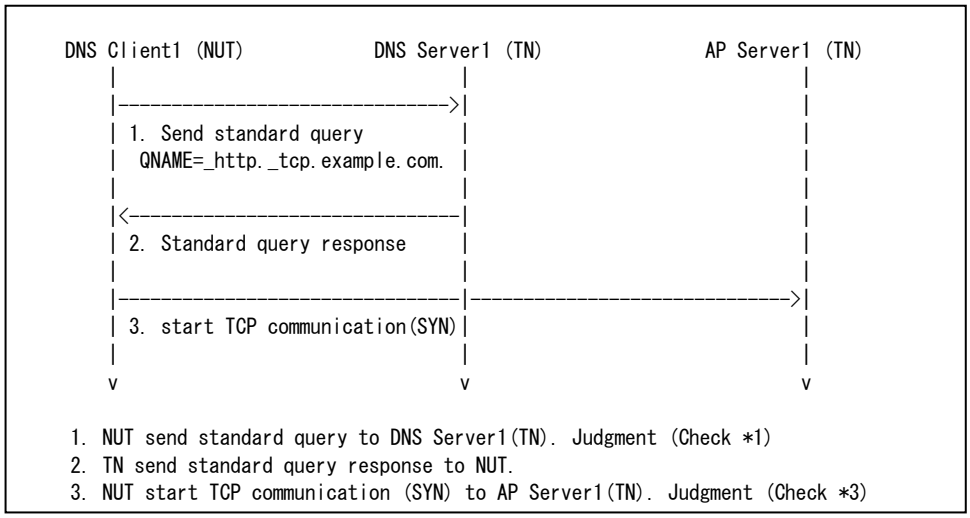
Client

Initialization

- **Network Topology**
  Refer the topology "Fig. 3 Topology No.3".
  AP server1 has a domain name "B.example.com".
- **Setup**
  Set the DNS Server1(TN)' s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for SRV type(IN class) of _http._tcp.example.com. to the DNS Server1(TN), NUT start TCP communication(SYN) to _http._tcp.example.com.

Procedure

This test sequence is following.



1. NUT send standard query to DNS Server1(TN). Judgment (Check *1)
2. TN send standard query response to NUT.
3. NUT start TCP communication (SYN) to AP Server1(TN). Judgment (Check *3)

Packet Description

1st Packet

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ

	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	_http._tcp.example.com.
	QTYPE	SRV (0x0031)
	QCLASS	IN (0x0001)

2nd packet.

2. Standard query response from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Same as 1st Packet's Src Port
DNS Header	ID	Same as 1st Packet's ID
	QR	1
	OPCODE	0
	AA	1
	TC	0
	RD	Same as 1st Packet's RD
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	1
	NSCOUNT	0
	ARCOUNT	0
DNS Question section	QNAME	_http._tcp.example.com.
	QTYPE	SRV (0x0021)
	QCLASS	IN (0x0001)
DNS Answer section	NAME	_http._tcp.example.org. (Pointer 0xC00C)

	TYPE	SRV (0x0021)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	21
	Priority	10
	Weight	20
	Port	80
	Target	B.example.com.
DNS Additional section	NAME	B.example.com. (Pointer 0xC03A)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	4
	ADDRESS	192.168.1.60

3rd Packet

3. Start TCP communication from DNS Client1 (NUT) to AP Server1 (TN)			
IP Header	Source Address		NUT_NETZ
	Destination Address		AP1_NETY
TCP	Source Port		any
	Destination Port		80
	Control Bits	URG	false
		ACK	false
		PSH	false
		RST	false
		SYN	true
		FIN	false

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Received standard query QNAME=_http._tcp.example.com. from NUT.
3. Received TCP packet (SYN) from NUT.

References

RFC1035 DOMAIN NAMES - CONCEPTS AND FACILITIES
5.2.1. Typical functions RFC2782 DNS SRV RR

5.90. Returning of answer (w/o Additional Data section)

Purpose

Verify that a NUT uses the returned RR

- If the Additional Data section doesn't contain address records for all the SRV RR's and the client may want to connect to the target host(s) involved, the client must look up the address record(s).

Category

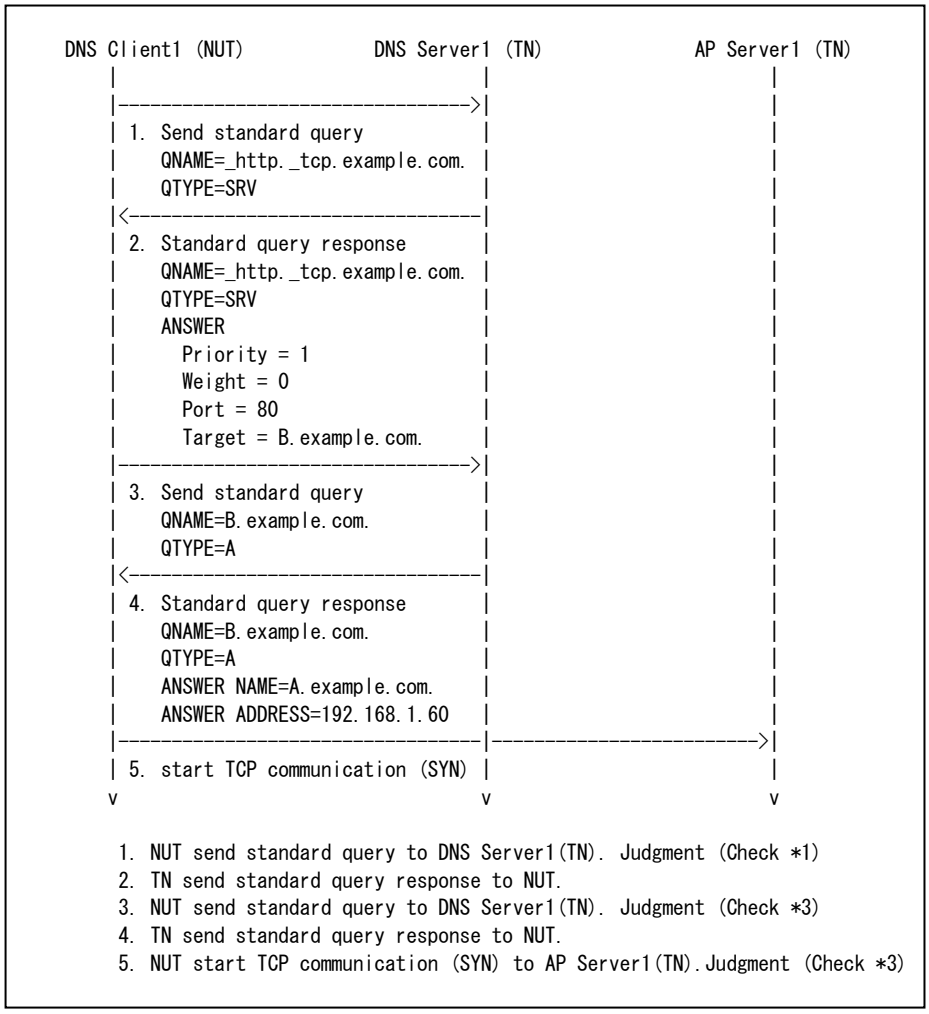
Client

Initialization

- **Network Topology**
  Refer the topology "Fig. 3 Topology No.3".
  AP server1 has a domain name "B.example.com".
- **Setup**
  Set the DNS Server1(TN)' s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for SRV type(IN class) of _http._tcp.example.com. to the DNS Server1(TN), NUT start TCP communication(SYN) to _http._tcp.example.com.

Procedure

This test sequence is following.



1. NUT send standard query to DNS Server1(TN). Judgment (Check *1)
2. TN send standard query response to NUT.
3. NUT send standard query to DNS Server1(TN). Judgment (Check *3)
4. TN send standard query response to NUT.
5. NUT start TCP communication (SYN) to AP Server1(TN).Judgment (Check *3)

Packet Description

1st Packet

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0

	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	_http._tcp.example.com.
	QTYPE	SRV (0x0031)
	QCLASS	IN (0x0001)

2nd packet.

2. Standard query response from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Same as 1st Packet's Src Port
DNS Header	ID	Same as 1st Packet's ID
	QR	1
	OPCODE	0
	AA	1
	TC	0
	RD	Same as 1st Packet's RD
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	1
	NSCOUNT	0
	ARCOUNT	0
DNS Question section	QNAME	_http._tcp.example.com.
	QTYPE	SRV (0x0021)
	QCLASS	IN (0x0001)
DNS Answer section	NAME	_http._tcp.example.org. (Pointer 0xC00C)
	TYPE	SRV (0x0021)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	21
	Priority	10
	Weight	20
	Port	80
	Target	B.example.com.

3rd Packet

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	B.example.com.
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)

4th packet.

2. Standard query response from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Same as 3rd Packet's Src Port
DNS Header	ID	Same as 3rd Packet's ID
	QR	1
	OPCODE	0
	AA	1
	TC	0
	RD	Same as 3rd Packet's RD
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	1
	NSCOUNT	0
	ARCOUNT	0
DNS Question section	QNAME	B.example.com.

	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)
DNS Answer section	NAME	B.example.org. (Pointer 0xC00C)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	4
	ADDRESS	192.168.1.60

5th Packet

3. Start TCP communication from DNS Client1 (NUT) to AP Server1 (TN)			
IP Header	Source Address		NUT_NETZ
	Destination Address		AP1_NETY
TCP	Source Port		any
	Destination Port		80
	Control Bits	URG	false
		ACK	false
		PSH	false
		RST	false
		SYN	true
		FIN	false

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Received standard query QNAME=_http._tcp.example.com. QTYPE=SRV from NUT.
3. Received standard query QNAME=B.example.com. QTYPE=A from NUT.
5. Received TCP packet (SYN) from NUT.

References

RFC1035 DOMAIN NAMES - CONCEPTS AND FACILITIES
5.2.1. Typical functions RFC2782 DNS SRV RR

5.91. Priority comparing

Purpose

Verify that a NUT compares Priority of Target

- The resolver must attempt to contact the target host with the lowest-numbered priority it can reach.

Category

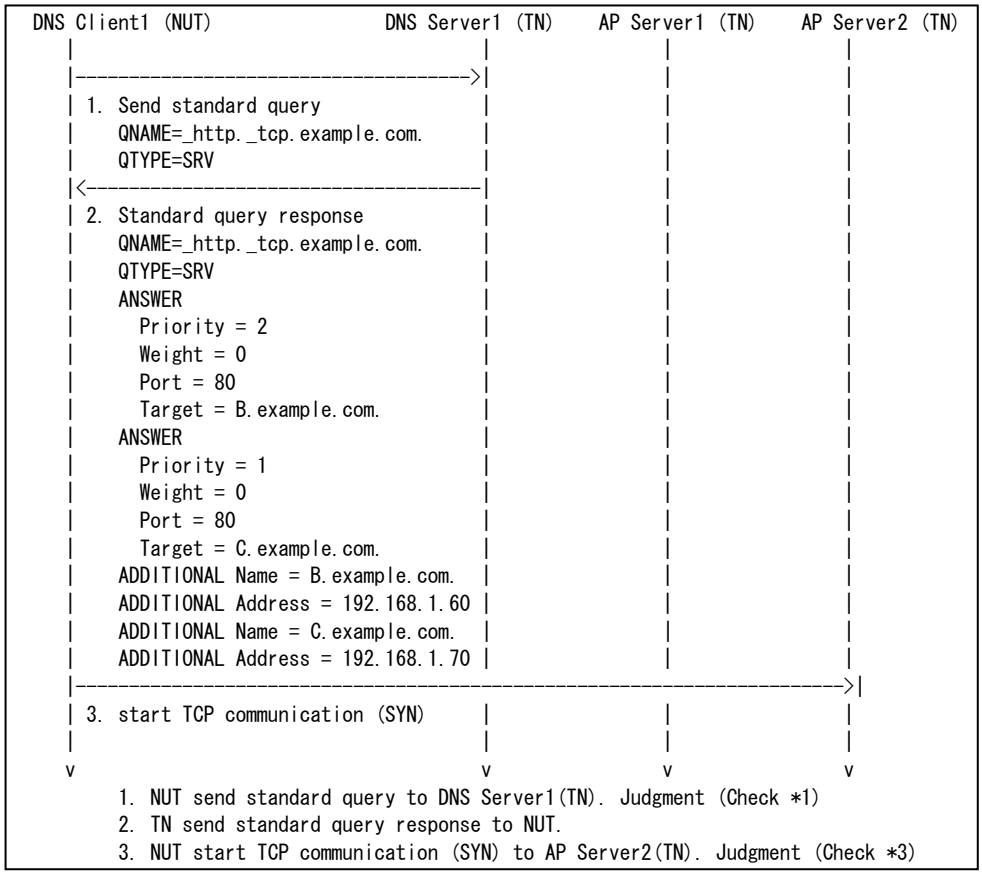
Client

Initialization

- **Network Topology**
  Refer the topology "Fig. 5 Topology No.5".
- **Setup**
  Set the DNS Server1(TN)'s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for SRV type(IN class) of _http._tcp.example.com. to the DNS Server1(TN), NUT start TCP communication (SYN) to _http._tcp.example.com.

Procedure

This test sequence is following.



Packet Description

1st Packet

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	_http._tcp.example.com.
	QTYPE	SRV (0x0031)
	QCLASS	IN (0x0001)

2nd packet.

2. Standard query response from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Same as 1st Packet's Src Port
DNS Header	ID	Same as 1st Packet's ID
	QR	1
	OPCODE	0
	AA	1
	TC	0
	RD	Same as 1st Packet's RD
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	1
	NSCOUNT	0
	ARCOUNT	0

DNS Question section	QNAME	_http._tcp.example.com.
	QTYPE	SRV (0x0021)
	QCLASS	IN (0x0001)
DNS Answer section	NAME	_http._tcp.example.org. (Pointer 0xC00C)
	TYPE	SRV (0x0021)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	21
	Priority	2
	Weight	0
	Port	80
	Target	B.example.com.
DNS Answer section	NAME	_http._tcp.example.org. (Pointer 0xC00C)
	TYPE	SRV (0x0021)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	21
	Priority	1
	Weight	0
	Port	80
	Target	C.example.com.
DNS Additional section	NAME	B.example.com. (Pointer 0xC03A)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	4
	ADDRESS	192.168.1.60
DNS Additional section	NAME	C.example.com. (Pointer 0xC05B)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	4
	ADDRESS	192.168.1.70

3rd Packet

3. Start TCP communication from DNS Client1 (NUT) to AP Server1 (TN)			
IP Header	Source Address		NUT_NETZ
	Destination Address		AP2_NETY
TCP	Source Port		any
	Destination Port		80
	Control Bits	URG	false
		ACK	false
		PSH	false

		RST	false
		SYN	true
		FIN	false

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Received standard query QNAME=_http._tcp.example.com. from NUT.
3. Received TCP packet (SYN) from NUT.

References

RFC1035 DOMAIN NAMES - CONCEPTS AND FACILITIES
5.2.1. Typical functions RFC2782 DNS SRV RR

5.92. Priority comparing (round-robin)

Purpose

Verify that a NUT compares Priority of Target

- The resolver must attempt to contact the target host with the lowest-numbered priority it can reach.

Category

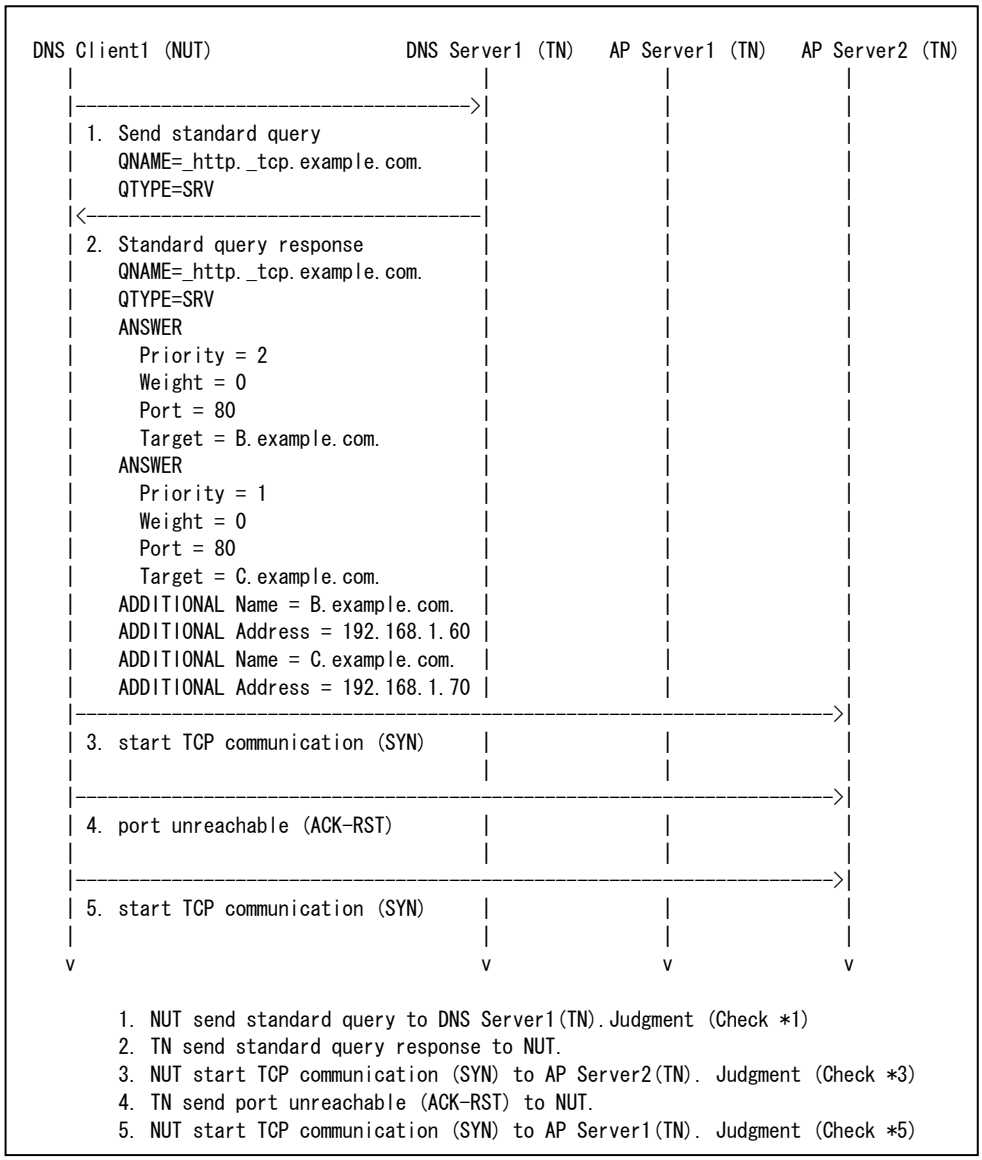
Client

Initialization

- **Network Topology**
  Refer the topology "Fig. 5 Topology No.5".
- **Setup**
  Set the DNS Server1(TN)'s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for SRV type(IN class) of _http._tcp.example.com. to the DNS Server1(TN), NUT start TCP communication (SYN) to _http._tcp.example.com.

Procedure

This test sequence is following.



1. NUT send standard query to DNS Server1(TN).Judgment (Check *1)
2. TN send standard query response to NUT.
3. NUT start TCP communication (SYN) to AP Server2(TN). Judgment (Check *3)
4. TN send port unreachable (ACK-RST) to NUT.
5. NUT start TCP communication (SYN) to AP Server1(TN). Judgment (Check *5)

Packet Description

1st Packet

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0

	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	_http._tcp.example.com.
	QTYPE	SRV (0x0031)
	QCLASS	IN (0x0001)

2nd packet.

2. Standard query response from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Same as 1st Packet's Src Port
DNS Header	ID	Same as 1st Packet's ID
	QR	1
	OPCODE	0
	AA	1
	TC	0
	RD	Same as 1st Packet's RD
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	1
	NSCOUNT	0
	ARCOUNT	0
DNS Question section	QNAME	_http._tcp.example.com.
	QTYPE	SRV (0x0021)
	QCLASS	IN (0x0001)
DNS Answer section	NAME	_http._tcp.example.org. (Pointer 0xC00C)
	TYPE	SRV (0x0021)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	21
	Priority	2
	Weight	0

	Port	80
	Target	B.example.com.
DNS Answer section	NAME	_http._tcp.example.org. (Pointer 0xC00C)
	TYPE	SRV (0x0021)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	21
	Priority	1
	Weight	0
	Port	80
	Target	C.example.com.
DNS Additional section	NAME	B.example.com. (Pointer 0xC03A)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	4
	ADDRESS	192.168.1.60
DNS Additional section	NAME	C.example.com. (Pointer 0xC05B)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	4
	ADDRESS	192.168.1.70

3rd Packet

3. Start TCP communication (SYN) from DNS Client1 (NUT) to AP Server2 (TN)			
IP Header	Source Address		NUT_NETZ
	Destination Address		AP2_NETY
TCP	Source Port		any
	Destination Port		80
	Control Bits	URG	false
		ACK	false
		PSH	false
		RST	false
		SYN	true
		FIN	false

4th Packet

4. port unreachable (ACK-RST) from AP Server2 (TN) to DNS Client1 (NUT)		
IP Header	Source Address	AP2_NETY
	Destination Address	NUT_NETZ
TCP	Source Port	80
	Destination Port	same as Source Port of 3rd Packet

	Control Bits	URG	false
		ACK	true
		PSH	false
		RST	true
		SYN	false
		FIN	false

5th Packet

5. Start TCP communication (SYN) from DNS Client1 (NUT) to AP Server1 (TN)			
IP Header	Source Address		NUT_NETZ
	Destination Address		AP1_NETY
TCP	Source Port		any
	Destination Port		80
	Control Bits	URG	false
		ACK	false
		PSH	false
		RST	false
		SYN	true
		FIN	false

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Received standard query QNAME=_http._tcp.example.com. from NUT.
3. Received TCP packet (SYN) from NUT.
5. Received TCP packet (SYN) from NUT.

References

RFC1035 DOMAIN NAMES - CONCEPTS AND FACILITIES
5.2.1. Typical functions RFC2782 DNS SRV RR

5.93. Weight comparing

Purpose

Verify that a NUT compares Weight of Target

- The weight field specifies a relative weight for entries with the same priority.
  Larger weights should be given a proportionately higher probability of being selected.

Category

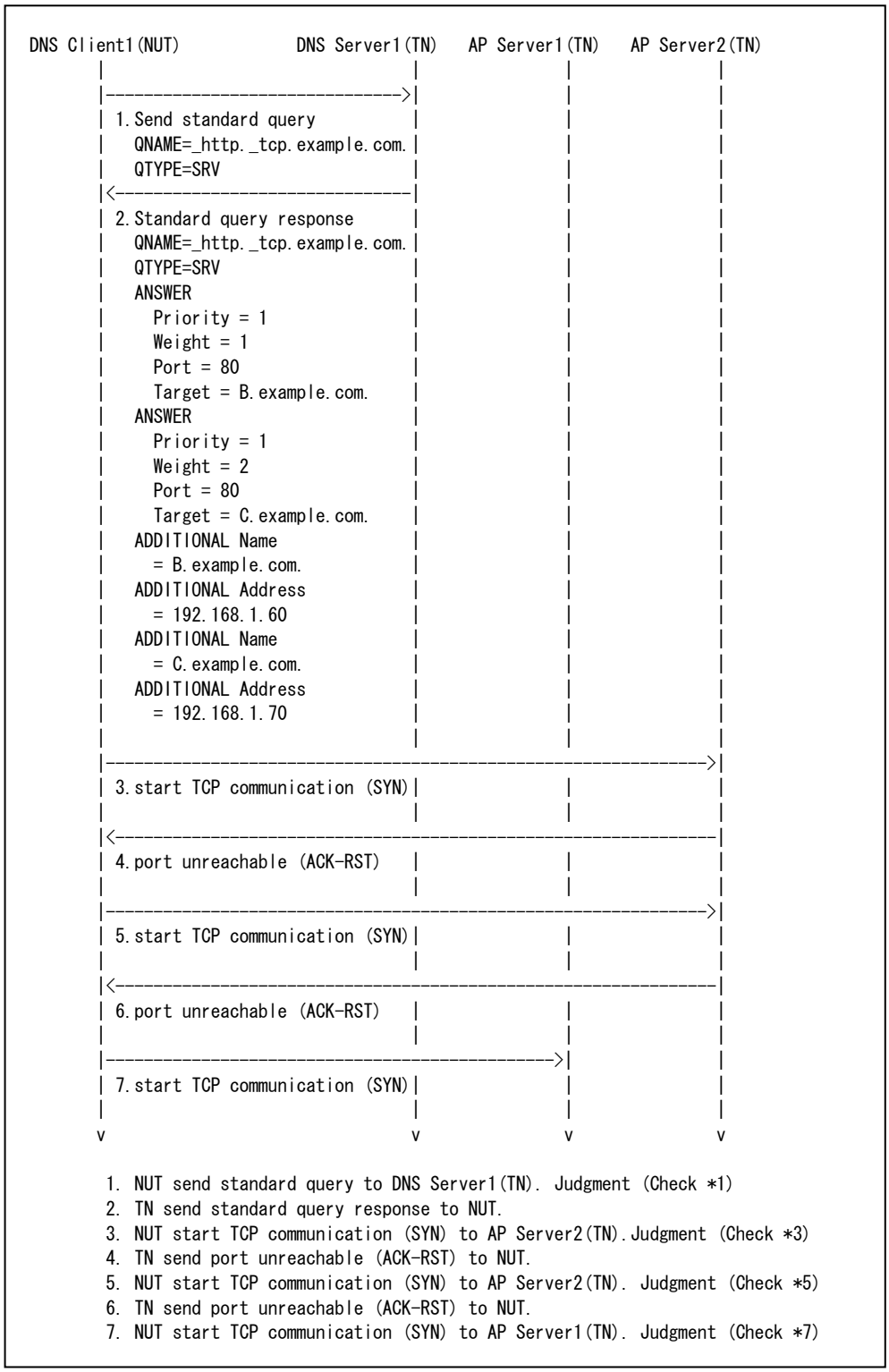
Client

Initialization

- **Network Topology**
  Refer the topology "Fig. 5 Topology No.5".
- **Setup**
  Set the DNS Server1(TN)'s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for SRV type(IN class) of _http._tcp.example.com. to the DNS Server1(TN), NUT start TCP communication (SYN) to _http._tcp.example.com.

Procedure

This test sequence is following.



1. NUT send standard query to DNS Server1(TN). Judgment (Check *1)
2. TN send standard query response to NUT.
3. NUT start TCP communication (SYN) to AP Server2(TN).Judgment (Check *3)
4. TN send port unreachable (ACK-RST) to NUT.
5. NUT start TCP communication (SYN) to AP Server2(TN). Judgment (Check *5)
6. TN send port unreachable (ACK-RST) to NUT.
7. NUT start TCP communication (SYN) to AP Server1(TN). Judgment (Check *7)

Packet Description

1st Packet

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	_http._tcp.example.com.
	QTYPE	SRV (0x0031)
	QCLASS	IN (0x0001)

2nd packet.

2. Standard query response from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Same as 1st Packet's Src Port
DNS Header	ID	Same as 1st Packet's ID
	QR	1
	OPCODE	0
	AA	1
	TC	0
	RD	Same as 1st Packet's RD
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	1
	NSCOUNT	0
	ARCOUNT	0

DNS Question section	QNAME	_http._tcp.example.com.
	QTYPE	SRV (0x0021)
	QCLASS	IN (0x0001)
DNS Answer section	NAME	_http._tcp.example.org. (Pointer 0xC00C)
	TYPE	SRV (0x0021)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	21
	Priority	11
	Weight	10
	Port	80
	Target	B.example.com.
DNS Answer section	NAME	_http._tcp.example.org. (Pointer 0xC00C)
	TYPE	SRV (0x0021)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	21
	Priority	10
	Weight	21
	Port	80
	Target	C.example.com.
DNS Additional section	NAME	B.example.com. (Pointer 0xC03A)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	4
	ADDRESS	192.168.1.60
DNS Additional section	NAME	C.example.com. (Pointer 0xC05B)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	1 day (86400)
	RDLENGTH	4
	ADDRESS	192.168.1.70

3rd Packet

3. Start TCP communication (SYN) from DNS Client1 (NUT) to AP Server1 (TN)			
IP Header	Source Address		NUT_NETZ
	Destination Address		AP2_NETY
TCP	Source Port		any
	Destination Port		80
	Control Bits	URG	false
		ACK	false
		PSH	false

		RST	false
		SYN	true
		FIN	false

4th Packet

4. port unreachable (ACK-RST) from AP Server1 (TN) to DNS Client1 (NUT)			
IP Header	Source Address		AP2_NETY
	Destination Address		NUT_NETZ
TCP	Source Port		80
	Destination Port		same as Source Port of 3rd Packet
	Control Bits	URG	false
		ACK	true
		PSH	false
		RST	true
		SYN	false
		FIN	false

5th Packet

5. Start TCP communication (SYN) from DNS Client1 (NUT) to AP Server1 (TN)			
IP Header	Source Address		NUT_NETZ
	Destination Address		AP2_NETY
TCP	Source Port		any
	Destination Port		80
	Control Bits	URG	false
		ACK	false
		PSH	false
		RST	false
		SYN	true
		FIN	false

6th Packet

6. port unreachable (ACK-RST) from AP Server1 (TN) to DNS Client1 (NUT)			
IP Header	Source Address		AP2_NETY
	Destination Address		NUT_NETZ
TCP	Source Port		80
	Destination Port		same as Source Port of 5th Packet
	Control Bits	URG	false
		ACK	true
		PSH	false
		RST	true
		SYN	false
		FIN	false

7th Packet

7. Start TCP communication (SYN) from DNS Client1 (NUT) to AP Server1 (TN)			
IP Header	Source Address		NUT_NETZ
	Destination Address		AP1_NETY
TCP	Source Port		any
	Destination Port		80
	Control Bits	URG	false
		ACK	false
		PSH	false
		RST	false
		SYN	true
		FIN	false

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Received standard query QNAME=_http._tcp.example.com. from NUT.
3. Received TCP packet (SYN) from NUT.
5. Received TCP packet (SYN) from NUT.
7. Received TCP packet (SYN) from NUT.

References

RFC1035 DOMAIN NAMES - CONCEPTS AND FACILITIES
5.2.1. Typical functions RFC2782 DNS SRV RR

5.94. NXDOMAIN

Purpose

Verify that a NUT handles the reply which isn't NOERROR, ANCOUNT>0

- When the reply isn't NOERROR, ANCOUNT>0 or there isn't at least one SRV RR which specifies the requested Service and Protocol in the reply, client do a lookup for QNAME=target, QCLASS=IN, QTYPE=A

Category

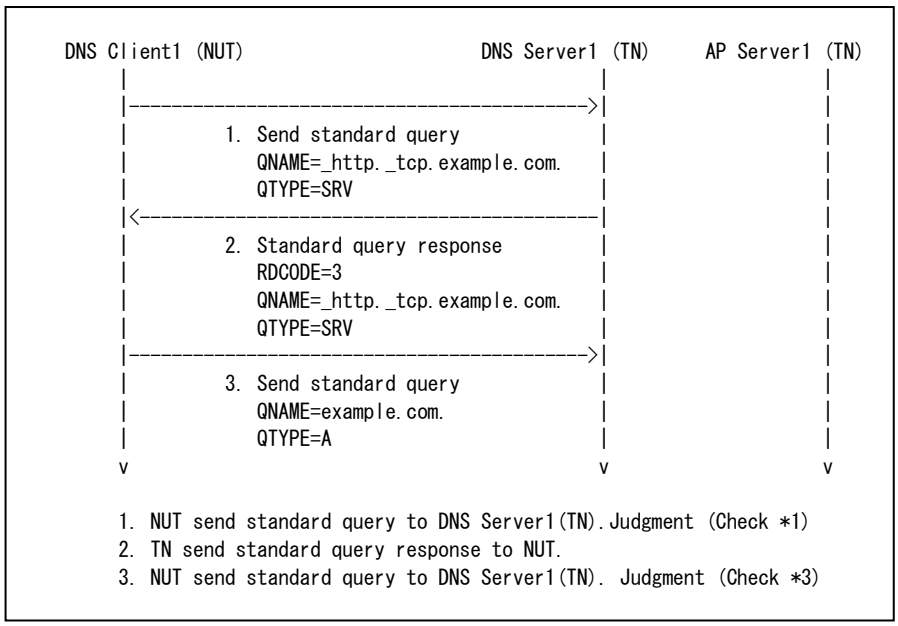
Client

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "A.example.com".
- **Setup**
  Set the DNS Server1(TN)'s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for SRV type(IN class) of _http._tcp.example.com. to the DNS Server1(TN),
  NUT start TCP communication (SYN) to _http._tcp.example.com.

Procedure

This test sequence is following.



Packet Description

1st Packet

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	_http._tcp.example.com.
	QTYPE	SRV (0x0031)
	QCLASS	IN (0x0001)

2nd packet.

2. Standard query response from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Same as 1st Packet's Src Port
DNS Header	ID	Same as 1st Packet's ID
	QR	1
	OPCODE	0
	AA	1
	TC	0
	RD	Same as 1st Packet's RD
	RA	0
	Z	0
	RCODE	3
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	0

DNS Question section	QNAME	_http._tcp.example.com.
	QTYPE	SRV (0x0021)
	QCLASS	IN (0x0001)

3rd Packet

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*
	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	example.com.
	QTYPE	A (0x0001)
	QCLASS	IN (0x0001)

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Received standard query QTYPE=SRV QNAME=_http._tcp.example.com. from NUT.
3. Received standard query QTYPE=A QNAME=example.com. from NUT.

References

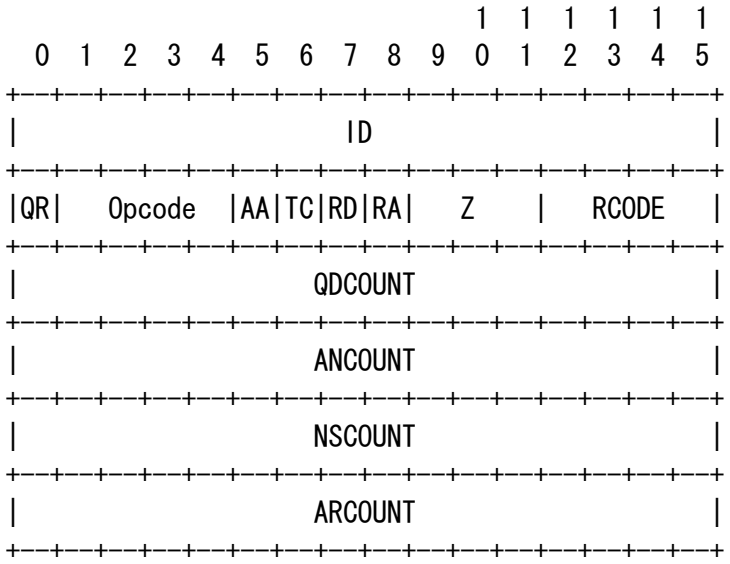
RFC1035 DOMAIN NAMES - CONCEPTS AND FACILITIES
5.2.1. Typical functions RFC2782 DNS SRV RR

5.95. NAPTR type in standard query

Purpose

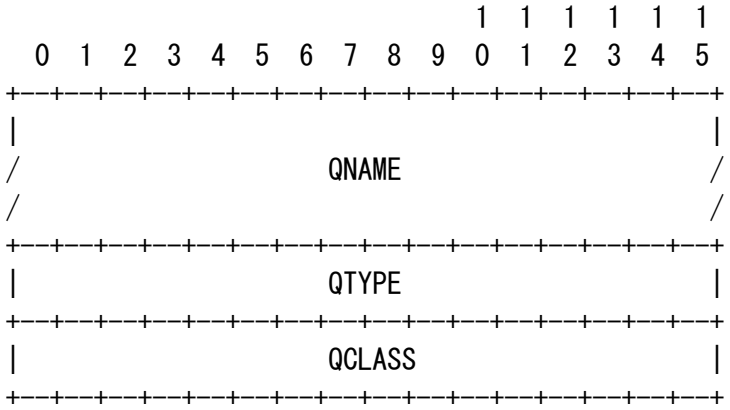
Verify that a NUT transmits correct standard query format for NAPTR type

- Header section format



QR	**Query (0)**
Opcode	**A standard query(QUERY) (0)**
Z	**Must be zero**
QDCOUNT	**1**
ANCOUNT	**0**
NSCOUNT	**0**
ARCOUNT	**0**

- Question section format



QNAME	**A.example.com**
QTYPE	**NAPTR type (35)**

- Answer section format
  Must be empty
- Authority section format
  Must be empty
- Additional section format
  Must be empty

Category

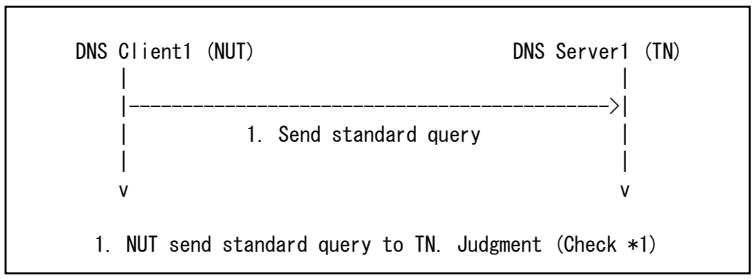
Client

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "A.example.com".
- **Setup**
  Set the DNS Server1(TN)'s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for NAPTR type of AP Server1(TN): A.example.com to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*

	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	A.example.com
	QTYPE	NAPTR (0x0023)
	QCLASS	*any*

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Standard query for NATPR type must be base on above Verification Points.

References

RFC3403 Dynamic Delegation Discovery System (DDDS)
Part Three: The Domain Name System (DNS) Database
4. NAPTR RR Format

5.96. Order comparison

Purpose

Verify a NUT process when NUT received message that includes multiple Naming Authority Pointer (NAPTR) Resource Records (RR) containing different order.

- ORDER
  A 16-bit unsigned integer specifying the order in which the NAPTR records MUST be processed in order to accurately represent the ordered list of Rules. The ordering is from lowest to highest. If two records have the same order value then they are considered to be the same rule and should be selected based on the combination of the Preference values and Services offered.
- A client MUST process multiple NAPTR records in the order specified by the "order" field, it MUST NOT simply use the first record that provides a known Service Parameter combination.

Category

Client (ADVANCED)

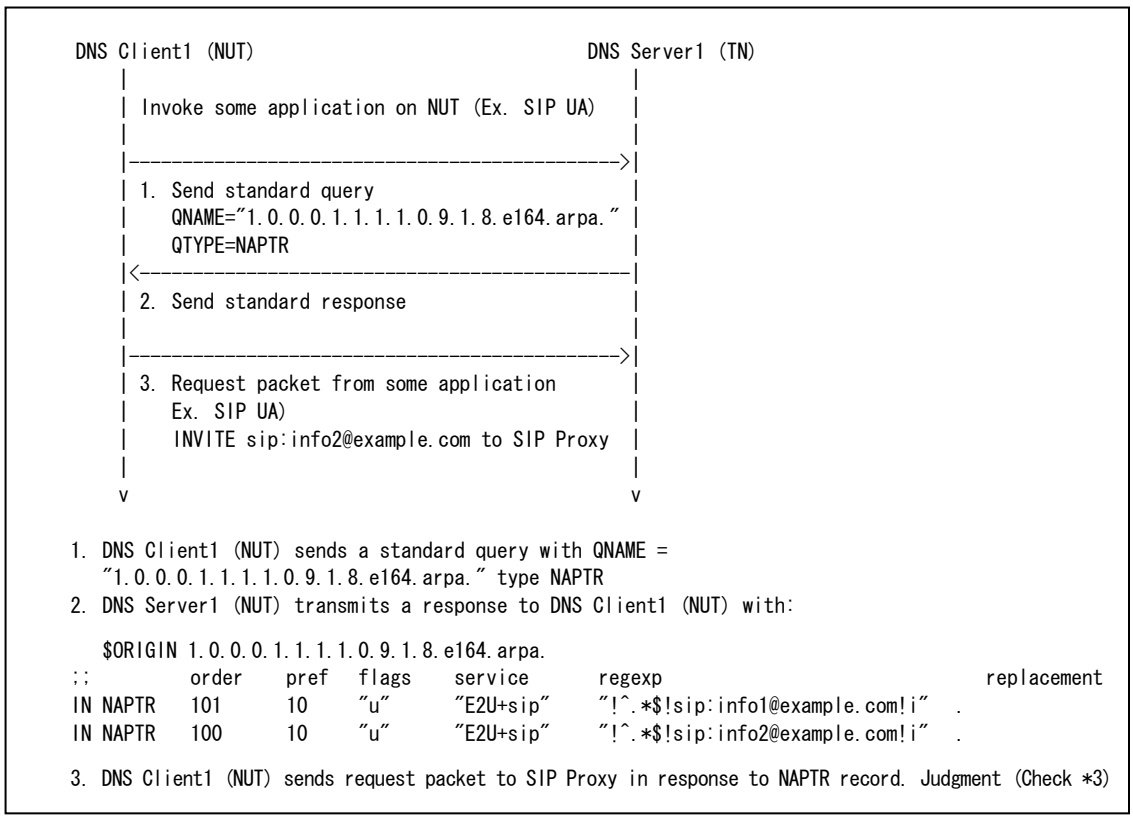
Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
- **Setup**
  Set the DNS Server1 (TN)'s address on DNS Client1 (NUT) as above mentioned Network Topology. If NUT use a SIP user agent as DDDS application, then set up SIP Proxy address: 192.168.1.20 (IPv4) or 3ffe:501:ffff:101::20 (IPv6).

Application Unique String (AUS)	+81-90-1111-0001
Converted to the Key	819011110001
Used domain-name to retrieve Rewrite Rules as NAPTR records	1.0.0.0.1.1.1.1.0.9.1.8.e164.arpa.

Procedure

This test sequence is following.



1. DNS Client1 (NUT) sends a standard query with QNAME = "1.0.0.0.1.1.1.1.0.9.1.8.e164.arpa." type NAPTR
2. DNS Server1 (NUT) transmits a response to DNS Client1 (NUT) with:

```
   $ORIGIN 1.0.0.0.1.1.1.1.0.9.1.8.e164.arpa.
;;         order    pref   flags    service      regexp                                  replacement
IN NAPTR   101      10     "u"      "E2U+sip"    "!^.*$!sip:info1@example.com!i"   .
IN NAPTR   100      10     "u"      "E2U+sip"    "!^.*$!sip:info2@example.com!i"   .
```

3. DNS Client1 (NUT) sends request packet to SIP Proxy in response to NAPTR record. Judgment (Check *3)

Packet Description

1st packet.

Standard query from DNS Client1 (NUT) to Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	ANY
	Dst Port	53
DNS Header	ID	ANY
	QR	0
	OPCODE	0
	AA	0
	TC	0
	RD	0
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1

	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	0
DNS Question section	QNAME	1.0.0.0.1.1.1.1.0.9.1.8.e164.arpa.
	QTYPE	NAPTR (0x0023)
	QCLASS	IN (0x0001)

2nd packet.

Standard query response from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Value that NUT uses
DNS Header	ID	Value that NUT uses
	QR	1
	OPCODE	0
	AA	1
	TC	0
	RD	0
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	2
	NSCOUNT	1
	ARCOUNT	2
DNS Question section	QNAME	1.0.0.0.1.1.1.1.0.9.1.8.e164.arpa.
	QTYPE	NAPTR (0x0023)
	QCLASS	IN (0x0001)
DNS Answer section	NAME	1.0.0.0.1.1.1.1.0.9.1.8.e164.arpa.(Pointer 0xC00C)
	TYPE	NAPTR (0x0023)
	CLASS	IN (0x0001)
	TTL	86400sec
	RDLENGTH	45
	ORDER	101
	PREFERENCE	10
	FLAGS	U
	SERVICES	E2U+sip
	REGEXP	!^.*$!sip:info1@example.com!i
	REPLACEMENT	.
DNS Answer section	NAME	1.0.0.0.1.1.1.1.0.9.1.8.e164.arpa.(Pointer 0xC00C)
	TYPE	NAPTR (0x0023)
	CLASS	IN (0x0001)

	TTL	86400sec
	RDLENGTH	45
	ORDER	100
	PREFERENCE	10
	FLAGS	U
	SERVICES	E2U+sip
	REGEXP	!^.*$!sip:info2@example.com!i
	REPLACEMENT	.
DNS Authority section	NAME	1.1.1.1.0.9.1.8.e164.arpa. (Pointer 0xC014)
	TYPE	NS (0x0002)
	CLASS	IN (0x0001)
	TTL	86400sec
	RDLENGTH	17
	NSDNAME	NS1.example.com
DNS Additional section	NAME	NS1.example.com (Pointer 0xC0B1)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	86400sec
	RDLENGTH	4
	ADDRESS	192.168.1.20
DNS Additional section	NAME	NS1.example.com (Pointer 0xC0B1)
	TYPE	AAAA (0x001C)
	CLASS	IN (0x0001)
	TTL	86400sec
	RDLENGTH	16
	ADDRESS	3ffe:501:ffff:101::20

3rd packet.

If NUT uses a SIP UA.

Request packet from DNS Client (NUT) to SIP Proxy (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	ANY
	Dst Port	5060
SIP message	Request-Line	INVITE sip:info2@example.com SIP/2.0
	message-header	ANY
	message-body	ANY

- **Termination**

  If NUT has cache function, clear the cache.

Judgment

3. Received the domain-name included in NAPTR RR of ORDER=100.

References

RFC3403 Dynamic Delegation Discovery System (DDDS)
Part Three: The Domain Name System (DNS) Database
4. NAPTR RR Format
6. Example
8. Notes

RFC3761 The E.164 to Uniform Resource Identifiers (URI)
Dynamic Delegation Discovery System (DDDS) Application (ENUM)

5.97. Preference comparison

Purpose

Verify a NUT process when NUT received message that includes multiple Naming Authority Pointer(NAPTR) Resource Records(RR) containing different preference.

- PREFERENCE
  Although it is called "preference" in deference to DNS terminology, this field is equivalent to the Priority value in the DDDS Algorithm. It is a 16-bit unsigned integer that specifies the order in which NAPTR records with equal Order values SHOULD be processed, low numbers being processed before high numbers. This is similar to the preference field in an MX record, and is used so domain administrators can direct clients towards more capable hosts or lighter weight protocols. A client MAY look at records with higher preference values if it has a good reason to do so such as not supporting some protocol or service very well.
- When multiple RRs have the same "order" and all other criteria being equal, the client should use the value of the preference field to select the next NAPTR to consider. However, because it will often be the case where preferred protocols or services exist, clients may use this additional criterion to sort the records.

Category

Client (ADVANCED)

Initialization

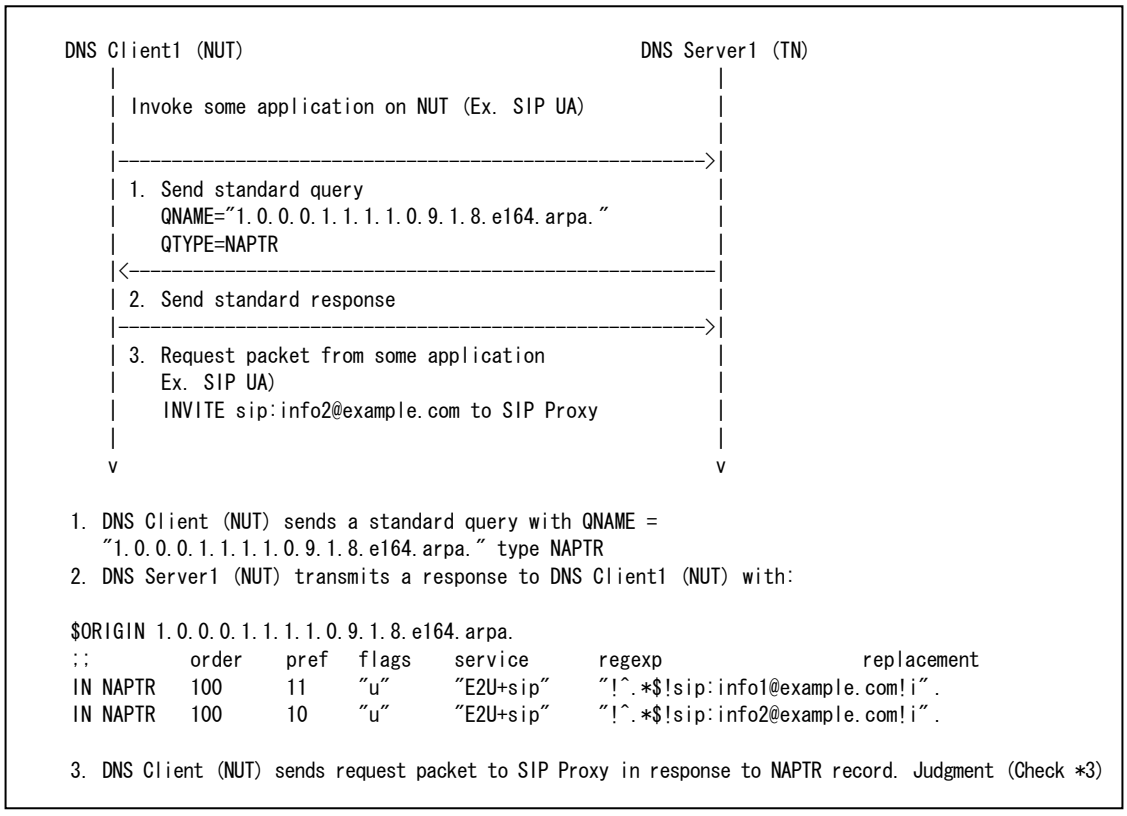
- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".

- **Setup**
  Set the DNS Server1 (TN)'s address on DNS Client1 (NUT) as above mentioned Network Topology. If NUT use a SIP user agent as DDDS application, then set up SIP Proxy address: 192.168.1.20 (IPv4) or 3ffe:501:ffff:101::20 (IPv6).

Application Unique String (AUS)	+81-90-1111-0001
Converted to the Key	819011110001
Used domain-name to retrieve Rewrite Rules as NAPTR records	1.0.0.0.1.1.1.1.0.9.1.8.e164.arpa.

Procedure

This test sequence is following.



Packet Description

1st packet.

Standard query from DNS Client1 (NUT) to Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	ANY
	Dst Port	53
DNS Header	ID	ANY
	QR	0
	OPCODE	0
	AA	0
	TC	0
	RD	0
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	0

	NSCOUNT	0
	ARCOUNT	0
DNS Question section	QNAME	1.0.0.0.1.1.1.1.0.9.1.8.e164.arpa.
	QTYPE	NAPTR (0x0023)
	QCLASS	IN (0x0001)

2nd packet.

Standard query response from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Value that NUT uses
DNS Header	ID	Value that NUT uses
	QR	1
	OPCODE	0
	AA	1
	TC	0
	RD	0
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	2
	NSCOUNT	1
	ARCOUNT	2
DNS Question section	QNAME	1.0.0.0.1.1.1.1.0.9.1.8.e164.arpa.
	QTYPE	NAPTR (0x0023)
	QCLASS	IN (0x0001)
DNS Answer section	NAME	1.0.0.0.1.1.1.1.0.9.1.8.e164.arpa. (Pointer 0xC00C)
	TYPE	NAPTR (0x0023)
	CLASS	IN (0x0001)
	TTL	86400sec
	RDLENGTH	45
	ORDER	100
	PREFERENCE	11
	FLAGS	U
	SERVICES	E2U+sip
	REGEXP	!^.*$!sip:info1@example.com!i
	REPLACEMENT	.
DNS Answer section	NAME	1.0.0.0.1.1.1.1.0.9.1.8.e164.arpa. (Pointer 0xC00C)
	TYPE	NAPTR (0x0023)
	CLASS	IN (0x0001)
	TTL	86400sec

	RDLENGTH	45
	ORDER	100
	PREFERENCE	10
	FLAGS	U
	SERVICES	E2U+sip
	REGEXP	!^.*$!sip:info2@example.com!i
	REPLACEMENT	.
DNS Authority section	NAME	1.1.1.1.0.9.1.8.e164.arpa. (Pointer 0xC014)
	TYPE	NS (0x0002)
	CLASS	IN (0x0001)
	TTL	86400sec
	RDLENGTH	17
	NSDNAME	NS1.example.com
DNS Additional section	NAME	NS1.example.com (Pointer 0xC0B1)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	86400sec
	RDLENGTH	4
	ADDRESS	192.168.1.20
DNS Additional section	NAME	NS1.example.com (Pointer 0xC0B1)
	TYPE	AAAA (0x001C)
	CLASS	IN (0x0001)
	TTL	86400sec
	RDLENGTH	16
	ADDRESS	3ffe:501:ffff:101::20

3rd packet.

If NUT uses a SIP UA.

Request packet from DNS Client (NUT) to SIP Proxy (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	ANY
	Dst Port	5060
SIP message	Request-Line	INVITE sip:info2@example.com SIP/2.0
	message-header	ANY
	message-body	ANY

- **Termination**

  If NUT has cache function, clear the cache.

Judgment

3. Received the domain-name included in NAPTR RR of PREFERENCE=10.

References

RFC3403 Dynamic Delegation Discovery System (DDDS)
Part Three: The Domain Name System (DNS) Database
4. NAPTR RR Format
6. Example
8. Notes

RFC3761 The E.164 to Uniform Resource Identifiers (URI)
Dynamic Delegation Discovery System (DDDS) Application (ENUM)

5.98. Flag "" to control rewriting and interpretation

Purpose

Verify a NUT process when NUT received message that includes multiple Naming Authority Pointer (NAPTR) Resource Records (RR) containing different flags.

- FLAGS

  A containing flags to control aspects of the rewriting and interpretation of the fields in the record. Flags are single characters from the set A-Z and 0-9. The case of the alphabetic characters is not significant. The field can be empty.

  It is up to the Application specifying how it is using this Database to define the Flags in this field. It must define which ones are terminal and which ones are not.

- If this flag is not present then this rule is non-terminal. If a Rule is non-terminal then clients MUST use the Key produced by this Rewrite Rule as the new Key in the DDDS loop (i.e., causing the client to query for new NAPTR records at the domain-name that is the result of this Rule).

Category

Client (ADVANCED)

Initialization

- **Network Topology**

  Refer the topology "Fig. 1 Topology No.1".

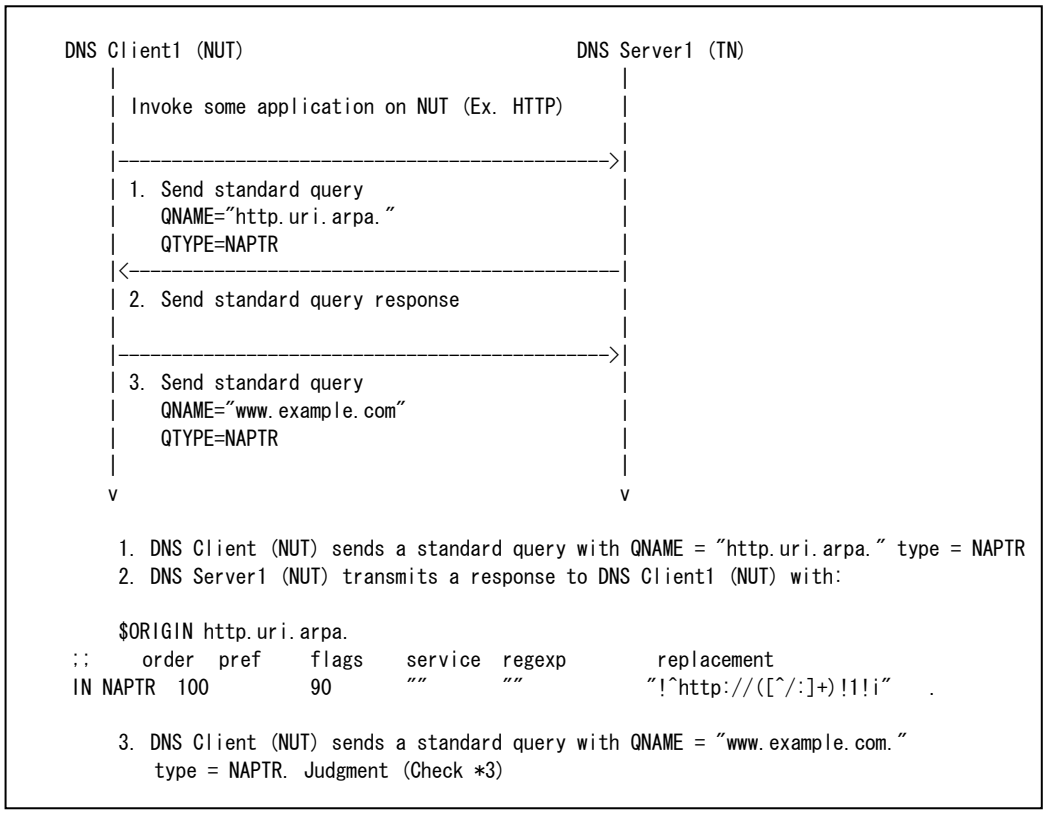
- **Setup**

  Set the DNS Server1 (TN)'s address on DNS Client1 (NUT) as above mentioned Network Topology. DNS client (NUT) needs a HTTP program as DDDS application.

Application Unique String (AUS)	http://www.example.com/dns/test.pdf
Key	http
Used domain-name to retrieve Rewrite Rules as NAPTR records	http.uri.arpa.

Procedure

This test sequence is following.



Packet Description

1st packet.

Standard query from DNS Client1 (NUT) to Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	ANY
	Dst Port	53
DNS Header	ID	ANY
	QR	0
	OPCODE	0
	AA	0
	TC	0
	RD	0
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	0

	NSCOUNT	0
	ARCOUNT	0
DNS Question section	QNAME	http.uri.arpa.
	QTYPE	NAPTR (0x0023)
	QCLASS	IN (0x0001)

2nd packet.

Standard query response from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Value that NUT uses
DNS Header	ID	Value that NUT uses
	QR	1
	OPCODE	0
	AA	1
	TC	0
	RD	0
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	1
	NSCOUNT	1
	ARCOUNT	2
DNS Question section	QNAME	http.uri.arpa.
	QTYPE	NAPTR (0x0023)
	QCLASS	IN (0x0001)
DNS Answer section	NAME	http.uri.arpa. (Pointer 0xC00C)
	TYPE	NAPTR (0x0023)
	CLASS	IN (0x0001)
	TTL	86400sec
	RDLENGTH	29
	ORDER	100
	PREFERENCE	90
	FLAGS	**(not present)**
	SERVICES	**(not present)**
	REGEXP	!^http://([^/:]+)!1!i
	REPLACEMENT	.
DNS Authority section	NAME	uri.arpa. (Pointer 0xC011)
	TYPE	NS (0x0002)
	CLASS	IN (0x0001)
	TTL	86400sec

	RDLENGTH	17
	NSDNAME	NS1.example.com
DNS Additional section	NAME	NS1.example.com (Pointer 0xC054)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	86400sec
	RDLENGTH	4
	ADDRESS	192.168.1.20
DNS Additional section	NAME	NS1.example.com (Pointer 0xC054)
	TYPE	AAAA (0x001C)
	CLASS	IN (0x0001)
	TTL	86400sec
	RDLENGTH	16
	ADDRESS	3ffe:501:ffff:101::20

3rd packet.

Standard query from DNS Client1 (NUT) to Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	ANY
	Dst Port	53
DNS Header	ID	ANY
	QR	0
	OPCODE	0
	AA	0
	TC	0
	RD	0
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	0
DNS Question section	QNAME	www.example.com.
	QTYPE	NAPTR (0x0023)
	QCLASS	IN (0x0001)

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

3. Received a query message in response to TN sent NAPTR resource record.

References

RFC3403 Dynamic Delegation Discovery System (DDDS)
Part Three: The Domain Name System (DNS) Database
4. NAPTR RR Format
RFC3404 Dynamic Delegation Discovery System (DDDS)
Part Four: The Uniform Resource Identifiers (URI)Resolution Application
5.3 Resolving an HTTP URI Scheme

5.99. Flag "A" to control rewriting and interpretation

Purpose

Verify a NUT process when NUT received message that includes multiple Naming Authority Pointer (NAPTR) Resource Records (RR) containing different flags.

- FLAGS

  A containing flags to control aspects of the rewriting and interpretation of the fields in the record. Flags are single characters from the set A-Z and 0-9. The case of the alphabetic characters is not significant. The field can be empty.

  It is up to the Application specifying how it is using this Database to define the Flags in this field. It must define which ones are terminal and which ones are not.

- If this flag is not present then this rule is non-terminal. If a Rule is non-terminal then clients MUST use the Key produced by this Rewrite Rule as the new Key in the DDDS loop (i.e., causing the client to query for new NAPTR records at the domain-name that is the result of this Rule).
- The "A" flags are for a terminal lookup. This means that the Rule is the last one and that the flag determines what the next stage should be. "A" means that the output of the Rule is a domain-name and should be used to lookup either A, AAAA, or A6 records for that domain.

Category

Client (ADVANCED)

Initialization

- **Network Topology**

  Refer the topology "Fig. 1 Topology No.1".

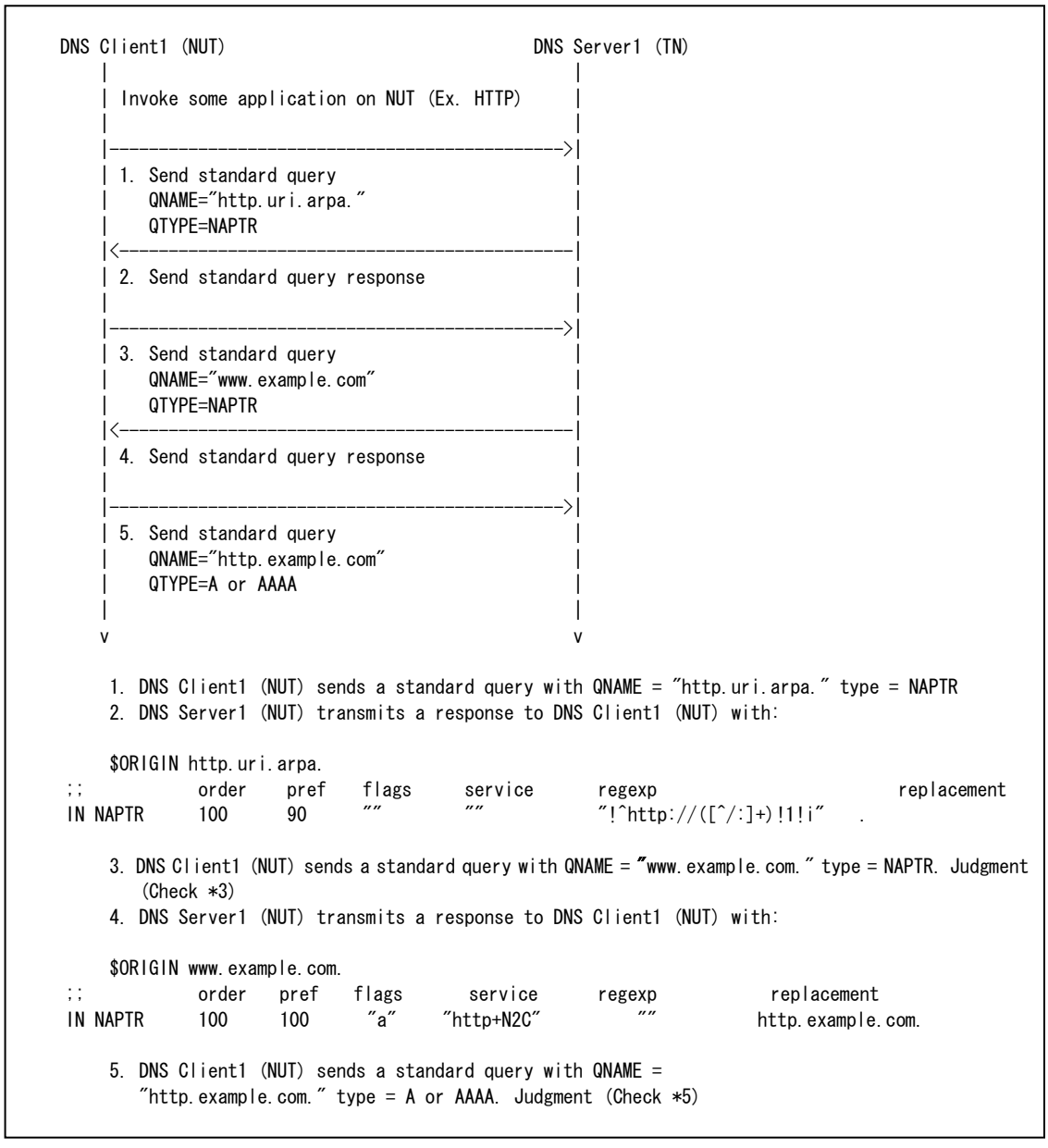
- **Setup**

  Set the DNS Server1 (TN)'s address on DNS Client1 (NUT) as above mentioned Network Topology. DNS client (NUT) needs a HTTP program as DDDS application.

Application Unique String (AUS)	http://www.example.com/dns/test.pdf
Key	http
Used domain-name to retrieve Rewrite Rules as NAPTR records	http.uri.arpa.

Procedure

This test sequence is following.



1. DNS Client1 (NUT) sends a standard query with QNAME = "http.uri.arpa." type = NAPTR
2. DNS Server1 (NUT) transmits a response to DNS Client1 (NUT) with:

```
$ORIGIN http.uri.arpa.
;;          order    pref    flags     service      regexp                          replacement
IN NAPTR    100      90      ""        ""           "!^http://([^/:]+)!1!i"    .
```

3. DNS Client1 (NUT) sends a standard query with QNAME = "www.example.com." type = NAPTR. Judgment (Check *3)
4. DNS Server1 (NUT) transmits a response to DNS Client1 (NUT) with:

```
$ORIGIN www.example.com.
;;          order    pref    flags      service      regexp          replacement
IN NAPTR    100      100      "a"     "http+N2C"         ""          http.example.com.
```

5. DNS Client1 (NUT) sends a standard query with QNAME = "http.example.com." type = A or AAAA. Judgment (Check *5)

Packet Description

1st packet.

Standard query from DNS Client1 (NUT) to Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	ANY
	Dst Port	53
DNS Header	ID	ANY

	QR	0
	OPCODE	0
	AA	0
	TC	0
	RD	0
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	0
DNS Question section	QNAME	http.uri.arpa.
	QTYPE	NAPTR (0x0023)
	QCLASS	IN (0x0001)

2nd packet.

Standard query response from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Value that NUT uses
DNS Header	ID	Value that NUT uses
	QR	1
	OPCODE	0
	AA	1
	TC	0
	RD	0
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	1
	NSCOUNT	1
	ARCOUNT	2
DNS Question section	QNAME	http.uri.arpa.
	QTYPE	NAPTR (0x0023)
	QCLASS	IN (0x0001)
DNS Answer section	NAME	http.uri.arpa. (Pointer 0xC00C)
	TYPE	NAPTR (0x0023)
	CLASS	IN (0x0001)
	TTL	86400sec
	RDLENGTH	29

	ORDER	100
	PREFERENCE	90
	FLAGS	(not present)
	SERVICES	(not present)
	REGEXP	!^http://([^/:]+)!1!i
	REPLACEMENT	.
DNS Authority section	NAME	uri.arpa. (Pointer 0xC011)
	TYPE	NS (0x0002)
	CLASS	IN (0x0001)
	TTL	86400sec
	RDLENGTH	17
	NSDNAME	NS1.example.com
DNS Additional section	NAME	NS1.example.com (Pointer 0xC054)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	86400sec
	RDLENGTH	4
	ADDRESS	192.168.1.20
DNS Additional section	NAME	NS1.example.com (Pointer 0xC054)
	TYPE	AAAA (0x001C)
	CLASS	IN (0x0001)
	TTL	86400sec
	RDLENGTH	16
	ADDRESS	3ffe:501:ffff:101::20

3rd packet.

Standard query from DNS Client1 (NUT) to Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	ANY
	Dst Port	53
DNS Header	ID	ANY
	QR	0
	OPCODE	0
	AA	0
	TC	0
	RD	0
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0

	ARCOUNT	0
DNS Question section	QNAME	www.example.com.
	QTYPE	NAPTR (0x0023)
	QCLASS	IN (0x0001)

4th packet.

Standard query response from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Value that NUT uses
DNS Header	ID	Value that NUT uses
	QR	1
	OPCODE	0
	AA	1
	TC	0
	RD	0
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	1
	NSCOUNT	1
	ARCOUNT	2
DNS Question section	QNAME	www.example.com.
	QTYPE	NAPTR (0x0023)
	QCLASS	IN (0x0001)
DNS Answer section	NAME	www.example.com. (Pointer 0xC00C)
	TYPE	NAPTR (0x0023)
	CLASS	IN (0x0001)
	TTL	86400sec
	RDLENGTH	34
	ORDER	100
	PREFERENCE	100
	FLAGS	**a**
	SERVICES	http+N2C
	REGEXP	**(not present)**
	REPLACEMENT	**http.example.com**
DNS Authority section	NAME	example.com. (Pointer 0xC042)
	TYPE	NS (0x0002)
	CLASS	IN (0x0001)
	TTL	86400sec
	RDLENGTH	17

	NSDNAME	NS1.example.com
DNS Additional section	NAME	NS1.example.com (Pointer 0xC05B)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	86400sec
	RDLENGTH	4
	ADDRESS	192.168.1.20
DNS Additional section	NAME	NS1.example.com (Pointer 0xC05B)
	TYPE	AAAA (0x001C)
	CLASS	IN (0x0001)
	TTL	86400sec
	RDLENGTH	16
	ADDRESS	3ffe:501:ffff:101::20

5th packet.

Standard query from DNS Client1 (NUT) to Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	ANY
	Dst Port	53
DNS Header	ID	ANY
	QR	0
	OPCODE	0
	AA	0
	TC	0
	RD	0
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	0
DNS Question section	QNAME	*http.example.com.*
	QTYPE	*A (0x0001) or AAAA (0x001C)*
	QCLASS	IN (0x0001)

- **Termination**

  If NUT has cache function, clear the cache.

Judgment

3. Received a query message that it includes QNAME=www.example.com, TYPE=NAPTR.
5. Received a query message that it includes QNAME=http.example.com, TYPE=A or AAAA.

References

RFC3403 Dynamic Delegation Discovery System (DDDS)
Part Three: The Domain Name System (DNS) Database
4. NAPTR RR Format
RFC3404 Dynamic Delegation Discovery System (DDDS)
Part Four: The Uniform Resource Identifiers (URI)
Resolution Application
5.3 Resolving an HTTP URI Scheme

5.100. Flag "S" to control rewriting and interpretation

Purpose

Verify a NUT process when NUT received message that includes multiple Naming Authority Pointer (NAPTR) Resource Records (RR) containing different flags.

- FLAGS

  A containing flags to control aspects of the rewriting and interpretation of the fields in the record. Flags are single characters from the set A-Z and 0-9. The case of the alphabetic characters is not significant. The field can be empty.

  It is up to the Application specifying how it is using this Database to define the Flags in this field. It must define which ones are terminal and which ones are not.

- If this flag is not present then this rule is non-terminal. If a Rule is non-terminal then clients MUST use the Key produced by this Rewrite Rule as the new Key in the DDDS loop (i.e., causing the client to query for new NAPTR records at the domain-name that is the result of this Rule).
- The "S" flag means that the output of this Rule is a domain-name for which one or more SRV [9] records exist.

Category

Client (ADVANCED)

Initialization

- **Network Topology**

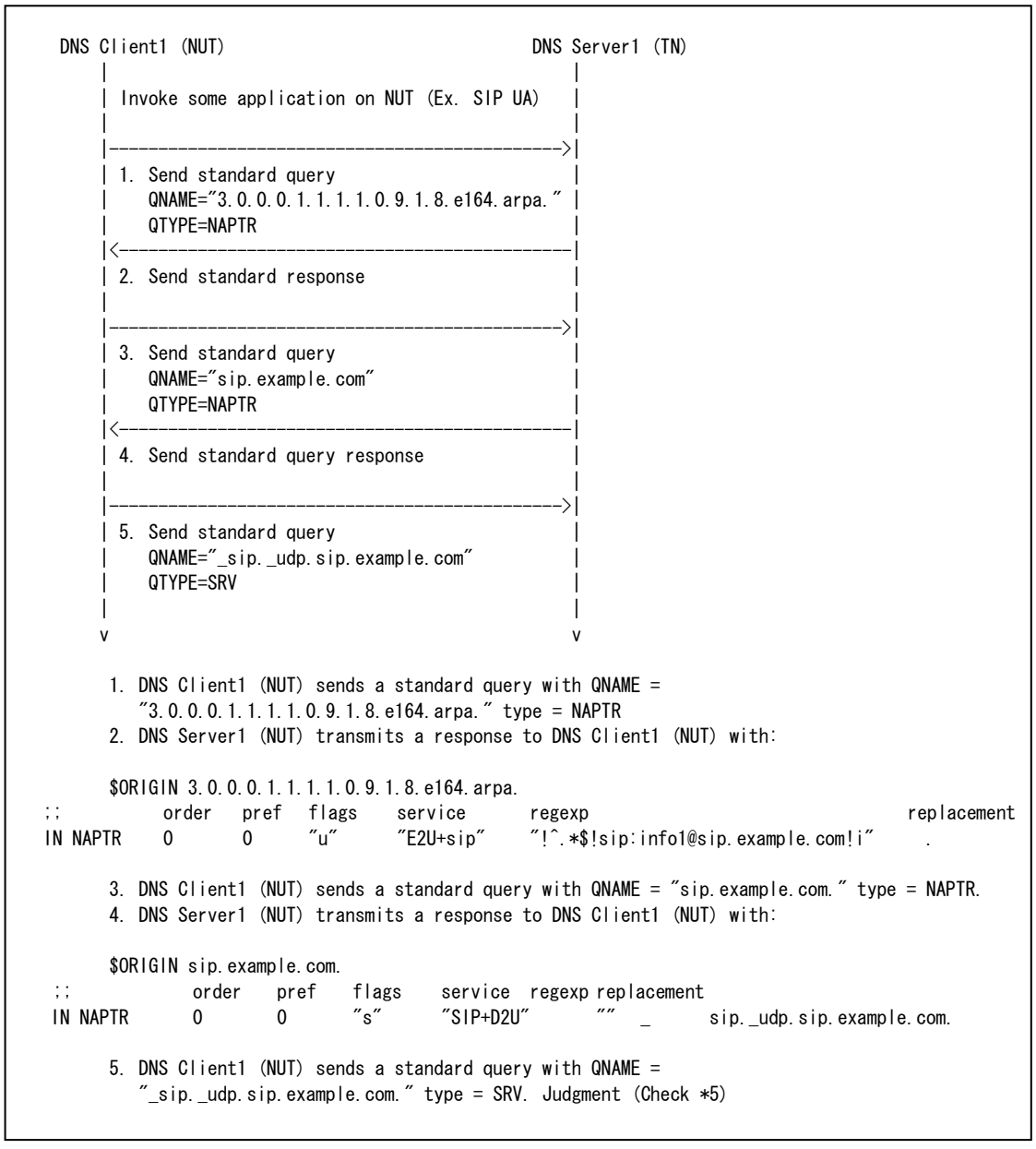
  Refer the topology "Fig. 1 Topology No.1".
- **Setup**

  Set the DNS Server1 (TN)'s address on DNS Client1 (NUT) as above mentioned Network Topology. DNS Client1 (NUT) may need a SIP user agent as DDDS application. Note that it doesn't use SIP Proxy.

Application Unique String (AUS)	+81-90-1111-0003
Converted to the Key	819011110003
Used domain-name to retrieve Rewrite Rules as NAPTR records	3.0.0.0.1.1.1.1.0.9.1.8.e164.arpa.

Procedure

This test sequence is following.



1. DNS Client1 (NUT) sends a standard query with QNAME = "3.0.0.0.1.1.1.1.0.9.1.8.e164.arpa." type = NAPTR
2. DNS Server1 (NUT) transmits a response to DNS Client1 (NUT) with:

```
$ORIGIN 3.0.0.0.1.1.1.1.0.9.1.8.e164.arpa.
;;          order   pref   flags    service      regexp                                  replacement
IN NAPTR    0       0      "u"      "E2U+sip"    "!^.*$!sip:info1@sip.example.com!i"     .
```

3. DNS Client1 (NUT) sends a standard query with QNAME = "sip.example.com." type = NAPTR.
4. DNS Server1 (NUT) transmits a response to DNS Client1 (NUT) with:

```
$ORIGIN sip.example.com.
;;            order    pref    flags    service  regexp replacement
IN NAPTR      0        0       "s"      "SIP+D2U"       ""   _      sip._udp.sip.example.com.
```

5. DNS Client1 (NUT) sends a standard query with QNAME = "_sip._udp.sip.example.com." type = SRV. Judgment (Check *5)

Packet Description

1st packet.

Standard query from DNS Client1 (NUT) to Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	ANY
	Dst Port	53

DNS Header	ID	ANY
	QR	0
	OPCODE	0
	AA	0
	TC	0
	RD	0
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	0
DNS Question section	QNAME	3.0.0.0.1.1.1.1.0.9.1.8.e164.arpa.
	QTYPE	NAPTR (0x0023)
	QCLASS	IN (0x0001)

2nd packet.

Standard query response from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Value that NUT uses
DNS Header	ID	Value that NUT uses
	QR	1
	OPCODE	0
	AA	1
	TC	0
	RD	0
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	1
	NSCOUNT	1
	ARCOUNT	2
DNS Question section	QNAME	3.0.0.0.1.1.1.1.0.9.1.8.e164.arpa.
	QTYPE	NAPTR (0x0023)
	QCLASS	IN (0x0001)
DNS Answer section	NAME	3.0.0.0.1.1.1.1.0.9.1.8.e164.arpa.(Pointer 0xC00C)
	TYPE	NAPTR (0x0023)
	CLASS	IN (0x0001)
	TTL	86400sec

	RDLENGTH	49
	ORDER	0
	PREFERENCE	0
	FLAGS	u
	SERVICES	E2U+sip
	REGEXP	!^.*$!sip:info1@sip.example.com!i
	REPLACEMENT	.
DNS Authority section	NAME	1.1.1.1.0.9.1.8.e164.arpa. (Pointer 0xC014)
	TYPE	NS (0x0002)
	CLASS	IN (0x0001)
	TTL	86400sec
	RDLENGTH	17
	NSDNAME	NS1.example.com
DNS Additional section	NAME	NS1.example.com (Pointer 0xC07C)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	86400sec
	RDLENGTH	4
	ADDRESS	192.168.1.20
DNS Additional section	NAME	NS1.example.com (Pointer 0xC07C)
	TYPE	AAAA (0x001C)
	CLASS	IN (0x0001)
	TTL	86400sec
	RDLENGTH	16
	ADDRESS	3ffe:501:ffff:101::20

3rd packet.

Standard query from DNS Client1 (NUT) to Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	ANY
	Dst Port	53
DNS Header	ID	ANY
	QR	0
	OPCODE	0
	AA	0
	TC	0
	RD	0
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	0

	NSCOUNT	0
	ARCOUNT	0
DNS Question section	QNAME	sip.example.com.
	QTYPE	NAPTR (0x0023)
	QCLASS	IN (0x0001)

4th packet.

Standard query response from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Value that NUT uses
DNS Header	ID	Value that NUT uses
	QR	1
	OPCODE	0
	AA	1
	TC	0
	RD	0
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	1
	NSCOUNT	1
	ARCOUNT	2
DNS Question section	QNAME	sip.example.com.
	QTYPE	NAPTR (0x0023)
	QCLASS	IN (0x0001)
DNS Answer section	NAME	sip.example.com. (Pointer 0xC00C)
	TYPE	NAPTR (0x0023)
	CLASS	IN (0x0001)
	TTL	86400sec
	RDLENGTH	42
	ORDER	0
	PREFERENCE	0
	FLAGS	**s**
	SERVICES	**SIP+D2U**
	REGEXP	**(not present)**
	REPLACEMENT	**_sip._udp.sip.example.com**
DNS Authority section	NAME	example.com. (Pointer 0xC04A)
	TYPE	NS (0x0002)
	CLASS	IN (0x0001)
	TTL	86400sec

	RDLENGTH	17
	NSDNAME	NS1.example.com
DNS Additional section	NAME	NS1.example.com (Pointer 0xC063)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	86400sec
	RDLENGTH	4
	ADDRESS	192.168.1.20
DNS Additional section	NAME	NS1.example.com (Pointer 0xC063)
	TYPE	AAAA (0x001C)
	CLASS	IN (0x0001)
	TTL	86400sec
	RDLENGTH	16
	ADDRESS	3ffe:501:ffff:101::20

5th packet.

Standard query from DNS Client1 (NUT) to Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	ANY
	Dst Port	53
DNS Header	ID	ANY
	QR	0
	OPCODE	0
	AA	0
	TC	0
	RD	0
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	0
DNS Question section	QNAME	*_sip._udp.sip.example.com.*
	QTYPE	*SRV (0x0021)*
	QCLASS	IN (0x0001)

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

5. Received a query message that it includes QNAME=_sip._udp.sip.example.com, TYPE=SRV.

References

RFC3403 Dynamic Delegation Discovery System (DDDS)
Part Three: The Domain Name System (DNS) Database
4. NAPTR RR Format
RFC3263 Session Initiation Protocol (SIP): Locating SIP Servers
RFC2782 A DNS RR for specifying the location of services (DNS SRV)

5.101. Selection of services

Purpose

Verify a NUT process when NUT received message that includes multiple Naming Authority Pointer (NAPTR) Resource Records (RR) containing different services.

- SERVICES

  A that specifies the Service Parameters applicable to this delegation path. It is up to the Application Specification to specify the values found in this field.

  Application specification defines what the allowed values for the Services and Protocols fields are.
- Enumservice specifications contain the functional specification (i.e., what it can be used for), the valid protocols, and the URI schemes that may be returned. Note that there is no implicit mapping between the textual string "type" or "subtype" in the grammar for the Enumservice and URI schemes or protocols. The mapping, if any, must be made explicit in the specification for the Enumservice itself. A registration of a specific Type also has to specify the Subtypes allowed.
- In Enumservice case, the only exception to the registration rule is for Types and Subtypes used for experimental purposes, and those are to start with the facet "X-". These elements are unregistered, experimental, and should be used only with the active agreement of the parties exchanging them.
- In SIP case, a client MUST discard any service fields that identify a resolution service whose value is not "D2X", for values of X that indicate transport protocols supported by the client.

Category

Client (ADVANCED)

Initialization

- **Network Topology**

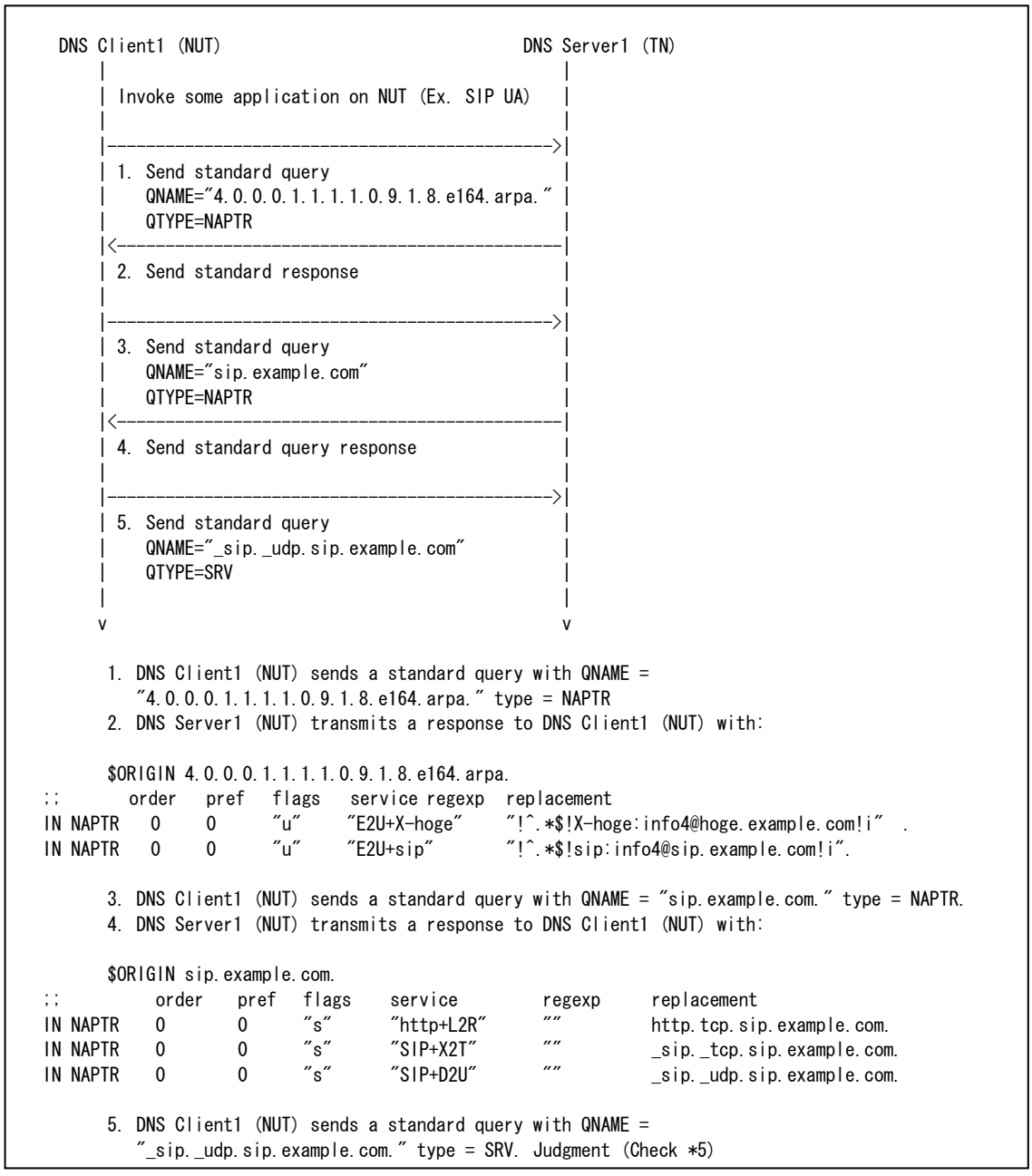
  Refer the topology "Fig. 1 Topology No.1".
- **Setup**

  Set the DNS Server1 (TN)'s address on DNS Client1 (NUT) as above mentioned Network Topology. DNS Client1 (NUT) may need a SIP user agent as DDDS application. Note that it doesn't use SIP Proxy.

Application Unique String (AUS)	+81-90-1111-0004
Converted to the Key	819011110004
Used domain-name to retrieve Rewrite Rules as NAPTR records	4.0.0.0.1.1.1.1.0.9.1.8.e164.arpa.

Procedure

This test sequence is following.



1. DNS Client1 (NUT) sends a standard query with QNAME = "4.0.0.0.1.1.1.1.0.9.1.8.e164.arpa." type = NAPTR
2. DNS Server1 (NUT) transmits a response to DNS Client1 (NUT) with:

```
$ORIGIN 4.0.0.0.1.1.1.1.0.9.1.8.e164.arpa.
;;       order   pref   flags   service regexp  replacement
IN NAPTR   0     0      "u"     "E2U+X-hoge"     "!^.*$!X-hoge:info4@hoge.example.com!i"  .
IN NAPTR   0     0      "u"     "E2U+sip"        "!^.*$!sip:info4@sip.example.com!i".
```

3. DNS Client1 (NUT) sends a standard query with QNAME = "sip.example.com." type = NAPTR.
4. DNS Server1 (NUT) transmits a response to DNS Client1 (NUT) with:

```
$ORIGIN sip.example.com.
;;          order    pref   flags    service         regexp     replacement
IN NAPTR    0        0      "s"      "http+L2R"      ""         http.tcp.sip.example.com.
IN NAPTR    0        0      "s"      "SIP+X2T"       ""         _sip._tcp.sip.example.com.
IN NAPTR    0        0      "s"      "SIP+D2U"       ""         _sip._udp.sip.example.com.
```

5. DNS Client1 (NUT) sends a standard query with QNAME = "_sip._udp.sip.example.com." type = SRV. Judgment (Check *5)

Packet Description

1st packet.

Standard query from DNS Client1 (NUT) to Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	ANY

	Dst Port	53
DNS Header	ID	ANY
	QR	0
	OPCODE	0
	AA	0
	TC	0
	RD	0
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	0
DNS Question section	QNAME	4.0.0.0.1.1.1.1.0.9.1.8.e164.arpa.
	QTYPE	NAPTR (0x0023)
	QCLASS	IN (0x0001)

2nd packet.

Standard query response from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Value that NUT uses
DNS Header	ID	Value that NUT uses
	QR	1
	OPCODE	0
	AA	1
	TC	0
	RD	0
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	1
	NSCOUNT	1
	ARCOUNT	2
DNS Question section	QNAME	4.0.0.0.1.1.1.1.0.9.1.8.e164.arpa.
	QTYPE	NAPTR (0x0023)
	QCLASS	IN (0x0001)
DNS Answer section	NAME	4.0.0.0.1.1.1.1.0.9.1.8.e164.arpa. (Pointer 0xC00C)
	TYPE	NAPTR (0x0023)
	CLASS	IN (0x0001)

	TTL	86400sec
	RDLENGTH	56
	ORDER	0
	PREFERENCE	0
	FLAGS	u
	SERVICES	**E2U+X-hoge**
	REGEXP	!^.*$!X-hoge:info4@hoge.example.com!i
	REPLACEMENT	.
DNS Answer section	NAME	4.0.0.0.1.1.1.1.0.9.1.8.e164.arpa. (Pointer 0xC00C)
	TYPE	NAPTR (0x0023)
	CLASS	IN (0x0001)
	TTL	86400sec
	RDLENGTH	49
	ORDER	0
	PREFERENCE	0
	FLAGS	u
	SERVICES	**E2U+sip**
	REGEXP	!^.*$!sip:info4@sip.example.com!i
	REPLACEMENT	.
DNS Authority section	NAME	1.1.1.1.0.9.1.8.e164.arpa. (Pointer 0xC014)
	TYPE	NS (0x0002)
	CLASS	IN (0x0001)
	TTL	86400sec
	RDLENGTH	17
	NSDNAME	NS1.example.com
DNS Additional section	NAME	NS1.example.com (Pointer 0xC00C)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	86400sec
	RDLENGTH	4
	ADDRESS	192.168.1.20
DNS Additional section	NAME	NS1.example.com (Pointer 0xC00C)
	TYPE	AAAA (0x001C)
	CLASS	IN (0x0001)
	TTL	86400sec
	RDLENGTH	16
	ADDRESS	3ffe:501:ffff:101::20

3rd packet.

Standard query from DNS Client1 (NUT) to Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	ANY

	Dst Port	53
DNS Header	ID	ANY
	QR	0
	OPCODE	0
	AA	0
	TC	0
	RD	0
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	0
DNS Question section	QNAME	*sip.example.com.*
	QTYPE	NAPTR (0x0023)
	QCLASS	IN (0x0001)

4th packet.

Standard query response from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Value that NUT uses
DNS Header	ID	Value that NUT uses
	QR	1
	OPCODE	0
	AA	1
	TC	0
	RD	0
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	1
	NSCOUNT	1
	ARCOUNT	2
DNS Question section	QNAME	sip.example.com.
	QTYPE	NAPTR (0x0023)
	QCLASS	IN (0x0001)
DNS Answer section	NAME	sip.example.com. (Pointer 0xC00C)
	TYPE	NAPTR (0x0023)
	CLASS	IN (0x0001)

	TTL	86400sec
	RDLENGTH	42
	ORDER	0
	PREFERENCE	0
	FLAGS	**s**
	SERVICES	**http+L2R**
	REGEXP	**(not present)**
	REPLACEMENT	**http.tcp.sip.example.com**
DNS Answer section	NAME	sip.example.com. (Pointer 0xC00C)
	TYPE	NAPTR (0x0023)
	CLASS	IN (0x0001)
	TTL	86400sec
	RDLENGTH	42
	ORDER	0
	PREFERENCE	0
	FLAGS	**s**
	SERVICES	**SIP+X2T**
	REGEXP	**(not present)**
	REPLACEMENT	**_sip._tcp.sip.example.com**
DNS Answer section	NAME	sip.example.com. (Pointer 0xC00C)
	TYPE	NAPTR (0x0023)
	CLASS	IN (0x0001)
	TTL	86400sec
	RDLENGTH	42
	ORDER	0
	PREFERENCE	0
	FLAGS	**s**
	SERVICES	**SIP+D2U**
	REGEXP	**(not present)**
	REPLACEMENT	**_sip._udp.sip.example.com**
DNS Authority section	NAME	example.com. (Pointer 0xC04A)
	TYPE	NS (0x0002)
	CLASS	IN (0x0001)
	TTL	86400sec
	RDLENGTH	17
	NSDNAME	NS1.example.com
DNS Additional section	NAME	NS1.example.com (Pointer 0xC0CF)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	86400sec
	RDLENGTH	4
	ADDRESS	192.168.1.20
DNS Additional section	NAME	NS1.example.com (Pointer 0xC0CF)

	TYPE	AAAA (0x001C)
	CLASS	IN (0x0001)
	TTL	86400sec
	RDLENGTH	16
	ADDRESS	3ffe:501:ffff:101::20

5th packet.

Standard query from DNS Client1 (NUT) to Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	ANY
	Dst Port	53
DNS Header	ID	ANY
	QR	0
	OPCODE	0
	AA	0
	TC	0
	RD	0
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	0
DNS Question section	QNAME	*_sip._udp.sip.example.com.*
	QTYPE	SRV (0x0021)
	QCLASS	IN (0x0001)

- **Termination**

  If NUT has cache function, clear the cache.

Judgment

3. Received a query message that it includes QNAME=sip.example.com, TYPE=NAPTR.
5. Received a query message that it includes QNAME=_sip._udp.sip.example.com, TYPE=SRV.

References

RFC3403 Dynamic Delegation Discovery System (DDDS)
Part Three: The Domain Name System (DNS) Database
4. NAPTR RR Format
RFC3263 Session Initiation Protocol (SIP): Locating SIP Servers
RFC3761 The E.164 to Uniform Resource Identifiers (URI)
Dynamic Delegation Discovery System (DDDS) Application (ENUM)
RFC2782 A DNS RR for specifying the location of services (DNS SRV)

5.102. Encounter Unknown flag

Purpose

Verify a NUT process when NUT received message that includes multiple Naming Authority Pointer (NAPTR) Resource Records (RR) containing unknown flag.

- The important difference between Order and Preference is that once a match is found the client MUST NOT consider records with a different Order but they MAY process records with the same Order but different Preferences. The only exception to this is noted in the second important Note in the DDDS algorithm specification concerning allowing clients to use more complex Service determination between steps 3 and 4 in the algorithm. Preference is used to give communicate a higher quality of service to rules that are considered the same from an authority standpoint but not from a simple load balancing standpoint.
- If a client encounters a record with an unknown flag, it MUST ignore it and move to the next Rule. This test takes precedence over any ordering since flags can control the interpretation placed on fields.

Category

Client (ADVANCED)

Initialization

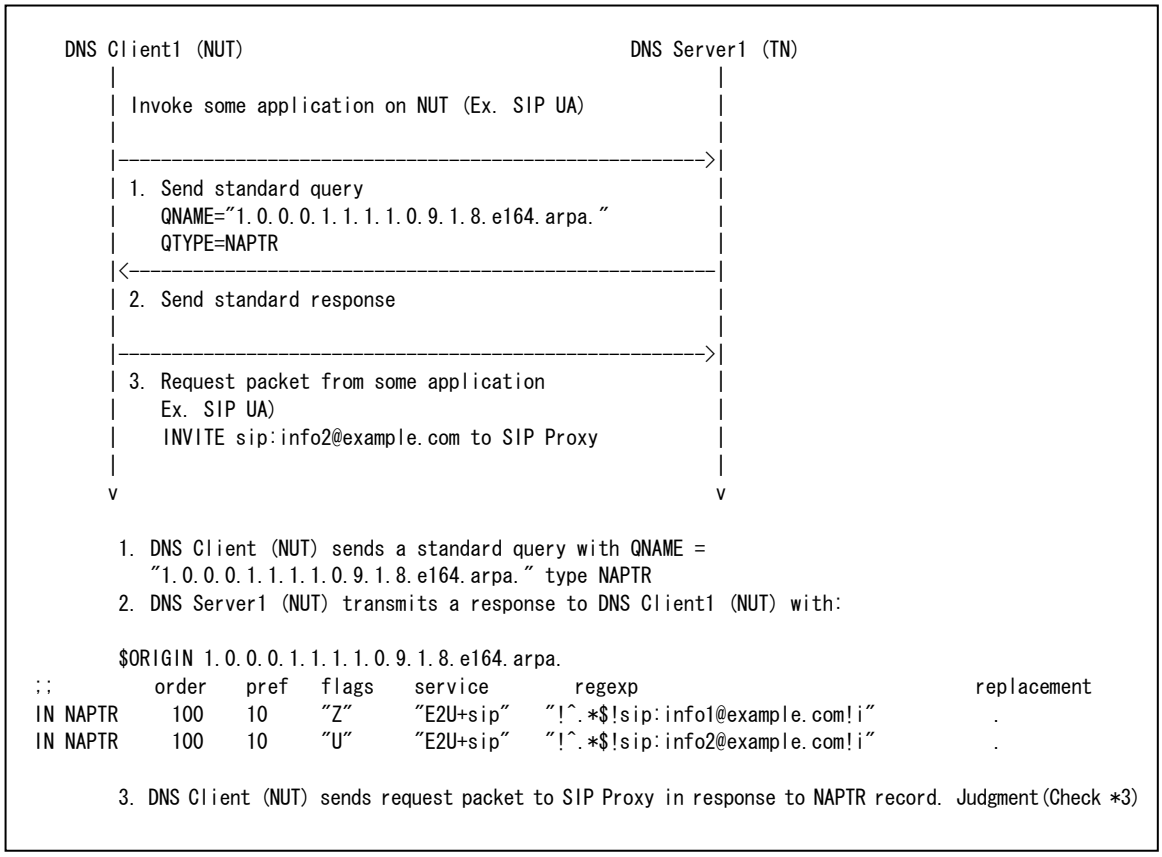
- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".

- **Setup**
  Set the DNS Server1 (TN)'s address on DNS Client1 (NUT) as above mentioned Network Topology. If NUT use a SIP user agent as DDDS application, then set up SIP Proxy address: 192.168.1.20 (IPv4) or 3ffe:501:ffff:101::20 (IPv6).

Application Unique String (AUS)	+81-90-1111-0001
Converted to the Key	819011110001
Used domain-name to retrieve Rewrite Rules as NAPTR records	1.0.0.0.1.1.1.1.0.9.1.8.e164.arpa.

Procedure

This test sequence is following.



1. DNS Client (NUT) sends a standard query with QNAME = "1.0.0.0.1.1.1.1.0.9.1.8.e164.arpa." type NAPTR
2. DNS Server1 (NUT) transmits a response to DNS Client1 (NUT) with:

```
$ORIGIN 1.0.0.0.1.1.1.1.0.9.1.8.e164.arpa.
;;          order    pref   flags    service        regexp                                  replacement
IN NAPTR     100     10     "Z"      "E2U+sip"    "!^.*$!sip:info1@example.com!i"            .
IN NAPTR     100     10     "U"      "E2U+sip"    "!^.*$!sip:info2@example.com!i"            .
```

3. DNS Client (NUT) sends request packet to SIP Proxy in response to NAPTR record. Judgment(Check *3)

Packet Description

1st packet.

Standard query from DNS Client1 (NUT) to Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	ANY
	Dst Port	53
DNS Header	ID	ANY
	QR	0
	OPCODE	0
	AA	0
	TC	0
	RD	0
	RA	0
	Z	0
	RCODE	0

	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	0
DNS Question section	QNAME	1.0.0.0.1.1.1.1.0.9.1.8.e164.arpa.
	QTYPE	NAPTR (0x0023)
	QCLASS	IN (0x0001)

2nd packet.

Standard query response from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Value that NUT uses
DNS Header	ID	Value that NUT uses
	QR	1
	OPCODE	0
	AA	1
	TC	0
	RD	0
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	2
	NSCOUNT	1
	ARCOUNT	2
DNS Question section	QNAME	1.0.0.0.1.1.1.1.0.9.1.8.e164.arpa.
	QTYPE	NAPTR (0x0023)
	QCLASS	IN (0x0001)
DNS Answer section	NAME	1.0.0.0.1.1.1.1.0.9.1.8.e164.arpa. (Pointer 0xC00C)
	TYPE	NAPTR (0x0023)
	CLASS	IN (0x0001)
	TTL	86400sec
	RDLENGTH	45
	ORDER	100
	PREFERENCE	10
	FLAGS	Z
	SERVICES	E2U+sip
	REGEXP	!^.*$!sip:info1@example.com!i
	REPLACEMENT	.
DNS Answer section	NAME	1.0.0.0.1.1.1.1.0.9.1.8.e164.arpa. (Pointer 0xC00C)
	TYPE	NAPTR (0x0023)

	CLASS	IN (0x0001)
	TTL	86400sec
	RDLENGTH	45
	ORDER	100
	PREFERENCE	10
	FLAGS	U
	SERVICES	E2U+sip
	REGEXP	!^.*$!sip:info2@example.com!i
	REPLACEMENT	.
DNS Authority section	NAME	1.1.1.1.0.9.1.8.e164.arpa. (Pointer 0xC014)
	TYPE	NS (0x0002)
	CLASS	IN (0x0001)
	TTL	86400sec
	RDLENGTH	17
	NSDNAME	NS1.example.com
DNS Additional section	NAME	NS1.example.com (Pointer 0xC0B1)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	86400sec
	RDLENGTH	4
	ADDRESS	192.168.1.20
DNS Additional section	NAME	NS1.example.com (Pointer 0xC0B1)
	TYPE	AAAA (0x001C)
	CLASS	IN (0x0001)
	TTL	86400sec
	RDLENGTH	16
	ADDRESS	3ffe:501:ffff:101::20

3rd packet.

If NUT uses a SIP UA.

Request packet from DNS Client (NUT) to SIP Proxy (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	ANY
	Dst Port	5060
SIP message	Request-Line	INVITE sip:info2@example.com SIP/2.0
	message-header	ANY
	message-body	ANY

- **Termination**

  If NUT has cache function, clear the cache.

Judgment

3. Received the domain-name included in NAPTR RR of FLAG=U.

References

RFC3403 Dynamic Delegation Discovery System (DDDS)
Part Three: The Domain Name System (DNS) Database
4. NAPTR RR Format
6. Example
8. Notes
RFC3761 The E.164 to Uniform Resource Identifiers (URI)
Dynamic Delegation Discovery System (DDDS) Application (ENUM)

5.103. Both REGEXP and REPLACEMENT fields exist

Purpose

Verify a NUT process when NUT received message that includes multiple Naming Authority Pointer (NAPTR) Resource Records (RR) containing both REGEXP and REPLACEMENT.

- This field and the REGEXP field together make up the Substitution Expression in the DDDS Algorithm. It is simply a historical optimization specifically for DNS compression that this field exists. The fields are also mutually exclusive. If a record is returned that has values for both fields then it is considered to be in error and SHOULD be either ignored or an error returned.

Category

Client (ADVANCED)

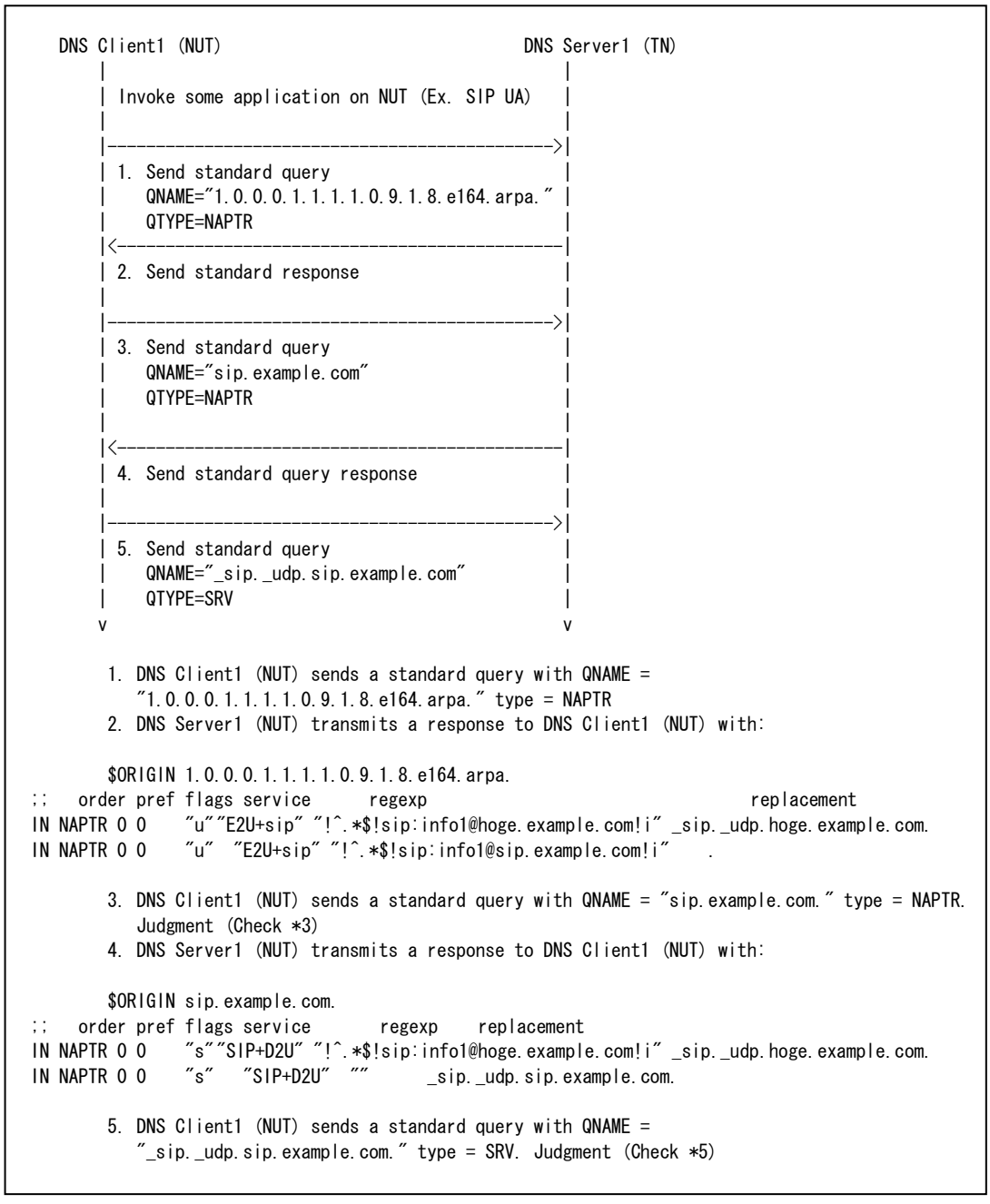
Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
- **Setup**
  Set the DNS Server1 (TN)'s address on DNS Client1 (NUT) as above mentioned Network Topology. DNS Client1 (NUT) may need a SIP user agent as DDDS application. Note that it doesn't use SIP Proxy.

Application Unique String (AUS)	+81-90-1111-0001
Converted to the Key	819011110001
Used domain-name to retrieve Rewrite Rules as NAPTR records	1.0.0.0.1.1.1.1.0.9.1.8.e164.arpa.

Procedure

This test sequence is following.



Packet Description

1st packet.

Standard query from DNS Client1 (NUT) to Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY

UDP Header	Src Port	ANY
	Dst Port	53
DNS Header	ID	ANY
	QR	0
	OPCODE	0
	AA	0
	TC	0
	RD	0
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	0
DNS Question section	QNAME	1.0.0.0.1.1.1.1.0.9.1.8.e164.arpa.
	QTYPE	NAPTR (0x0023)
	QCLASS	IN (0x0001)

2nd packet.

Standard query response from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Value that NUT uses
DNS Header	ID	Value that NUT uses
	QR	1
	OPCODE	0
	AA	1
	TC	0
	RD	0
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	2
	NSCOUNT	1
	ARCOUNT	2
DNS Question section	QNAME	1.0.0.0.1.1.1.1.0.9.1.8.e164.arpa.
	QTYPE	NAPTR (0x0023)
	QCLASS	IN (0x0001)
DNS Answer section	NAME	1.0.0.0.1.1.1.1.0.9.1.8.e164.arpa. (Pointer 0xC00C)
	TYPE	NAPTR (0x0023)

	CLASS	IN (0x0001)
	TTL	86400sec
	RDLENGTH	76
	ORDER	0
	PREFERENCE	0
	FLAGS	u
	SERVICES	E2U+sip
	REGEXP	!^.*$!sip:info1@hoge.example.com!i
	REPLACEMENT	_sip._udp.hoge.example.com.
DNS Answer section	NAME	1.0.0.0.1.1.1.1.0.9.1.8.e164.arpa. (Pointer 0xC00C)
	TYPE	NAPTR (0x0023)
	CLASS	IN (0x0001)
	TTL	86400sec
	RDLENGTH	49
	ORDER	0
	PREFERENCE	0
	FLAGS	u
	SERVICES	E2U+sip
	REGEXP	!^.*$!sip:info1@sip.example.com!i
	REPLACEMENT	.
DNS Authority section	NAME	1.1.1.1.0.9.1.8.e164.arpa. (Pointer 0xC014)
	TYPE	NS (0x0002)
	CLASS	IN (0x0001)
	TTL	86400sec
	RDLENGTH	17
	NSDNAME	NS1.example.com
DNS Additional section	NAME	NS1.example.com (Pointer 0xC0D4)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	86400sec
	RDLENGTH	4
	ADDRESS	192.168.1.20
DNS Additional section	NAME	NS1.example.com (Pointer 0xC0D4)
	TYPE	AAAA (0x001C)
	CLASS	IN (0x0001)
	TTL	86400sec
	RDLENGTH	16
	ADDRESS	3ffe:501:ffff:101::20

3rd packet.

Standard query from DNS Client1 (NUT) to Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY

UDP Header	Src Port	ANY
	Dst Port	53
DNS Header	ID	ANY
	QR	0
	OPCODE	0
	AA	0
	TC	0
	RD	0
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	0
DNS Question section	QNAME	sip.example.com.
	QTYPE	NAPTR (0x0023)
	QCLASS	IN (0x0001)

4th packet.

Standard query response from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Value that NUT uses
DNS Header	ID	Value that NUT uses
	QR	1
	OPCODE	0
	AA	1
	TC	0
	RD	0
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	2
	NSCOUNT	1
	ARCOUNT	2
DNS Question section	QNAME	sip.example.com.
	QTYPE	NAPTR (0x0023)
	QCLASS	IN (0x0001)
DNS Answer section	NAME	sip.example.com. (Pointer 0xC00C)
	TYPE	NAPTR (0x0023)

	CLASS	IN (0x0001)
	TTL	86400sec
	RDLENGTH	76
	ORDER	0
	PREFERENCE	0
	FLAGS	**s**
	SERVICES	**SIP+D2U**
	REGEXP	**"!^.*$!sip info1@hoge.example.com!i"**
	REPLACEMENT	**_sip._udp.hoge.example.com**
DNS Answer section	NAME	sip.example.com. (Pointer 0xC00C)
	TYPE	NAPTR (0x0023)
	CLASS	IN (0x0001)
	TTL	86400sec
	RDLENGTH	42
	ORDER	0
	PREFERENCE	0
	FLAGS	**s**
	SERVICES	**SIP+D2U**
	REGEXP	**(not present)**
	REPLACEMENT	**_sip._udp.sip.example.com**
DNS Authority section	NAME	example.com. (Pointer 0xC010)
	TYPE	NS (0x0002)
	CLASS	IN (0x0001)
	TTL	86400sec
	RDLENGTH	17
	NSDNAME	NS1.example.com
DNS Additional section	NAME	NS1.example.com (Pointer 0xC099)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	86400sec
	RDLENGTH	4
	ADDRESS	192.168.1.20
DNS Additional section	NAME	NS1.example.com (Pointer 0xC099)
	TYPE	AAAA (0x001C)
	CLASS	IN (0x0001)
	TTL	86400sec
	RDLENGTH	16
	ADDRESS	3ffe:501:ffff:101::20

5th packet.

Standard query from DNS Client1 (NUT) to Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY

UDP Header	Src Port	ANY
	Dst Port	53
DNS Header	ID	ANY
	QR	0
	OPCODE	0
	AA	0
	TC	0
	RD	0
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	0
DNS Question section	QNAME	*_sip._udp.sip.example.com.*
	QTYPE	*SRV (0x0021)*
	QCLASS	IN (0x0001)

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

3. Received a query message that it includes QNAME=sip.example.com, TYPE=NAPTR.
5. Received a query message that it includes QNAME=_sip._udp.sip.example.com, TYPE=SRV.

References

RFC3403 Dynamic Delegation Discovery System (DDDS)
Part Three: The Domain Name System (DNS) Database
4. NAPTR RR Format
RFC3263 Session Initiation Protocol (SIP): Locating SIP Servers
RFC3761 The E.164 to Uniform Resource Identifiers (URI)
Dynamic Delegation Discovery System (DDDS) Application (ENUM)
RFC2782 A DNS RR for specifying the location of services (DNS SRV)

5.104. E164 to Uniform Resource Identifiers (URI)

Purpose

Verify NUT's process that a telephone number to be mapped to a URI.

- This DDDS Database is usable by any application that makes use of the DDDS algorithm. In addition to the items required to specify a DDDS Application, an application wishing to use this Database must also define the following values:
  - What domain the Key that is produced by the First Well Known Rule belongs to. Any application must ensure that its rules do not collide with rules used by another application making use of this Database.
  - What the allowed values for the Services and Protocols fields are.
  - What the expected output is of the terminal rewrite rule in addition to how the Flags are actually encoded and utilized.

- In case of ENUM, Flag, "U", is defined. This means that this Rule is the last one and that the output of the Rule is a URI.

Category

Client

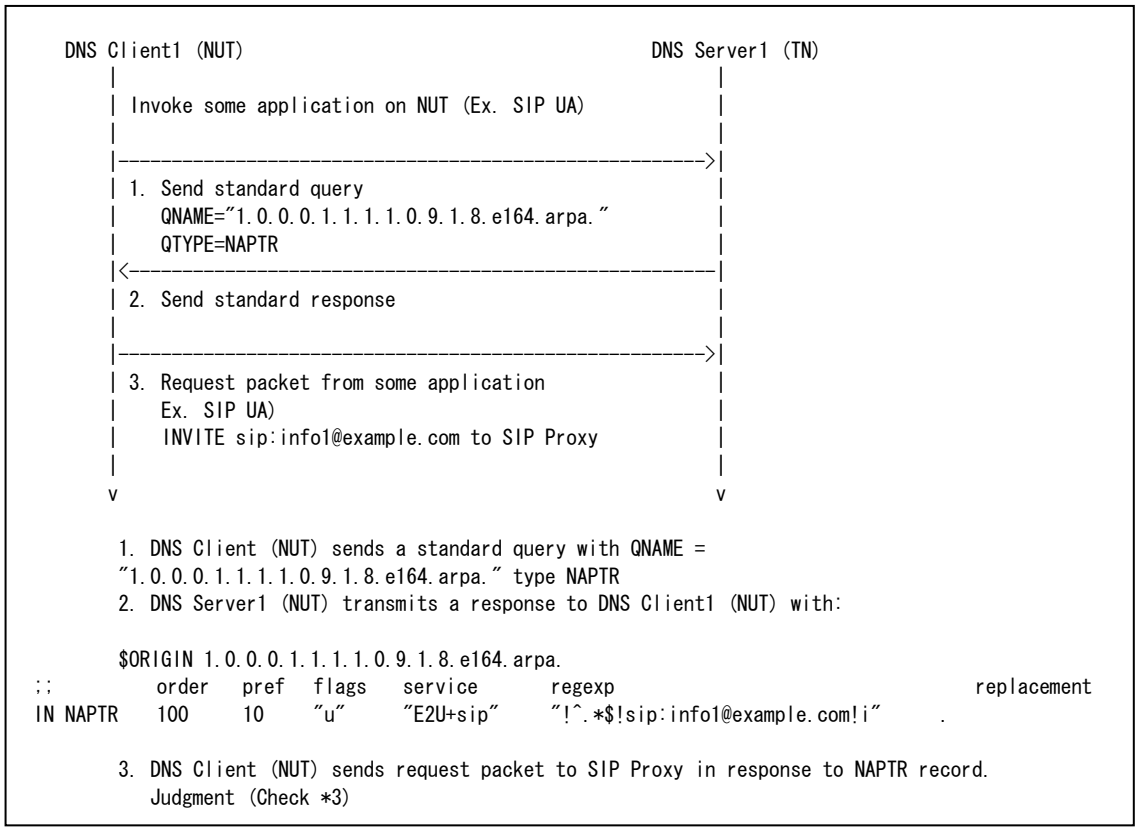
Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
- **Setup**
  Set the DNS Server1 (TN)'s address on DNS Client1 (NUT) as above mentioned Network Topology. If NUT use a SIP user agent as DDDS application, then set up SIP Proxy address: 192.168.1.20 (IPv4) or 3ffe:501:ffff:101::20 (IPv6).

Application Unique String (AUS)	+81-90-1111-0001
Converted to the Key	819011110001
Used domain-name to retrieve Rewrite Rules as NAPTR records	1.0.0.0.1.1.1.1.0.9.1.8.e164.arpa.

Procedure

This test sequence is following.



Packet Description

1st packet.

Standard query from DNS Client1 (NUT) to Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	ANY
	Dst Port	53
DNS Header	ID	ANY
	QR	0
	OPCODE	0
	AA	0
	TC	0
	RD	0
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1

	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	0
DNS Question section	QNAME	1.0.0.0.1.1.1.1.0.9.1.8.e164.arpa.
	QTYPE	NAPTR (0x0023)
	QCLASS	IN (0x0001)

2nd packet.

Standard query response from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Value that NUT uses
DNS Header	ID	Value that NUT uses
	QR	1
	OPCODE	0
	AA	1
	TC	0
	RD	0
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	1
	NSCOUNT	1
	ARCOUNT	2
DNS Question section	QNAME	1.0.0.0.1.1.1.1.0.9.1.8.e164.arpa.
	QTYPE	NAPTR (0x0023)
	QCLASS	IN (0x0001)
DNS Answer section	NAME	1.0.0.0.1.1.1.1.0.9.1.8.e164.arpa. (Pointer 0xC00C)
	TYPE	NAPTR (0x0023)
	CLASS	IN (0x0001)
	TTL	86400sec
	RDLENGTH	45
	ORDER	100
	PREFERENCE	10
	FLAGS	U
	SERVICES	sip+E2U
	REGEXP	!^.*$!sip:info1@example.com!i
	REPLACEMENT	.
DNS Authority section	NAME	1.1.1.1.0.9.1.8.e164.arpa. (Pointer 0xC014)
	TYPE	NS (0x0002)
	CLASS	IN (0x0001)

	TTL	86400sec
	RDLENGTH	17
	NSDNAME	NS1.example.com
DNS Additional section	NAME	NS1.example.com (Pointer 0xC078)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	86400sec
	RDLENGTH	4
	ADDRESS	192.168.1.20
DNS Additional section	NAME	NS1.example.com (Pointer 0xC078)
	TYPE	AAAA (0x001C)
	CLASS	IN (0x0001)
	TTL	86400sec
	RDLENGTH	16
	ADDRESS	3ffe:501:ffff:101::20

3rd packet.
If NUT use a SIP UA

Request packet from DNS Client (NUT) to SIP Proxy (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	ANY
	Dst Port	5060
SIP message	Request-Line	INVITE sip:info1@example.com SIP/2.0
	message-header	ANY
	message-body	ANY

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

3. Received request message in response to TN sent NAPTR resource record.

References

RFC3403 Dynamic Delegation Discovery System (DDDS)
Part Three: The Domain Name System (DNS) Database
4. NAPTR RR Format
6. Example
RFC3761 The E.164 to Uniform Resource Identifiers (URI)
Dynamic Delegation Discovery System (DDDS) Application (ENUM)

5.105. URN resolution

Purpose

Verify a NUT process to resolve URN

- The Application Unique String is the URN for which an authoritative server is being located. This URN MUST be canonicalzed and hex encoded according to the "absolute-uri" production found in the Collected ABNF from RFC 2396.
- The output of the First Well Known Rule of the URN Resolution Application is the URN's namespace id. In order to convert this to a unique key in this Database the string '.urn.arpa.' is appended to the end. This domain-name is used to request NAPTR records which produces new keys in the form of domain-names.

Category

Client (ADVANCED)

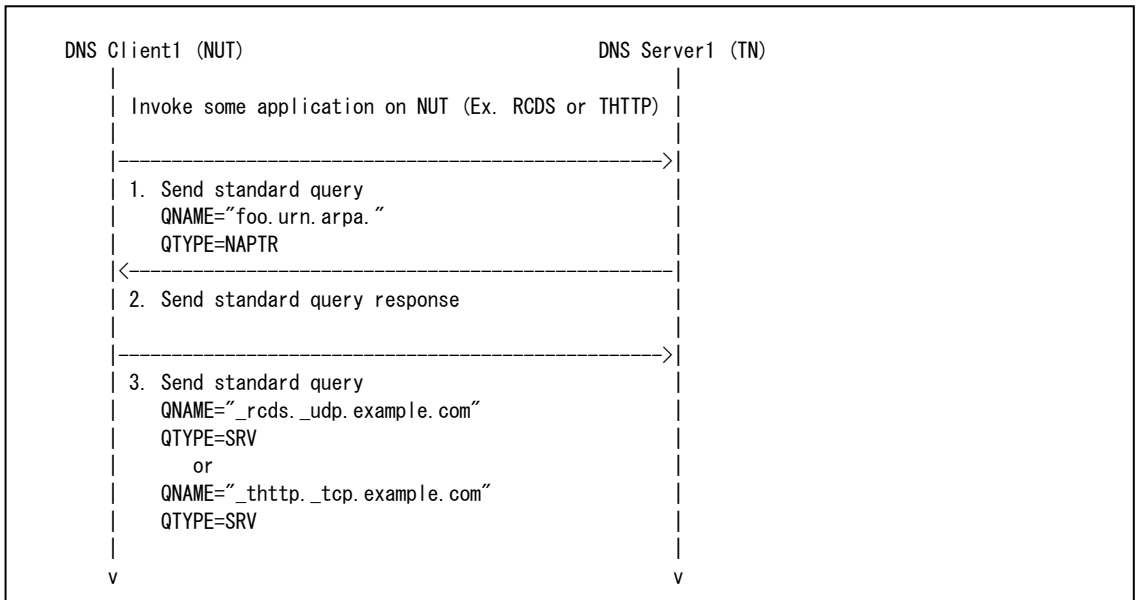
Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
- **Setup**
  Set the DNS Server1 (TN)'s address on DNS Client1 (NUT) as above mentioned Network Topology. DNS client (NUT) needs a Resource Cataloging and Distribution Service (RCDS) or THTTP program as DDDS application.

Application Unique String (AUS)	urn:foo:002372413:annual-report-1997
Key	URN
Used domain-name to retrieve Rewrite Rules as NAPTR records	foo.urn.arpa.

Procedure

This test sequence is following.



1. DNS Client (NUT) sends a standard query with QNAME = "foo.urn.arpa." type = NAPTR
2. DNS Server1 (NUT) transmits a response to DNS Client1 (NUT) with:

```
$ORIGIN foo.urn.arpa.
;;          order   pref  flags   service                    regexp        replacement
IN NAPTR    100     10    "s"     "foolink+I2L+I2C"     ""  _foolink._udp.example.com.
IN NAPTR     100    20    "s"     "rcds+I2C"                  ""  _rcds._udp.example.com.
IN NAPTR     100    30    "s"     "thttp+I2L+I2C+I2R"   ""  _thttp._tcp.example.com.
```

3. DNS Client (NUT) sends a standard query message which one NUT application supporting RCDS includes QNAME = "_rcds._udp.example.com.", type = SRV, the other NUT application supporting THTTP includes QNAME = "_thttp._tcp.example.com", type = SRV. Judgment (Check *3)

Packet Description

1st packet.

Standard query from DNS Client1 (NUT) to Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	ANY
	Dst Port	53
DNS Header	ID	ANY
	QR	0
	OPCODE	0
	AA	0
	TC	0
	RD	0

	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	0
DNS Question section	QNAME	foo.urn.arpa.
	QTYPE	NAPTR (0x0023)
	QCLASS	IN (0x0001)

2nd packet.

Standard query response from DNS Server1 (TN) to Client1 (NUT)		
IP Header	Source Address	SV1_NETY
	Destination Address	NUT_NETZ
UDP Header	Src Port	53
	Dst Port	Value that NUT uses
DNS Header	ID	Value that NUT uses
	QR	1
	OPCODE	0
	AA	1
	TC	0
	RD	0
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	3
	NSCOUNT	1
	ARCOUNT	2
DNS Question section	QNAME	foo.urn.arpa.
	QTYPE	NAPTR (0x0023)
	QCLASS	IN (0x0001)
DNS Answer section	NAME	foo.urn.arpa. (Pointer 0xC00C)
	TYPE	NAPTR (0x0023)
	CLASS	IN (0x0001)
	TTL	86400sec
	RDLENGTH	50
	ORDER	100
	PREFERENCE	10
	FLAGS	"s"
	SERVICES	"foolink+I2L+I2C"
	REGEXP	""

	REPLACEMENT	_foolink._udp.example.com.
DNS Answer section	NAME	foo.urn.arpa. (Pointer 0xC00C)
	TYPE	NAPTR (0x0023)
	CLASS	IN (0x0001)
	TTL	86400sec
	RDLENGTH	40
	ORDER	100
	PREFERENCE	20
	FLAGS	"s"
	SERVICES	"rcds+I2C"
	REGEXP	""
	REPLACEMENT	_rcds._udp.example.com.
DNS Answer section	NAME	foo.urn.arpa. (Pointer 0xC00C)
	TYPE	NAPTR (0x0023)
	CLASS	IN (0x0001)
	TTL	86400sec
	RDLENGTH	50
	ORDER	100
	PREFERENCE	30
	FLAGS	"s"
	SERVICES	"thttp+I2L+I2C+I2R"
	REGEXP	""
	REPLACEMENT	_thttp._tcp.example.com.
DNS Authority section	NAME	urn.arpa. (Pointer 0xC010)
	TYPE	NS (0x0002)
	CLASS	IN (0x0001)
	TTL	86400sec
	RDLENGTH	6
	NSDNAME	NS1.example.com (NS1 + Pointer 0xC0C1)
DNS Additional section	NAME	NS1.example.com (Pointer 0xC0DA)
	TYPE	A (0x0001)
	CLASS	IN (0x0001)
	TTL	86400sec
	RDLENGTH	4
	ADDRESS	192.168.1.20
DNS Additional section	NAME	NS1.example.com (Pointer 0xC0DA)
	TYPE	AAAA (0x001C)
	CLASS	IN (0x0001)
	TTL	86400sec
	RDLENGTH	16
	ADDRESS	3ffe:501:ffff:101::20

3rd packet.

Standard query from DNS Client1 (NUT) to Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	ANY
	Dst Port	53
DNS Header	ID	ANY
	QR	0
	OPCODE	0
	AA	0
	TC	0
	RD	0
	RA	0
	Z	0
	RCODE	0
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	0
DNS Question section	QNAME	*_rcds._udp.example.com.* or *_thttp._tcp.example.com.*
	QTYPE	*SRV (0x0021)*
	QCLASS	IN (0x0001)

- **Termination**

  If NUT has cache function, clear the cache.

Judgment

3. Received a query message in response to TN sent NAPTR resource record.

References

RFC3403 Dynamic Delegation Discovery System (DDDS)
Part Three: The Domain Name System (DNS) Database
4. NAPTR RR Format
RFC3404 Dynamic Delegation Discovery System (DDDS)
Part Four: The Uniform Resource Identifiers (URI)
Resolution Application
5.1 An Example Using a URN
RFC2782 A DNS RR for specifying the location of services (DNS SRV)

5.106. Obsoleting IQUERY

Purpose

Verify that a NUT does not transmits an inverse query

Opcode	1, an inverse query (IQUERY) (obsolete)

Category

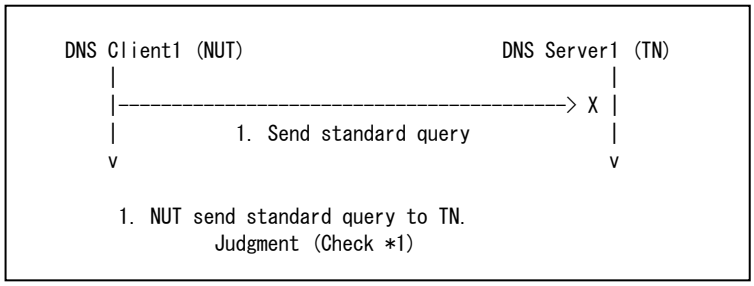
Client

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "A.example.com".
- **Setup**
  Set the DNS Server1(TN)' s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the status query to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	*any*
	OPCODE	1
	AA	*any*
	TC	*any*
	RD	*any*

	RA	*any*
	Z	*any*
	RCODE	*any*
	QDCOUNT	*any*
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	*any*
	QTYPE	*any*
	QCLASS	*any*

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. NUT must not send an inverse query.

References

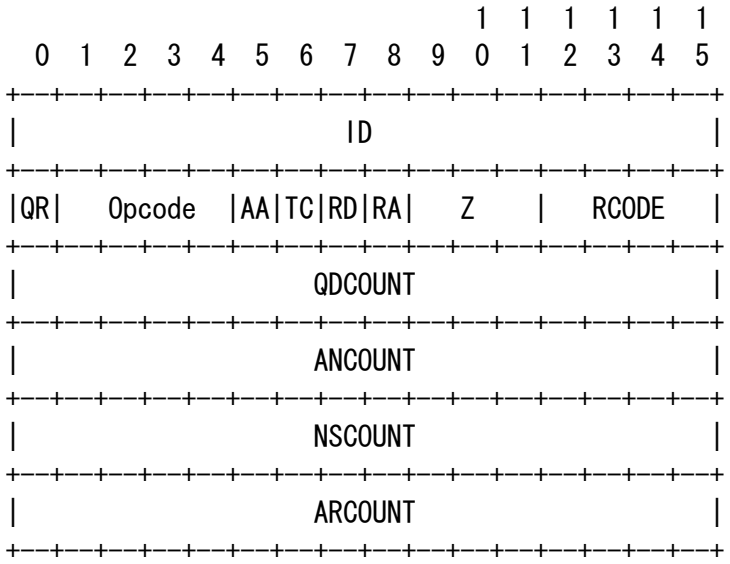
RFC3425 Obsoleting IQUERY
3 - Effect on RFC 1035

5.107. AAAA type in standard query

Purpose

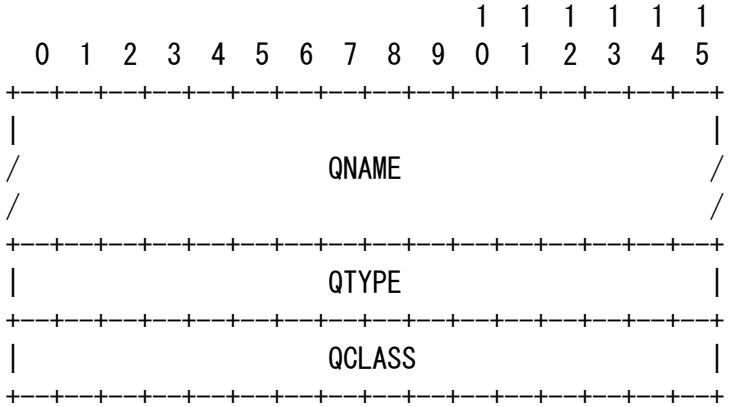
Verify that a NUT transmits correct standard query format for AAAA type

- Header section format



QR	**Query (0)**
Opcode	**A standard query(QUERY) (0)**
Z	**Must be zero**
QDCOUNT	**1**
ANCOUNT	**0**
NSCOUNT	**0**
ARCOUNT	**0**

- Question section format



QNAME	**A.example.com**
QTYPE	**AAAA type (28)**

- Answer section format
  Must be empty
- Authority section format
  Must be empty
- Additional section format
  Must be empty

Category

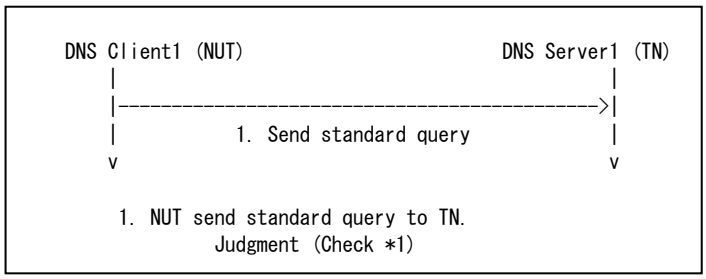
Client

Initialization

- **Network Topology**
  Refer the topology "Fig. 1 Topology No.1".
  AP server1 has a domain name "A.example.com".
- **Setup**
  Set the DNS Server1(TN)'s address on NUT as above mentioned Network Topology.
- **Pre-Sequence**
  In order to send the query for AAAA type of AP Server1(TN): A.example.com to the DNS Server1(TN), NUT is configured.

Procedure

This test sequence is following.



Packet Description

1. Standard query from DNS Client1 (NUT) to DNS Server1 (TN)		
IP Header	Source Address	NUT_NETZ
	Destination Address	SV1_NETY
UDP Header	Src Port	*any*
	Dst Port	53
DNS Header	ID	*any*
	QR	0
	OPCODE	0
	AA	*any*
	TC	0
	RD	*any*

	RA	*any*
	Z	any
	RCODE	*any*
	QDCOUNT	1
	ANCOUNT	0
	NSCOUNT	0
	ARCOUNT	any
DNS Question section	QNAME	A.example.com
	QTYPE	AAAA (0x001C)
	QCLASS	*any*

- **Termination**
  If NUT has cache function, clear the cache.

Judgment

1. Standard query for AAAA type must be base on above Verification Points.

References

RFC3596 DNS Extensions to Support IP Version 6
2.1 AAAA record type