DNS Extensions Working Group   Cindy WANG
Internet Draft   Jian JIN
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Xiaodong LEE
                                                             CNNIC
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A mechanism for synchronization across name servers on zone creation
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Status of this Memo

Abstract

This memo describes the NEWZONE_NOTIFY opcode for DNS, by which a
primary master server advises a set of slave servers that there is a
zone has been created and that a query should be initiated to
discover the new zone data.

This draft also specifies a mechanism for the slave servers to
achieve authenticated synchronization of zone data as well as zone
synchronization information with the primary when a zone is created
on the primary.

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1. Introduction

For large and busy domain name registrars, the zone creation
operations resulted from frequent domain name registrations are
almost daily routines. However, for these operations there are no
technical specifications for automatic zone synchronization across
multiple name servers. Moreover, the manual operations turn into
heavy burden for administrators when there is large number of name
servers authoritative for the zones.

The major obstacle to the synchronization in the above situation is
that, specified by the original design of DNS, when authority zones
are created, they must be declared to have one or more authoritative
name servers, usually consisting of one primary name server and
several secondary name servers. The configuration of the
synchronization relationships among the name servers depends upon out
of band information and manual processes, which are normally
specified with the zone creation.

This draft specifies a mechanism for the slave servers to achieve
authenticated synchronization of both zone data and dependency
configuration with the master servers when a zone is created.

2. Conventions used in this document

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT",
"SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in
this document are to be interpreted as described in RFC-2119 [1].

3. Definitions and Invariants

The following definitions are used in this document, and intended to
be consistent with [RFC1996] and [RFC2136]:

o   Slave: an authoritative server which uses zone transfer to
retrieve the zone. All slave servers are named in the NS RRs
for the zone.

o   Master: an authoritative server configured to be the source of
zone transfer for one or more slave servers.

o   Primary Master: the master server at the root of the zone
replication dependency graph. The primary master is named in
the zone's SOA MNAME field and optionally by an NS RR. There is
by definition only one primary master server per zone and the
source of zone creation for one or more slave servers.

o   Notify Set: set of servers to be notified of changes to some
new zone. Default is all servers named in the NS RRset of the
zone, except for any server also named in the SOA MNAME. Some
implementations will permit the name server administrator to
override this set or add elements to it (such as, for example,
the "also-notify" implemented in BIND [DNS_BIND]).
o   Trusted-Master Set: set of servers whose notification could be
trusted by the slave and the set is specified out-of-bind.

o   Dependency graph: organization of the zone's name servers, such
that there is a primary master, and all other servers must
request zone replication either from the primary master or from
some slave which is also a master. NO loops are permitted in
the dependency graph. The dependency graph is created with the
zone by the administrator on the primary master. For example,
the set of servers for a zone is {p, s1, s2, s3, s4, s5, s6,
s7}, where p is the address of the primary and {s1... s7}
addresses of the slaves. The dependency graph could be defined
as {{p->s1}, {p->s2}, {p->s3}, {s1->s2}, {s2->s3}, {s2->s4},
{s2->s5}, {s3->s6}, {s3->s7}}, where "->" denotes "is the
master of". An example of the "master of" relationship would
look like, {1.2.3.4->5.6.7.8}.

4. NEWZONE_NOTIFY message

4.1. When a primary master has a new zone, the master may send the created zone's name, class, type, and the name of the master from which the slave to request the zone data, to each known slave server using a protocol based on the NEWZONE_NOTIFY opcode.

4.2. NEWZONE_NOTIFY employs the DNS Message Format [RFC 1034], although it uses only a subset of the available fields. Fields not otherwise described herein are to be filled with binary zero (0).

4.3. NEWZONE_NOTIFY is similar to QUERY in that it has a request message with the header QR flag "clear" and a response message with QR "set". The response message contains no useful information, but its reception by the master is an indication that the slave has received the NEWZONE_NOTIFY and that the master can remove the slave from any retry queue for this NEWZONE_NOTIFY event.

4.4. TSIG MUST be enabled between parties exchanging the NEWZONE_NOTIFY messages.

4.5. The NEWZONE_NOTIFY request has the following characteristics:
Header:

```
     query ID:   (new)
     opcode:     NEWZONE_NOTIFY  (5)
     resp:       NOERROR
     flags:      AA
     qdcount:    1
     ancount:    1
Question Section:
     qname:      (zone name)
     qclass:     (zone class)
     qtype:      * (matches all RR types)
Answer Section:
        Name of one of the masters m which satisfies m->s, where s is
the notified slave.
```

The defined NEWZONE_NOTIFY event in this situation is that a zone has

been created (QTYPE=*) on the primary master server.

5. Automating the synchronization on zone creation across multiple
name servers

5.1. Zone created on the primary master server

1.   The primary master should send a NEWZONE_NOTIFY request to all
the servers in the dependency graph except for itself.

2.   The notifying order should be decided by the distances (number
of other masters in between) of the slaves to the primary
master. A slave CANNOT be notified until at least one of its
masters responds back to the primary master with success.

3.   For slaves with more than one master, the primary master MUST
send multiple notification messages, one for each master.

5.2. Slave Receives a NEWZONE_NOTIFY Request from the Primary Master
When a slave server receives a NEWZONE_NOTIFY request enclosing the
given QNAME, with QTYPE=* and QR=0, first of all, it MUST check the
authentication of the message by examining,

1.   The notifying IP must be present in the slave's 'Trusted-Master
Set'; (protecting the slave from being flooded by malicious
messages.)

2.   By requesting the SOA and NS record sets for the created zone
from the notifying master,

3.   The notifying master MUST carry a SOA record for the notified
zone;

4.   The notifying master MUST either appear in the MNAME of the SOA
record or goes with one name in the NS record-set for the
created zone;

5.   The set of NS records for the created zone, as retrieved by the
slave from the notifying master, MUST include the name that
goes with the IP address of the notified master.

If the notification is justified by all the above conditions, the
slave should behave as though the zone given in the QNAME had been
created on the primary master. It should respond to the
NEWZONE_NOTIFY message with the following actions,

1.   **Firstly, it requests the SOA record of the named zone locally**
to determine whether the zone exists or not.

2.   **If the zone exists, then the synchronization has been done from**
other master of the slave; otherwise, it is a zone creation
notification and a zone transfer (AXFR) [AXFR_clarify] should
be initiated to the master specified in the answer section of
the NEWZONE_NOTIFY message from the primary master.

3.   **In both cases, the master appearing in the answer section is**
configured locally to be one of the masters of the slave.

4.   **Finally, the updates are loaded into memory and the master**
specified in the answer section of the NEWZONE_NOTIFY message
is added to the master list of the slave.

5.   **Whether the AXFR succeeds or not, the slave will also send a**
NEWZONE_NOTIFY response back to the NEWZONE_NOTIFY request's
source, with the following characteristics:

```
Header:
      query ID:  (same)
      opcode:    NEWZONE_NOTIFY  (5)
      RCODE:     NOERROR (AXFR succeeds) or Server failure (AXFR
fails)
      flags:     OR AA
      qdcount:   1
Question Section:
      qname:     (zone name)
      qclass:    (zone class)
      qtype:     * (matches all RR types)
Answer Section:
 MUST be EMPTY
```

5.3. **Primary Master Receives a NEWZONE_NOTIFY Response from Slave**

1.   **If a NEWZONE_NOTIFY response from a slave with RCODE= Server**
failure arrives, the primary master keeps the NEWZONE_NOTIFY
query in the retry queue.

2.   Otherwise, if the primary master server receives a
NEWZONE_NOTIFY response from a slave with RCODE= NOERROR, it
initiates the notification process to all the slaves of that
slave. Next it deletes the successful query from the retry
queue, thus completing the notification process of the zone
creation change to the notifying slave.

6. Security Considerations

This document is believed to introduce no additional security
problems to the current DNS protocol.

7. References

7.1. Normative References

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facilities", STD 13, RFC 1034, November 1987.

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7.2. Informative References

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Authors' Addresses
Cindy WANG
CNNIC
4, South 4th Street, Zhongguancun
Beijing 100190
P.R. China
Email: wangxin@cnnic.cn

Jian Jin
CNNIC
4, South 4th Street, Zhongguancun
Beijing 100190
P.R. China
Email: jinjian@cnnic.cn

Feng Han
CNNIC
4, South 4th Street, Zhongguancun
Beijing 100190
P.R. China
Email: hanfeng@cnnic.cn

Xiaodong LEE
CNNIC
4, South 4th Street, Zhongguancun
Beijing 100190
P.R. China
Email: lee@cnnic.cn