              xNAME loop detection and its usage suggestion
                    draft-yao-dnsop-xname-loop-00.txt

Abstract

   The Domain Name System (DNS) has provided some means, such as CNAME
   or DNAME, where a query can be redirected to a different name. The
   zone operator should be careful about this redirection, which may
   forms a loop. The detail analysis of xNAME loop detection and its
   impacts are not specified in the RFC 1035 and RFC 2672. This
   document gives a detail analysis of xNAME loop and its impacts. It
   also gives some advices for using xNAME.

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1. Introduction

   RFC 1035 defines the canonical name (CNAME) RR, which directs itself
   to other names. RFC 2672 defines the DNAME RR, which directs its
   descedants to other names. There has been a proposal for another
   redirection RR, "BNAME", which will direct both itself and its
   descedants to other names. In addition, as specified in [RFC2672],
   redirection through a DNAME also results in the synthesis of a CNAME
   RR in the response; as described in [I-D.yao-dnsext-bname],
   redirection through a BNAME also results in the synthesis of a CNAME
   RR in the response In this document, we will refer to all RRs causing
   such redirection as xNAME RRs. Naming loops can be created with
   CNAME, DNAME or BNAME record alone, or any combinations of CNAME,
   DNAME and BNAME records. Implementors should note, however, that
   fairly lengthy chains of xNAME records may be valid. The zone
   operator should be careful about this redirection, which may forms a
   loop. However, the detail analysis of name loop detection and its
   impacts are not specified in the RFC 1035 and RFC 2672. This
   document gives a detail analysis of xNAME loop and its impacts. It
   also gives some advices for using xNAME.

   xNAME RRs can be explicitly retrieved by querying for the xNAME type.
   When a different type is queried and an xNAME RR is encountered, the
   xNAME RR (and possibly a synthesized CNAME) is added to the answer of
   the response, and the query is restarted with the name to which it
   was redirected. An xNAME may redirect a query to a name at which
   there is another xNAME and so on. In this document, we use "xNAME
   chain" to refer to a series of one or more xNAMEs each of which
   refers to another xNAME except the last, which may refer to a non-
   xNAME or results in an error.

1.1. Terminology

   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 [RFC2119]

   All the basic terms used in this specification are defined in the
   documents [RFC1034] and [RFC1035].

2. Single xNAME

   If there is only one xNAME which does not creat any chain, it will
   not cause a xNAME loop.

[2.1](#). a CNAME b

   A single CNAME RR identifies its owner name as an alias. If a CNAME
   b, and b refers to a non-xNAME or results in an error, it will not
   cause the loop.

[2.2](#). a DNAME b

   A single DNAME RR directs its descedants to other names. If a DNAME
   b, and b refers to a non-xNAMEor results in an error, it will not
   cause the loop.

[2.3](#). a BNAME b

   A single BNAME RR directs both the owner name itself and its
   descedants to other names. If a BNAME b, and b refers to a non-xNAME
   or results in an error, it will not cause the loop.

[3](#). Single-mapping and Multi-mapping

   The resource record "a CNAME b" creates a one-to-one mapping, which
   means that name a is redirected to b. We call such mapping as
   single-mapping, and such xNAME as single-mapping xNAME. The resource
   record "a DNAME b" or "a BNAME b" create a many-to-many mapping,
   which means that many names under a is redirected to many names under
   b. We call such mapping as multi-mapping, and such xNAME as multi-
   mapping xNAME.

[4](#). Combination of xNAMEs

[4.1](#). Combination of xNAMEs of the same type

   It is possible to form a xNAME loop due to the same types.

[4.1.1](#). CNAME chain

   CNAME can form a long chain. We can chain together CNAME records,
   which may lead to create a CNAME loop. For example,

      a CNAME b
      b CNAME c
      c CNAME d

   In this case, d may point to another CNAME or a non-xNAME or results
   in an error. CNAME is a kind of one to one mapping, which means that
   one name points or maps to only one name. The resolver can detect

the loop, just following the chain.

4.1.2. DNAME chain

DNAME can form a long chain. We can chain together DNAME records,
which may lead to create a DNAME loop. For example,

```
a DNAME b
b DNAME c
c DNAME d
```

In this case, d may point to another DNAME or a non-xNAME or results
in an error. DNAME is a kind of many to many mapping, which means
that many names point or map to many names. The resolver can not
easily detect the loop. Using the example above, for any X which is
a valid name string, we have

```
X.a CNAME X.b
X.b CNAME X.c
X.c CNAME X.d
```

In this case, in order to detect whether it forms a loop, it must
check every name under "d" domain while "d" may have millions of
names or thousands of sub-zones. If the domain "a" and "d" are not
under the control of the same owner, detection of dname loop are
impossilbe if "a" and "d" have too many childrens.

4.1.3. BNAME chain

BNAME can form a long chain. we can chain together BNAME records,
which may lead to create a BNAME loop. For example,

```
a BNAME b
b BNAME c
c BNAME d
```

In this case, d may point to another BNAME or a non-xNAME or results
in an error. BNAME is a kind of many to many mapping, which means
that many names point or map to many names. The resolver can not
easily detect the loop. Using the example above, for any X which is
a valid name string, we have

```
X.a CNAME X.b
X.b CNAME X.c
X.c CNAME X.d
```

In this case, in order to detect whether it forms a loop, it must
check every name under "d" domain while "d" may have millions of

names or thousands of sub-zones. If the domain "a" and "d" are not
under the control of the same owner, detection of dname loop are
impossilbe if "a" and "d" have too many childrens. On the other
hand, since the BNAME also maps the owner name itself, we also have

```
a CNAME b;
b CNAME c;
c CNAME d;
```

For this case, it is easy to detect the name loop. But in the whole,
it is not easy to detect the BNAME loop.

4.2. Combination of xNAMEs of the different types

If there are many different types of xNAME in the chain, it is very
difficulty to identify the loop.

Different xNAMEs can form a long chain. We can chain together
different xNAME records, which may lead to create a xNAME loop. For
example,

```
a xNAME b;
x xNAME c;
```

if xNAME is DNAME or BNAME, it will creat a many to many mapping; if
it is CNAME, it will create a one to one mapping. For the example
above, we can divid it into 4 cases: For the case 1:

```
a Single-mapping  b;
x Single-mapping  c;
```

For the case 2:

```
a Multi-mapping b;
x Multi-mapping c;
```

For the case 3:

```
a Single-mapping b;
x Multi-mapping c;
```

For the case 4:

```
a Multi-mapping b;
x Single-mapping c;
```

In the cases above for the example provided in this section, the user
may easily detect the loop for the case 1. For other cases, it is

very difficult to detect the mapping since Multi-mapping create
complex mappling which is not easily detected.

There are other more complex examples. But one thing is clear. If
Multi-mapping xNAME is involved, it will create the complex of
detecting of the loop of xNAME.

5. Suggestion of xNAME use

If the xNAME chain is formed with single-mapping xNAME only, it can
easily check the xNAME loop. But when multi-mapping xNAME is added
into the chain, it makes the xNAME detection very difficult.

In order to avoid the possible loop, the following suggestions should
be considered:

1. If there is a xNAME chain, it is better that all names related to
    xNAME records are under the control of the same owner.
2. If there is a xNAME chain, the shortes chain is preferred.
3. If there is a xNAME chain, there should have only one multi-
    mapping xNAME
4. Adding a new xNAME to a xNAME chain, the 1, 2 and 3 requirements
    listed above should be considered to check whether the new xNAME
    should be configured.

6. IANA Considerations

IANA is requested to do nothing for this document

7. Security Considerations

TBD

8. Change History

[[anchor16: RFC Editor: Please remove this section.]]

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o xNAME loop detection

9. References

9.1. Normative References

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               STD 13, RFC 1034, November 1987.

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   [RFC2119]   Bradner, S., "Key words for use in RFCs to Indicate
               Requirement Levels", BCP 14, RFC 2119, March 1997.

   [RFC2672]   Crawford, M., "Non-Terminal DNS Name Redirection",
               RFC 2672, August 1999.

9.2. Informative References

   [I-D.yao-dnsext-bname]
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