ATR: Additional Truncated Packets for Large DNS Response

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ABSTRACT

Internet works on reliable naming and IP package transmission. As complexity added into Internet infrastructure due to security and stability consideration, some mismatch and unexpected fragility are exposed. One case is in the field of DNS (DNSSEC) and IPv6. There are some public evidence and concerns on IPv6 fragmentation issues due to larger DNS payloads over IPv6. Different from other measurement work, in this paper we proposed "glueless" measurement mechanism to analyze the end-to-end users experience. It is based on a live, real and global Ads system and shows that the IPv6 large packet drop rate is up to 38%. We also identify "other issues" in some aspects(With More details). In the meanwhile, we advance a solution called ATR (Additional Truncated Response) as a fix on DNS server which requires no modification on users side (DNS resolver) and support incremental deployment. We also conducted a measurement which shows more than 68% impacted users can be relieved on DNS latency and failures due to large DNS response.

1 INTRODUCTION

Large DNS response is identified as a issue for a long time. There is an inherent mechanism defined in [RFC1035] to handle large DNS response (larger than 512 octets) by indicating (set TrunCation bit) the resolver to fall back to query via TCP. Due to the fear of cost of TCP, EDNS(0) [RFC6891] was proposed which encourages server to response larger response instead of falling back to TCP. However, as the increasing use of DNSSEC and IPv6, there are more public evidence and concerns on user's suffering due to packets dropping caused by IPv6 fragmentation in DNS due to large DNS response.

It is observed that some IPv6 network devices like firewalls intentionally choose to drop the IPv6 packets with fragmentation Headers[I-D.taylor-v6ops-fragdrop]. [RFC7872] reported more than 30drop rates for sending fragmented packets. Regarding IPv6 fragmentation issue due to larger DNS payloads in response, one measurement [IPv6-frag-DNS] reported 35IPv6-capable DNS resolver can not receive a fragmented IPv6 response over UDP. Moreover, most of the underlying issues with fragments are unrevealed due to good redundancy and resilience of DNS. It is hard for DNS client and server operators to trace and locate the issue when fragments are blocked or dropped. The noticeable DNS failures and latency experienced by end users are just the tip of the iceberg.

Depending on retry model, the resolver's failing to receive fragmented response may experience long latency or failure due to timeout and reties. One typical case is that the resolver finally got the answer after several retires and it falls back to TCP after deceasing the payload size in EDNS0. To avoid that issue, some authoritative servers may adopt a policy ignoring the UDP payload size in EDNS0 extension and always truncating the response when the response size is large than a expected one. However one study [Not-speak-TCP] shows that about 17not ask a query in TCP when they receive truncated response. It seems a dilemma to choose hurting either the users who can not receive fragments or the users without TCP fallback capacity. There is also some voice of "moving all DNS over TCP". But It is generally desired that DNS can keep the efficiency and high performance by using DNS UDP in most of time and fallback as soon as possible to TCP if necessary for some corner case.

To relieve the problem, this memo introduces an small improvement on DNS responding process by replying an Additional Truncated Response (ATR) just after a normal large response which is to be fragmented. Generally speaking ATR provides a way to decouple the EDNS0 and TCP fallback in which they can work independently according to the server operator's requirement. One goal of ATR is to relieve the hurt of users, both stub and recursive resolver, from the position of server, both authoritative and recursive server. It does not require any changes on resolver and has a deploy-and-gain feature to encourage operators to implement it to benefit their resolvers.

[REMOVE BEFORE PUBLICATION] Note that ATR is not just a proposed idea. Some advocates of ATR implemented it based on BIND9. And Some verify it based on an large-scale experiment platform of APNIC lab Section 3 which is introduced in this memo.

2 RELATED WORK

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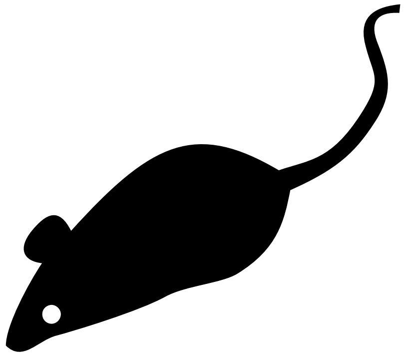

Figure 1: Hello, here is some text without a meaning. This text should show what a printed text will look like at this place. If you read this text, you will get no information. Really? Is there no information? Is there a difference between this text and some nonsense like "Huardest gefburn"? Kjift – not at all! A blind text like this gives you information about the selected font, how the letters are written and an impression of the look. This text should contain all letters of the alphabet and it should be written in of the original language. There is no need for special content, but the length of words should match the language.

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3 SYSTEM DESIGN

3.1 The First Layer

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4 EVALUATION

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5 CONCLUSION

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