An Proxy Use Case of DNS over HTTPS

draft-ietf-dnsop-dns-wireformat-http-03

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2018-07-17 @IETF 102 Montreal

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Brief History of this document

- First drafted in February 17, 2016 intending to record an novel experiment during WIDECAMPE
- This draft was presented in IETF 95
  - with the title “DNS wire-format over HTTP”
  - including two scenarios : proxy mode and director mode
- Accepted as WG document in September 15, 2016
  - postponed by Chair later due to concerns from HTTP people
  - Waited for DOH to define a good transport protocol, draft-ietf-doh-dns-over-https
- Awake and focus on proxy scenario with DOH protocol
  - Change the title to “An Proxy Use Case of DNS over HTTPS” and still be an experimental document
  - Try several approaches of keep the transparency in DOH proxy

DNS over HTTP wire format

- Documents two implementations
- As simple as possible… but not simpler
- Normal HTTP POST message
- Wire-format DNS message
- Headers
  - Content-Type: application/octet-stream
  - Proxy-DNS-Transport: udp *(or tcp)*

Source : 2016-04-08 DNSOP IETF95 presented by Shane Kerr

Wire format scenarios

- Proxy mode
  - Either client or server can run as a proxy
  - "drop-in" support
- Direct mode
  - Support in server
    - none yet… is it useful?
  - Support in applications
    - via API
    - Better in truncation case

Source : 2016-04-08 DNSOP IETF95 presented by Shane Kerr

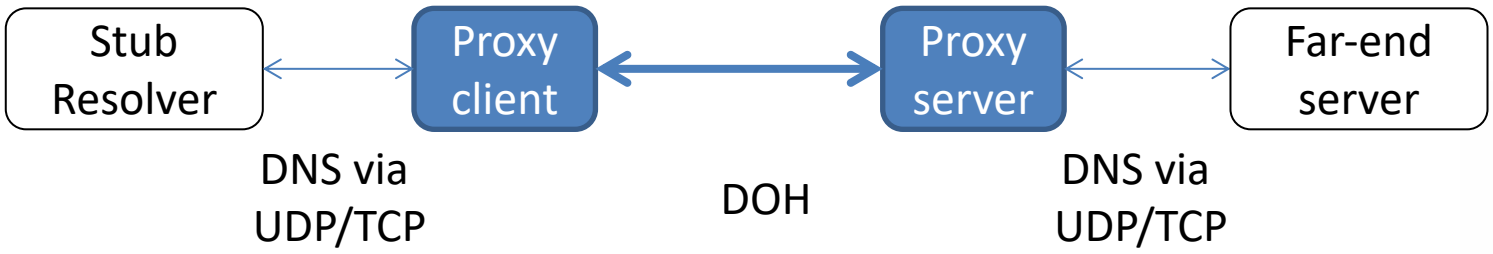
Wire format latest discussion

- POST vs. GET for HTTP message
- *Could* be used by web developers
- TCP/UDP flag required
- Clarification of 2-byte length field in TCP
- Expanded security section
  - A bit vague, since all DNS, HTTP, and TLS vulnerabilities may be applicable....
- `/.well-known/dns-over-http`
- Thanks to Bob Harold and Paul Hoffman for review!

Source : 2016-04-08 DNSOP IETF95 presented by Shane Kerr

DOH in Proxy scenario

- DOH proposes a approach to cure DNS's long-time suffering from on-path attack by spoofing and blocking
- Proxy use case served as an incremental adoption tool when DOH is not widely available
  - To leverage the DOH protocol as a substrate to tunnel DNS data over HTTPs which is called DOH proxy
  - DOH proxy works as a simple DNS forwarder keeping the transparency principle, as a normal DNS proxy described in RFC5625



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Related work on DOH proxy

- Facebook's doh-proxy implementation
- Frank Denis' doh-proxy (server-side proxy) and dnscrypt-proxy (client proxy)
- Travis Burtrum's jDnsProxy DNS proxy and cache

Transparency principle in DOH Proxy

- DOH proxy keeps transparency principle of DNS proxy recommended in RFC5625
  - “Proxies should be as transparent as possible, such that any "hop-by-hop" mechanisms or newly introduced protocol extensions operate as if the proxy were not there.”
- Original transport indicator in DOH proxy
  - Introduce a indicator to allow the proxy server use the same transport protocol (UDP or TCP) to forward DNS query to far-end server just as the stub-client does without DOH proxy

Relation with DOH protocol

- Inherit most protocol definition from DOH
  - Can use both GET and POST
  - HTTPs is mandatory for proxy case
  - Use and process application/dns-message media type
  - Keep most HTTP context in DOH, like HTTP Cache, HTTP/2, server push and content Negotiation
- Extension of DOH for proxy use case
  - Extend the DOH URI Template with a new a new variable "proto" , "proto=tcp " or "proto=udp“
  - Two-byte length field in wireformat TCP DNS message will be omitted by proxy client

Variable "proto" examples

- https://example.com/proxy_dns?proto=tcp" will cause the server to make a request using TCP
- "https://example.com/proxy_dns?proto=udp" will cause the server to make a request using UDP

Suggested Implementation

- The DOH proxy may return TC bit to the sub-resolver which will cause TCP fallback starting from the sub-resolver. An alternative advised is that the proxy has to have sufficient smarts to recognize the returned TC bit and re-issue the request over TCP to the back-end DNS server.
- Another implementation is suggested that DOH proxy server has a pool of TCP connections from the proxy to the back-end DNS server(s), over which incoming requests can be multiplexed

Next step

- Adoption?
  - More examples of DOH proxy usage ?
  - Informational or experimental?