DNS Queries over CoAP (DoC)

draft-lenders-dns-over-coap
(https://github.com/anr-bmbf-pivot/draft-dns-over-coap)

Martine S. Lenders, Christian Amsüss, Cenk Gündoğan,
Thomas C. Schmidt, Matthias Wählisch

IETF CoRE WG Interim Meeting, 2021-10-13

Outline

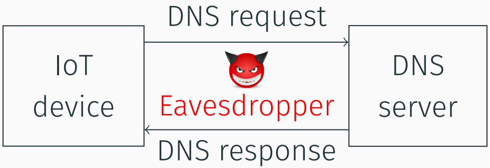
Introduction

Basic Message Exchange

Discussion

Motivation

Attack Scenario



Countermeasure

- Encrypt name resolution triggered by IoT devices against eavesdropping
- For the record, DoH and DoT conflict w/ constrained resouces ;)
- Share system resources by using DNS over CoAP
  - Same socket and buffers can be used
  - Re-use of the CoAP retransmission mechanism

Overview

```
                - GET coaps://[2001:db8::1]/?dns=example.org
               /- POST/FETCH coaps://[2001:db8::1]/
              /
             CoAP request
+---------+  [DNS query]   +---------+   DNS query    +---------+
|   DoC   |--------------->|   DoC   |...............>|   DNS   |
| Client  |<---------------| Server  |<...............| Server  |
+---------+ CoAP response  +---------+  DNS response  +---------+
            [DNS response]
```

Message Formats

DNS Queries

- SHOULD be CoAP Confirmable (CON) message
- CoAP method types:
  1. GET: DNS query encoded in URI query parameter **dns** in ”base64url”
  2. POST: DNS query in CoAP body as ”application/dns-message”
  3. FETCH: DNS query in CoAP body as ”application/dns-message”

DNS Responses

- DNS response in CoAP body of response
- DNS layer errors (e.g. SERVFAIL) SHOULD be carried in ”2.xx Success” response

Caching and Timing

Problem

- Relative times control cache age in DNS (TTL) *and* CoAP (Max-Age)

Three Solutions

1. DoH way: use minimum TTL for Max-Age
   ⇒ Relative time frames make TTL go out of sync when cached
2. Adopt Max-Age to TTL (or vice-versa): Clients calculate actual TTL from Max-Age
3. New (absolute) Age option as in HTTP?

Details

- `https://github.com/anr-bmbf-pivot/draft-dns-over-coap/issues/5`

Do we really need GET, POST, and FETCH?

	GET	POST	FETCH
Cacheable	✓	✗	✓
Block-wise transferable query	✗	✓	✓
URI Template not needed	✗	✓	✓

Current State of Discussion

- Solution w/o URI Template eases integration into CoRE-RD
- But, if FETCH is not widely deployed, “Wild” implementations using GET or POST may pop up
- Compromise: Define GET/POST usage in Appendix

Details

- `https://github.com/anr-bmbf-pivot/draft-dns-over-coap/pull/8`

FETCH Implementation Status

FETCH supported in 9 of 15 active FOSS implementations (last commit <1y):

aiocoap	Californium	Californium (Leshan)	cantcoap	coap-lite	Erbium (Wakaama)	gcoap (RIOT)	Go-CoAP (go-ocf)	libcoap	Lobaro CoAP	mbed-CoAP	nanocoap (RIOT)	node-coap	Waher.Networking.CoAP	Zephyr CoAP
✓	✓	✓	✗	✓	✗	✓	✗	✓	✗	✗	✓	✓	✓	✗

+ FETCH implementation is near trivial

Full overview:

`https://gist.github.com/miri64/48d83316afd1d5e600ed2ec0bbab3624`

Discussion Topics

1. Is this topic relevant for CoRE?
2. **How to handle relative aging and caching?**
3. **Should we abandon GET and POST in DoC completely or partly?**
4. …