Privacy analysis of DNS resolver solutions

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Introduction

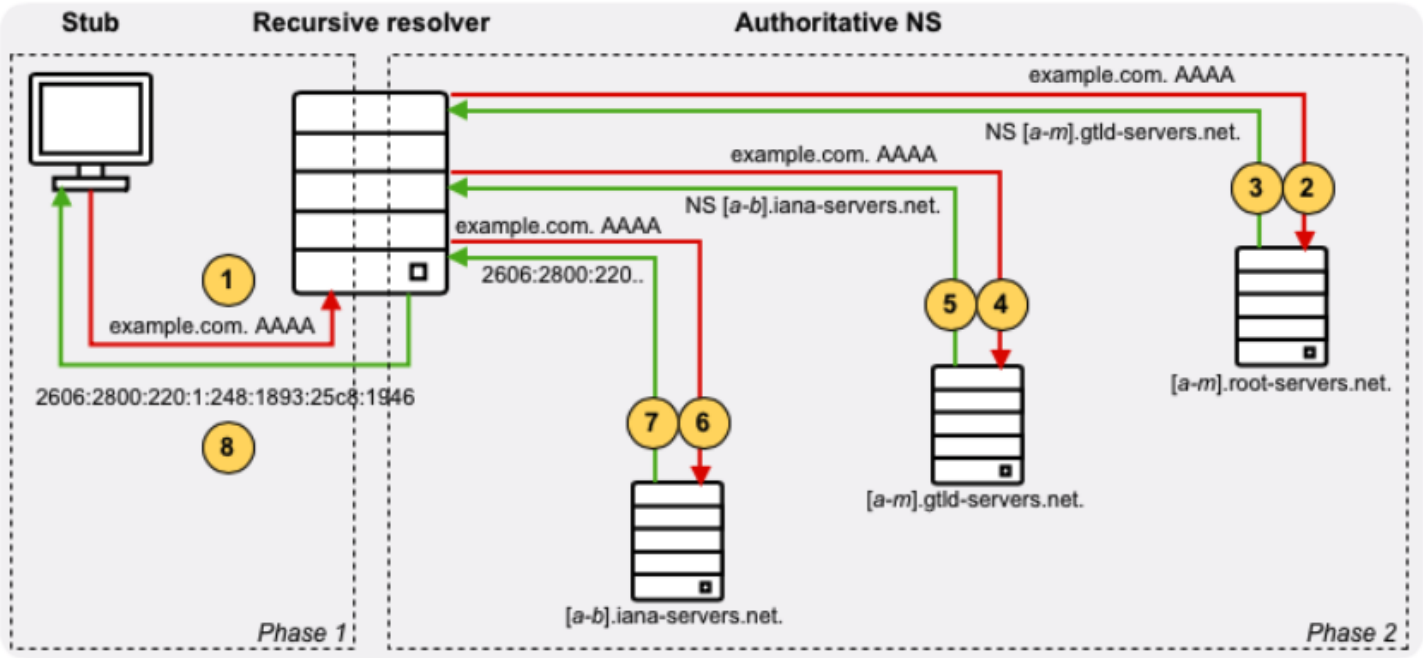
”We’ve updated our privacy policy”

Introduction

Research question:
How can modern techniques improve the privacy of DNS users?

- Regular DNS resolution
- The problem of DNS privacy
- Modern techniques to solve this
- Combine techniques for the best result

DNS resolution 1/2



DNS resolution 2/2

- DNS server types
  - Stub resolver
  - Recursive resolver
  - Forwarding resolver
  - Authoritative server
- Recursive/forwarder locations
  - Local
  - Remote
  - ISP
  - Public

The problem of DNS privacy

Eavesdropping & MITM

DNS data:

- QNAME
- QTYPE
- IP-addresses
- Responses
- Metadata (TTL, flags, etc.)

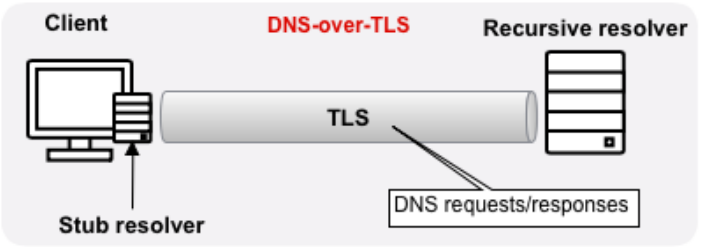
EDNS(0)

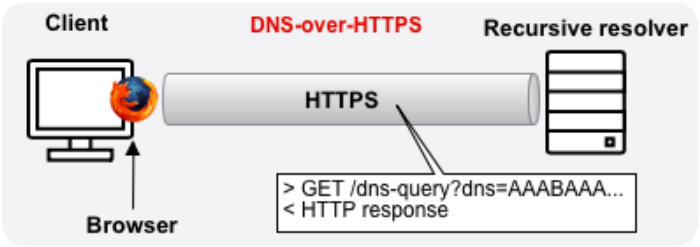
- Client subnet
- Client ID

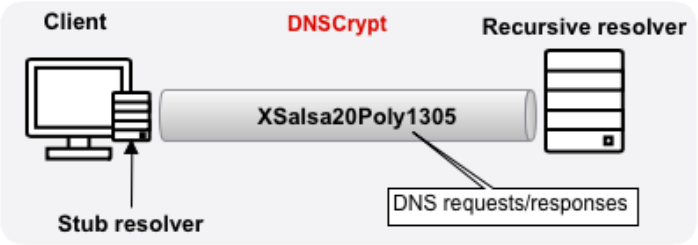
DNSSEC

Privacy techniques

- DNS-over-TLS
- DNS-over-HTTPS
- DNSCrypt
- Oblivious DNS
- DNSCurve
- QNAME minimisation

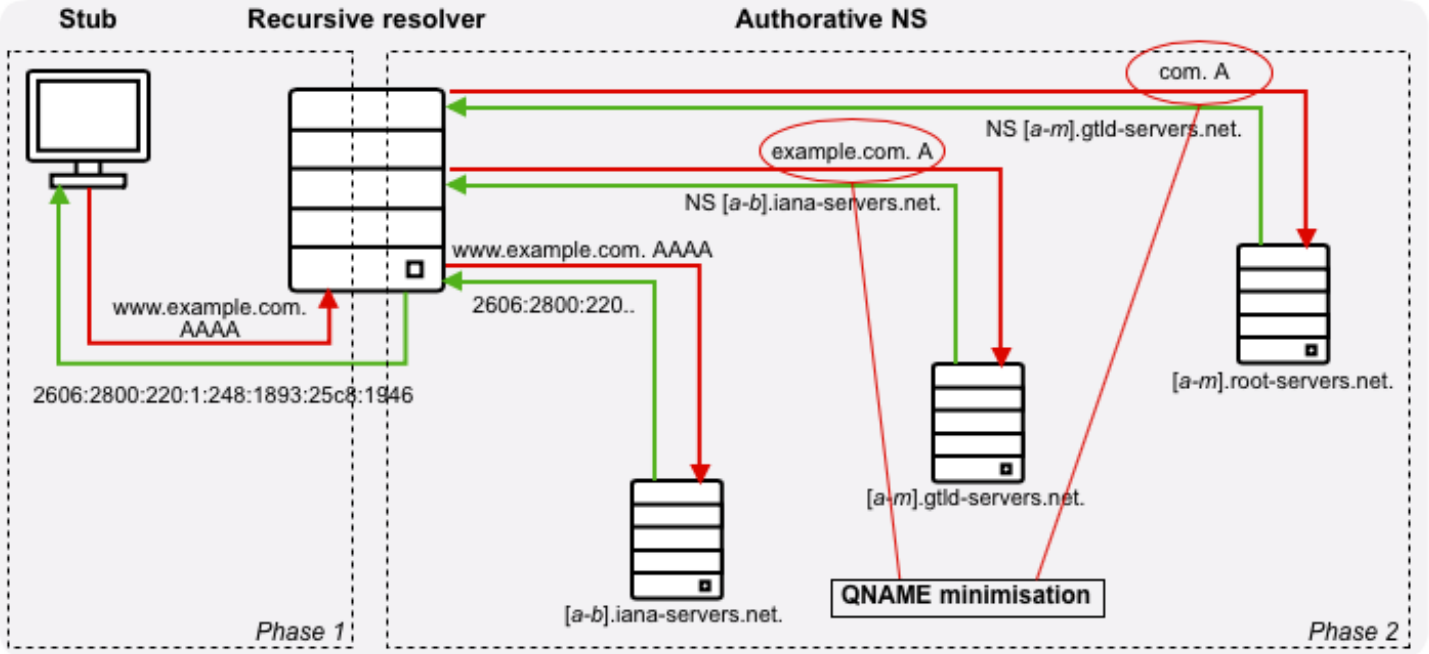






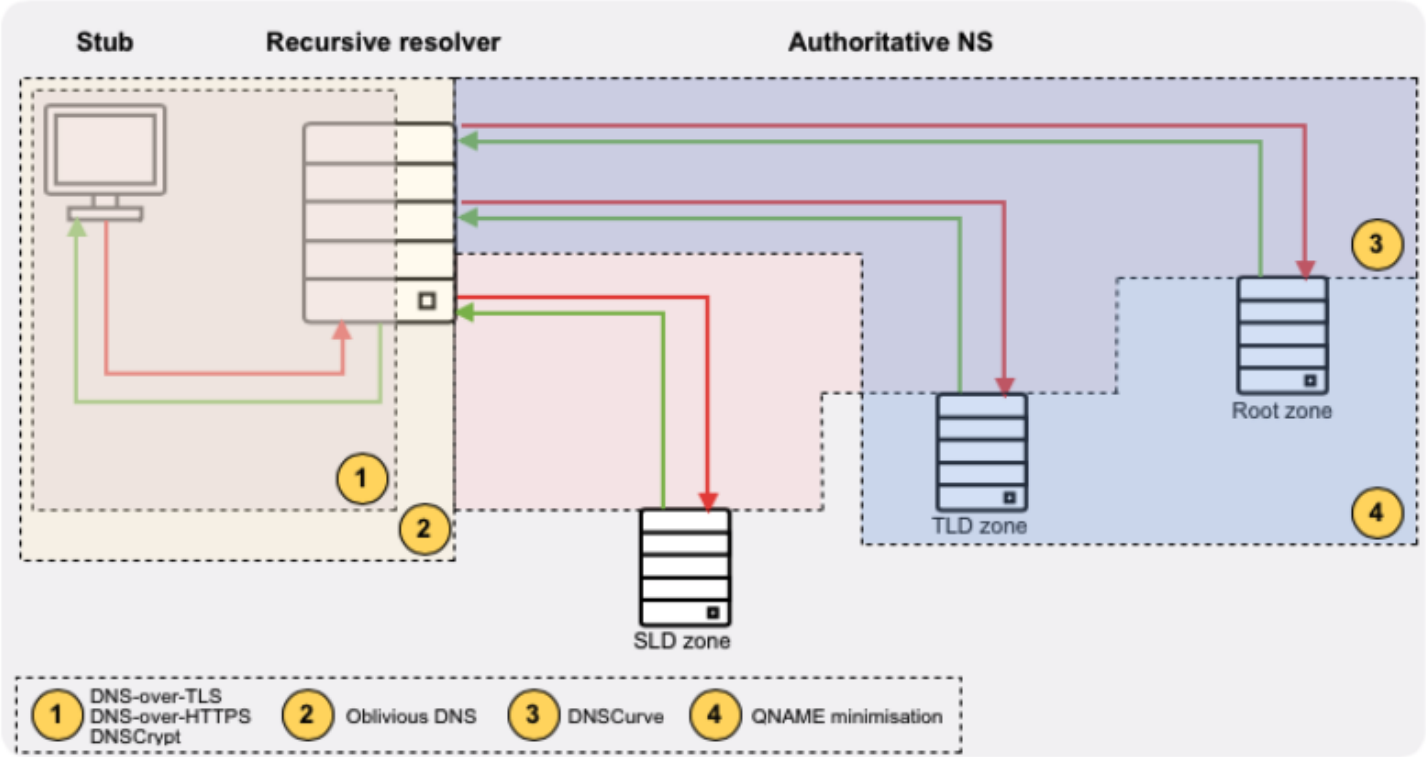
Privacy techniques

- Query Name (QNAME) minimisation



Privacy techniques

- Coverage of techniques



Combining techniques

Combining previous techniques and resolver types/locations together.

Techniques not available to the user:

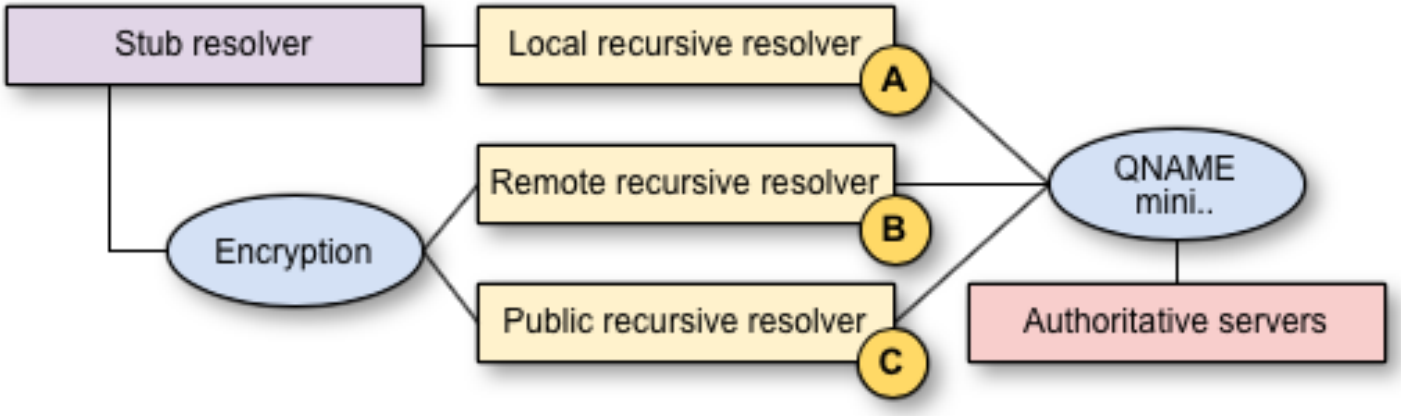
- Oblivious DNS
- DNSCurve

Do not use the ISP's resolver

- Regulation
- No support for techniques
- IP-address to user relation

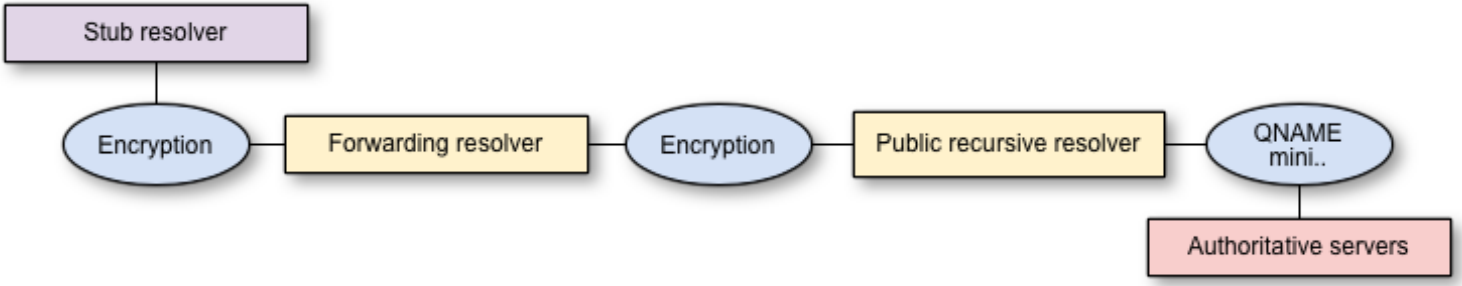
Combining techniques

Who do you trust with your data?



Combining techniques

Decouple data over different servers



And share the forwarding resolver with trusted friends...

Conclusion

Conclusion

- Work done
- Importance of caching
- Recursive resolver selection (ECS, logging)

Discussion & future work:

- TLS SNI
- DNS padding
- Overlay networks (Tor)
- Multiple public resolvers

Acknowledgements

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