DNS-over-QUIC
(DoQ)
draft-ietf-dprive-dnsoquic

Christain Huitema
Sara Dickinson
Allison Mankin

DoQ - Background

- **April 2017** - First Draft in QUIC WG (stub to resolver ONLY)
  - **Since then -** Christian has worked on QUIC and DoQ implementations
- **March 2019** - IETF 104 some hackathon work….
- **March 2020** - Draft moved to DPRIVE WG (adopted Apr 2020)

DoQ - Background

- **Nov 2020** - (IETF 109) DPRIVE WG meeting
  - Still no clear answer on whether WG wants to pursue for stub-rec
    - Is it needed? Is it (more) performant?
  - Asked to consider extending draft to cover rec-auth and XFR
- **Dec 2020** - AgGuard launched first DoQ resolver service
- **Feb 2021** - Core QUIC docs now in RFC Editor Queue
- **Feb 2021** - XoT draft passes WGLC

Updates in -02 draft (Feb 2020)

- Add implementation section
- Add appendix on how to potentially support XFR
- Update IANA Considerations: Plan to request port 8853
  - Port 784 used previously for for experiments
- Minor updates related to transport parameters
  - Based on feedback from interop between picoquic and aioquic. Thanks, Stéphane!

Implementation status (all open source)

Implementation	Language	Notes
CoreDNS	Go	AdGuard use as DoQ server
AdGuard DNS Proxy	Go	Simple proxy or server supporting DoQ (used in ADGuard Home)
dnslookup	Go	Command line utility wrapper for Adguard DNS proxy
AdGuard C++ DNS libs	C++	AdGuard use in mobile app
Quicdoc	C	Simple DoQ impl based on Picoquic
aioquic	Python	QUIC implementation includes example DoQ client/server
Flamethrower	C++	DNS performance utility with experimental DoQ

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- **Performance Measurements**
  - None yet AFAWK
  - But... AdGuard claim performs well in mobile environment (lower bandwidth, handles packet loss better, connection migration)

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  - Both have dedicated port and same authentication model

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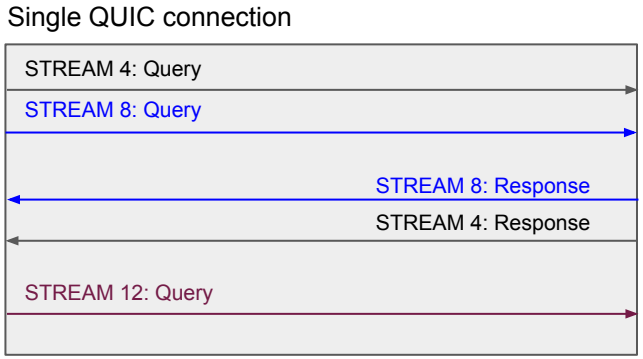
- Issue arises for XFR support….
  - Current draft uses very simple ‘clean’ mapping:
    - **1 DNS query/response pair maps to 1 QUIC stream**
      (stream is closed by each end immediately after sending)
    - StreamData is a UDP-like payload (Query ID=0) - no 2 byte length field

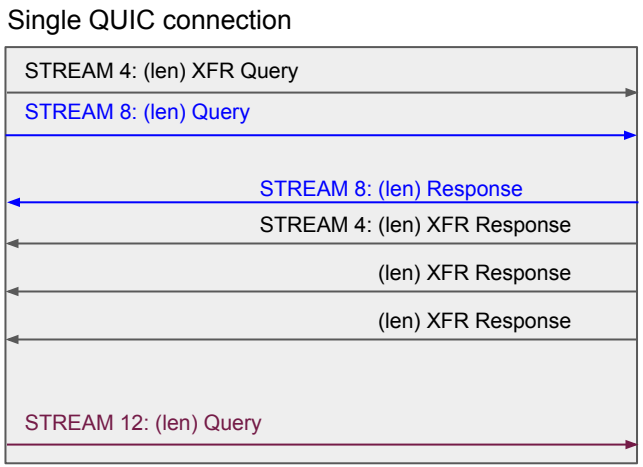


  - **But...XFRs can have multiple responses….**

How to support XFR?

- **Initial proposal** in Appendix of current draft describes an alternative mapping
  - Prepend ALL DNS messages with a 2 byte length field
  - Relax mapping to allow multiple responses on a single stream for an XFR query
    (In practice, DoQ stream content is similar to a TCP connection)

- **Pros**: Supports XFR, ALPN allows backwards compatibility
- **Cons**: Complicates mapping, small overhead, new error conditions



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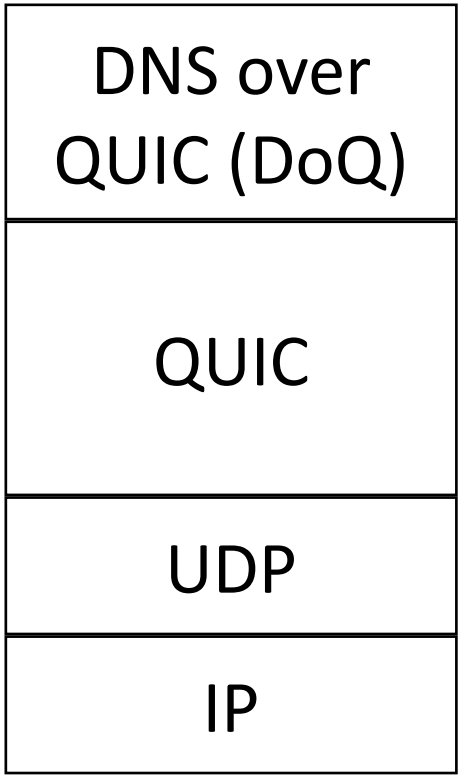
- Range of other possibilities to also consider…
  - Require server to add 2 byte length field ONLY to XFR responses
  - Use separate server initiated streams for each XFR response
  - Define new stream type for XFRs within DoQ
  - Define XFR-over-QUIC as a separate protocol with different ALPN
    - NOTE: QUIC supports server initiated streams so a PUSH model is possible

Questions for Working Group

- Implementation and operational progress
  - Why not move forward with specification?
  - Is more performance data still needed?
- Scope: stub-rec, rec-auth or both?
- If rec-auth is included, how/if to handle XFR support?

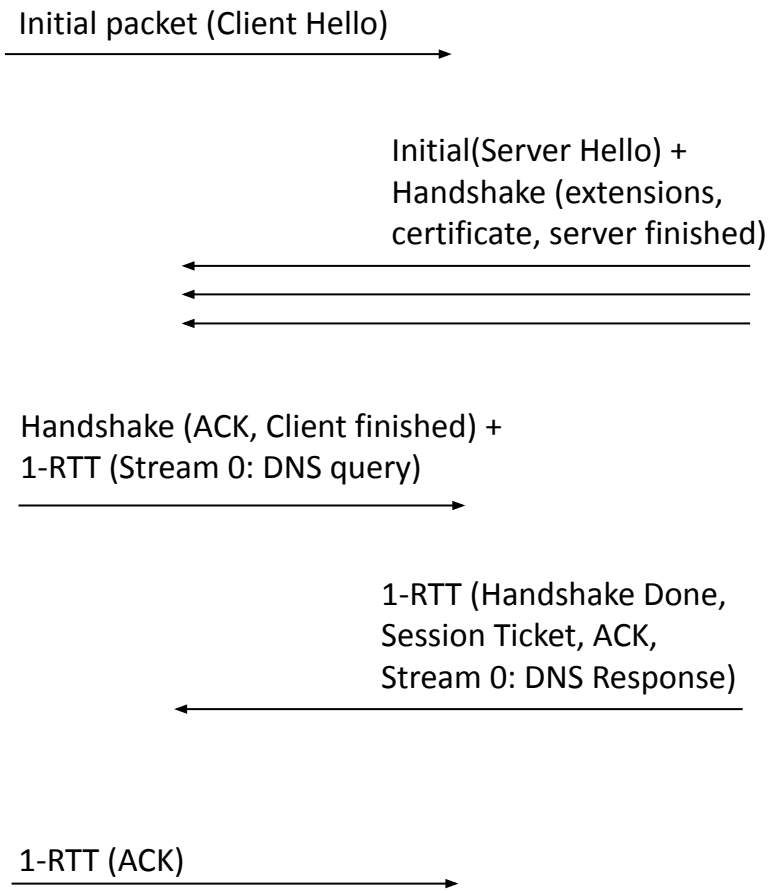
Backup slides

What is DoQ?



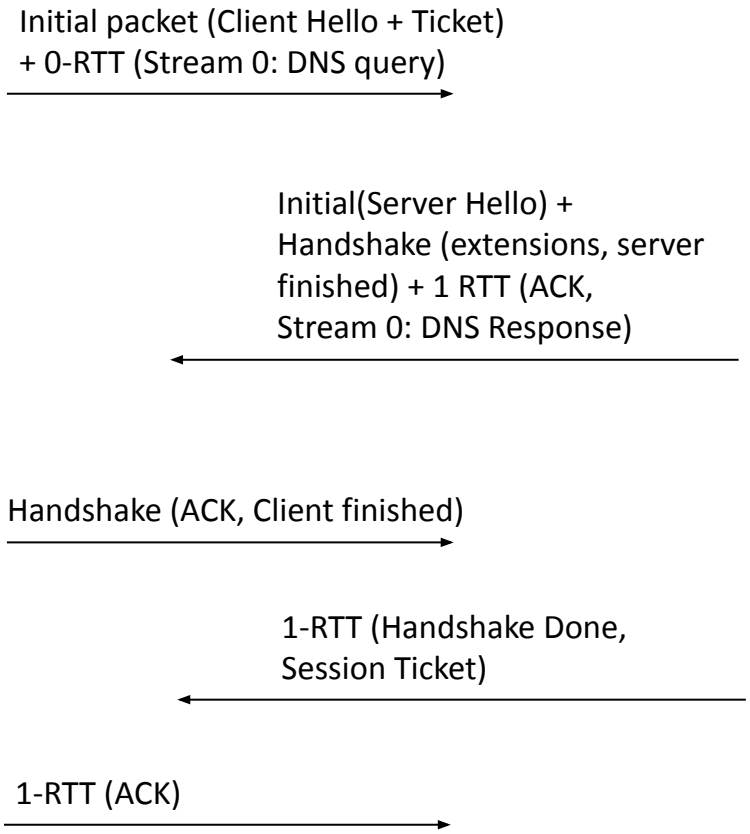
- Simple mapping of DNS over dedicated QUIC connections
  - One QUIC Stream per DNS Query/Response
  - Query and Response size up to 64K (65536)
  - Parallel processing, no head of queue blocking
  - QUIC handles timers, retransmissions, connection management
- Draft currently targets the stub-recursive scenario
  - Recursive-authoritative requires discovery
- Operates on dedicated port (TBC-IANA)

Example flow, First connection, 1-RTT



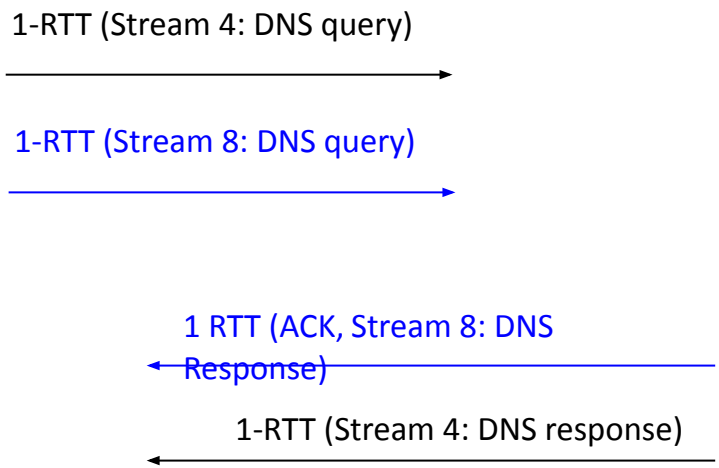
- QUIC handshake embeds TLS handshake
  - Size of server responses depends on size of server certificate, signature
- DNS Query can be sent as soon as server first flight is received
- Response arrives after 2-RTT plus service time.

Example flow, Second connection, 0-RTT



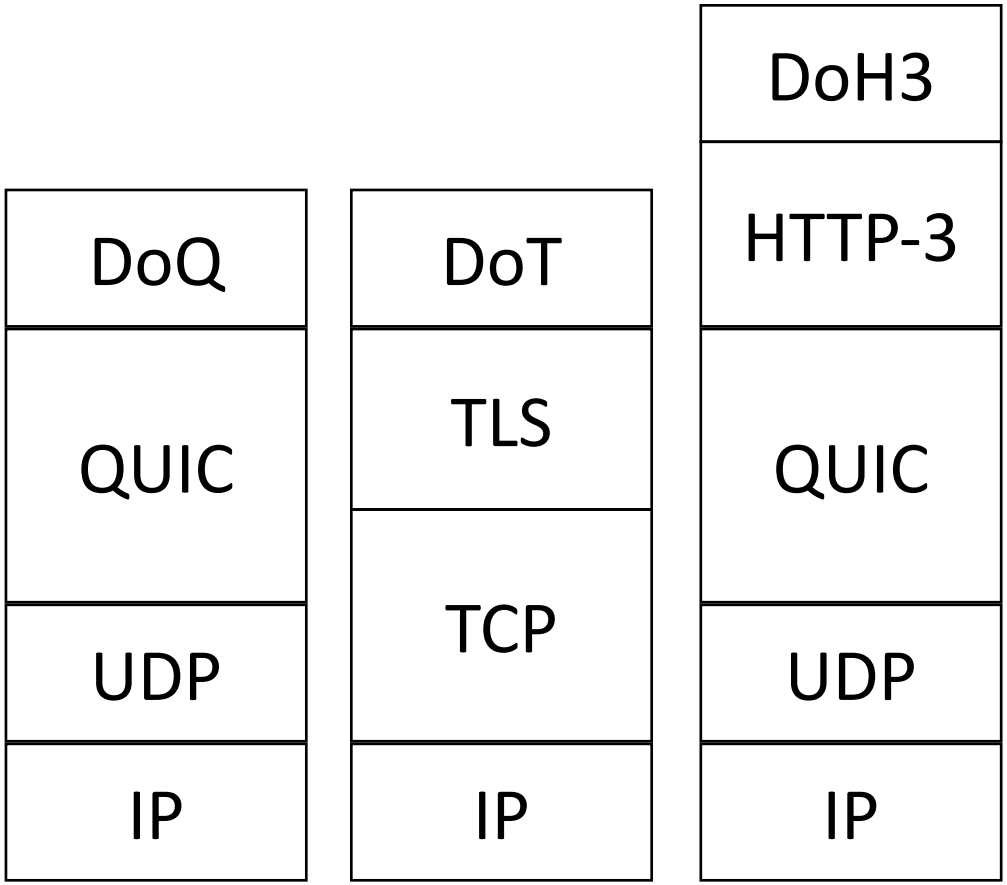
- Session Ticket obtained during previous connection
- DNS Query sent immediately as 0-RTT data
- DNS Response sent with first server flight
- Response arrives after 1-RTT plus service time.

Example flow, DNS Queries (following HS)



- Each Query uses a new QUIC stream (Query-ID is always 0)
- Responses can arrive in any order

DoQ vs DoT vs DoH3?



- Differences with DoT
  - QUIC instead of TLS + TCP
- Difference with DoH3
  - DoH3 has integration with the Web
  - DoQ does not need to use the HTTP-3 layer
  - DoQ has no dependency on HTTP platforms
- With ESNI/ECHO, all 3 solutions can cross firewalls