TurboTLS IETF 118

Faster handshaking over UDP

The problem

We want to cut TLS latency (specifically, connection establishment)

QUIC provides a nice solution for this. Migrate to QUIC :)

…unless you can’t! Upgrading legacy software can be difficult

Can we construct a minimally invasive technique to make fast TLS connection establishment available to all?

The idea

Conduct TLS handshake via UDP while TCP connection is being set up in parallel

Switch back to TCP once connection is up

This eliminates one round trip from a TLS handshake in the best case scenario

If UDP fails, fallback to TLS-over-TCP after a small timeout

Does not affect TLS security model (**transport only**)

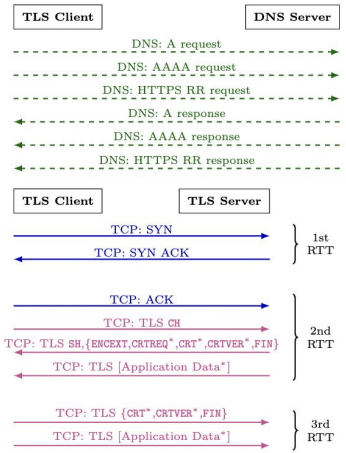


Fig. 1: TLS 1.3 connection establishment

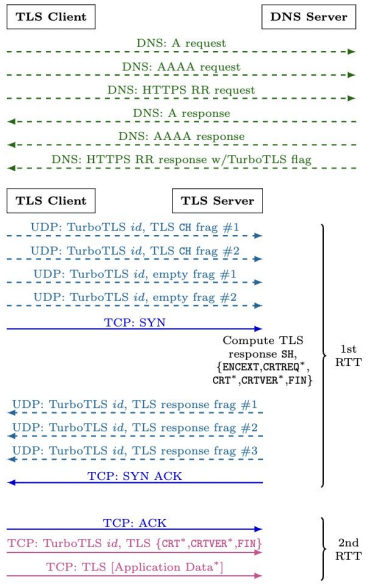


Fig. 2: TurboTLS connection establishment

TurboTLS vs QUIC (it’s not a competition!)

QUIC provides many benefits that TurboTLS does not intend to replicate

TurboTLS **only modifies transport for handshaking**, with techniques for fallback

Some firewalls struggle to perform Deep Packet Inspection due to encrypted transport headers. Thus QUIC is sometimes blocked

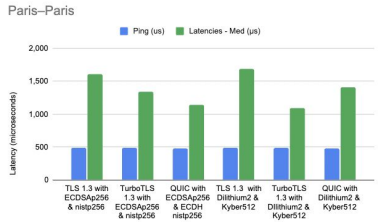
QUIC supports only TLS1.3. TurboTLS works for any version

TurboTLS can be implemented as a transparent proxy, thus in legacy applications no code needs updating.

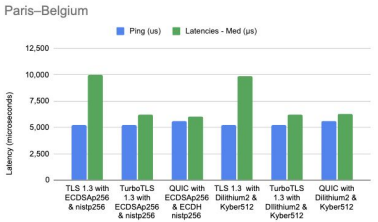
The results so far…

Tested in GCP→GCP environments

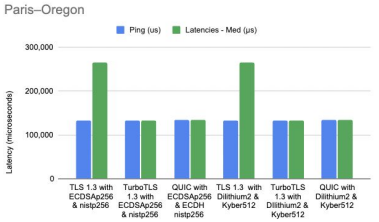
- long distance (intercontinental) 50% improvement
- short distance (same postcode, city) no improvement
- National-distance: significant improvement
- Compared with QUIC, near identical performance (expected)



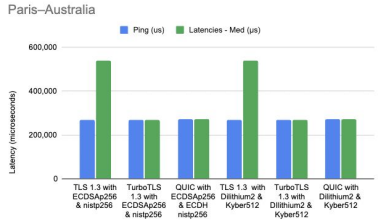
(a) Local: Client and server in same data center



(b) Continental: Client in Paris, server in Belgium



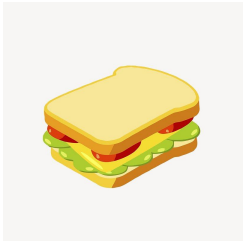
(c) Intercontinental: Client in Paris, server in Oregon



(d) Intercontinental: Client in Paris, server in Australia

Implementation + remaining questions

An experimental implementation is included in Sandwich



An transparent proxy will be released in the near future

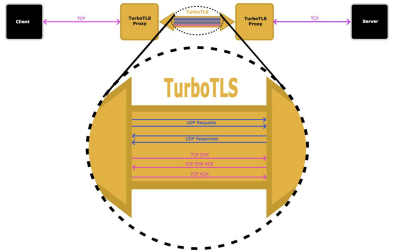


Fig. 4: A client and a server each using a proxy to use TurboTLS

We propose a technique called client request-based fragmentation to mitigate against middlebox filtering. We would like your opinions

Merging UDP and TCP streams raises questions (e.g. TCP fallback)

Draft

Internet-Draft: https://datatracker.ietf.org/doc/draft-joseph-tls-turbotls/

Github Repo: https://github.com/PhDJsandboxaq/draft-joseph-tls-turbotls

Questions?

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https://datatracker.ietf.org/doc/draft-joseph-tls-turbotls/

Batch signatures IETF 118

Higher online TLS throughput via Merkle Trees

The problem

Load balancers, reverse proxies, etc have to deal with many incoming TLS requests per second

Post-quantum signatures have much higher latency than ECC/RSA. This has the potential to cause performance issues when signing threads get clogged

Can we make post-quantum signatures more performant?

The idea

Construct Merkle tree from message transcripts

Sign the root with a base signature algorithm

Signature is the Merkle tree sibling path (to reconstruct the root) plus the root signature

Sibling path varies for each signature

Same root signature for all in same batch

Idea **first proposed** in:

[draft-davidben-tls-batch-signing-00]

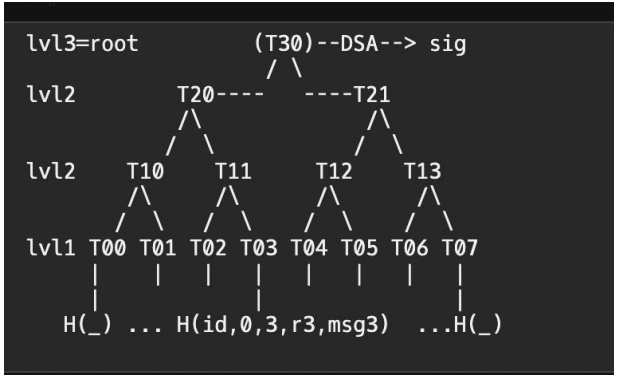

Figure 1: Merkle tree batch signature construction

Updates

In Batch Signatures, Revisited, the authors provide security proofs for the construction, including privacy notions

We based security on Target Collision Resistance, instead of Collision resistance. This enables **halving of the sibling path length.** Technique from SPHINCS+

Development in PQC (and acknowledgement of its performance problems) makes high throughput signing increasingly appealing

Different use case and applications to Merkle tree certs, however the TCR/CR update would be applicable there.

Draft

Internet-Draft: https://datatracker.ietf.org/doc/draft-joseph-tls-batch-signatures/

Github Repo: https://github.com/PhDJsandboxaq/draft-joseph-batch-signatures

Questions?

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