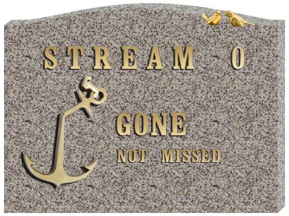
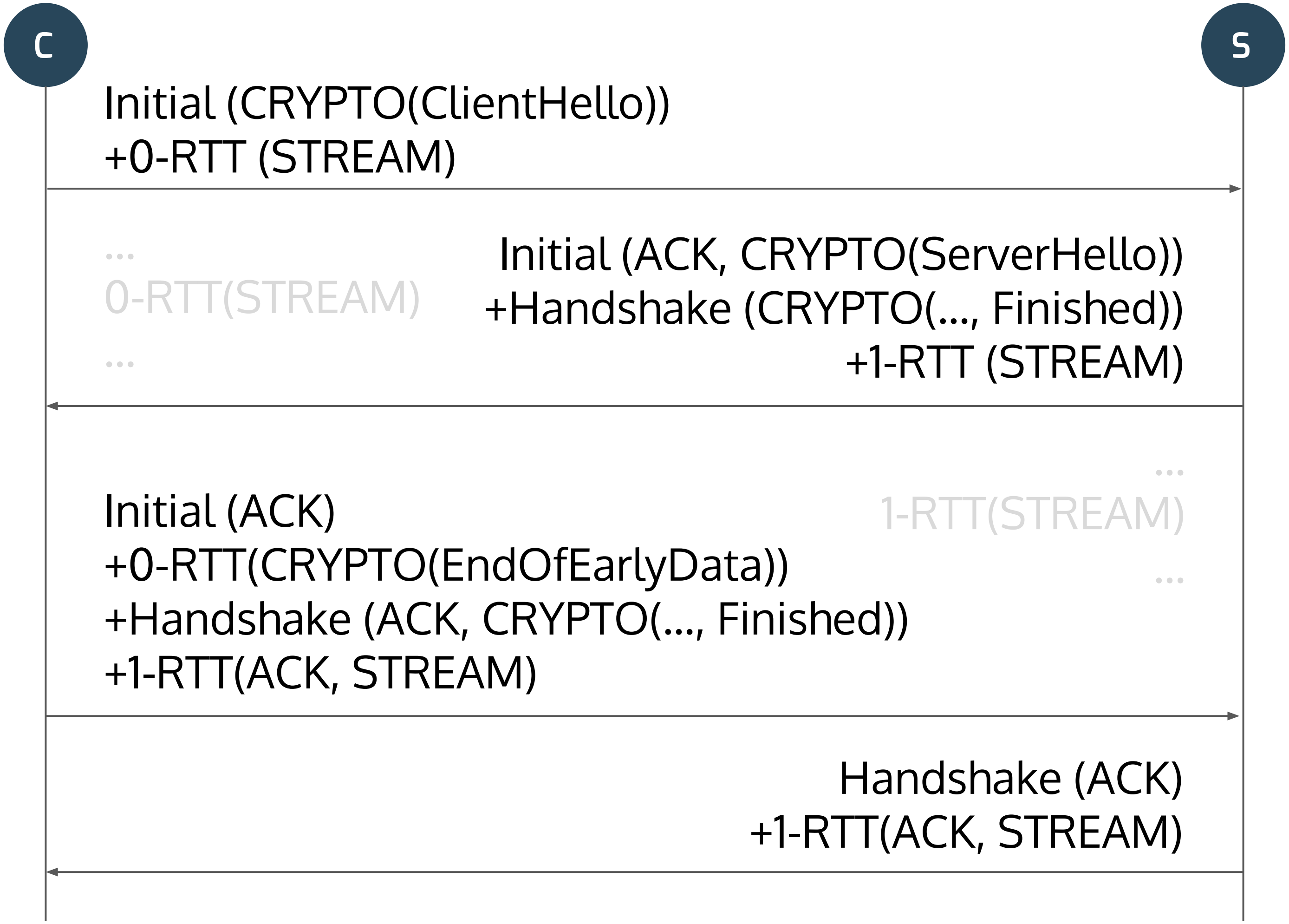
Discarding Handshake Keys

QUIC IETF 102, Montreal, July 2018
Martin Thomson

When Can Keys Be Destroyed? (#1544)





Initial (CRYPTO(ClientHello))
+0-RTT (STREAM)

…
0-RTT(STREAM)
…

Initial (ACK, CRYPTO(ServerHello))
+Handshake (CRYPTO(…, Finished))
+1-RTT (STREAM)

…
1-RTT(STREAM)
…

Initial (ACK)
+0-RTT(CRYPTO(EndOfEarlyData))
+Handshake (ACK, CRYPTO(…, Finished))
+1-RTT(ACK, STREAM)

Handshake (ACK)
+1-RTT(ACK, STREAM)

Simple Solution: Timers

Treat each packet number space separately

A space is done when both read and write keys for the next space are ready

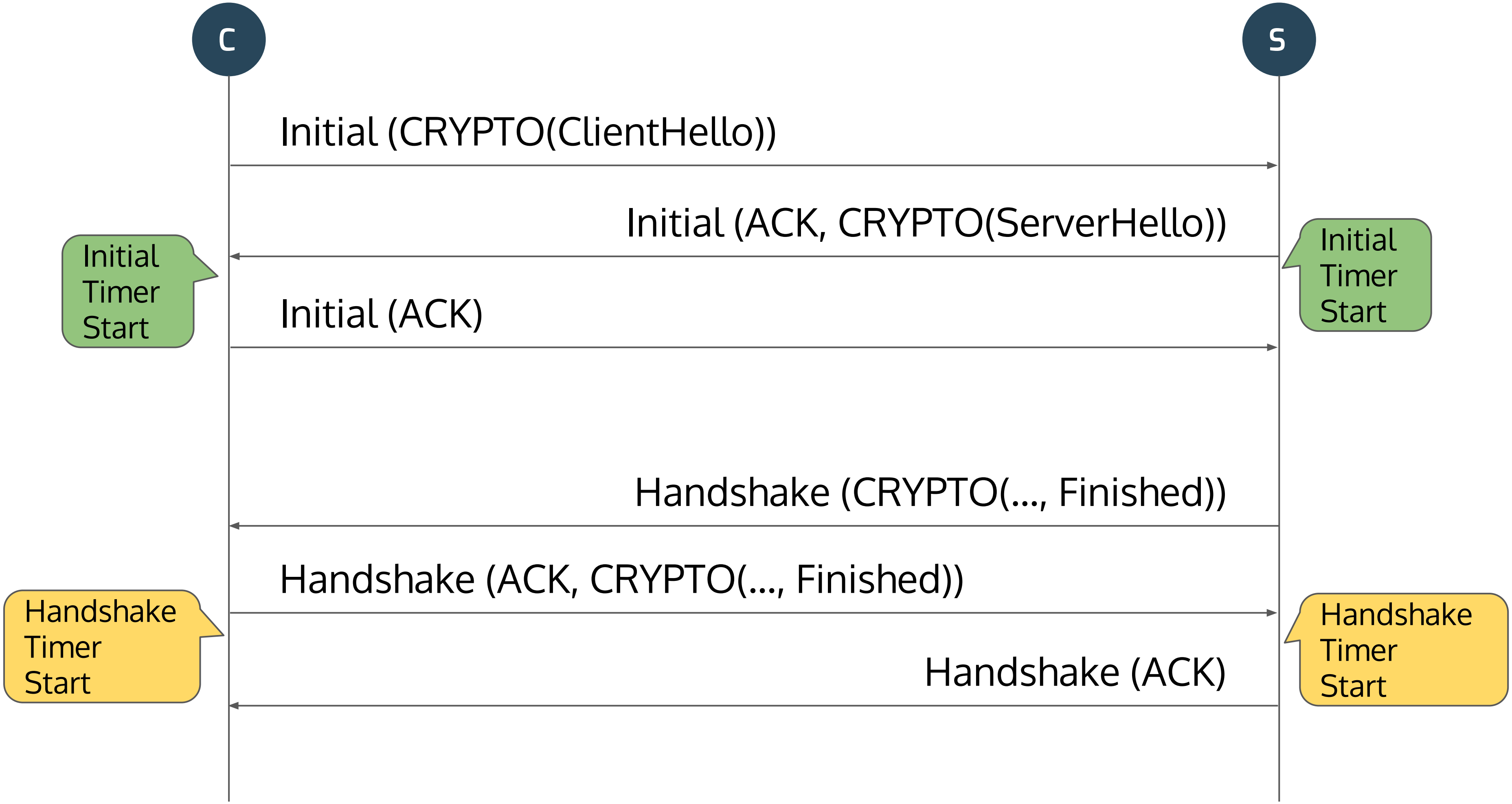
Set a timer when done and destroy the keys when it expires

… until then, resend CRYPTO and send ACK as normal

… afterwards, drop packets protected with those keys

The timer can be long-ish (no practical harm in infinite)

Separate Packet Number Spaces



C

S

Initial (CRYPTO(ClientHello))

Initial (ACK, CRYPTO(ServerHello))

Initial Timer Start

Initial Timer Start

Initial (ACK)

Handshake (CRYPTO(..., Finished))

Handshake (ACK, CRYPTO(..., Finished))

Handshake Timer Start

Handshake Timer Start

Handshake (ACK)

Optimization: Implicit Acknowledgment

Receiving Handshake packets implies that all CRYPTO frames from Initial packets were received

Receiving 1-RTT packets at a server means that all CRYPTO frames in Handshake packets were received by the client

Receiving acknowledgments for 1-RTT packets at a client means that all CRYPTO frames in Handshake and 0-RTT packets were received by a server

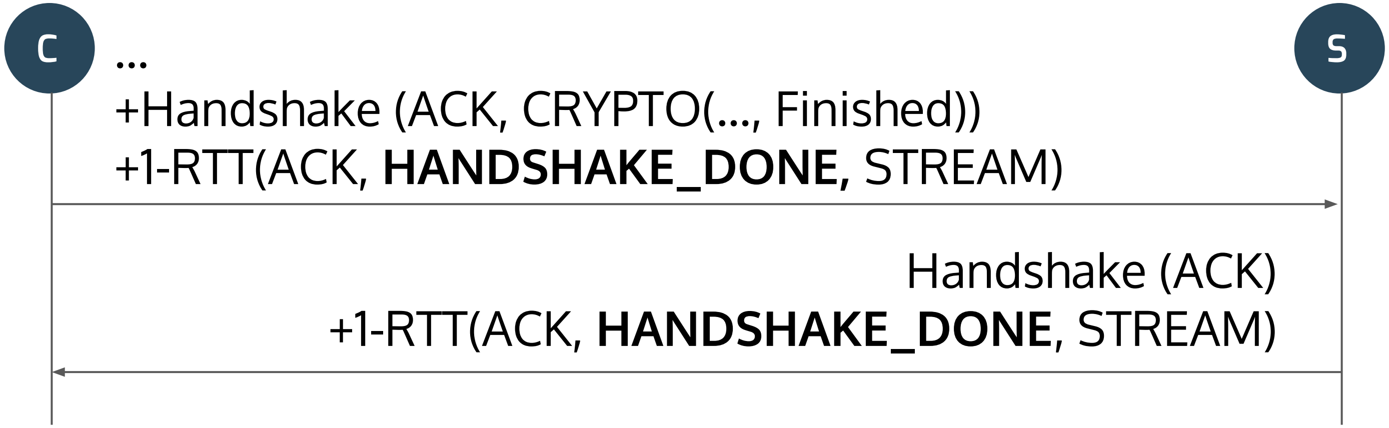
Stop sending those CRYPTO frames then

Let the packets with ACK frames that appear afterwards drop

Alternative: HANDSHAKE_DONE Frame

An explicit signal that an endpoint believes that the handshake is done

On receipt endpoints could destroy all handshake keys



…
+Handshake (ACK, CRYPTO(…, Finished))
+1-RTT(ACK, **HANDSHAKE_DONE,** STREAM)

Handshake (ACK)
+1-RTT(ACK, **HANDSHAKE_DONE**, STREAM)

Doesn’t address 0-RTT receive keys at the server

Proposal: Document Timer-based Cleanup

Optimizations are fun, but they don’t need to be standard