tcpcrypt

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What’s new?

- Integrated with ENO.
- Simplified spec - cut it in half (25 pages). No more RSA, no more SYNCOOKIE TCP option, basic TLV (no more keep-alive sync-req & other app-layer messages).
- Updated Windows, OSX and Linux code.

Goals

- Simple: what’s the simplest change needed to TCP to add encryption?

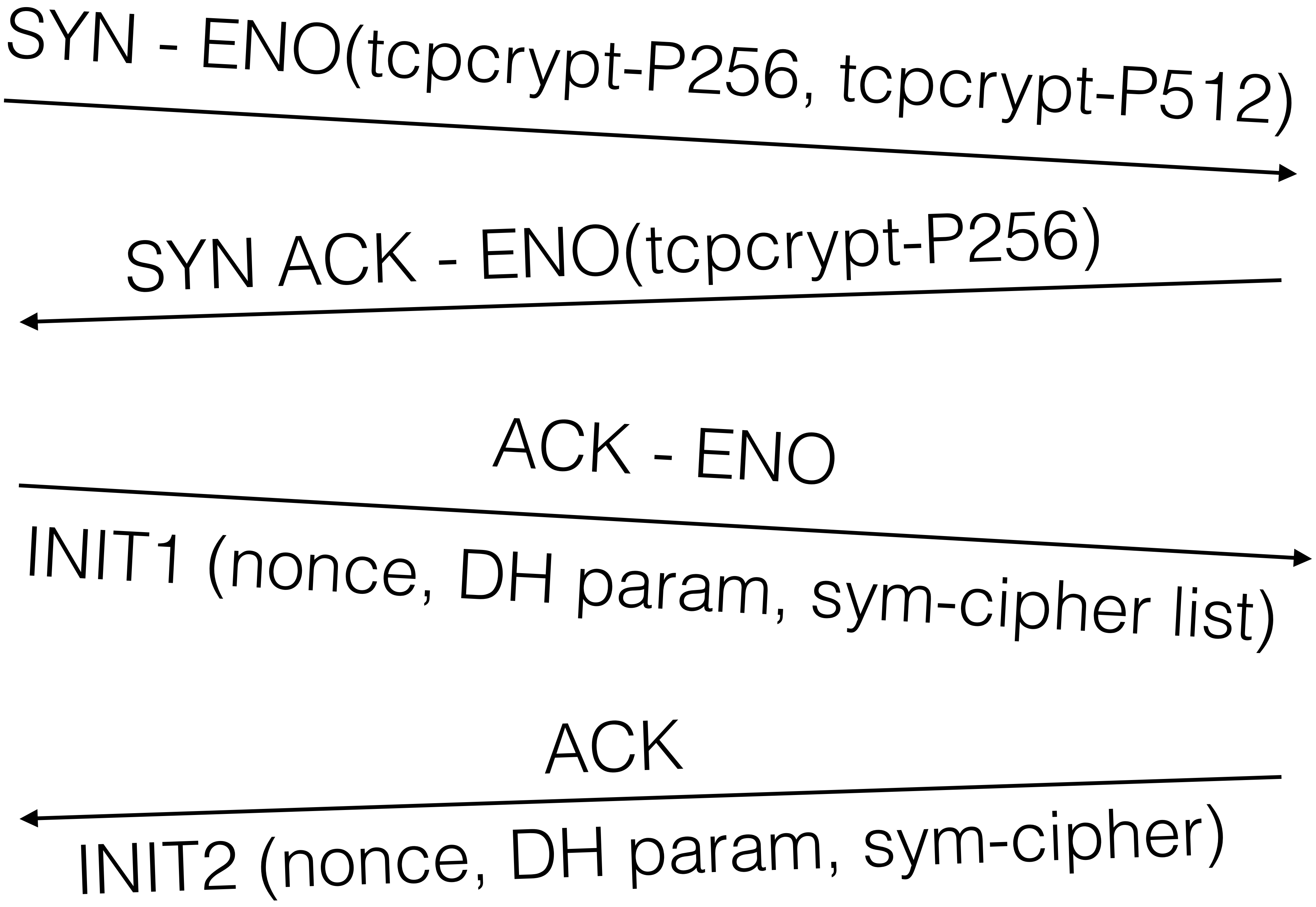
- Self-contained: no dependencies, be amenable to implementations in kernels and embedded systems.

- Minimal: tailored for the task at hand (opportunistic encryption) with no unnecessary crypto.

Overview

- Use ENO to negotiate key exchange mechanism.
- Use first two TCP data segments to exchange keys.
- Wrap application data in a basic Type-Length-Value (TLV) record and apply authenticated encryption on it.

Handshake



SYN - ENO(tcpcrypt-P256, tcpcrypt-P512)

SYN ACK - ENO(tcpcrypt-P256)

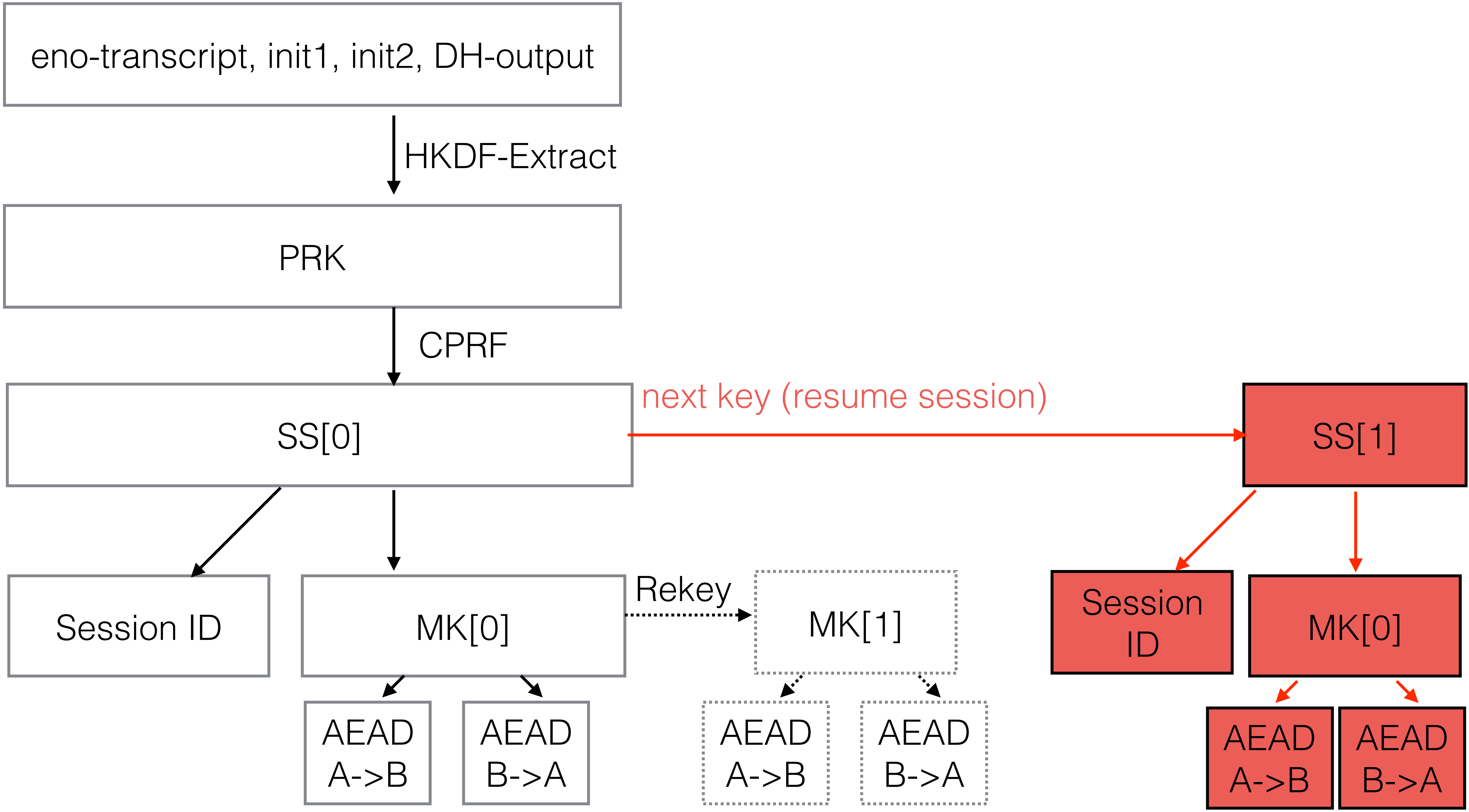
ACK - ENO

INIT1 (nonce, DH param, sym-cipher list)

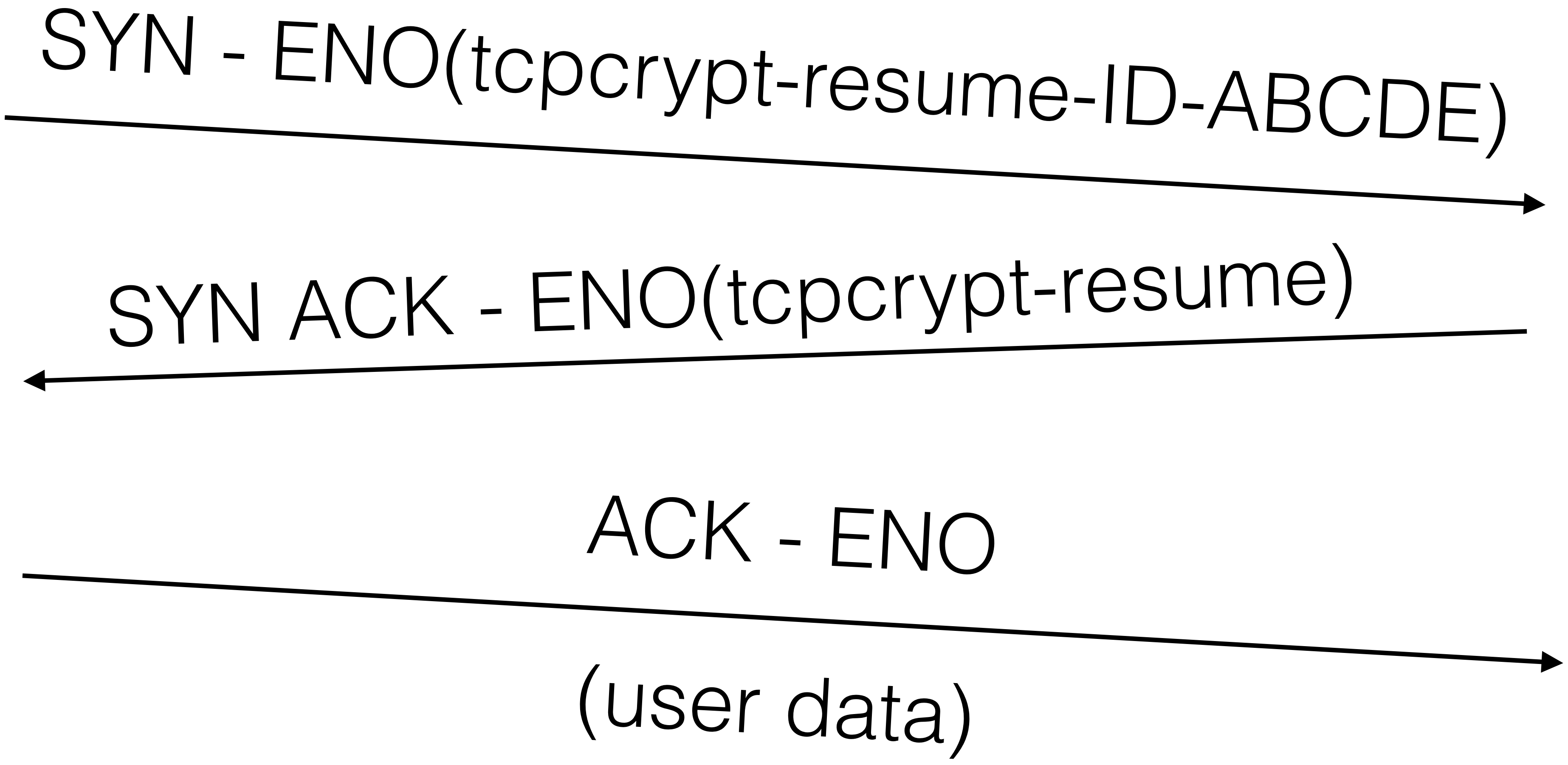
ACK

INIT2 (nonce, DH param, sym-cipher)

Key scheduling



Session resumption



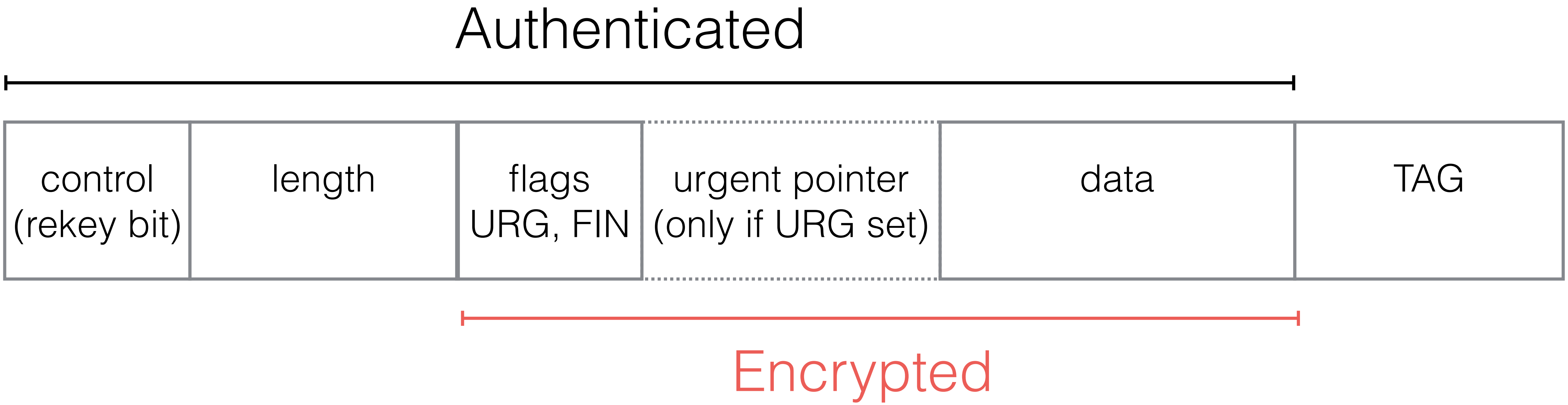
SYN - ENO(tcpcrypt-resume-ID-ABCDE)

SYN ACK - ENO(tcpcrypt-resume)

ACK - ENO

(user data)

Payload protection



Authenticated

control (rekey bit)	length	flags URG, FIN	urgent pointer (only if URG set)	data	TAG

Encrypted

AEAD nonce is byte offset in underlying TCP stream

System-wide user-space implementation notes

- Divert sockets - kernel sends packets to process for modification.
  - Pro: can modify 3-way handshake.
  - Con: hard to add TLV to TCP stream (need to map sequence and ack numbers).
- Redirect (transparent proxy) - kernel redirects connection (stream) to process.
  - Pro: easy to inject TLV and modify payload.
  - Con: cannot modify handshake.
  - Con: don’t know destination until connection is accepted. Destination may not be listening and so we’ll accept() and close() socket instead of connection being refused - different semantics / behavior.

OS support

	Windows	OSX	Linux
Divert	🟩	N/A	🟩
Redirect	N/A	🟩	🟩

Current tcpcrypt implementation supports all these combinations