TLSv1.3

...quite a big change

TLSv1.3

- Administrivia
- Process
- Protocol
- Issues

Administrivia

- TLSv1.3 = draft-ietf-tls-tls13-26
- Draft is (after 4 years) at the final stages of approval
- https://tools.ietf.org/html/draft-ietf-tls-tls13-26
- Don’t worry if that -26 is incremented, it won’t change much and the latest version will be fine to read
- RFC will likely pop out in a month or two
- 155 pages (eek!) - do not ignore Apendices C,D and E!
- Written for implementers – you may need to read it more than once (some less clear forward references), but it’s pretty readable really
- Github repo for the spec:
  https://github.com/tlswg/tls13-spec
- Implementations:
  https://github.com/tlswg/tls13-spec/wiki/Implementations

Process

- Work started in 2014, motivations included TLS attacks seen in theory and in the wild and Snowdonia
- Represents a **major** change in the protocol - version numbering bikeshed was well painted
- Academic cryptographers worked closely with implementers to (hopefully!) ensure we don't see the same crypto/protocol failures in future
- Two academic workshops were held and the protocol design was modified numerous times to better match cryptographic theory
    - TRON: https://www.ndss-symposium.org/ndss2016/tron-workshop-programme/
    - TLS-DIV: https://www.mitls.org/tls:div/

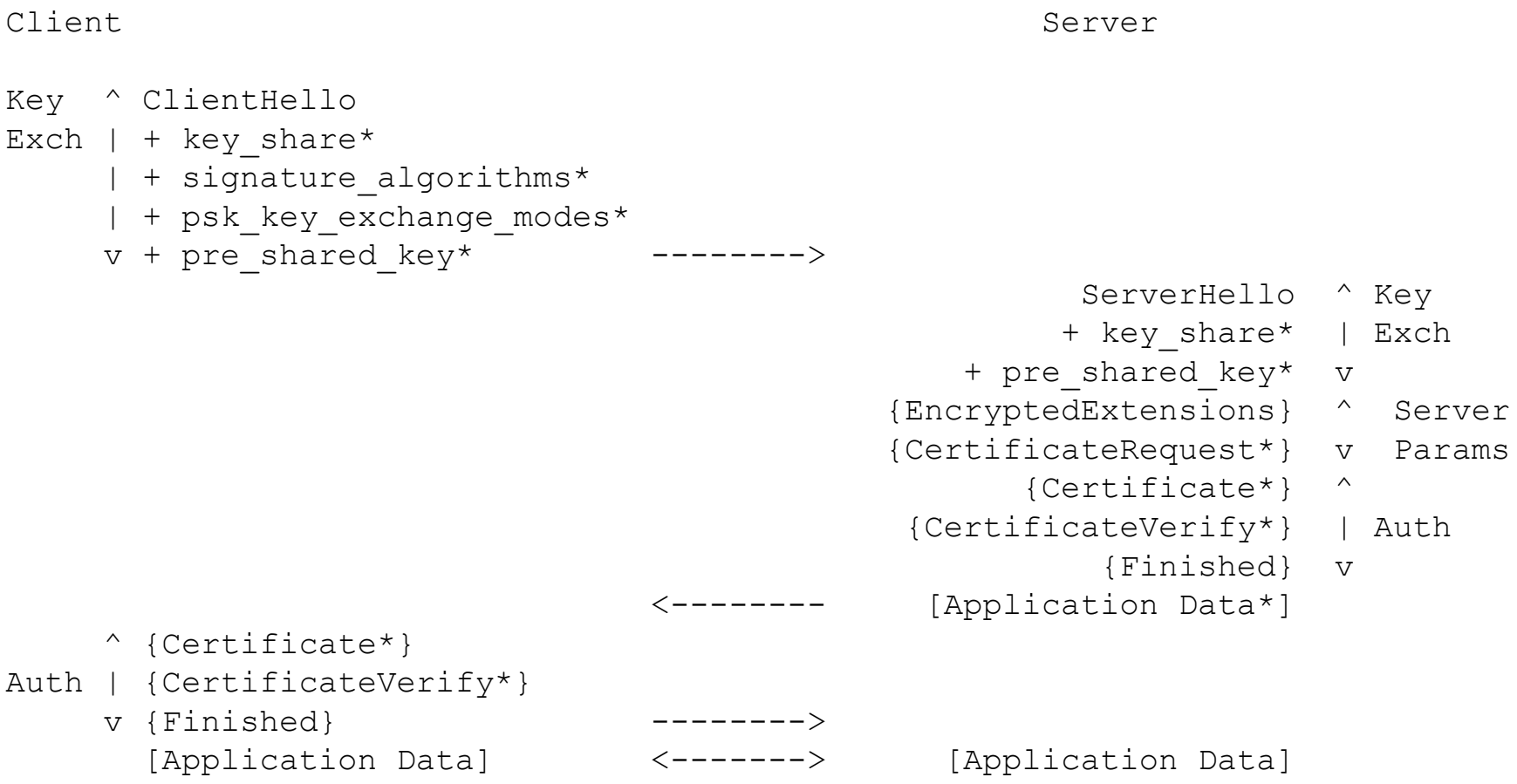
Major Changes

- Drop less desirable algorithms and move to AEAD everywhere
- Change how new ciphersuites get defined and get RECOMMENDED
- Added “0-RTT” mode, a double-edged sword! (aka sharp implement)
- RSA key transport removed, all key exchanges provide forward secrecy
- More encryption of handshake including some extensions
- ECC is now built-in
- No more compression or custom DH groups
- Pre-shared keying, tickets and session handling all done in one way
- PKCS#1v1.5 -> RSA PSS for protocol signatures (but not certificates)
- Versioning muck – need to pretend to not be TLSv1.3 for deployment in the real world of middleboxes

TLSv1.3 Features

- These slides are **not** a replacement for reading the spec
- 1-RTT handshake
- HRR
- PSK/Resumption
- 0-RTT
- Ciphersuite re-factoring
- Key Derivation
- Versioning muck
- (Notable) extensions
- Record Protocol
- Security Properties

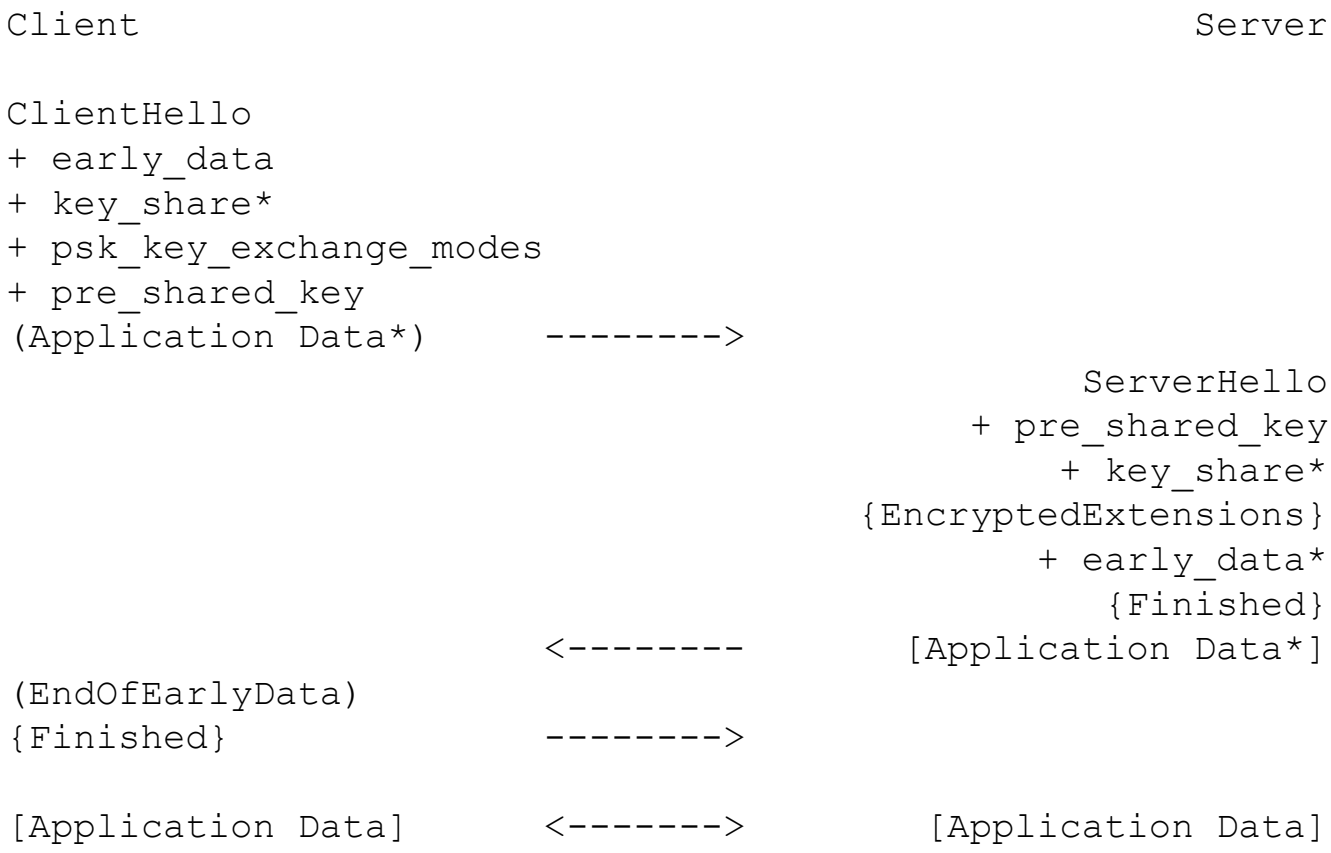
Full "1-RTT" Handshake



Handshake with HelloRetryRequest

Resumption/Re-use of PSK

"0-RTT" Early Data



“0-RTT” Issues

- “0-RTT” is a DANGEROUS IMPLEMENT
  - “0-RTT” isn’t really quite accurate terminology – client needs first to have a PSK, and of course doesn’t get an answer for at least one RTT and there could be a DNS RTT first
- Motivation: browsers want to send HTTP GET requests in “first flight”
  - Without this feature it’s likely TLSv1.3 would not be adopted in the web
  - People need more incentives than just better security to cause them to upgrade
- Problem: **early-data can be REPLAYed**
  - Attacker records 0-RTT messages incl. early data
  - Replay that against another instance of a load-balanced server, e.g. in another data-centre where load-balanced instances can’t easily share an anti-replay cache
  - Example: DPRIVE – DNS/TLS with anycast recursives
- Bigger problem: properly handling the semantics of early-data is neither simple nor obvious, but the attraction of go-faster-stripes is simple and obvious
  - Prediction: this’ll lead to headlines when it goes badly wrong
- Smaller problem – early-data is not authenticated until server has validated the client’s Finished – can cause API headaches in servers, but rule is to not act on early-data until after Finished is checked
  - Web servers might or might not (yuk) adhere to this rule, as in theory (but not in practice), HTTP GET and some other HTTP request methods are idempotent
  - HTTP processing of early-data: https://tools.ietf.org/html/draft-ietf-httpbis-replay-02