# TLS 1.3 Tutorial

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# Will address TLS 1.3’s:

Whats

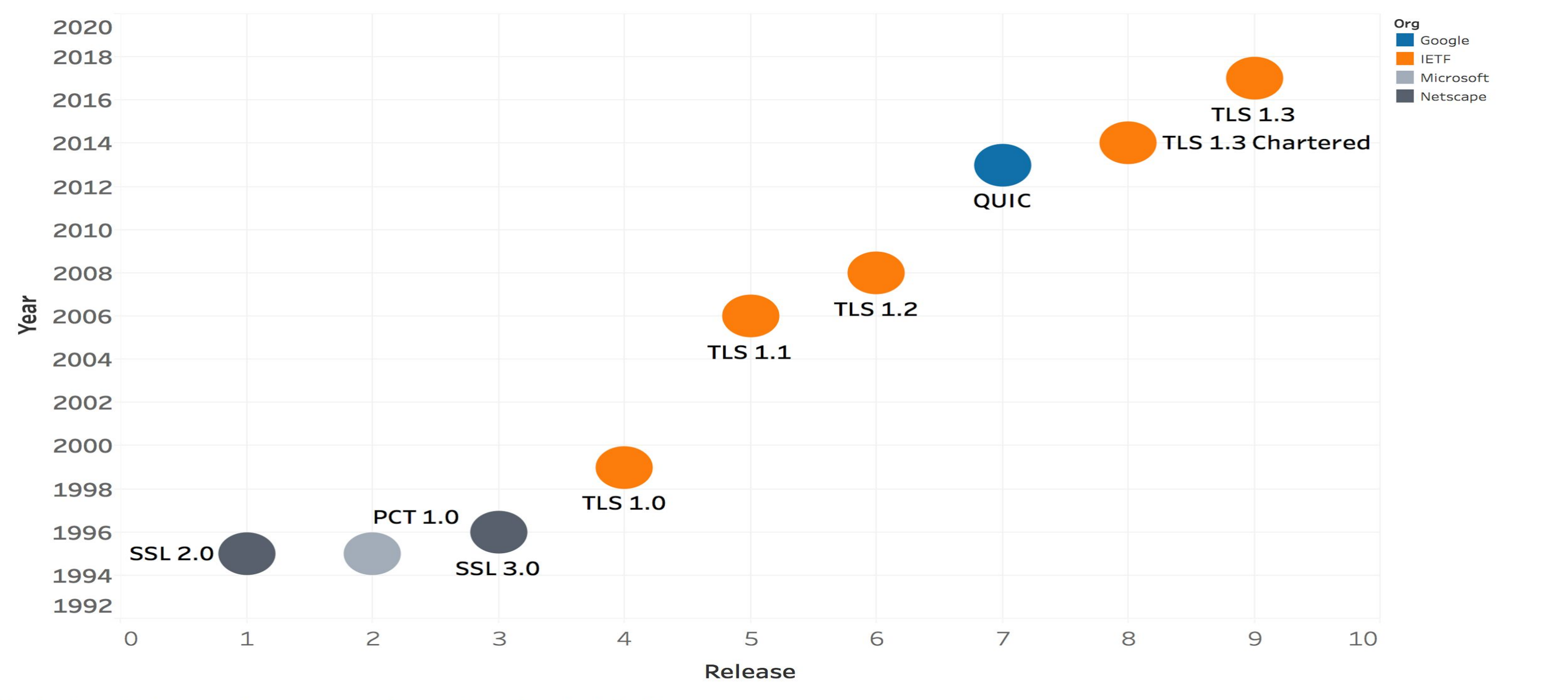
Wheres

Hows

# We promise:

Not too Technical
Lots o' Links
Lame Nerd Humor

# Whence does it come?



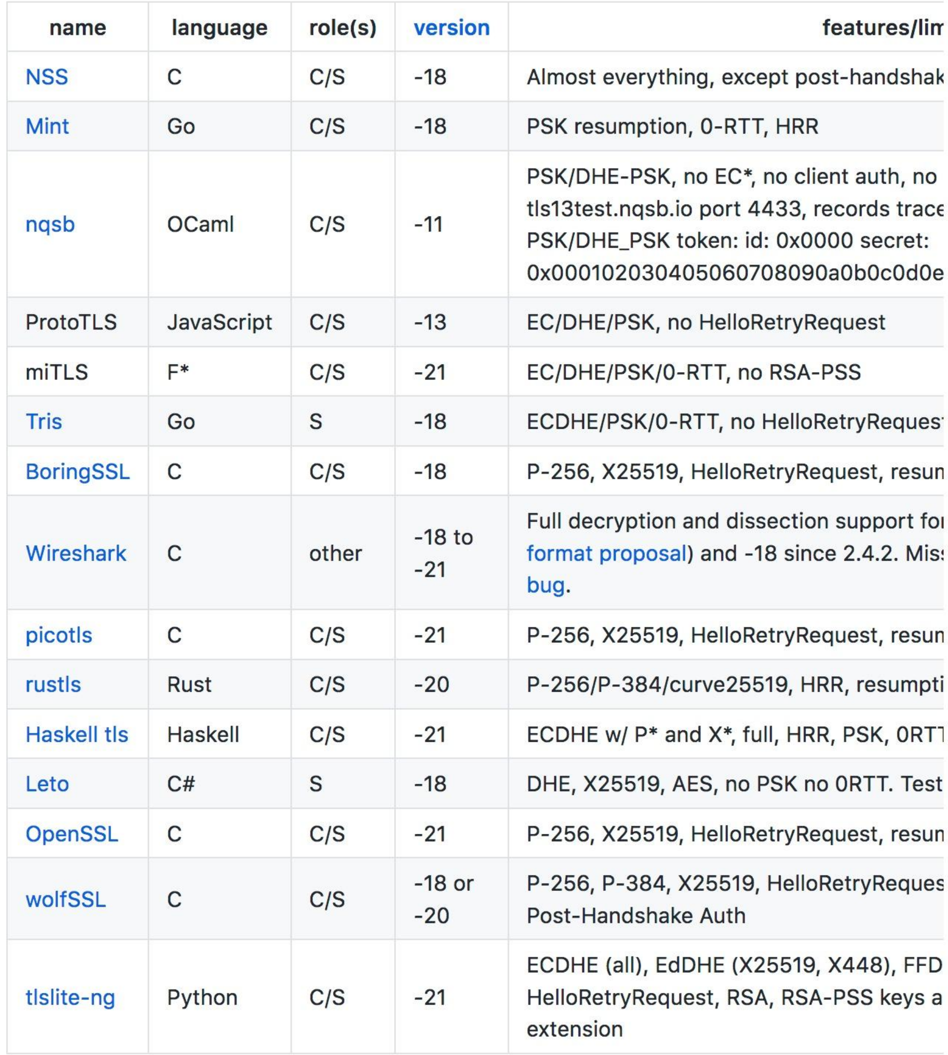
The plot of sum of Order for Year. Color shows details about Org. The marks are labeled by Milestone.

# Who’s implementing 1.3?

Open source!

Browsers!

Test servers available!



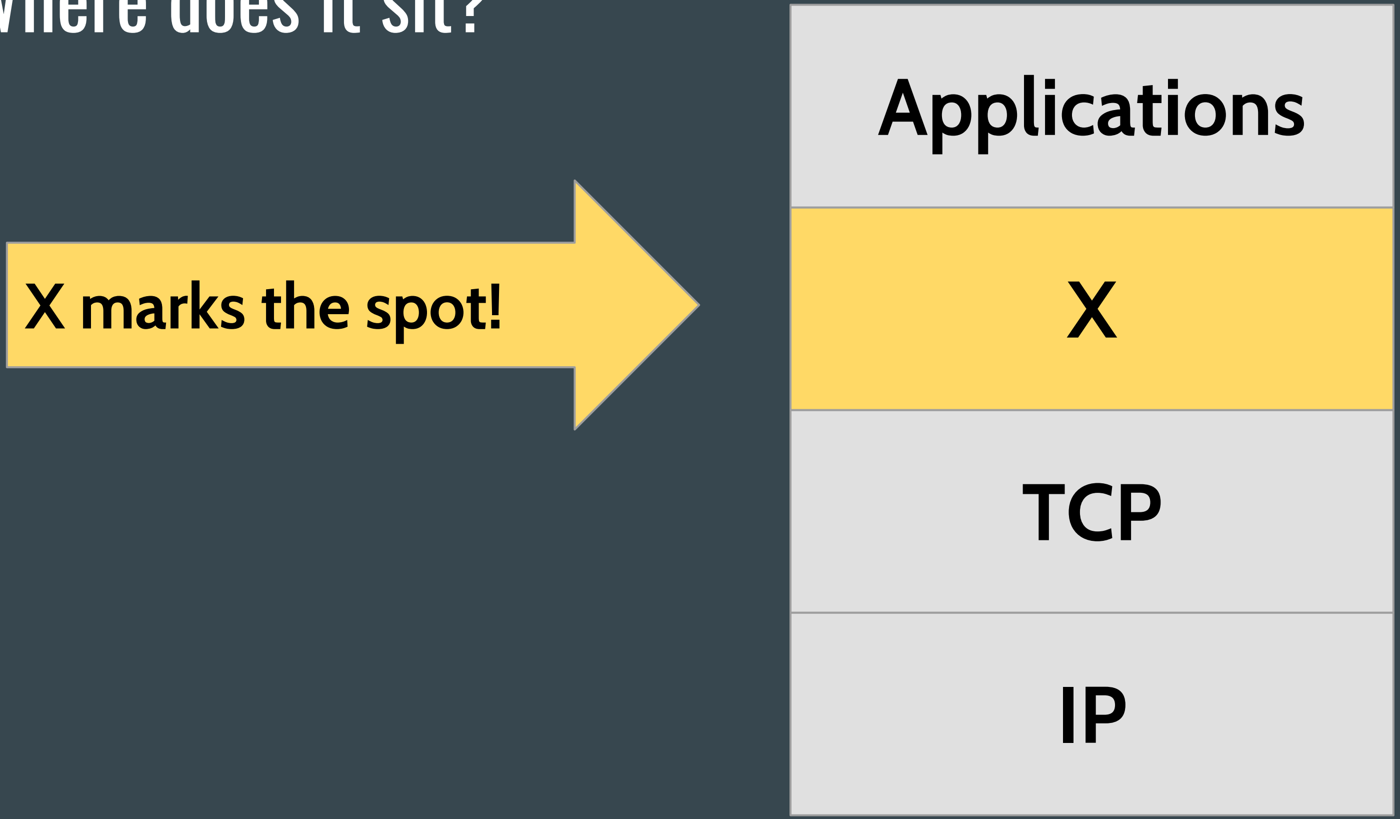
| name | language | role(s) | version | features/lim |
|---|---|---|---|---|
| NSS | C | C/S | -18 | Almost everything, except post-handshak |
| Mint | Go | C/S | -18 | PSK resumption, 0-RTT, HRR |
| nqsb | OCaml | C/S | -11 | PSK/DHE-PSK, no EC*, no client auth, no tls13test.nqsb.io port 4433, records trace PSK/DHE_PSK token: id: 0x0000 secret: 0x000102030405060708090a0b0c0d0e |
| ProtoTLS | JavaScript | C/S | -13 | EC/DHE/PSK, no HelloRetryRequest |
| miTLS | F* | C/S | -21 | EC/DHE/PSK/0-RTT, no RSA-PSS |
| Tris | Go | S | -18 | ECDHE/PSK/0-RTT, no HelloRetryReques |
| BoringSSL | C | C/S | -18 | P-256, X25519, HelloRetryRequest, resun |
| Wireshark | C | other | -18 to -21 | Full decryption and dissection support fo format proposal) and -18 since 2.4.2. Mis bug. |
| picotls | C | C/S | -21 | P-256, X25519, HelloRetryRequest, resun |
| rustls | Rust | C/S | -20 | P-256/P-384/curve25519, HRR, resumpti |
| Haskell tls | Haskell | C/S | -21 | ECDHE w/ P* and X*, full, HRR, PSK, 0RT |
| Leto | C# | S | -18 | DHE, X25519, AES, no PSK no 0RTT. Test |
| OpenSSL | C | C/S | -21 | P-256, X25519, HelloRetryRequest, resun |
| wolfSSL | C | C/S | -18 or -20 | P-256, P-384, X25519, HelloRetryReques Post-Handshake Auth |
| tlslite-ng | Python | C/S | -21 | ECDHE (all), EdDHE (X25519, X448), FFD HelloRetryRequest, RSA, RSA-PSS keys a extension |

# Where are the specifications?

Working copy

Official I-D

# Where does it sit?



X marks the spot!

Applications

X

TCP

IP

# What does it do?

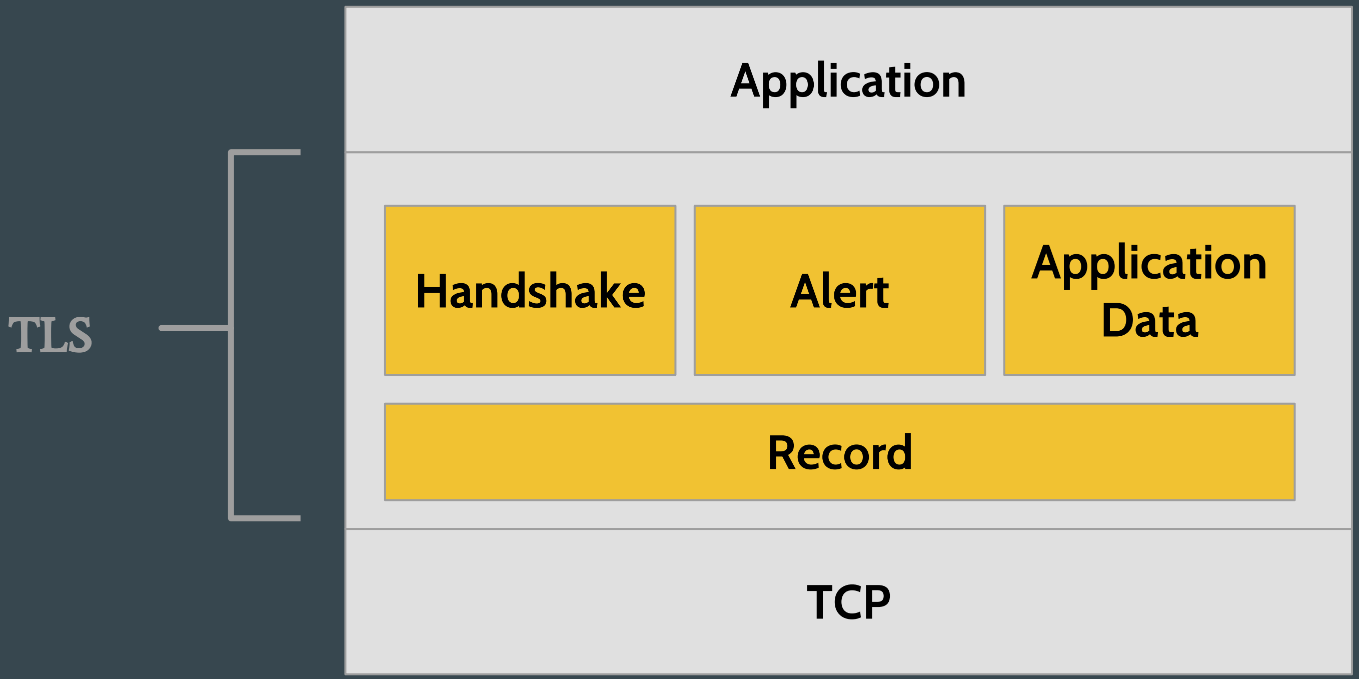
Begone Eve!

Mallory No More!

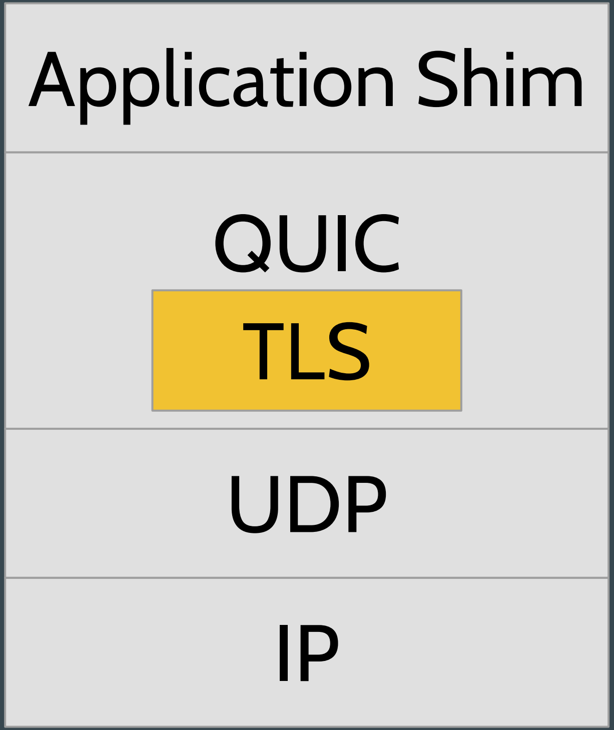
ALICE SENDS A MESSAGE TO BOB SAYING TO MEET HER SOMEWHERE.
UH HUH.
BUT EVE SEES IT, TOO, AND GOES TO THE PLACE.
WITH YOU SO FAR.
BOB IS DELAYED, AND ALICE AND EVE MEET.
YEAH?
I'VE DISCOVERED A WAY TO GET COMPUTER SCIENTISTS TO LISTEN TO ANY BORING STORY.

From xkcd.com

# Wat, Wat! There's how many protocols!?

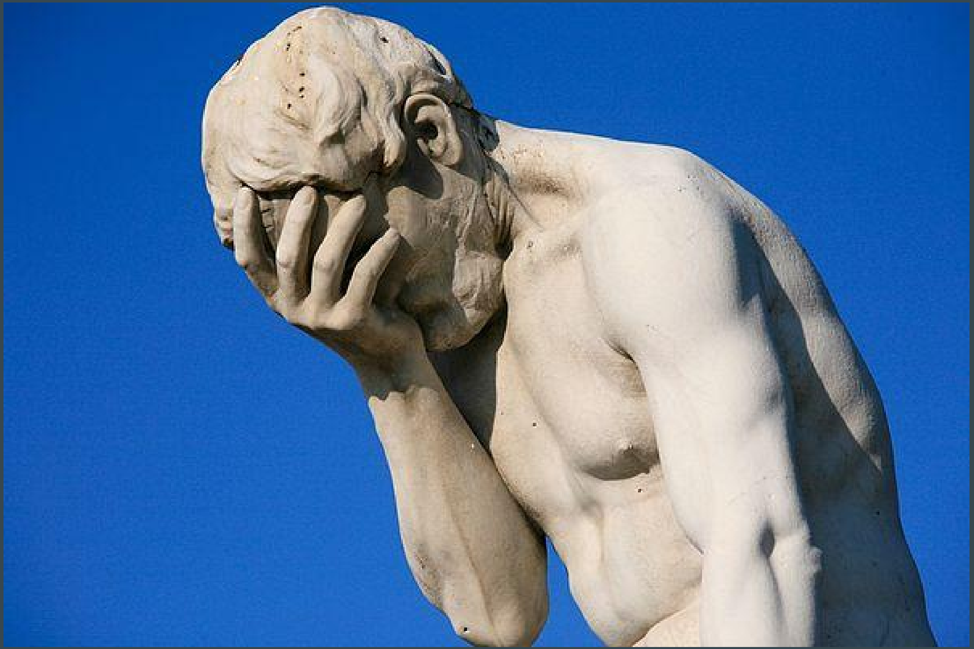


# Wat! Wat! You don’t need to use all the protocols?



QUIC does not use
TLS’ Application Data

# What was wrong with the previous versions?



Lucky 13

BEAST

Freak

Logjam

Drown

Crime

Breach

Triple Handshake

Poodle

Sweet32

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# What were the design goals?

CAMERON SPENCER/GETTY IMAGES

PRIVATE

# Why is it more secure?

# What did you remove to make it more secure?

SHA-1

Compression

Stream Ciphers

Static RSA Key Exchange

Renegotiation

Block Ciphers

# Why is it more secure?

Record Payload Algorithms: AEAD-only

Key Establishment Algorithms: (EC)DHE or PSK

Convergence of PSK, Session Resumption, Session Tickets and 0-RTT

TLS1.2

>100

Cipher Suites

TLS1.3

005

# What algorithms are supported?

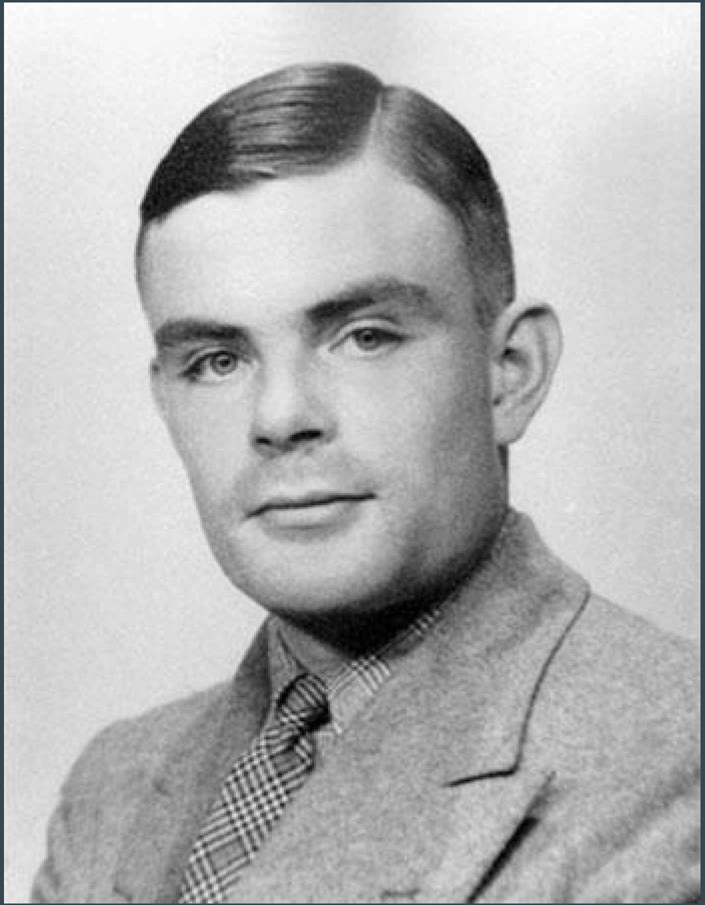
AEAD: AES-GCM, AES-CCM, CHACHA20-Poly1305

ECs:

- Sig: p256, p384, p521, EdDSA (25519 and 448)
- KE Groups: p256, p384, p521, 25519, 448

Named FFDHE Groups

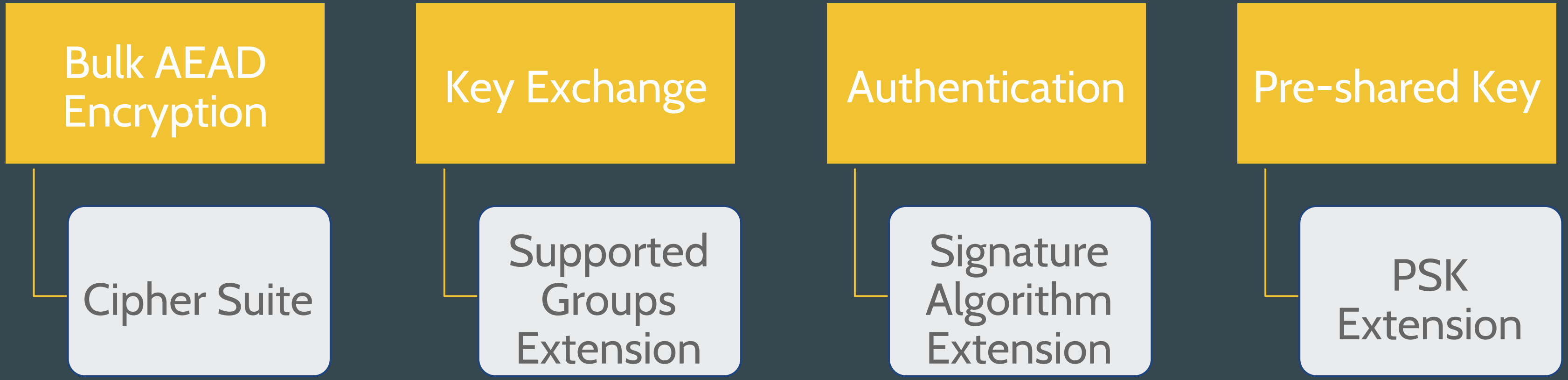
RSA-PSS Signatures



# How do you specify ciphers?

OLD: TLS_ECDHE_RSA_WITH_AES_256_GCM_SHA384

NEW: a la carte



Bulk AEAD Encryption

Cipher Suite

Key Exchange

Supported Groups Extension

Authentication

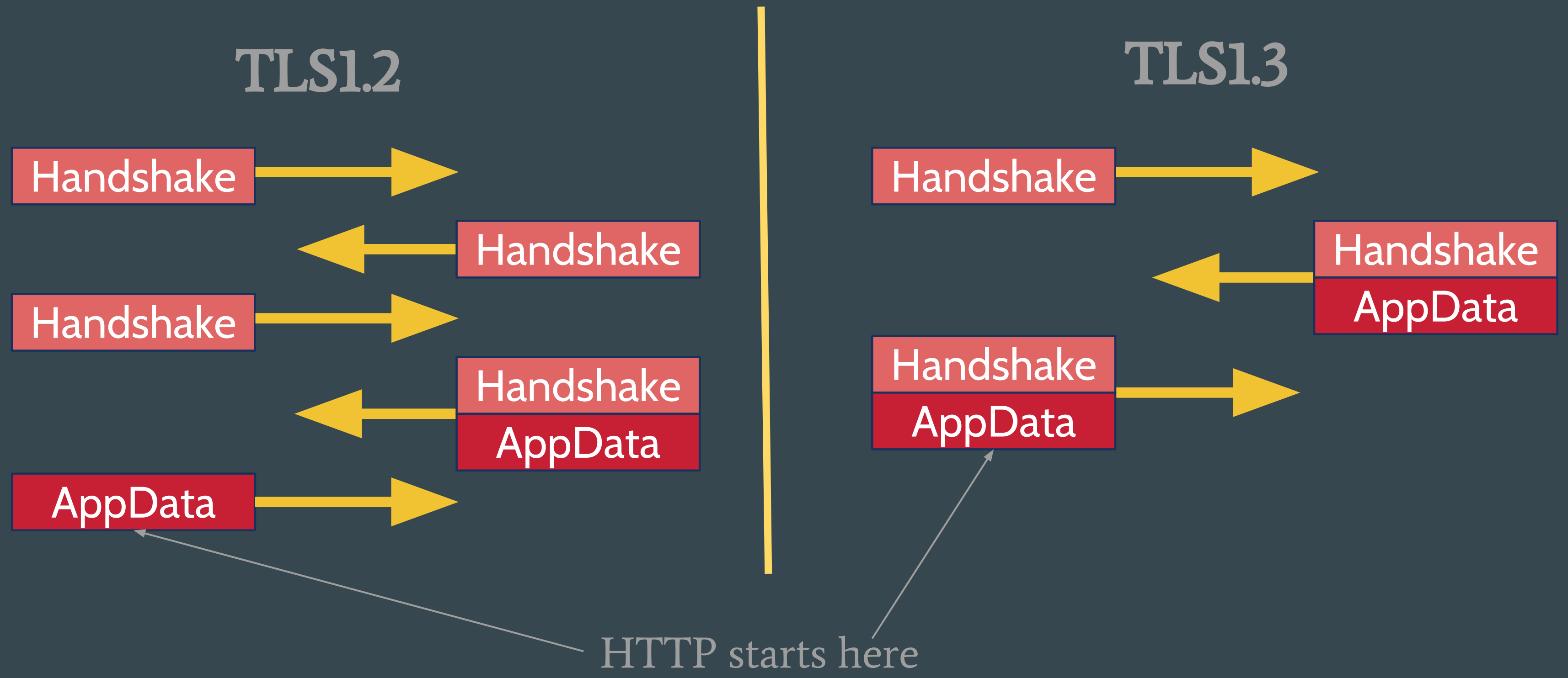
Signature Algorithm Extension

Pre-shared Key

PSK Extension

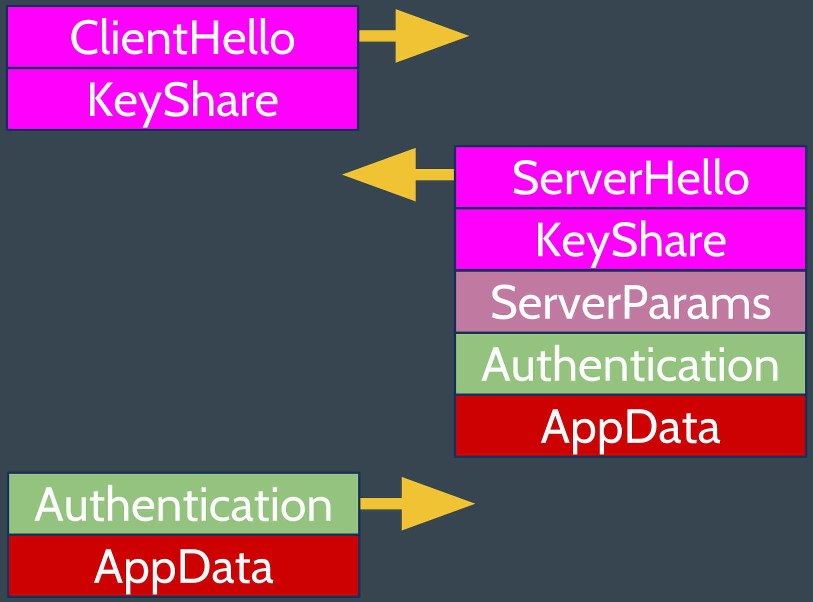
IANA Registry will include Recommended column

# Come again - it’s faster?



# What are the normal modes?

## 1-RTT

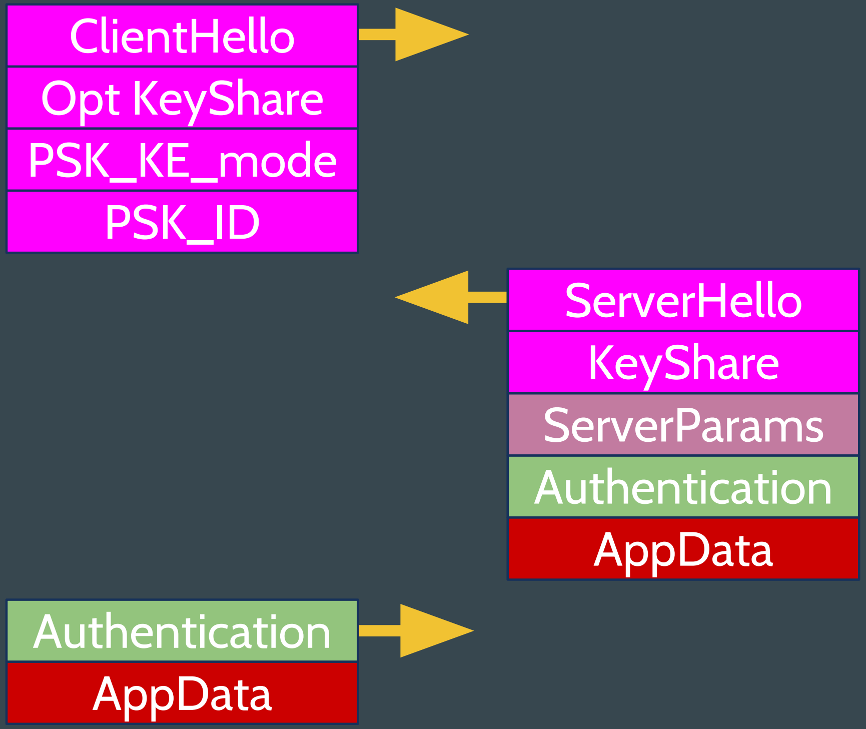


ClientHello
KeyShare

ServerHello
KeyShare
ServerParams
Authentication
AppData

Authentication
AppData

## Resumption (PSK)



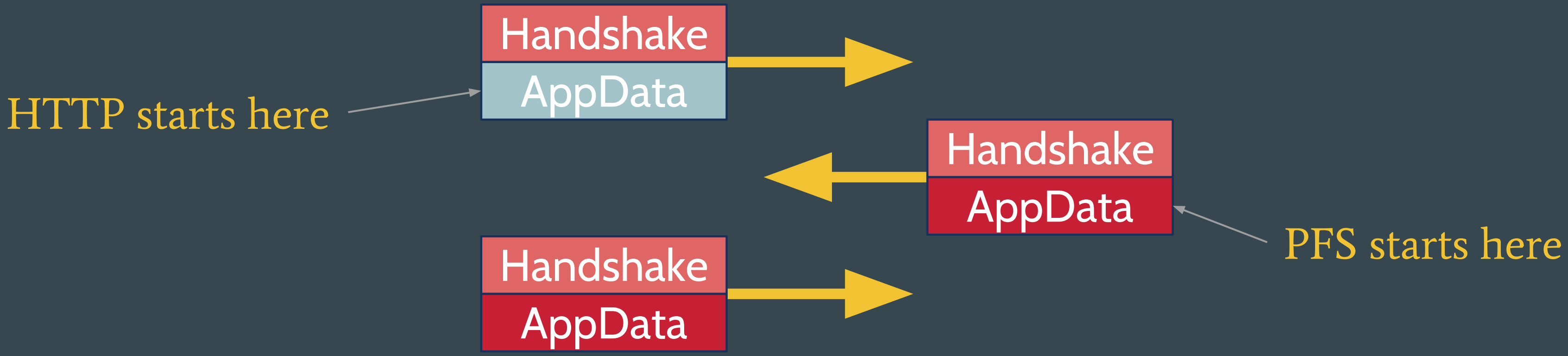
ClientHello
Opt KeyShare
PSK_KE_mode
PSK_ID

ServerHello
KeyShare
ServerParams
Authentication
AppData

Authentication
AppData

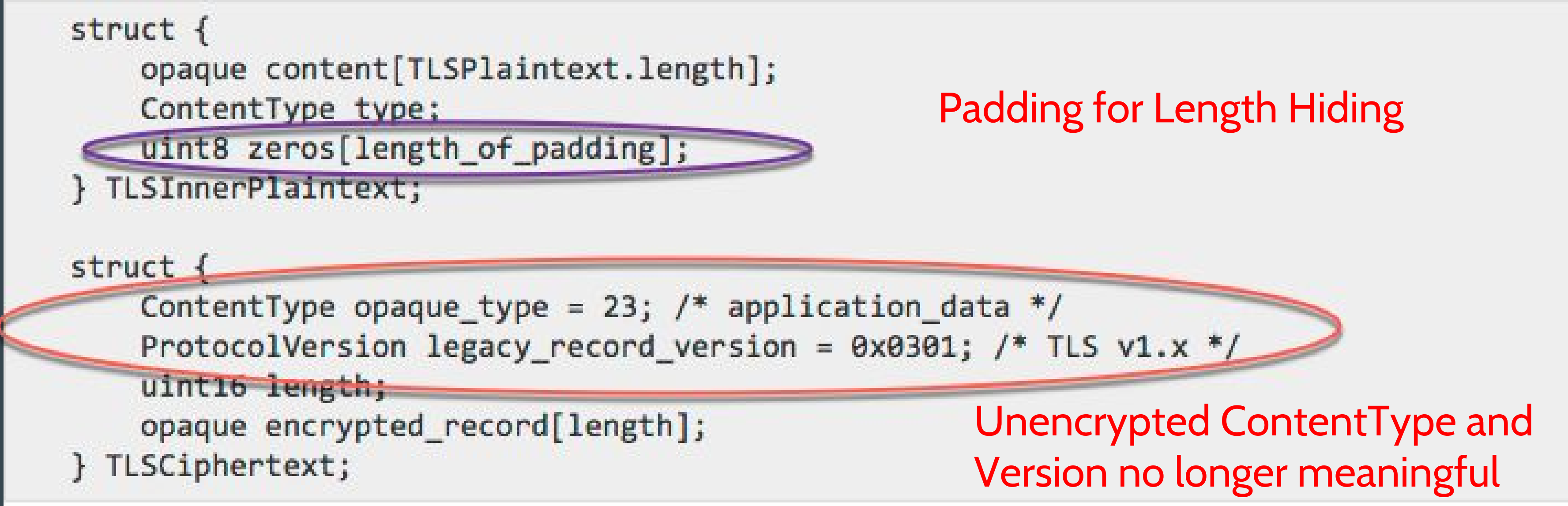
# Is that *all* you got?

## TLS1.3 0-RTT Data



**WARNING: 0-RTT Data is replayable and not PFS!**

# It supports record protection?



```
struct {
    opaque content[TLSPlaintext.length];
    ContentType type;
    uint8 zeros[length_of_padding];
} TLSInnerPlaintext;

struct {
    ContentType opaque_type = 23; /* application_data */
    ProtocolVersion legacy_record_version = 0x0301; /* TLS v1.x */
    uint16 length;
    opaque encrypted_record[length];
} TLSCiphertext;
```

Padding for Length Hiding

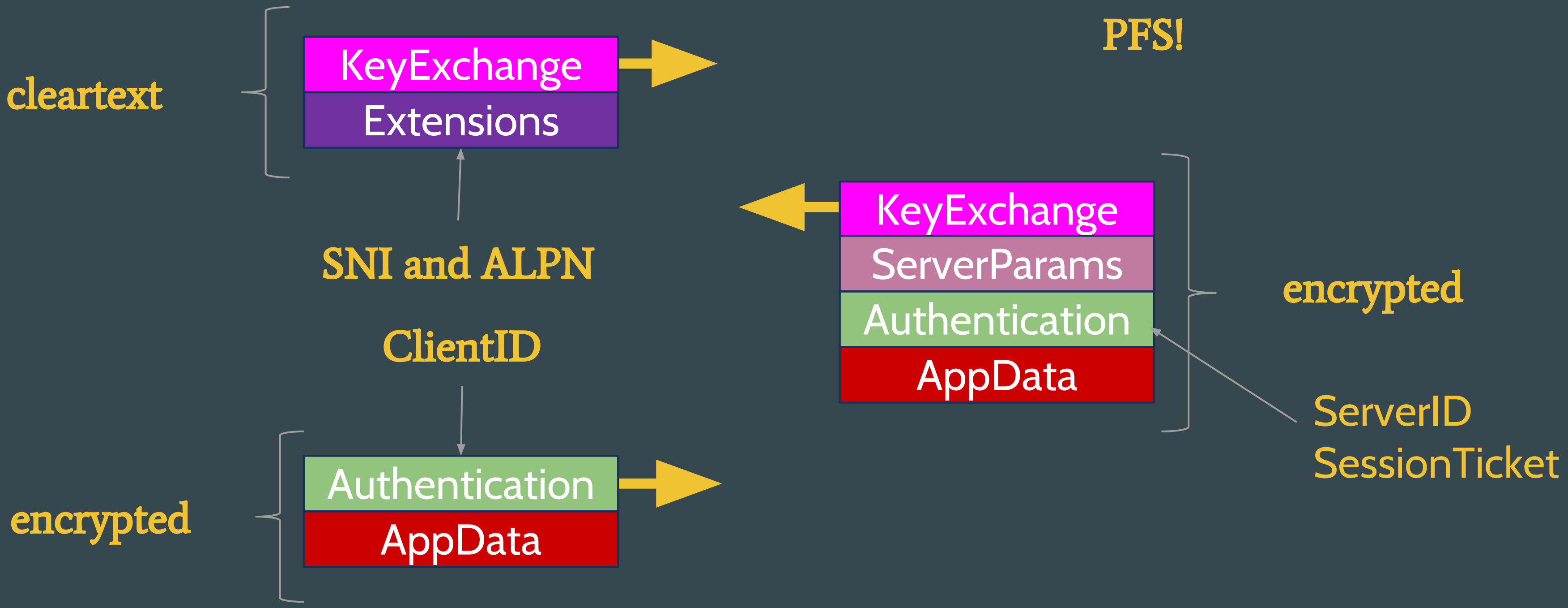
Unencrypted ContentType and Version no longer meaningful

# You turned PFS on!?

Perfect Forward Secrecy is the default.

Also available with PSK modes.

# You’re encrypting more early though, right!?



# What’s not to like!?

# TLS1.3-related drafts

## TLS1.3 Test Vectors

Working copy

Official I-D

## DTLS1.3

Working copy

Official I-D

please tell us what you thought about this session:

https://www.surveymonkey.com/r/100tls