Aalto University

Network Security:
TLS 1.3 PSK and session resumption

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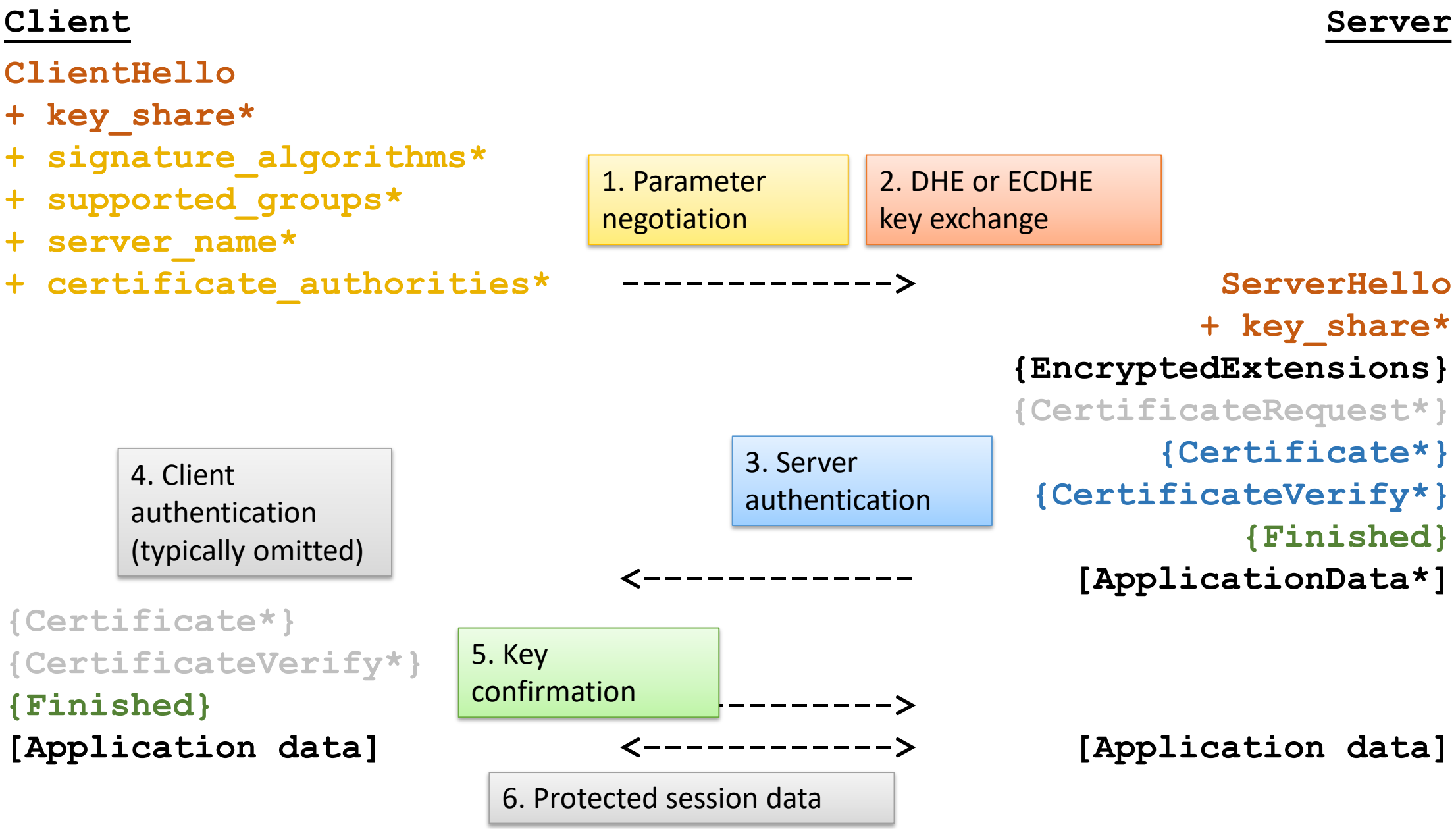
CS-E4300 Network security

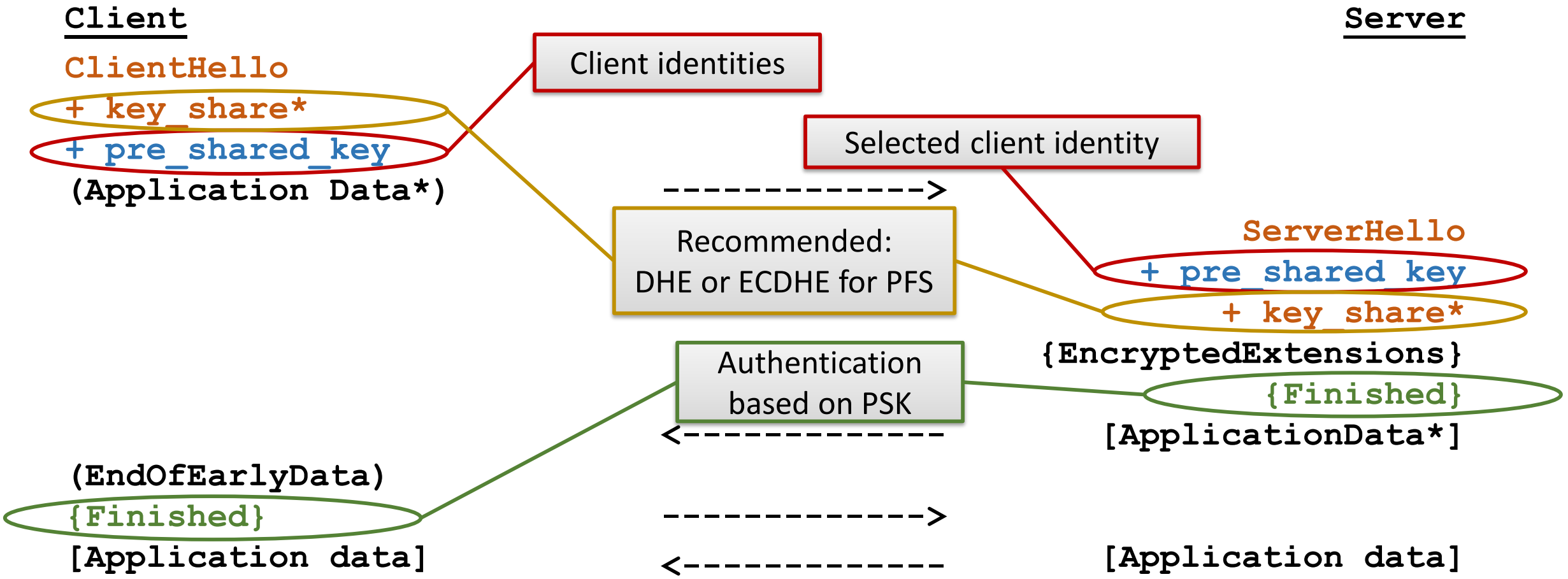
Outline

- Recall TLS 1.3 full handshake
- Pre-shared key (PSK) mode
- Session resumption

TLS 1.3 full handshake



Pre-shared key (PSK) mode

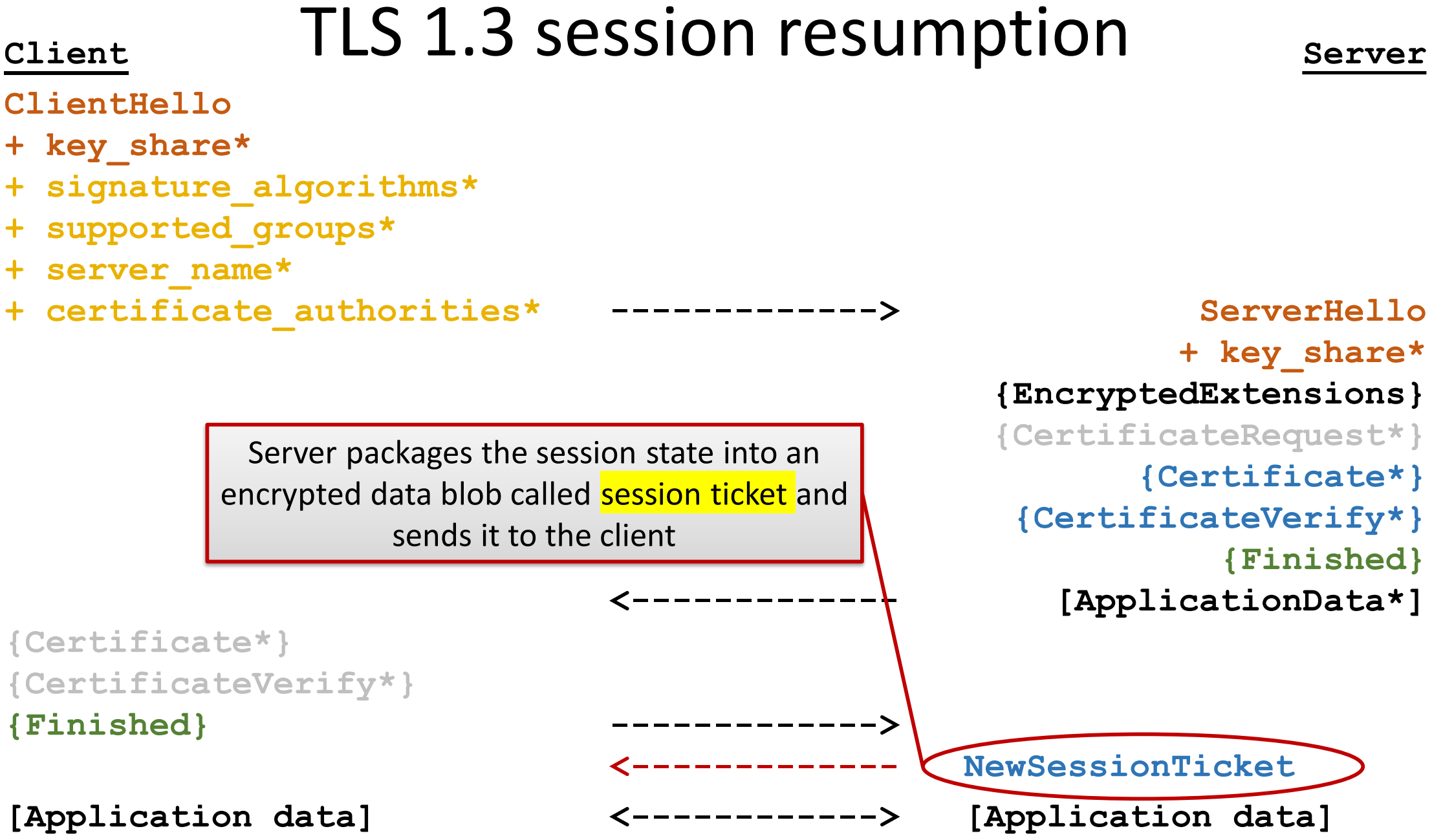


Pre-shared key (PSK) mode

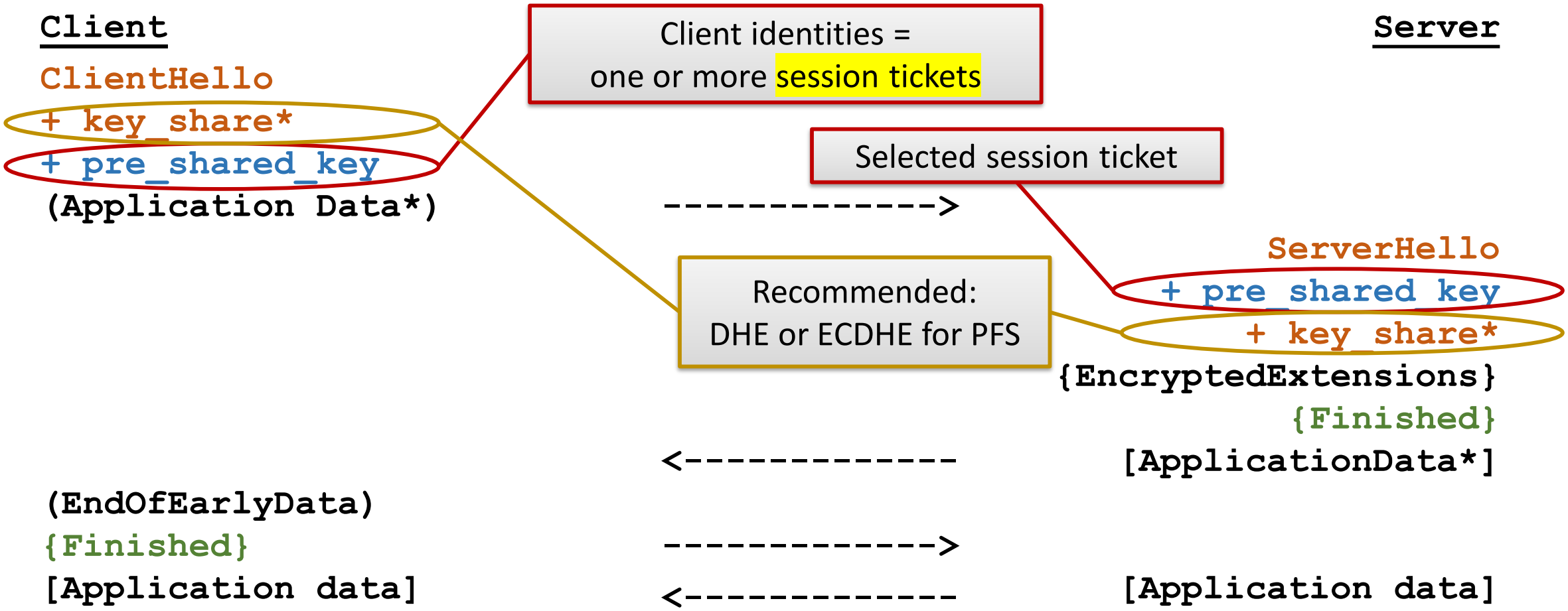
1. C → S: N_C, g^x, ClientIdentity
2. S → C: N_S, g^y, $HMAC_{Kfks}(TH)$, early data
3. C → S: $HMAC_{Kfkc}(TH)$

- Mutual authentication based on a pre-established identity and session key (*external PSK*)
  - PSK = pre-established shared key between C and S
  - HMAC keys for K_{fks} and K_{fkc} Finished message are derived from PSK, g^{xy} and TH, and so at the session keys

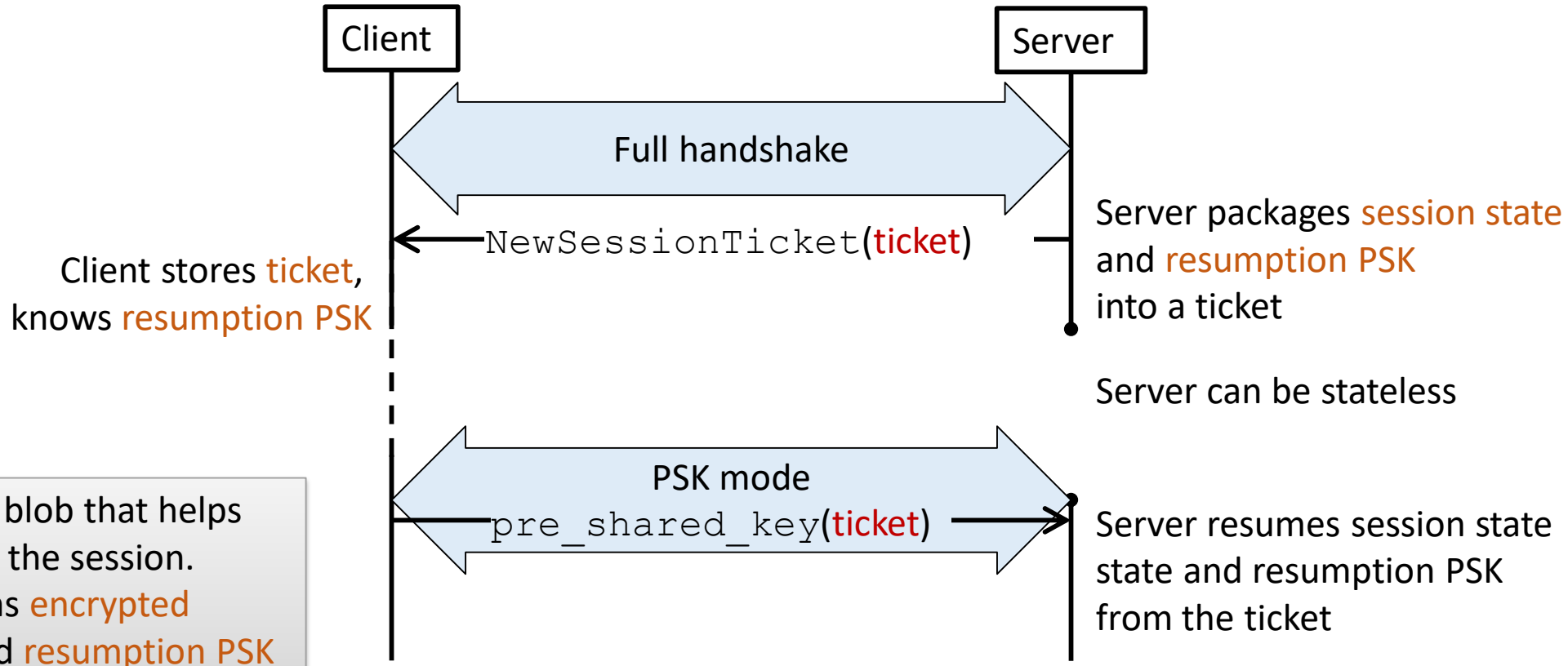
TLS 1.3 session resumption



TLS 1.3 session resumption



TLS 1.3 session resumption

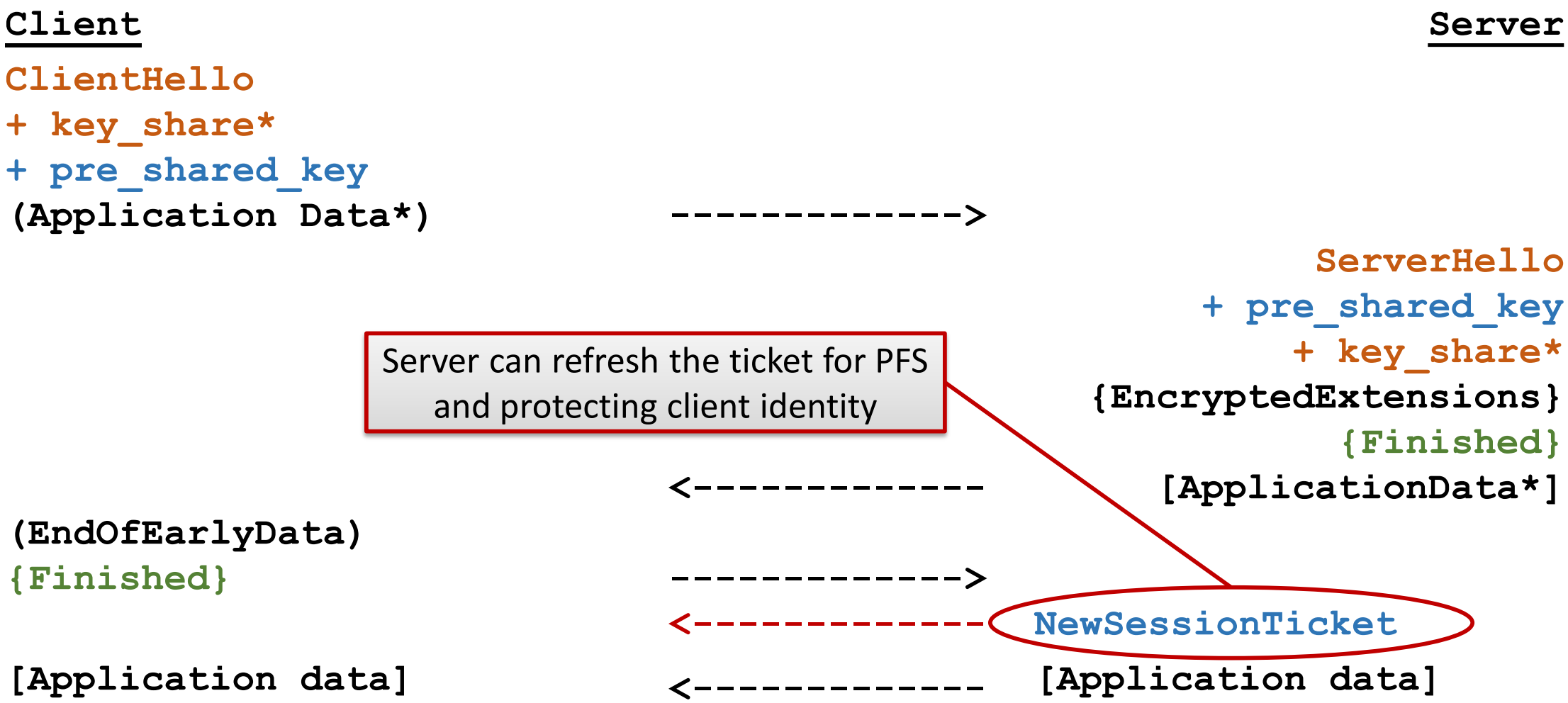


Ticket = opaque blob that helps the server recall the session. Typically contains encrypted session state and resumption PSK

TLS 1.3 session resumption

- TLS 1.3 session resumption = PSK mode handshake with ticket as client identity and resumption key as the PSK
  - Currently the main purpose of the PSK mode
- When useful?
  - Server does not want to store the TLS sessions over idle periods
  - If client authenticated with smartcard, avoids repeated user action
  - Mobile clients keep changing their IP address and need frequent reconnection
  - Resume session with a different server instance in the cloud

TLS 1.3 session resumption



Key derivation

Inputs to key derivation:

1. PSK (external PSK or resumption PSK)
2. DHE/ECDHE secret

} one or both, as available

3. Transcript of handshake messages, up to the point where the key is derived

Keys:

- client_early_traffic_secret → used to derive AEAD keys for early data in 0-RTT (…)
- client/server_handshake_traffic_secret → used to derive AEAD keys for handshake messages {…} and Finished HMAC keys
- client/server_application_traffic_secret_N → used to derive AEAD encryption keys for post-handshake application data and messages […]
- resumption_master_secret and ticket_nonce → derive resumption PSK
- exporter_master_secret → used to create keys for the application layer

Identity protection?

- Session tickets are encrypted
- Session ticket can become a pseudo-identifier
  → Server should regularly refresh ticket