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Network Security: TLS 1.3 0-RTT handshake

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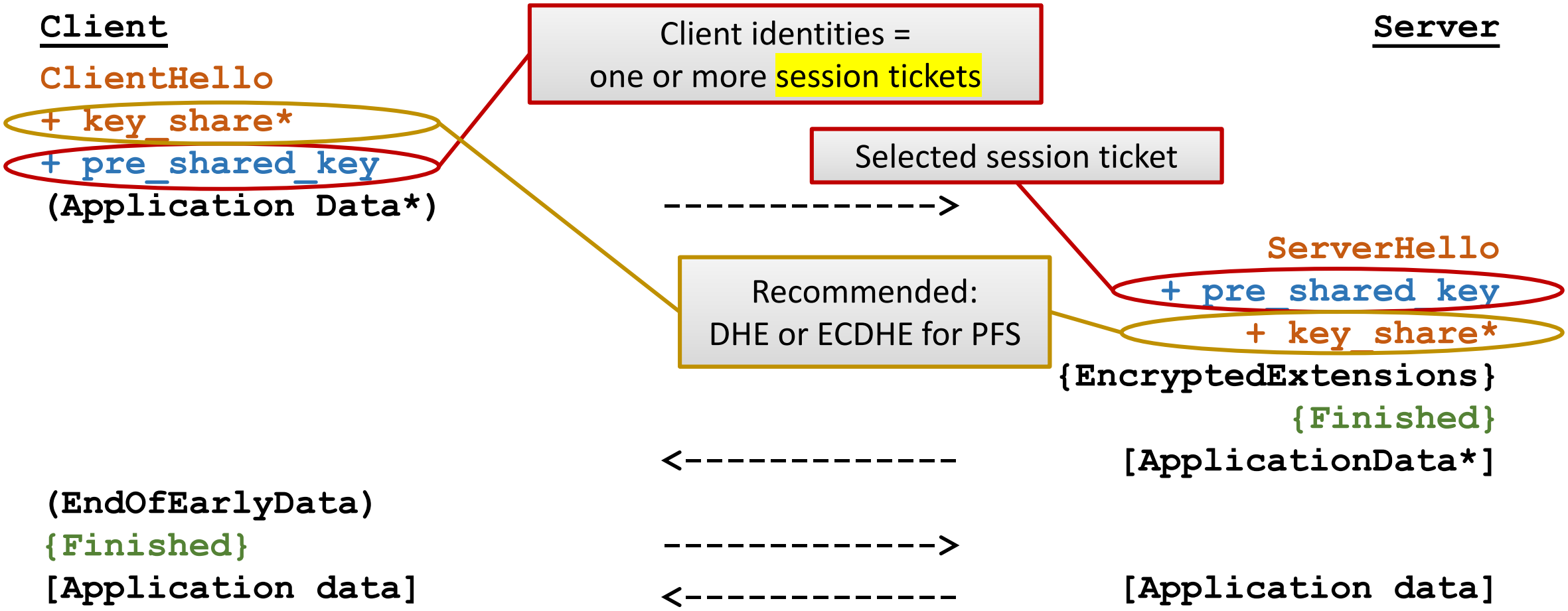
CS-E4300 Network security

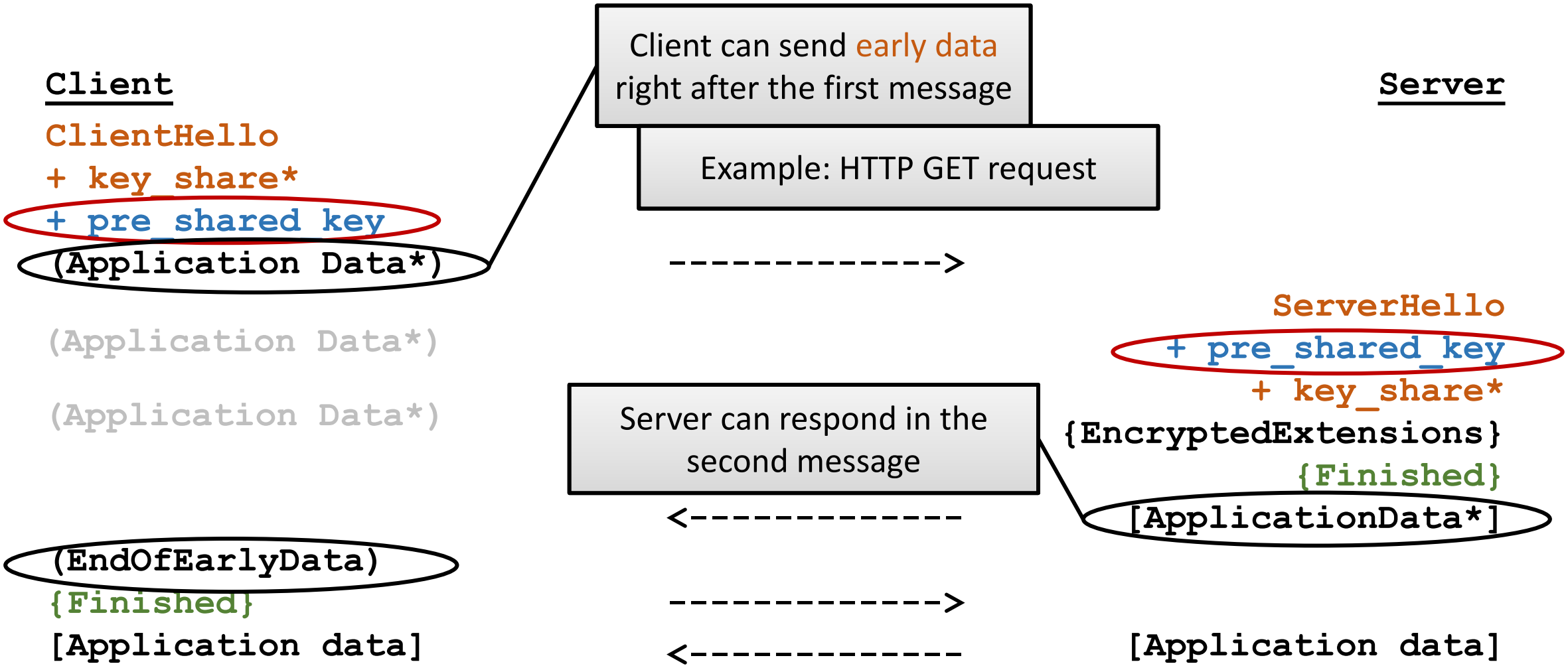
Outline

- Recall PSK handshake and session resumption
- 0-RTT handshake

TLS 1.3 session resumption



0-RTT handshake



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

0-RTT handshake

- With session resumption or PSK, client can send application data (early data) right after ClientHello
  - Lower latency for web browsing and APIs. However, TCP handshake in the underlying transport layer still takes one RTT
- Serious security limitations:
  - Early data is vulnerable to replay attacks (no fresh server nonce yet)
  - No PFS for the early data
- Ok for idempotent requests (mainly HTTP GET) that do not require long-term secrecy
- Application must explicitly enable 0-RTT
  - TLS layer cannot decide when the lower security of 0-RTT is acceptable