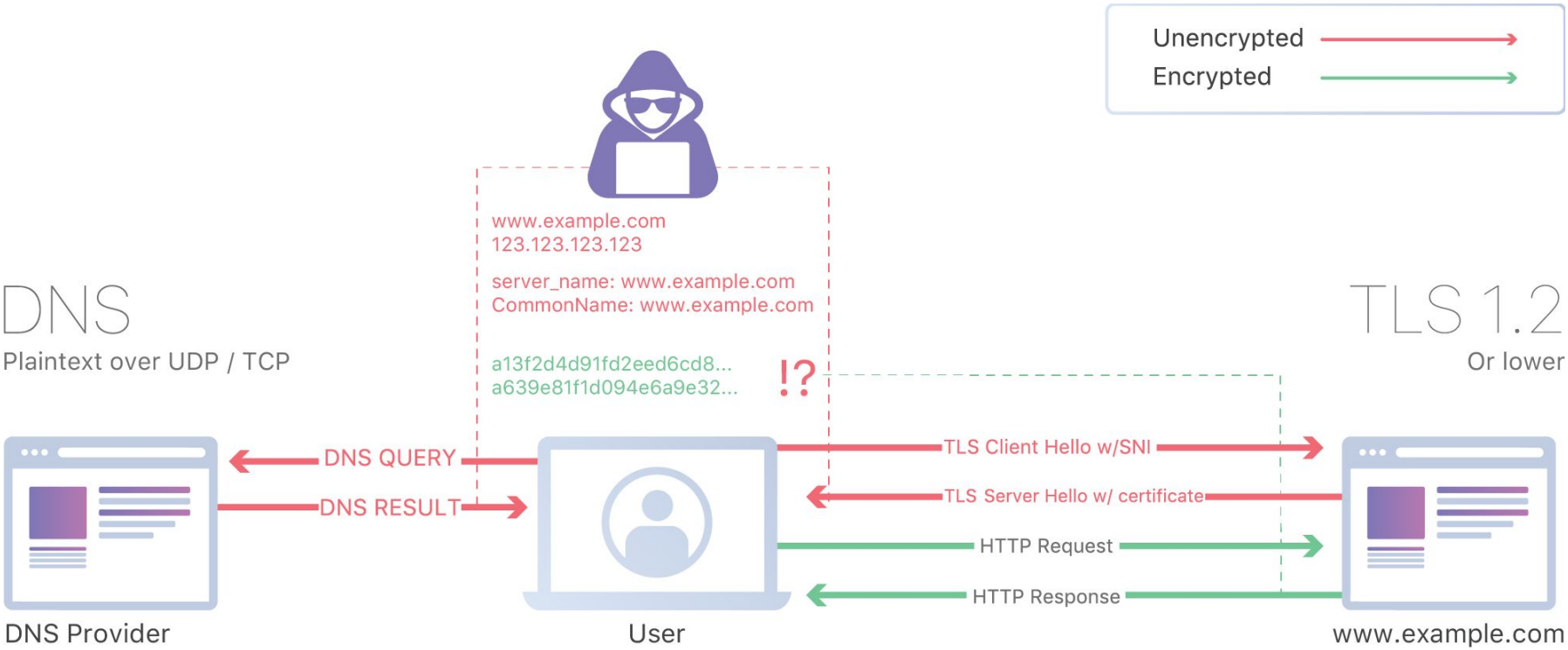
Encrypted SNI

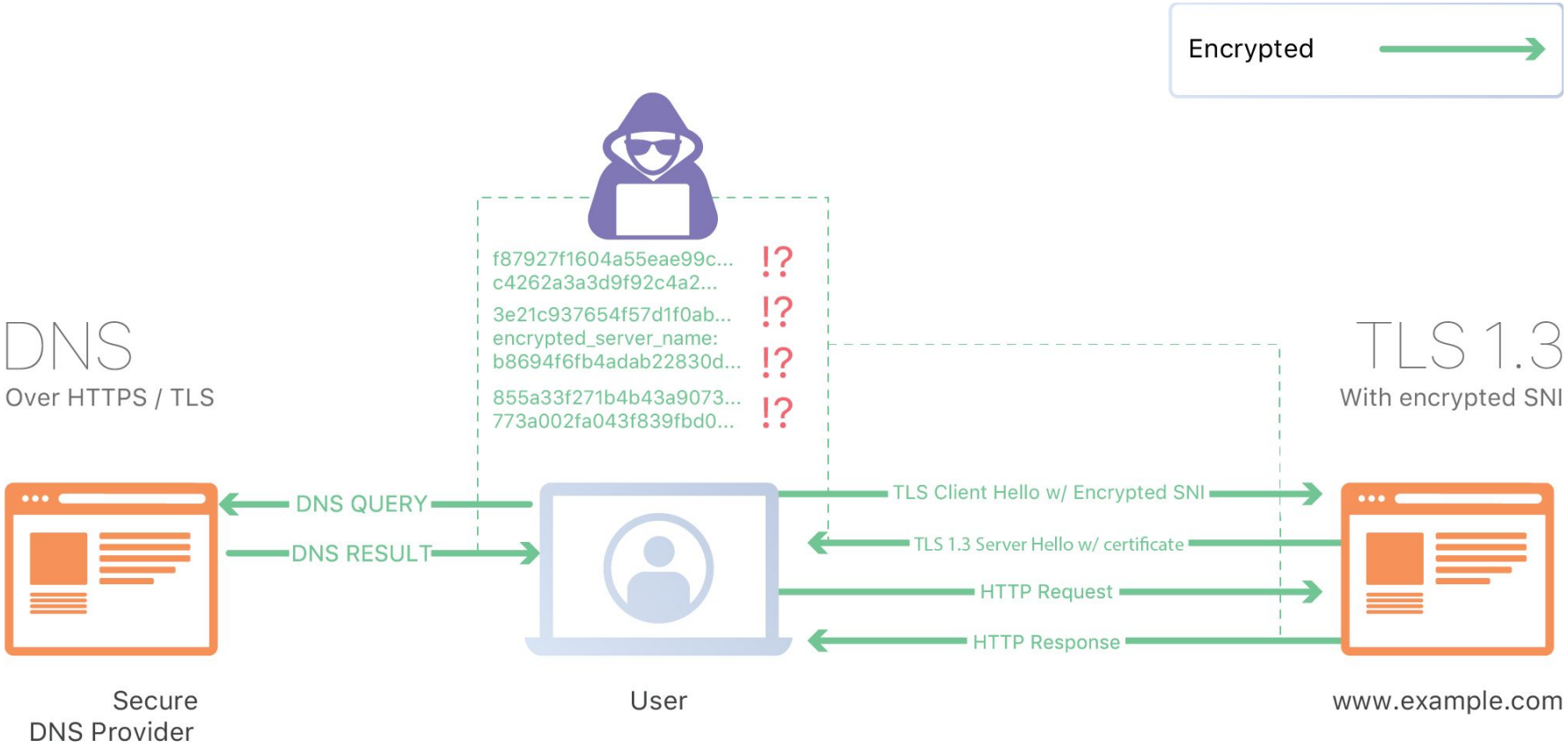
E. Rescorla, K. Oku, N. Sullivan, C. Wood

draft-ietf-tls-esni-02

Overview


Unencrypted
Encrypted
www.example.com
123.123.123.123
server_name: www.example.com
CommonName: www.example.com
a13f2d4d91fd2eed6cd8...
a639e81f1d094e6a9e32...
!?
DNS
Plaintext over UDP / TCP
TLS 1.2
Or lower
DNS QUERY
DNS RESULT
TLS Client Hello w/SNI
TLS Server Hello w/ certificate
HTTP Request
HTTP Response
DNS Provider
User
www.example.com

Overview


Encrypted
f87927f1604a55eae99c...
c4262a3a3d9f92c4a2...
3e21c937654f57d1f0ab...
encrypted_server_name:
b8694f6fb4adab22830d...
855a33f271b4b43a9073...
773a002fa043f839fbd0...
!?
DNS
Over HTTPS / TLS
TLS 1.3
With encrypted SNI
DNS QUERY
DNS RESULT
TLS Client Hello w/ Encrypted SNI
TLS 1.3 Server Hello w/ certificate
HTTP Request
HTTP Response
Secure
DNS Provider
User
www.example.com

Updates since IETF 102

Draft adopted

-00, -01, -02 published

Deployment by Cloudflare and Firefox Nightly

Lots of discussion on the list

Summary of changes from initial draft

Independent client key shares for ESNI, TLS

- Prevents DNS from dictating key exchange mechanism

Added nonce, AEAD covering of KeyShareClientHello

- Replay protection

Added version

- Future compatibility

Pending changes for -03

Use ESNI RRType instead of TXT (Issue #109)

- Simplifies CNAME setup by removing prefix
- Easier to deploy new types if managed without users
- “more correct”/“don’t overload TXT”

Operational Issues

Hard failure if DNS and server get out of sync

Multi-CDN case

Hard failure if DNS and server get out of sync

Risks

- DNS over-caching issues
- Bigger risk if keys rotated quickly for forward secrecy

Impact

- Site unavailable

Hard failure if DNS and server get out of sync

Possible solution

- Fallback hostname in ESNI structure
- Default certificate covers fallback hostname
- Fresh ESNI sent as part of EncryptedExtensions

Assumptions

- TLS-terminating server is in sync with proxy server
- Additional 1-RTT handshake is ok

Multi-CDN case

Overview

- example.com has DNS load balancing of A/AAAA
  - Returns set of A records corresponding to multiple providers
- www.example.com has DNS load balancing via CNAME
  - Returns CNAME that terminates at www.example.com.cdn1.com or www.example.com.cdn2.com randomly

Multi-CDN case

Failure case

- A/AAAA record request independent of TXT/ESNI record request
- A/AAAA for CDN1, TXT/ESNI for CDN2

CDN1/2 have different ESNI keys, or only CDN1 supports ESNI

Result: Failed connection with no fallback or unnecessary privacy leak

Multi-CDN case

Requirements for a solution

- Prefer soft failures to hard failures
- No serialization of DNS queries
- Works in majority of deployment scenarios
- Prefer few changes to authoritative servers

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