LURK Protocol for TLS/DTLS1.2

draft-mglt-lurk-tls

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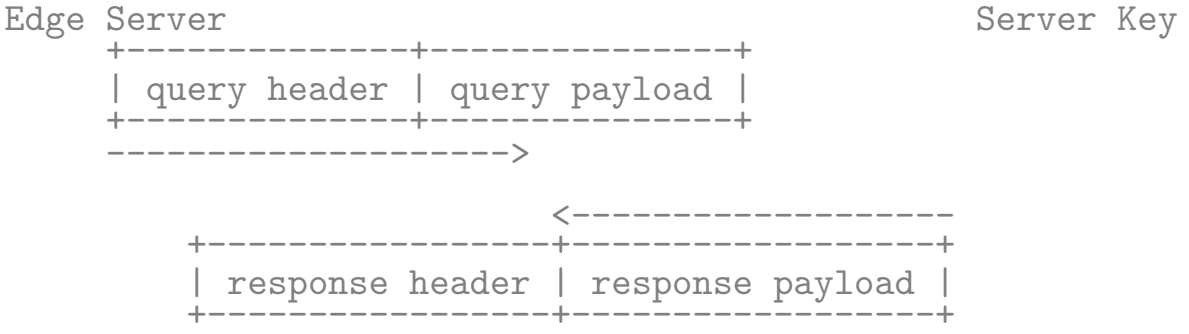
LURK/TLS Scope

Scope of LURK/TLS:

- Query / response between Edge Server and Key Server
- TLS authentication methods are limited to:
  - RSA
  - ECDHE_RSA
  - ECDHE_DSA
- TLS version 1.2
- Binary protocol

General Design



ECDHE

```
TLS Client          Edge Server         Key Server

ClientHello
   ProtocolVersion server_version
   Random client_random
   Cipher_suite
       TLS_ECDHE_ECDSA_*, TLS_ECDHE_RSA_*, ...
       Extension Supported EC, Supported Point Format
-------->

                    LURKTLS Header (Query)
                    LURKTLSECDHEInputPayload
                    -------->
                                1. Generating the signature

                                     LURKTLS Header (Response)
                                     LURKTLSDigitallySignedPayloads
                                     signature
                                     <--------

                    ServerHello
                        ProtocolVersion edge_server_version
                        Random server_random
                        Cipher_suite=TLS_ECDHE_ECDSA
                        Extension Supported EC, Supported Point Format
                    Certificate
                        ECDSA Public Key
                    ServerKeyExchange
                        ecdhe_params
                        signature
                    ServerHelloDone
                    <--------
```

ECDHE Security - signing oracle

Exposing the Private Key to first chosen bytes signing attacks:

- TLS exposes to the first 32 byte signing attack by TLS Clients
- LURK 64 byte signing attack by Edge Servers
  - Unlike TLS Clients, Edge Servers are authenticated
  - Unpredictable ECDHE reduces the first chosen to 32

ECDHE Security - cross protocol attacks

The signature is bound to the ClientHello.random, ServerHello.random but not:

- the TLS Version
- the authentication method

As a result, a given signature can be used across different TLS Versions, authentication methods, and signed parameters

- TLS1.3 solves this issue with context

Assumption:

- Key Server provides ECDHE_RSA, ECDHE_ECDSA and RSA
- The Private Key is only hosted on the Key Server
- TLS Version is TLS1.0, TLS1.1 TLS1.2

ECDHE Security - cross protocol attacks

TLS Version

- Authentication methods are identical across version
  - There is little chance to have a vulnerability associated to the TLS Version

Signature Scheme across authentication methods

- RSA signature is used in DHE_RSA and ECDHE_RSA
- ECDSA signature are only used for ECDHE_ECDSA
  - Collision restricted to DHE_RSA and ECDHE_RSA

Signed parameters

  - DHE / ECDHE have probability of collisions
    - Rejecting parameters matching other authentication method's parameters

Security

Authentication credentials generated by the Key Server SHOULD:

- Be restrained to a single TLS session
- Not leak information of the Private Key
- Involve a reasonable amount of resource (cpu / bandwidth)

We believe RSA, ECHDE:

- Exchanges meet this requirements
- Does not (significantly) increase weakness presented by TLS1.2
  - Is it acceptable to consider raising an unauthenticated TLS Client 32 first byte signing attack to an authenticated Edge Server 64 first byte attack ?

Security

By centralizing the authentication operations to the Key Server:

- LURK presents a bottleneck architecture
  - Resource provisioning MUST consider this

However LURK presents significant security advantages:

- Private Key is not shared anymore between running Edge Servers, Edge Servers images, Content Owner, CDNs, ...
- Compromise Edge Server does not leak the Private Key
  - It may only perform authorized cryptographic operations
- Centralizing Private Key operation eases monitoring and detection of malicious behaviors.

Thank you for your attention