Sequoia: A Cool OpenPGP Library

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Delta X, July 21, 2018

https://sequoia-pgp.org/talks/2018-08-introduction

Outline

Introduction

Architectural Overview

Status Quo & Future Directions

Introduction

- A new OpenPGP implementation in Rust
- Motivation
  - GnuPG is hard to modify
    - Code and API grew organically over 21 years
    - Lack of unit tests
    - Tight component coupling
  - Many developers unsatisfied with GnuPG's API
  - Rust is memory safe
  - GnuPG can't be used on iOS due to GPL

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Sequoia's Goals

- Social
- Technical

Social Goals

- Inclusive environment
- Free Software
- Community-centered project
  - Development in the open
  - Collaborating with other OpenPGP implementors on design
  - Working with application developers to define API

Technical Goals

- First-class library API, second-class command-line interface
- Friendly API
- Unopinionated low-level API & opinionated high-level API
- Loose component coupling
- Tests, tests, tests, . . .
- All modern platforms
- Tight integration with host systems

Who We Are

p≡p

- Neal, Justus, Kai
  - Former GnuPG developers (2–2.5 years at g10code)
  - At p≡p since Fall 2017
- Funding
  - p≡p (primary)
  - Wau Holland Stiftung (secondary)
  - Actively looking to diversify funding base!

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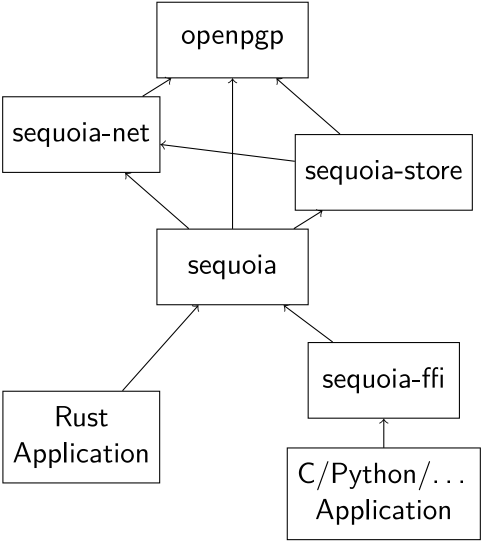
Components


openpgp
sequoia-net
sequoia-store
sequoia
sequoia-ffi
Rust Application
C/Python/. . . Application

OpenPGP Crate

- Unopinionated low-level API
- All of RFC 4880
    - Minus the very dangerous bits (MD5, IDEA, ...)
    - Supports streaming
        - Some protection against emission of invalid data
- Intended for advanced OpenPGP use cases
    - Add a signature to an existing message
    - Strip encryption
    - Reencrypt
    - Forensics
    - Analysis
    - etc.

Sequoia Store

- Key database (SQLite based)
  - Public keys
  - Private keys

Public Key Store

- More like a per-domain address book than a PGP keyring
  - Domain: email, software signatures, authentication, . . .
    - (or per application?)
  - Keys addressed using labels, not user ids
  - Per-domain $\text{label} \Longrightarrow \text{key}$ mapping, keys shared
- Arbitrary, associated, structured data
  - Useful for implementing trust models
- Keys automatically refreshed in background (à la Parcimonie)

Private Key Store

- Smartcard-like API for using all types of keys
  - Local, Remote, Smartcard, TPM, Trusted Enclave, . . .
- One optional password for all local keys
- Automatic key rotation for forward secrecy
  - Mostly compatible with existing OpenPGP implementations
  - (Individual at-rest and transport encryption subkeys)

Sequoia Net

- Accesses keyservers, etc.
- Colocated, not a daemon

Sequoia

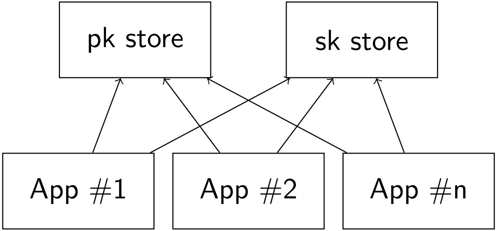
- High-level API
  - Easy to use
  - Sensible defaults
  - API driven by application needs
  - Minimal manipulation of OpenPGP messages

  - `generate_key`
  - `encrypt_sign`
  - `decrypt_verify`
  - etc.

FFI

- We maintain important language bindings
- Idiomatic interface
- C bindings
  - Already exist
  - Easy to use

Services



- Process separation for security; colocation for reliability
  - Sequoia tries to use a shared service, falls back to colocation
  - When using colocation: synchronization via SQLite

  - IPC protocol: capnproto

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Progress (✓ > 90% done :-)

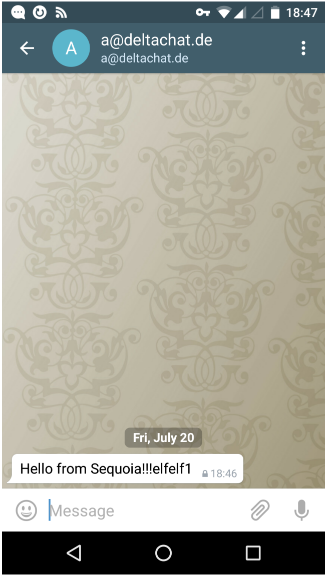
- OpenPGP Crate
  - ✓ Parsing
  - ✓ Serialization
  - ✓ Encryption
  - ✓ Signature Verification
  - ✓ Decryption
  - ✓ Signature Generation
  - 🚧 Key Generation
- Store
  - ✓ Public keys
  - 🚧 Private keys
    - 🚧 Local
    - x Smartcards, etc.
    - x Remote
  - x Associated data
  - ✓ Parcimonie
- Net
  - ✓ Keyservers
  - x WKD
  - 🚧 Tor support
- 🚧 Sequoia Crate
- FFI
  - 🚧 C
  - 🚧 Python
  - x ...
- Protocol
  - 🚧 Forward Secrecy
  - 🚧 Multi-device
  - 🚧 OpenPGP Specification

Ecosystem

- MUAs
  - x p≡p
  - x Enigmail / Thunderbird
  - ⚠ Delta Chat
  - x Leap
- Infrastructure
  - ⚠ Keyserver
  - x Kuvert
  - x Schleuder
- Package Managers
  - ✓ sqv (≈ gpgv)
  - x Cargo (Rust)
- Tools
  - ✓ sq split (≈ gpgsplit)
  - ⚠ pgpdump
  - x gpg-sync
  - x git
  - x wget

Sequoia & Delta Chat

- `netpgp`-based
  - Incomplete
  - No upstream development
- Uses ca. 10 OpenPGP functions
  - Key generation
  - Sign and encrypt
  - ...
- After 1 day of work... 50% ported!



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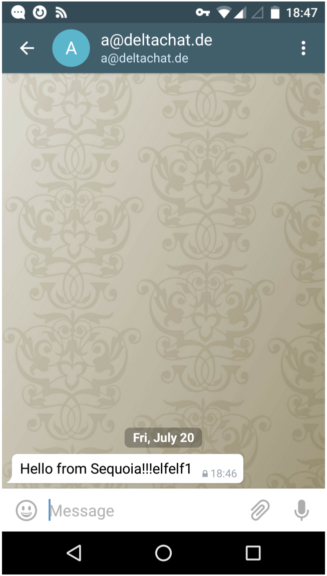

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Release Schedule

- sqv and openpgp library this fall
  - . . . but no promises :-)
- Further development
  - High-level API
  - Smardcard, etc. support
  - System-specific protection mechanisms
  - Forward secrecy, multi-device support

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Summary

`https://sequoia-pgp.org`

- Sequoia is a new OpenPGP implementation
- User-focused development
- Portable & highly integrated
- Low-level API is already usable
- Join us on...
  - irc: #sequoia on Freenode
  - mailing list: devel@sequoia-pgp.org
  - gitlab: `gitlab.com/sequoia-pgp/`

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