KeyChain Extension and Integration

Presentation

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Motivation

- KeyChain is poorly used in current Android Versions
- Lack of integration between key access and its use
- Broader acceptance of encryption

Goals:

- Improve secure storage and authorization handling for keys
- Support easy use of cryptographic functions for apps

Requirements

- ARM EABI v7a System Image (API 17)
- Extended KeyChain framework

Existing Android API

Java Cryptography Architecture (JCA)

- offers interfaces for SecretKey/PublicKey/PrivateKey
- offers factories for ciphers, signature schemes etc. to work on the corresponding implementation of keys

native (C++) keystore daemon

- stores key material encrypted using phone lock passphrase, pin or pattern
- offers an OpenSSL engine for loading JCA Key objects from the store without exposing the key material itself, but...
  - there is no real access control
  - only RSA keys are supported
  - attempting to use the keys for anything causes a SIGSEGV in dalvik :-(

Overview

- a system app for key management, such as
  - key generation
  - import/export/deletion of key pairs
  - granting key access
- a public API which allows
  - encryption / decryption
  - authentication (signature/MAC) / verification
  - generation / import of symmetric keys
  - key agreement protocols

Key Identification

- each key is referenced by a unique string alias
- keys can be assigned to contacts using the *Key Management* app
- each assignment has a *key usage type identifier*
  - arbitrary string token (application defined)
  - apps can request a key with a given type for a given contact
  - this way the user can easily choose which key to use for which app, and replace keys once they are obsoleted

API usage

- API calls are forwarded using binder IPC to the *keychain* system app
- system app checks if the calling app is allowed to use the key
- system app may present the user with a dialog to authorize the access
- if authorized, the system app processes the request and sends the result back to the caller

Considerations

- Separate UI for sending
- Lookup of keys (key usage type)
- Storage of SMS
- Recognize encrypted messages
- Keep it as simple as possible

Sending and Receiving

Sending

- Select contact
- Encrypt composed message
- Send Base64-encoded message via SMS
- Store copy of plain message locally

Receiving

- Capture `SMS_RECEIVED` broadcast
- Recognizing encrypted SMS

Receiving Workflow

Require: all message parts have been received and the full message is reassembled

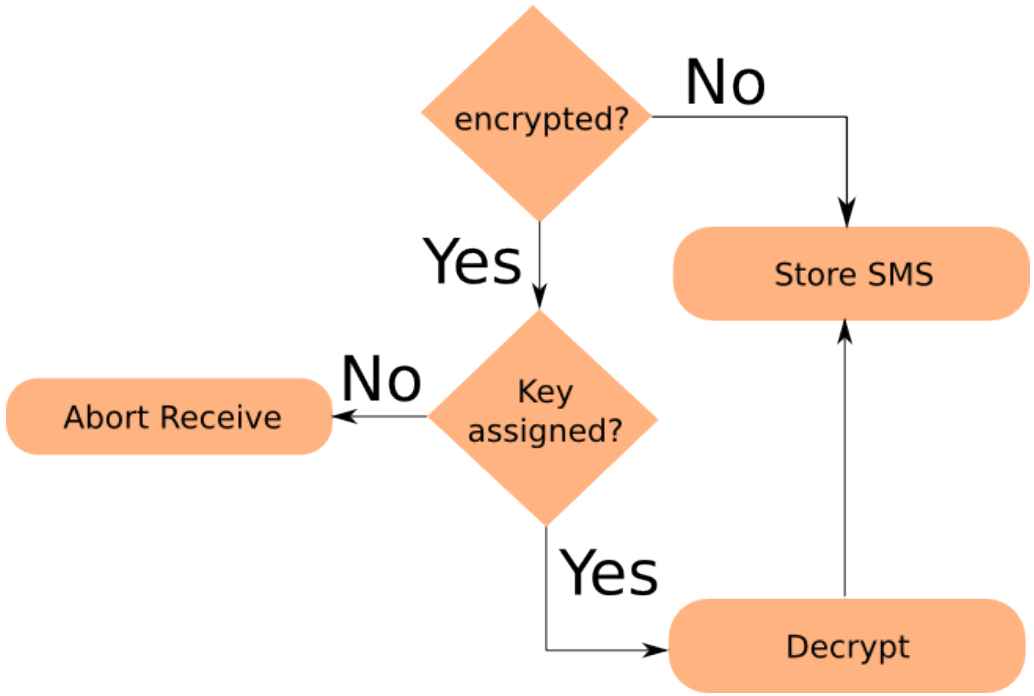

Figure: Receiving workflow

Trivia

- time spent building full images: approx. 80 hours
- RSA 1024-bit key generation
  - regular MIPS emulator image: 10 minutes
  - x86 emulator image using VT-x/AMD-V: less than 5 seconds