

# Cry – Project 2

## (Software Requirements Specification): Report

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## 1 Introduction

Michael Degraw

### 1.1 Purpose

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## 1.2 Scope

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## 1.3 Definitions, acronyms, and abbreviations

Please write here.

## 1.4 References

Please write here.

## 1.5 Overview

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# 2 Overall description

Daniel Dunning

## 2.1 Product perspective

**Cry** will be implemented as a stand-alone framework, with built in libraries updated as needed. No other frameworks or applications are needed to run **cry**: it is a standalone application. It will be used as a tool for cryptographers and developers alike, and all systems will be self-contained in the framework.

### 2.1.1 User Interface

**Cry** will be used as a command line application, being accessed with the command '**cry**'.

## 2.2 Product functions

The essential functions of **Cry** can be broken into two separate parts: testing and reporting.

### 2.2.1 Testing

- Users will be able to develop new cryptosystems
- Users will be able to develop new eavesdropping methods.
- Users will be able to develop new methods for breaking a cryptosystem.
- Using a combination of cryptosystems, eavesdropping, and breaking, users will have the ability to test systems' security.

### 2.2.2 Reporting

- Upon performing a test, users will receive feedback on their methods.
- Reports will be shown to suggest the security of the cryptosystem and to give helpful feedback in the area of weaknesses in the cryptosystem.

## 2.3 User characteristics

User of **Cry** will most likely have a medium to high level of experience with cryptosystems. This is not a requirement, it is an open application. However, **Cry** aims to aid the developing cryptosystems, and this implies a high level of experience. If more complicated libraries are implemented, users will need a high level of experience to understand these methods and therefore apply them.

## 2.4 Constraints

**Cry** will need certain base requirements

- Basic memory and CPU availability
- Command line permissions

In addition to baseline requirements, parallel operation and interfacing with other applications may become necessary if future library additions dictate such.

## 2.5 Assumptions and dependencies

Few assumptions are needed as **Cry** will run on all operating systems and is a standalone framework. The single assumption to be made, as mentioned in constraints, is that certain permissions may be needed from the command line. These are assumed to be available for all users.

# 3 Specific Requirements

Vu Phan

## 3.1 Interface

- The end-users are *Alice*, *Bob*, and *Eve*.
- *Alice* wants to send a confidential message to *Bob*.
- *Eve* wants to eavesdrop that message.
- These end-users invoke their downloaded **Cry** binaries using command-line shells.

## 3.2 Performance

Minimum hardware:

RAM	4 GB
CPU	1.5 GHz

### 3.2.1 Key Generation

(by *Bob*, the receiver)

Input:

```
$ cry generatekeys -cryptosystem=<cryptosystem>
```

Output:

```
The public & private keys are <public key> & <private key>
(took <key-generation time>).
```

Requirements:

- <cryptosystem> is the name of an available cryptosystem, such as `rsa`
- <public key> and <private key> are integers
- <key-generation time> (how long the command takes) shall be less than 1 minute (with the aforementioned minimum hardware)

### 3.2.2 Encryption

(by *Alice*, the sender)

Input:

```
$ cry encrypt -cryptosystem=<cryptosystem> \
> -publickey=<public key> -plaintext=<plaintext>
```

Output:

```
The ciphertext is <ciphertext> (took <encryption time>).
```

Requirements:

- <plaintext> is an obviously meaningful string, such as “I hate *Eve*.”
- <ciphertext> is an apparently meaningless string, such as “sdofAOVI29347”
- <encryption time> shall be less than 1 minute

### 3.2.3 Decryption

(by *Bob*, the receiver)

Input:

```
$ cry decrypt -cryptosystem=<cryptosystem> \
> -privatekey=<private key> -ciphertext=<ciphertext>
```

Output:

```
The plaintext is <plaintext> (took <decryption time>).
```

Requirements:

- <decryption time> shall be less than 1 minute

### 3.2.4 Cryptanalysis

(by *Eve*, the eavesdropper)

Input:

```
$ cry cryptanalyze -cryptosystem=<cryptosystem> \  
> -publickey=<public key> -ciphertext=<ciphertext>
```

Output:

```
The plaintext is <plaintext> (took <cryptanalysis time>).
```

Requirements:

- <cryptanalysis time> shall be more than 1 day

### 3.3 Classes

#### 3.3.1 cryptosystem/

cryptosystem.h

```
#ifndef CRYPTOSYSTEM_CRYPTOSYSTEM_H  
#define CRYPTOSYSTEM_CRYPTOSYSTEM_H  
  
/////////////////////////////////////  
  
enum EnumeratedCryptosystem {rsa}; // more to come  
  
/////////////////////////////////////  
  
using IntPtr = mpz_t; // GNU Multiple Precision Integer Type  
using Key = IntPtr;  
using Text = IntPtr;  
  
/////////////////////////////////////  
  
class Cryptosystem {  
public:  
    virtual void generateKeys(Key publicKey, Key privateKey); // set these  
  
    virtual void encrypt(Text ciphertext, // set this  
        const Text plaintext, const Key publicKey);  
  
    virtual void decrypt(Text plaintext, // set this  
        const Text ciphertext, const Key privateKey);  
  
    virtual void cryptanalyze(Text plaintext, // set this  
        const Text ciphertext, const Key publicKey);  
};  
  
/////////////////////////////////////  
  
#endif // CRYPTOSYSTEM_CRYPTOSYSTEM_H
```

rsa.h

```

#ifndef CRYPTOSYSTEM_RSA_H
#define CRYPTOSYSTEM_RSA_H

////////////////////////////////////

#include "cryptosystem.h"

////////////////////////////////////

class Rsa : public Cryptosystem {
public:
    void generateKeys(Key publicKey, Key privateKey); // set these

    void encrypt(Text ciphertext, // set this
        const Text plaintext, const Key publicKey);

    void decrypt(Text plaintext, // set this
        const Text ciphertext, const Key privateKey);

    void cryptanalyze(Text plaintext, // set this
        const Text ciphertext, const Key publicKey);
};

////////////////////////////////////

#endif // CRYPTOSYSTEM_RSA_H

```

### 3.3.2 party/

party.h

```

#ifndef PARTY_PARTY_H
#define PARTY_PARTY_H

////////////////////////////////////

#include "../cryptosystem/cryptosystem.h"

////////////////////////////////////

class Party {
public:
    Cryptosystem cryptosystem;

    Party(EnumeratedCryptosystem enumeratedCryptosystem);
};

```

```
////////////////////////////////////  
#endif // PARTY_PARTY_H
```

sender.h

```
#ifndef PARTY_SENDER  
#define PARTY_SENDER  
  
////////////////////////////////////  
#include "party.h"  
  
////////////////////////////////////  
  
class Sender : public Party {  
public:  
    Text ciphertext;  
  
private:  
    Text plaintext;  
  
    void encrypt(const Key publicKey);  
    // { cryptosystem.encrypt(ciphertext, plaintext, publicKey)}  
};  
  
////////////////////////////////////  
#endif // PARTY_SENDER
```

receiver.h

```
#ifndef PARTY_RECEIVER  
#define PARTY_RECEIVER  
  
////////////////////////////////////  
#include "party.h"  
  
////////////////////////////////////  
  
class Receiver : public Party {  
public:  
    Key publicKey;  
  
private:  
    Key privateKey;  
    Text plaintext;
```

```

    void generateKeys();
        // { cryptosystem.generateKeys(publicKey, privateKey)}

    void decrypt(const Text ciphertext);
        // { cryptosystem.decrypt(plaintext, ciphertext, privateKey)}
};

////////////////////////////////////

#endif // PARTY_RECEIVER

```

#### eavesdropper.h

```

#ifndef PARTY_EAVESDROPPER
#define PARTY_EAVESDROPPER

////////////////////////////////////

#include "party.h"

////////////////////////////////////

class Eavesdropper : public Party {
private:
    Text plaintext;

    void cryptanalyze(const Text ciphertext, const Key publicKey);
        // { cryptosystem.cryptanalyze(plaintext, ciphertext, publicKey)}
};

////////////////////////////////////

#endif // PARTY_EAVESDROPPER

```

#### 3.3.3 cryptoframework.h

```

#ifndef CRYPTOFRAMEWORK_H
#define CRYPTOFRAMEWORK_H

////////////////////////////////////

#include "party/sender.h"
#include "party/receiver.h"
#include "party/eavesdropper.h"

////////////////////////////////////

```



```

class Cryptoframework {
public:
    Sender sender;
    Receiver receiver;
    Eavesdropper eavesdropper;

    Cryptoframework(EnumeratedCryptosystem enumeratedCryptosystem);

    void testKeyGeneration();
        // { receiver.generateKeys() }

    void testEncryption();
        // { sender.encrypt(receiver.publicKey) }

    void testDecryption();
        // { receiver.decrypt(sender.ciphertext) }

    void testCryptanalysis();
        // { eavesdropper.cryptanalyze(sender.ciphertext, receiver.publicKey) }
};

////////////////////////////////////

#endif // CRYPTOFRAMEWORK_H

```