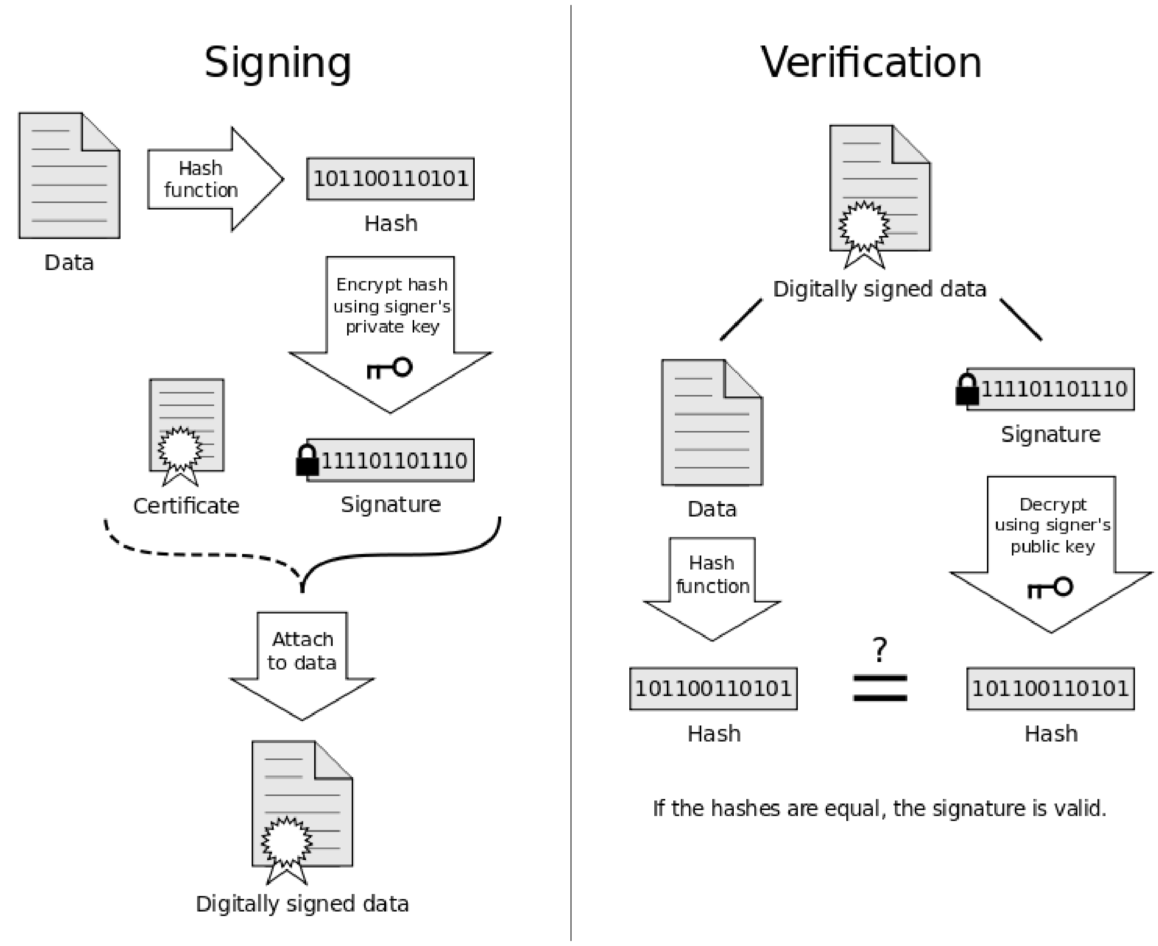
# THE SIGNATURE SCHEME DEMO

## 1. Introduction

This documentation describes the demo for the signature scheme based on the Sodium crypto library. In summary:

- A console application (64 bit Windows environment) that supports to sign and verify a digital signature as mentioned in this diagram.



- Using the libsodium open source library (Signature: Ed25519, Hash: SHA-2).

## 2. The demo

You can run the demo by two ways:

- build and run by Visual Studio .NET 2013 or
- run the libsodium.exe file (in the source code zip file)

The demo includes 2 sub modules:

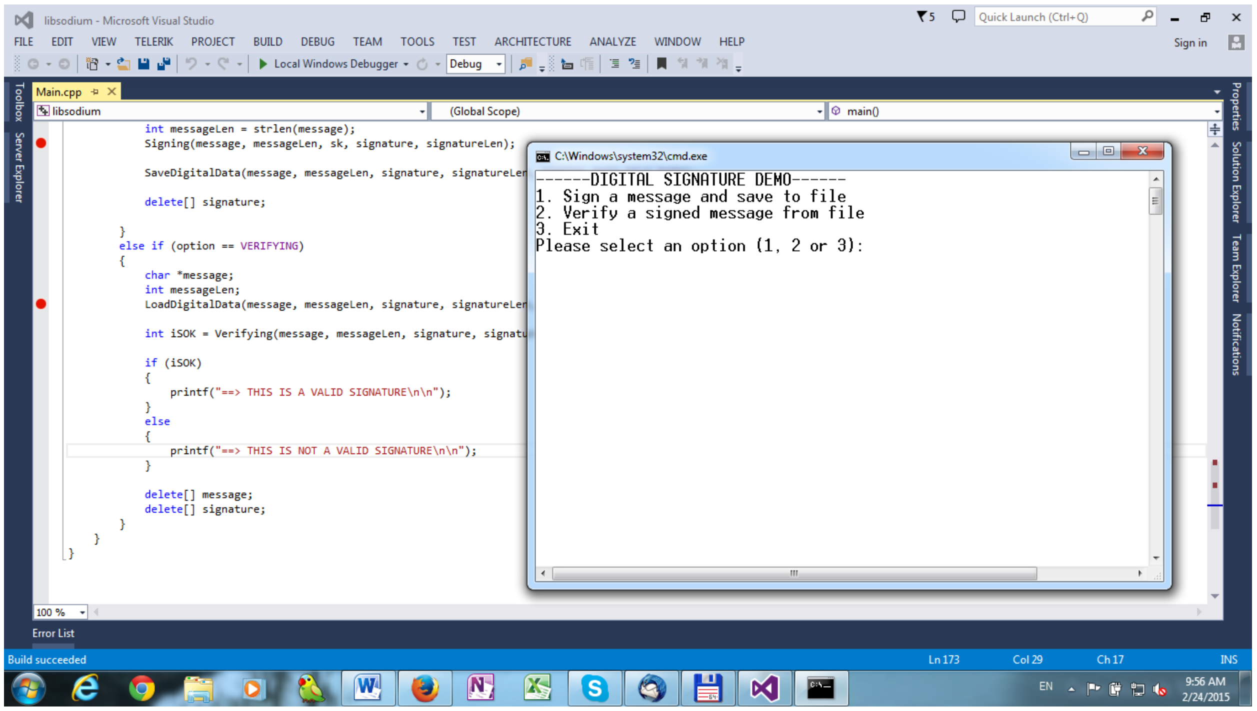
- The SIGNING module:
    - User enter a test message

- The module hash this message by SHA-2
- The module encrypts the hashed message by a private key to have the signature.
- The module save the both the original message and the signature to a file

- The VERIFYING module
  - The module load the original message and the signature from the file
  - The module hash this message by SHA-2 (1)
  - The module decrypt the signature by a public key (2)
  - The module compares the result of (1) and (2) to see whether the signature is OK or not.

## The screenshots

### Screenshot 1: The main menu



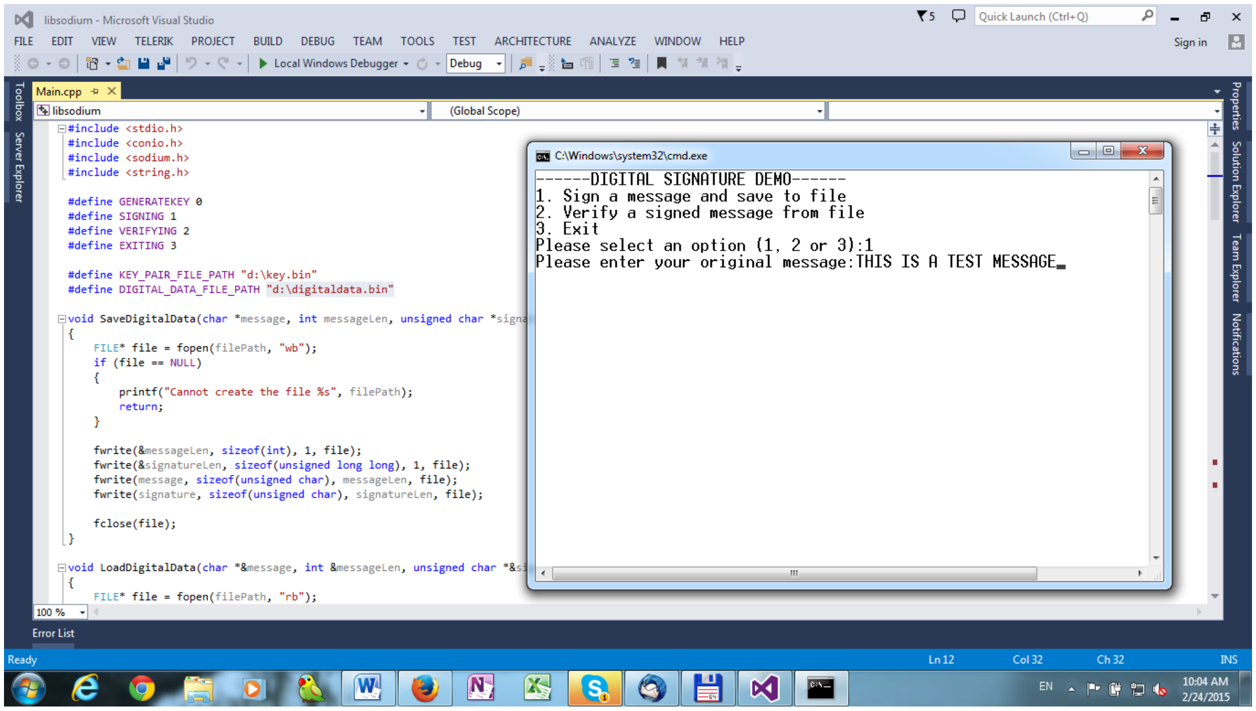
```
            int messageLen = strlen(message);
            Signing(message, messageLen, sk, signature, signatureLen);

            SaveDigitalData(message, messageLen, signature, signatureLen

            delete[] signature;

        }
        else if (option == VERIFYING)
        {
            char *message;
            int messageLen;
            LoadDigitalData(message, messageLen, signature, signatureLen

            int iSOK = Verifying(message, messageLen, signature, signatu

            if (iSOK)
            {
                printf("==> THIS IS A VALID SIGNATURE\n\n");
            }
            else
            {
                printf("==> THIS IS NOT A VALID SIGNATURE\n\n");
            }

            delete[] message;
            delete[] signature;
        }
    }
}
```

```
------DIGITAL SIGNATURE DEMO------
1. Sign a message and save to file
2. Verify a signed message from file
3. Exit
Please select an option (1, 2 or 3):
```

At this screenshot, you can select the feature that you want to do. There are 3 options:

- **Option 1. Sign a message and save to file** => You will enter a message, and then this message will be hashed and encrypted to create the digital signature (SIGNING module). This signature will be saved to a file (d:\digitaldata.bin).
- **Option 2. Verify a signed message from file** => The application will read the message and signature from the file (d:\digitaldata.bin), then check that whether the signature is OK or not (VERIFYING module).
- **Option 3. Exit the application**

## Screenshot 2: Sign a message

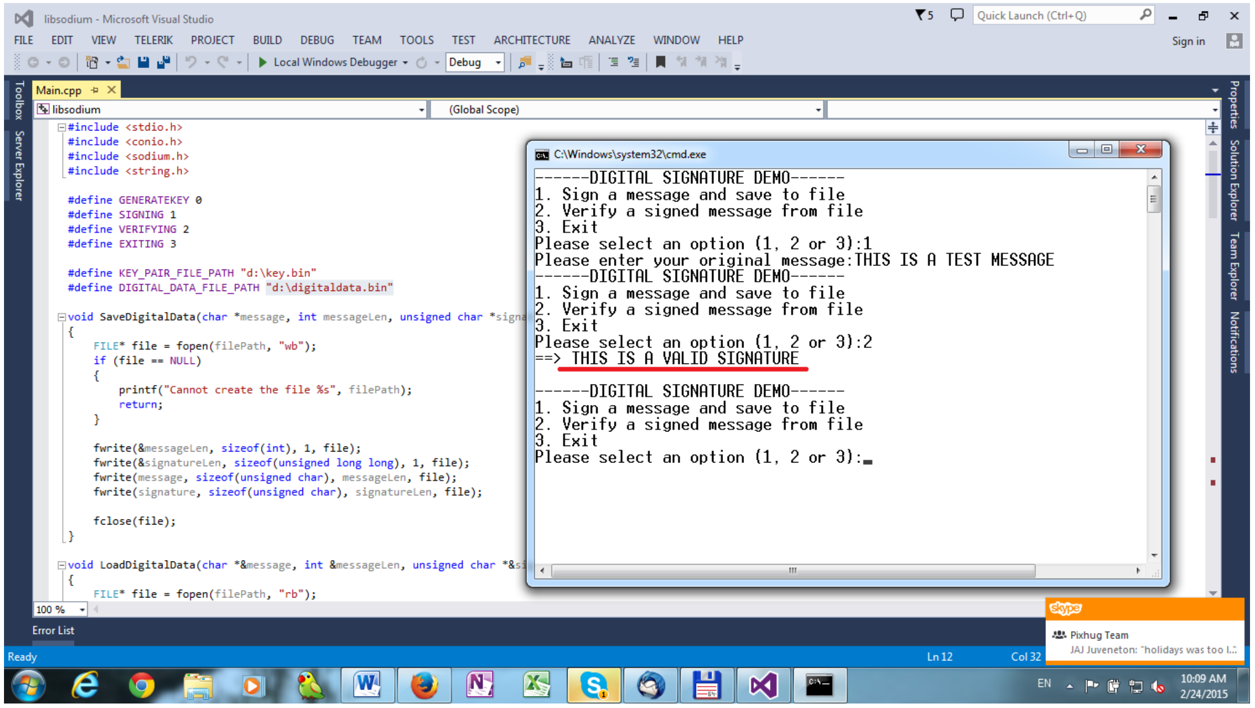


```
#include <stdio.h>
#include <conio.h>
#include <sodium.h>
#include <string.h>

#define GENERATEKEY 0
#define SIGNING 1
#define VERIFYING 2
#define EXITING 3

#define KEY_PAIR_FILE_PATH "d:\key.bin"
#define DIGITAL_DATA_FILE_PATH "d:\digitaldata.bin"

void SaveDigitalData(char *message, int messageLen, unsigned char *signa
{
    FILE* file = fopen(filePath, "wb");
    if (file == NULL)
    {
        printf("Cannot create the file %s", filePath);
        return;
    }

    fwrite(&messageLen, sizeof(int), 1, file);
    fwrite(&signatureLen, sizeof(unsigned long long), 1, file);
    fwrite(message, sizeof(unsigned char), messageLen, file);
    fwrite(signature, sizeof(unsigned char), signatureLen, file);

    fclose(file);
}

void LoadDigitalData(char *&message, int &messageLen, unsigned char *&si
{
    FILE* file = fopen(filePath, "rb");
```

```
------DIGITAL SIGNATURE DEMO------
1. Sign a message and save to file
2. Verify a signed message from file
3. Exit
Please select an option (1, 2 or 3):1
Please enter your original message:THIS IS A TEST MESSAGE_
```

After this step, you will see that there is a new file located at “d:\digitaldata.bin” that stores the original message and the signature.

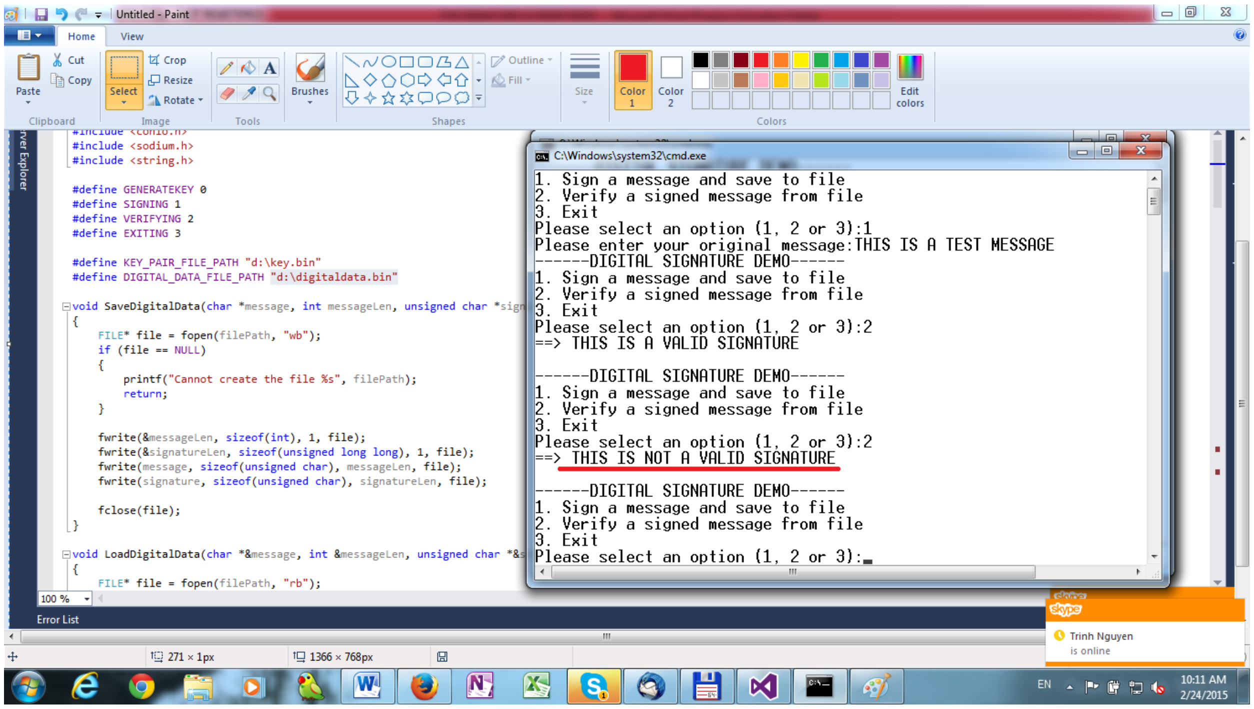
## Screenshot 3: Verify a signature (SUCCESS scenario)



```
#include <stdio.h>
#include <conio.h>
#include <sodium.h>
#include <string.h>

#define GENERATEKEY 0
#define SIGNING 1
#define VERIFYING 2
#define EXITING 3

#define KEY_PAIR_FILE_PATH "d:\key.bin"
#define DIGITAL_DATA_FILE_PATH "d:\digitaldata.bin"

void SaveDigitalData(char *message, int messageLen, unsigned char *signa
{
    FILE* file = fopen(filePath, "wb");
    if (file == NULL)
    {
        printf("Cannot create the file %s", filePath);
        return;
    }

    fwrite(&messageLen, sizeof(int), 1, file);
    fwrite(&signatureLen, sizeof(unsigned long long), 1, file);
    fwrite(message, sizeof(unsigned char), messageLen, file);
    fwrite(signature, sizeof(unsigned char), signatureLen, file);

    fclose(file);
}

void LoadDigitalData(char *&message, int &messageLen, unsigned char *&s
{
    FILE* file = fopen(filePath, "rb");
```

```
------DIGITAL SIGNATURE DEMO------
1. Sign a message and save to file
2. Verify a signed message from file
3. Exit
Please select an option (1, 2 or 3):1
Please enter your original message:THIS IS A TEST MESSAGE
------DIGITAL SIGNATURE DEMO------
1. Sign a message and save to file
2. Verify a signed message from file
3. Exit
Please select an option (1, 2 or 3):2
==> THIS IS A VALID SIGNATURE

------DIGITAL SIGNATURE DEMO------
1. Sign a message and save to file
2. Verify a signed message from file
3. Exit
Please select an option (1, 2 or 3):_
```

## Screenshot 4: Verify a signature (FAILED scenario)



```
#include <conio.h>
#include <sodium.h>
#include <string.h>

#define GENERATEKEY 0
#define SIGNING 1
#define VERIFYING 2
#define EXITING 3

#define KEY_PAIR_FILE_PATH "d:\key.bin"
#define DIGITAL_DATA_FILE_PATH "d:\digitaldata.bin"

void SaveDigitalData(char *message, int messageLen, unsigned char *sign
{
    FILE* file = fopen(filePath, "wb");
    if (file == NULL)
    {
        printf("Cannot create the file %s", filePath);
        return;
    }

    fwrite(&messageLen, sizeof(int), 1, file);
    fwrite(&signatureLen, sizeof(unsigned long long), 1, file);
    fwrite(message, sizeof(unsigned char), messageLen, file);
    fwrite(signature, sizeof(unsigned char), signatureLen, file);

    fclose(file);
}

void LoadDigitalData(char *&message, int &messageLen, unsigned char *&s
{
    FILE* file = fopen(filePath, "rb");
```

```
C:\Windows\system32\cmd.exe
1. Sign a message and save to file
2. Verify a signed message from file
3. Exit
Please select an option (1, 2 or 3):1
Please enter your original message:THIS IS A TEST MESSAGE
------DIGITAL SIGNATURE DEMO------
1. Sign a message and save to file
2. Verify a signed message from file
3. Exit
Please select an option (1, 2 or 3):2
==> THIS IS A VALID SIGNATURE

------DIGITAL SIGNATURE DEMO------
1. Sign a message and save to file
2. Verify a signed message from file
3. Exit
Please select an option (1, 2 or 3):2
==> THIS IS NOT A VALID SIGNATURE

------DIGITAL SIGNATURE DEMO------
1. Sign a message and save to file
2. Verify a signed message from file
3. Exit
Please select an option (1, 2 or 3):
```

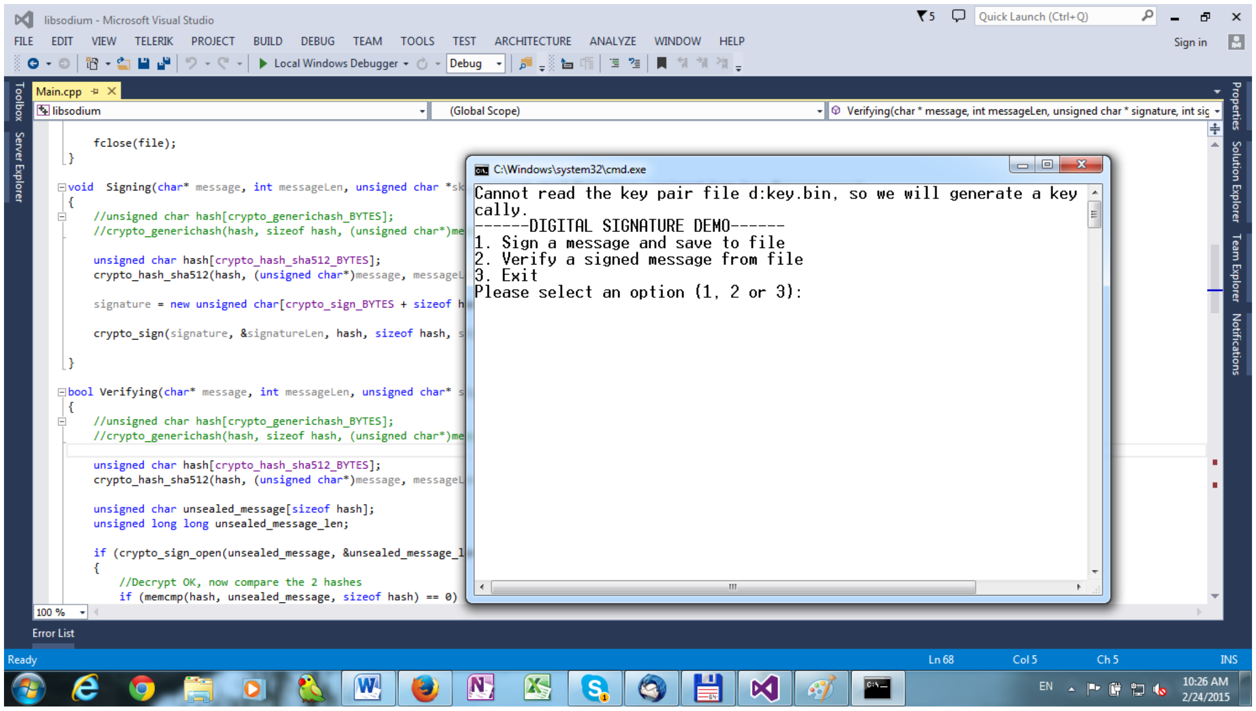
## How to test the demo

- **Verify a signature: SUCCESS scenario**. Please follow these steps:
  - Run the application
  - Select option 1 (sign a message and save to file)
  - Enter a test message (ex: “THIS IS A TEST MESSAGE”)
  - Select option 2 (verify a signed message from file)
  - You will see the screenshot 3.

- **Verify a signature: FAILED scenario.** Please follow these steps:
  - Run the application
  - Select option 1 (sign a message and save to file)
  - Enter the test message (ex: “THIS IS A TEST MESSAGE”)
  - Edit the “d:\digitaldata.bin” file (ex: add some more bytes, remove some bytes).
  - Select option 2 (verify a signed message from file)
  - You will see the screenshot 4.

## About the key pair

There is a public / secret key pair that stored at “d:\key.bin” file. The secret key is used when signing a message. And the public key is used when verifying a signature. When you run the application at the first time, you will see this screenshot.



libsodium - Microsoft Visual Studio
FILE EDIT VIEW TELERIK PROJECT BUILD DEBUG TEAM TOOLS TEST ARCHITECTURE ANALYZE WINDOW HELP
Local Windows Debugger
Debug
Main.cpp
libsodium
(Global Scope)
Verifying(char * message, int messageLen, unsigned char * signature, int sig
C:\Windows\system32\cmd.exe
100 %
Error List
Ready
Ln 68
Col 5
Ch 5
INS
10:26 AM
2/24/2015

```
    fclose(file);
}

void  Signing(char* message, int messageLen, unsigned char *sk
{
    //unsigned char hash[crypto_generichash_BYTES];
    //crypto_generichash(hash, sizeof hash, (unsigned char*)me

    unsigned char hash[crypto_hash_sha512_BYTES];
    crypto_hash_sha512(hash, (unsigned char*)message, messageL

    signature = new unsigned char[crypto_sign_BYTES + sizeof h

    crypto_sign(signature, &signatureLen, hash, sizeof hash, s

}

bool Verifying(char* message, int messageLen, unsigned char* s
{
    //unsigned char hash[crypto_generichash_BYTES];
    //crypto_generichash(hash, sizeof hash, (unsigned char*)me

    unsigned char hash[crypto_hash_sha512_BYTES];
    crypto_hash_sha512(hash, (unsigned char*)message, messageL

    unsigned char unsealed_message[sizeof hash];
    unsigned long long unsealed_message_len;

    if (crypto_sign_open(unsealed_message, &unsealed_message_l
    {
        //Decrypt OK, now compare the 2 hashes
        if (memcmp(hash, unsealed_message, sizeof hash) == 0)
```

```
Cannot read the key pair file d:key.bin, so we will generate a key
cally.
------DIGITAL SIGNATURE DEMO------
1. Sign a message and save to file
2. Verify a signed message from file
3. Exit
Please select an option (1, 2 or 3):
```

If there is no key pair file, the application will generate a key pair automatically and saved it to the d:\key.bin file.

## What did I do to have this demo?

- Download the source code package of the Sodium library (http://download.dnscrypt.org/libsodium/releases/libsodium-1.0.1.tar.gz)
- Add a new code file Main.cpp at \libsodium-1.0.1\src
- Let the Visual Studio .NET 2013 build the exe file instead of the lib file.

# 3. The Sodium library

Sodium is a modern, easy-to-use software library for encryption, decryption, signatures, password hashing and more. **It is a portable, cross-compilable, installable, packageable fork of NaCl, with a compatible API, and an extended API to improve usability even further.**

Its goal is to provide all of the core operations needed to build higher-level cryptographic tools. **Sodium supports a variety of compilers and operating systems, including Windows (with MinGW or Visual Studio, x86 and x64), iOS and Android**.

NaCl is a great library but it itself is not portable, only targeted for *nix systems. The Sodium library solves this by making it portable and making a few minor changes to better suite being distributed as a compiled binary.

**Links:**
http://labs.opendns.com/2013/03/06/announcing-sodium-a-new-cryptographic-library/
http://doc.libsodium.org/