



iOS SDK 1.8.0.0 for Xcode User Guide



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Table of Contents

Prerequisite	4
 Part 1. Put SDK in right place	
1-1 Move downloaded SDK file into your project folder	5
1-2 Un-compress moved SDK file by double clicking it	6
1-3 Compare Bundle ID of your project with the registered bundle ID of SDK	7
 Part 2. Add additional files to your project	
2-1 Open your Xcode project	8
2-2 Perform 'File >> Add Files to "TestApp_Swift"...' menu action	8
2-3 Add Bridging header into Swift project	10
2-4 Append AppSealing header to bridging header file (Swift-project only)	11
 Part 3. Add simple GUI for iOS security intrusion	
3-1 Show UIAlertController window in your app	12
 Part 4. Modify "Build Settings" of your project	
4-1 Select top project at Project Navigator and select "TestApp_Swift" target at TARGETS	16
4-2 Select "Build Settings" tab and type "Other link" in search box	16
4-3 Build Settings "Architectures - Excluded Architectures"	18
4-4 Reminds about Xcode build mode	21
4-5 Generate App integrity and certificate snapshot	22
4-6 Upload re-signed IPA to App Store Connect	28
 Part 5. Acquire AppSealing device unique identifier	
5-1 Show acquired device unique identifier	33
 Part 6. How to apply enhanced jailbreak-detection using app server	
6-1 Overview and Necessity of Enhanced Jailbreak Detection Method	35
6-2 iOS App Code	36
6-3 Verification at app server	37

Part 7. Resign and upload from Xcode Cloud

7-1 Configure Xcode Cloud	52
7-2 ci_scripts preparation process	54
7-3 Check the build and upload process	62

Part 8. Apply source code string encryption

8-1 Setting project's Build Phase.	67
8-2 Append encryption tag to strings	72
8-3 Precautions for Swift string encryption	77
8-4 Handle compile error: Restore encrypted string	78

Part 9. Troubleshooting

9-1 Xcode Build error (1) Use of undeclared type 'AppSealingInterface'	80
9-2 Xcode Build error (2) Undefined symbols for architecture arm64: "_OBJC_CLASS_\$_AppSealingInterface"	81
9-3 Xcode Build error (3) ld: library not found for -lStaticAppSec_Debug	83
9-4 Xcode Build error (4) Undefined symbols for architecture arm64: "ObjC_IsAbnormalEnvironmentDetected()", "Appsealing()"	85
9-5 Xcode Build error (5) Undefined symbols for architecture arm64: "ObjC_IsAbnormalEnvironmentDetected()" (Objective-C project only)	85
9-6 Execution error (1) App terminated immediately after launch	87
9-7 Execution error (2) App terminated suddenly while running	89
9-8 Cannot execute "generate_hash" : Permission denied	90
9-9 Using AppSealing SDK in Continuous Integration Tools	90

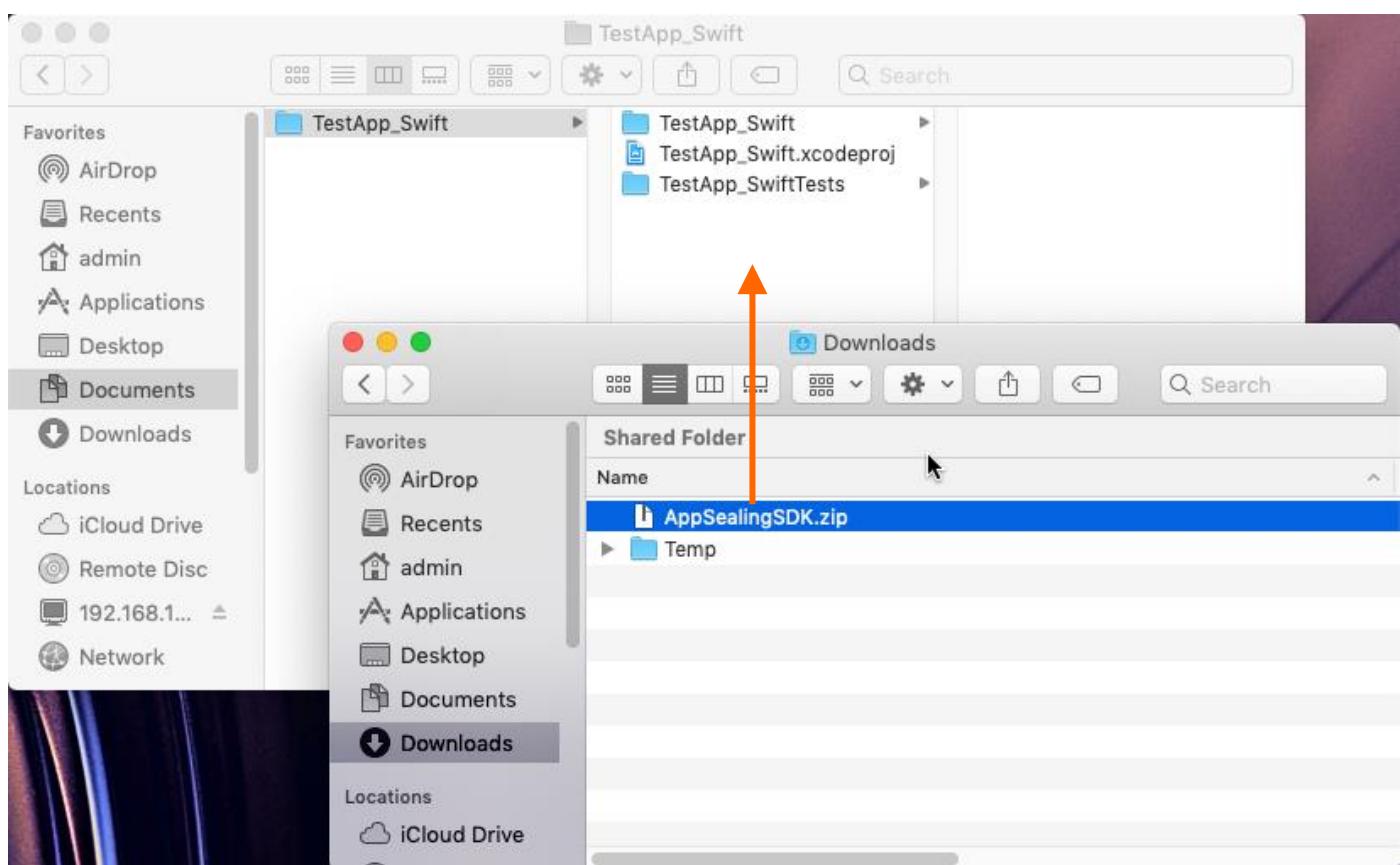
Prerequisite

- Xcode 12.5.1 or newer (macOS 11 or newer)
- iOS Device with iOS 9.0 or newer

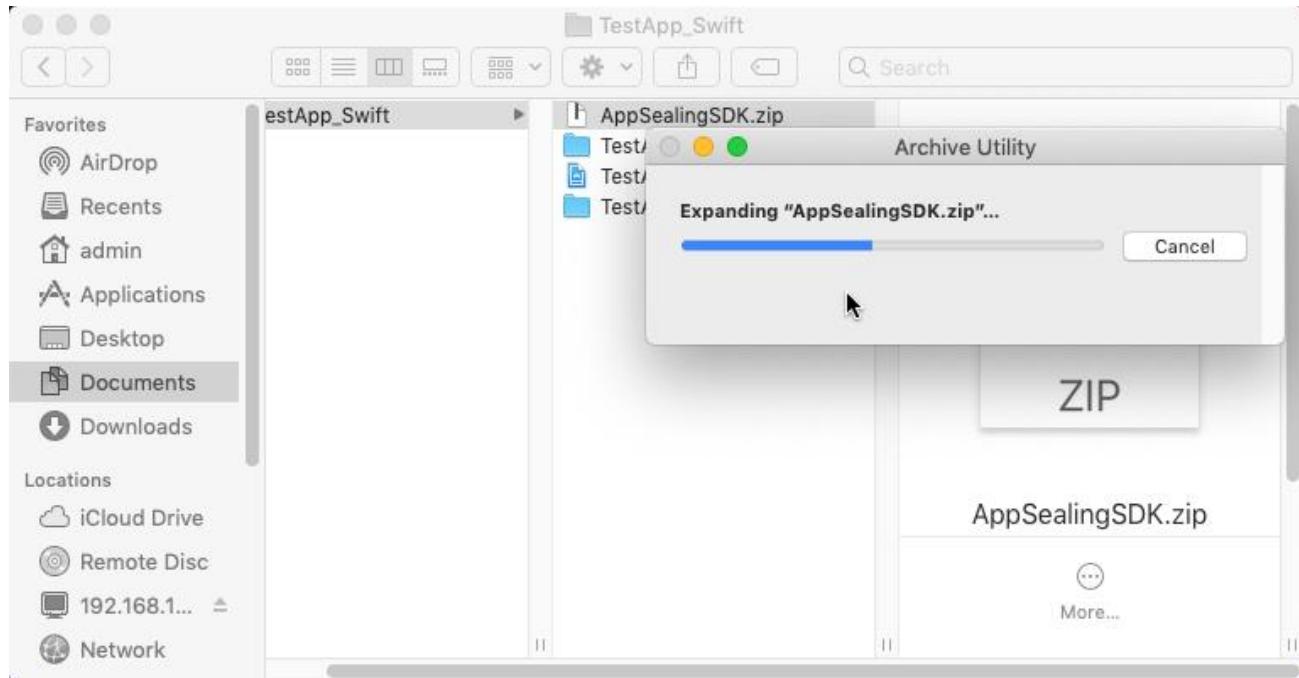
Part 1. Put SDK in right place

After you downloaded AppSealingSDK zip file, you should un-compress it into your Xcode project folder. This document will use sample Xcode swift project named 'TestApp_Swift' for illustration, and its location is "~/Documents/TestApp_Swift".

1-1 Move downloaded SDK file into your project folder



**** Warning: SDK versions that include "AdhocEnabled" in the name of the compressed file are SDKs with weakened security features, enabling app distribution through methods other than the official App Store or TestFlight (such as Ad-Hoc, enterprise, MDM, and other third-party stores). Distribution outside of the App Store can make you vulnerable to attacks, so unless absolutely necessary, we recommend downloading a version that does not include AdhocEnabled.**

1-2 Un-compress moved SDK file by double clicking it

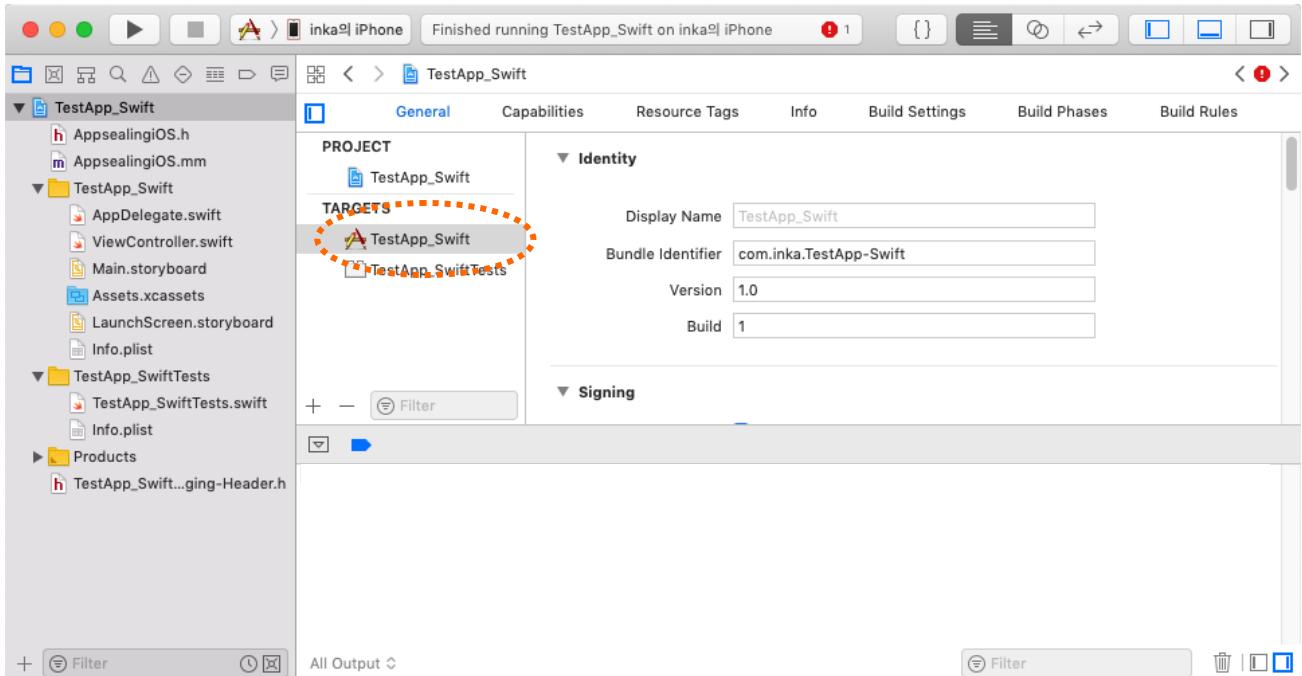
After uncompressing zip file, check whether all files are generated like following structure.

Name
Code Samples.txt
Documents
iOS_AppSealingSDK_UserGuide_for_XcodeProject_EN.pdf
Libraries
appsealing.lic
AppsealingiOS.h
AppsealingiOS.mm
libStaticAppSec_Debug.a
libStaticAppSec.a
Release-Notes.txt
Tools
generate_hash

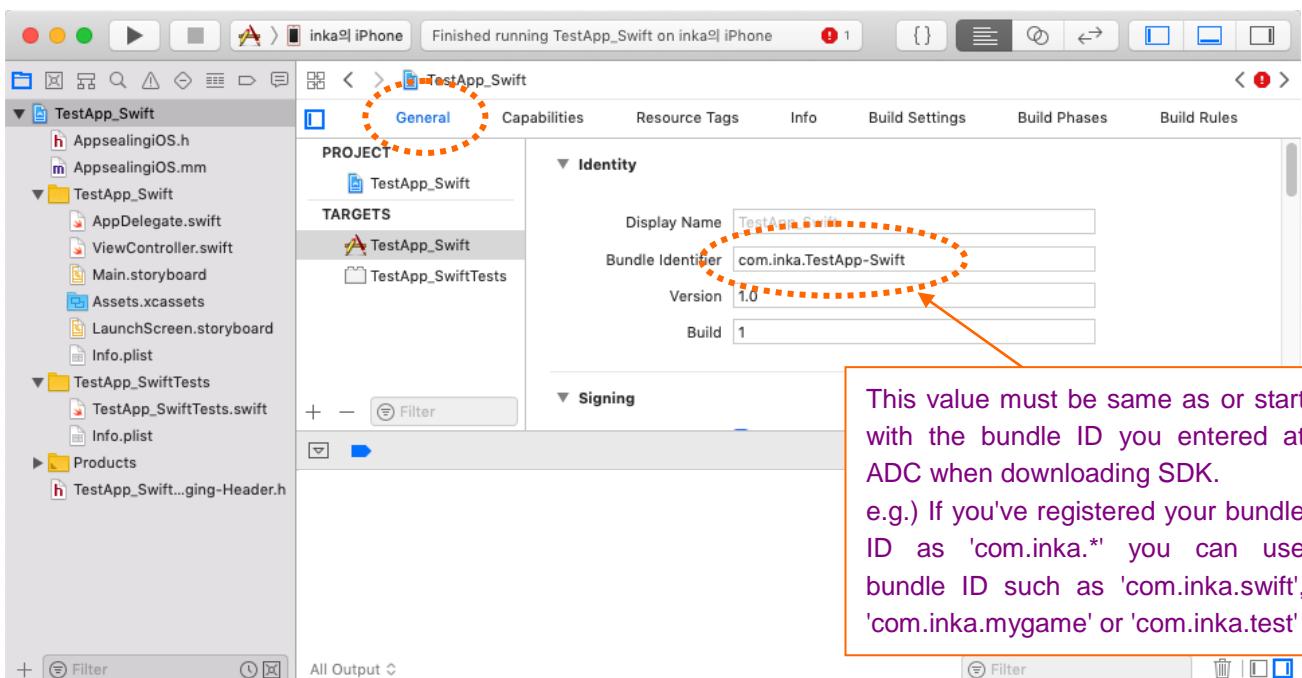
If any file is missing try re-download SDK or try expand zip file again.

1-3 Compare Bundle ID of your project with the registered bundle ID of SDK

After you've uncompressed SDK zip file, you should check your bundle ID is valid. Open Xcode and select top project at left panel and select your project name (TestApp_Swift) in TARGETS list.

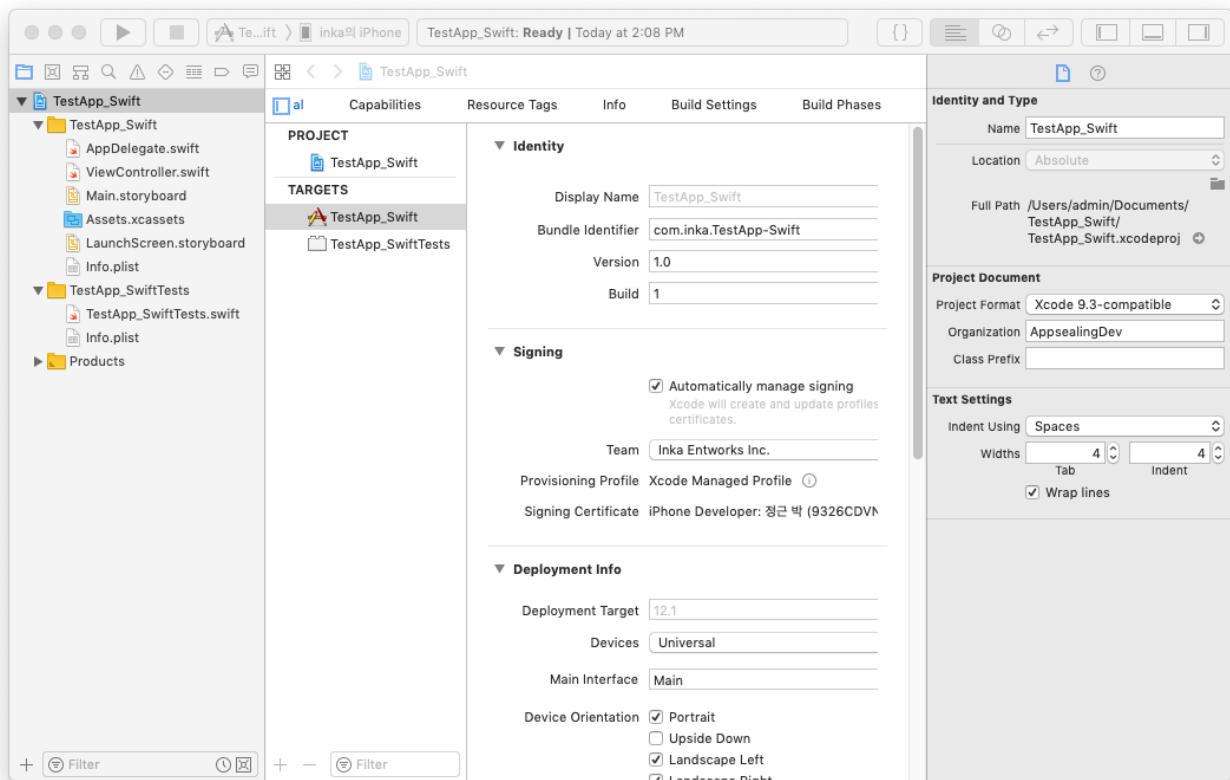


Then select "General" tab and check your bundle Id whether it is same as or starts with the value you entered when downloading SDK at AppSealing Developer Center (ADC).

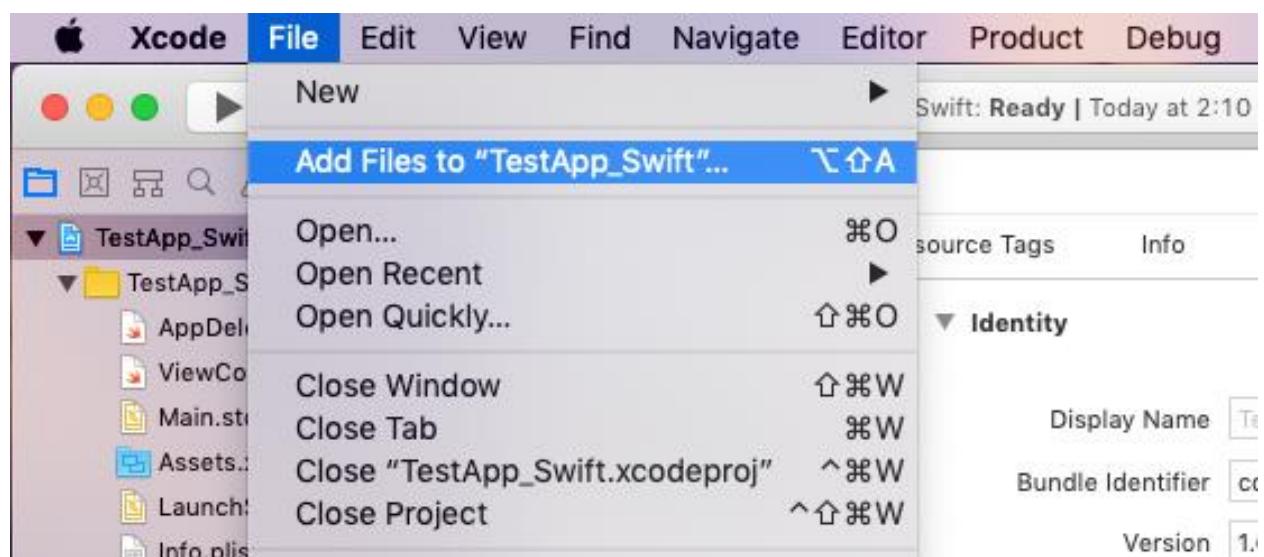


Part 2. Add additional files to your project

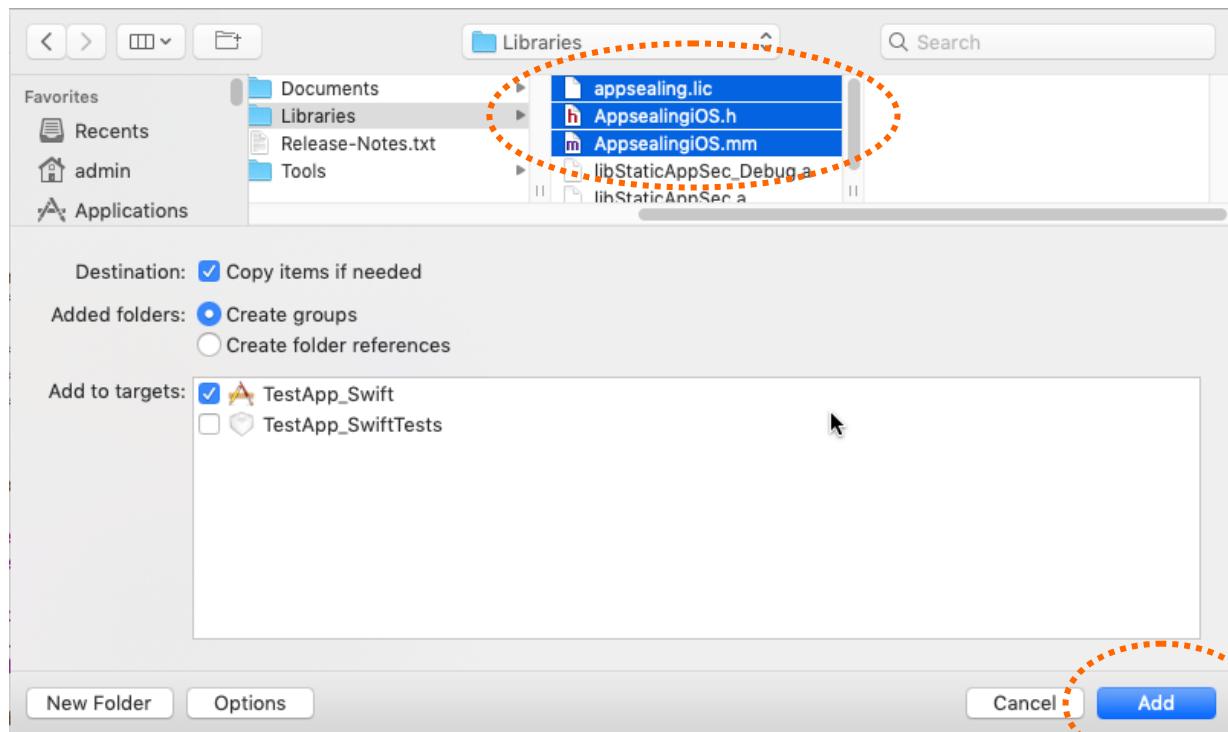
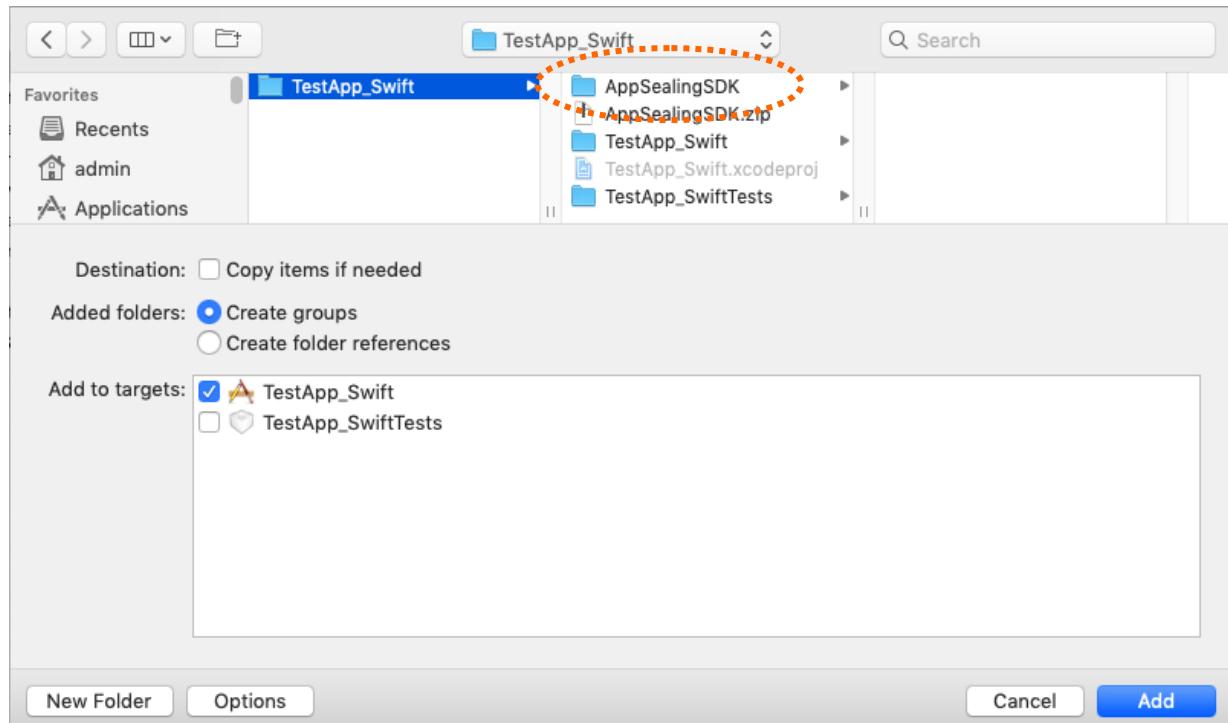
2-1 Open your Xcode project



2-2 Perform 'File >> Add Files to "TestApp_Swift"...' menu action



In dialog box, select "**appsealing.lic**", "**AppsealingiOS.h**" and "**AppsealingiOS.mm**" files in "AppSealingSDK/Libraries/" folder and click "Add" button.



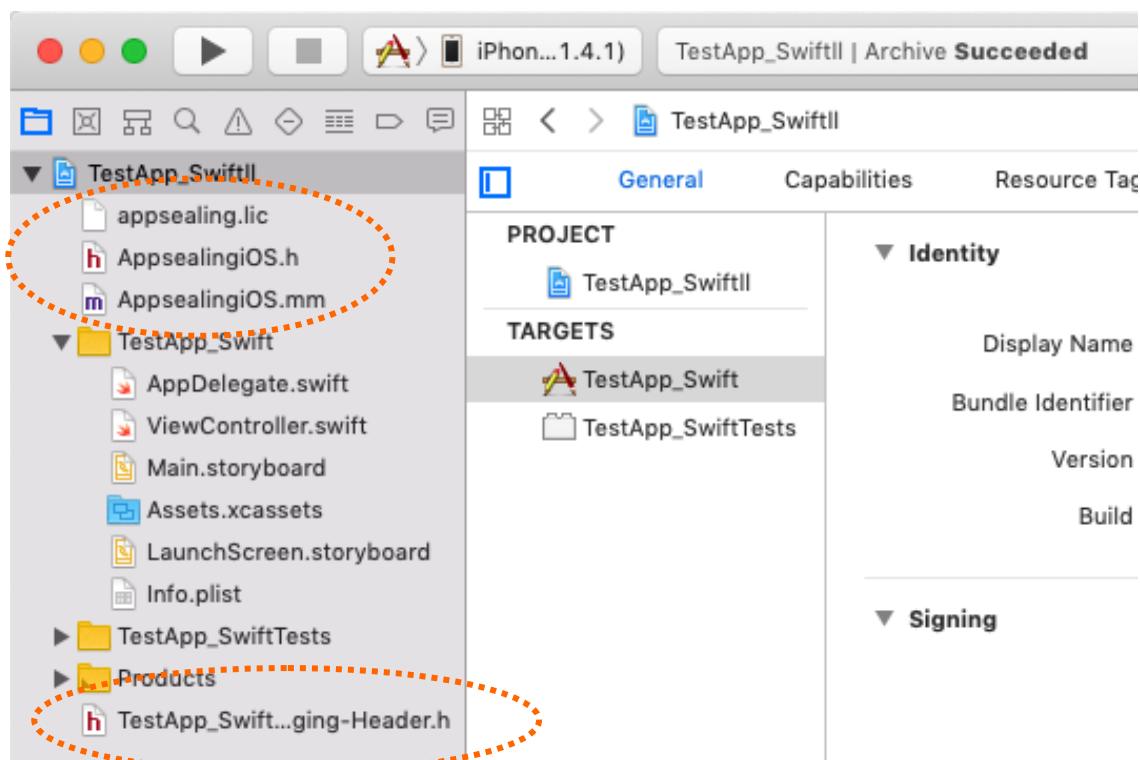
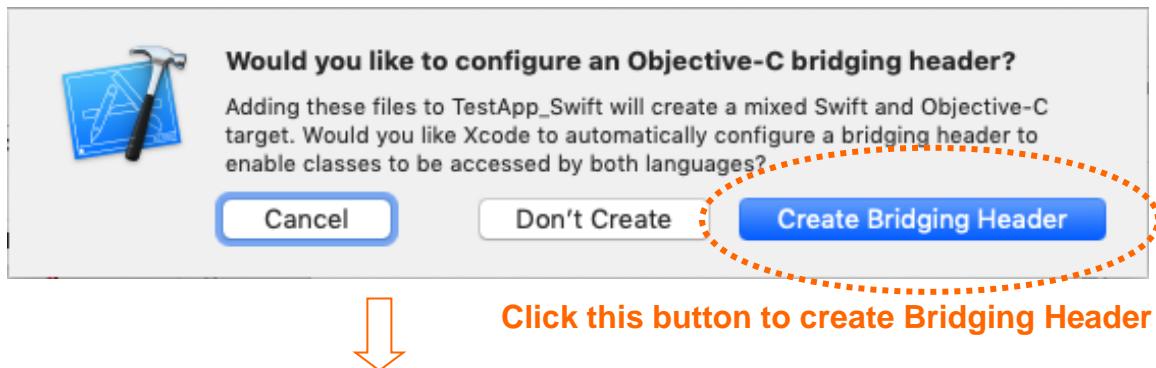
Click button to add files

2-3 Add Bridging Header into swift project



Only if your project is Swift based
(Do not refer this & next pages if your project is objective-c based)

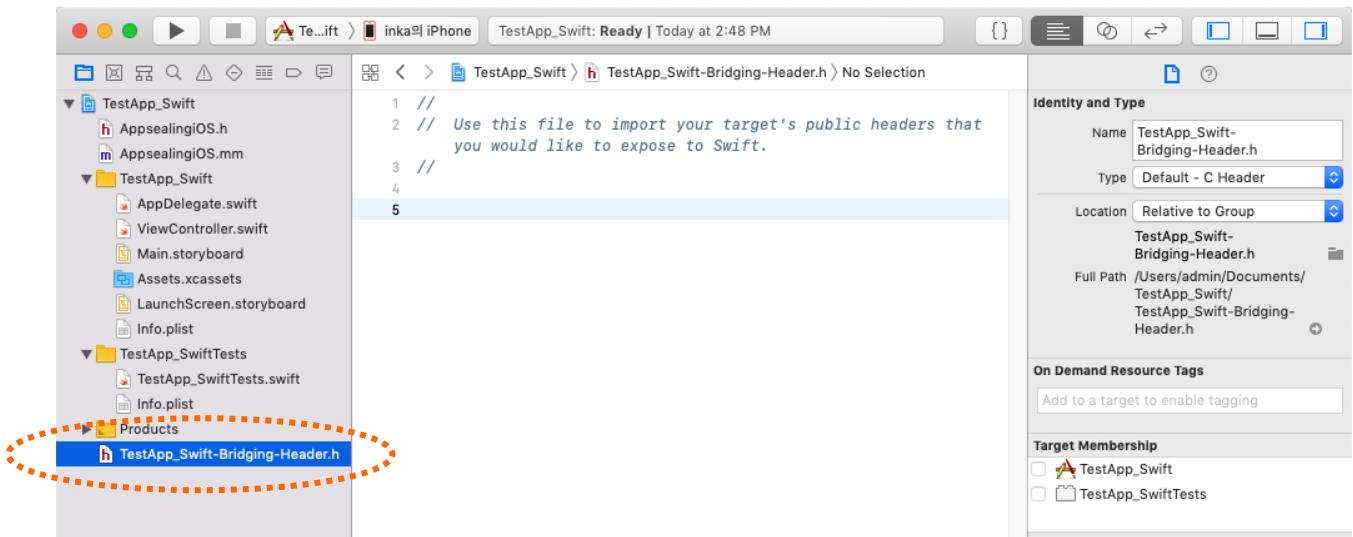
Since your project is swift-based project, you would encounter a dialog box which asks you create a bridging header file or not only if there's no bridging header in your project yet. You should click "Create Bridging Header".



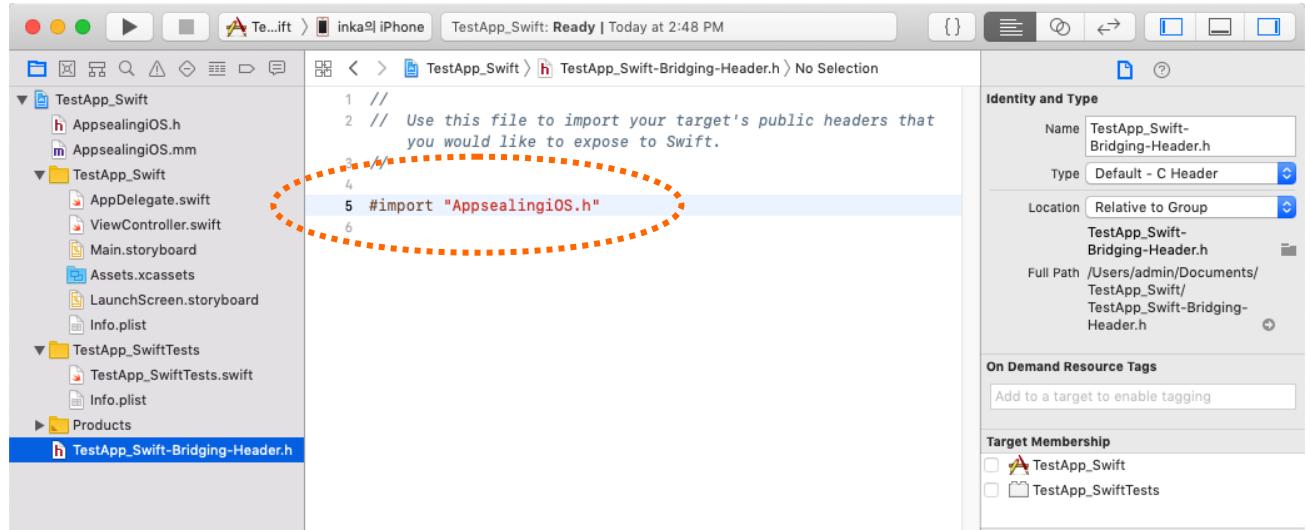
* Supposing your project already has bridging header file, the upper dialog box will not appear and you can use your existing bridging header file.

** If your project is Objective-C based, the bridging header file is not used.

2-4 Append AppSealing header to bridging header file (Swift-project only)



Select newly created "TestApp_Swift-Bridging-Header.h" file (or existing bridging header file) and append `#import "AppsealingiOS.h"` to end of document like below.



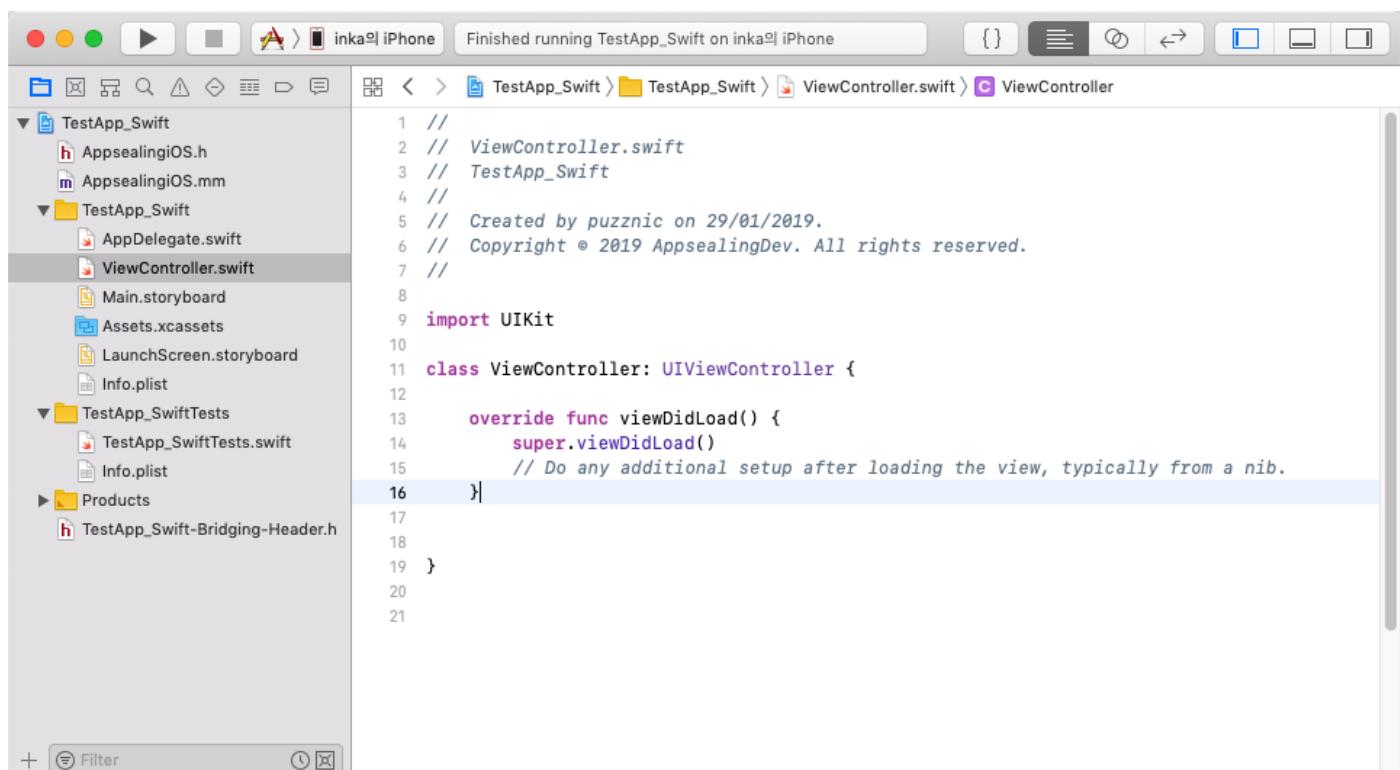
Part 3. Add simple GUI for iOS security intrusion

The AppSealing library within your App is automatically activated when right after App has launched. If AppSealing library has detected any abnormal environment (such as jailbroken-device, executable has decrypted or debugger has attached) it will close the app after 20 seconds irrespectively of user action, so the app should notify the detection result to user and show some proper message box for user can recognize there's some invalid environment in his/her device.

If you want to show that dialog box in your app, you can easily do that inserting small chunk of code into "ViewController.swift" file. (In case of Objective-C based project, change extension of ViewController.m to mm and modify file)

3-1 Show UIAlertController window in your app

First, open your Xcode project and open "ViewController.swift" file.



The screenshot shows the Xcode interface with the "ViewController.swift" file open in the editor. The file contains the following Swift code:

```
1 //  
2 // Viewcontroller.swift  
3 // TestApp_Swift  
4 //  
5 // Created by puzznic on 29/01/2019.  
6 // Copyright © 2019 AppsealingDev. All rights reserved.  
7 //  
8  
9 import UIKit  
10  
11 class ViewController: UIViewController {  
12  
13     override func viewDidLoad() {  
14         super.viewDidLoad()  
15         // Do any additional setup after loading the view, typically from a nib.  
16    }  
17  
18  
19 }  
20  
21
```

After you opened the swift file put following code into that (If ViewController.swift file has already included 'viewDidAppear' method just insert the body of following code below 'super.viewDidAppear(animated):' line.)

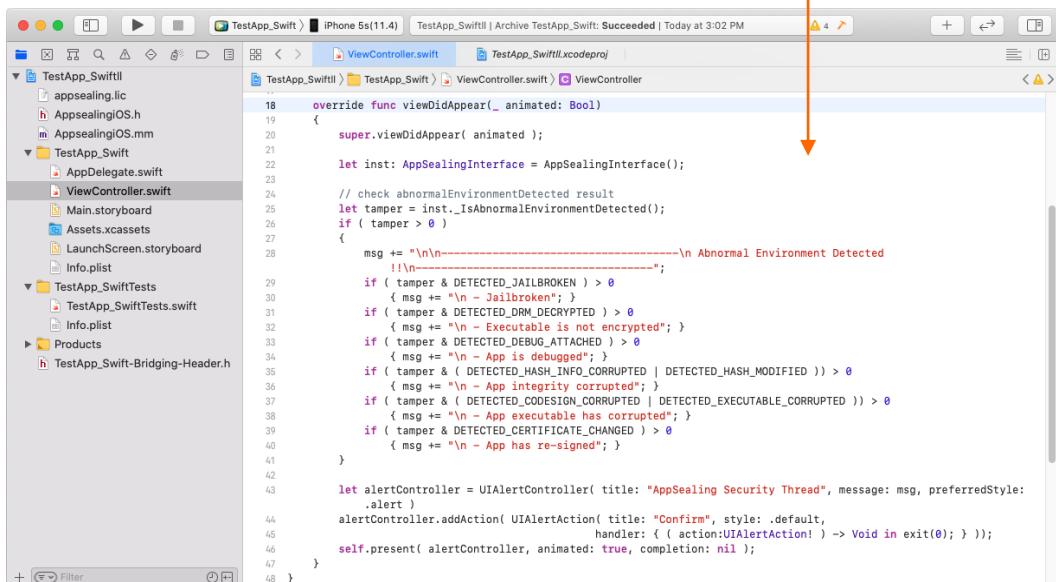
Simple UI code into 'ViewController.swift' for Swift project

```

override func viewDidAppear(_ animated: Bool)
{
    super.viewDidAppear( animated );

    let inst: AppSealingInterface = AppSealingInterface();
    let tamper: Int32 = inst._IsAbnormalEnvironmentDetected();
    if ( tamper > 0 )
    {
        var msg = "Abnormal Environment Detected !!";
        if ( tamper & DETECTED_JAILBROKEN ) > 0
            { msg += "\n - Jailbroken"; }
        if ( tamper & DETECTED_DRM_DECRYPTED ) > 0
            { msg += "\n - Executable is not encrypted"; }
        if ( tamper & DETECTED_DEBUG_ATTACHED ) > 0
            { msg += "\n - App is debugged"; }
        if ( tamper & ( DETECTED_HASH_INFO_CORRUPTED | DETECTED_HASH_MODIFIED ) ) > 0
            { msg += "\n - App integrity corrupted"; }
        if ( tamper & ( DETECTED_CODESIGN_CORRUPTED | DETECTED_EXECUTABLE_CORRUPTED ) ) > 0
            { msg += "\n - App executable has corrupted"; }
        if ( tamper & DETECTED_CERTIFICATE_CHANGED ) > 0
            { msg += "\n - App has re-signed"; }
        if ( tamper & DETECTED_BLACKLIST_CORRUPTED ) > 0
            { msg += "\n - Blacklist has corrupted or missing"; }
        if ( tamper & DETECTED_CHEAT_TOOL ) > 0
            { msg += "\n - Cheat tool detected"; }
        let alertController = UIAlertController(title: "AppSealing",
                                              message: msg, preferredStyle: .alert );
        alertController.addAction(UIAlertAction(title: "Confirm", style: .default,
                                              handler: { (action:UIAlertAction!) -> Void in
#if !DEBUG // Debug mode does not kill app even if security threat has found
                exit(0);
#endif
                } ));
        self.present(alertController, animated: true, completion: nil);
    }
}

```



Sample UI code above is also included in "Release-Notes.txt" file so you can copy & paste int that file.

If your project is Objective-C based then you can use following code to show simple UI.

Simple UI code into 'ViewController.mm' for **Objective-C** project

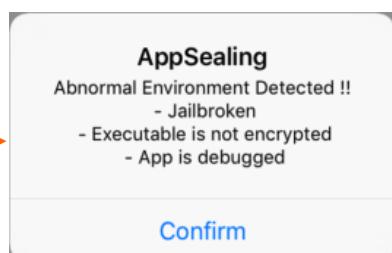
```
#include "AppsealingiOS.h"
- (void)viewDidLoad:(BOOL)animated
{
    [super viewDidLoad];

    int tamper = ObjC_IsAbnormalEnvironmentDetected();
    if ( tamper > 0 )
    {
        NSString* msg = @"Abnormal Environment Detected !!";
        if (( tamper & DETECTED_JAILBROKEN ) > 0 )
            msg = [msg stringByAppendingString:@"\n - Jailbroken"];
        if (( tamper & DETECTED_DRM_DECRYPTED ) > 0 )
            msg = [msg stringByAppendingString:@"\n - Executable is not encrypted"];
        if (( tamper & DETECTED_DEBUG_ATTACHED ) > 0 )
            msg = [msg stringByAppendingString:@"\n - App is debugged"];
        if ( tamper & ( DETECTED_HASH_INFO_CORRUPTED | DETECTED_HASH_MODIFIED ) ) > 0
            msg = [msg stringByAppendingString:@"\n - App integrity corrupted"];
        if ( tamper & ( DETECTED_CODESIGN_CORRUPTED | DETECTED_EXECUTABLE_CORRUPTED ) ) > 0
            msg = [msg stringByAppendingString:@"\n - App executable has corrupted"];
        if ( tamper & DETECTED_CERTIFICATE_CHANGED ) > 0
            msg = [msg stringByAppendingString:@"\n - App has re-signed"];
        if (( tamper & DETECTED_BLACKLIST_CORRUPTED ) > 0 )
            msg = [msg stringByAppendingString:@"\n - Blacklist has corrupted or missing"];
        if (( tamper & DETECTED_CHEAT_TOOL ) > 0 )
            msg = [msg stringByAppendingString:@"\n - Cheat tool detected"];

        UIAlertController *alert = [UIAlertController alertControllerWithTitle:@"AppSealing"
                                message:msg
                                preferredStyle:UIAlertControllerStyleAlert];
        UIAlertAction *confirm = [UIAlertAction actionWithTitle:@"Confirm"
                                                style:UIAlertActionStyleDefault
                                              handler:^(UIAlertAction * _Nonnull action) {
#if !DEBUG && !defined(DEBUG) // Debug mode does not kill app even if security threat has found
                exit(0);
#endif
                }];
        [alert addAction:confirm];
        [self presentViewController:alert animated:YES completion:nil];
    }
}
```

Your app will show simple alert box like below when you run your app on abnormal device such as jailbroken or debug your app using Xcode or gdb. In such situation irrespective of user action the app will exit after 20 seconds automatically.

When security intrusion has detected in iOS device, simple alert view will appear and app will close after 20 seconds or when user touches "Confirm" button





If your project is flutter based, the ViewController.swift file is not created, so you can create the GUI by adding the following modified code to AppDelegate.swift file

Simple UI code into 'AppDelegate.swift' for **flutter** project

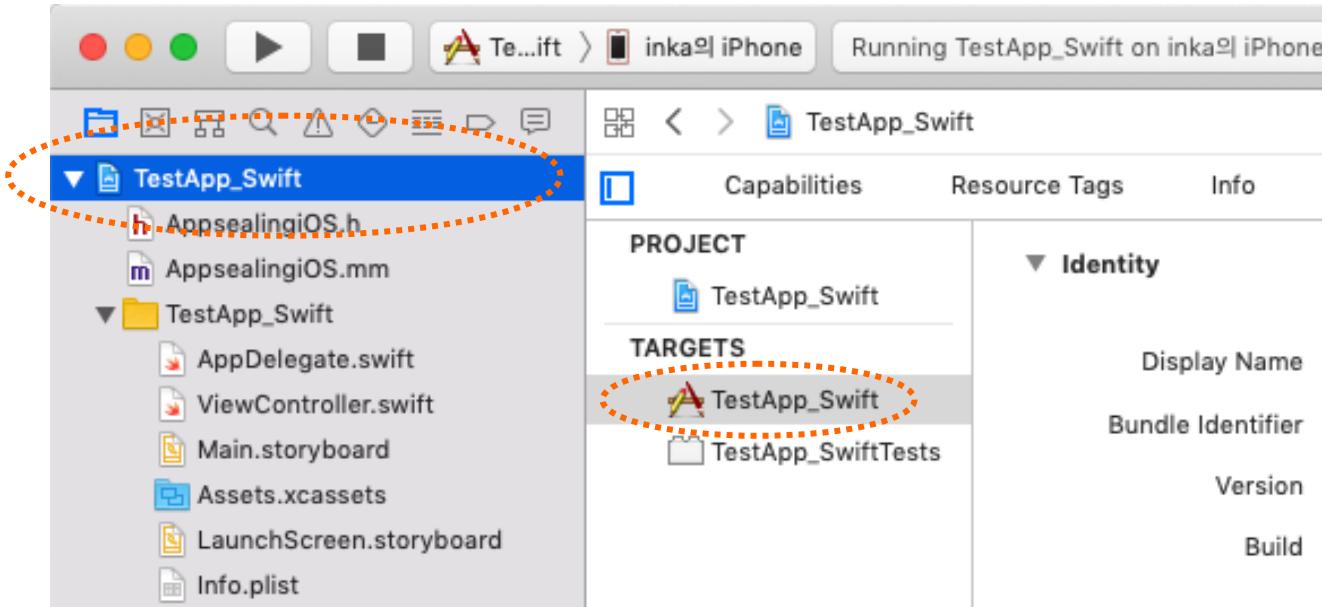
```
func application(_ application: UIApplication, didFinishLaunchingWithOptions launchOptions: [UIApplication.LaunchOptionsKey: Any]?) -> Bool
{
    // Override point for customization after application launch.

    let inst: AppSealingInterface = AppSealingInterface();
    let tamper: Int32 = inst._IsAbnormalEnvironmentDetected();
    if ( tamper > 0 )
    {
        var msg = "Abnormal Environment Detected !!";
        if ( tamper & DETECTED_JAILBROKEN ) > 0
            { msg += "\n - Jailbroken"; }
        if ( tamper & DETECTED_DRM_DECRYPTED ) > 0
            { msg += "\n - Executable is not encrypted"; }
        if ( tamper & DETECTED_DEBUG_ATTACHED ) > 0
            { msg += "\n - App is debugged"; }
        if ( tamper & ( DETECTED_HASH_INFO_CORRUPTED | DETECTED_HASH_MODIFIED ) ) > 0
            { msg += "\n - App integrity corrupted"; }
        if ( tamper & ( DETECTED_CODESIGN_CORRUPTED | DETECTED_EXECUTABLE_CORRUPTED ) ) > 0
            { msg += "\n - App executable has corrupted"; }
        if ( tamper & DETECTED_CERTIFICATE_CHANGED ) > 0
            { msg += "\n - App has re-signed"; }
        if ( tamper & DETECTED_BLACKLIST_CORRUPTED ) > 0
            { msg += "\n - Blacklist has corrupted or missing"; }
        if ( tamper & DETECTED_CHEAT_TOOL ) > 0
            { msg += "\n - Cheat tool detected"; }

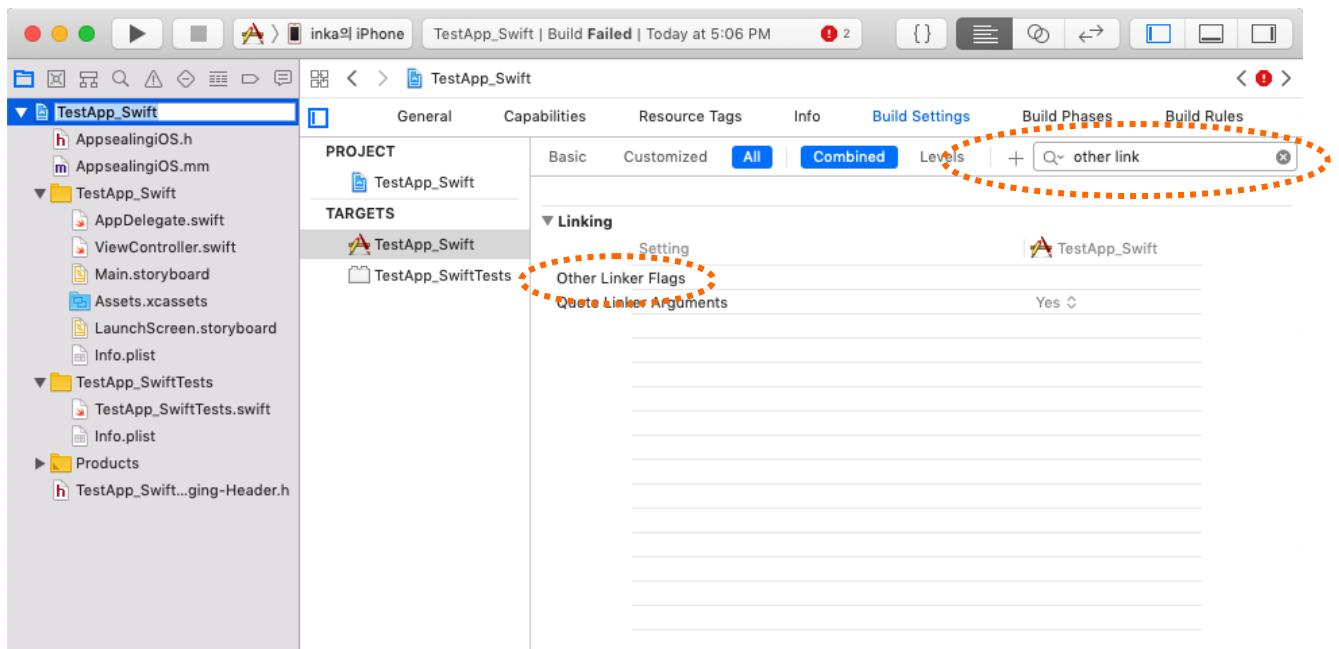
        let alertController = UIAlertController(title: "AppSealing",
                                              message: msg, preferredStyle: .alert );
        alertController.addAction(UIAlertAction(title: "Confirm", style: .default,
                                              handler: { (action:UIAlertAction!) -> Void in
#if !DEBUG // Debug mode does not kill app even if security threat has found
                                              exit(0);
#endif
                } ));
        // show alert
        let alertWindow = UIWindow( frame: UIScreen.main.bounds )
        alertWindow.rootViewController = UIViewController()
        alertWindow.windowLevel = UIWindow.Level.alert + 1;
        alertWindow.makeKeyAndVisible()
        alertWindow.rootViewController?.present( alertController,
                                              animated: true, completion: nil )
    }
    return true;
}
```

Part 4. Modify "Build Settings" of your project

4-1 Select top project at Project Navigator and select "TestApp_Swift" target at TARGETS

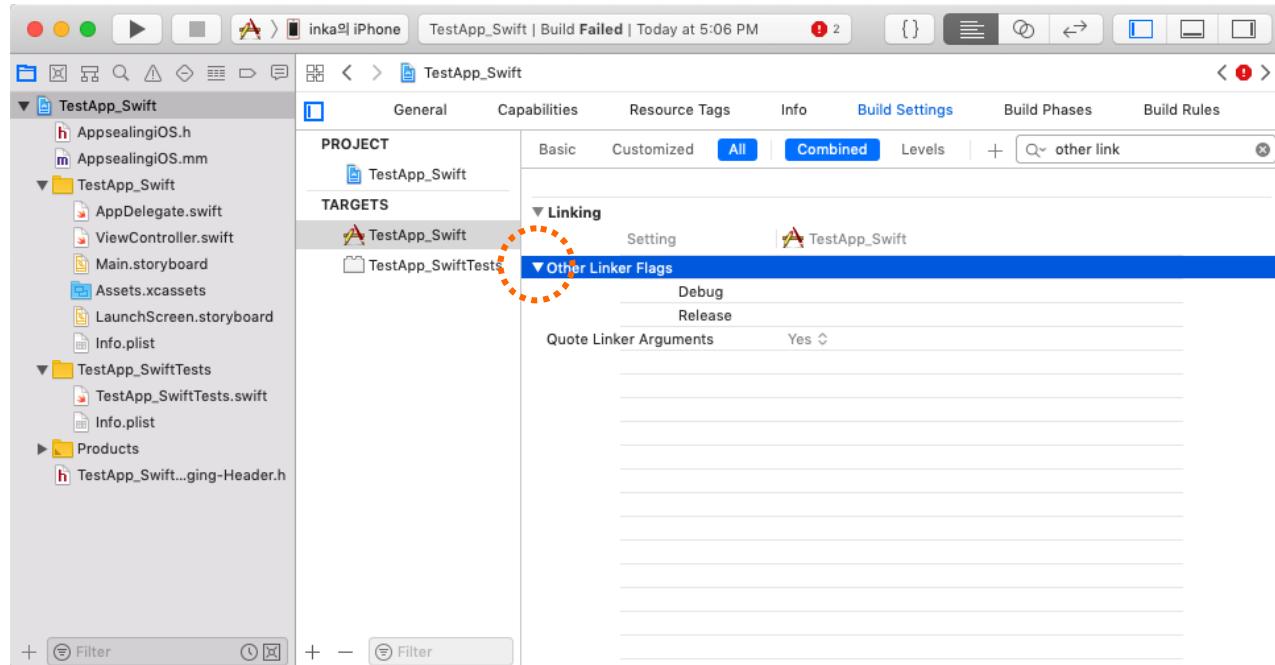


4-2 Select "Build Settings" tab and type "Other link" in search box



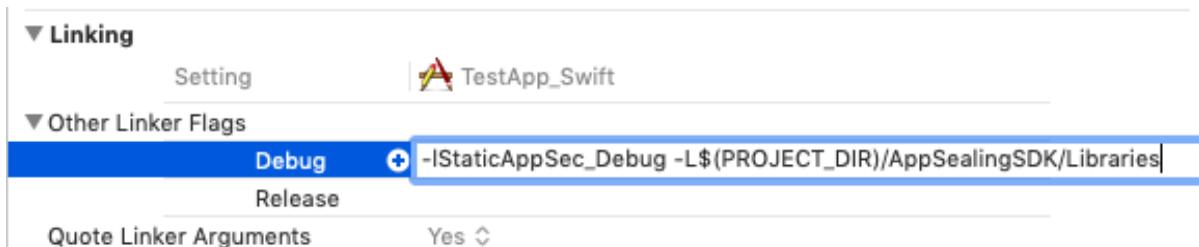
Then you will see "**Other Linker Flags**" field. Now, fill this settings by following steps.

1) Expand "Other Linker Flags" by clicking the triangle icon left to "Other Linker Flags"



2) Select "Debug" item and click to edit/insert value, then type in following text.

-IStaticAppSec_Debug -L\$(PROJECT_DIR)/AppSealingSDK/Libraries

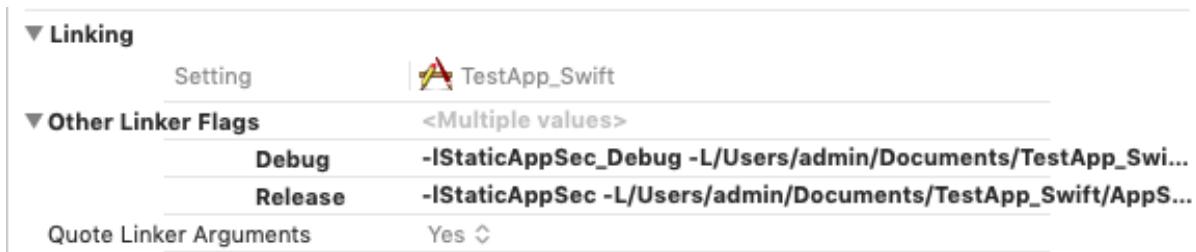


`$(PROJECT_DIR)` is an environment variable specifying the current project path. To replace this value with an absolute path, you must change the entire `$(PROJECT_DIR)`, not `PROJECT_DIR` in parentheses. For example, if the target project path is `/Users/myname/MyProject/SampleProject1`, the following string should be added to the value of Other Linker Flags.

-L/Users/myname/MyProject/SampleProject1/AppSealingSDK/Libraries

3) Select "Release" item and click to edit/insert value, then type in following text.

-IStaticAppSec -L\$(PROJECT_DIR)/AppSealingSDK/Libraries

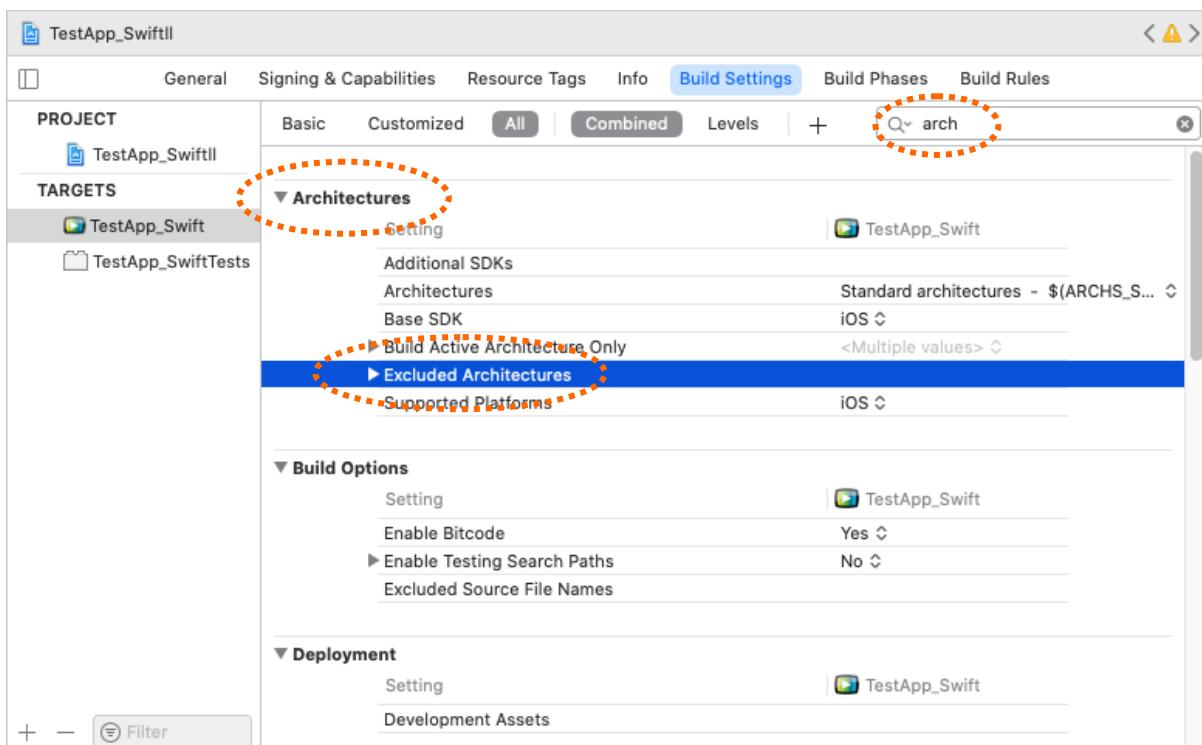


When using an absolute path even for Release, be careful not to change only the path in parentheses while leaving \$() as it is.

Below step is needed only when you launch app in Simulator with Release build. If you don't need to run your Release build in simulator you can skip this step.

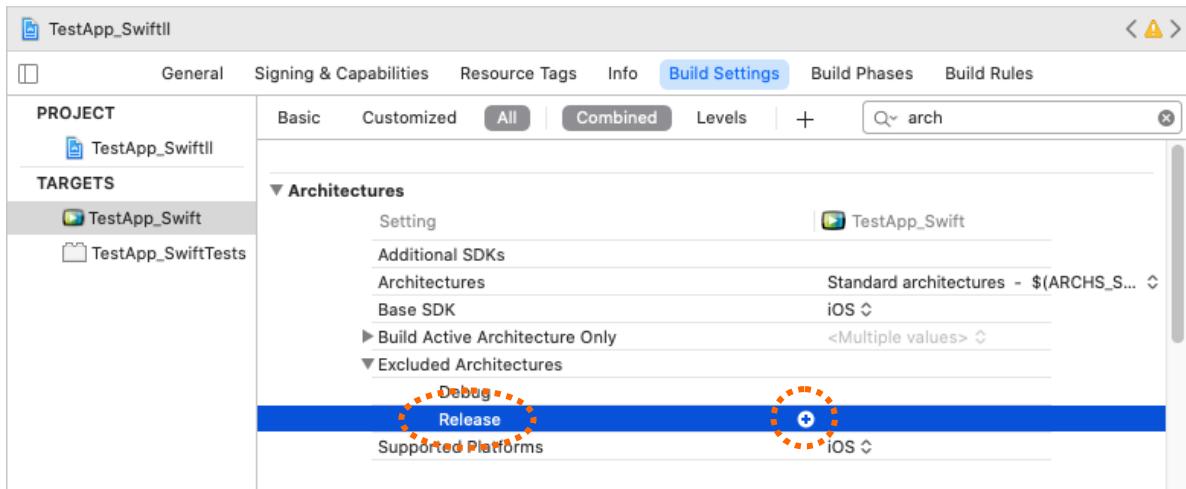
4-3 Configure Build Settings "Architectures – Excluded Architectures"

Search "arch" keyword at Build Settings panel.

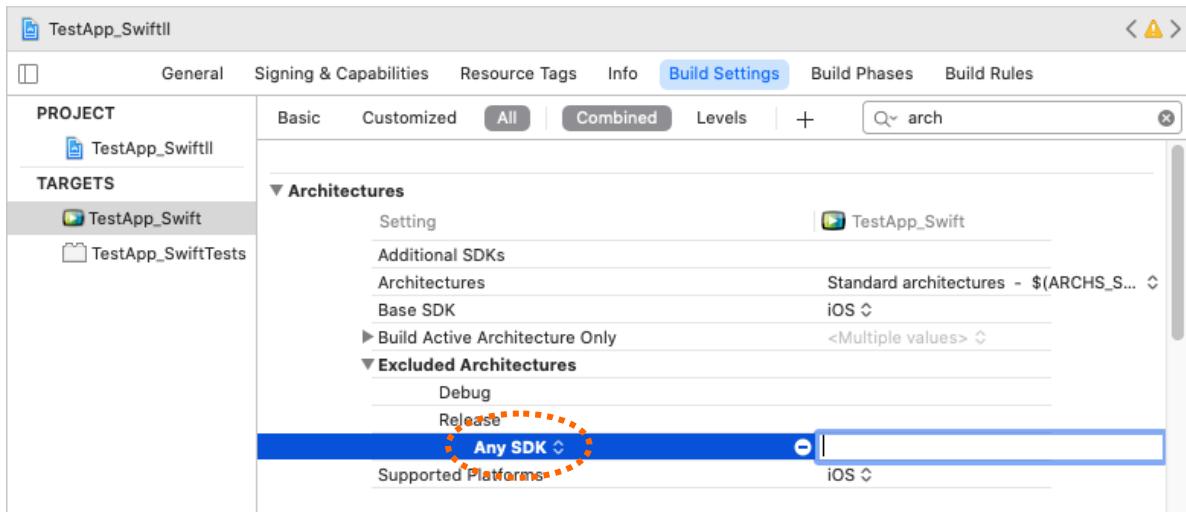


Follow next steps after "Architectures" field has shown.

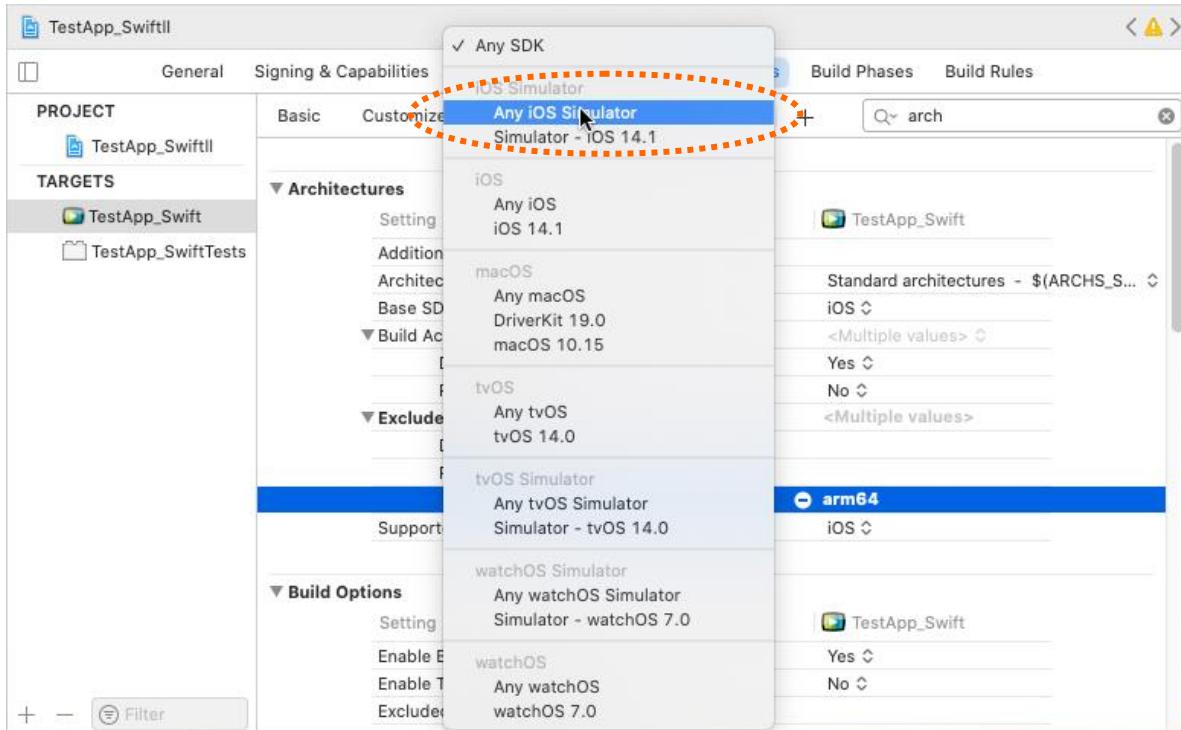
1) Expand "Excluded Architectures" by clicking the left-side triangle icon.



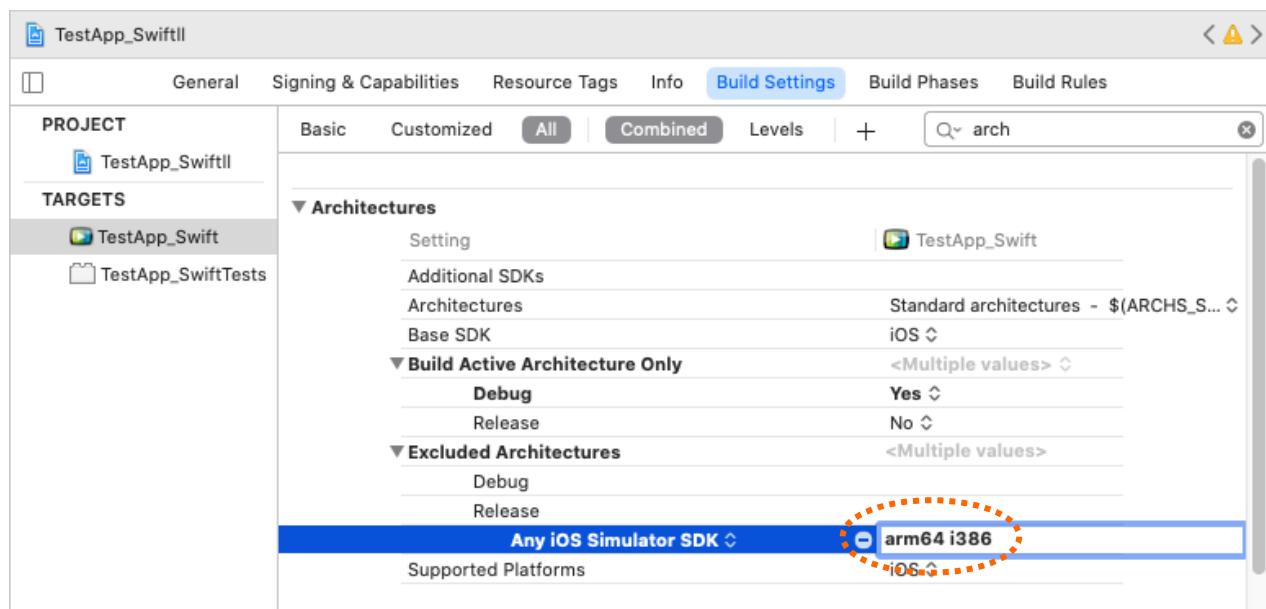
2) Select "Release" item and click right-side "+" icon.



3) After "Any SDK" item has created click it to show popup menu.



4) Select "Any iOS Simulator" item in popup menus.



5) Enter value for "Any iOS Simulator SDK" as "arm64 i386". (Space between arm64 and i386)

Now AppSealing security features have been adopted to your project. Go on 'Build', 'Run', 'Archive' as usual.

4-4 Reminds about Xcode build mode

* AppSealing work differently in debug mode and release mode.

If you build an app in Debug mode, AppSealing's security features are disabled for convenient development :

- Jailbreak detection
- Anti-debugging
- Not encrypted executable file detection
- App-Integrity corruption detection
- Re-signing detection

These features are enabled when you build app as Release mode.

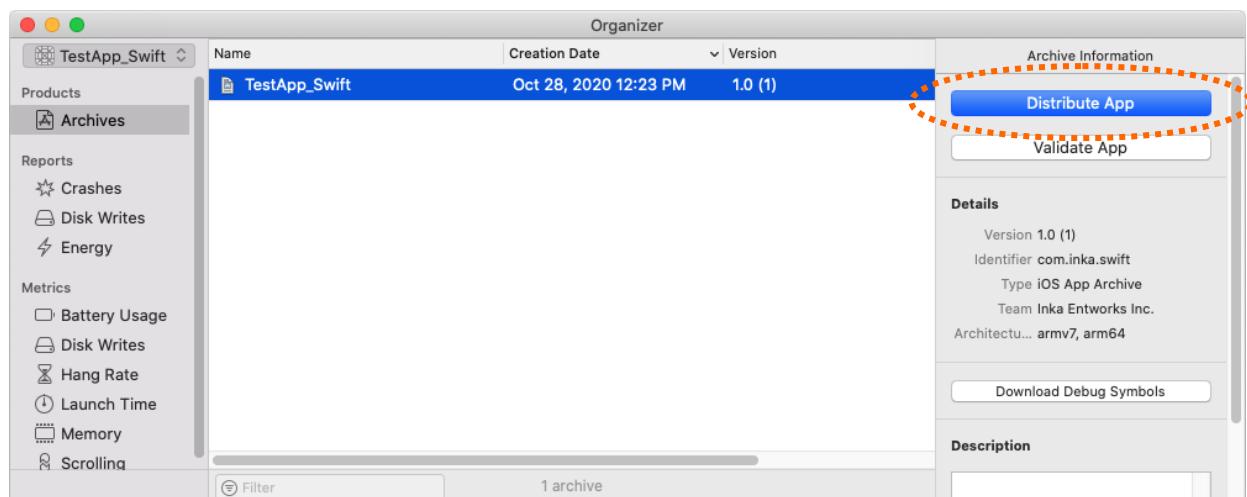
You will build the app as Release mode when distributing to the App Store. If you test AppSealing with Release mode, your app should be distributed to App Store or 'TestFlight'. If not, the executable file will be detected as not encrypted, so the app will be closed.

4-5 Generate App integrity & certificate verification snapshot

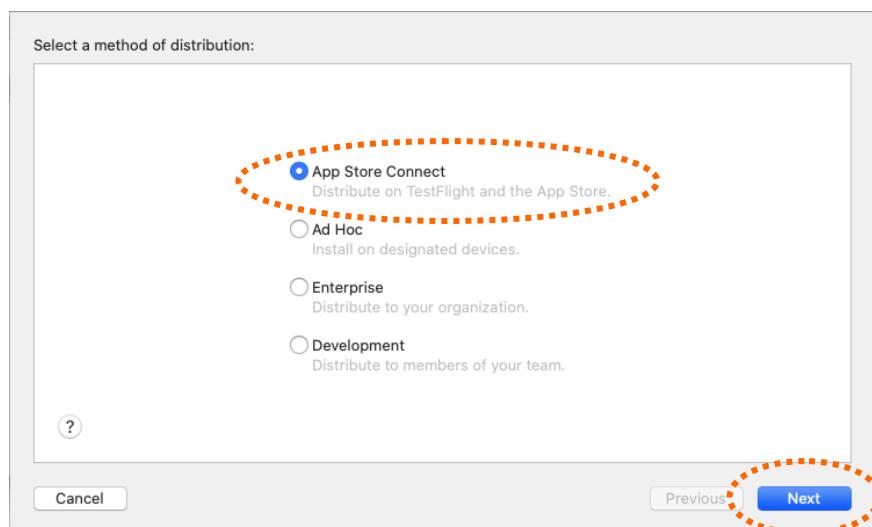
There is additional process to verify app integrity & certificate when you test your app or distribute app through app store. If you skip this step the app running on device will be terminated after few seconds for broken app integrity.

When distributing app built in Release mode through Development or Ad Hoc it will be terminated for security check which tells the executable has not encrypted by Fairplay DRM so skipping this step will have the same result, but **you should process this step when you distribute your app through TestFlight or App Store.**

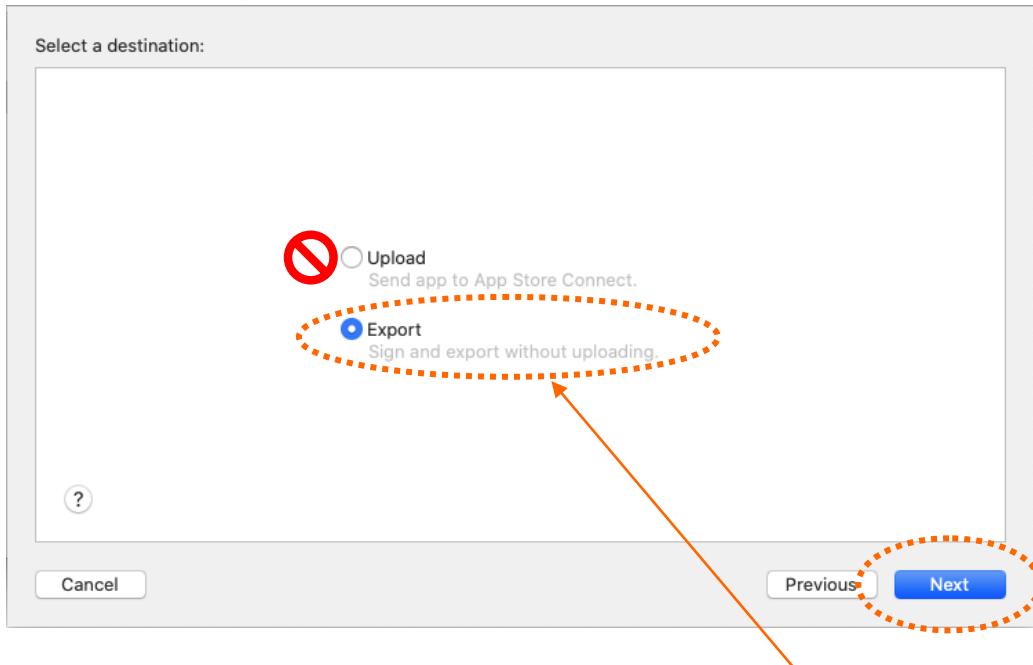
Let's see the upload process to App Store or TestFlight step by step. Below is Organizer window after Archive from Xcode.



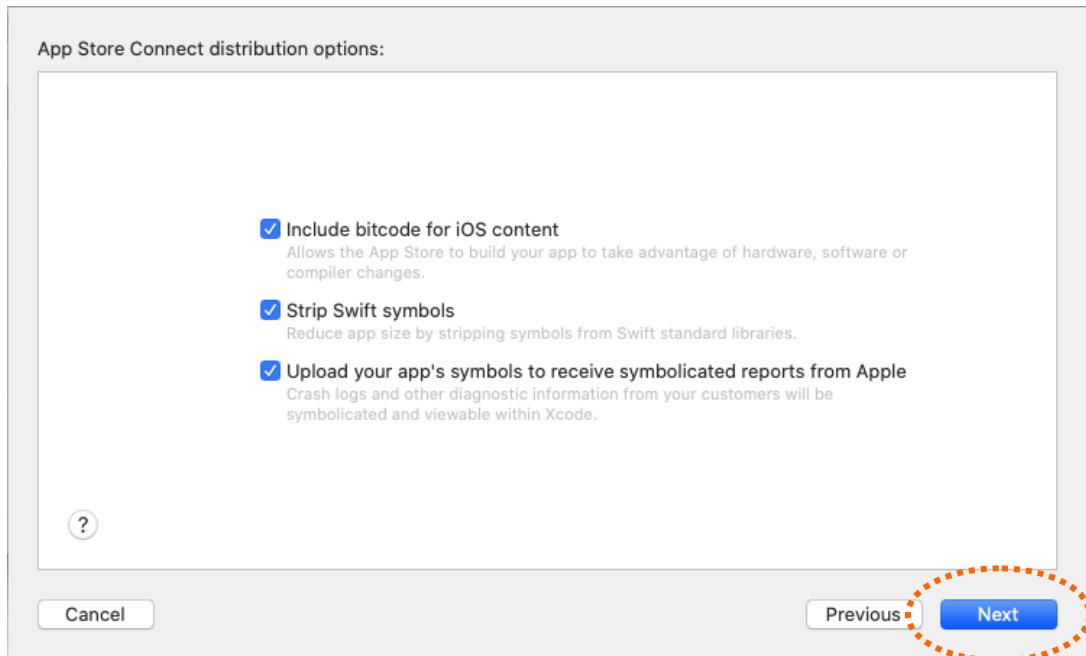
Click "Distribute App" button to generate IPA for uploading to App Store.



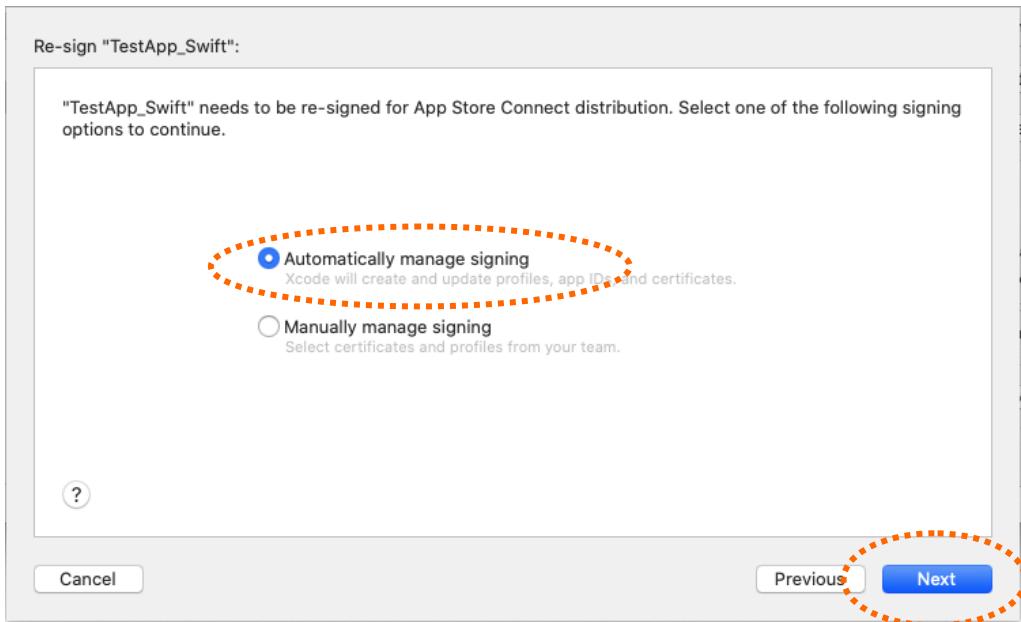
Click "Next" button with "App Store Connect" is selected.



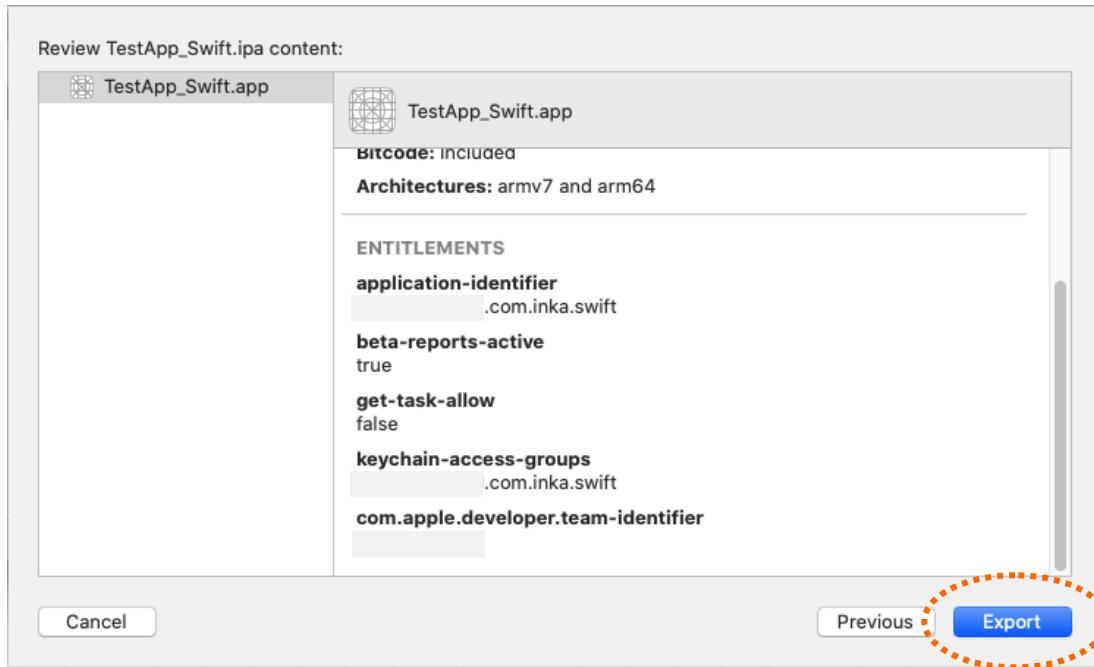
You usually selected "Upload" almost but you **must select "Export" to apply AppSealing**. This is because taking snapshot for app integrity and certificate is needed and your **app will not run normally on device without this process**. Click "Next" button with "Export" is selected.



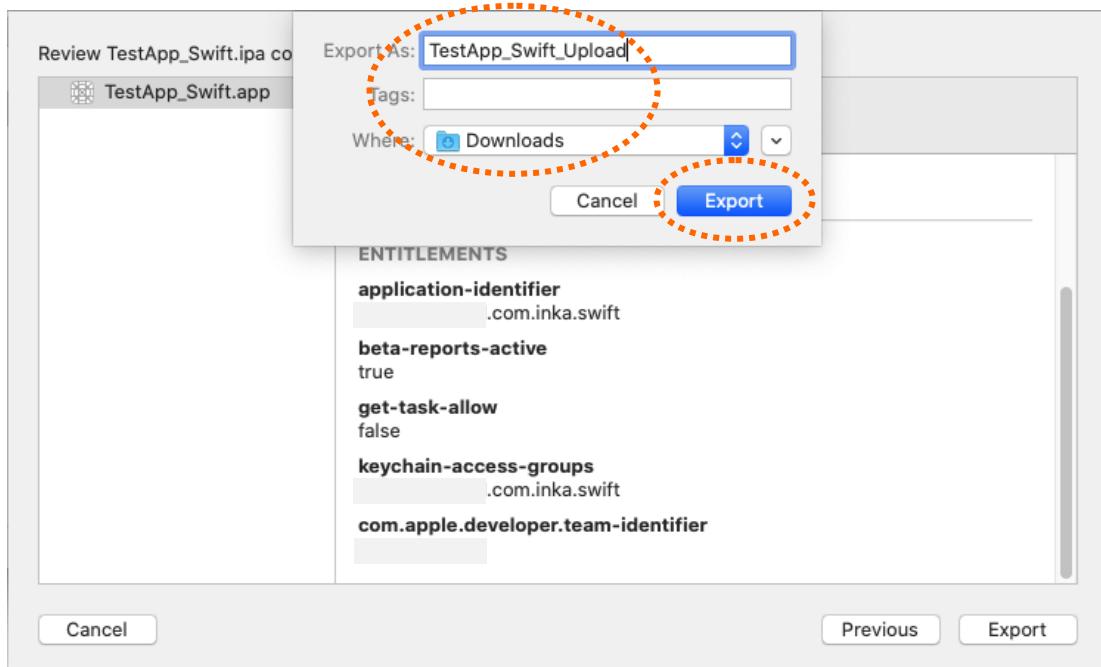
Click "Next" button with all options keep default.



With default options retained, click "Next" button. Then you can see the window from which you can export as an IPA.

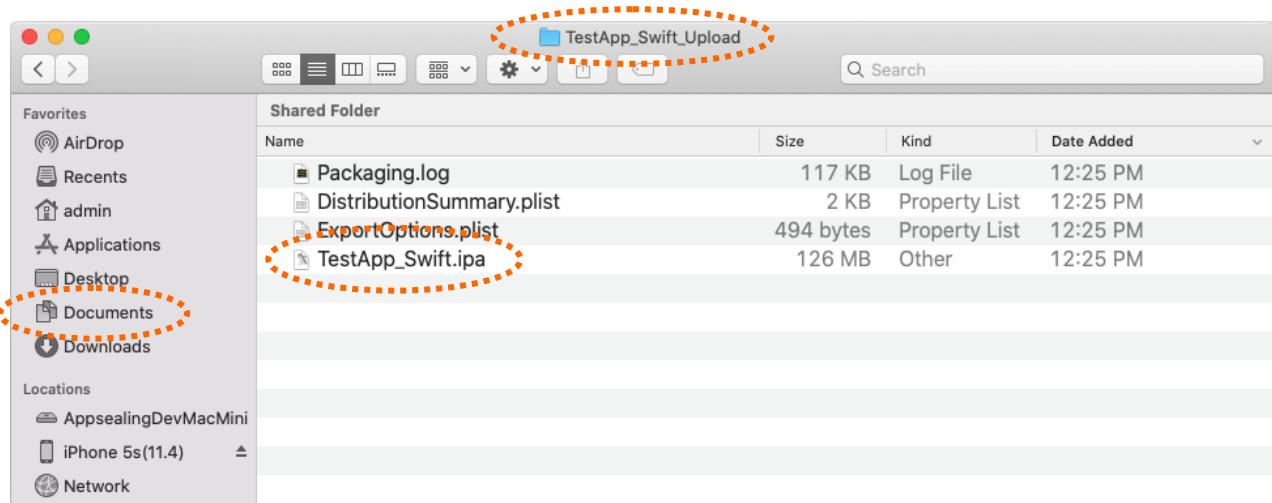


Verify the brief contents and click "Export" button.

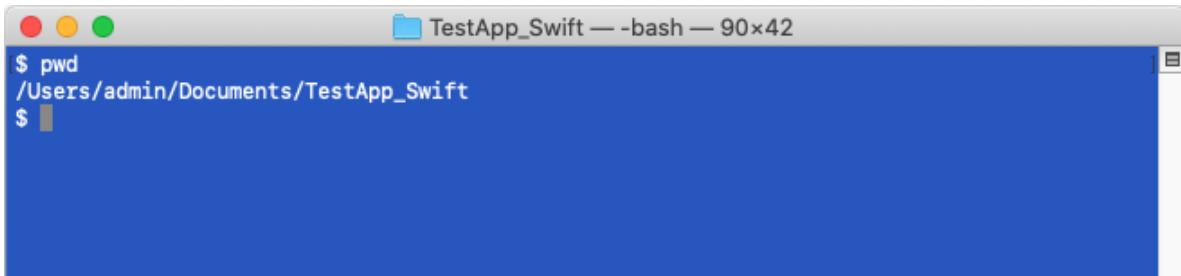


When destination dialog appear select store location and click "Export" button. This document used folder named "~/Downloads/TestApp_Swift_Upload"

After you've clicked "Export" button IPA file will be created at the designated folder. You can see the generated IPA file at finder like below. Now, you should keep in mind the location of IPA or remain finder widow opened.



Now you should process next step with exported IPA. Launch terminal app and move to Xcode project folder.



```
$ pwd  
/Users/admin/Documents/TestApp_Swift
```

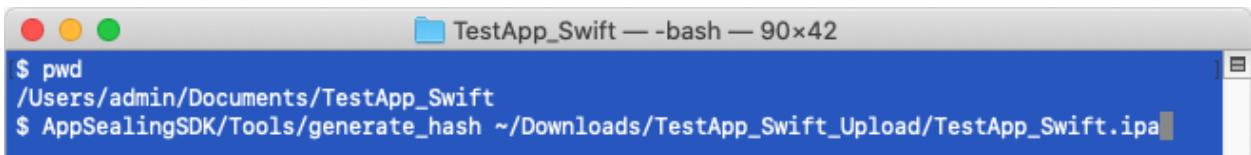
This document used project path for unity-exported Xcode project as "~/Documents/TestApp_Swift". You can verify the path name by pwd command like above picture.

Run add permission command like below.

```
$ chmod +x AppSealingSDK/Tools/*
```

Now you run 'generate_hash' script like below. This script has only one parameter which is path to the exported IPA file in previous step. You can type the IPA path manually or drag & drop the IPA file from the opened Finder window in previous step.

```
$ AppSealingSDK/Tools/generate_hash ~/Downloads/TestApp_Swift_Upload/TestApp_Swift.ipa
```



```
$ pwd  
/Users/admin/Documents/TestApp_Swift  
$ AppSealingSDK/Tools/generate_hash ~/Downloads/TestApp_Swift_Upload/TestApp_Swift.ipa
```

After you execute the script you will see the progress like below and snapshot for app integrity and certificate will be added to the IPA file.

```
$ AppSealingSDK/Tools/generate_hash ~/Downloads/TestApp_Swift_Upload/TestApp_Swift.ipa

AppSealing IPA Hash Generator V1.0 : provided by INKA Entworks

[Target IPA]      = /Users/admin/Downloads/TestApp_Swift_Upload/TestApp_Swift.ipa
[Working Directory] = /var/folders/vd/qcxck8j5171d3ztm4m0wzjb80000gn/T/AppSealing/384e5429bee14b96a8d43f46f2824797/

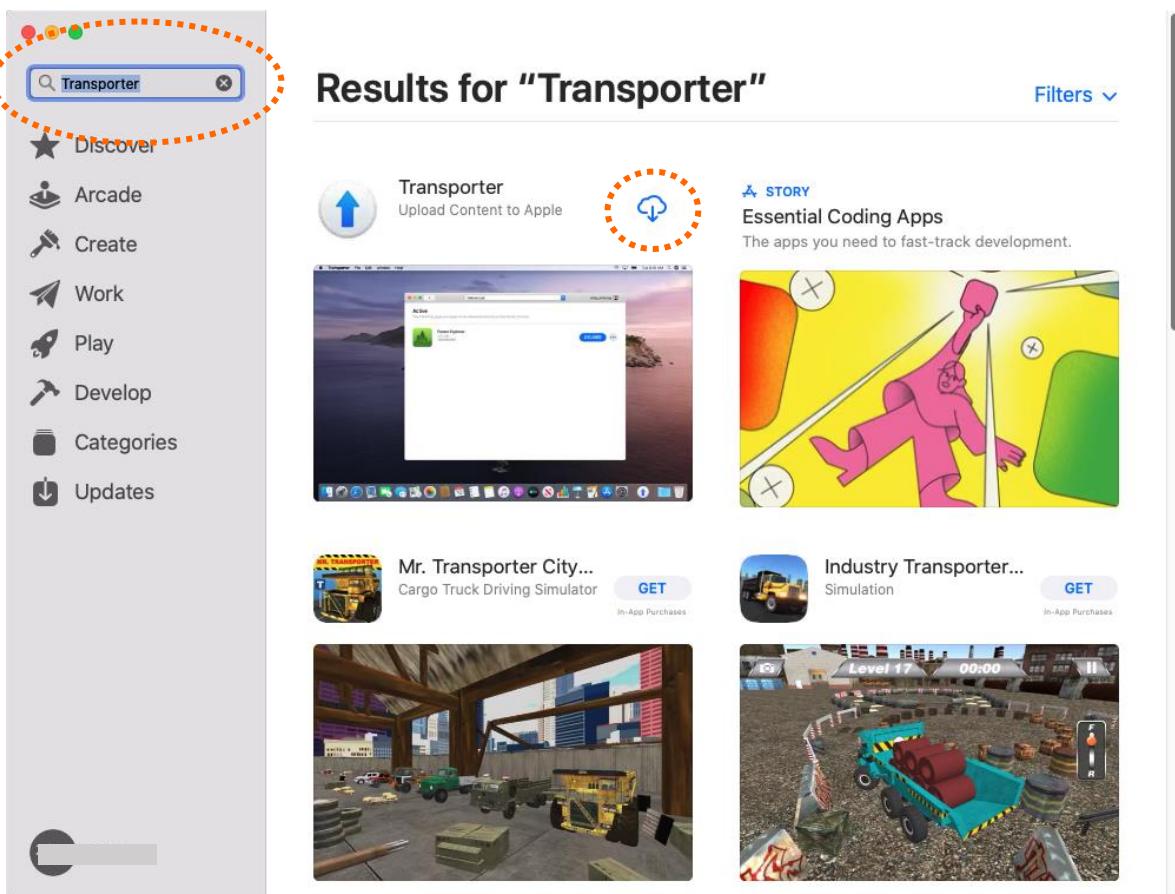
1. Payload has extracted from the IPA ...
2. Trying to receive encryption key from AppSealing server ...
3. Successfully received encryption key ...
4. Generating app integrity/certificate snapshot ...
Executable=/private/var/folders/vd/qcxck8j5171d3ztm4m0wzjb80000gn/T/AppSealing/384e5429bee14b96a8d43f46f2824797/Package/Payload/TestApp_Swift.app/TestApp_Swift
5. Encrypting app integrity/certificate snapshot ...
6. Inserting app integrity/certificate snapshot into IPA ...
7. Codesigning your app using certificate used to sign your IPA ...
Executable=/private/var/folders/vd/qcxck8j5171d3ztm4m0wzjb80000gn/T/AppSealing/384e5429bee14b96a8d43f46f2824797/Package/Payload/TestApp_Swift.app/TestApp_Swift
Certificate="Apple Distribution: Inka Entworks Inc. (██████)"
/var/folders/vd/qcxck8j5171d3ztm4m0wzjb80000gn/T/AppSealing/384e5429bee14b96a8d43f46f2824797/Package/Payload/TestApp_Swift.app/: replacing existing signature
8. Rebuilding & re-signing IPA ...

>>> All processes have done successfully .....
```

This process has to be applied to distribution step as "Ad Hoc", "Enterprise", "Development" identically.

4-6 Upload re-signed IPA to App Store Connect

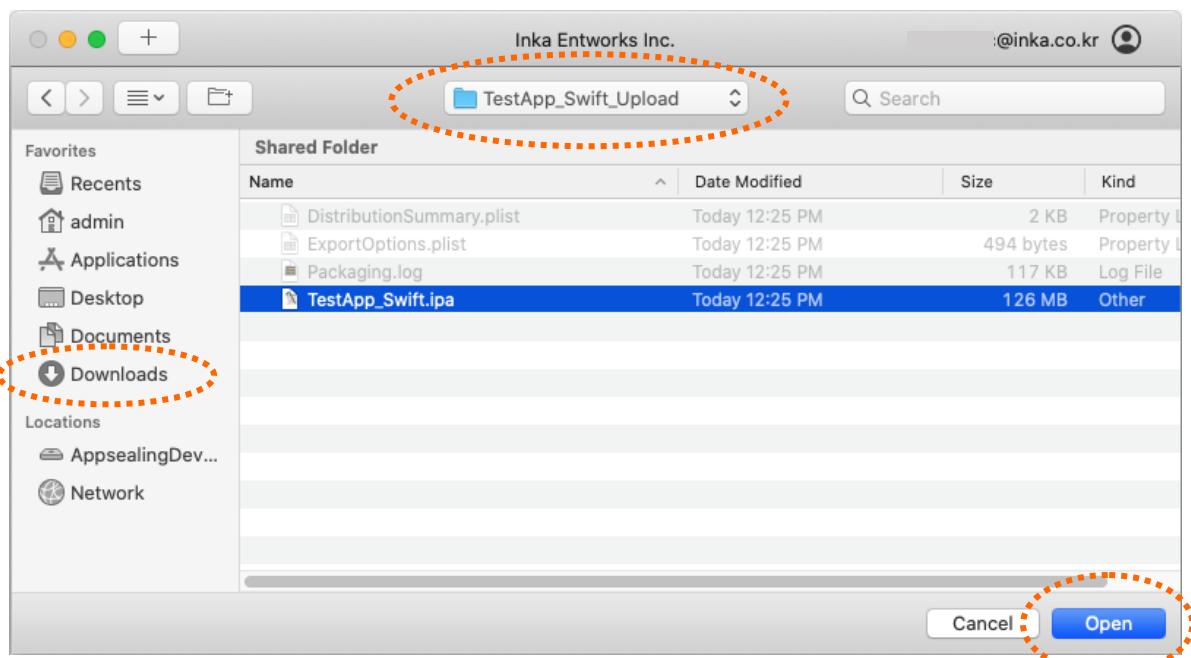
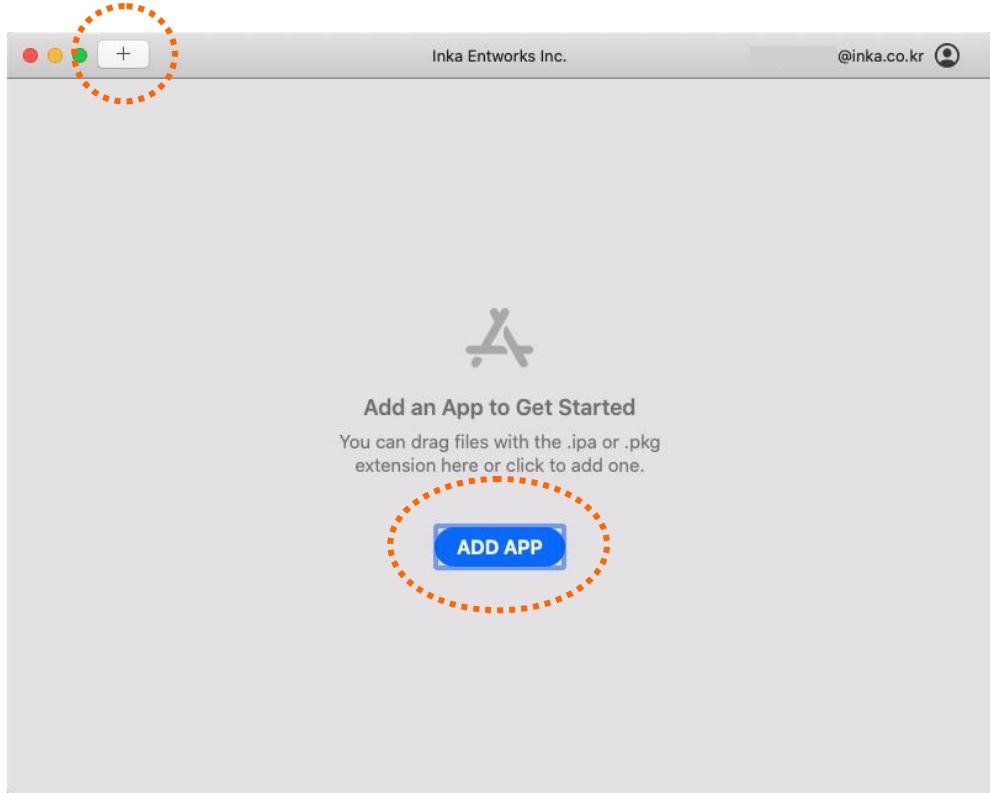
Now you can upload re-signed IPA to App Store Connect. This document uses Transporter app (MAC) for convenient uploading. If the Transporter app has not installed in your MAC you can open Mac AppStore, search "Transporter" and install.



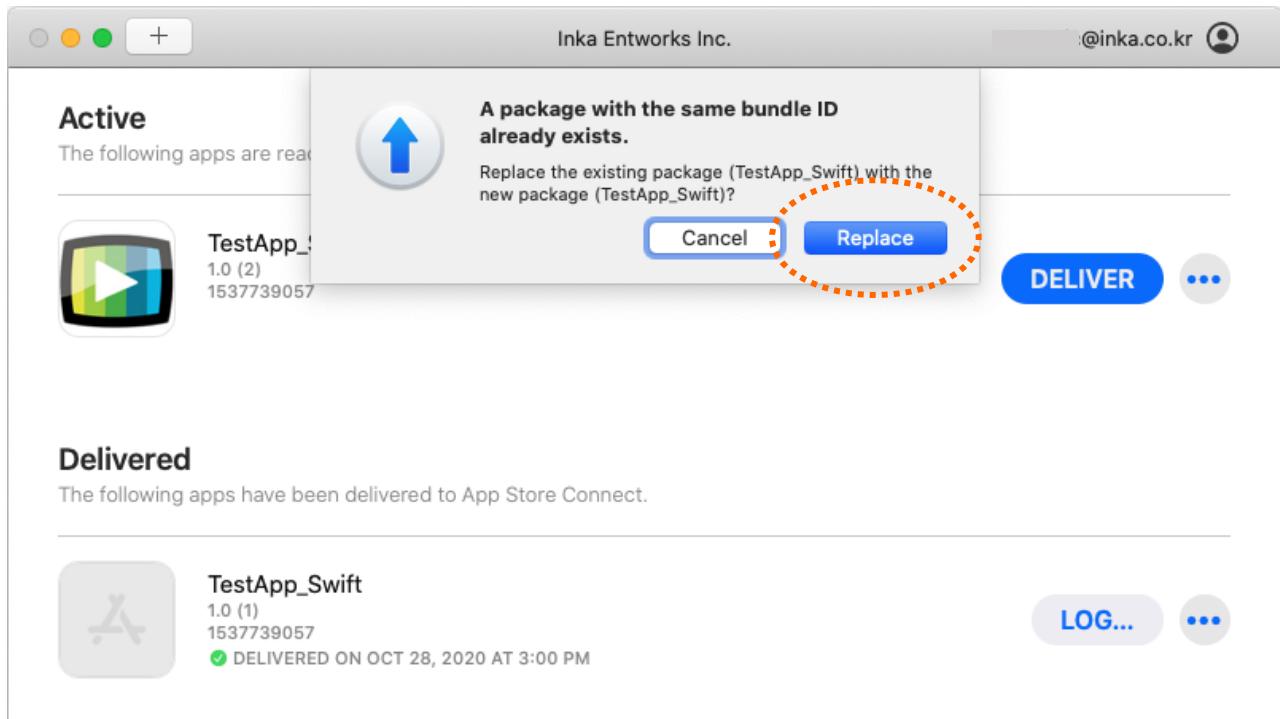
Launch Transporter after installation you are requested for Apple ID like below. Enter your Apple ID and password. (This step is required only once for the first time)



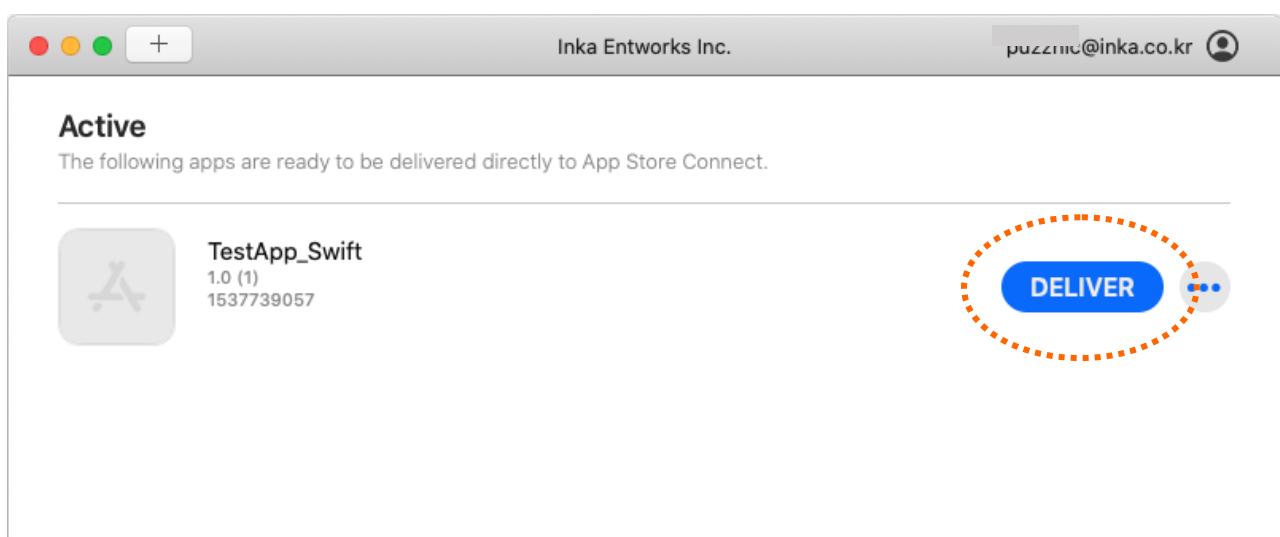
After you login with your ID and password you can see the Transporter window like below. Click the "+" button upper-left or "ADD APP" button in the middle to select IPA to be uploaded and select the re-signed IPA in previous step.

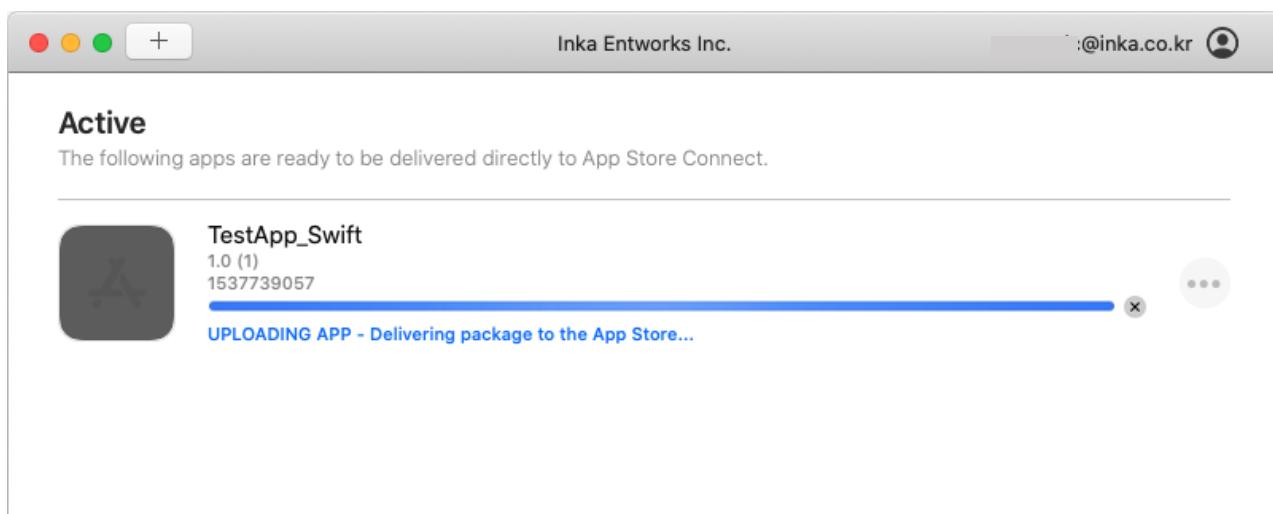
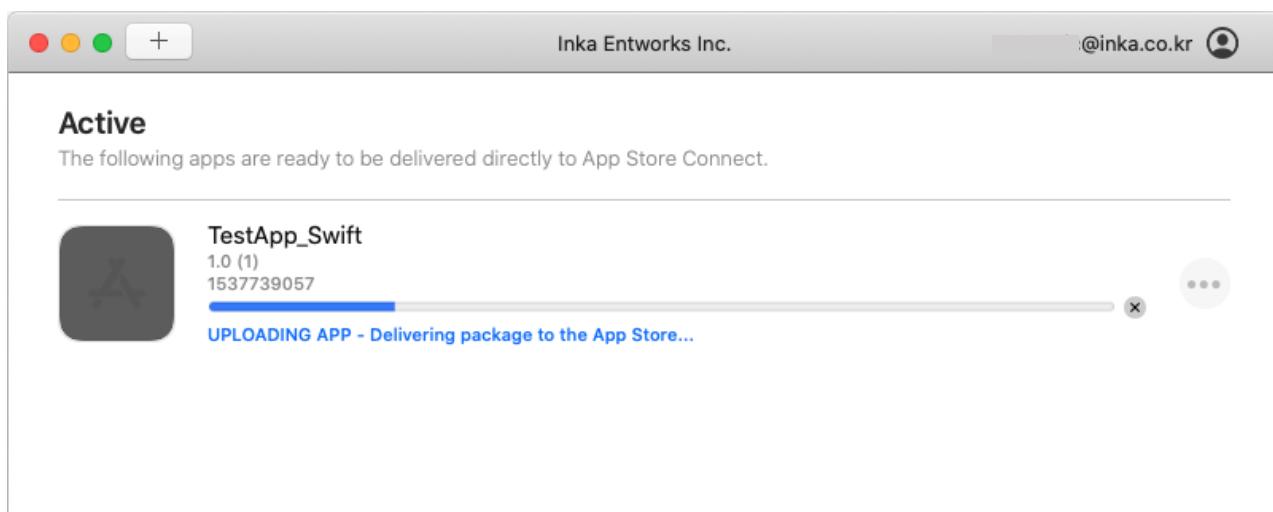
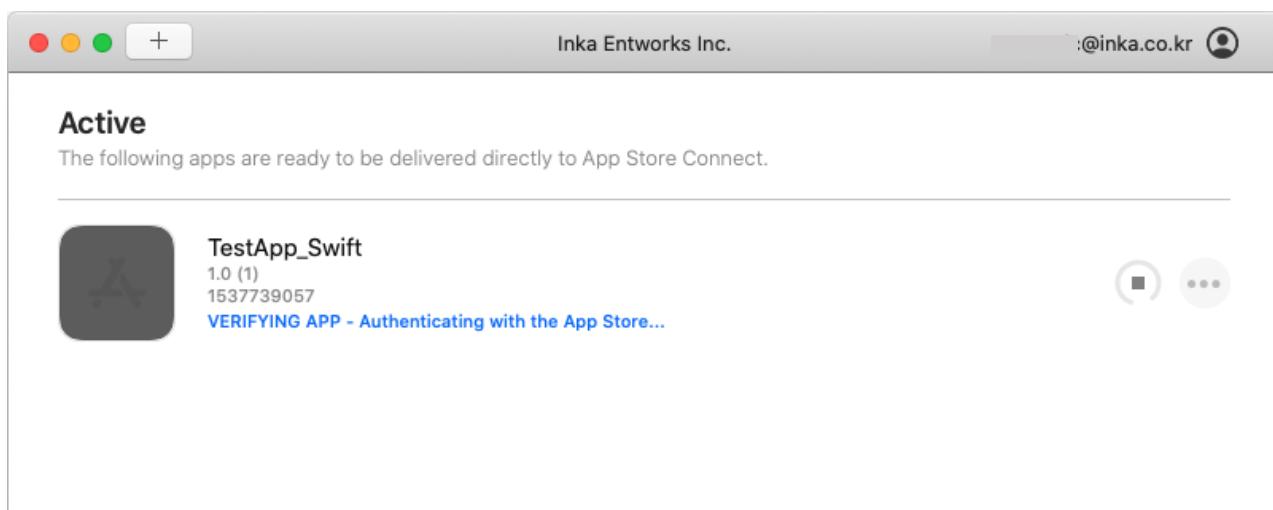


When you update your app by adding IPA file with new version or higher build number a warning dialog can appear like below because of same bundle ID. In this case just click "Replace" button to upload new IPA.

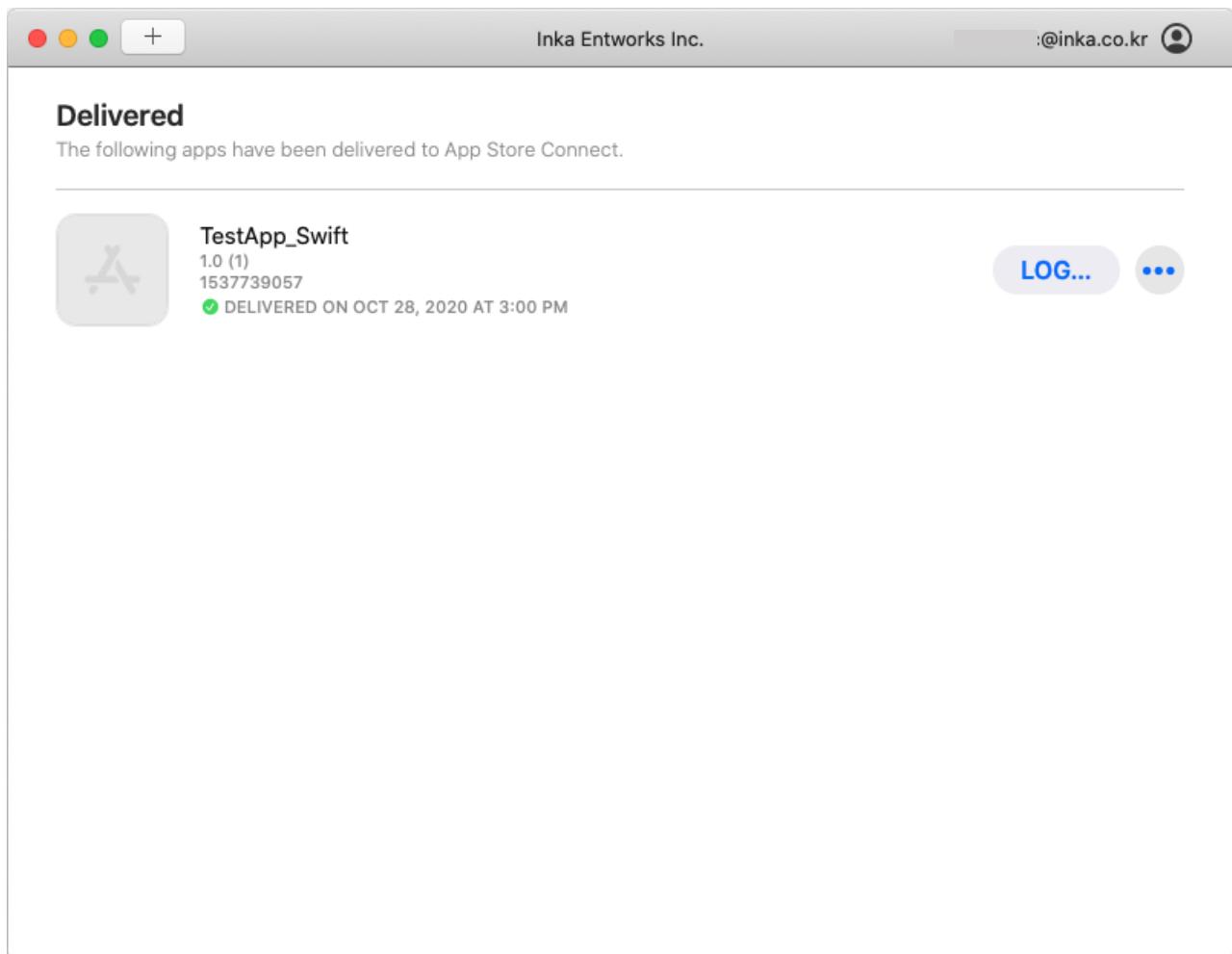


After IPA file has added, click "DELIVER" button then verifying and uploading to App Store Connect process will be in progress.





If you encounter below window the upload process has finished and you can submit your build for App Store review or TestFlight distribution.



Part 5. Acquire AppSealing device unique identifier

AppSealing SDK generates and manages unique identifier for each device. Customer who use the AppSealing SDK can use the interface of AppSealing to verify the device unique identifier, if necessary. And can be used for the business using the hacking data service provided by AppSealing.

5-1 Show acquire device unique identifier

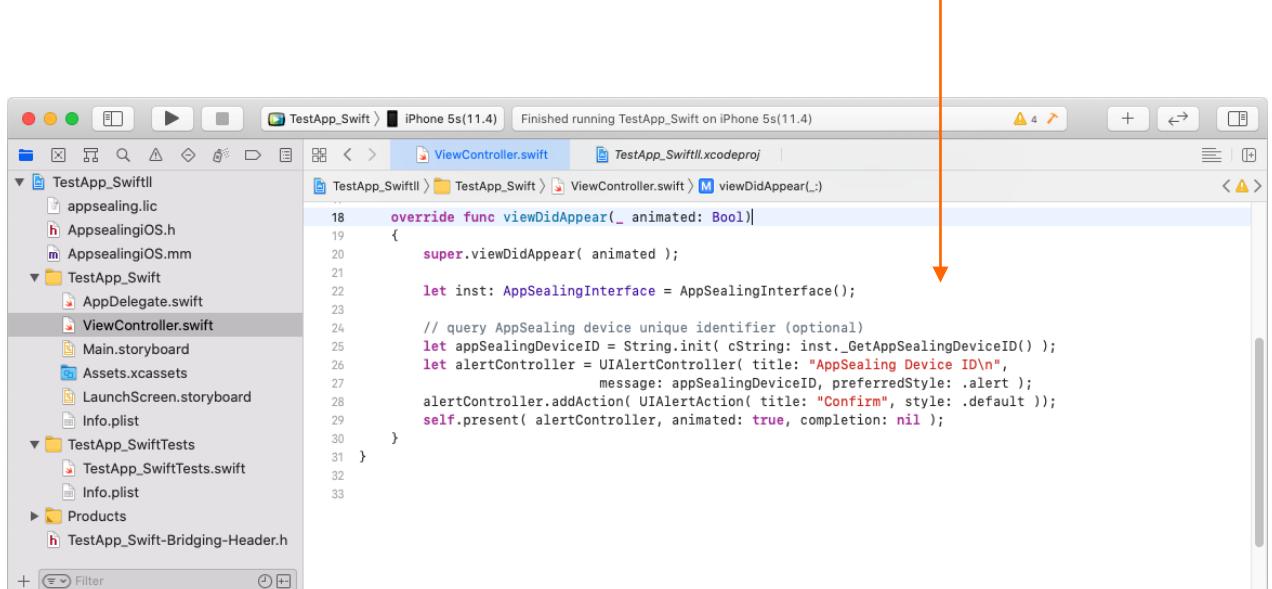
First, open your Xcode project and open "ViewController.swift" file. After you opened the swift file put following code into that (If ViewController.swift file has already included '`viewDidAppear`' method just insert the body of following code below '`super.viewDidAppear(animated)`;' line.)

Simple UI code into 'ViewController.swift' for **Swift** project

```
override func viewDidAppear(_ animated: Bool)
{
    super.viewDidAppear( animated );

    let inst: AppSealingInterface = AppSealingInterface();
    let appSealingDeviceID = String.init( cString: inst._GetAppSealingDeviceID() );
    let alertController = UIAlertController( title: "AppSealing DeviceID",
                                           message: appSealingDeviceID, preferredStyle: .alert );

    alertController.addAction( UIAlertAction( title: "Confirm", style: .default ) );
    self.present( alertController, animated: true, completion: nil );
}
```



Sample code is also included in "AppSealingiOS.mm" file so you can copy & paste in that file.

If your project is Objective-C based then you can use following code to show simple UI.

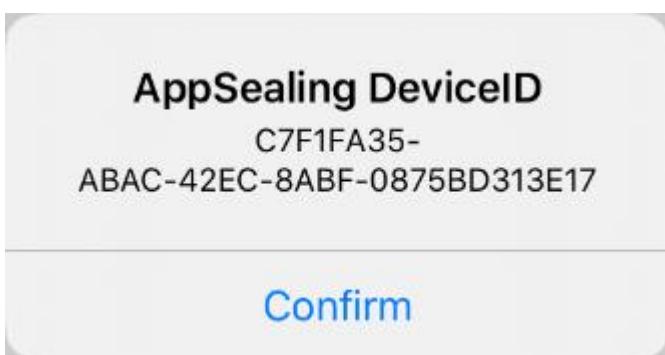
Simple UI code into 'ViewController.mm' for **Objective-C** project

```
#include "AppsealingiOS.h"

char _appSealingDeviceID[64];
- (void)viewDidAppear:(BOOL)animated
{
    [super viewDidAppear:animated];

    if ( ObjC_GetAppSealingDeviceID( _appSealingDeviceID ) == 0 )
    {
        UIAlertController *alert = [UIAlertController alertControllerWithTitle:@"AppSealing DeviceID"
                                                               message:[NSString alloc] initWithUTF8String:_appSealingDeviceID]
                                                               preferredStyle:UIAlertControllerStyleAlert];
        UIAlertAction *confirm = [UIAlertAction actionWithTitle:@"Confirm"
                                                       style:UIAlertActionStyleDefault
                                                       handler:^(UIAlertAction * _Nonnull action) { }];
        [alert addAction:confirm];
        [self presentViewController:alert animated:YES completion:nil];
    }
}
```

Your app will show simple alert box like below when you run your app.



Part 6. Enhanced jailbreak-detection using app server

6-1 Overview and Necessity of Enhanced Jailbreak Detection Method

One of the main functions within AppSealing SDK is detecting the environment of the jailbroken device and forcibly closes the app. However, there is a possibility that these detection functions will be bypassed by more sophisticated attack methods. This is because, due to the characteristics of the iOS operating system, the code of the loaded dynamic library (dylib) is executed first when the app is launched. An attacker may distribute the code to patch a specific area of the executable file in such a dynamic library.

If this code patch occurs before AppSealing's detection logic is executed, the code that terminates the app has been removed, so even if a jailbreak is detected, the app will remain running.

Of course, not everyone can perform this type of attack easily, but since this type of attack has been confirmed by a group of hackers with specialized hacking knowledge, AppSealing provides an additional jailbreak detection method to overcome such an attack situation.

Since the characteristic of this attack method is to change the code of the running app in advance, no matter how strong detection logic is added to the AppSealing library itself, the situation in which the code is patched by the dynamic library is unavoidable. Therefore, the newly provided jailbreak detection function does not detect in the app, but in a way that rejects all services and actions, such as log-in in or accepting API calls, in the case of a terminal suspected of being jailbroken in the server linked to the app.

The basic method is to obtain server credentials from the app through the AppSealing interface, add them to the existing authentication parameters, and send them to the server.

This method cannot be applied for a client-only app that does not work with the server.

The following sections describe, with example code, how to obtain and validate server credentials.

6-2 iOS App Code

Additional process of your app needs verify the server credentials is to call a function in the AppSealing SDK to get the server credential string and send it to the server along with the existing authentication parameters.

Most apps that work with the server will go through a user authentication or login process, and in this process, the account information entered by the user will be transmitted to the server. You can add the server credential string to the parameters you send to the server.

The server credential string is obtained in the following way:

Simple UI code into 'ViewController.swift' for **Swift** project

```
func userLogin( userID: String, password: String ) -> Bool
{
    let inst: AppSealingInterface = AppSealingInterface();
    let appSealingCredential = String.init( cString: inst._GetEncryptedCredential() );
    // credential 값을 인증 정보와 함께 서버로 올린다
    let loginResult = processLogin( user: userID, pwd: password, credential: appSealingCredential );
    ...
}
```

Simple UI code into 'ViewController.mm' for **Objective-C** project

```
- (BOOL)userLogin:(NSString*)userID withPassword:(NSString*)password
{
    char _appSealingCredential[290] = { 0, };
    ObjC_GetEncryptedCredential( _appSealingCredential );
    // credential 값을 인증 정보와 함께 서버로 올린다
    BOOL loginResult = processLogin( userID, password, _appSealingCredential );
    ...
}
```

If your server fails to validate credential, you should also force the login to fail and the app to not proceed further. However, since code such as checking the login result and closing the app is likely to be tampered by an attacker, the best practice is configuring your server to deny service or response for any requests from that client after the server fails credential validation.

This will be discussed again in the next section.

6-3 Verification at app server

The credential data (hex string) returned from the interface call to the AppSealing module is only valid when the security logic inside AppSealing is normally performed and no dangerous situation is detected in the device.

If code patch attack is made through the dynamic library or the security logic is bypassed by other methods, valid credential data will not be generated, so the server should verify this value and blocks the attack situation of the device.

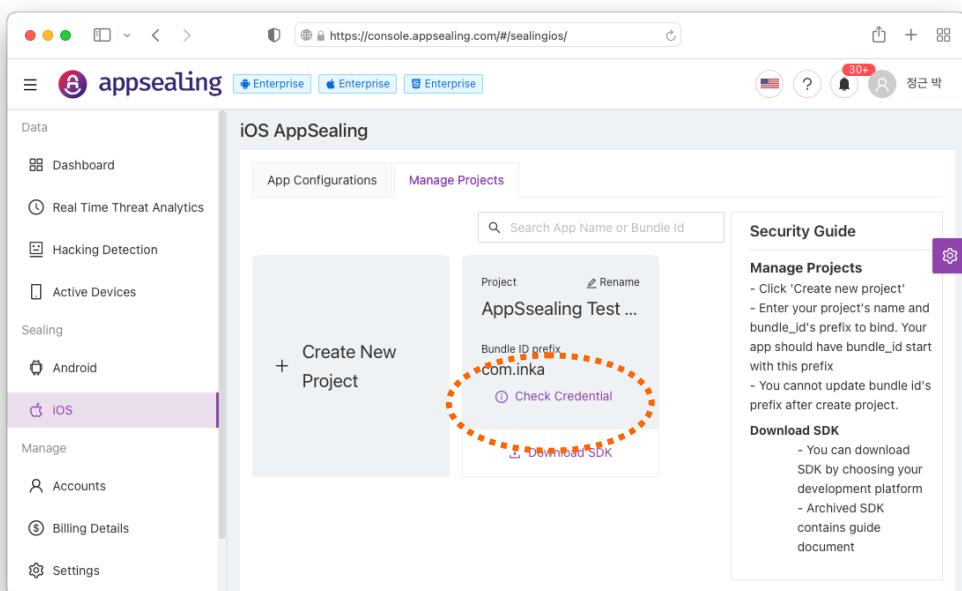
The app server must check whether the credential value sent by the client (app) is correct, and if it is not correct, it must deny authentication (login) and then deny any services (API call) requested by that client.

[Preparation]

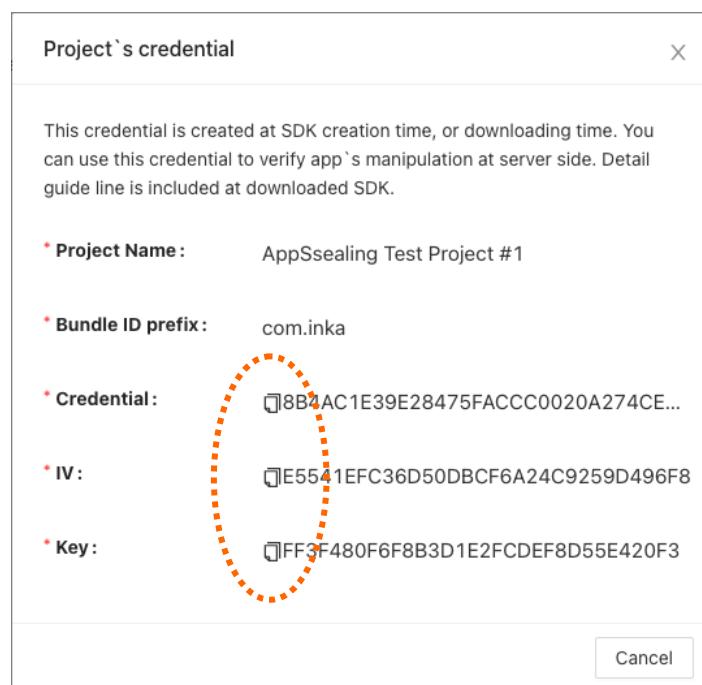
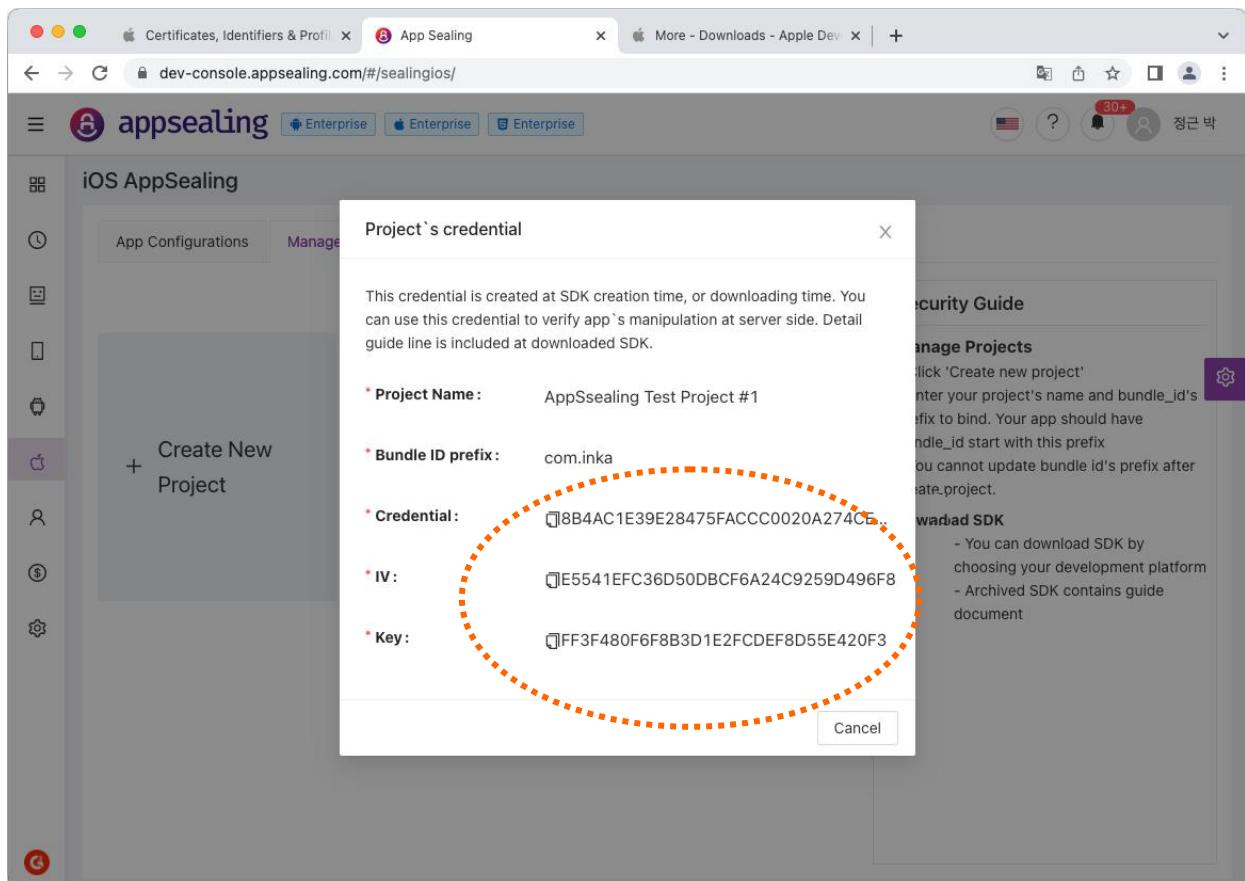
To verify credential data on the server, you need an AES Key and IV to decrypt the data sent from the client, and the original credential data to compare and verify.

All of these values can be acquired through the "Check Credential" button of the project in the ADC. Just copy the Hex string shown here and paste it into the example code and use it. First, connect to ADC as shown in the screen below and click the "Check Credential" button in the project box.

If you click the button, the following window is displayed, where you can check the Credential value and IV and key to be used for decryption. You can use the copy button to the left of the string to copy this value as it is, paste it into the server-side verification code and use it.



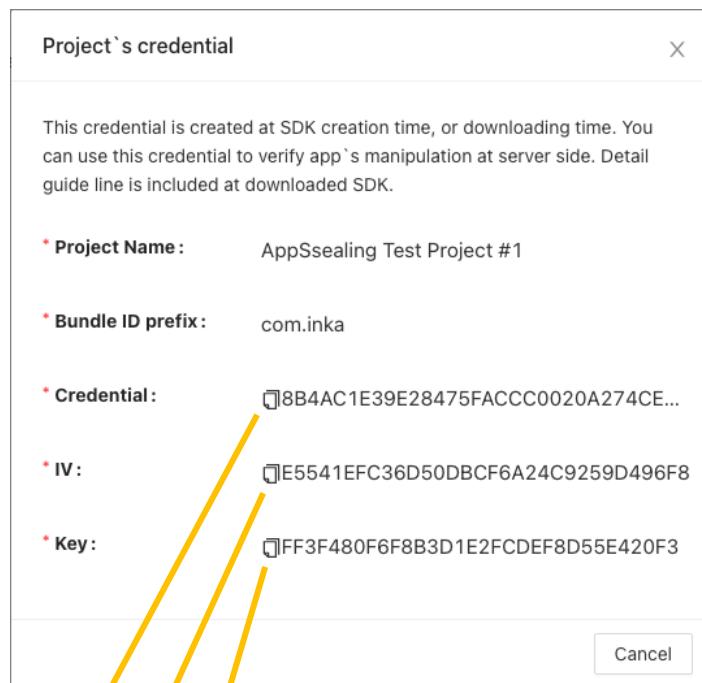
If you click the button, the following window is displayed, where you can check the Credential value and IV and AES key to be used for decryption. You can use the copy button to the left of the string to copy this value as it is, paste it into the server-side verification code and use it.



[In case your server code is using Node.js/Javascript]

Add following code to your existing code and use it for credential data validation. Authenticity can be determined by passing the credential value sent as a parameter in the login or authentication function of the existing server code to the verifyAppSealingCredential function provided in the code below. (The code below is also included in the SDK as a file named appsealing_credential.js).

**** Note: In the code below, ORG_CREDENTIAL, AES_IV, and AES_KEY must be replaced with values obtained through the "Check Credential" function of the corresponding project in the ADC. If you just take the example code and use it intactly, credential value will not be verified properly.**



```
var crypto = require('crypto');

function verifyAppSealingCredential( credential )
{
    // Need to Change : Get From ADC (via 'Check Credential') -----
    const ORG_CREDENTIAL =
"572E0E1459453F2078D6576FF71ECD0DBCA0484430C7FA7FE45B788A37DE3A04204F5A55FEA83AC9AFBA2C688594F75A3828B23972DB34858EC4F6CC3202533E44121
E5F2614B227E18B6419A83810F7511D5E51FCACD5175A1CC550F83CB874A7378ACDAFE78EB2E329CD5D3C384061C4669674F1EE6B1B59FB7D91835DB7EE";
    const AES_IV = "055772B7434A4174749A09B1413472";
    const AES_KEY = "71CA94A64A4DEBF5566495AB03F6798F";
    //-----
}
```

```
// convert credential from hex string to byte array
let decrypted_UTC = 0, decrypted_buffer, aes_key2;

// decrypt UTC
try
{
    const decipher = crypto.createDecipheriv( 'aes-128-ctr', Buffer.from( AES_KEY, 'hex' ), Buffer.from( AES_IV, 'hex' ) );
    decrypted_buffer = Buffer.concat( [decipher.update( credential.substr( 0, 32 ), 'hex' ), decipher.final()] );
    decrypted_UTC = decrypted_buffer.slice( 0, 8 ).readUInt32LE();
}
catch( error )
{
    throw error;
}

// verify UTC with current time (+/-) 10sec
const current_UTC = parseInt( Date.now() / 1000 ); // get current UTC in seconds
if ( Math.abs( current_UTC - decrypted_UTC ) > 10 )
{
    console.log( "Invalid UTC value has sent, deny login & all services for this client..." + Math.abs( current_UTC - decrypted_UTC ) );
    return false;
}
console.log( "*** UTC verified : " + decrypted_UTC + " (current = " + current_UTC + ", diff = " + Math.abs( current_UTC - decrypted_UTC ) + ")" );

// get AES KEY2
aes_key2 = Buffer.concat( [new Uint8Array( decrypted_buffer.slice( 0, 8 )), new Uint8Array( Buffer.from( ORG_CREDENTIAL.substring( 52, 52 + 16 ), 'hex' ) )] );
for( let i = 0; i < 16; i++ )
    aes_key2[i] ^= Buffer.from( AES_IV.substring( i * 2, i * 2 + 2 ), 'hex' ).readUInt8();

// decrypt credential
let decrypted_credential = [];
try
{
    const decipher = crypto.createDecipheriv( 'aes-128-ctr', aes_key2, Buffer.from( AES_IV, 'hex' ) );
    decrypted_credential = Buffer.concat( [decipher.update( credential.substr( 32, 256 ), 'hex' ), decipher.final()] );
}
catch( error )
{
    throw error;
}

// verify credential with CREDENTIAL(ADC)
// return if fail
if ( ORG_CREDENTIAL.toLowerCase() != decrypted_credential.toString( 'hex' ).toLowerCase() )
{
    console.log( "Invalid credential value has sent, deny login & all services for this client..." );
    return false;
}

console.log( "*** Credential verified : PASS" );
return true;
}
```

[In case your server code is using Java]

Add following code to your existing code and use it for credential data validation. Authenticity can be determined by passing the credential value sent as a parameter in the login or authentication function of the existing server code to the verifyAppSealingCredential function provided in the code below. (The code below is also included in the SDK as a file named appsealing_credential.java).

**** Note: In the code below, ORG_CREDENTIAL, AES_IV, and AES_KEY must be replaced with values obtained through the "Check Credential" function of the corresponding project in the ADC. If you just take the example code and use it intactly, credential value will not be verified properly.**

```
import java.nio.ByteBuffer;
import java.nio.ByteOrder;
import java.util.Arrays;

import javax.crypto.Cipher;
import javax.crypto.spec.IvParameterSpec;
import javax.crypto.spec.SecretKeySpec;
import javax.xml.bind.DatatypeConverter;

public class AppSealingCredential
{
    private static boolean verifyAppSealingCredential( final String credential )
    {
        // Need to Change : Get From ADC (via 'Check Credential') -----
        final String ORG_CREDENTIAL =
"572E0E145945F2078D6576FF71ECD0DBCA0484430C7FA7FE45B788A37DE3A04204F5A55FEA83AC9AFBA2C688594F75A3828B23972DB34858EC4F6CC
3202533E44121E5F2614B227E18B6419A83810F7511D5E51FCACD5175A1CC550F83CB874A7378ACDAFE78EB2E329CD5D3C384061C4669674F1EE6B1B5
9FB7D91835DB7EE";

        final String AES_IV = "055772B7434A4174749AFE09B1413472";
        final String AES_KEY = "71CA94A64A4DEBF5566495AB03F6798F";
        //-----

        long decrypted_UTC = 0;
        byte[] decryptedUTC = new byte[8];

        // decrypt UTC
        try
        {
            SecretKeySpec key = new SecretKeySpec( DatatypeConverter.parseHexBinary( AES_KEY ), "AES" );
            IvParameterSpec ivSpec = new IvParameterSpec( DatatypeConverter.parseHexBinary( AES_IV ) );

            Cipher cipher = Cipher.getInstance( "AES/CTR/NoPadding" );
            cipher.init( Cipher.DECRYPT_MODE, key, ivSpec );

            byte[] encryptedUTC = DatatypeConverter.parseHexBinary( credential.substring( 0, 32 ) );
            System.arraycopy( cipher.doFinal( encryptedUTC ), 0, decryptedUTC, 0, 8 );
            System.out.println( DatatypeConverter.printHexBinary( decryptedUTC ) );
        }
    }
}
```

```

        decrypted_UTC = ByteBuffer.wrap( decryptedUTC ).order( ByteOrder.LITTLE_ENDIAN ).getInt() & 0xFFFFFFFFL;
    }
    catch( Exception e )
    {
        System.out.println( "[Error] " + e.getLocalizedMessage() );
    }

    // verify UTC with current time (+/-) 10sec
    long current_UTC = System.currentTimeMillis() / 1000; // get current UTC in seconds

    if ( Math.abs( current_UTC - decrypted_UTC ) > 10 )
    {
        System.out.println( "Invalid UTC value has sent, deny login & all services for this client..." );
        return false;
    }
    System.out.println( "*** UTC verified : " + decrypted_UTC + " (current = " + current_UTC + ", diff = " +
Math.abs( current_UTC - decrypted_UTC ) + ")" );

    // get AES KEY2
    byte[] aes_key2 = Arrays.copyOf( decryptedUTC, 16 );
    byte[] xor = DatatypeConverter.parseHexBinary( ORG_CREDENTIAL.substring( 52, 52 + 16 ) );
    System.arraycopy( xor, 0, aes_key2, decryptedUTC.length, xor.length );

    for( int i = 0; i < 16; i++ )
        aes_key2[i] ^= ( byte )DatatypeConverter.parseHexBinary( AES_IV.substring( i * 2, i * 2 + 2 )[0] );
    System.out.println( DatatypeConverter.printHexBinary( aes_key2 ) );

    // decrypt credential
    byte[] decrypted_credential = null;
    try
    {
        SecretKeySpec key = new SecretKeySpec( aes_key2, "AES" );
        IvParameterSpec ivSpec = new IvParameterSpec( DatatypeConverter.parseHexBinary( AES_IV ) );

        Cipher cipher = Cipher.getInstance( "AES/CTR/NoPadding" );
        cipher.init( Cipher.DECRYPT_MODE, key, ivSpec );

        System.out.println( "##### " + credential.substring( 32, 32 + 256 ) );
        byte[] encrypted_credential = DatatypeConverter.parseHexBinary( credential.substring( 32, 32 + 256 ) );
        decrypted_credential = cipher.doFinal( encrypted_credential );
    }
    catch( Exception e )
    {
        System.out.println( "[Error] " + e.getLocalizedMessage() );
    }

    // verify credential with CREDENTIAL(ADC)
    // return if fail
    if ( !ORG_CREDENTIAL.equalsIgnoreCase( DatatypeConverter.printHexBinary( decrypted_credential ) ) )
    {
        System.out.println( "Invalid credential value has sent, deny login & all services for this client..." );
        return false;
    }

    System.out.println( "*** Credential verified : PASS" );
    return true;
}
}

```

[In case your server code is using ASP.NET / C#]

Add following code to your existing code and use it for credential data validation. Authenticity can be determined by passing the credential value sent as a parameter in the login or authentication function of the existing server code to the verifyAppSealingCredential function provided in the code below. (The code below is also included in the SDK as a file named appsealing_credential.cs, because C# does not support AES CTR mode, you must include the AesCtrTransform function for CTR processing as shown in the code below.)

**** Note: In the code below, ORG_CREDENTIAL, AES_IV, and AES_KEY must be replaced with values obtained through the "Check Credential" function of the corresponding project in the ADC. If you just take the example code and use it intactly, credential value will not be verified properly.**

```
using System;
using System.Collections.Generic;
using System.IO;
using System.Linq;
using System.Security.Cryptography;
using System.Text;
using System.Threading.Tasks;

namespace AppSealingSDK
{
    class AppSealingCredential
    {
        public static void AesCtrTransform( byte[] key, byte[] salt, Stream inputStream, Stream outputStream )
        {
            SymmetricAlgorithm aes = new AesManaged { Mode = CipherMode.ECB, Padding = PaddingMode.None };

            int blockSize = aes.BlockSize / 8;
            if ( salt.Length != blockSize )
                throw new ArgumentException( "Salt size must be same as block size " + $"(actual: {salt.Length}, expected: {blockSize})" );

            byte[] counter = ( byte[] )salt.Clone();

            Queue<byte> xorMask = new Queue<byte>();
            var zeroIv = new byte[blockSize];
            ICryptoTransform counterEncryptor = aes.CreateEncryptor( key, zeroIv );

            int b;
            while(( b = inputStream.ReadByte() ) != -1 )
            {
                if ( xorMask.Count == 0 )
                {
                    var counterModeBlock = new byte[blockSize];
```

```

        counterEncryptor.TransformBlock( counter, 0, counter.Length, counterModeBlock, 0 );

        for( var i2 = counter.Length - 1; i2 >= 0; i2-- )
        {
            if ( ++counter[i2] != 0 )
                break;
        }
        foreach( var b2 in counterModeBlock )
            xorMask.Enqueue( b2 );
    }

    var mask = xorMask.Dequeue();
    outputStream.WriteByte((( byte )(( ( byte )b ) ^ mask )));
}

public static byte[] StringToByteArray( String hex )
{
    return Enumerable.Range( 0, hex.Length / 2 ).Select( x => Convert.ToByte( hex.Substring( x * 2, 2 ), 16 ) ).ToArray();
}

public static bool VerifyAppSealingCredential( String credential )
{
    // Need to Change : Get From ADC (via 'Check Credential') -----
    const String ORG_CREDENTIAL =
"572E0E1459453F2078D6576FF71ECD0DBCA0484430C7FA7FE45B788A37DE3A04204F5A55FEA83AC9AFBA2C688594F75A3828B23972DB34858EC4F6CC
3202533E44121E5F2614B227E18B6419A83810F7511D5E51FCACD5175A1CC550F83CB874A7378ACDAFE78EB2E329CD5D3C384061C4669674F1EE6B1B5
9FB7D91835DB7EE";

    const String AES_IV  = "055772B7434A4174749AFE09B1413472";
    const String AES_KEY = "71CA94A64A4DEBF5566495AB03F6798F";
    //-----

    long decrypted_UTC = 0;
    byte[] decrypted_buffer = new byte[8];

    // decrypt UTC
    try
    {
        byte[] encrypted_UTC = StringToByteArray( credential.Substring( 0, 32 ) );
        byte[] result = new byte[16];
        AesCtrTransform( StringToByteArray( AES_KEY ), StringToByteArray( AES_IV ), new MemoryStream( encrypted_UTC ), new MemoryStream( result ) );
        Array.Copy( result, 0, decrypted_buffer, 0, 8 );
        decrypted_UTC = BitConverter.ToInt64( decrypted_buffer, 0 );
        System.Console.WriteLine( "*** UTC = " + decrypted_UTC );
    }
    catch( Exception e )
    {
        System.Console.WriteLine( "[Error] " + e.Message );
    }

    // verify UTC with current time (+/-) 10sec
    long current_UTC = DateTimeOffset.Now.ToUnixTimeMilliseconds() / 1000;// get current UTC in seconds
    if ( Math.Abs( current_UTC - decrypted_UTC ) > 10 )
    {
        System.Console.WriteLine( "Invalid UTC value has sent, deny login & all services for this client..." );
        return false;
    }
    System.Console.WriteLine( "*** UTC verified : " + decrypted_UTC + " (current = " + current_UTC + ", diff = " + Math.Abs( current_UTC - decrypted_UTC ) + ")" );
}

```

```
// get AES KEY2
byte[] aes_key2 = new byte[16];
Array.Copy( decrypted_buffer, 0, aes_key2, 0, 8 );
byte[] xor = StringToByteArray( ORG_CREDENTIAL.Substring( 52, 16 ) );
Array.Copy( xor, 0, aes_key2, decrypted_buffer.Length, xor.Length );

for(int i = 0; i< 16; i++ )
    aes_key2[i] ^= ( byte )StringToByteArray( AES_IV.Substring( i* 2, 2 ))[0];

// decrypt credential
byte[] decrypted_credential = null;
try
{
    byte[] encrypted_credential = StringToByteArray( credential.Substring( 32, 256 ) );
    decrypted_credential = new byte[encrypted_credential.Length];
    AesCtrTransform( aes_key2, StringToByteArray( AES_IV ), new MemoryStream( encrypted_credential ), new
MemoryStream( decrypted_credential ) );
}
catch(Exception e )
{
    System.Console.WriteLine( "[Error] " + e.Message );
}

// verify credential with CREDENTIAL(ADC)
// return if fail
if ( !ORG_CREDENTIAL.Equals( BitConverter.ToString( decrypted_credential ).Replace( "-", "" ),
StringComparison.InvariantCultureIgnoreCase ) )
{
    System.Console.WriteLine( "Invalid credential value has sent, deny login & all services for this
client..." );
    return false;
}

System.Console.WriteLine( "** Credential verified : PASS" );
return true;
}
```

[In case your server code is using python]

Add following code to your existing code and use it for credential data validation. Authenticity can be determined by passing the credential value sent as a parameter in the login or authentication function of the existing server code to the verifyAppSealingCredential function provided in the code below. (The code below is also included in the SDK as a file named appsealing_credential.py)

**** Note: In the code below, ORG_CREDENTIAL, AES_IV, and AES_KEY must be replaced with values obtained through the "Check Credential" function of the corresponding project in the ADC. If you just take the example code and use it intactly, credential value will not be verified properly.**

```
from Crypto.Cipher import AES
from Crypto.Util import Counter
import time

#-----
def verifyAppSealingCredential( credential ):

    # Need to Change : Get From ADC (via 'Check Credential')
    ORG_CREDENTIAL =
"572E0E1459453F2078D6576FF71ECD0DBCA0484430C7FA7FE45B788A37DE3A04204F5A55FEA83AC9AFBA2C688594F75A3828B23972DB34858EC4F6CC
3202533E44121E5F2614B227E18B6419A83810F7511D5E51FCACD5175A1CC550F83CB874A7378ACDAFE78EB2E329CD5D3C384061C4669674F1EE6B1B5
9FB7D91835DB7EE"
    AES_IV  = "055772B7434A4174749AFE09B1413472"
    AES_KEY = "71CA94A64A4DEBF5566495AB03F6798F"
    #-----

    # decrypt UTC
    try:
        counter = Counter.new( 128, initial_value = int.from_bytes( bytes.fromhex( AES_IV ), "big" ) )
        cipher = AES.new( bytes.fromhex( AES_KEY ), AES.MODE_CTR, counter = counter )
        decrypted_buffer = cipher.decrypt( bytes.fromhex( credential[:32] ) )

        decrypted_UTC = int.from_bytes( decrypted_buffer[:8], "little" )
    except Exception as e:
        print( '[Error] ', e )
        return 0;

    # verify UTC with current time (+/-) 10sec
    current_UTC = round( time.time() * 1000 );      # get current UTC in seconds

    if abs( current_UTC - decrypted_UTC ) > 10:
        print( "Invalid UTC value has sent, deny login & all services for this client..." )
        #return 0

    print( "** UTC verified : ", decrypted_UTC, " (current = ", current_UTC, ", diff = ", abs( current_UTC -
decrypted_UTC ), ")" )
```

```
# get AES KEY2
aes_key2 = bytearray( 16 )
aes_key2[0:8] = descrypted_buffer[0:8]
aes_key2[8:8] = bytes.fromhex( ORG_CREDENTIAL[52:68] )
print( aes_key2[:16].hex() )

for i in range( 0, 16 ):
    aes_key2[i] ^= bytes.fromhex( AES_IV[i * 2:i * 2 + 2] )[0]
print( aes_key2[:16].hex() )

# decrypt credential
try:
    counter2 = Counter.new( 128, initial_value = int.from_bytes( bytes.fromhex( AES_IV ), "big" ) )
    cipher2 = AES.new( aes_key2[:16], AES.MODE_CTR, counter = counter2 )
    print( credential[32:288] )
    decrypted_credential = cipher2.decrypt( bytes.fromhex( credential[32:288] ) )
except Exception as e:
    print( '[Error] ', e )
    return 0;

# verify credential with CREDENTIAL(ADC)
# return if fail
if ORG_CREDENTIAL.casfold() != decrypted_credential.hex().casfold():
    print( "Invalid credential value has sent, deny login & all services for this client..." )
    return 0

print( "** Credential verified : PASS" )
return 1
```

[In case your server code is using ruby script]

Add following code to your existing code and use it for credential data validation. Authenticity can be determined by passing the credential value sent as a parameter in the login or authentication function of the existing server code to the verifyAppSealingCredential function provided in the code below. (The code below is also included in the SDK as a file named appsealing_credential.rb)

**** Note: In the code below, ORG_CREDENTIAL, AES_IV, and AES_KEY must be replaced with values obtained through the "Check Credential" function of the corresponding project in the ADC. If you just take the example code and use it intactly, credential value will not be verified properly.**

```
require 'securerandom'
require 'net/https'
require 'json'

# Need to Change : Get From ADC (via 'Check Credential') -----
ORG_CREDENTIAL =
"572E0E1459453F2078D6576FF71ECD0DBCA0484430C7FA7FE45B788A37DE3A04204F5A55FEA83AC9AFBA2C688594F75A3828B23972DB34858EC4F6CC
3202533E44121E5F2614B227E18B6419A83810F7511D5E51FCACD5175A1CC550F83CB874A7378ACDAFE78EB2E329CD5D3C384061C4669674F1EE6B1B5
9FB7D91835DB7EE"
AES_IV  = "055772B7434A4174749AFE09B1413472"
AES_KEY = "71CA94A64A4DEBF5566495AB03F6798F"
#-----

def verifyAppSealingCredential( credential )

  # decrypt UTC
  begin
    aes = OpenSSL::Cipher::AES.new( "128-CTR" )
    aes.decrypt
    aes.key = [AES_KEY].pack( 'H*' )
    aes.iv = [AES_IV].pack( 'H*' )
    decrypted_buffer = aes.update( [credential[0..31]].pack( 'H*' )) + aes.final

    decrypted_UTC = decrypted_buffer.slice( 0, 8 ).unpack( 'V' ).first
  rescue => e
    puts '[Error] ' + e.to_s
    return 0
  end

  # verify UTC with current time (+/-) 10sec
  current_UTC = Time.now.strftime( '%s%L' ).to_i;           # get current UTC in seconds

  if ( current_UTC - decrypted_UTC ).abs > 10
    puts "Invalid UTC value has sent, deny login & all services for this client..."
    return 0
  end
end
```

```
puts "** UTC verified : " + decrypted_UTC.to_s + " (current = " + current_UTC.to_s + ", diff = " + ( current_UTC - decrypted_UTC ).abs.to_s + ")"
```

```
# get AES KEY2
aes_key2 = decrypted_buffer.bytes.slice( 0, 8 ) + [ORG_CREDENTIAL[52..67]].pack( 'H*' ).bytes
for i in 0..15 do
    aes_key2[i] ^= [AES_IV[i * 2..i * 2 + 1]].pack( 'H*' ).bytes[0]
end
```

```
# decrypt credential
begin
    aes = OpenSSL::Cipher::AES.new( "128-CTR" )
    aes.decrypt
    aes.key = aes_key2.pack( 'C*' )
    aes.iv = [AES_IV].pack( 'H*' )
    decrypted_credential = aes.update( [credential[32..287]].pack( 'H*' ) ) + aes.final
rescue => e
    puts '[Error] ' + e.to_s
    return 0
end
```

```
# verify credential with CREDENTIAL(ADC)
# return if fail
if ORG_CREDENTIAL.casecmp( decrypted_credential.unpack( 'H*' ).first ) != 0
    print( "Invalid credential value has sent, deny login & all services for this client..." )
    return 0
end
```

```
print( "** Credential verified : PASS" )
return 1
```

```
end
```

[In case your server code is using C++]

Add following code to your existing code and use it for credential data validation. Authenticity can be determined by passing the credential value sent as a parameter in the login or authentication function of the existing server code to the verifyAppSealingCredential function provided in the code below. (The code below is also included in the SDK as a file named appsealing_credential.cpp with aes.hpp/aes.cpp)

**** Note: In the code below, ORG_CREDENTIAL, AES_IV, and AES_KEY must be replaced with values obtained through the "Check Credential" function of the corresponding project in the ADC. If you just take the example code and use it intactly, credential value will not be verified properly.**

```
#include <iostream>
#include <vector>
#include <time.h>
#include "aes.cpp"

typedef std::vector<unsigned char> bytes;
bytes HexToBytes( const std::string& hex )
{
    std::vector<unsigned char> bytes;
    for( unsigned int i = 0; i < hex.length(); i += 2 )
    {
        std::string byteString = hex.substr( i, 2 );
        unsigned char byte = ( unsigned char )strtol( byteString.c_str(), NULL, 16 );
        bytes.push_back( byte );
    }
    return bytes;
}

static bool verifyAppSealingCredential( const char* credential )
{
    // Need to Change : Get From ADC (via 'Check Credential') -----
    const char* ORG_CREDENTIAL =
"572E0E1459453F2078D6576FF71ECD0DBCA0484430C7FA7FE45B78A37DE3A04204F5A55FEA83AC9AFBA2C688594F75A3828B23972DB34858EC4F6CC
3202533E44121E5F2614B227E18B6419A83810F7511D5E51FCACD5175A1CC550F83CB874A7378ACDAFE78EB2E329CD5D3C384061C4669674F1EE6B1B5
9FB7D91835DB7EE";
    const char* AES_IV  = "055772B7434A4174749AFE09B1413472";
    const char* AES_KEY = "71CA94A64A4DEBF5566495AB03F6798F";
    //-----

    unsigned char decrypted_buffer[16], decrypted_credential[128];

    // decrypt UTC
    struct AES_ctx ctx;
    try
    {
```

```
memcpy( decrypted_buffer, HexToBytes( std::string( credential ).substr( 0, 32 )).data(), 16 );

AES_init_ctx_iv( &ctx, HexToBytes( AES_KEY ).data(), HexToBytes( AES_IV ).data() );
AES_CTR_xcrypt_buffer( &ctx, decrypted_buffer, 16 );

long decrypted_UTC = *(( long* )decrypted_buffer );

std::cout << "*** UTC = " << decrypted_UTC << "\n";

// verify UTC with current time (+/-) 10sec
time_t current_UTC = time( 0 );
current_UTC = 1664439768;//REMOVE
if ( abs( current_UTC - decrypted_UTC ) > 10 )
{
    std::cout << "Invalid UTC value has sent, deny login & all services for this client...\n";
    return false;
}
std::cout << "*** UTC verified : " << decrypted_UTC << " (current = " << current_UTC << ", diff = " <<
abs(current_UTC - decrypted_UTC ) << ")\n";

// get AES KEY2
unsigned char aes_key2[16];
memcpy( aes_key2, decrypted_buffer, 8 );
bytes XOR = HexToBytes( std::string( ORG_CREDENTIAL ).substr( 52, 16 ) );
memcpy( aes_key2 + 8, XOR.data(), XOR.size() );

for( int i = 0; i < 16; i++ )
    aes_key2[i] ^= HexToBytes( std::string( AES_IV ).substr( i * 2, 2 )).data()[0];

// decrypt credential
memcpy( decrypted_credential, HexToBytes( std::string( credential ).substr( 32, 256 )).data(), 128 );

AES_init_ctx_iv( &ctx, aes_key2, HexToBytes( AES_IV ).data() );
AES_CTR_xcrypt_buffer( &ctx, decrypted_credential, 128 );
}

catch( const std::out_of_range& e )
{
    std::cout << "pos exceeds string size\n";
}

// verify credential with CREDENTIAL(ADC)
// return if fail
if ( memcmp( HexToBytes( ORG_CREDENTIAL ).data(), decrypted_credential, 128 ) != 0 )
{
    std::cout << "Invalid credential value has sent, deny login & all services for this client..." ;
    return false;
}
std::cout << "*** Credential verified : PASS";
}
```

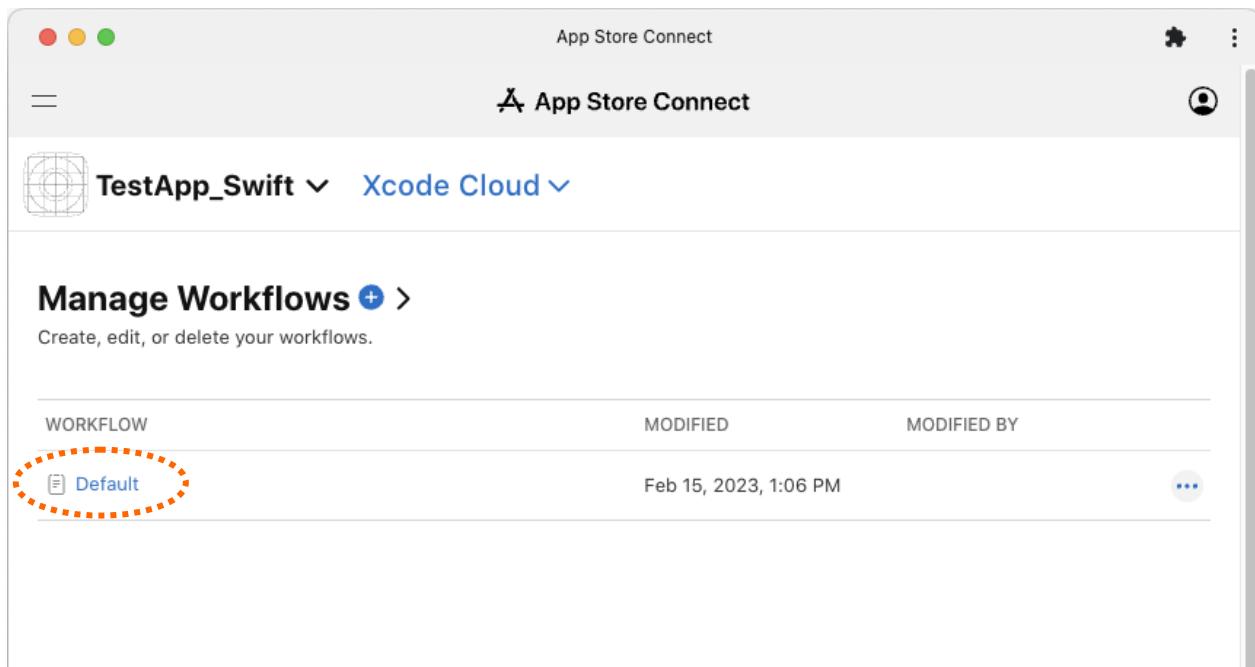
Part 7. Resign and upload from Xcode Cloud

AppSealing SDK can be applied to projects using Xcode Cloud. After adding the necessary files for the SDK and pushing them to the Git repository, the app is archived and exported as an IPA in the way Xcode Cloud works, and then the IPA with security-related features added is uploaded to App Store Connect by performing a re-signing script. will do.

However, in this process, some actions must be performed differently from the original Xcode Cloud operation, so additional settings and preparations are required. Follow the steps outlined below to prepare the process.

7-1 Configure Xcode Cloud

Integration of Xcode Cloud and project Git repository is assumed to be completed as described in the Xcode Cloud documentation. First you need to change the workflow settings in Xcode Cloud. The project name used in this document is "TestApp_Swift" and the workflow name is "Default". Connect to "App Store Connect" and go to the "Xcode Cloud" page of the project.



Click on the workflow name to go to the settings screen.

When the setting screen is displayed, leave other items as they are, scroll the page to the bottom, select "None" as the value of "Actions - Deployment Preparation" and leave "Post-Actions" blank so that no action is entered.

The screenshot shows the 'Xcode Cloud' settings for the 'TestApp_Swift' app. It includes sections for 'Start Conditions' (Branch Changes, Auto-cancel Builds, Files and Folders), 'Actions' (Archive - iOS, Deployment Preparation, Post-Actions), and 'Post-Actions'. The 'Deployment Preparation' section has three options: 'None' (selected and highlighted with a red dotted circle), 'TestFlight (Internal Testing Only)', and 'TestFlight and App Store'. The 'Post-Actions' section is empty, displaying the message 'No post-actions have been added.'

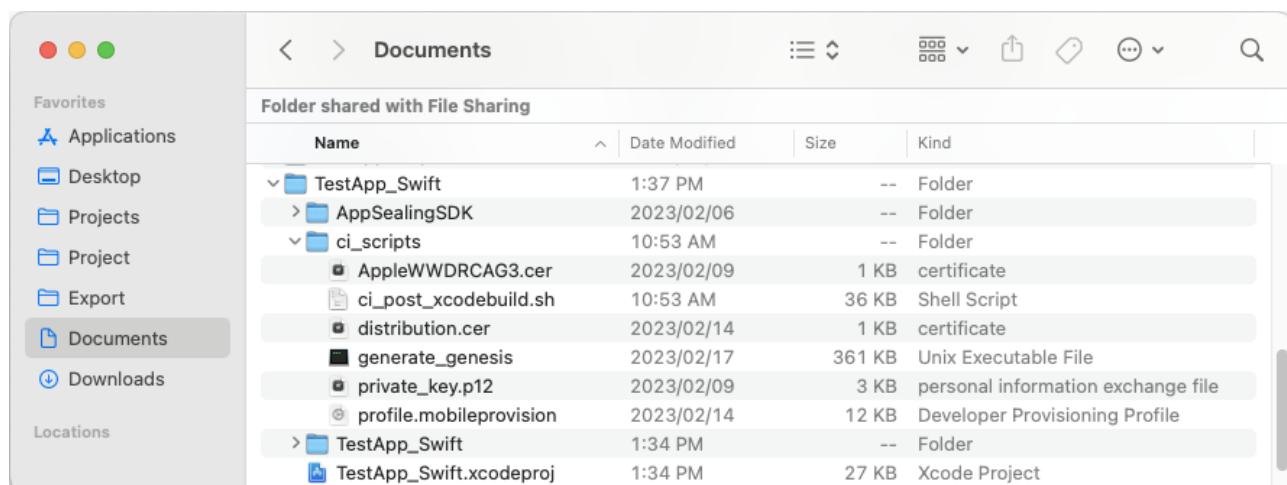
If you do not select "None" as the value of the "Deployment Preparation" item, the app will not run normally because the built IPA is uploaded to App Store Connect without going through the re-signing process. The same goes for Post-Actions, so these two must be left blank or set to "None"

7-2 ci_scripts preparation process

To re-sign the built IPA with security settings file in the Xcode Cloud environment, a custom script file, a signing certificate & private key, and a provisioning profile for distribution are additionally required to upload the modified IPA to App Store Connect.

All of these files should be included in the ci_scripts folder of your project path. In addition to the ci_scripts configuration items provided by the AppSealing SDK, the following items are additionally required and added by yourself.

- Certificate for App Store distribution : distribution.cer
- Private key for distribution certificate : private_key.p12 (password: "" [empty])
- Provisioning profile for App Store distribution : profile.mobileprovision
- Apple ID & App-Specific password (to be written in script)



The ci_scripts configuration of the AppSealing SDK includes the Apple root certificate "AppleWWDRCAg3.cer" certificate file, "ci_post_xcodebuild.sh" ruby script file, and "generate_genesis" executable file. These files should not be renamed either.

The three previously mentioned files (distribution.cer, private_key.p12, profile.mobileprovision) are added to these basic files, resulting in a total six files as shown in the picture above.

Certificate for App Store distribution

The ci_scripts folder must contain the distribution certificate. This certificate must be a CER format file downloaded from the Apple Developer site, and the file name must be fixed to "distribution.cer". If you add a certificate other than the one for App Store distribution or the file name is different, re-signing will not work properly.

Private key for distribution certificate

The private key file corresponding to the distribution certificate included earlier must also be included in the ci_scripts folder. The private key file can be exported from the Mac Keychain app, with the format set to PKCS#12 (extension .p12) and the password for the private key file must be set to an empty string. The name of the private key file must also be fixed to "private_key.p12".

If the file name does not match or a non-empty value is set in the password, re-signing will not proceed properly. If you want to set a password in the private key file, proceed with additional steps in the script modification section below.

Below is a step-by-step explanation of the private key file creation process. If you have already created a private key file, skip these instructions.

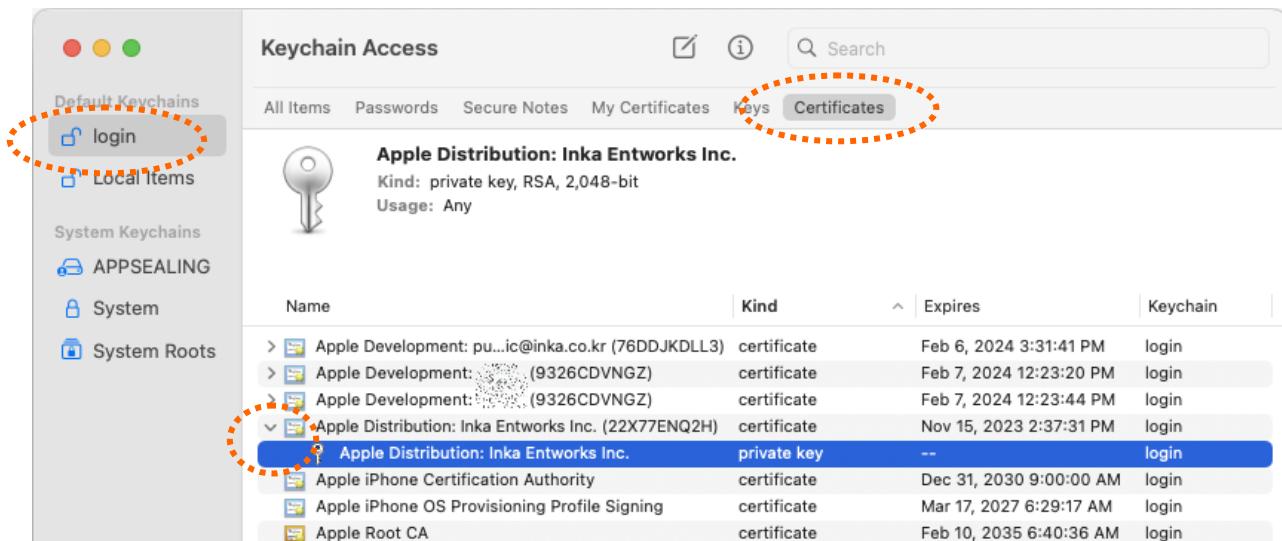
STEP Private key file creation process in Mac Keychain app

If you go to "Etc." in Mac's launchpad, the "Keychain Access" app will appear. Run this app and when the screen below appears, select the "login" item from the left tab.

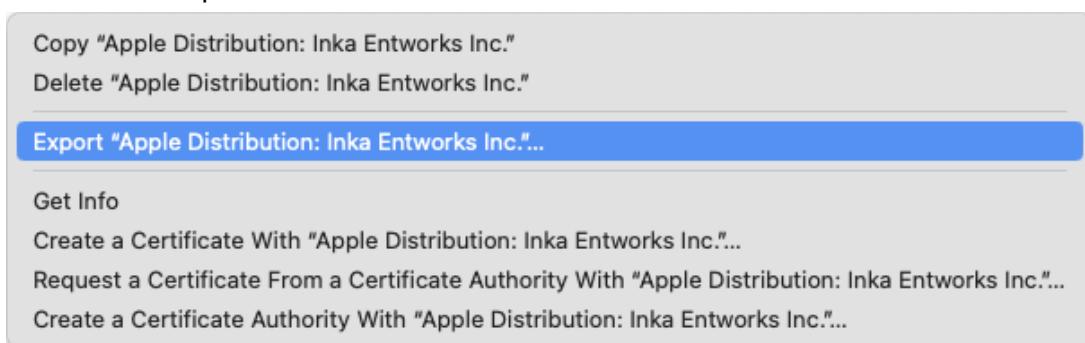


Select "Certificates" from the top tab menu in the right pane.

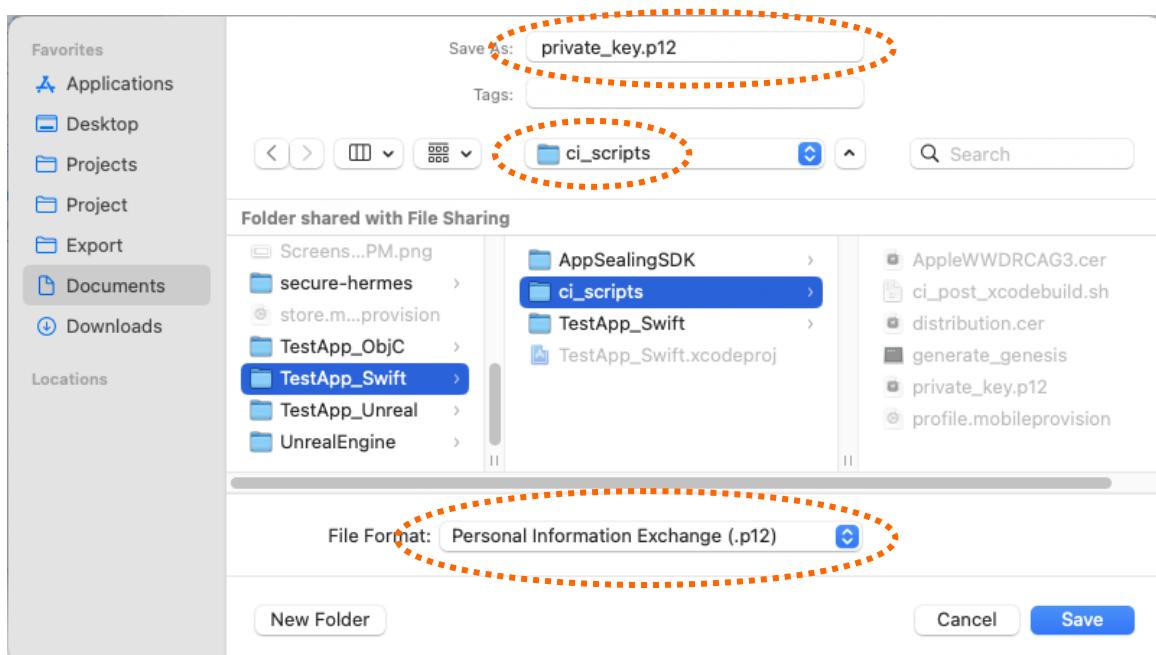
Click the right-angle bracket (>) to the left of the distribution certificate registered in the keychain to display the private key of the certificate.



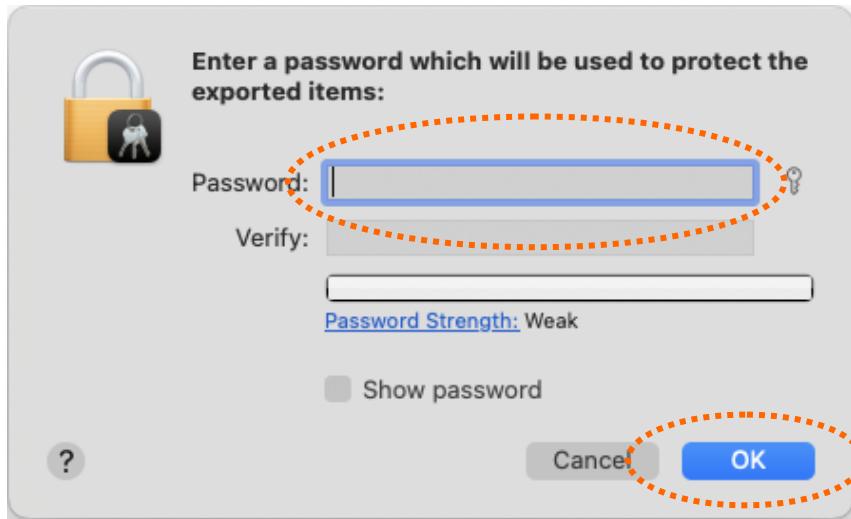
After selecting the private key, right-click the mouse and when the context menu appears, select "Export..." item.



Select the "ci_scripts" folder of the project as the save location, the file name as "private_key.p12", and the file format as "Personal Information Exchange."



When the password input window appears, leave the password blank and save it.



If you specify a password, you must edit the ci_post_xcodebuild.sh file.

Open the file with an editor and go to line 445. You can see that the password for the private key file is left blank in this line of commands.

```

441 system( 'security create-keychain -p 0000 ' + APPSEALING_KEYCHAIN )
442 system( 'security list-keychains -d user -s login.keychain ' + APPSEALING_KEYCHAIN )
443 system( 'security import ./AppleWWDRCAg3.cer -k ' + APPSEALING_KEYCHAIN + ' -t cert -A -P ""' )
444 system( 'security import ./distribution.cer -k ' + APPSEALING_KEYCHAIN + ' -t cert -A -P ""' )
445 system( 'security import ./private_key.p12 -k ' + APPSEALING_KEYCHAIN + ' -t priv -A -P ""' )
446 system( 'security default-keychain -d user -s ' + APPSEALING_KEYCHAIN )
447 system( 'security unlock-keychain -p 0000 ' + APPSEALING_KEYCHAIN )
448 system( 'security set-keychain-settings ' + APPSEALING_KEYCHAIN )
449 system( 'security set-key-partition-list -S apple-tool:,apple:,codesign: -s -k 0000 ' + APPSEALING_KEYCHAIN + ' > /dev/null' )

```

Write down the password you specified and save the file in this location. If you saved your password as the string "your_password", you must modify it as follows.

```

441 system( 'security create-keychain -p 0000 ' + APPSEALING_KEYCHAIN )
442 system( 'security list-keychains -d user -s login.keychain ' + APPSEALING_KEYCHAIN )
443 system( 'security import ./AppleWWDRCAg3.cer -k ' + APPSEALING_KEYCHAIN + ' -t cert -A -P ""' )
444 system( 'security import ./distribution.cer -k ' + APPSEALING_KEYCHAIN + ' -t cert -A -P ""' )
445 system( 'security import ./private_key.p12 -k ' + APPSEALING_KEYCHAIN + ' -t priv -A -P "your_password"' )
446 system( 'security default-keychain -d user -s ' + APPSEALING_KEYCHAIN )
447 system( 'security unlock-keychain -p 0000 ' + APPSEALING_KEYCHAIN )
448 system( 'security set-keychain-settings ' + APPSEALING_KEYCHAIN )
449 system( 'security set-key-partition-list -S apple-tool:,apple:,codesign: -s -k 0000 ' + APPSEALING_KEYCHAIN + ' > /dev/null' )

```

Provisioning profiles for App Store distribution

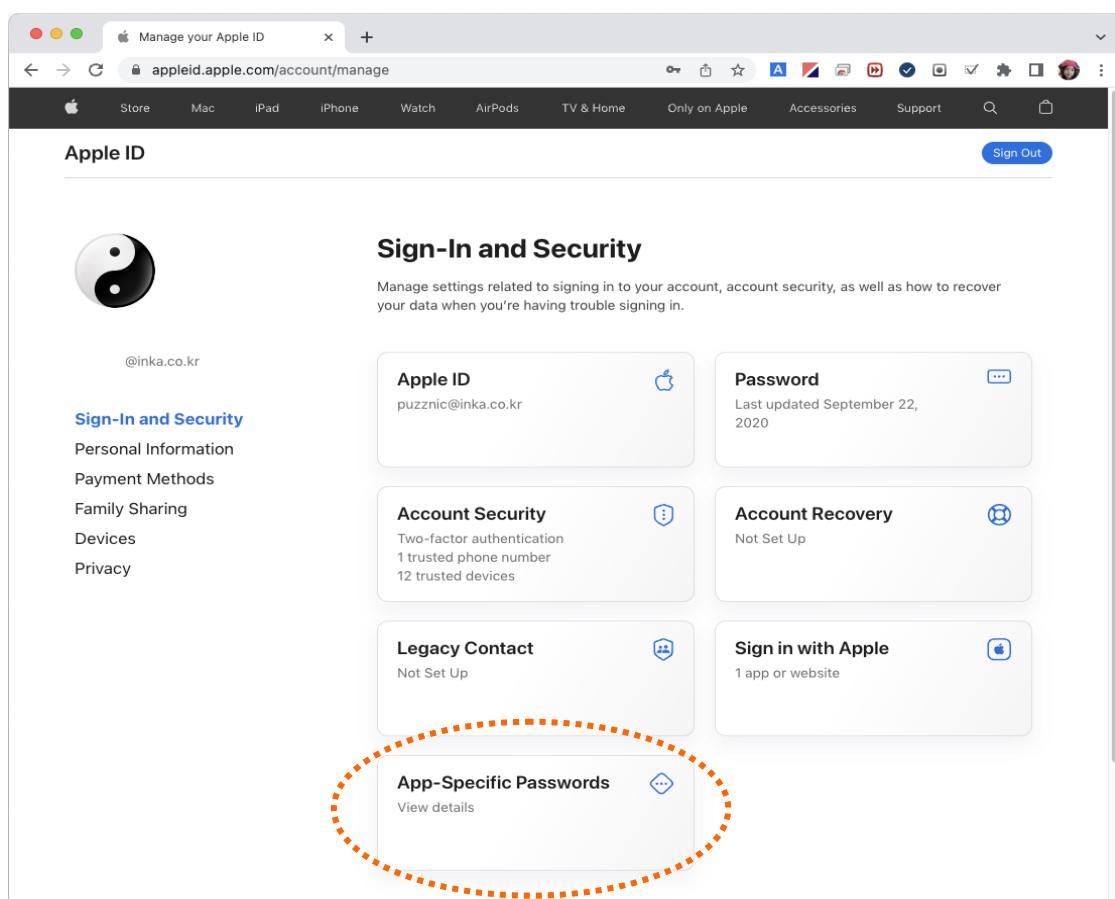
The `ci_scripts` folder must contain a provisioning profile for App store deployment. This file should contain the profile downloaded from the Apple Developer site with the name "profile.mobileprovision". If the file name does not match or the profile is not correct, re-signing may fail or the app may not install/run properly.

Custom scripts for post-build processing

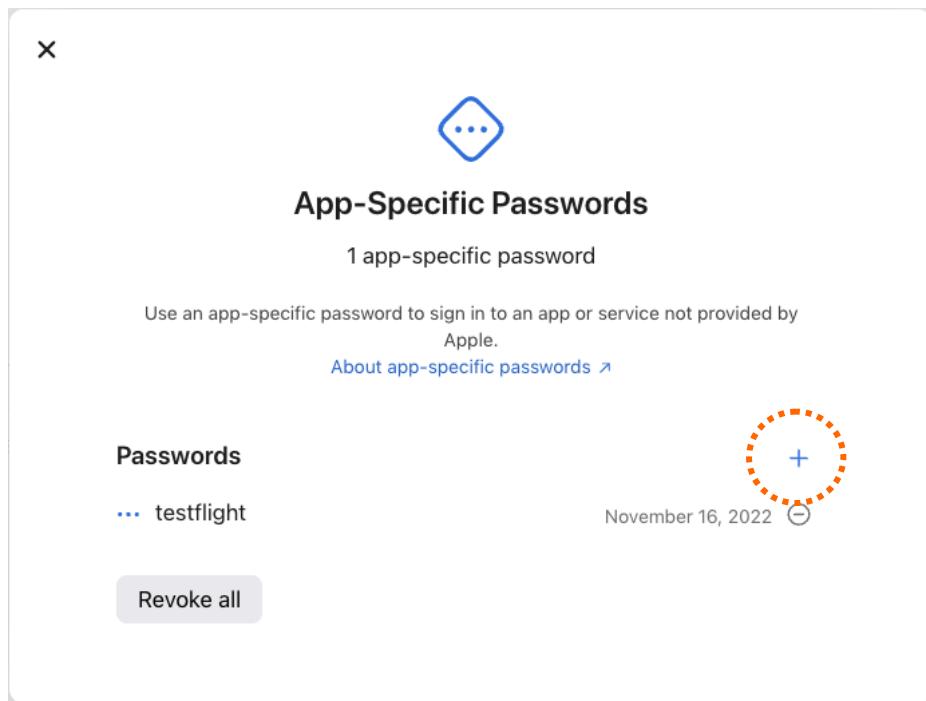
The `ci_scripts` folder contains the `ci_post_xcodebuild.sh` script file by default. The content of the script includes a process for uploading the re-signed IPA to App Store Connect. To perform this operation, the app developer's Apple account and app password are required. (Not password for Apple account ID!)

If you do not have an app password, you can create one on below Apple's page.

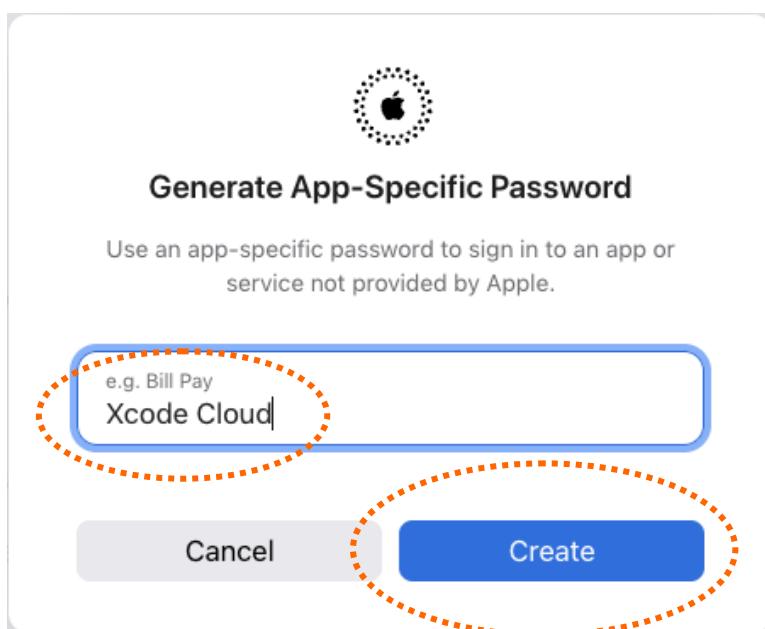
<https://appleid.apple.com/account/manage>



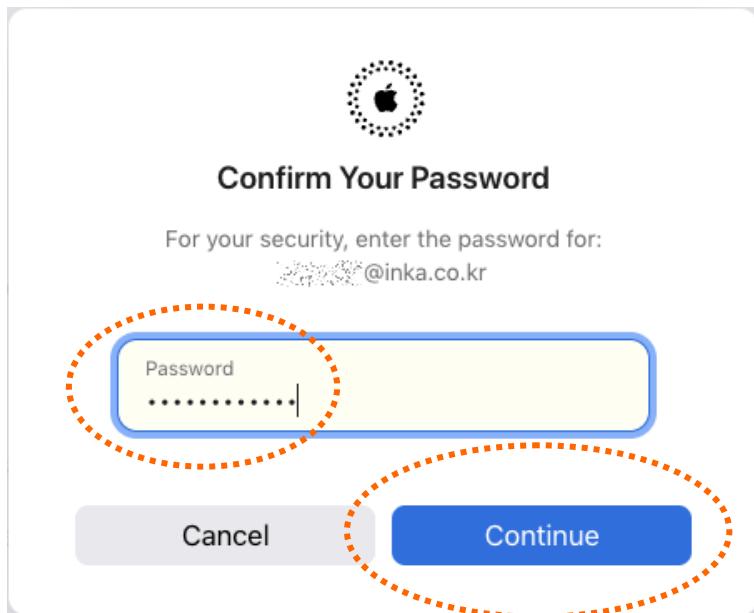
When you select the "App-Specific Passwords" item of the "Sign-In and Security" page, the "App-Specific Passwords" window will appear as shown below. Here, click the + button to start creating a new app password.



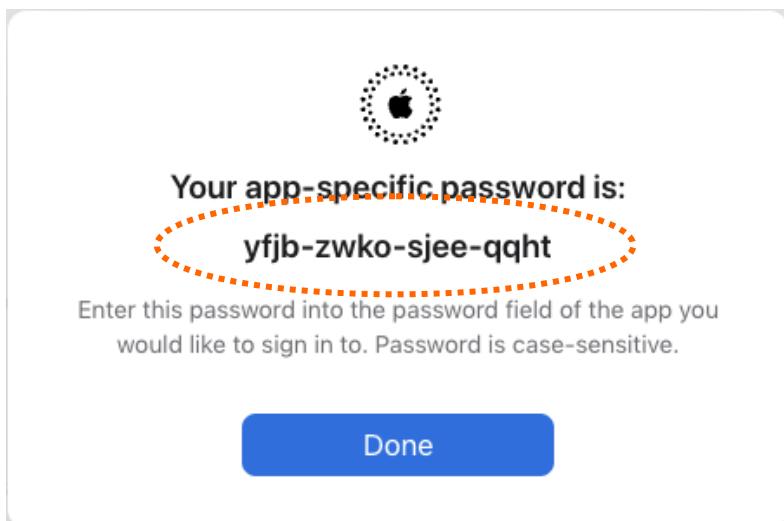
When you click the + button, a window will appear where you can enter the name of the app password. Please enter a name that is easy to recognize and suit the purpose. Here we arbitrarily entered the name "Xcode Cloud". Now click on the "Create" button.



Now, when a window asking you to enter your Apple account password appears, enter the account password of your Apple ID and click the "Continue" button.



You will now see your newly created 16-digit app password as shown in the window below. Passwords created in this way cannot be verified later and can only be discarded, so they must be well recorded.



Now, write your Apple account and app password in lines 14 to 15 at the top of the ci_post_xcodebuild.sh file and save the file.

```
#!/usr/bin/env ruby
#
# Copyright © 2023 AppsealingDev. All rights reserved.

require 'pathname'
require 'tmpdir'
require 'securerandom'
require 'net/https'
require 'json'
require 'io/console'

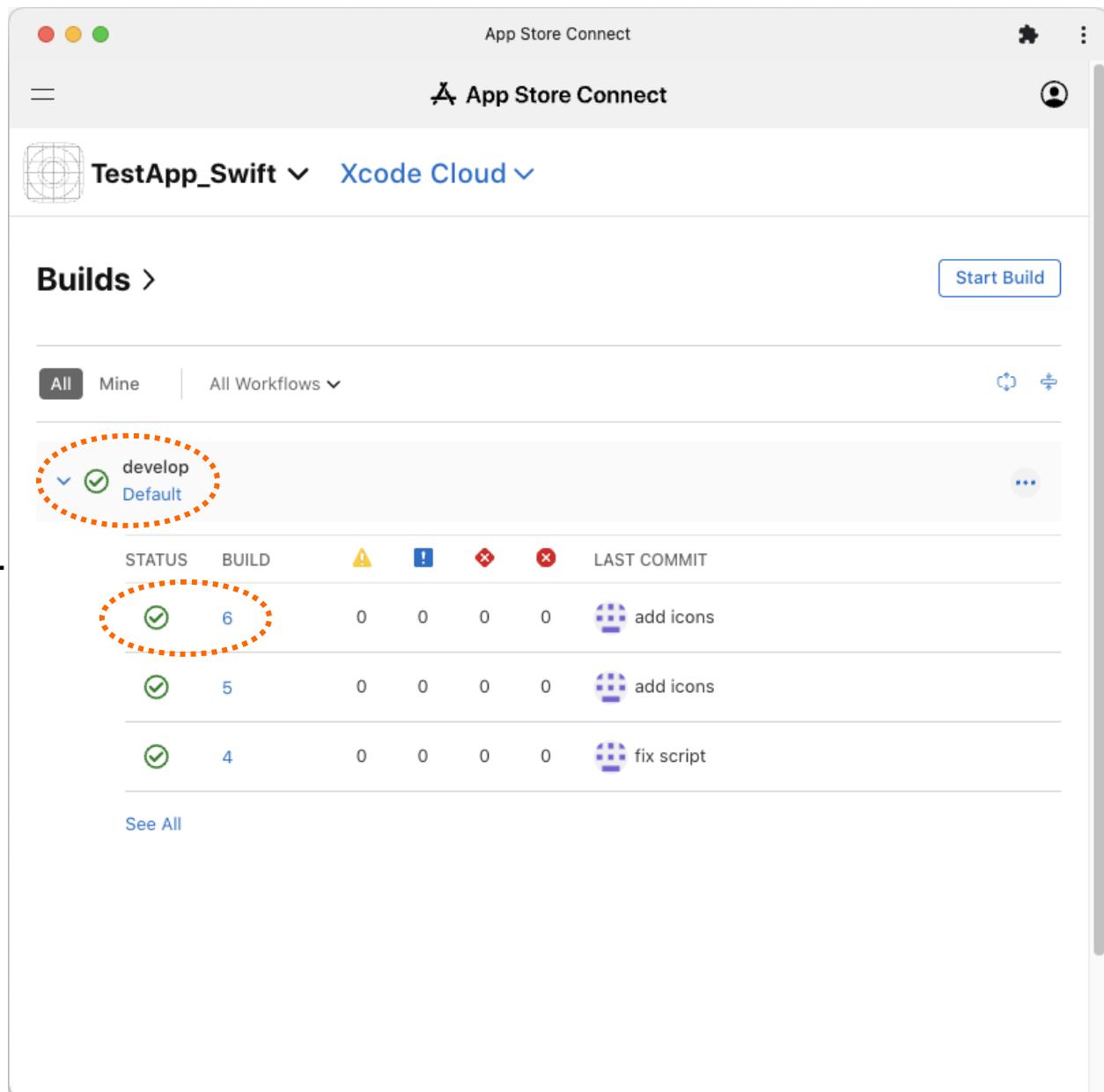
#
#-----#
14 APPLE_ID = "support@inka.co.kr"          # Replace with your apple developer ID
15 APPLE_APP_PASSWORD = "aaaa-bbbb-cccc-dddd" # Replace with your apple application password (https://appleid.apple.com/account/manage)
# NOT ACCOUNT PASSWORD !
#
#-----#
17
18 UNREAL_URL_SCHEME = ""                  # replace with your URL scheme of unreal app
19                                         # Unreal Shipping IPA를 App Store Connect에 업로드 할 때 "ERROR ITMS-90158" 오류가 발생하면
20                                         # 이 파라미터를 추가해 Info.plist의 CFBundleURLSchemes 값을 새로 설정하여 오류를 수정할 수 있음
21
22 $baseUrl = 'https://api.appsealing.com/covault/gw/'
23 $position = 0
24 $isUnreal = false
25 $isXamarin = false
26
27 #
28 # _CodeSignature/CodeResources 파일을 읽어 <key>files</key> 항목의 모든 데이터를 문자열로 변환하여 리턴
29 #
30 #
31 def generate_hash_snapshot( path )
32
```

If the Apple account is "myappleid@company.com" and the issued app password is "yfjb-zwko-sjee-qqht", lines 14 to 15 of the script file should be changed as follows.

```
13 #
14 #-----#
14 APPLE_ID = "myappleid@company.com"      # replace with your apple developer ID
15 APPLE_APP_PASSWORD = "yfjb-zwko-sjee-qqht" # replace with your apple application password
# NOT ACCOUNT PASSWORD !
16 #
17 #-----#
```

7-3 Check the build and upload process

Once you have completed setting up the Xcode Cloud environment and preparing the files required for the ci_scripts folder, push the files added to ci_scripts to the git repository. Now connect to App Store Connect and confirm that the build of the target branch (in this document, develop) has been completed.



The screenshot shows the App Store Connect interface with the title "App Store Connect" at the top. Below it, the section "Builds >" is displayed. A "Start Build" button is located in the top right corner of this section. The main area shows a table of builds. At the top left of the table, there are filters: "All" (selected), "Mine", and "All Workflows". To the right of the table are two small icons. The table has columns: STATUS, BUILD, and LAST COMMIT. There are four rows of data:

STATUS	BUILD	LAST COMMIT
✓ (green)	6	0 0 0 0 add icons
✓ (green)	5	0 0 0 0 add icons
✓ (green)	4	0 0 0 0 fix script

Each row has a green checkmark icon and a blue workflow name. The first row (Build 6) is highlighted with a red dashed oval. The first column (STATUS) also has a red dashed oval around the green checkmark icon. The first two rows (Builds 6 and 5) have their workflow names "add icons" under LAST COMMIT highlighted with a red dashed oval.

Click the build number to go to the build overview screen. Click the arrow to the right of the "Archive – iOS" item under "Actions" on the left to expand the menu and check the log.

The screenshot shows the App Store Connect interface. At the top, there are tabs for Analytics, Trends, Reports, Users and Access, Agreements, and a user profile for 'Inka Entworks Inc.'. Below the tabs, the app name 'TestApp_Swift' is displayed with a dropdown arrow. The 'Logs' tab is selected, showing a list of build tasks. On the left, under 'Actions', the 'Archive iOS' task is checked, and the 'Logs' and 'Artifacts' sub-options are highlighted with orange dashed circles. The main area displays the 'Logs' table with columns for 'TASK' and 'DURATION'. The table lists various steps of the build process, including configuration, environment setup, source code fetching, dependency resolution, and archive export. The 'Run ci_post_xcodebuild.sh script' and 'Save artifacts' steps are circled with a dashed orange line.

TASK	DURATION
Configure macOS Ventura 13.2.1 (22D68)	0.4s
> Set environment variables	0s
> Configure Xcode 14.2 (14C18)	1.4s
> Configure git	0.7s
> Fetch source code	4.4s
> Post-Clone script not found at ci_scripts/ci_post_clone.sh	0s
> Resolve package dependencies	3.5s
> Check project and workflow configuration	2.3s
> Pre-Xcodebuild script not found at ci_scripts/ci_pre_xcodebuild.sh	0s
> Run xcodebuild archive	22.3s
> Export archive for app-store distribution	12s
> Export archive for ad-hoc distribution	12.2s
> Export archive for development distribution	12.1s
> Check project configuration	2.4s
> Run ci_post_xcodebuild.sh script	55s
> Save artifacts	3.2s

As shown in the screen above, all tasks under "Build Archive" should be performed normally. In particular, no further operations should be performed after "Run ci_post_xcodebuild.sh script" and "Save artifacts". If there is a progress log for another task, you must refer to section 7-1 to modify the workflow settings and then proceed with the build again.

Now click on the left angle sign (>) of the "Run ci_post_xcodebuild.sh script" item to expand the script log. You can check the log where the ci_post_xcodebuild.sh script was executed for the exported IPA. Scroll to the bottom of the log to see that the IPA was successfully uploaded.

The screenshot shows a CI build log for the app 'TestApp_Swift' in the 'Xcode Cloud' environment. A specific step, 'Run ci_post_xcodebuild.sh script', is highlighted with a red dotted oval. The log details the process of extracting the IPA payload, receiving an encryption key from the AppSealing server, and re-signing the app with a new certificate. The final step shown is uploading the app to App Store Connect.

```
Run command: cd /Volumes/workspace/repository/ci_scripts && CI_XCODEBUILD_EXIT_CODE=0 /Volumes/workspace/repository/ci_scripts/ci_post_xcodebuild.sh

[Target IPA] = /Volumes/workspace/appstoreexport/TestApp_Swift.ipa

[Working Directory] = /var/folders/3/_c0j0cjxx7fv_k37j5d_0_5x00000gn/T/AppSealing/a7de227c03e21acae81534aec14d5708/

1. Payload has extracted from the IPA ...
1 certificate imported.
1 certificate imported.
1 identity imported.

2. Trying to receive encryption key from AppSealing server ...

3. Successfully received encryption key ...
Executable=/private/var/folders/3/_c0j0cjxx7fv_k37j5d_0_5x00000gn/T/AppSealing/a7de227c03e21acae81534aec14d5708/Package/Payload/TestApp_Swift.app/TestApp_Swift
==> Application ID replaced : 22X77ENQ2H.com.inka.* >> 22X77ENQ2H.com.inka.swift

4. Codesigning your app using certificate used to sign your IPA ...
Executable=/private/var/folders/3/_c0j0cjxx7fv_k37j5d_0_5x00000gn/T/AppSealing/a7de227c03e21acae81534aec14d5708/Package/Payload/TestApp_Swift.app/TestApp_Swift
/var/folders/3/_c0j0cjxx7fv_k37j5d_0_5x00000gn/T/AppSealing/a7de227c03e21acae81534aec14d5708/Package/Payload/TestApp_Swift.app/: replacing existing signature

5. Generating app integrity/certificate snapshot ...

6. Downloading blacklist/whitelist from AppSealing server ...

7. Encrypting app integrity/certificate snapshot ...

8. Codesigning your app using certificate used to sign your IPA ...
Executable=/private/var/folders/3/_c0j0cjxx7fv_k37j5d_0_5x00000gn/T/AppSealing/a7de227c03e21acae81534aec14d5708/Package/Payload/TestApp_Swift.app/TestApp_Swift
/var/folders/3/_c0j0cjxx7fv_k37j5d_0_5x00000gn/T/AppSealing/a7de227c03e21acae81534aec14d5708/Package/Payload/TestApp_Swift.app/: replacing existing signature

9. Rebuilding & re-signing IPA ...

10. Uploading your app to App Store Connect ...
```

App Store Connect

TestApp_Swift ▾ **Xcode Cloud** ▾

```
2023-02-20 20:24:56.539 INFO: Show Progress: Sending analysis to App Store Connect...
2023-02-20 20:24:57.142 INFO: COMPLETED - PART 1 - asset-description-073C7CA2-3459-43D3-AF35-DAB36F8F1503.xml - eTag: "A633C5AF47BF50AF67F7282E8F21F4D4"
2023-02-20 20:24:57.148 INFO: Show Progress: Waiting for App Store Connect analysis response...
2023-02-20 20:25:25.057 INFO: Show Progress: Sending SPI analysis to App Store Connect...
2023-02-20 20:25:25.494 INFO: COMPLETED - PART 1 - DTAppAnalyzerExtractorOutput-A4A3233A-7F5C-47FE-BC93-1B02E76051F2.zip - eTag: "75EC67A6C8B2B5D6996D3EB18A2C439C"
2023-02-20 20:25:25.499 INFO: Show Progress: Waiting for App Store Connect SPI analysis response...
2023-02-20 20:25:32.884 INFO: Show Progress: Collecting package attributes...
2023-02-20 20:25:32.885 INFO: Show Progress: Requesting upload instructions from App Store Connect...
2023-02-20 20:25:33.385 INFO: Part 1 still needs to be uploaded (716110 bytes).
2023-02-20 20:25:33.386 INFO: 1 upload operations were requested for 1 parts. (Build ID = d55082e6-77d7-4b32-8e63-5a106f447168)
2023-02-20 20:25:33.386 INFO: Show Progress: Preparing file for upload to App Store Connect...
2023-02-20 20:25:33.393 INFO: Show Progress: Preparing file for upload to App Store Connect...
2023-02-20 20:25:33.407 INFO: Show Progress: Uploading to App Store Connect...
2023-02-20 20:25:33.849 INFO: COMPLETED - PART 1 - TestApp_Swift.ipa - eTag: "69828632A74104B0527E74C5553BC9E7"
2023-02-20 20:25:33.862 INFO: Time to transfer: 0.021 seconds (34558.44KB/s)
2023-02-20 20:25:33.866 INFO: Show Progress: Checking build state...
2023-02-20 20:25:33.867 INFO: Show Progress: Completing upload...
2023-02-20 20:25:36.007 INFO: Show Progress: Waiting for package to begin processing...
2023-02-20 20:25:36.341 INFO: Show Progress: Uploaded package is processing.
2023-02-20 20:25:36.346 INFO: Show Progress: Upload succeeded.
2023-02-20 20:25:36.346 INFO:

=====

UPLOAD SUCCEEDED
Delivery UUID: d55082e6-77d7-4b32-8e63-5a106f447168

Transferred 716110 bytes in 0.021 seconds (34.6MB/s)
=====
No errors uploading '/Volumes/workspace/appstoreexport/TestApp_Swift.ipa'
Command executed successfully
>  Save artifacts 3.1s
```

App Store Connect

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Now if we go to TestFlight, we can see that the version we just built (6) is registered.

The screenshot shows the App Store Connect TestFlight interface. At the top, it displays the app's name, "TestApp_Swift", and the distribution channel, "TestFlight". Below this, under the heading "iOS Builds", it lists three versions: Version 4.3, Version 4.2, Version 4.1, and Version 4.0. Version 4.3 is expanded, showing two build entries: Build 6 (Status: Ready to Submit, Expires in 90 days) and Build 5 (Status: Missing Compliance). The interface includes standard filtering options like "Versions" and "Build Groups", and columns for BUILD, STATUS, GROUPS, INSTALLS, and CRASHES.

BUILD	STATUS	GROUPS	INSTALLS	CRASHES
6	Ready to Submit Expires in 90 days	AC	-	-
5	Missing Compliance Manage			

Part 8. Apply source code string encryption

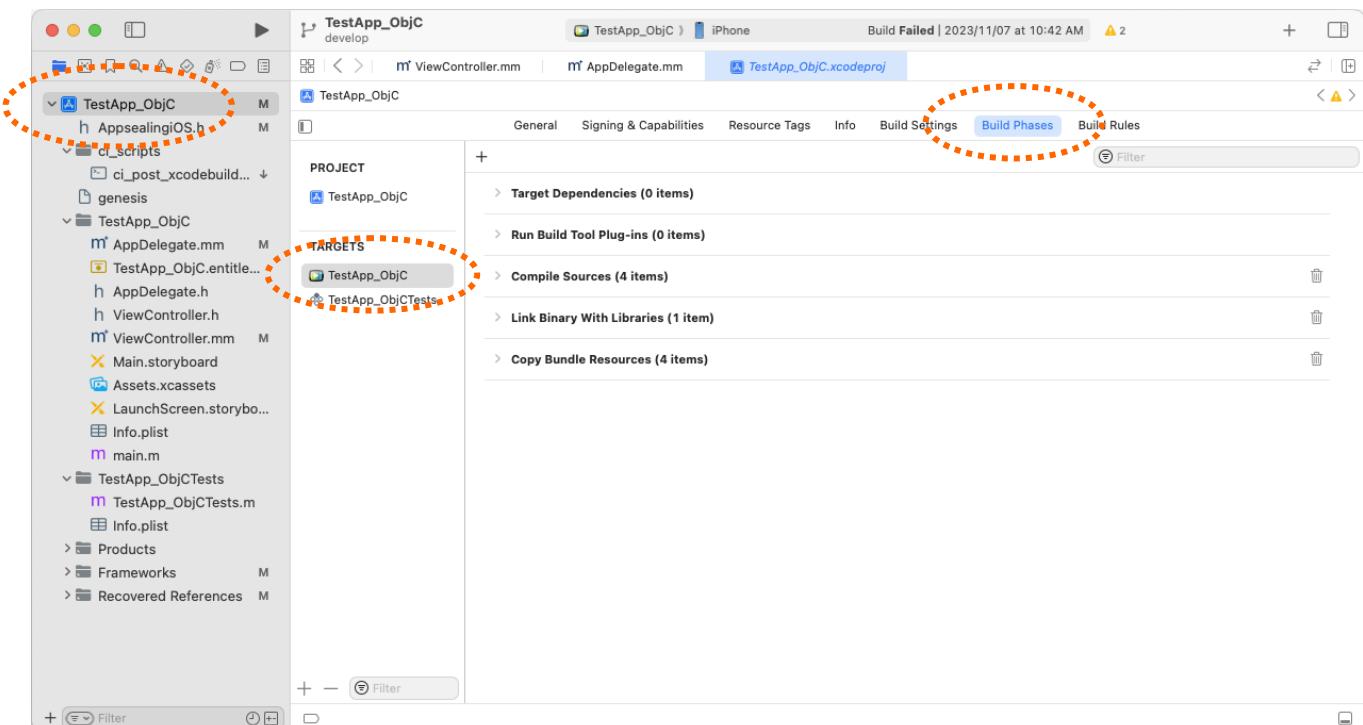
8-1 Setting project's Build Phase

AppSealing SDK provides the ability to encrypt source code strings, completely hiding them from the executable. In general, it is not necessary to encrypt all strings in the source code, but in the case of strings containing serial numbers or sensitive information, or if it is necessary to prevent string copying, the string can be protected through encryption.

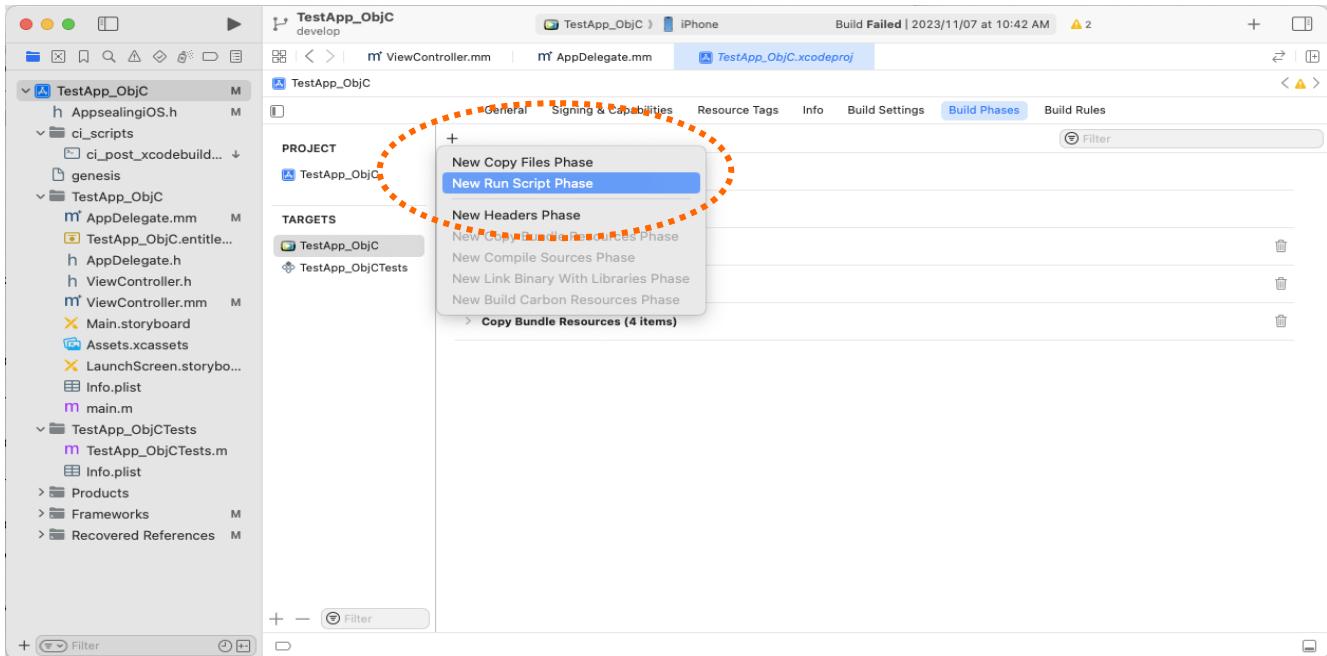
Therefore, AppSealing's string encryption function does not encrypt all strings in the source code, but app developer should append a designated tag only to strings that require protection in the source code. The tagged string preserves its original string form and is then replaced with an encrypted string just before compilation. When compilation is completed, the original tagged string form is restored. However, this requires additional settings during the Xcode build process. Follow the steps outlined below to set up the build script.

This chapter uses an Objective-C-based project named "TestApp_ObjC" as a sample project.

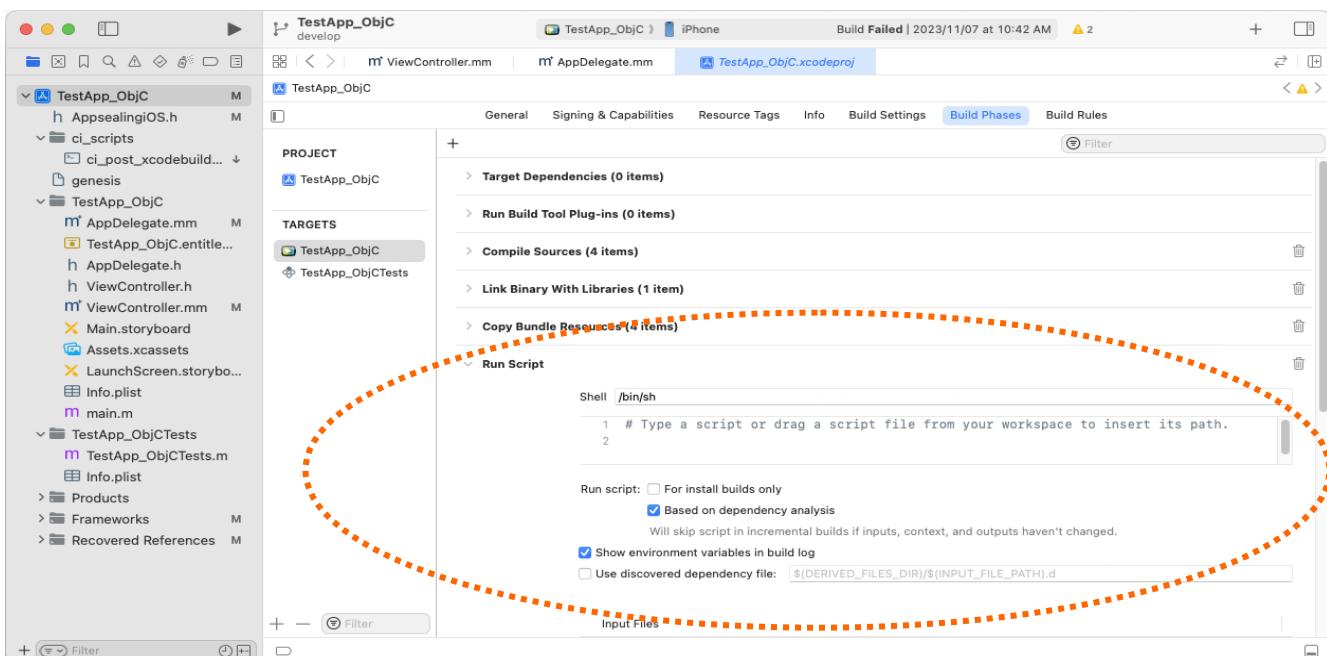
First, select the project in the Project Navigator and select the main target "TestApp_ObjC" in TARGETS. Select the "Build Phase" tab from the tabs displayed on the right.



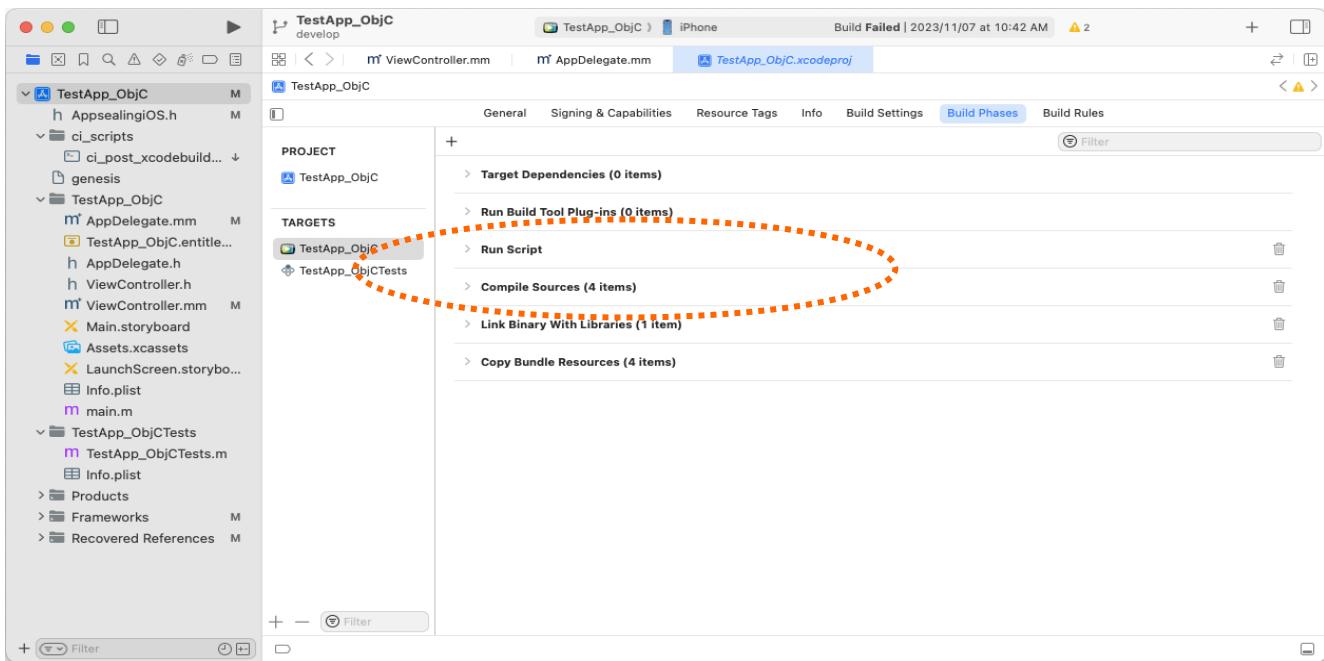
When the "Build Phase" tab screen is displayed, click the "+" icon in the upper left corner to display the menu and select "New Run Script Phase" from there.



As shown in the screen below, a "Run Script" step is added and a box where you can add script commands is displayed.

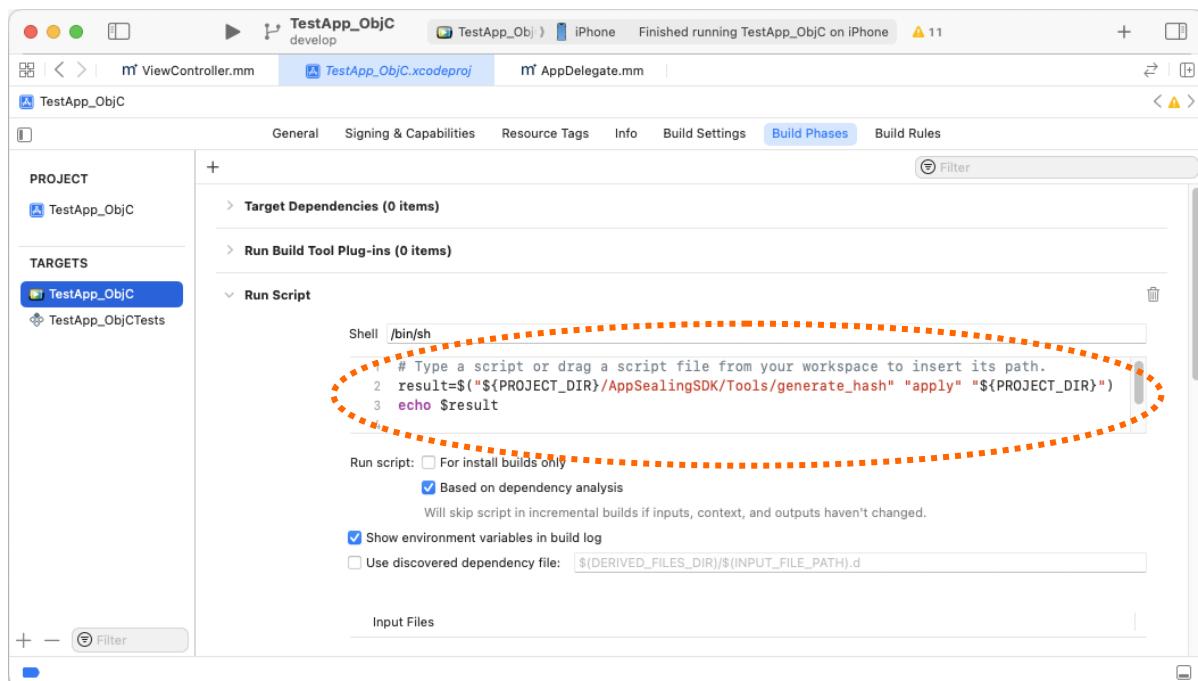


Click the inverted caret (v) icon to the left of "Run Script" to collapse the expanded script contents, then grab and drag the "Run Script" item with the left mouse button and move it above the "Compile Sources (## items)" item. It should look like the screen below.

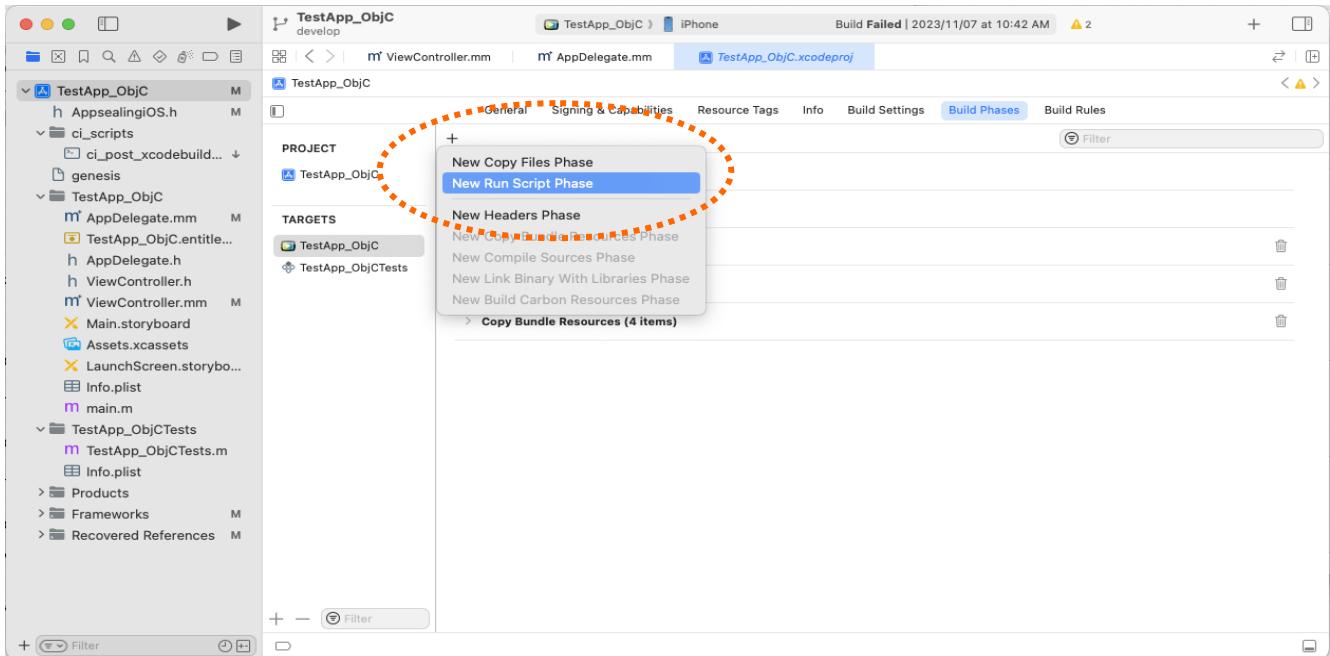


Click the ">" icon to the left of "Run Script" again to expand the script items, then copy and paste the contents below into the script box.

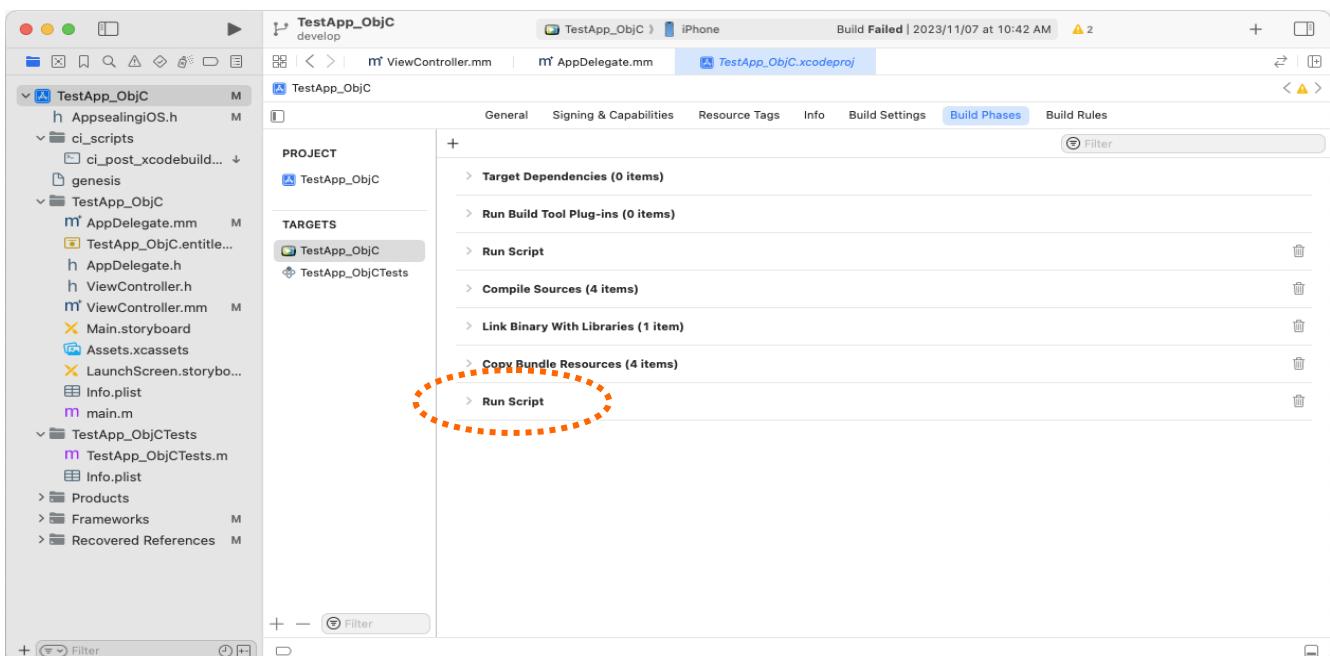
```
result=$( "${PROJECT_DIR}/AppSealingSDK/Tools/generate_hash" "apply" "${PROJECT_DIR}" )
echo $result
```



Next, click the "+" icon in the upper left corner once more to display the menu and additionally select the "New Run Script Phase" item.

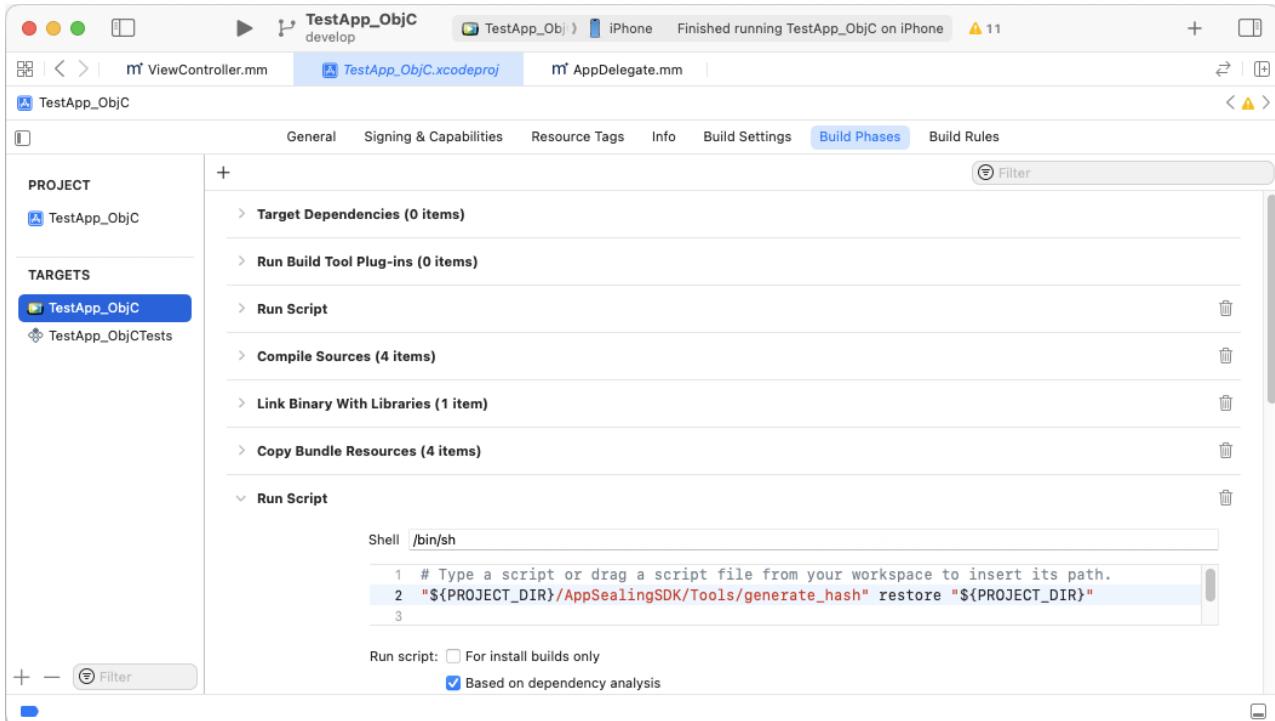


Now, one more "Run Script" item should be added at the bottom as shown in the screen below.



Click the ">" icon to the left of "Run Script" to expand the script items, then copy and paste the contents below into the script box.

```
"${PROJECT_DIR}/AppSealingSDK/Tools/generate_hash" "restore" "${PROJECT_DIR}"
```



8-2 Append encryption tag to strings

Now, all Build Phase settings for string encryption have been completed. You need to add tags to the strings that you want to apply encryption to in source code. The encryption tag is "\0x1\0x1\0x1\0x1" and must be added to the end of the string.

e.g)

"This is my string" → "This is my string\0x1\0x1\0x1\0x1"

"Special char !@#\$%^\" → "Special char !@#\$%^\"\\0x1\0x1\0x1\0x1"

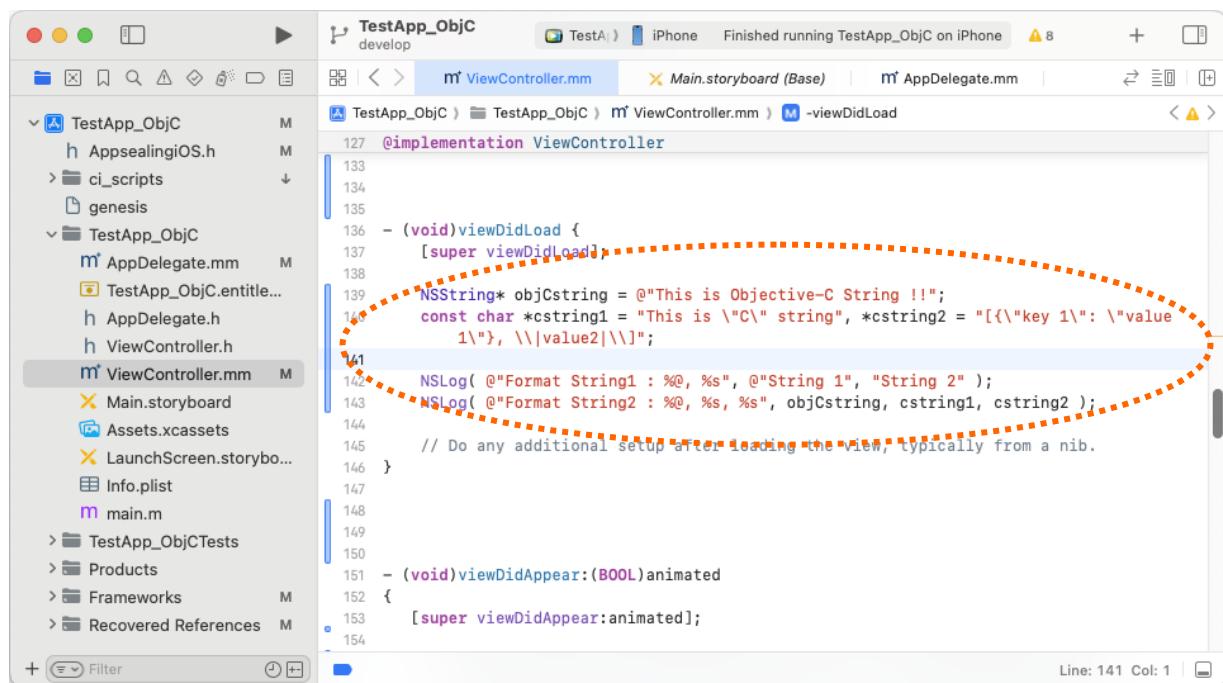
"문자열을 암호화 합니다" → "문자열을 암호화 합니다\0x1\0x1\0x1\0x1"

"文字列を暗号化します" → "文字列を暗号化します\0x1\0x1\0x1\0x1"

"加密字符串" → "加密字符串\0x1\0x1\0x1\0x1"

"Cifrar la cadena" → "Cifrar la cadena\0x1\0x1\0x1\0x1"

Let's apply tags to a string in actual source code. The TestApp_ObjC project is based on the Objective-C language, so it can include both C/C++ strings and Objective-C strings in the source code.



```

TestApp_ObjC
develop
TestA iPhone Finished running TestApp_ObjC on iPhone 8
+ □
m ViewController.mm X Main.storyboard (Base) M AppDelegate.mm
TestApp_ObjC
M ViewDidLoad
M AppDelegate.mm M
TestApp_ObjC.entitlements
M AppDelegate.h
M ViewController.h
m ViewController.mm M
X Main.storyboard
Assets.xcassets
X LaunchScreen.storyboard
Info.plist
m main.m
TestApp_ObjCTests
Products
Frameworks M
Recovered References M
+ Filter
Line: 141 Col: 1
127 @implementation ViewController
133
134
135
136 - (void)viewDidLoad {
137     [super viewDidLoad];
138
139     NSString* objCstring = @\"This is Objective-C String !!\";
140     const char *cstring1 = "This is \"C\" string", *cstring2 = "[{\\"key 1\\": \\"value
141         1\"}, \\\\|value2|\\\\]";
142
143     NSLog( @\"Format String1 : %@, %s\", @\"String 1\", \"String 2\" );
144     NSLog( @\"Format String2 : %@, %s, %s\", objCstring, cstring1, cstring2 );
145
146     // Do any additional setup after loading the view, typically from a nib.
147
148
149
150
151 - (void)viewDidAppear:(BOOL)animated
152 {
153     [super viewDidAppear:animated];
154

```

Let's apply encryption to four Objective-C strings and three C strings in the viewDidLoad function in the code above.

[Objective-C strings]

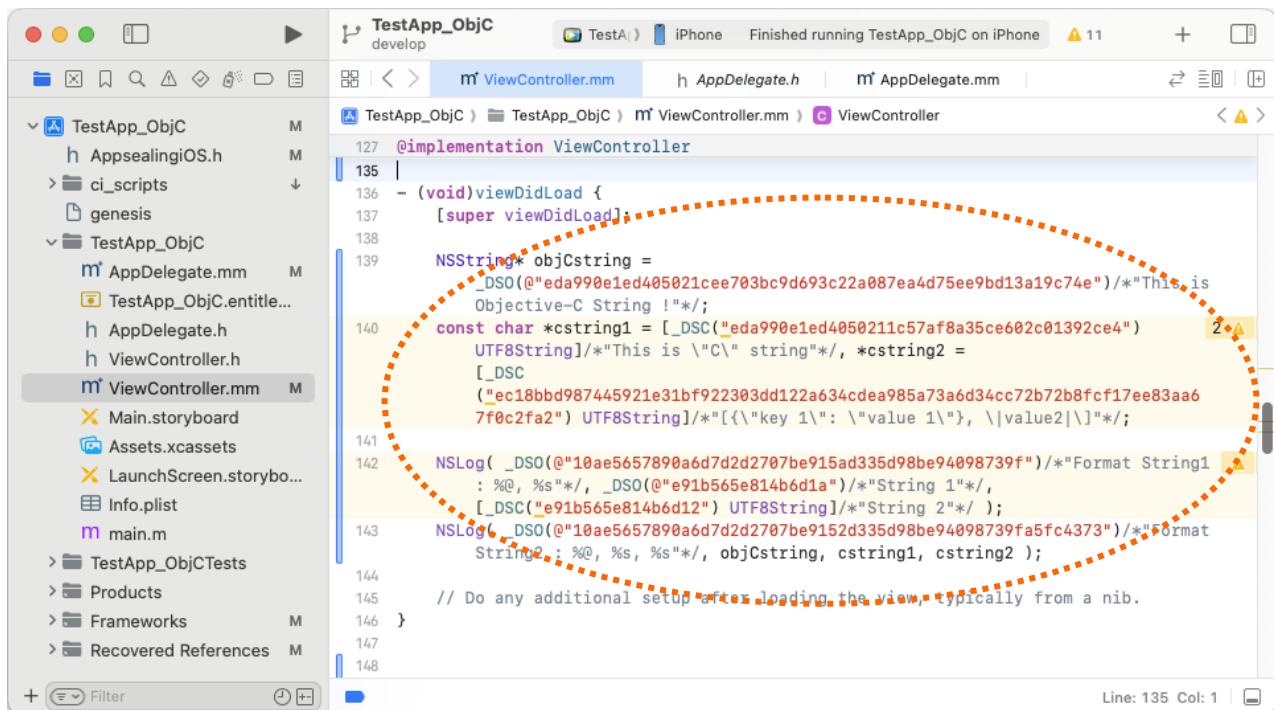
```
@"This is Objective-C String !" ➔ @"This is Objective-C String !\0x1\0x1\0x1\0x1"
@"Format String1 : %@", %s" ➔ @"Format String1 : %@", %s\0x1\0x1\0x1\0x1"
@"String 1" ➔ @"String 1\0x1\0x1\0x1\0x1"
@"Format String2 : %@", %s, %s" ➔ @"Format String2 : %@", %s, %s\0x1\0x1\0x1\0x1"
```

[C strings]

```
"This is \"C\" string" ➔ "This is \"C\" string\0x1\0x1\0x1\0x1"
"[{"key 1": "value 1"}, \\|value2|\\]" ➔
    "[{"key 1": "value 1"}, \\|value2|\\]\0x1\0x1\0x1\0x1"
"String 2" ➔ "String 2\0x1\0x1\0x1\0x1"
```

The code with all tags applied is as follows.

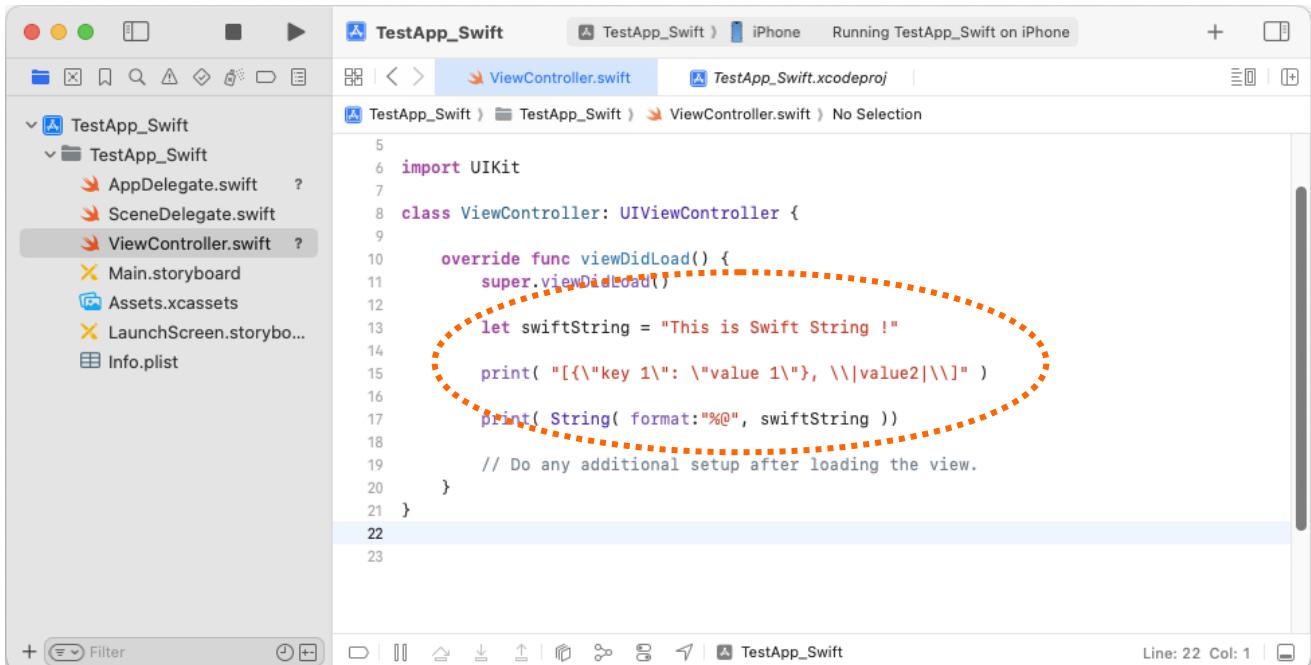
Objective-C code with this tag applied is converted to an encrypted string as shown below at the time of compilation, and when compilation is completed, it is restored to the original tagged string as shown in the picture above. (So Objective-C code containing encrypted strings like the one below won't be visible under normal circumstances)



The screenshot shows the Xcode interface with the project 'TestApp_ObjC' open. The file 'ViewController.mm' is selected in the editor. A red dashed oval highlights several lines of code where the string literals have been replaced by their encrypted equivalents. The original string literals are visible as comments within the code.

```
127 @implementation ViewController
135 | - (void)viewDidLoad {
136 |     [super viewDidLoad];
137 |
138 |
139 |     NSString* objCString =
140 |         _DSO(@"eda990e1ed4050211ce703bc9d693c22a087ea4d75ee9bd13a19c74e")/*This is
141 |         Objective-C String !*/;
142 |     const char *cstring1 = [_DSC("eda990e1ed4050211c57af8a35ce602c01392ce4")
143 |         UTF8String]/*"This is \"C\" string"*/, *cstring2 =
144 |         [_DSC
145 |             ("ec18bbd987445921e31bf922303dd122a634cdea985a73a6d34cc72b72b8fcf17ee83aa
146 |             7f0c2fa2") UTF8String]/*"[{"key 1": "value 1"}, {"value2"}]"*/;
147 |
148 |
149 |     NSLog( _DSO(@"10ae5657890a6d7d2d2707be915ad335d98be94098739f")/*Format String1
150 |         : %@, %s"*/, _DSO(@"e91b565e814b6d1a")/*"String 1"*/,
151 |         [_DSC("e91b565e814b6d12") UTF8String]/*"String 2"*/ );
152 |     NSLog( _DSO(@"10ae5657890a6d7d2d2707be9152d335d98be94098739fa5fc4373")/*"Format
153 |         String2 : %@, %s, %s"*/, objCString, cstring1, cstring2 );
154 |
155 |     // Do any additional setup after loading the view, typically from a nib.
156 | }
```

For Swift source code, tag application is done in the same way.



```

5
6 import UIKit
7
8 class ViewController: UIViewController {
9
10    override func viewDidLoad() {
11        super.viewDidLoad()
12
13        let swiftString = "This is Swift String !"
14
15        print( "[{\"key 1\": \"value 1\"}, \\\"value2\\\"]" )
16
17        print( String( format:@"%@", swiftString ) )
18
19        // Do any additional setup after loading the view.
20    }
21
22
23

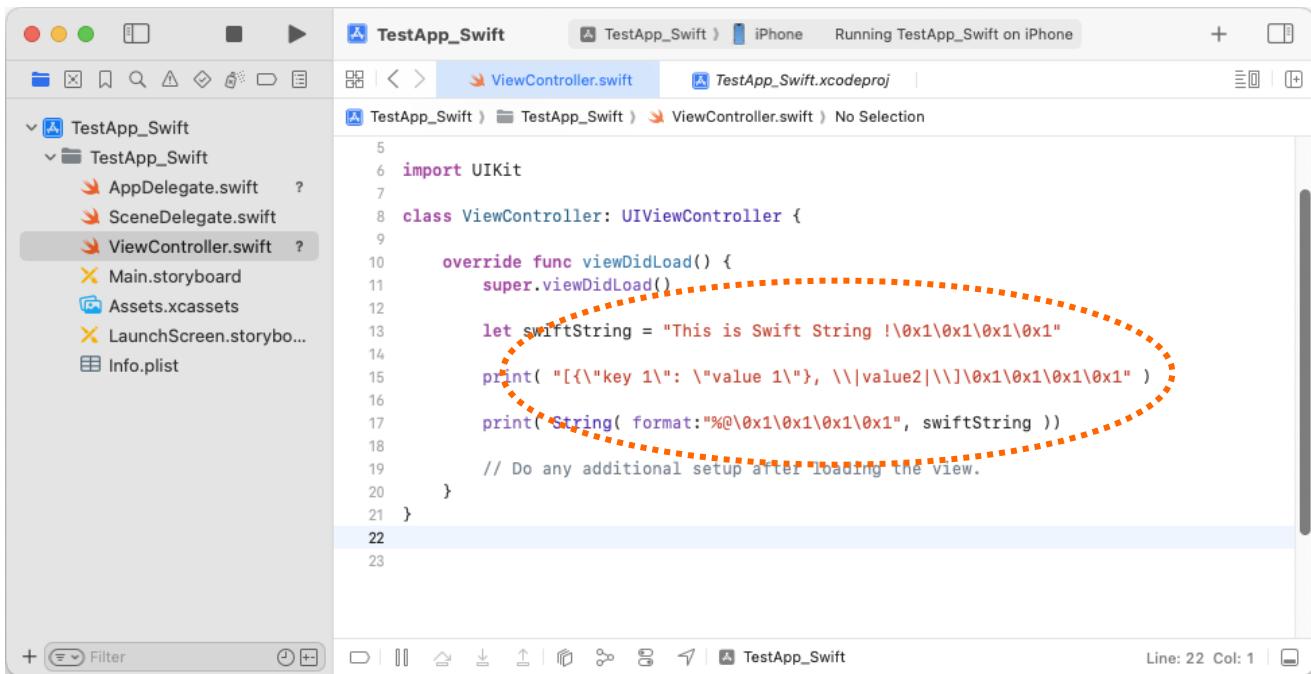
```

"This is Swift string" → "This is Swift string\0x1\0x1\0x1\0x1"

"[{"key 1": "value 1"}, \"value2\"]" →

[{"key 1": "value 1"}, \"value2\"]\0x1\0x1\0x1\0x1"

"%" → "%@\0x1\0x1\0x1\0x1"

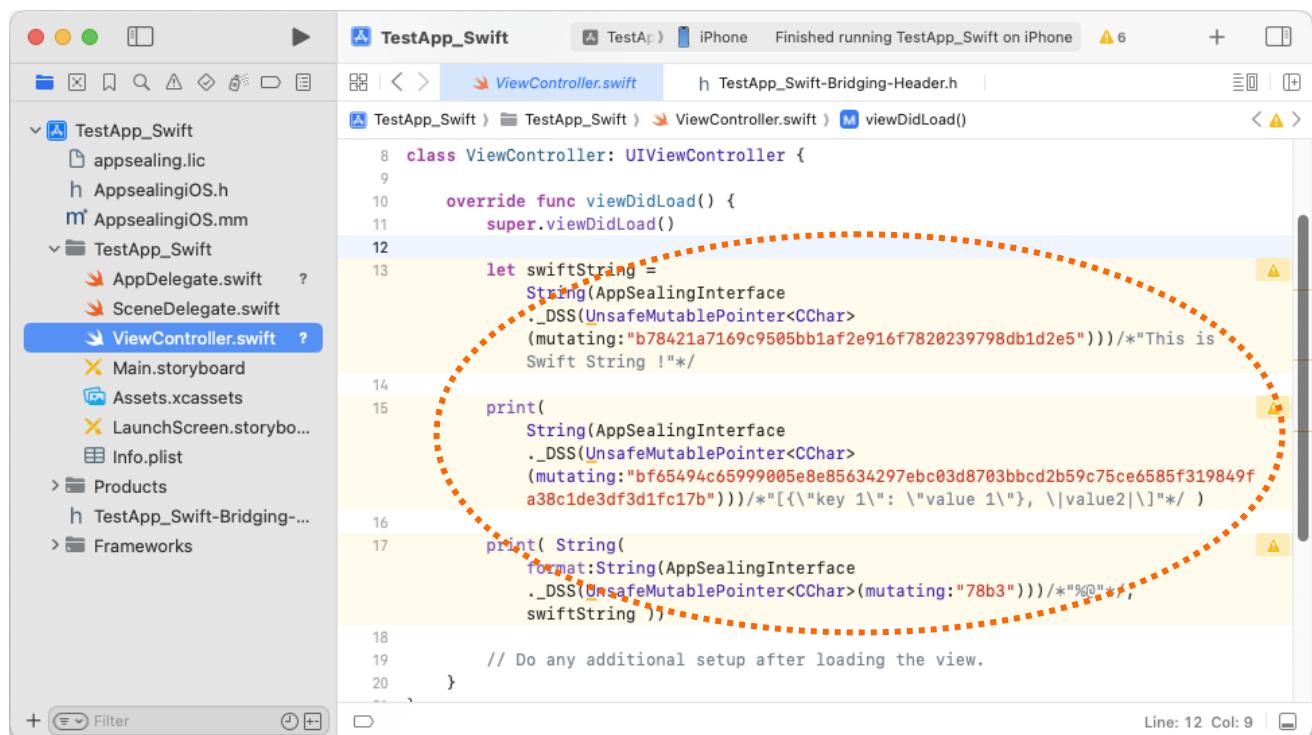


```

5
6 import UIKit
7
8 class ViewController: UIViewController {
9
10    override func viewDidLoad() {
11        super.viewDidLoad()
12
13        let swiftString = "This is Swift String !\0x1\0x1\0x1\0x1"
14
15        print( "[{\"key 1\": \"value 1\"}, \\\"value2\\\"]\0x1\0x1\0x1\0x1" )
16
17        print( String( format:@"%@\0x1\0x1\0x1\0x1", swiftString ) )
18
19        // Do any additional setup after loading the view.
20    }
21
22
23

```

The tagged Swift code is converted to an encrypted string as shown below at the time of compilation, and when compilation is completed, it is restored to the original tagged string as shown above. (Similarly, Swift code containing encrypted strings like the one below is also not visible under normal circumstances)



The screenshot shows the Xcode interface with the project 'TestApp_Swift' open. The 'ViewController.swift' file is selected in the left sidebar. The code editor displays the following Swift code:

```
8 class ViewController: UIViewController {
9
10    override func viewDidLoad() {
11        super.viewDidLoad()
12
13        let swiftString = String(AppSealingInterface
14            ._DSS(UnsafeMutablePointer<CChar>
15            (mutating: "b78421a7169c9505bb1af2e916f7820239798db1d2e5"))/*This is
16        Swift String !*/
17
18        print(
19            String(AppSealingInterface
20                ._DSS(UnsafeMutablePointer<CChar>(mutating: "bf65494c65999005e8e85634297ebc03d8703bbcd2b59c75ce6585f319849f
21                a38c1de3df3d1fc17b"))/*[{"key 1": "value 1"}, {"key 2": "value 2"}]*/
22
23        print( String(
24            format:String(AppSealingInterface
25                ._DSS(UnsafeMutablePointer<CChar>(mutating: "78b3"))/*"%@"*/,
26            swiftString ))
27
28        // Do any additional setup after loading the view.
29    }
30}
```

A red dotted circle highlights the line of code where a Swift String is converted to an encrypted string using the `_DSS` function. The code is annotated with comments explaining the conversion process.

8-3 Precautions for Swift string encryption

- When using the string enumeration like the following, tags cannot be added to strings specified as raw values. If you add tags, a compilation error will occur.

```
enum StringEnum: String
{
    case first = "FIRST"
    case second = "SECOND"
    case third = "THIRD"
}
```



```
enum StringEnum: String
{
    case first = "FIRST\0x1\0x1\0x1\0x1"
    case second = "SECOND\0x1\0x1\0x1\0x1"
    case third = "THIRD\0x1\0x1\0x1\0x1"
}
```

- You cannot add tags to multiline strings like the following.

```
let str = """
    This is multi
    line string,
    do not use tag
"""

```



```
let str = """
    This is multi\0x1\0x1\0x1\0x1
    line string,\0x1\0x1\0x1\0x1
    do not use tag\0x1\0x1\0x1\0x1
"""

```

- Tags cannot be added to strings that have string interpolation applied, as shown below.

```
var city = "Seoul"
var message = "Welcome to \(city)!"
print( "Message : \(message)" )
```



```
var city = "Seoul"
var message = "Welcome to \(city)!\0x1\0x1\0x1\0x1"
print( "Message : \(message)\0x1\0x1\0x1\0x1" )
```

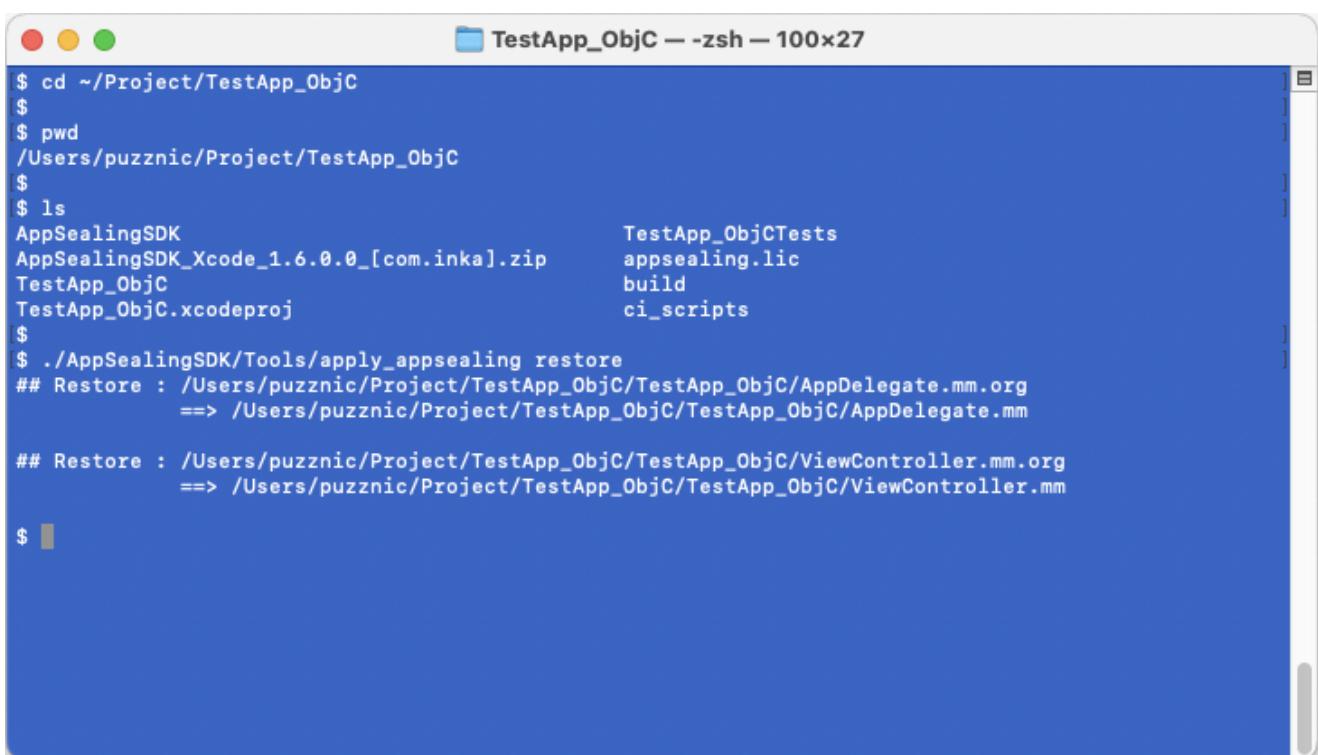
8-4 Handle compile error: Restore encrypted string

The tagged string is changed to an encrypted string just before compilation and restored to the original string after compilation (8-1 Run Script). However, if a compilation error occurs or the compilation process is interrupted for any reason, the script after compilation will not be executed, this will lead to a problem where the encrypted string will remain in the source code without being restored.

In this case, there are two ways to restore the encrypted string to its original state.

The first is restoration through script execution. Launch the Terminal app and navigate to your project directory. Then run the “AppSealingSDK/Tools/apply_appsealing” script with the “restore” parameter to restore the original code.

```
$ ./AppSealingSDK/Tools/apply_appsealing restore
```



```
[~] $ cd ~/Project/TestApp_ObjC
[~] $
[~] $ pwd
/Users/puzznic/Project/TestApp_ObjC
[~] $
[~] $ ls
AppSealingSDK          TestApp_ObjCTests
AppSealingSDK_Xcode_1.6.0.0_[com.inka].zip   appsealing.lic
TestApp_ObjC            build
TestApp_ObjC.xcodeproj    ci_scripts
[~] $
[~] $ ./AppSealingSDK/Tools/apply_appsealing restore
## Restore : /Users/puzznic/Project/TestApp_ObjC/TestApp_ObjC/AppDelegate.mm.org
      ==> /Users/puzznic/Project/TestApp_ObjC/TestApp_ObjC/AppDelegate.mm

## Restore : /Users/puzznic/Project/TestApp_ObjC/TestApp_ObjC/ViewController.mm.org
      ==> /Users/puzznic/Project/TestApp_ObjC/TestApp_ObjC/ViewController.mm
```

When you run the script, you will see a message displayed that the two source codes of the TestApp_ObjC project used as an example, AppDelegate.mm and ViewController.mm, have been restored.

The second method is to return the backed-up code file to its original name by directly entering a shell command in the terminal. Taking the TestApp_ObjC project as an example, if you list the contents of the TestApp_ObjC subfolder under the TestApp_ObjC folder, you can see that two source codes are backed up with the extension ".org", as shown in the screen below.

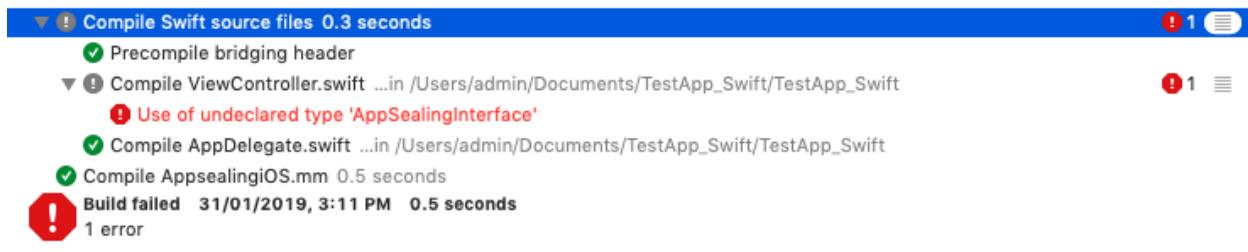
Now enter the command below to return the two files to their original names.

```
$ mv ./TestApp_ObjC/ViewController.mm.org ./TestApp_ObjC/ViewController.mm  
$ mv ./TestApp_ObjC/AppDelegate.mm.org ./TestApp_ObjC/AppDelegate.mm
```

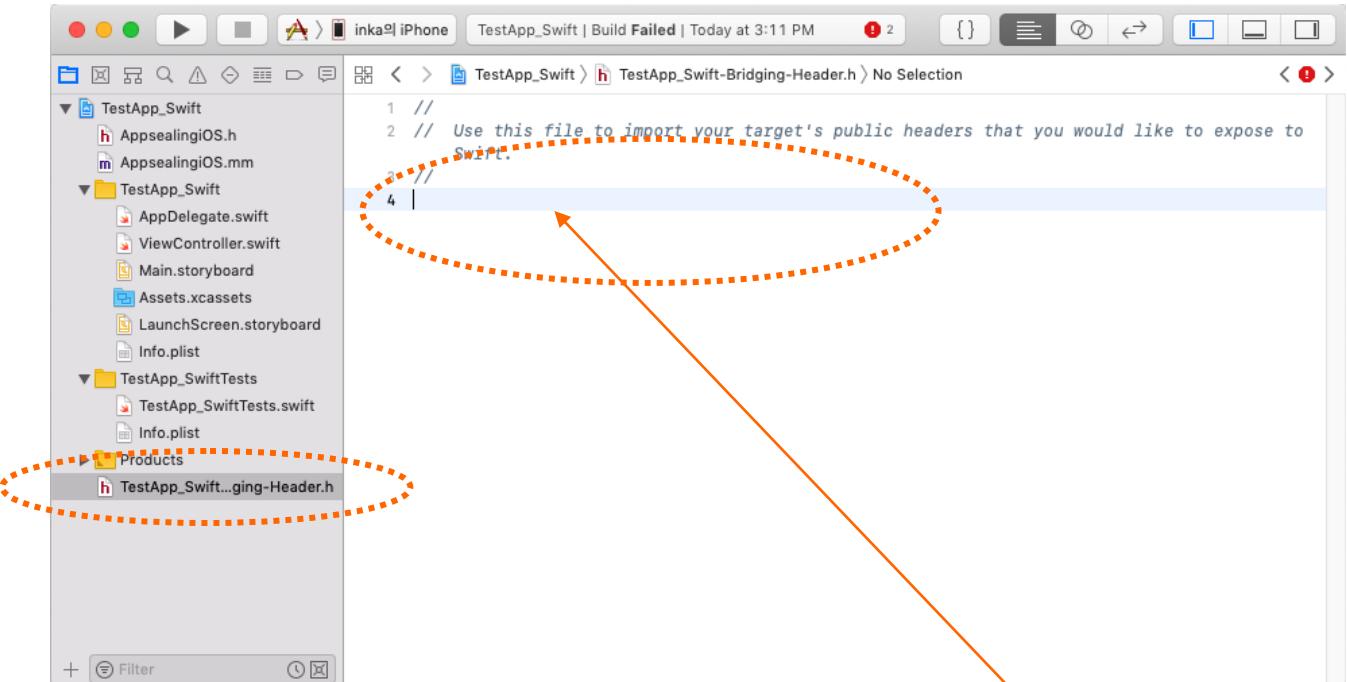
```
$ ls -al ./TestApp_ObjC  
total 208  
drwxrwxr-x 17 puzznic staff 544 11 21 11:56 .  
drwxr-xr-x@ 12 puzznic staff 384 10 26 17:48 ..  
-rw-rw-r--@ 1 puzznic staff 6148 4 24 2023 .DS_Store  
-rw-rw-r--@ 1 puzznic staff 284 1 23 2019 AppDelegate.h  
-rw-rw-r--@ 1 puzznic staff 6111 11 21 11:56 AppDelegate.mm  
-rw-rw-r--@ 1 puzznic staff 6085 11 21 11:56 AppDelegate.mm.org  
drwxrwxr-x 4 puzznic staff 128 10 15 2021 Assets.xcassets  
drwxrwxr-x 4 puzznic staff 128 1 23 2019 Base.lproj  
-rw-rw-r--@ 1 puzznic staff 1557 5 18 2023 Info.plist  
-rw-rw-r--@ 1 puzznic staff 181 1 3 2023 TestApp_ObjC.entitlements  
-rw-rw-r--@ 1 puzznic staff 500 1 16 2023 ViewController.h  
-rw-rw-r--@ 1 puzznic staff 11609 11 21 11:56 ViewController.mm  
-rw-rw-r--@ 1 puzznic staff 11292 11 21 11:56 ViewController.mm.org  
-rw-rw-r-- 1 puzznic staff 19019 10 25 2022 aes.cpp  
-rw-rw-r-- 1 puzznic staff 2790 10 25 2022 aes.hpp  
-rw-----@ 1 puzznic staff 9573 12 27 2022 genesis  
-rw-rw-r--@ 1 puzznic staff 341 1 23 2019 main.m  
$  
$ mv ./TestApp_ObjC/ViewController.mm.org ./TestApp_ObjC/ViewController.mm  
$  
$ mv ./TestApp_ObjC/AppDelegate.mm.org ./TestApp_ObjC/AppDelegate.mm  
$
```

Part 9. Troubleshooting

9-1 Xcode Build error (1) Use of undeclared type 'AppSealingInterface'



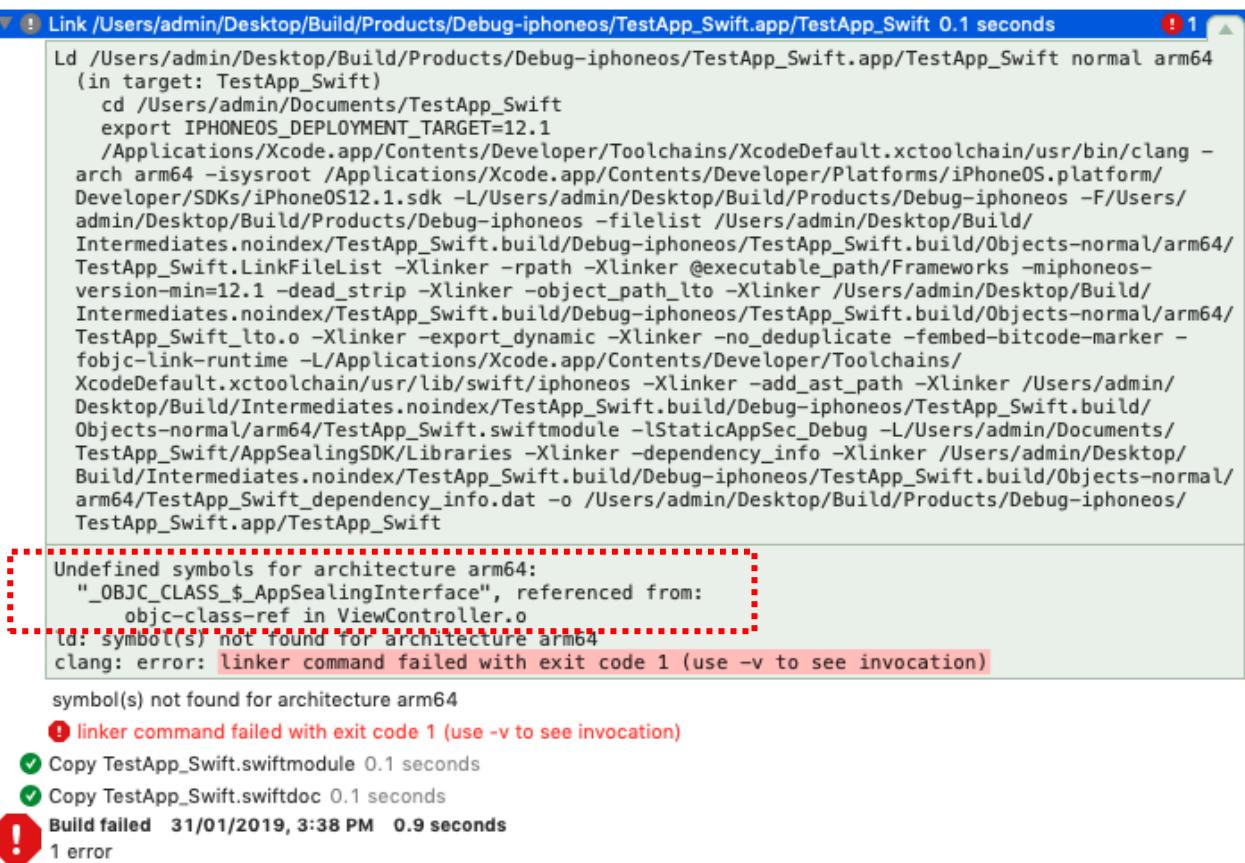
You will get an error message like above when you omit or miss-typed '#import "AppsealingiOS.h"' sentence in Bridging Header file.



Select "TestApp_Swift-Bridging-Header.h" and append '#import "AppsealingiOS.h"' at the end of document. Be sure that "AppsealingiOS.h" file exist in the designated folder (Xcode project/AppSealingSDK/Libraries/AppsealingiOS.h)

Also, the "AppsealingiOS.h" file must be included in your project with "AppsealingiOS.mm" file.

9-2 Xcode Build error (2) **Undefined symbols for architecture arm64:** "**_OBJC_CLASS_\$_AppSealingInterface**"



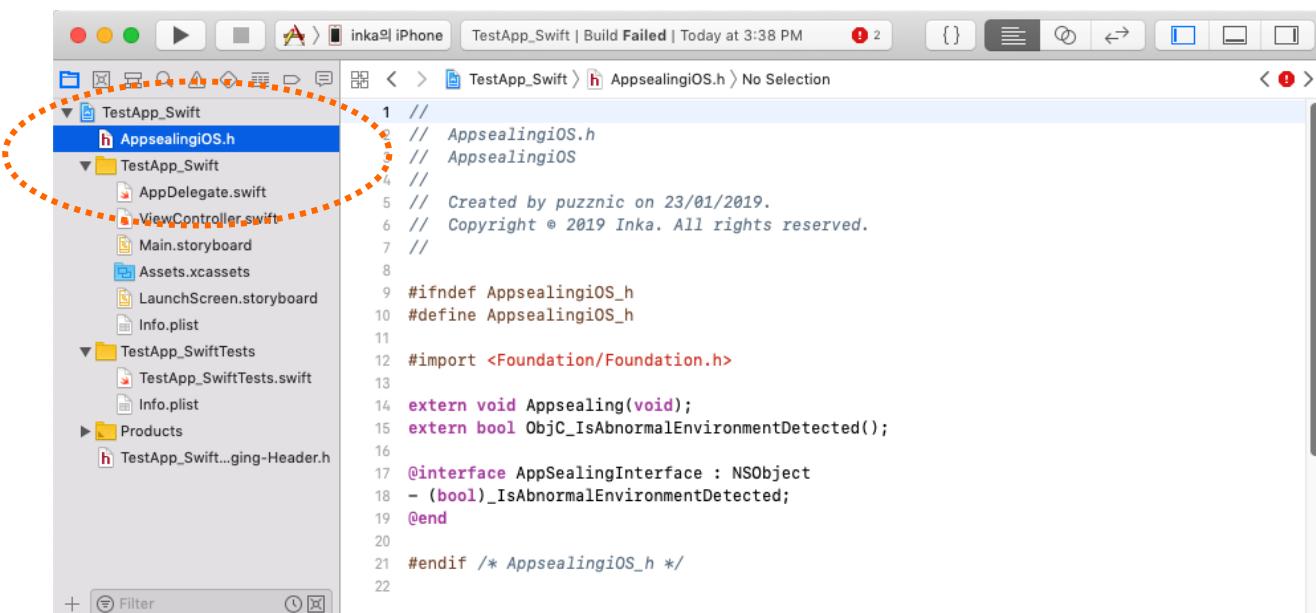
```

Ld /Users/admin/Desktop/Build/Products/Debug-iphoneos/TestApp_Swift.app/TestApp_Swift 0.1 seconds
  Ld /Users/admin/Desktop/Build/Products/Debug-iphoneos/TestApp_Swift.app/TestApp_Swift normal arm64
    (in target: TestApp_Swift)
      cd /Users/admin/Documents/TestApp_Swift
      export IPHONEOS_DEPLOYMENT_TARGET=12.1
      /Applications/Xcode.app/Contents/Developer/Toolchains/XcodeDefault.xctoolchain/usr/bin/clang -
        arch arm64 -isysroot /Applications/Xcode.app/Contents/Developer/Platforms/iPhoneOS.platform/
        Developer/SDKs/iPhoneOS12.1.sdk -L/Users/admin/Desktop/Build/Products/Debug-iphoneos -F/Users/
        admin/Desktop/Build/Products/Debug-iphoneos -filelist /Users/admin/Desktop/Build/
        Intermediates.noindex/TestApp_Swift.build/Debug-iphoneos/TestApp_Swift.build/Objects-normal/arm64/
        TestApp_Swift.LinkFileList -Xlinker -rpath -Xlinker @executable_path/Frameworks -miphoneos-
        version-min=12.1 -dead_strip -Xlinker -object_path_lto -Xlinker /Users/admin/Desktop/Build/
        Intermediates.noindex/TestApp_Swift.build/Debug-iphoneos/TestApp_Swift.build/Objects-normal/arm64/
        TestApp_Swift_lto.o -Xlinker -export_dynamic -Xlinker -no_deduplicate -fembed-bitcode-marker -
        fobjc-link-runtime -L/Applications/Xcode.app/Contents/Developer/Toolchains/
        XcodeDefault.xctoolchain/usr/lib/swift/iphoneos -Xlinker -add_ast_path -Xlinker /Users/admin/
        Desktop/Build/Intermediates.noindex/TestApp_Swift.build/Debug-iphoneos/TestApp_Swift.build/
        Objects-normal/arm64/TestApp_Swift.swiftmodule -lStaticAppSec_Debug -L/Users/admin/Documents/
        TestApp_Swift/AppSealingSDK/Libraries -Xlinker -dependency_info -Xlinker /Users/admin/Desktop/
        Build/Intermediates.noindex/TestApp_Swift.build/Debug-iphoneos/TestApp_Swift.build/Objects-normal/
        arm64/TestApp_Swift_dependency_info.dat -o /Users/admin/Desktop/Build/Products/Debug-iphoneos/
        TestApp_Swift.app/TestApp_Swift

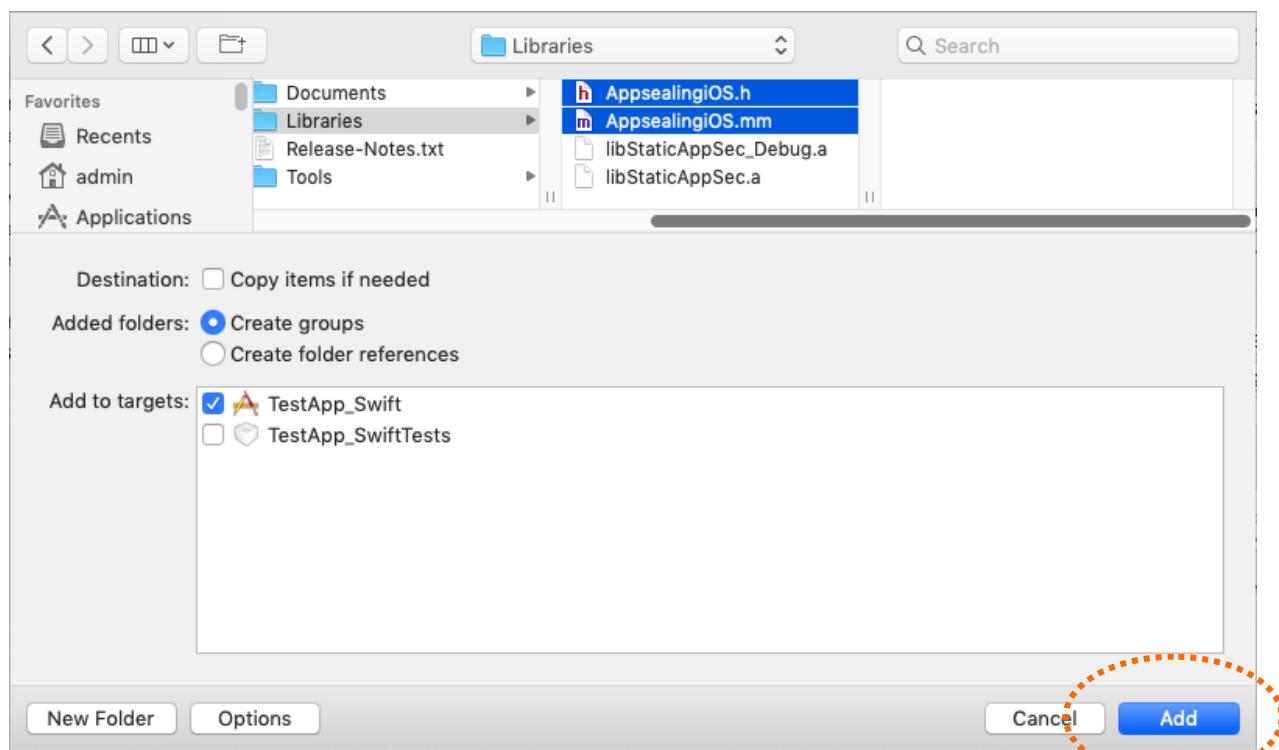
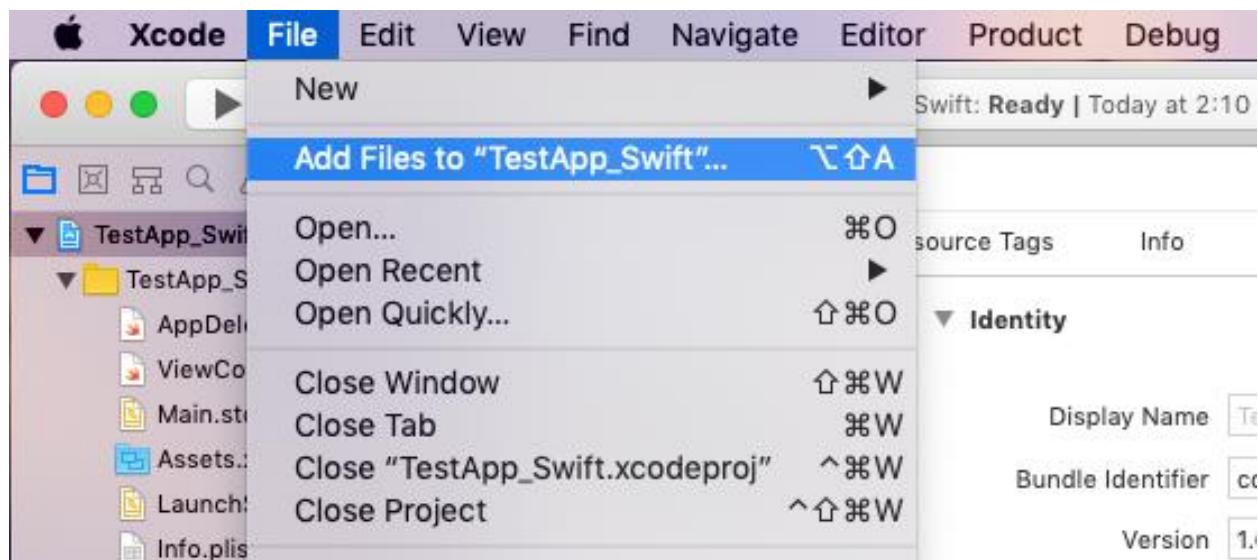
Undefined symbols for architecture arm64:
  "_OBJC_CLASS_$_AppSealingInterface", referenced from:
    objc-class-ref in ViewController.o
ld: symbol(s) not found for architecture arm64
clang: error: linker command failed with exit code 1 (use -v to see invocation)

symbol(s) not found for architecture arm64
  1 linker command failed with exit code 1 (use -v to see invocation)
  ✓ Copy TestApp_Swift.swiftmodule 0.1 seconds
  ✓ Copy TestApp_Swift.swiftdoc 0.1 seconds
Build failed 31/01/2019, 3:38 PM 0.9 seconds
  1 error
!
```

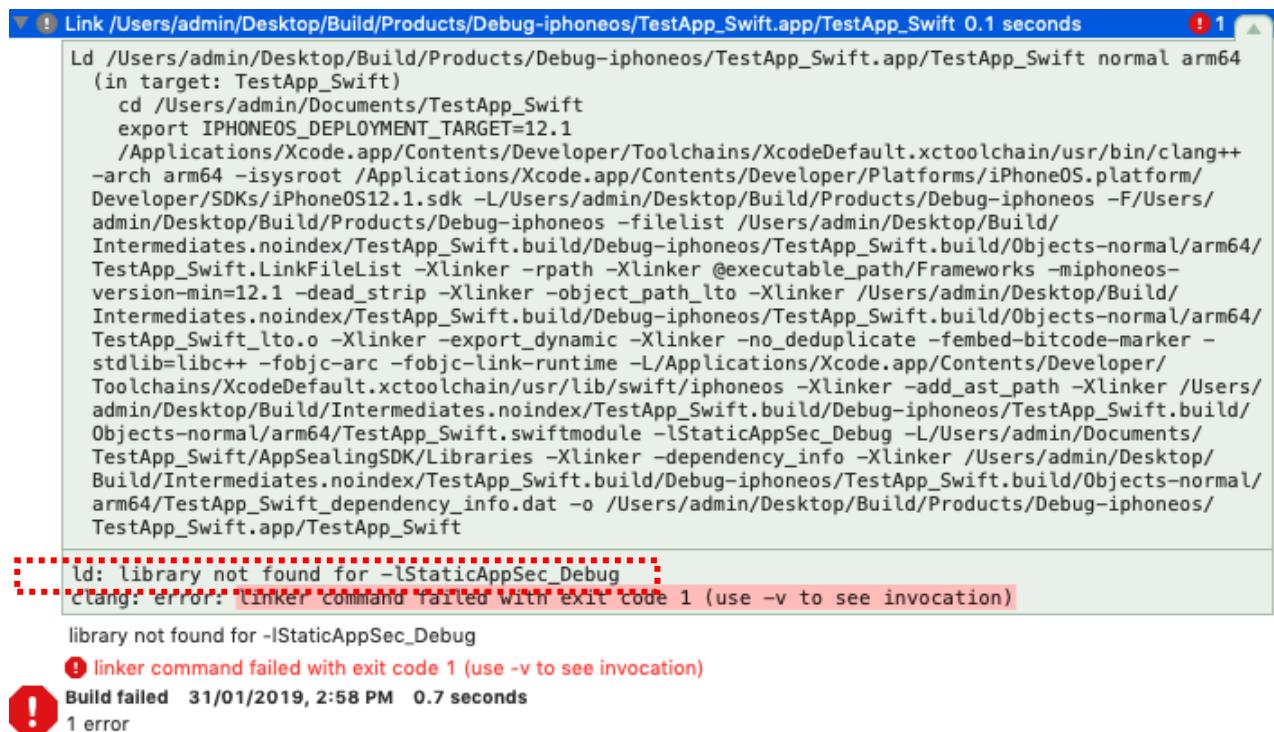
This linker error occurs when the "AppsealingiOS.mm" is not included in your project. Check project tree whether the file has added or not.



If the "AppsealingiOS.mm" file is not included in your project, perform "File > Add Files to "TestApp_Swift" ... " menu action.



9-3 Xcode Build error (3) **ld: library not found for -lStaticAppSec_Debug**



```
Ld /Users/admin/Desktop/Build/Products/Debug-iphoneos/TestApp_Swift.app/TestApp_Swift normal arm64
(in target: TestApp_Swift)
cd /Users/admin/Documents/TestApp_Swift
export IPHONEOS_DEPLOYMENT_TARGET=12.1
/Applications/Xcode.app/Contents/Developer/Toolchains/XcodeDefault.xctoolchain/usr/bin/clang++
-arch arm64 -isysroot /Applications/Xcode.app/Contents/Developer/Platforms/iPhoneOS.platform/
Developer/SDKs/iPhoneOS12.1.sdk -L/Users/admin/Desktop/Build/Products/Debug-iphoneos -F/Users/
admin/Desktop/Build/Products/Debug-iphoneos -filelist /Users/admin/Desktop/Build/
Intermediates.noindex/TestApp_Swift.build/Debug-iphoneos/TestApp_Swift.build/Objects-normal/arm64-
TestApp_Swift.LinkFileList -Xlinker -rpath -Xlinker @executable_path/Frameworks -miphoneos-
version-min=12.1 -dead_strip -Xlinker -object_path_lto -Xlinker /Users/admin/Desktop/Build/
Intermediates.noindex/TestApp_Swift.build/Debug-iphoneos/TestApp_Swift.build/Objects-normal/arm64-
TestApp_Swift_lto.o -Xlinker -export_dynamic -Xlinker -no_deduplicate -fembed-bitcode-marker -
stdlib=libc++ -fobjc-arc -fobjc-link-runtime -L/Applications/Xcode.app/Contents/Developer/
Toolchains/XcodeDefault.xctoolchain/usr/lib/iphoneos -Xlinker -add_ast_path -Xlinker /Users/
admin/Desktop/Build/Intermediates.noindex/TestApp_Swift.build/Debug-iphoneos/TestApp_Swift.build/
Objects-normal/arm64/TestApp_Swift.swiftmodule -lStaticAppSec_Debug -L/Users/admin/Documents/
TestApp_Swift/AppSealingSDK/Libraries -Xlinker -dependency_info -Xlinker /Users/admin/Desktop/
Build/Intermediates.noindex/TestApp_Swift.build/Debug-iphoneos/TestApp_Swift.build/Objects-normal/
arm64/TestApp_Swift_dependency_info.dat -o /Users/admin/Desktop/Build/Products/Debug-iphoneos/
TestApp_Swift.app/TestApp_Swift

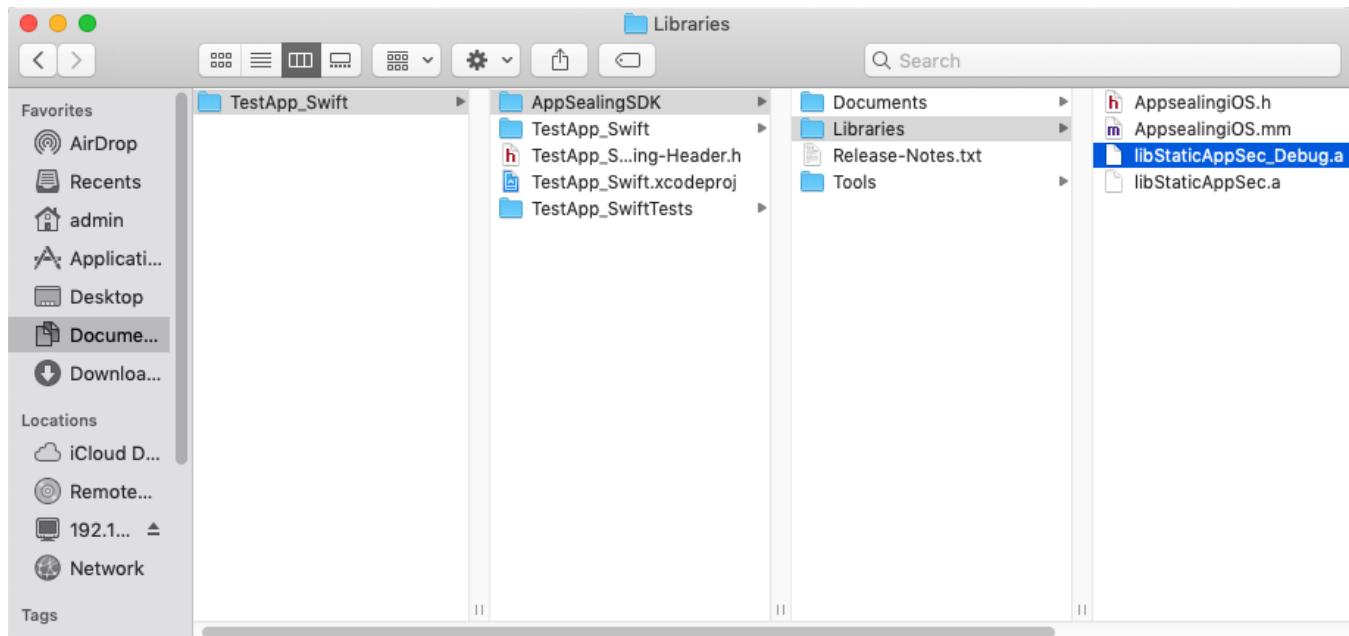
ld: library not found for -lStaticAppSec_Debug
clang: error: linker command failed with exit code 1 (use -v to see invocation)

library not found for -lStaticAppSec_Debug
linker command failed with exit code 1 (use -v to see invocation)
```

Build failed 31/01/2019, 2:58 PM 0.7 seconds
1 error

This linker error occurs when the libStaticAppSec_Debug.a file is not exist in the designated folder or corrupted. The libStaticAppSec_Debug.a file should be exist in following path.

"*TestApp_Swift* (Project folder) > *AppSealingSDK* > *Libraries* > *libStaticAppSec_Debug.a*"

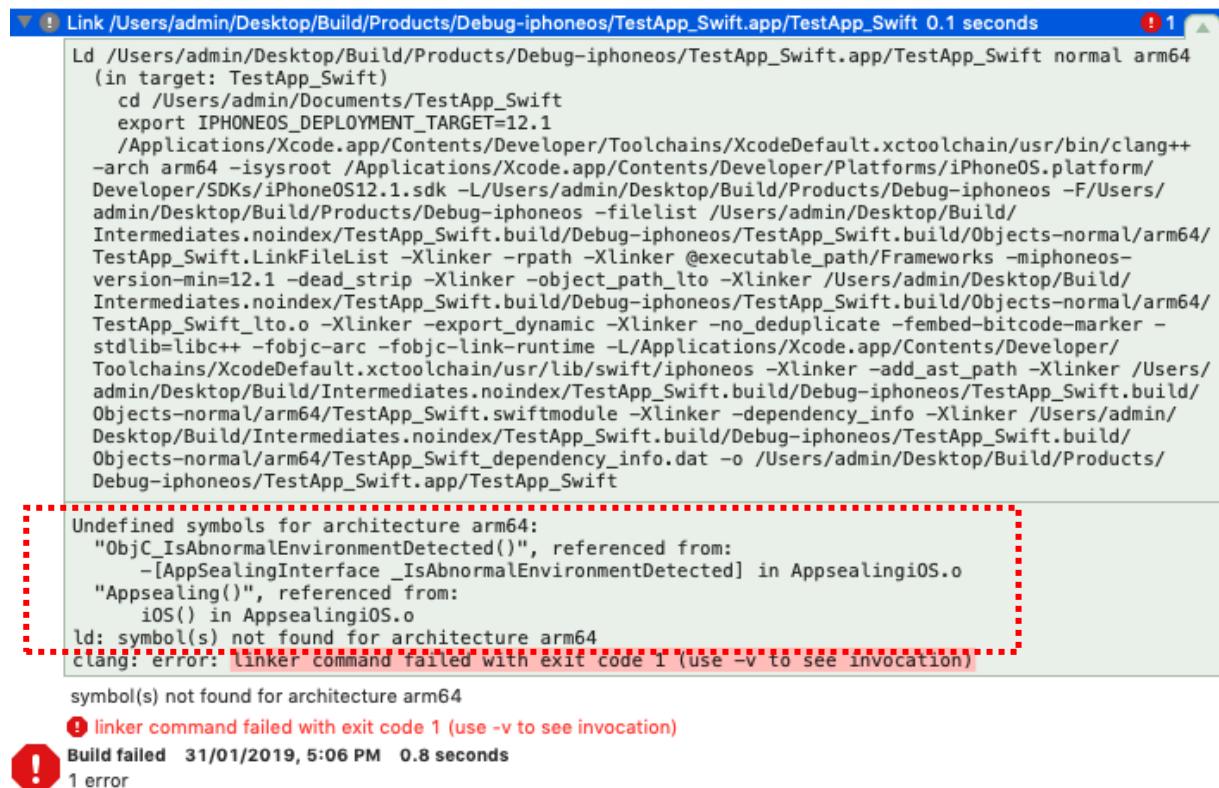


If the file is missing (or maybe corrupted) try to re-download or re-expand AppSealingSDK zip file.

This step is also applied to the linker error that says "ld: library not found for -lStaticAppSec" by just replacing "lStaticAppSec_Debug" to "lStaticAppSec". For Release builds, the file "libStaticAppSec.a" must exist in the correct location.

"TestApp_Swift (Project folder) > AppSealingSDK > Libraries > libStaticAppSec.a"

9-4 Xcode Build error (4) **Undefined symbols for architecture arm64:** "**ObjC_IsAbnormalEnvironmentDetected()", "Appsealing()**"



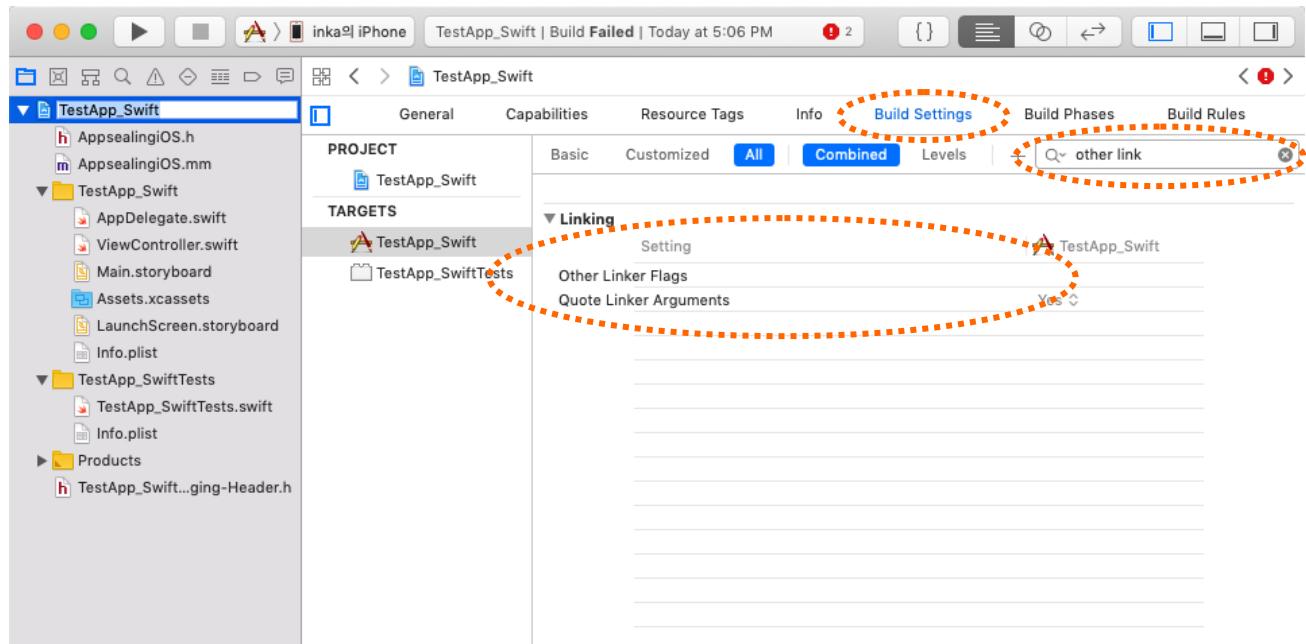
```
Ld /Users/admin/Desktop/Build/Products/Debug-iphoneos/TestApp_Swift.app/TestApp_Swift normal arm64
(in target: TestApp_Swift)
cd /Users/admin/Documents/TestApp_Swift
export IPHONEOS_DEPLOYMENT_TARGET=12.1
/Applications/Xcode.app/Contents/Developer/Toolchains/XcodeDefault.xctoolchain/usr/bin/clang++
-arch arm64 -isysroot /Applications/Xcode.app/Contents/Developer/Platforms/iPhoneOS.platform/
Developer/SDKs/iPhoneOS12.1.sdk -L/Users/admin/Desktop/Build/Products/Debug-iphoneos -F/Users/
admin/Desktop/Build/Products/Debug-iphoneos -filelist /Users/admin/Desktop/Build/
Intermediates.noindex/TestApp_Swift.build/Debug-iphoneos/TestApp_Swift.build/Objects-normal/arm64/
TestApp_Swift.LinkFileList -Xlinker -rpath -Xlinker @executable_path/Frameworks -miphoneos-
version-min=12.1 -dead_strip -Xlinker -object_path_lto -Xlinker /Users/admin/Desktop/Build/
Intermediates.noindex/TestApp_Swift.build/Debug-iphoneos/TestApp_Swift.build/Objects-normal/arm64/
TestApp_Swift_lto.o -Xlinker -export_dynamic -Xlinker -no_deduplicate -fembed-bitcode-marker -
stdlib=libc++ -fobjc-arc -fobjc-link-runtime -L/Applications/Xcode.app/Contents/Developer/
Toolchains/XcodeDefault.xctoolchain/usr/lib/swift/iphoneos -Xlinker -add_ast_path -Xlinker /Users/
admin/Desktop/Build/Intermediates.noindex/TestApp_Swift.build/Debug-iphoneos/TestApp_Swift.build/
Objects-normal/arm64/TestApp_Swift.swiftmodule -Xlinker -dependency_info -Xlinker /Users/admin/
Desktop/Build/Intermediates.noindex/TestApp_Swift.build/Debug-iphoneos/TestApp_Swift.build/
Objects-normal/arm64/TestApp_Swift_dependency_info.dat -o /Users/admin/Desktop/Build/Products/
Debug-iphoneos/TestApp_Swift.app/TestApp_Swift

Undefined symbols for architecture arm64:
"ObjC_IsAbnormalEnvironmentDetected()", referenced from:
-[AppSealingInterface _IsAbnormalEnvironmentDetected] in AppsealingiOS.o
"Appsealing()", referenced from:
    iOS() in AppsealingiOS.o
ld: symbol(s) not found for architecture arm64
clang: error: linker command failed with exit code 1 (use -v to see invocation)

symbol(s) not found for architecture arm64
! linker command failed with exit code 1 (use -v to see invocation)
Build failed 31/01/2019, 5:06 PM 0.8 seconds
1 error
```

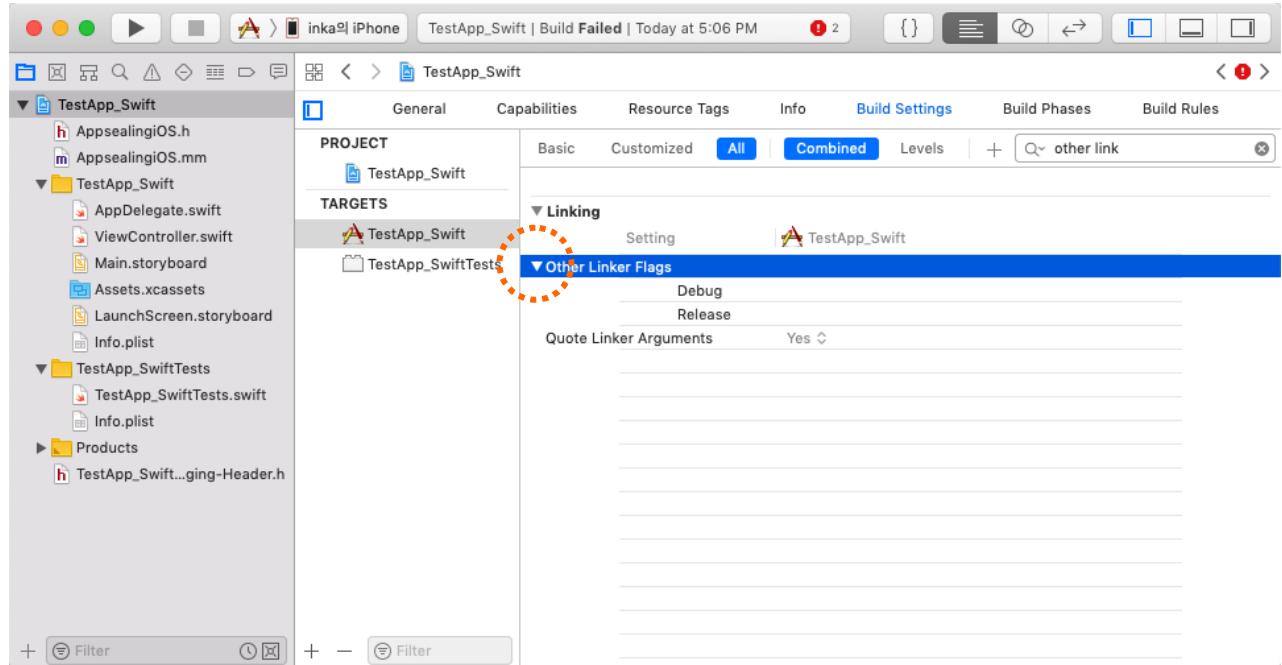
This linker error occurs when the value of "Other Linker Flags" field within "Build Settings" configuration section is missing or invalid.

First, check "Build Settings" for "**Other Linker Flags**" field value.



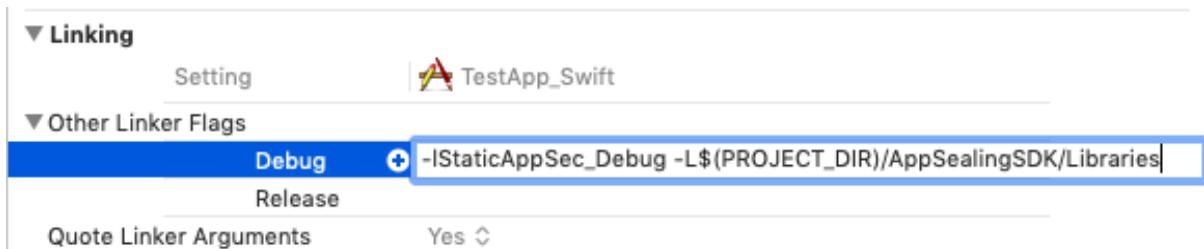
Now, restore the "Other Linker Flags" settings by following steps.

- 1) Clear the setting value : select "Other Linker Flags" row and press 'Delete' key.
- 2) Expand "Other Linker Flags" by clicking the triangle icon left to "Other Linker Flags"



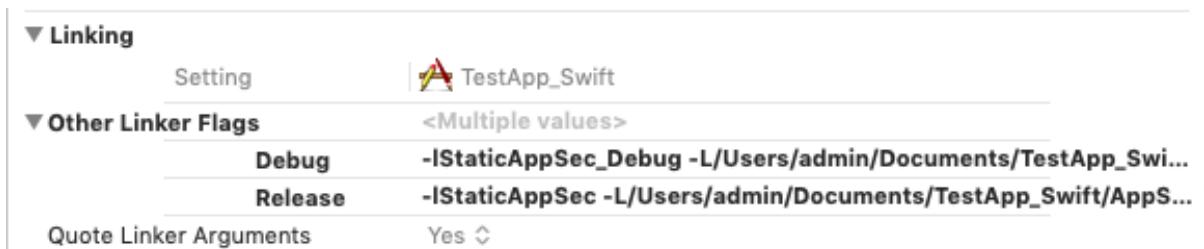
- 3) Select "Debug" item and click to edit/insert value, then type in following text.

-IStaticAppSec_Debug -L\$(PROJECT_DIR)/AppSealingSDK/Libraries



- 4) Select "Release" item and click to edit/insert value, then type in following text.

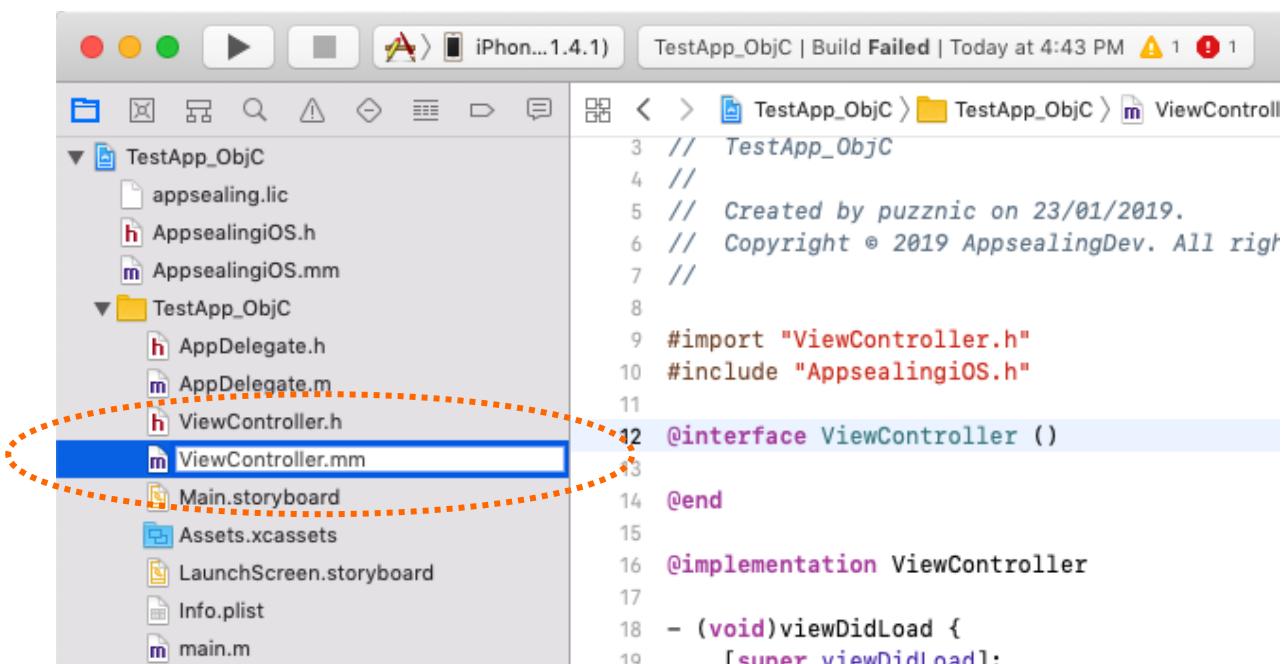
-IStaticAppSec -L\$(PROJECT_DIR)/AppSealingSDK/Libraries



9-5 Xcode Build error (5) **Undefined symbols for architecture arm64:**
"ObjC_IsAbnormalEnvironmentDetected()" (Objective-C project only)

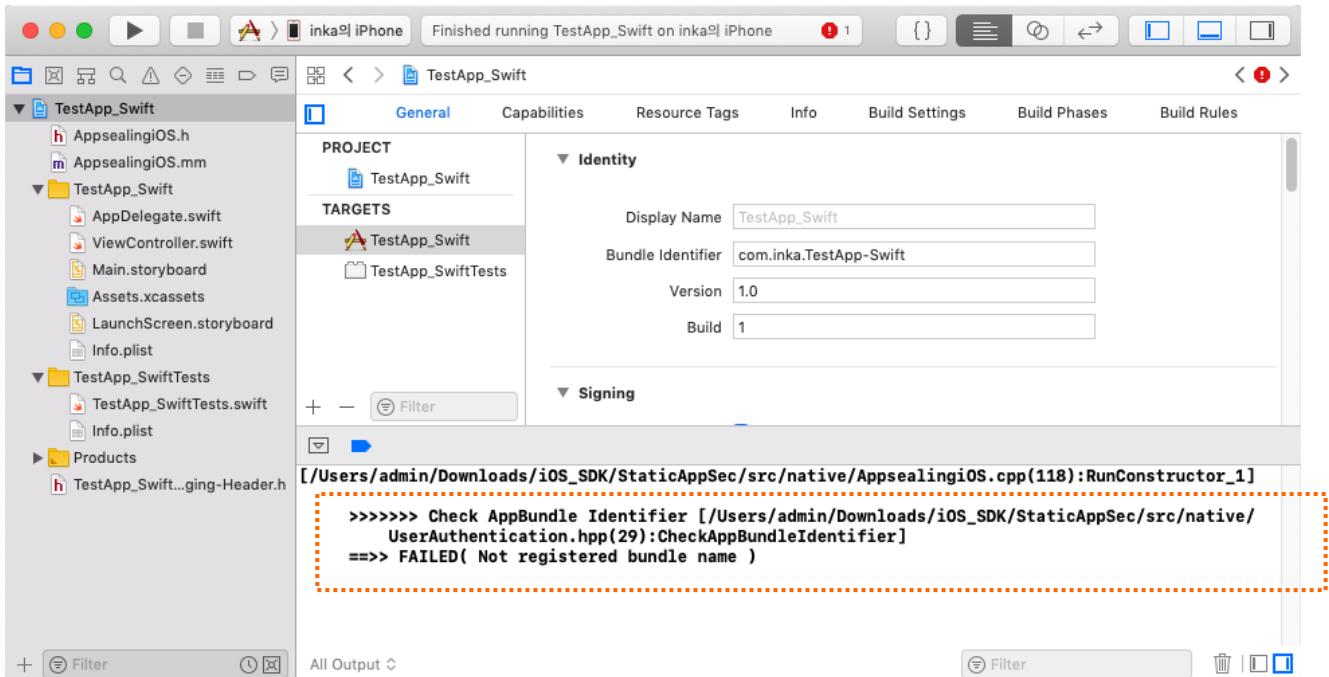
```
Ld /Users/admin/Desktop/Build/Intermediates.noindex/TestApp_ObjC.build/Release-iphoneos/
TestApp_ObjC.build/Objects-normal/armv7/TestApp_ObjC normal armv7 (in target:
TestApp_ObjC)
cd /Users/admin/Documents/TestApp_ObjC
export IPHONEOS_DEPLOYMENT_TARGET=9.0
/Applications/Xcode.app/Contents/Developer/Toolchains/XcodeDefault.xctoolchain/usr/bin/
clang++ -arch armv7 -isysroot /Applications/Xcode.app/Contents/Developer/Platforms/
iPhoneOS.platform/Developer/SDKs/iPhoneOS12.1.sdk -L/Users/admin/Desktop/Build/Products/
Release-iphoneos -F/Users/admin/Desktop/Build/Products/Release-iphoneos -filelist /Users/
admin/Desktop/Build/Intermediates.noindex/TestApp_ObjC.build/Release-iphoneos/
TestApp_ObjC.build/Objects-normal/armv7/TestApp_ObjC.LinkFileList -Xlinker -rpath -
-Xlinker @executable_path/Frameworks -miphoneos-version-min=9.0 -dead_strip -Xlinker -
object_path_lto -Xlinker /Users/admin/Desktop/Build/Intermediates.noindex/
TestApp_ObjC.build/Release-iphoneos/TestApp_ObjC.build/Objects-normal/armv7/
TestApp_ObjC_lto.o -fembed-bitcode-marker -stdlib=libc++ -fobjc-arc -fobjc-link-runtime -
-LstaticAppSec -L/Users/admin/Documents/TestApp_ObjC/AppSealingSDK/Libraries -Xlinker -
dependency_info -Xlinker /Users/admin/Desktop/Build/Intermediates.noindex/
TestApp_ObjC.build/Release-iphoneos/TestApp_ObjC.build/Objects-normal/armv7/
TestApp_ObjC_dependency_info.dat -o /Users/admin/Desktop/Build/Intermediates.noindex/
TestApp_ObjC.build/Release-iphoneos/TestApp_ObjC.build/Objects-normal/armv7/TestApp_ObjC
```

This linker error occurs when your project is Objective-C based and ViewController source code file has extension ".m". Just change the extension to ".mm".

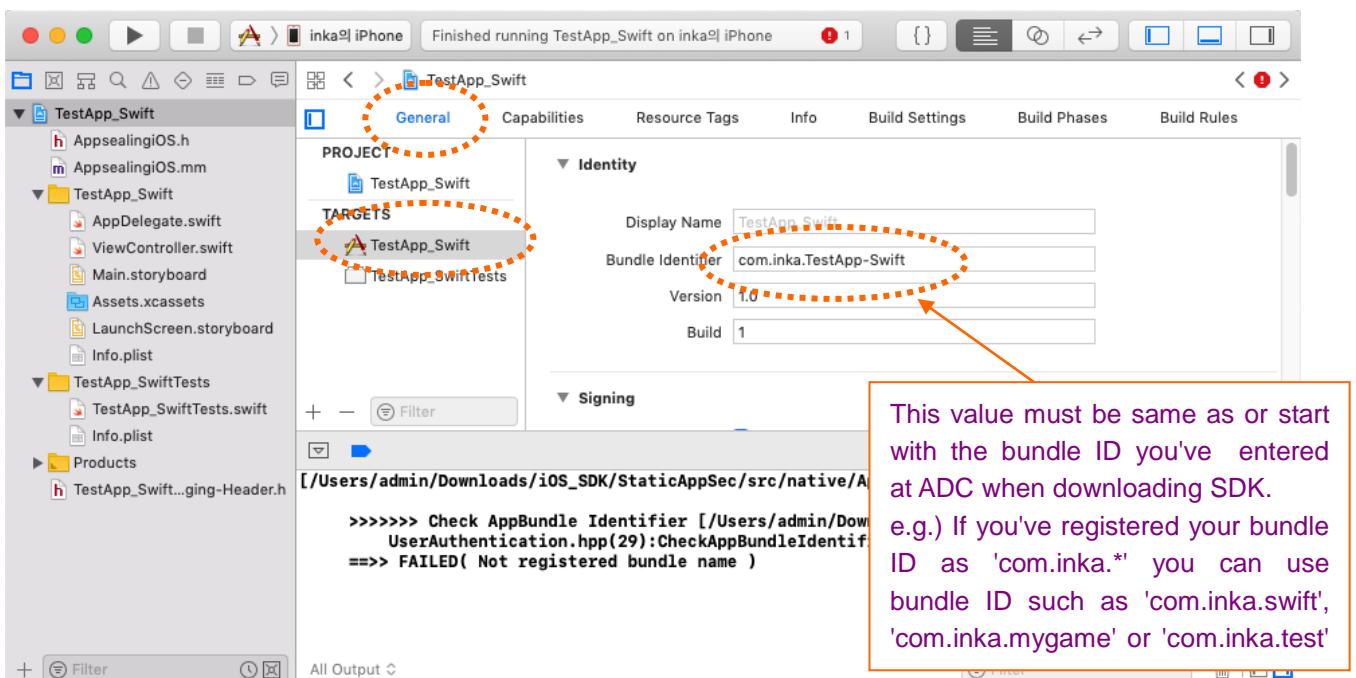


9-6 Execution error (I) App terminated immediately after launch

If your app has terminated right after launching in device, you should check the execution log message whether your bundle ID is valid.

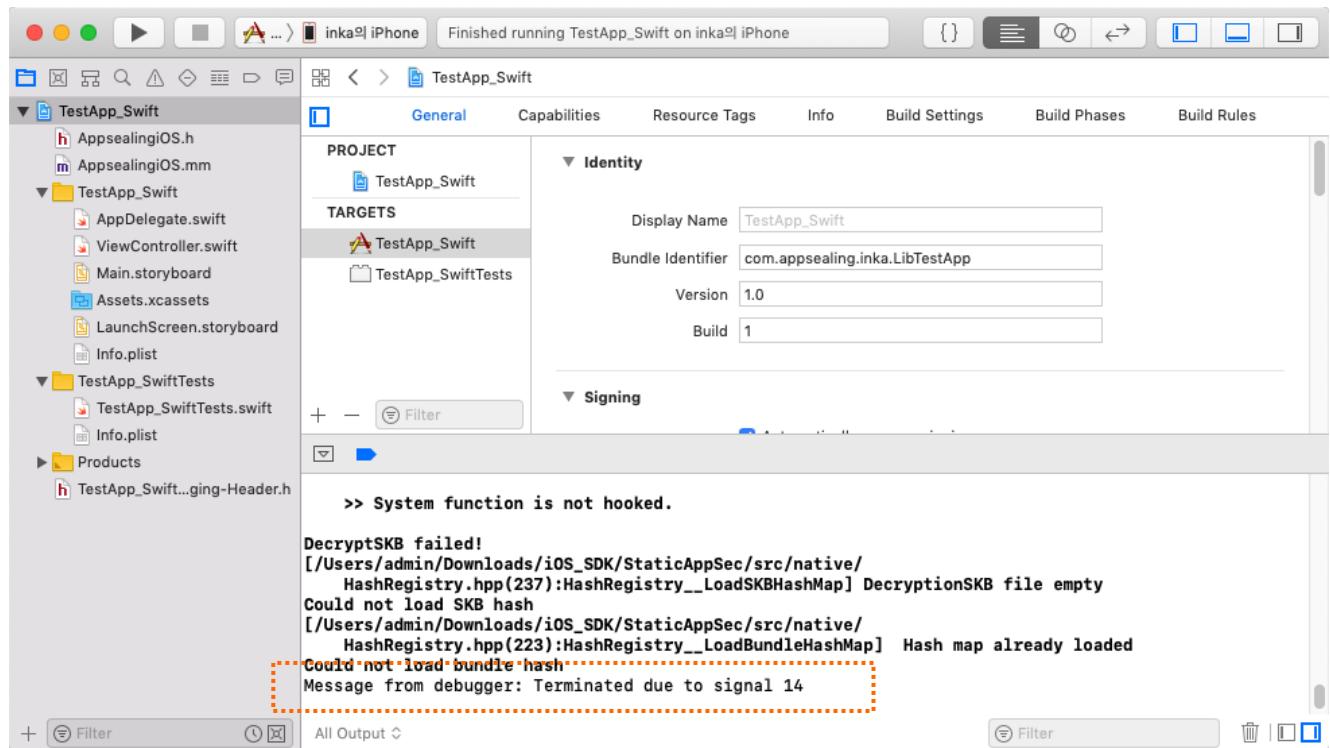


If the log message contains string like "`==>> FAILED(Not registered bundle name)`" then it tells the bundle Id you used is not registered properly at AppSealing Developer Center (ADC) while downloading AppSealing SDK file. Check your bundle Id if it is same as the value you entered when downloading SDK at ADC.



9-7 Execution error (II) **App terminated suddenly while running**

If your app has terminated suddenly while running about after 20 seconds from launching you should check the execution log message whether you have run your app with Release configuration.

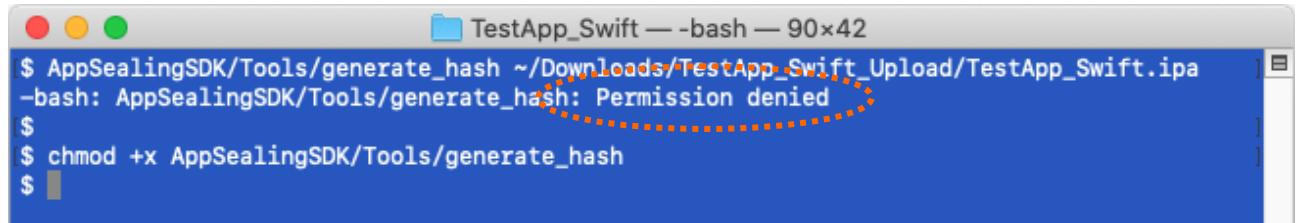


If the log message contains string like "[Message from debugger: Terminated due to signal 14](#)" then it tells that you have built & run your app in Release configuration and so AppSealing detection logic has activated. AppSealing logic in Release configuration checks some security intrusion such as jailbreak, debugger attachment, execution file encryption flag and if there is some problem it will close the app after 20 seconds irrespectively of user action or other circumstances.

Only in Release configuration the AppSealing logic will be activated and will terminate your app, so you should run your app with Debug configuration until you distribute the app to AppStore or TestFlight because the built executable file doesn't have encrypted with FairPlay DRM before it is installed from AppStore to device. AppSealing logic will detect that executable file has decrypted abnormally and it will terminate the app after 20 seconds while running your app in device at Xcode.

9-8 Cannot execute "generate_hash" : Permission denied

It may happens that script execution in step 3-5 "Generate App integrity and certificate snapshot" fails by "Permission denied" error message like below.



A screenshot of a Mac OS X terminal window titled "TestApp_Swift — bash — 90x42". The window shows the following command-line session:

```
$ AppSealingSDK/Tools/generate_hash ~/Downloads/TestApp_Swift_Upload/TestApp_Swift.ipa
-bash: AppSealingSDK/Tools/generate_hash: Permission denied
$ chmod +x AppSealingSDK/Tools/generate_hash
$
```

The line "-bash: AppSealingSDK/Tools/generate_hash: Permission denied" is highlighted with a red dotted circle.

In this situation run add permission command like below and try again.

```
$ chmod +x AppSealingSDK/Tools/generate_hash
```

9-9 Using AppSealing SDK in **Continuous Integration** Tools

AppSealing SDK can be integrated naturally into CI (continues integration) tools such as "Buddy" or "Jenkins" etc. Once the AppSealing SDK has applied to your Xcode project, you can archive and export the project with command line shell script as usual.