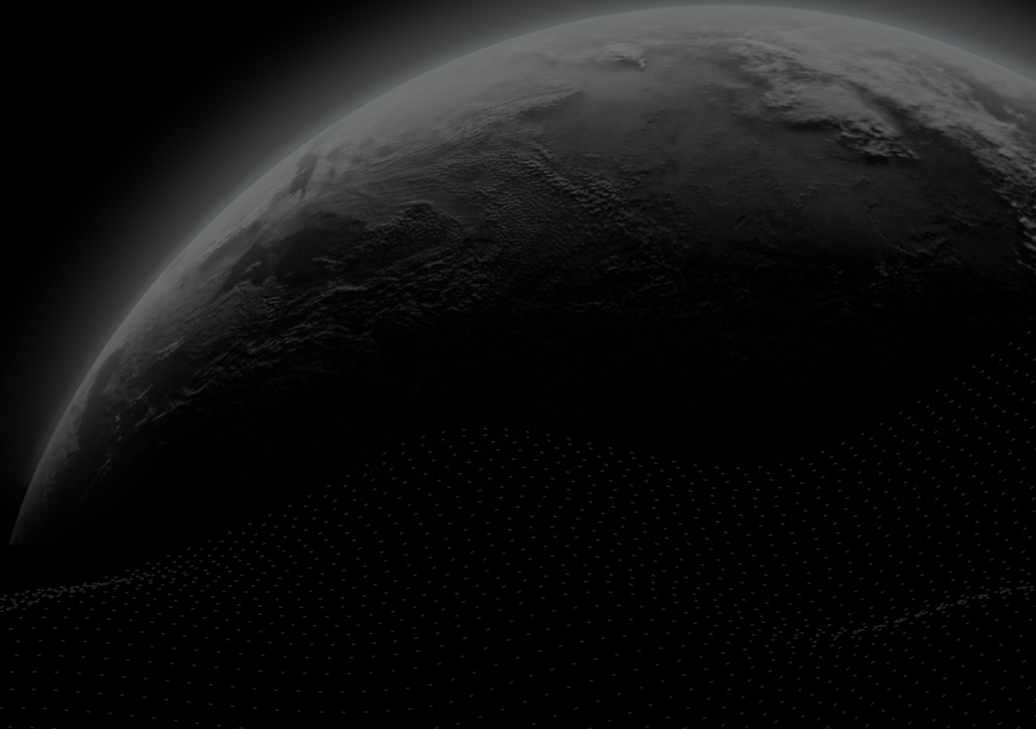# CERTIK

Security Assessment

OKX SDK

CertiK Assessed on May 19th, 2024

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OKX SDK

The security assessment was prepared by CertiK, the leader in Web3.0 security.

Executive Summary

TYPES	ECOSYSTEM	METHODS
Exchange	OKX	Manual Review, Static Analysis

LANGUAGE	TIMELINE	KEY COMPONENTS
Swift	Delivered on 05/19/2024	N/A

Vulnerability Summary

5 Total Findings	3 Resolved	0 Mitigated	2 Partially Resolved	0 Acknowledged	0 Declined

■ 0	Critical		Critical risks are those that impact the safe functioning of a platform and must be addressed before launch. Users should not invest in any project with outstanding critical risks.
■ 0	Major		Major risks can include centralization issues and logical errors. Under specific circumstances, these major risks can lead to loss of funds and/or control of the project.
■ 0	Medium		Medium risks may not pose a direct risk to users' funds, but they can affect the overall functioning of a platform.
■ 2	Minor	2 Partially Resolved	Minor risks can be any of the above, but on a smaller scale. They generally do not compromise the overall integrity of the project, but they may be less efficient than other solutions.
■ 3	Informational	3 Resolved	Informational errors are often recommendations to improve the style of the code or certain operations to fall within industry best practices. They usually do not affect the overall functioning of the code.

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AUDIT SCOPE | OKX SDK

0 files audited

ID	Repo	File	SHA256 Checksum

APPROACH & METHODS | OKX SDK

Introduction

This report has been prepared for OKX to identify issues and vulnerabilities in the supplied source code snippets of the front-end, mobile (iOS/Android), and SDK components. The code snippets are supplied to us in individual zipped files, each having the following `sha1` hash:

```
0b02b2b5c25d7b00f4d52a4c90fa89f9ed736f37  FE.zip

1188830aa5af47af8c148dccc755cc5571b288c9  Mobile.zip

094d5a1d0d39cdd287a4a874d41706978bf321e0  sdk.zip
```

The primary goal of this engagement was to scrutinise the source code to gauge the application's resilience against various logic issues and vulnerabilities targeting its controls and functionalities. This process was essential for identifying vulnerabilities and weaknesses within the codebase, thereby enabling the provision of tailored recommendations to enhance and fortify its security posture.

This security assessment is an extension of the previous OKX SDK's Blackbox penetration test performed on the OKX wallet. The findings of the prior assessment are documented separately and are not included in this report.

Scope of the Auditing

During this audit review process, CertiK security team has reviewed the following components.

A portion of Mobile App Source Code: The mobile source code contains both the iOS and Android components responsible for wallet creation/import, password management, and data backup to cloud platforms.

A Front End Module: The front-end source code contains the ReactJS UI components for the wallet functionalities, as well as the JS controllers used for interacting with the keyring.

Multiple Modules of Wallet SDK: The SDK contains the following components:

- **Bitcoin SDK:** written in Golang, it is used to interact with the Bitcoin Mainnet or Testnet.
- **okwallet-core:** mnemonic generator and wallet management.
- **src:** Javascript/Typescript component containing BIP32 and BIP39 support and various mathematical modules, ranging from elliptic curve calculation to hashing algorithms.

Summary of Findings

Overall we found the modules being reviewed are secure against the risks being considered in this audit process. The exact risk being reviewed and our evaluation results are presented below in separate sections.

Through this static review process, we found 5 security issues. Three of them are low risk and informational findings, and two of them are with undetermined risk levels. They are likely low risk, but we can not make a final determination due to the scope limit.

Limitations

The following limitations were encountered during the audit, which significantly restricted our ability to perform a comprehensive and thorough security assessment.

The constraints outlined below limit our ability to holistically evaluate the codebase and assess the overall security of the applications and the SDKs:

- Only certain parts of the codebase were shared, it is NOT possible to establish how/where certain functions are used and if memory cleanup is done correctly.
- Given that only partial code was shared, we cannot perform dynamic analysis. Dynamic analysis would clarify if there are any signs of PII leakage, either through application memory or filesystem.
- For the third party dependencies used, the versions could not be established. Some of the libraries used have security vulnerabilities in older versions and it is not possible to determine if the client is at risk or not.
- Mobile app configurations were not shared. (AndroidManifest.xml / Info.plist)
- The shared codebase makes extensive use of internal dependencies which could not be audited. This makes it impossible to determine if the client is exposed to dependency confusion or supply chain attacks.

Mobile Application Audit Summary

Two mobile applications, an iOS app written in Swift + Objective-C and an Android app written in Kotlin, were provided by the client. The application code mostly concerned wallet operations, the entire source code was not provided but sensitive operations regarding wallets and backups could be analyzed.

Threat Vectors Being Reviewed

Our testing was focused on the following attack vectors:

- **Dependency Confusion / Supply Chain attacks**

  - Mobile apps mostly use OKX's internal libraries, most of which were not provided.
  - We check whether the application depends on any known risky third-party packages.

- **Insecure Data Storage**

  - The application allows users to backup their wallets on Huawei Drive, Google Drive or iCloud. We check whether the backup process is implemented following good coding practices.

- **Insecure Cryptographic Primitives**

  - Check whether the cryptographic primitives in use adhere to the standards.

- **Memory Manipulation**

  - Check whether the applications adopt good memory operation practice.

- **Hard-coded Secrets**

  - We check whether the applications contain or make use of hard-coded secrets.

Summary Review Results

Below is our summary of the code security status

- **Dependency Confusion / Supply Chain attacks**

  - Mobile apps mostly use OKX's internal libraries, most of which were not provided. The other third-party dependencies that are used by the applications are either static or primitives of the respective platform which are unlikely to contain malicious code.

- **Insecure Data Storage**

  - The sensitive information corresponding to each wallet is encrypted throughout the lifecycle of the application. The password is encrypted with an AES key that is generated at runtime. The sensitive information is also not logged or stored unencrypted on the filesystem.
  - We confirm these backups are encrypted with a symmetric key that is derived from a user-supplied password. A password is required to enable backups.

- **Insecure Cryptographic Primitives**

  - We confirm that the cryptographic primitives in use adhere to the standards. The apps make use of

strong symmetric and asymmetric encryption algorithms.

- **Memory Manipulation**

  - The applications generally manage memory well. An information recommendation is provided in the finding section.
  - No UAF risks were identified in the client's source code.

- **Hard-coded Secrets**

  - The applications do not contain or make use of hard-coded secrets.

SDK Audit Summary

The following components were provided by the client for the presented engagement:

- **Bitcoin SDK:** written in Golang, used to interact with the Bitcoin Mainnet or Testnet.
- **okwallet-core:** written in Golang, used for mnemonic generation and wallet management.
- **src:** Javascript/Typescript component containing BIP32 and BIP39 support and various mathematical modules, ranging from elliptic curve calculation to hashing algorithms.

Threat Vectors Being Reviewed

Our testing was focused on the following attack vectors:

- **Dependency Confusion / Supply Chain attacks**

  - The SDK uses multiple sources for the module importing within both the JS and Golang components of the SDK. The sources range from local files to libraries located in OKX's internal repositories, as well as third-party modules.
  - We check whether the application depends on any known risky third-party packages.

- **Data Storage**

  - We check whether the data access to the storage is limited and secure.

- **Cryptographic Primitives**

- Check whether the cryptographic primitives in use adhere to the standards.

- **Hard-coded Secrets**

  - We check whether the applications contain or make use of hard-coded secrets.

- **Data Handling**

  - We check whether the implementation adopt good security practices on handling data processing.

Summary Review Results

Our testing was focused on the following attack vectors:

- **Dependency Confusion / Supply Chain attacks**

  - We found some component use modules that are no longer under active development. Please find detailed information in the finding section.
  - The version of `crypto-js` used in the client's SDK could not be established based on the shared source code.
  - he internal repositories used within the imports are located at `okinc.com(64.98.135.50)` and `gitlab.okg.com (10.254.3.52)`.
  - Making use of internal dependencies is recommended but it is not possible to establish if the referenced internal dependencies could be vulnerable to supply chain attacks, as they were not shared in the scope of the audit. It's strongly recommended to review the configuration and contents of the third-party modules imported within the applications.

- **Data Storage**

  - The okwallet-core library is used for mnemonic generation and wallet management. The data is transmitted within the function calls, mostly through the `storage` object.

- **Cryptographic Primitives**

  - The cryptographic primitives in use adhere to the standards. The apps make use of strong symmetric and asymmetric encryption algorithms. Hard-coded Secrets
  - We found a hard-coded secret in the code, however, no function calls towards these functions have been observed within the provided codebase. Details are provided in the finding section.

- **Data Handling**

  - We identified a snippet of code that could allow an integer overflow if a sufficiently large integer is cast as a uint32. This function is actively used in the codebase but it is not possible to determine if there is a real risk of an integer overflow in the client's codebase, as we cannot establish the runtime values of the provided parameters.

Front-End Audit Summary

The supplied codebase contains the ReactJS UI components for the wallet functionalities, as well as the JS controllers used for interacting with the keyring. The keyring controllers offer support for multiple environments: BTC, ETH, Ronin, Harmony, and Cardano.

Threat Vectors Being Reviewed

Our testing was focused on the following attack vectors:

- **Dependency Confusion / Supply Chain attacks**

  - We check whether the application depends on any known risky third-party packages.

- **Data Storage**

  - We check whether the data access to the storage is limited and secure.

- **Cryptographic Primitives**

  - Check whether the cryptographic primitives in use adhere to the standards.

- **Hard-coded Secrets**

  - We check whether the applications contain or make use of hard-coded secrets.

- **Data Handling**

  - We check whether the implementation adopt good security practices on handling data processing.

Summary Review Results

Below is a summary of our evaluation of front-end code against the above risks:

- **Dependency Confusion / Supply Chain attacks**

  - The application mostly uses OKX's shared libraries, most of which were not provided. The other third-party dependencies that are used by the applications are either static or primitives of the respective platform which are unlikely to contain malicious code.

- **Data Storage**

  - The sensitive information corresponding to each keychain is encrypted throughout the lifecycle of the application within the okxwallet/app/scripts/controllers/keyrings/browser-passworder.ts file.

- **Insecure Cryptographic Primitives**

  - The cryptographic primitives in use mostly adhere to the standards, with the following exception:
  - The random number generator is a custom implementation, which has a potential risk. Detail is provided in the finding section.

- **Code Injection/Cross-Site Scripting**

  - The application sanitizes the input before injecting it into the UI components through ReactJS's sanitization mechanism. Furthermore, vulnerable calls such as dangerouslySetInnerHTML were not observed within the codebase.

- **Hard-coded Secrets**

  - The application does not contain or make use of hard-coded secrets.

REVIEW NOTES | OKX SDK

This security assessment is an extension of the previous OKX SDK's Blackbox penetration test performed on the OKX wallet. The findings of the prior assessment are documented separately and are not included in this report.

FINDINGS │ OKX SDK

5	**0**	**0**	**0**	**2**	**3**
Total Findings	Critical	Major	Medium	Minor	Informational

This report has been prepared to discover issues and vulnerabilities for OKX SDK. Through this audit, we have uncovered 5 issues ranging from different severity levels. Utilizing the techniques of Manual Review & Static Analysis to complement rigorous manual code reviews, we discovered the following findings:

ID	Title	Category	Severity	Status
GLOBAL-01	SDK Uses Crypto Modules That Are No Longer Active	Coding Issue	Minor	● Partially Resolved
GLOBAL-02	FrontEnd Use Insecure Cryptographic Primitives	Coding Issue	Minor	● Partially Resolved
GLOBAL-03	Risky Implementation On Memory Free Operation	Coding Issue	Informational	● Resolved
GLOBAL-04	Hard-Coded Secrets Found In SDK Code	Coding Issue	Informational	● Resolved
GLOBAL-05	Potential Integer Overflow Risk In Data Handling.	Coding Issue	Informational	● Resolved

GLOBAL-01 | SDK USES CRYPTO MODULES THAT ARE NO LONGER ACTIVE

Category	Severity	Location	Status
Coding Issue	● Minor		● Partially Resolved

Description

The SDK uses multiple sources for the module importing within both the JS and Golang components of the SDK. The JS component (audit/src/index.ts) uses the `crypto-js` module, which is no longer under active development.

The Golang components (audit/src/index.ts) use the `crypto-js` module, which is no longer under active development. It's recommended to replace the import with the native `Crypto` library.

Recommendation

It's recommended to replace the import with the native `Crypto` library.

Alleviation

The developers will replace the `crypto-js` module in a future release.

GLOBAL-02 | FRONTEND USE INSECURE CRYPTOGRAPHIC PRIMITIVES

Category	Severity	Location	Status
Coding Issue	● Minor		● Partially Resolved

Description

We found the cryptographic primitives used a custom random number generation implementation. It's using the `Math.random()` JS function, which is cryptographically insecure.

`okxwallet/app/scripts/controllers/keyrings/utils/random.js`

Recommendation

It's strongly recommended to use the `Crypto.getRandomValues()` function.

Alleviation

The developers will replace the `Math.random()` function with a more cryptographically secure generation method.

GLOBAL-03 | RISKY IMPLEMENTATION ON MEMORY FREE OPERATION

Category	Severity	Location	Status
Coding Issue	● Informational		● Resolved

Description

In the iOS app, we identified a snippet of code that potentially could free previously allocated memory. No concrete memory manipulation risks (UAF) were identified in the client's source code.

The memory being free here (ptr) could be already freed in other calls, and ptr is not set to NULL (which is not a must in free).

```
/** 释放某个指针 */
void tryToFreePtr(void *ptr){
    if(ptr == NULL){
        return;
    }
    free(ptr);
}
```

Recommendation

This snippet of code could be improved by null-ing the pointer values after free-ing, to prevent potential Use-after-Free (UAF) vulnerabilities by protecting against a dangling pointer:

```
void tryToFreePtr(void **ptr) {
  if (ptr && *ptr) {
    free(*ptr);      // Free the allocated memory
    *ptr = NULL;     // Set the original pointer to NULL
  }
}
```

It's also worth noting that if the pointer describes a nested structure, other nested pointers should also be freed beforehand, to avoid memory leaks.

Alleviation

The Client fixed the issue in the code snippet that was sent after the engagement.

GLOBAL-04 | HARD-CODED SECRETS FOUND IN SDK CODE

Category	Severity	Location	Status
Coding Issue	● Informational		● Resolved

Description

The okwallet-core component contains the AesEncrypt and AesDecrypt functions which use the encryption key that is hardcoded at `audit/okwallet-core/util/util.go:267` :

```go
var AesHardKey = common.MD5("1697773335922")


// AesEncrypt AES 加密数据
func AesEncrypt(message, key string) (string, error) {
    if len(message) == 0 {
        return "", fmt.Errorf("message is empty")
    }
    if len(key) == 0 {
        key = AesHardKey
    }
    return common.Encrypt(message, key)
}
```

No function calls towards these functions have been observed within the provided codebase. If this code snippet is not actively used, there are no security issues. **However, if this code is being used in other parts of the client's software, this potentially poses a serious security problem.**

Note: The reason this issue is undetermined is that we have only partial code. Although no reference to this hard coded secret was found in the code given to us, we can not conclude that code not shared with us did not use this hard-coded secret As such, the Severity is set as Informational, however it could be higher.

Recommendation

Remove this hard-coded secret from code, and make sure no other place in the software use it.

Alleviation

The hardcoded secret was removed from the codebase.

GLOBAL-05 | POTENTIAL INTEGER OVERFLOW RISK IN DATA HANDLING.

Category	Severity	Location	Status
Coding Issue	● Informational		● Resolved

Description

We identified a snippet of code that could allow an integer overflow if a sufficiently large integer is cast as a `uint32` . The snippet of code is found here: `bitcoin/brc20/util.go:15`

```
func ConvertToUint32(v string) uint32 {
    i, _ := strconv.Atoi(v)
    return uint32(i)
}
```

Note: This function is actively used in the codebase but it is not possible to determine if there is a real risk of an integer overflow in the client's codebase, as we cannot establish the runtime values of the provided parameters. As such, the Severity is set as Informational, however it could be higher.

Recommendation

The snippet of code could be improved by using the `strconv.ParseInt` function.

Alleviation

The new version of the code uses the `strconv.ParseInt` function in order to convert the supplied string.

APPENDIX | OKX SDK

Finding Categories

Categories	Description
Coding Issue	Coding Issue findings are about general code quality including, but not limited to, coding mistakes, compile errors, and performance issues.

Checksum Calculation Method

The "Checksum" field in the "Audit Scope" section is calculated as the SHA-256 (Secure Hash Algorithm 2 with digest size of 256 bits) digest of the content of each file hosted in the listed source repository under the specified commit.

The result is hexadecimal encoded and is the same as the output of the Linux "sha256sum" command against the target file.

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