NexVault Wallet-audit

Security Assessment

CertiK Assessed on Jan 1st, 2025

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

Executive Summary

TYPES	ECOSYSTEM	METHODS
DeFi	Binance Smart Chain (BSC) | Ethereum (ETH)	Manual Review, Static Analysis

LANGUAGE	TIMELINE	KEY COMPONENTS
Solidity	Delivered on 01/01/2025	N/A

CODEBASE

https://github.com/nexvault/safe-contracts/tree/b91255866d904720503bed85d521803440b5e284

View All in Codebase Page

COMMITS

b91255866d904720503bed85d521803440b5e284

bbae913b03254eaddc596ebf02e673eeeef99d75

View All in Codebase Page

Vulnerability Summary

4	1	0	0	3	0
Total Findings	Resolved	Mitigated	Partially Resolved	Acknowledged	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.
3	Minor	3 Acknowledged	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.
1	Informational	1 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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CODEBASE | NEXVAULT WALLET-AUDIT

Repository

https://github.com/nexvault/safe-contracts/tree/b91255866d904720503bed85d521803440b5e284

Commit

b91255866d904720503bed85d521803440b5e284
bbae913b03254eaddc596ebf02e673eeeef99d75

AUDIT SCOPE | NEXVAULT WALLET-AUDIT

5 files audited ● 5 files without findings

ID	Repo	File	SHA256 Checksum
NXC	nexvault/nxv-safe-wallet	contracts/NXV.sol	896006fb1159e37d8297e75e499210f589601c77b93c0aee6358d85224a3048d
NVM	nexvault/nxv-safe-wallet	contracts/libraries/NXVMigration.sol	99f863b2e30613c126d1a07d33ce5c81918bcdc08e80d380f83683ae80e686dd
NVS	nexvault/nxv-safe-wallet	contracts/libraries/NXVStorage.sol	86d2e0125ea1565d5de525821897b93b8bcc137c6d220279cdfe01249bb67538
SIG	nexvault/nxv-safe-wallet	contracts/libraries/SignMessageLib.sol	da74c979662164d26f71ca2ae4733c54a2386d725d88a35d2e8ef8b092252350
NXF	nexvault/nxv-safe-wallet	contracts/proxies/NXVProxyFactory.sol	547f3106e2db16cab9968be31457e19fd5d404ed45cb05ca4f01553e044bb4f0

APPROACH & METHODS | NEXVAULT WALLET-AUDIT

This report has been prepared for NexVault to discover issues and vulnerabilities in the source code of the NexVault Wallet-audit project as well as any contract dependencies that were not part of an officially recognized library. A comprehensive examination has been performed, utilizing Manual Review and Static Analysis techniques.

The auditing process pays special attention to the following considerations:

- Testing the smart contracts against both common and uncommon attack vectors.
- Assessing the codebase to ensure compliance with current best practices and industry standards.
- Ensuring contract logic meets the specifications and intentions of the client.
- Cross referencing contract structure and implementation against similar smart contracts produced by industry leaders.
- Thorough line-by-line manual review of the entire codebase by industry experts.

The security assessment resulted in findings that ranged from critical to informational. We recommend addressing these findings to ensure a high level of security standards and industry practices. We suggest recommendations that could better serve the project from the security perspective:

- Testing the smart contracts against both common and uncommon attack vectors;
- Enhance general coding practices for better structures of source codes;
- Add enough unit tests to cover the possible use cases;
- Provide more comments per each function for readability, especially contracts that are verified in public;
- Provide more transparency on privileged activities once the protocol is live.

REVIEW NOTES | NEXVAULT WALLET-AUDIT

The "safe-contracts" for "NexVault" are forked from the "https://github.com/safe-global/safe-smart-account" project. The auditor cross-examined the codebase to identify the files with code modifications other than variable name and comment changes, which are as follows. The following code was audited in the review:

- contracts/
    - NXV.sol
- contracts/libraries
    - NXVMigration.sol
    - NXVStorage.sol
    - SignMessageLib.sol
- contracts/libraries
    - NXVProxyFactory.sol

FINDINGS | NEXVAULT WALLET-AUDIT

4	0	0	0	3	1
Total Findings	Critical	Major	Medium	Minor	Informational

This report has been prepared to discover issues and vulnerabilities for NexVault Wallet-audit. Through this audit, we have uncovered 4 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
CON-02	Lack Of Access Control	Access Control	Minor	Acknowledged
GLOBAL-01	Out Of Scope Dependency	Access Control	Minor	Acknowledged
NXV-02	Signature Malleability Of `ecrecover`	Volatile Code	Minor	Acknowledged
NXP-01	Lack Of Comments And Mismatch Between Comments And Implementation	Coding Style	Informational	Resolved

CON-02 | LACK OF ACCESS CONTROL

Category	Severity	Location	Status
Access Control	Minor	NXV.sol (b912558): 88; FallbackManager.sol (b912558): 50	Acknowledged

Description

The function `setup()` can be called by anyone as it has no access restriction. This enables anyone to call this and set an initial storage of the NXV contract. If a proxy was created without setting up, anyone can call setup and claim the proxy.

Recommendation

We recommend ensuring that the function setup() is called when the proxy is created.

Alleviation

The team acknowledged the finding and decided not to change the current codebase.

[NexVault Team, 01/29/2024]: In combination with the platform's business scenarios, all Proxy wallet contracts will be created through a factory contract, and will be initialized during the creation process by calling the setup() function of the Proxy wallet contract. The platform will not process any Proxy wallet contracts that are not created normally.

GLOBAL-01 | OUT OF SCOPE DEPENDENCY

Category	Severity	Location	Status
Access Control	Minor		Acknowledged

Description

The multi-sig safe contract serves as a middleware proxy, calling other user-supplied target contract addresses with user-supplied input data. It allows performing 'call' or 'delegatecall' to the target contract. Calling an arbitrary contract with a 'delegatecall' is dangerous, as the `delegatecall` function enables a contract to call another contract's function within the context of the caller's state. If the callee is untrusted and malicious, it can result in the caller contract modifying its storage in an unexpected way. If a self-destructor is used in the target contract, it could affect the multi-sig contract as well. The audit considers the contracts called through the multi-sig safe contract as out of scope, and users who use the multi-sig contract should ensure that their calls are to trusted contracts.

Recommendation

It's recommended that the project remind users to ensure they only interact with trusted contract addresses. Also, remind users of the implications of using a 'delegatecall', and to avoid 'delegatecall' if not necessary.

Alleviation

The team acknowledged the finding and decided not to change the current codebase.

[NexVault Team, 01/29/2024]: For the current contract architecture, the delegatecall method is essential, particularly in scenarios involving logic contract upgrades and flexible external library calls. For the Nexvault platform, all transaction data created through the platform undergoes strict parameter parsing and risk assessment.

NXV-02 | SIGNATURE MALLEABILITY OF `ecrecover`

Category	Severity	Location	Status
Volatile Code	Minor	NXV.sol (b912558): 132, 155, 178	Acknowledged

Description

The `ecrecover()` function is subject to signature malleability. The signature malleability is possible within the Elliptic Curve cryptographic system. An Elliptic Curve is symmetric on the `X`-axis, meaning two points can exist with the same `X` value. In the `r`, `s` and `v` representation this permits us to carefully adjust `s` to produce a second valid signature for the same `r`, thus breaking the assumption that a signature cannot be replayed in what is known as a replay-attack.

```
132         checkSignatures(txHash, "", signatures);
```

- `checkSignatures` called.

```
155         checkNSignatures(txHash, data, signatures, _threshold);
```

- `checkNSignatures` called.

```
178             currentOwner = ecrecover(txHash, v, r, s);
```

- `ecrecover` called without proper checks.

Recommendation

We recommend adding the following checks or to consider the example in `ECDSA.sol` from the OpenZeppelin library.

```
require(uint256(s) <=
0x7FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF5D576E7357A4501DDFE92F46681B20A0, "ECDSA: invalid
signature 's' value");
require(uint8(v) == 27 || uint8(v) == 28, "ECDSA: invalid signature 'v' value");
```

Alleviation

The team acknowledged the finding and decided not to change the current codebase.

[NexVault Team, 01/29/2024]: Because we have integrated third-party wallets to sign transaction information using EIP-712, we cannot guarantee that the handling of signatures by third-party wallets strictly adheres to the EIP-2 standard. For the

parties we integrate with, we do not wish to alter the signature results of third-party wallets by reversing the changes to the 's' value.

NXP-01 LACK OF COMMENTS AND MISMATCH BETWEEN COMMENTS AND IMPLEMENTATION

Category	Severity	Location	Status
Coding Style	Informational	NXVProxyFactory.sol (b912558): 108~138	Resolved

Description

Some of the comments in the codebase do not match the implementation. This is likely because the code was forked from another project, and the comments have not been adjusted to match the current implementation. For example, the "Guard" and "Modules" features have been removed, but the comments remain in the code.

```
 *      - Guard: Guard is a contract that can execute pre- and post-transaction
checks. Managed in `GuardManager`.
 *      - Modules: Modules are contracts that can be used to extend the write
functionality of a Safe. Managed in `ModuleManager`.
```

For the two newly added functions, "createProxyWithTransaction" and "calculateNXVAddress" in the "NXVProxyFactory.sol", the comments are missing compared to other functions in the same file.

Recommendation

It is recommended that the team modify the comments in the code to ensure they match the current implementation and also insert comments for newly added functions.

Alleviation

[NexVault Team, 01/29/2024]: The team heeded the advice and resolved the issue in commit 66e99ba15d7b0129d9226110dcf03613f43be4c5.

OPTIMIZATIONS | NEXVAULT WALLET-AUDIT

ID	Title	Category	Severity	Status
CON-03	Inefficient Memory Parameter	Inconsistency	Optimization	Acknowledged

CON-03 | INEFFICIENT MEMORY PARAMETER

Category	Severity	Location	Status
Inconsistency	Optimization	NXV.sol (b912558): 120; NXVProxyFactory.sol (b912558): 80, 99, 110, 117, 125	Acknowledged

Description

One or more parameters with `memory` data location are never modified in their functions and those functions are never called internally within the contract. Thus, their data location can be changed to `calldata` to avoid the gas consumption copying from calldata to memory.

```
114     function execTransaction(
```

`execTransaction` has memory location parameters: `signatures`.

```
78     function createChainSpecificProxyWithNonce(
```

`createChainSpecificProxyWithNonce` has memory location parameters: `initializer`.

```
97     function createProxyWithCallback(
```

`createProxyWithCallback` has memory location parameters: `initializer`.

```
108     function createProxyWithTransaction(
```

`createProxyWithTransaction` has memory location parameters: `initializer`, `signatures`.

```
123     function calculateNXVAddress(
```

`calculateNXVAddress` has memory location parameters: `initializer`.

Recommendation

We recommend changing the parameter's data location to `calldata` to save gas.

- For Solidity versions prior to 0.6.9, since public functions are not allowed to have calldata parameters, the function visibility also needs to be changed to `external`.
- For Solidity versions prior to 0.5.0, since parameter data location is implicit, changing the function visibility to `external` will change the parameter's data location to calldata as well.

Alleviation

The team acknowledged the finding and decided not to change the current codebase.

[NexVault Team, 01/29/2024]: After modifying the test according to the suggested method, it was found that the Gas consumption did not significantly decrease.

APPENDIX | NEXVAULT WALLET-AUDIT

Finding Categories

Categories	Description
Coding Style	Coding Style findings may not affect code behavior, but indicate areas where coding practices can be improved to make the code more understandable and maintainable.
Access Control	Access Control findings are about security vulnerabilities that make protected assets unsafe.
Inconsistency	Inconsistency findings refer to different parts of code that are not consistent or code that does not behave according to its specification.
Volatile Code	Volatile Code findings refer to segments of code that behave unexpectedly on certain edge cases and may result in vulnerabilities.

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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Elevating Your Entire Web3 Journey

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