CERTIK

Security Assessment

Rubic Finance

Nov 29th, 2021

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Summary

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

- 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.

Overview

Project Summary

Project Name	Rubic Finance
Platform	Custom
Language	Solidity
Codebase	https://github.com/Cryptorubic/CrossChainTokenSwap
Commit	7d01d19c9471615e80d31b19ae87da922f7ee405 aaf37206f3f146de8caca62eabe1b3ee6c68f38a a3845b09c4bdea9dec141af0b2166075e0e4312e 6c55d71932729d7a177c8f68ab0a48ce6e506e2f

Audit Summary

Delivery Date	Nov 29, 2021
Audit Methodology	Static Analysis, Manual Review
Key Components	

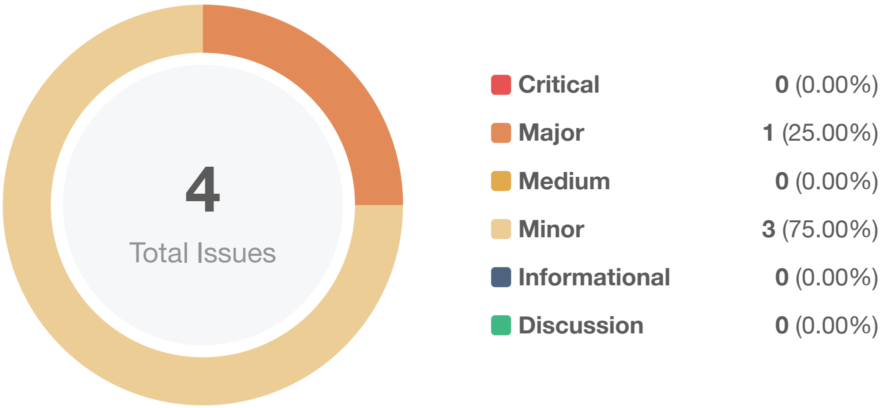
Vulnerability Summary

Vulnerability Level	Total	Pending	Declined	Acknowledged	Partially Resolved	Resolved
● Critical	0	0	0	0	0	0
● Major	1	0	0	0	0	1
● Medium	0	0	0	0	0	0
● Minor	3	0	0	0	0	3
● Informational	0	0	0	0	0	0
● Discussion	0	0	0	0	0	0

Audit Scope

ID	File	SHA256 Checksum
IPR	interfaces/IPangolinRouter.sol	a74d709bcf8014ce87b2695f380680e44d7387a66a7c4db7833c94bca5d3949c
ECD	libraries/ECDSAOffsetRecovery.sol	2153a7e16657e037e82b42c09bf053aefe10e0441f3a82584a32a096d6ebd32c
FMR	libraries/FullMath.sol	921e3025fa1fc030a75370d6cff6476126fdc57c613b4aceb3feb5edc861bebf
SCR	SwapContract.sol	bb570c1504c016e99b9a86cab8e4d3abd7ee5c47a538ed3956b115472e4cc771

Findings



ID	Title	Category	Severity	Status
SCR-01	Centralization Risk	**Centralization / Privilege**	● **Major**	✓ Resolved
SCR-02	Missing Input Validation	Volatile Code	● Minor	✓ Resolved
SCR-03	Usage Of `send()` For Sending Ether	Volatile Code	● Minor	✓ Resolved
SCR-04	Documentation Discrepancy	Inconsistency	● Minor	✓ Resolved

SCR-01 | Centralization Risk

Category	Severity	Location	Status
Centralization / Privilege	● **Major**	projects/RubicFinance/SwapContract.sol (23688cf)	✓ Resolved

Description

In the contract `SwapContract`, the role `OWNER_ROLE` has the authority over the following functions:

- `addOtherBlockchain()`
- `removeOtherBlockchain()`
- `changeOtherBlockchain()`
- `collectCryptoFee()`
- `collectTokenFee()`
- `setMinConfirmationSignatures()`
- `transferOwnerAndSetManager()`
- `pauseExecution()`
- `continueExecution()`
- `setRouter()`
- `setFeeAmountOfBlockchain()`
- `setCryptoFeeOfBlockchain()`
- `setRubicAddressOfBlockchain()`
- `setMinTokenAmount()`
- `setMaxTokenAmount()`
- `setMaxGasPrice()`
- `setMinConfirmationBlocks()`
- `setRefundSlippage()`
- `poolBalancing()`

Any compromise to the `OWNER_ROLE` account may allow the hacker to take advantage of this and manipulate the entire project. Especially in the functions `collectCryptoFee()` and `collectTokenFee()`, hacker can take advantage of these two functions to withdraw all the ETH/BNB & tokens to the hacker's address.

Meanwhile, the role `MANAGER_ROLE` has the authority over the following functions:

- `setRouter()`
- `setFeeAmountOfBlockchain()`

- `setCryptoFeeOfBlockchain()`
- `setRubicAddressOfBlockchain()`
- `setMinTokenAmount()`
- `setMaxTokenAmount()`
- `setMaxGasPrice()`
- `setMinConfirmationBlocks()`
- `setRefundSlippage()`

Any compromise to the `MANAGER_ROLE` account may allow the hacker to take advantage of this and change the sensitive variables without any restriction.

Meanwhile, the role `RELAYER_ROLE` has the authority over the following functions:

- `swapTokensToUserWithFee()`
- `swapCryptoToUserWithFee()`
- `refundTokensToUser()`
- `refundCryptoToUser()``
- `changeTxStatus()`
- `setCryptoFeeOfBlockchain()`

`RELAYER_ROLE` is supposed to be the relayer contract or EOA to relay the cross-chain swap event messages. However, any compromise to the `RELAYER_ROLE` account may allow the hacker to take advantage of this and control the entire cross-chain swap mechanism.

Recommendation

We advise the client to carefully manage the privileged account's private key to avoid any potential risks of being hacked. In general, we strongly recommend centralized privileges or roles in the protocol to be improved via a decentralized mechanism or smart-contract-based accounts with enhanced security practices, e.g., Multisignature wallets.

Indicatively, here is some feasible suggestions that would also mitigate the potential risk at the different level in term of short-term and long-term:

- Time-lock with reasonable latency, e.g., 48 hours, for awareness on privileged operations;
- Assignment of privileged roles to multi-signature wallets to prevent a single point of failure due to the private key;
- Introduction of a DAO/governance/voting module to increase transparency and user involvement.

Alleviation

`[Rubic Finance Team]`: According to medium post published by the team, Multisig wallet will be used for privileged roles. The addresses are listed as follows:

- MULTISIG ADDRESS: 0x6129B000f43D82E533CF20A7FD89c43E5A772BCD
    - Vladimir Tikhomirov: 0x105A3BA3637A29D36F61c7F03f55Da44B4591Cd1
    - Korneva Alexandra: 0x836f2051cDe3ba744aafE668F6a6070BA80668F9
    - Dmitry Ershov: 0x9499179d309B6Bf0253DcE9A35c2E37a75C41E47

Multisig, which is used for `OWNER_ROLE`, requires 2 out of 3 signatures for a transaction to be approved.

Reference: Rubic Multi-Chain routing Decentralization https://cryptorubic.medium.com/rubic-multi-chain-routing-decentralization-530241d3c89d

SCR-02 | Missing Input Validation

Category	Severity	Location	Status
Volatile Code	● Minor	projects/RubicFinance/SwapContract.sol (23688cf): 276~285	✓ Resolved

Description

The given input is missing the check for the non-zero address.

Recommendation

We advise adding the check for the passed-in values to prevent unexpected error as below:

```
require( address(_blockchainRouter) != address(0), "_blockchainRouter is address 0" );
```

Alleviation

`[Rubic Finance Team]`: The client heeded the advice and fixed the issue in the commit aaf37206f3f146de8caca62eabe1b3ee6c68f38a

SCR-03 | Usage Of `send()` For Sending Ether

Category	Severity	Location	Status
Volatile Code	● Minor	projects/RubicFinance/SwapContract.sol (23688cf): 445~447, 685	✓ Resolved

Description

After EIP-1884 was included in the Istanbul hard fork, it is not recommended to use `.transfer()` or `.send()` for transferring ether as these functions have a hard-coded value for gas costs making them obsolete as they are forwarding a fixed amount of gas, specifically `2300`. This can cause issues in case the linked statements are meant to be able to transfer funds to other contracts instead of EOAs.

Recommendation

We advise that the linked `.transfer()` and `.send()` calls are substituted with the utilization of the `sendValue()` function from the `Address.sol` implementation of OpenZeppelin either by directly importing the library or copying the linked code.

Alleviation

`[Rubic Finance Team]`: The client heeded the advice and fixed the issue in the commit aaf37206f3f146de8caca62eabe1b3ee6c68f38a

SCR-04 | Documentation Discrepancy

Category	Severity	Location	Status
Inconsistency	● Minor	projects/RubicFinance/SwapContract.sol (23688cf): 376, 428	✓ Resolved

Description

Due to refactoring the following functions in the commit a3845b09c4bdea9dec141af0b2166075e0e4312e, the comment of these functions lacks the detailed explanation of the params. Especially `params.exactRBCtokenOut` and `params.tokenInAmount` in the function `swapTokensToOtherBlockchain()`, as this function is external function, user could be confused.

- `swapTokensToOtherBlockchain()`
- `swapCryptoToOtherBlockchain()`

Recommendation

We advise to rectify the comment on the aforementioned functions to increase the legibility of the codebase.

Alleviation

`[Rubic Finance Team]`: The client heeded the advice and updated the annotations in the commit 6c55d71932729d7a177c8f68ab0a48ce6e506e2f

Appendix

Finding Categories

Centralization / Privilege

Centralization / Privilege findings refer to either feature logic or implementation of components that act against the nature of decentralization, such as explicit ownership or specialized access roles in combination with a mechanism to relocate funds.

Volatile Code

Volatile Code findings refer to segments of code that behave unexpectedly on certain edge cases that may result in a vulnerability.

Inconsistency

Inconsistency findings refer to functions that should seemingly behave similarly yet contain different code, such as a constructor assignment imposing different require statements on the input variables than a setter function.

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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