CERTIK

Security Assessment

CheersLand

Oct 11th, 2021

Table of Contents

Summary

This report has been prepared for CheersLand to discover issues and vulnerabilities in the source code of the CheersLand 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.

Additionally, this audit is based on a premise that all external smart contracts are implemented safely. And the following `sol` file is not within the scope of the audit:

- `./../owner/Auth.sol`

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	CheersLand
Platform	Ethereum
Language	Solidity
Codebase	https://github.com/CheersLand/cheersland-igo-smart-contract
Commit	ec525d786518905c37bcf3142901a50d5344abc4

Audit Summary

Delivery Date	Oct 11, 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	2	0	0	1	0	1
Medium	1	0	0	0	0	1
Minor	2	0	0	0	0	2
Informational	1	0	0	0	0	1
Discussion	0	0	0	0	0	0

Audit Scope

ID	File	SHA256 Checksum
FIP	FundraisingIdoPool.sol	8cf9607fa80dfafc8de2d2ae2b33220b91c75bec244b13b2ebf0b2e9a4cff4cb

Understandings

Overview

`CheersLand` is a project for users to purchase `lpAddress` token.

Users use `fundRaisingAddress` token to buy the `lpAddress`.

There is a fundraising goal that is set by the team. When the fundraising goal is reached, the team will only receive the designated amount mandated for the fundraising goal. The remaining tokens will be returned to users.

There is a `startTime` and `endTime` which represents the start time and end time of the purchase activity. There is a `claimTime`. After claim time, users can get `lpAddress` they purchased, and reclaim the excess proceeds from the remaining `fundRaisingAddress`. The team can only claim the designated amount described per the `fundRaisingAddress` not greater than the fundraising goal and extract the surplus `lpAddress`.

There is a white list strategy. Variable `rand` is used to mark users at a whitelist level. `rank` has four values: 0, 1, 2, 3, respectively means: 0: never be a whitelist, 1: normal whitelist, 2: super whitelist, 3: ever a whitelist, and later become not a whitelist. Only users in the whitelist can purchase `lpAddress`. Users in the normal whitelist have a default purchase limit `whiteListQuota`. Users in the super whitelist can have a purchase limit that is set by `operator`.

If the user's mortgage num is greater than the `threshold` in a third pool `poolAddress`, he will be set as a normal white list when he purchases `lpAddress`.

Additionally, the contract `FundraisingIdoPool` can work correctly only when there is enough `lpAddress` in it. According to the codebase, the amount of `lpAddress` should be `lpQuantitySold` when the activity starts.

Privileged Functions

The project contains the following privileged functions. They are used to modify the contract configurations and address attributes. We grouped these functions below:

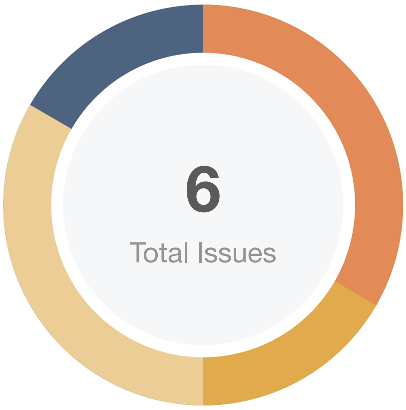
The `onlyOperator` modifier:

contract `FundraisingIdoPool.sol`:

- function setPoolAddress()

- function setAdminAddress()
- function setWhiteListQuota()
- function setExchangeRate()
- function setUpperLimit()
- function setEndTime()
- function setClaimTime()
- function addSuperWhiteList()
- function setWhiteList()
- function ownerClaim()
- function extractSurplusLp()

Findings



Critical	**0** (0.00%)
Major	**2** (33.33%)
Medium	**1** (16.67%)
Minor	**2** (33.33%)
Informational	**1** (16.67%)
Discussion	**0** (0.00%)

ID	Title	Category	Severity	Status
CheersLand-01	Centralization Risk	**Centralization / Privilege**	**Major**	Acknowledged
FIP-01	Missing Input Validation	Volatile Code	Minor	Resolved
FIP-02	Function Visibility Optimization	Gas Optimization	Informational	Resolved
FIP-03	Unchecked Value of ERC-20 `transfer()`/`transferFrom()` Call	Volatile Code	Minor	Resolved
FIP-04	Potential Reentrancy Attack	Logical Issue	Medium	Resolved
FIP-05	Users May Be Unable To Claim The Tokens They Purchased	Logical Issue	Major	Resolved

CheersLand-01 | Centralization Risk

Category	Severity	Location	Status
Centralization / Privilege	Major	Global	Acknowledged

Description

In the contract `FundraisingIdoPool`, the role `operator` has the authority over the following function:

1. Update `poolAddress` through `setPoolAddress`.
2. Update `_adminAddress` through `setAdminAddress` function.
3. Update `whiteListQuota` through `setWhiteListQuota` function.
4. Update `exchangeRate` through `setExchangeRate` function.
5. Update `upperLimit[_account]` through `setUpperLimit` function.
6. Update `endTime` through `setEndTime` function.
7. Update `claimTime` through `setClaimTime` function.
8. Set super white list through `addSuperWhiteList` function.
9. Set white list through `setWhiteList` function.
10. Claim `fundRaisingAddress` through `ownerClaim` function.
11. Extract surplus `lpAddress` through `extractSurplusLp` function.

without obtaining the consensus of the community.

Recommendation

We advise the client to carefully manage the `owner`, `injector`, `operator` 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 are some feasible suggestions that would also mitigate the potential risk at the different levels in terms 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

No Alleviation.

FIP-01 | Missing Input Validation

Category	Severity	Location	Status
Volatile Code	Minor	FundraisingIdoPool.sol: 92, 93, 99, 108, 112	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:

Alleviation

The team heeded our advice and added a zero check. Code change was applied in commit : d333c208cc2f1c9f52244f66773eda6f9fd7d3ad.

FIP-02 | Function Visibility Optimization

Category	Severity	Location	Status
Gas Optimization	Informational	FundraisingIdoPool.sol: 136	Resolved

Description

The following functions are declared as `public`, contain array function arguments, and are not invoked in any of the contracts contained within the project's scope. The functions that are never called internally within the contract should have external visibility.

Recommendation

We advise that the functions' visibility specifiers are set to `external` and the array-based arguments change their data location from `memory` to `calldata`, optimizing the gas cost of the function.

Alleviation

The team heeded our advice and change `public` to `external`. Code change was applied in commit : d333c208cc2f1c9f52244f66773eda6f9fd7d3ad.

FIP-03 | Unchecked Value of ERC-20 `transfer()`/`transferFrom()` Call

Category	Severity	Location	Status
Volatile Code	Minor	FundraisingIdoPool.sol: 213, 240, 243, 263, 276	Resolved

Description

The linked `transfer()`/`transferFrom()` invocations do not check the return value of the function call which should yield a `true` result in case of proper ERC-20 implementation.

Recommendation

As many tokens do not follow the ERC-20 standard faithfully, they may not return a `bool` variable in this function's execution meaning that simply expecting it can cause incompatibility with these types of tokens. Instead, we advise that OpenZeppelin's `SafeERC20.sol` implementation is utilized for interacting with the `transfer()` and `transferFrom()` functions of ERC-20 tokens. The OZ implementation optionally checks for a return value rendering compatible with all ERC-20 token implementations.

Alleviation

The team heeded our advice and change to `safeTransfer` and `safeTransferFrom`. Code change was applied in commit : d333c208cc2f1c9f52244f66773eda6f9fd7d3ad.

FIP-04 | Potential Reentrancy Attack

Category	Severity	Location	Status
Logical Issue	Medium	FundraisingIdoPool.sol: 239~246, 262~266	Resolved

Description

A reentrancy attack can occur when the contract creates a function that makes an external call to another untrusted contract before resolving any effects. If the attacker can control the untrusted contract, they can make a recursive call back to the original function, repeating interactions that would have otherwise not run after the external call resolved the effects.

Recommendation

We recommend using the Checks-Effects-Interactions Pattern to avoid the risk of calling unknown contracts or applying OpenZeppelin ReentrancyGuard library - `nonReentrant` modifier for the aforementioned functions to prevent reentrancy attack.

Alleviation

The team heeded our advice and added an inspector lock. Code change was applied in commit : d333c208cc2f1c9f52244f66773eda6f9fd7d3ad.

FIP-05 | Users May Be Unable To Claim The Tokens They Purchased

Category	Severity	Location	Status
Logical Issue	Major	FundraisingIdoPool.sol: 271~279	Resolved

Description

`operator` can transfer all the `lpAddress` in contract `FundraisingIdoPool` to his own account after `claimTime` through function `extractSurplusLp()`. This operation may be earlier than the users to call `calim()`. This will cause the users unable to get the `lpAddress` they purchased.

Recommendation

The team should ensure users can get all the `lpAddress` they purchased.

Alleviation

The team heeded our advice and removed the `extractSurplusLp` function. Added a logic in function `ownerClaim` to ensure there will be enough `lpAddress` in the contract for users to claim. Code change was applied in commit : d333c208cc2f1c9f52244f66773eda6f9fd7d3ad.

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.

Gas Optimization

Gas Optimization findings do not affect the functionality of the code but generate different, more optimal EVM opcodes resulting in a reduction on the total gas cost of a transaction.

Logical Issue

Logical Issue findings detail a fault in the logic of the linked code, such as an incorrect notion on how block.timestamp works.

Volatile Code

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

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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