Code Security Assessment

Airdrop Grapes Token

Feb 25th, 2022

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Summary

This report has been prepared for Airdrop Grapes to discover issues and vulnerabilities in the source code of the Airdrop Grapes Token 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	Airdrop Grapes Token
Platform	Other
Language	Solidity
Codebase	https://github.com/HorizenLabs/grapes-erc20
Commit	498b5453953b33e142947f4a9365ccc88449085d

Audit Summary

Delivery Date	Feb 25, 2022
Audit Methodology	Static Analysis, Manual Review

Vulnerability Summary

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

Audit Scope

ID	File	SHA256 Checksum
AGT	AirdropGrapesToken.sol	dcc0c5ef21dfb3c3f36a25379da87a56f1675988f34826f2603fbaee4d154c90
MCK	Migrations.sol	773e9056aee531c9f7a806d4bb7dc458fea321846dc830c73fffcbadcbb5831c

Understandings

Dependencies

There are depending injection contracts or addresses in the current project:

- `grapesToken`, `alpha`, `beta` and `gamma` for the contract `AirdropGrapesToken`.

We assume these contracts or addresses are valid and non-vulnerable actors and implement proper logic to collaborate with the current project.

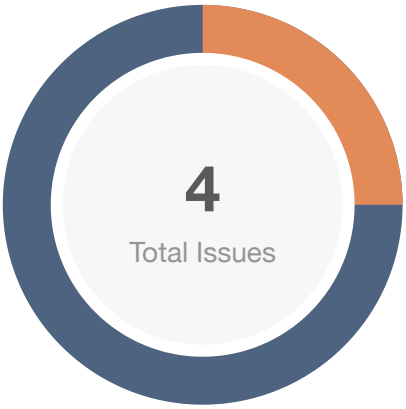
Privileged Functions

In the contract `AirdropGrapesToken`, the role `_owner` is adopted for contract governance. The `_owner` has the authority over the following functions:

- `claimUnclaimedTokens()`: transfer the remaining unclaimed token to the owner's address.
- `startClaimablePeriod()`: start the claimable period at any time.
- `pauseClaimablePeriod()`: pause the contract any time.

To improve the trustworthiness of the project, dynamic runtime updates in the project should be notified to the community. Any plan to invoke the aforementioned functions should be also considered to move to the execution queue of the `Timelock` contract.

Findings



Critical	0 (0.00%)
Major	1 (25.00%)
Medium	0 (0.00%)
Minor	0 (0.00%)
Informational	3 (75.00%)
Discussion	0 (0.00%)

ID	Title	Category	Severity	Status
AGT-01	Centralization Related Risks	**Centralization / Privilege**	**Major**	Acknowledged
AGT-02	Avoid Multiple Initializations	Control Flow	Informational	Acknowledged
AGT-03	Improper Usage of Public and External Type	Gas Optimization	Informational	Acknowledged
AGT-04	Missing Emit Events	Coding Style	Informational	Acknowledged

AGT-01 | Centralization Related Risks

Category	Severity	Location	Status
Centralization / Privilege	**Major**	AirdropGrapesToken.sol: 189, 88, 99	Acknowledged

Description

In the function `claimUnclaimedTokens()`, when the function is triggered, the owner will transfer the remaining unclaimed token to the owner's address.

In the contract `AirdropGrapesToken.sol`, the role `onlyOwner` has authority over the following functions:

- `claimUnclaimedTokens()`: when the function is triggered, the owner will transfer the remaining unclaimed token to the owner's address.
- `startClaimablePeriod()`: The onlyOwner can start the claimable period at any time.
- `pauseClaimablePeriod()`: The onlyOwner can pause the contract any time.

Any compromise to the `onlyOwner` account may allow a hacker to take advantage of this authority.

Exploit Scenario:
Note: Suppose the attacker gets the private key of the owner.

1. The attacker calls `pauseClaimablePeriod()` to pause the contract.
2. The attacker calls `startClaimablePeriod()` and set the `claimDuration` parameter to be a very small value (e.g., 1) in the contract.
3. The attacker calls `claimUnclaimedTokens()` to receive all the `grapesToken` and ETH.
4. The attacker sells `grapeToken`.

Recommendation

The risk describes the current project design and potentially makes iterations to improve in the security operation and level of decentralization, which in most cases cannot be resolved entirely at the present stage. 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 be improved via a decentralized mechanism or smart-contract-based accounts with enhanced security practices, e.g., multi-signature wallets.

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

Short Term:

Timelock and Multi sign (⅔, ⅗) combination *mitigate* by delaying the sensitive operation and avoiding a single point of key management failure.

- Time-lock with reasonable latency, e.g., 48 hours, for awareness on privileged operations;
  AND
- Assignment of privileged roles to multi-signature wallets to prevent a single point of failure due to the private key compromised;
  AND
- A medium/blog link for sharing the timelock contract and multi-signers addresses information with the public audience.

Long Term:

Timelock and DAO, the combination, *mitigate* by applying decentralization and transparency.

- Time-lock with reasonable latency, e.g., 48 hours, for awareness on privileged operations;
  AND
- Introduction of a DAO/governance/voting module to increase transparency and user involvement;
  AND
- A medium/blog link for sharing the timelock contract, multi-signers addresses, and DAO information with the public audience.

Permanent:

Renouncing the ownership or removing the function can be considered *fully resolved*.

- Renounce the ownership and never claim back the privileged roles;
  OR
- Remove the risky functionality.

Noted: Recommend considering the long-term solution or the permanent solution. The project team shall make a decision based on the current state of their project, timeline, and project resources.

Alleviation

[Grapes]: Ownership of the smart contract is immediately transferred to a Gnosis Multi-Sig Wallet. A blog post will be written to share address information of multi-signers with the public audience.

AGT-02 | Avoid Multiple Initializations

Category	Severity	Location	Status
Control Flow	Informational	AirdropGrapesToken.sol: 63~71	Acknowledged

Description

The contract is paused after the deployment and configuration initiation. The constructor initialization may not need to happen at the same time. It will be a good practice to avoid allowing multiple initializations.

Recommendation

Recommend separating the constructor and initialized operation and enabled when your workflow requires it. It will be easier for Etherscan verification as you do not have to deal with messy constructor arguments. It can be used to avoid the 'Stack too deep, try removing local variables' error when passing.

```
contract AirdropGrapesToken {
  bool isInitialized = false;

  function initialize(
    uint256 _param1,
    uint256 _param2,
    uint256 _param3,
    address _param4,

  ) public {
    require(!isInitialized, 'Contract is already initialized!');
    isInitialized = true;

    param1 = _param1;
    ...
    param4 = _param4;

  }
}
```

Alleviation

[Grapes]: The team acknowledged this issue and decided not to change the current codebase.

AGT-03 | Improper Usage Of Public And External Type

Category	Severity	Location	Status
Gas Optimization	Informational	AirdropGrapesToken.sol: 144	Acknowledged

Description

public functions that are never called by the contract could be declared external. When the inputs are arrays external functions are more efficient than “public” functions.

Examples:

`getClaimableTokenAmount()`

Recommendation

Consider using the external attribute for functions never called from the contract.

Alleviation

[Grapes]: The team acknowledged this issue and decided not to change the current codebase.

AGT-04 | Missing Emit Events

Category	Severity	Location	Status
Coding Style	Informational	AirdropGrapesToken.sol: 99~101	Acknowledged

Description

The function `pauseClaimablePeriod()` affects the sensitive status of the contract and should emit events as notifications to users.

Recommendation

Consider adding an event for sensitive action, and emit it in the function.

Alleviation

[Grapes]: The team acknowledged this issue and decided not to change the current codebase.

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.

Control Flow

Control Flow findings concern the access control imposed on functions, such as owner-only functions being invoke-able by anyone under certain circumstances.

Coding Style

Coding Style findings usually do not affect the generated byte-code but rather comment on how to make the codebase more legible and, as a result, easily maintainable.

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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