METATRUST

Security Assessment for

# Uniwhale

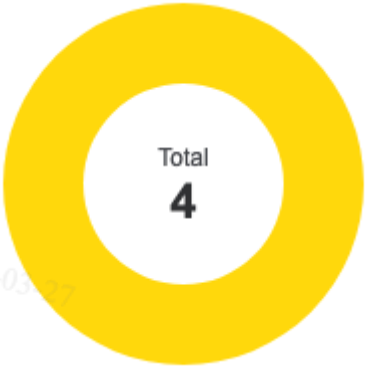
March 27, 2023

## Executive Summary

| Overview | |
|---|---|
| Project Name | Uniwhale |
| Codebase Path | git://github.com/uniwhale-io/uniwhale-v1 |
| Scan Engine | Security Analyzer |
| Scan Time | 2023/03/27 17:22:16 |
| Source Code | uniwhale-io/uniwhale-v1 commit:508f2a11 |

| Total | |
|---|---|
| Critical Issues | 0 |
| High risk Issues | 0 |
| Medium risk Issues | 4 |
| Low risk Issues | 0 |
| Informational Issues | 0 |

| | |
|---|---|
| Critical Issues | The issue can cause large economic losses, large-scale data disorder, loss of control of authority management, failure of key functions, or indirectly affect the correct operation of other smart contracts interacting with it. |
| High Risk Issues | The issue puts a large number of users' sensitive information at risk or is reasonably likely to lead to catastrophic impacts on clients' reputations or serious financial implications for clients and users. |
| Medium Risk Issues | The issue puts a subset of users' sensitive information at risk, would be detrimental to the client's reputation if exploited, or is reasonably likely to lead to moderate financial impact. |
| Low Risk Issues | The risk is relatively small and could not be exploited on a recurring basis, or is a risk that the client has indicated is low-impact in view of the client's business circumstances. |
| Informational Issue | The issue does not pose an immediate risk but is relevant to security best practices or Defence in Depth. |




| | | |
|---|---|---|
| Critical Issues | 0% | 0 |
| High risk Issues | 0% | 0 |
| Medium risk Issues | 100% | 4 |
| Low risk Issues | 0% | 0 |
| Informational Issues | 0% | 0 |

## Summary of Findings

MetaScan security assessment was performed on **March 27, 2023 17:22:16** on project **Uniwhale** with the repository **uniwhale-io/uniwhale-v1** on branch **default branch**. The assessment was carried out by scanning the project's codebase using the scan engine **Security Analyzer**. There are in total **4** vulnerabilities / security risks discovered during the scanning session, among which **0** critical vulnerabilities, **0** high risk vulnerabilities, **4** medium risk vulnerabilities, **0** low risk vulnerabilities, **0** informational issues.

| ID | Description | Severity | Alleviation |
|---|---|---|---|
| MSA-001 | Centralized Roles | Medium risk | Acknowledged |
| MSA-002 | Set Share on an Existing Claimer | Medium risk | Fixed |
| MSA-003 | Functions That are Necessary but not Called | Medium risk | Fixed |
| MSA-004 | The Rule of Update Reward in the `_update` Function | Medium risk | Acknowledged |

# Findings

## Critical (0)

No Critical vulnerabilities found here

## High risk (0)

No High risk vulnerabilities found here

## Medium risk (4)

### 1. Centralized Roles

Medium risk | Security Analyzer

In the contract UniwhaleToken, the role owner has the privileges of the below functions:

- snapshot();
- pause(): pause the contract;
- unpause(): unpause the contract;
- safeTransferrable(): set the transferrable;
- setEmission(): set the _balanceLastUpdate;
- pauseStaking(): set the _stakingPaused. In the contract UniwhaleToken, the role MINTER_ROLE has the privileges of the below functions:
- mint(): mint tokens to the to address;
- addBalance: add the balance;
- removeBalance: decrease the balance. In the contract RevenuePool, the role owner has the privileges of the below functions:
- transferBase(): transfer baseToken from the contract to any account.
- transferFromPool(): transfer baseToken from the contract to any account;
- setShare: set _shares; In the contract RevenuePool, the role approvedClaimer has the privileges of the below functions:
- addBalance: add balance to the ApprovedClaimer role;
- removeBalance: remove balance to the ApprovedClaimer role.
- mint(): mint tokens to any account.

**File(s) Affected**

contracts/RevenuePool.sol #1-12
contracts/tokens/UniwhaleToken.sol #1-21

**Examples**

```
1  // SPDX-License-Identifier: BUSL-1.1
2
3  import "./interfaces/AbstractPool.sol";
   ...
10 pragma solidity ^0.8.17;
11
12 contract RevenuePool is AbstractPool, IDistributable {
```

**Recommendation**

Applying the multi-signature wallet and the timelock to mitigate the risk of centralized roles.

**Alleviation** Acknowledged

The owner would be a multi-sig contract, partially mitigating the centralization risk.

## 2. Set Share on an Existing Claimer

Medium risk Security Analyzer

The function `setShare` requires the total shares of all the claimers to be less than or equal to `1e18`.However. it lacks a check on whether the claimer existed in the set `_shares` or not. If the parameter `claimer` existed in the array `_shares`, the `_sum` should deduct the old share of the existing `claimer` before the `_require` check.

**File(s) Affected**

contracts/RevenuePool.sol #63-74

**Examples**

```
63   function setShare(address claimer, uint256 _share) external onlyOwner {
64     _shares.set(claimer, _share);
65     uint256 _length = _shares.length();
   ...
72
73     emit SetShareEvent(claimer, _share);
74   }
```

**Recommendation**

Check if the `claimer` existed in the `_shares` set or not and deduct the old share of the existing `claimer`.

**Alleviation** Fixed

The client fixed this issue by updating the share for the user first and then checking the sum shares in the PR: https://github.com/uniwhale-io/uniwhale-v1/pull/258/files

## 3. Functions That are Necessary but not Called

Medium risk Security Analyzer

In the parent contract `AbstractStakeable`, the internal function `_addRewardToken()` adds the rewardToken to the set `_rewardTokens`. However, the sub-contract `UniwhaleToken` does not call the `_addRewardToken()` function in the parent contract. As a result, the set `_rewardTokens` will always be empty and users will not get any reward for their stakings. Similarly to the `_removeRewardToken()` function of the parent contract `AbstractStakeable`.

**File(s) Affected**

contracts/interfaces/AbstractStakeable.sol #103-106

**Examples**

```
103   function _addRewardToken(IMintable rewardToken) internal virtual {
104     _rewardTokens.add(address(rewardToken));
105     emit AddRewardTokenEvent(address(rewardToken));
106   }
```

**Recommendation**

Add a function in the sub-contract `UniwhaleToken` to call its parent's internal functions `_addRewardToken()` and `_removeRewardToken()`

**Alleviation** Fixed

The client fixed this issue as the recommendation, in the PR: https://github.com/uniwhale-io/uniwhale-v1/pull/258/files

## 4. The Rule of Update Reward in the `_update` Function

Medium risk Security Analyzer

The _update() function in the AbstractERC20Stakeable contract tries to update the reward of each staker. However, the following steps will make Alice withdraw all the reward:

- Assume the owner gives some rewardToken first and the rewardToken.balance() is 100;
- Alice stakes 10 tokens;
- Bob stakes 20 tokens;
- Alice stakes 10 tokens and the transaction will revert because of an overflow.

- Alice can claim 100 reward tokens without waiting once the owner gives the rewardToken to the pool. Here are the calculation steps of the _update function caused by the above three calls.

```
//Alice stakes with an amount of 10 tokens;
//_update(Alice,10)
_update(Alice, 10)
oldStaked = 0
newStaked = 0 + 10 = 10
If _length == 1

accuredRewards = _getRewards(Alice, rewardToken) = 0

balanceOut = 0 + 0 = 0
newTotalStaked = 0 - 0 = 0

balanceIn = 100 - 0 = 100 since rewardToken.balance() == 100
newTotalStaked > 0 is false

rewardToken.removeBalance(0);
rewardToken.addBalance(100); results rewardToken.balance() == 200
_balanceBaseByStaker[Alice][rewardToken] = 100

_accuredRewardsByStaker[Alice][rewardToken] += 0 = 0

_stakedByStaker[Alice] = 10
totalStaked = 0 + 10 = 10

---
_getRewards()
totalStaked == 0
  Return 0;

//Bob stakes with an amount of 20 tokens;
//_update(Alice,10)->_update(Bob,20)
_update(Bob, 20)
oldStaked = 0
newStaked = 0 + 20 = 20
If _length = 1

accruedRewards = 0

balanceOut = 0 + 0 = 0
newTotalStaked = 10 - 0 = 10

balanceIn = 200 - 0 = 200
If (newTotalStaked > 0)
  balanceIn = 200 * 20 / 10 = 400

rewardToken.removeBalance(0)
rewardToken.addBalance(400); results in rewardToken.balance() == 600
_balanceBaseByStaker[Bob][rewardToken] = 400

_accruedRewardsByStaker[Bob][rewardToken] += 0 = 0

_stakedByStaker[Bob] = 20
totalStaked = 10 + 20 = 30

----
_getRewards()
  200
  * 0
  / 10
  - 0
  = 0
```

```
//Alice stakes with an amount of 10 tokens
//_update(Alice,10)->_update(Bob,20)
//->_update(Alice,10)
oldStaked = 10
newStaked = 10 + 10 = 20
If _length == 1

accruedRewards = 100;

balanceOut = 100 + 100 = 200
newTotalStaked = 30 - 10 = 20

balanceIn = 600 - 200 = 400
newTotalStaked > 0
  balanceIn = 400 * 20 / 20 = 400

rewardToken.removeBalance(200);
rewardToken.addBalance(400); results in the rewardToken.balance() == 800;
_balanceBaseByStaker[Alice][rewardToken] = 400;

_accruedRewardsByStaker[Alice][rewardToken] += 100 = 100

_stakedByStaker[Alice] = 20
totalStaked = 30 + 10 = 40
----
_getRewards()
  600
  * 10
  / 30
  - 100
  = 100

//Alice claims tokens
//_update(Alice, 0)
oldStaked = 20;
newStaked = 20 + 0 = 20;
assumes that _length == 1

accruedRewards = 0
...
_accruedRewardByStaker[Alice][rewardToken] += 0 = 100

---
_getRewards()
  800
  * 20
  / 40
  - 400
```

Here is another case where Bob can withdraw most of the reward by using the sandwich attack with the following steps:

- Alice stakes 10 tokens for 1 month;
- A month later.
- Bob stakes 1000 tokens (before the owner distributes the reward token);
- Assume the owner gives some rewardToken first and the rewardToken.balance() is 100;
- Bob claims the 99 reward token, even though Alice has been staking longer; Here are the calculation steps of the _update function caused by the above three calls.

```
//Alice stakes with an amount of 10 tokens;
//_update(Alice,10)
_update(Alice, 10)
oldStaked = 0
newStaked = 0 + 10 = 10
If _length == 1
```

```
accuredRewards = _getRewards(Alice, rewardToken) = 0

balanceOut = 0 + 0 = 0
newTotalStaked = 0 - 0 = 0

balanceIn = 0 - 0 = 0
newTotalStaked > 0 is false

rewardToken.removeBalance(0);
rewardToken.addBalance(0); results rewardToken.balance() == 0
_balanceBaseByStaker[Alice][rewardToken] = 0

_accuredRewardsByStaker[Alice][rewardToken] += 0 = 0

_stakedByStaker[Alice] = 10
totalStaked = 0 + 10 = 10

---
_getRewards()
totalStaked == 0
  Return 0;

//Bob stakes with an amount of 1000 tokens;
//_update(Alice,10)->_update(Bob,1000)
_update(Bob, 100)
oldStaked = 0
newStaked = 0 + 1000 = 1000
If _length = 1

accruedRewards = 0

balanceOut = 0 + 0 = 0
newTotalStaked = 10 - 0 = 10

balanceIn = 0 - 0 = 0
If (newTotalStaked > 0)
  balanceIn = 0 * 1000 / 10 = 0

rewardToken.removeBalance(0)
rewardToken.addBalance(0);
_balanceBaseByStaker[Bob][rewardToken] = 0

_accruedRewardsByStaker[Bob][rewardToken] += 0 = 0

_stakedByStaker[Bob] = 1000
totalStaked = 10 + 1000 = 1010

----
_getRewards()
  0
  - 0
  = 0

//Alice stakes with an amount of 10 tokens
//_update(Alice,10)->_update(Bob,1000)-> minter add 100 reward token

rewardToken.balance() == 100

//Bob claims tokens
//_update(Bob, 0)
oldStaked = 1000;
newStaked = 1000 + 0 = 1000;
assumes that _length == 1

accruedRewards = 0
...
```

```
_accruedRewardByStaker[Alice][rewardToken] += 0 = 99

---
_getRewards()
  100
  * 1000
  / 1010
  - 0
```

**File(s) Affected**

contracts/interfaces/AbstractStakeable.sol #113-158

**Examples**

```
113    function _update(address staker, int256 stakedDelta) internal virtual {
114      uint256 oldStaked = _stakedByStaker[staker];
115      uint256 newStaked = oldStaked.add(stakedDelta).toUint256();
  •••
156          .divDown(_totalStaked)
157          .sub(_balanceBaseByStaker[staker][_rewardToken]);
158    }
```

**Alleviation** Acknowledged

The Uniwhale team responded that the team mitigates the issue by distributing the rewards in a linear way, and the team is looking to improve on the economic design/logic.

## Low risk (0)

No Low risk vulnerabilities found here

## Informational (0)

No Informational vulnerabilities found here

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