Cyberscope

Audit Report

GLUTECH

July 2023

Network	BSC TESTNET
Address	0x8e53635A780F045f12A1EE8D2B7C1f31212c8D78
Audited by	© cyberscope

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Review

Explorer	https://testnet.bscscan.com/address/0x8e53635a780f045f12a1ee8d2b7c1f31212c8d78

Audit Updates

Initial Audit	01 Jul 2023 https://github.com/cyberscope-io/audits/blob/main/1-glu/v1/audit.pdf
Corrected Phase 2	11 Jul 2023

Source Files

Filename	SHA256
contracts/StakingManager.sol	1ac638a11795a7e6fba368732a1a79c2b5c7c15b7c613da8decf5c10695861bb
@openzeppelin/contracts/utils/math/SafeMath.sol	0dc33698a1661b22981abad8e5c6f5ebca0dfe5ec14916369a2935d888ff257a
@openzeppelin/contracts/security/ReentrancyGuard.sol	aa73590d5265031c5bb64b5c0e7f84c44cf5f8539e6d8606b763adac784e8b2e

Overview

The StakingManager contract is a comprehensive staking mechanism that enables users to stake tokens according to various staking plans and earn rewards based on their stake amount and the duration of the stake.

The contract owner has pre-set the staking plans, the leadership ranks and referral Levels. Each staking plan has unique parameters, including minimum and maximum stake amounts, daily Return on Investment (ROI), staking period, and keeps track of the total staked, and total payout amounts.

Stake

The StakingManager contract allows users to stake tokens in a specific staking plan by depositing a certain amount. The rewards for the staked tokens accrue over time, based on the parameters of the staking plan they have chosen.

Unstake

Users have the flexibility to unstake their tokens, including all of their accumulated rewards, at any time. However, if the unstaking action occurs before the end of the staking period defined in the plan, a penalty fee is applied.

Harvest

In addition to staking and unstaking, users can also harvest their rewards by calling the `harvest` and `harvestReferralEarnings` functions. This allows users to claim their accumulated rewards without unstaking their tokens.

Fees

The contract implements several fees to manage the staking process. When users stake tokens, a fee of 30% is applied. Additionally, a harvest fee of 3% is charged every time users harvest their rewards or their referral rewards. If users unstake their tokens before the end of the staking plan period, a penalty fee of 25% is applied. These fees are designed to incentivize users to maintain their stakes for longer periods and to support the sustainability of the staking platform.

Rewards

The contract enables users to accumulate rewards in two distinct ways. The first way is through staking rewards. These are calculated based on the daily ROI set for each staking plan, the amount of tokens a user has staked, and the duration of the stake. This calculation is performed by the `getRewards` function, which takes into account the user's stake amount, the staking plan's daily ROI, and the elapsed time since the user's earning start time.

The second way is through team sales earnings, which are calculated based on the user's leadership rank. The `teamEarnings` function calculates these rewards, taking into account the user's current rank and the weekly earnings associated with that rank. However, in order for the `teamEarnings` function to be called for a user, the user must first call the `unstake` or the `harvest` function. This is necessary because these functions update the `lastTeamHarvest` variable, which must not be zero for the `teamEarnings` function to work correctly.

Users are encouraged to claim their rewards as near to the conclusion of the staking period as feasible. This is due to the fact that rewards are increased with the number of weeks that have elapsed from the time of staking until the end of the staking period. Once the staking period has concluded, the user's account will not accrue any additional rewards.

Leadership Ranks

Users can ascend to higher leadership ranks by fulfilling certain criteria. These criteria include increasing the total number of totalDirectReferrals, which is the total referrals each user have, increasing the totalInvestments which is the total amount each user has staked, and increasing the leadershipScore, which is the total amount that users who referred the user have staked.

When all these criteria are met, the user is eligible to ascend to a higher leadership rank, which can result in increased rewards. This system incentivizes users to actively participate in the staking process and to refer new users to the platform, thereby contributing to the growth and sustainability of the staking ecosystem.

Harvest Referral Earnings

In addition to the staking rewards, the contract also provides a mechanism for users to earn rewards from referrals. Users can harvest their referral earnings by calling the `harvestReferralEarnings` function.

The contract uses the OpenZeppelin library for secure and standard compliant implementations of ERC20 token interactions, safe math operations, and protection against re-entrancy attacks.

The StakingManager contract is a powerful solution for managing staking activities, providing users with a variety of options to earn rewards, and ensuring the security and integrity of the staking process.

Roles

Owner

The owner has the authority to set the StakingManager contract. The owner is responsible for setting up the 'admin' and 'liquiditySupportBot' wallets in the constructor function during the deployment process.

User

The user can interact with the following functions:

- `function teamEarnings(address _user)`
- `function getRewards(address _account,uint256 planId)`
- `function getUserPlanDetails(address _address,uint256 planId)`
- `function getAllUserPlansEarnings(address _address)`
- `function getUserDetails(address _address)`
- `function getAvailableReferralRewards(address _account)`
- `function getReferralRewards(address _account)`
- `function stake(uint256 planId)`
- `function harvest(uint256 planId)`
- `function harvestReferralEarnings()`
- `function unstake(uint256 planId)`
- `function recordReferral(address _referrer)`

Findings Breakdown

Critical	0
Medium	0
Minor / Informative	9

Severity	Unresolved	Acknowledged	Resolved	Other
Critical	0	0	0	0
Medium	0	0	0	0
Minor / Informative	9	0	0	0

Diagnostics

Critical Medium Minor / Informative

Severity	Code	Description	Status
	PRCM	Potential Referrals Counter Manipulation	Unresolved
	ULI	Unnecessary Loop Iterations	Unresolved
	CO	Code Optimization	Unresolved
	LAFI	Leadership Amount Format Inconsistency	Unresolved
	AOI	Arithmetic Operations Inconsistency	Unresolved
	RSML	Redundant SafeMath Library	Unresolved
	RSK	Redundant Storage Keyword	Unresolved
	L04	Conformance to Solidity Naming Conventions	Unresolved
	L16	Validate Variable Setters	Unresolved

PRCM - Potential Referrals Counter Manipulation

Criticality	Minor / Informative
Location	contracts/StakingManager.sol#L490
Status	Unresolved

Description

The contract is designed to record referrals using the `recordReferral` function. This function is `public`, which means that anyone can call it. A malicious user could potentially exploit this by using multiple different wallets to refer the same account (`_referrer`) repeatedly. This would artificially inflate the `totalDirectReferrals` count of the user (`_referrer`), as each call to the function from the different wallets would increment the `totalDirectReferrals` value. This could lead to an inaccurate representation of the actual referrals made by a user.

```
function recordReferral(address _referrer) public nonReentrant {
    ...

    user.referrals.push(msg.sender);
    user.totalDirectReferrals = user.totalDirectReferrals.add(1);

    totalTeams = totalTeams.add(1);

    ...
}
```

Recommendation

The team is recommended to implement a mechanism that requires a user to have already staked a certain amount in the contract before they can call the `recordReferral` function. This would add an additional layer of security and make it more difficult for a user to manipulate the referral count.

This way ensures that the `recordReferral` function can only be called by a user who has staked an amount greater than zero.

ULI - Unnecessary Loop Iterations

Criticality	Minor / Informative
Location	contracts/StakingManager.sol#L539,593
Status	Unresolved

Description

The contract is using a for loop within the `updateUplinesEarnings` and `balanceLeadershipRank` functions to iterate over the array `userUps` in both functions. For each iteration, the functions check `userUps[i] != address(0)`. If this condition is met, the function executes the code inside the if segment.

However, the loop does not terminate after the if condition is met and continues to the next iterations. This could potentially lead to unnecessary iterations, especially if the referrer is not equal to the null address in the first few iterations. Once the if condition is met, there is no need for the loop to continue to the next iterations, as the necessary updates have already been made.

```
function updateUplinesEarnings(address _address, uint256 planId)
internal {
    if (referrals[_address] != address(0)) {
        uint256 userEarnings = getRewards(_address, planId);
        address[] memory userUps = getUplines(_address);

        for (uint i = 0; i < userUps.length; i++) {
            if (userUps[i] != address(0)) {
                User storage user = users[userUps[i]];
                uint256 referralEarningsPercentage = referralLevels[i +
1];
                uint256 referralReward = userEarnings
                        .mul(referralEarningsPercentage)
                        .div(10000);
                    user.referralDebt =
user.referralDebt.add(referralReward);
                    user.totalCommissionEarned += referralReward;
                    emit ReferralEarningsReceived(userUps[i],
referralReward);
            }
        }
    }
}
```

```
function balanceLeadershipRank(
    address _user,
    uint256 _transactionAmount
) internal {
    address referrer = referrals[_user];
    if (referrer != address(0)) {
        address[] memory userUps = getUplines(_user);

        for (uint256 i = 0; i < userUps.length; i++) {
            if (userUps[i] != address(0)) {

            ...
}
```

Recommendation

The team is advised to include a break statement within the if condition to terminate the loop as soon as the if condition is met. This will optimize the function by avoiding

CO - Code Optimization

Criticality	Minor / Informative
Location	contracts/StakingManager.sol#L210,213
Status	Unresolved

Description

There are code segments that could be optimized. A segment may be optimized so that it becomes a smaller size, consumes less memory, executes more rapidly, or performs fewer operations.

The contract contains an inefficiency in the `getRewards` function, specifically in the calculation and assignment of the `rewardAmount` variable. The function first calculates `rewardAmount` and `if timeDiff >= stakingPlan.stakingPeriod`, the function recalculates and reassigns the `rewardAmount` variable using `stakingPlan.stakingPeriod` instead of `timeDiff`.

This results in unnecessary computation and variable reassignment, as the function performs a calculation that may be immediately overwritten. This redundancy could lead to increased gas costs for the function, and makes the code more complex and difficult to maintain.

```
function getRewards(
    address _account,
    uint256 planId
) public view validPlanId(planId) returns (uint256) {

    ...

    uint256 timeDiff = block.timestamp.sub(staking.earningStartTime);
    uint256 earningRate = staking.amount * stakingPlan.dailyROI;
    uint256 rewardAmount = (earningRate * timeDiff) / (10000 * 1 days);

    if (timeDiff >= stakingPlan.stakingPeriod) {
        rewardAmount =
            (earningRate * stakingPlan.stakingPeriod) /
            (10000 * 1 days);
    }

    return staking.rewardDebt.add(rewardAmount);
}
```

Recommendation

The team is advised to take these segments into consideration and rewrite them so the runtime will be more performant. It is recommended to use `timeDiff` or `stakingPlan.stakingPeriod` in the calculation before performing it, thus only calculating and assigning `rewardAmount` once. This would reduce the complexity of the function and improve the readability of the contract and also reduce the cost of executing it.

LAFI - Leadership Amount Format Inconsistency

Criticality	Minor / Informative
Location	contracts/StakingManager.sol#L126
Status	Unresolved

Description

The contract assigns values to the leadershipRanks mappings. However, the value assigned to the fourth parameter of `leadershipRanks[5]` is `10799999999999999000`, which is not expressed in the 'ether' unit like the corresponding values in the other LeadershipRank structures.

This could potentially lead to confusion or errors, as it deviates from the standard formatting used elsewhere in the contract.

```
leadershipRanks[5] = LeadershipRank(
    7.21 ether,
    20,
    360.27 ether,
    10799999999999999000
);

leadershipRanks[6] = LeadershipRank(
    18.01 ether,
    20,
    900.69 ether,
    18 ether
);
```

Recommendation

It is advised to review the value assigned to the fourth parameter of `leadershipRanks[5]` to ensure it aligns with the intended logic of the contract.

It is recommended to standardize the usage of ether units throughout the contract. The contract should be modified to either exclusively use the 'ether' keyword for all ether values or entirely rely on wei units, depending on the specific requirements and design

considerations. This consistency will help maintain the contract's integrity and mitigate potential confusion or errors arising from inconsistent unit usage.

AOI - Arithmetic Operations Inconsistency

Criticality	Minor / Informative
Location	contracts/StakingManager.sol#L297
Status	Unresolved

Description

The contract uses both the SafeMath library and native arithmetic operations. The SafeMath library is commonly used to mitigate vulnerabilities related to integer overflow and underflow issues. However, it was observed that the contract also employs native arithmetic operators (such as +, -, *, /) in certain sections of the code.

The combination of SafeMath library and native arithmetic operations can introduce inconsistencies and undermine the intended safety measures. This discrepancy creates an inconsistency in the contract's arithmetic operations, increasing the risk of unintended consequences such as inconsistency in error handling, or unexpected behavior.

```
uint256 maxGenerations = REFERRAL_LEVELS - 1;

uint256 timeDiff = block.timestamp.sub(staking.earningStartTime);
```

Recommendation

To address this finding and ensure consistency in arithmetic operations, it is recommended to standardize the usage of arithmetic operations throughout the contract. The contract should be modified to either exclusively use SafeMath library functions or entirely rely on native arithmetic operations, depending on the specific requirements and design considerations. This consistency will help maintain the contract's integrity and mitigate potential vulnerabilities arising from inconsistent arithmetic operations.

RSML - Redundant SafeMath Library

Criticality	Minor / Informative
Location	contracts/StakingManager.sol
Status	Unresolved

Description

SafeMath is a popular Solidity library that provides a set of functions for performing common arithmetic operations in a way that is resistant to integer overflows and underflows.

Starting with Solidity versions that are greater than or equal to 0.8.0, the arithmetic operations revert to underflow and overflow. As a result, the native functionality of the Solidity operations replaces the SafeMath library. Hence, the usage of the SafeMath library adds complexity, overhead and increases gas consumption unnecessarily.

```
library SafeMath {...}
```

Recommendation

The team is advised to remove the SafeMath library. Since the version of the contract is greater than `0.8.0` then the pure Solidity arithmetic operations produce the same result.

If the previous functionality is required, then the contract could exploit the `unchecked { ... }` statement.

Read more about the breaking change on https://docs.soliditylang.org/en/v0.8.16/080-breaking-changes.html#solidity-v0-8-0-breaking-changes.

RSK - Redundant Storage Keyword

Criticality	Minor / Informative
Location	contracts/StakingManager.sol#L173,201,207,260,279,287,295,506
Status	Unresolved

Description

The contract uses the `storage` keyword in a view function. The `storage` keyword is used to persist data on the contract's storage. View functions are functions that do not modify the state of the contract and do not perform any actions that cost gas (such as sending a transaction). As a result, the use of the `storage` keyword in view functions is redundant.

```
User storage user
Staking storage staking
StakingPlan storage stakingPlan
User storage referredUser
```

Recommendation

It is generally considered good practice to avoid using the `storage` keyword in view functions because it is unnecessary and can make the code less readable.

L04 - Conformance to Solidity Naming Conventions

Criticality	Minor / Informative
Location	contracts/StakingManager.sol#L172,198,222,231,241,277,284,467,519,531,551,567,583,584
Status	Unresolved

Description

The Solidity style guide is a set of guidelines for writing clean and consistent Solidity code. Adhering to a style guide can help improve the readability and maintainability of the Solidity code, making it easier for others to understand and work with.

The followings are a few key points from the Solidity style guide:

1. Use camelCase for function and variable names, with the first letter in lowercase (e.g., myVariable, updateCounter).
2. Use PascalCase for contract, struct, and enum names, with the first letter in uppercase (e.g., MyContract, UserStruct, ErrorEnum).
3. Use uppercase for constant variables and enums (e.g., MAX_VALUE, ERROR_CODE).
4. Use indentation to improve readability and structure.
5. Use spaces between operators and after commas.
6. Use comments to explain the purpose and behavior of the code.
7. Keep lines short (around 120 characters) to improve readability.

```
address _user
address _account
address _address
address _referrer
uint256 _transactionAmount
```

Recommendation

By following the Solidity naming convention guidelines, the codebase increased the readability, maintainability, and makes it easier to work with.
Find more information on the Solidity documentation
https://docs.soliditylang.org/en/v0.8.17/style-guide.html#naming-convention.

L16 - Validate Variable Setters

Criticality	Minor / Informative
Location	contracts/StakingManager.sol#L86,87
Status	Unresolved

Description

The contract performs operations on variables that have been configured on user-supplied input. These variables are missing of proper check for the case where a value is zero. This can lead to problems when the contract is executed, as certain actions may not be properly handled when the value is zero.

```
admin = _adminAdd
liquiditySupportBot = _liquiditySupportBotAddress
```

Recommendation

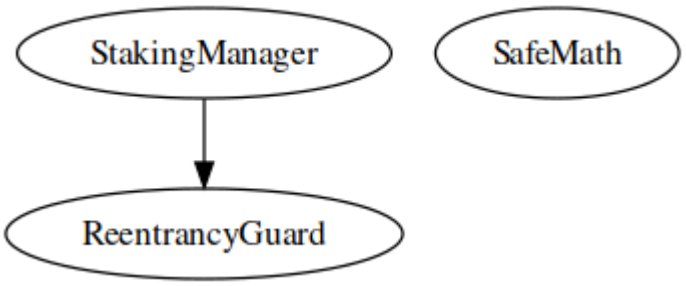
By adding the proper check, the contract will not allow the variables to be configured with zero value. This will ensure that the contract can handle all possible input values and avoid unexpected behavior or errors. Hence, it can help to prevent the contract from being exploited or operating unexpectedly.

Functions Analysis

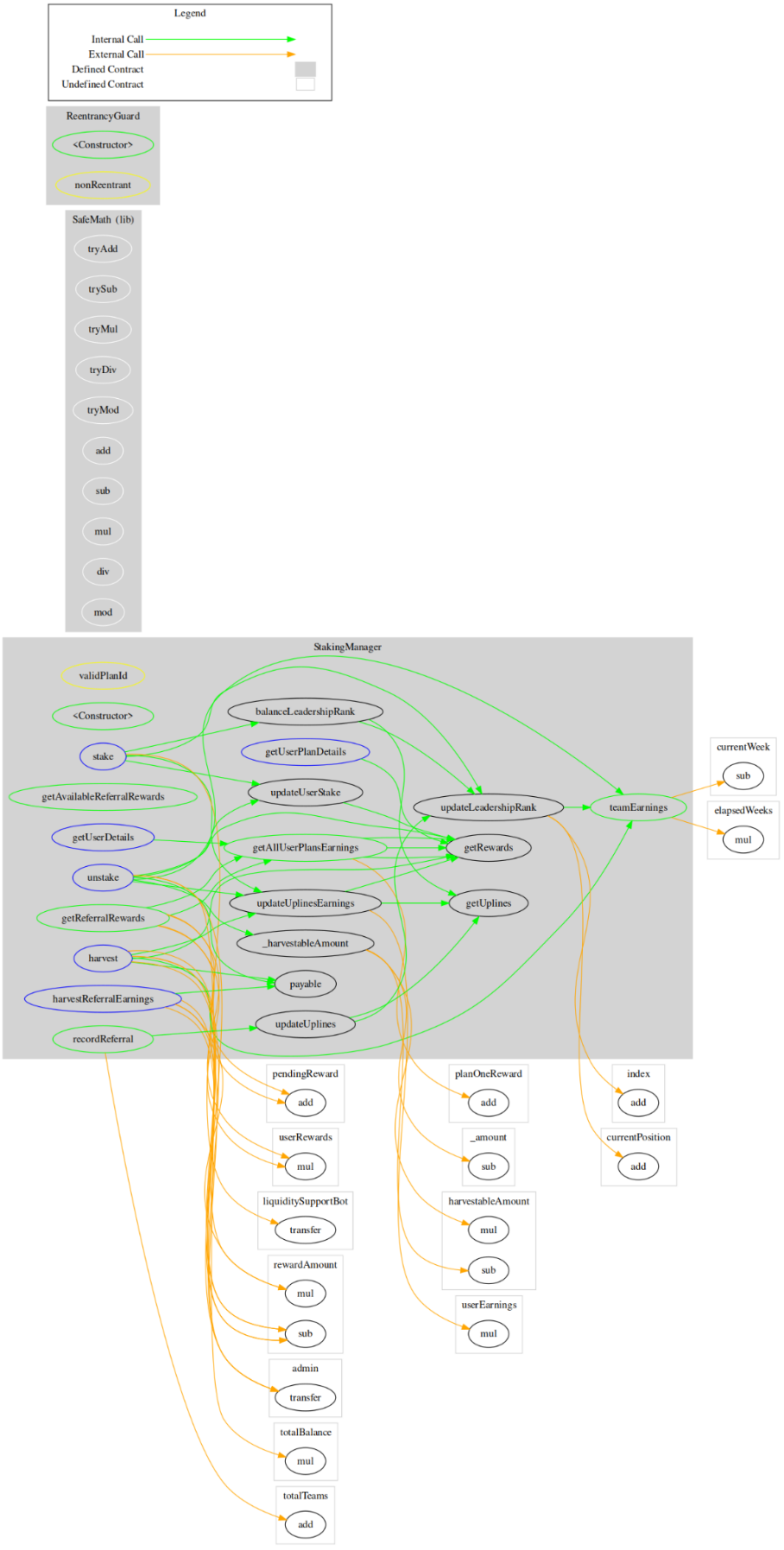
Contract	Type	Bases		
	Function Name	**Visibility**	**Mutability**	**Modifiers**
StakingManager	Implementation	ReentrancyGuard		
		Public	✓	-
	teamEarnings	Public		-
	getRewards	Public		validPlanId
	getUserPlanDetails	External		-
	getAllUserPlansEarnings	Public		-
	getUserDetails	External		-
	getAvailableReferralRewards	Public		-
	getReferralRewards	Public		-
	stake	External	Payable	nonReentrant validPlanId
	harvest	External	✓	nonReentrant validPlanId
	harvestReferralEarnings	External	✓	nonReentrant
	unstake	External	✓	nonReentrant validPlanId
	recordReferral	Public	✓	nonReentrant
	_harvestableAmount	Private		
	updateUserStake	Internal	✓	
	updateUplinesEarnings	Internal	✓	

	updateUplines	Internal	✓	
	getUplines	Internal		
	balanceLeadershipRank	Internal	✓	
	updateLeadershipRank	Internal	✓	

Inheritance Graph



Flow Graph


Legend
Internal Call
External Call
Defined Contract
Undefined Contract
ReentrancyGuard
<Constructor>
nonReentrant
SafeMath (lib)
tryAdd
trySub
tryMul
tryDiv
tryMod
add
sub
mul
div
mod
StakingManager
validPlanId
<Constructor>
stake
getAvailableReferralRewards
getUserDetails
unstake
getReferralRewards
harvest
harvestReferralEarnings
recordReferral
balanceLeadershipRank
getUserPlanDetails
updateUserStake
getAllUserPlansEarnings
updateUplinesEarnings
_harvestableAmount
payable
updateUplines
updateLeadershipRank
getRewards
getUplines
teamEarnings
currentWeek
sub
elapsedWeeks
mul
pendingReward
add
userRewards
mul
liquiditySupportBot
transfer
rewardAmount
mul
sub
admin
transfer
totalBalance
mul
totalTeams
add
planOneReward
add
_amount
sub
harvestableAmount
mul
sub
userEarnings
mul
index
add
currentPosition
add

Summary

StakingManager contract implements a staking and rewards mechanism. This audit investigates security issues, business logic concerns and potential improvements.

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Blockchain technology and cryptographic assets present a high level of ongoing risk Cyberscope's position is that each company and individual are responsible for their own due diligence and continuous security Cyberscope's goal is to help reduce the attack vectors and the high level of variance associated with utilizing new and consistently changing technologies and in no way claims any guarantee of security or functionality of the technology we agree to analyze. The assessment services provided by Cyberscope are subject to dependencies and are under continuing development. You agree that your access and/or use including but not limited to any services reports and materials will be at your sole risk on an as-is where-is and as-available basis Cryptographic tokens are emergent technologies and carry with them high levels of technical risk and uncertainty. The assessment reports could include false positives false negatives and other unpredictable results. The services may access and depend upon multiple layers of third parties.

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Cyberscope is one of the leading smart contract audit firms in the crypto space and has built a high-profile network of clients and partners.

The Cyberscope team

https://www.cyberscope.io