CredShields

Smart Contract Audit

Aug 6th, 2023 • CONFIDENTIAL

Description

This document details the process and result of the Smart Contract Audit audit performed by CredShields Technologies PTE. LTD. on behalf of The HumanPlus Inc. between July 26th, 2023, and July 30th, 2023. And a retest was performed on Aug 2nd, 2023.

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Prepared for

The HumanPlus Inc.

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1. Executive Summary

The HumanPlus Inc. engaged CredShields to perform a smart contract audit from July 26th, 2023, to July 30th, 2023. During this timeframe, Nine (9) vulnerabilities were identified. **A retest was performed on Aug 2nd, 2023, and all the bugs have been addressed.**

During the audit, zero (0) vulnerabilities were found with a severity rating of either High or Critical. These vulnerabilities represent the greatest immediate risk to "The HumanPlus Inc." and should be prioritized for remediation, and fortunately, none were found.

The table below shows the in-scope assets and a breakdown of findings by severity per asset. Section 2.3 contains more information on how severity is calculated.

Assets in Scope	Critical	High	Medium	Low	info	Gas	Σ
Smart Contract Audit	0	0	1	3	3	2	**9**
	0	**0**	**1**	**3**	**3**	**2**	**9**

Table: Vulnerabilities Per Asset in Scope

The CredShields team conducted the security audit to focus on identifying vulnerabilities in Smart Contract Audit's scope during the testing window while abiding by the policies set forth by Smart Contract Audit's team.

State of Security

To maintain a robust security posture, it is essential to continuously review and improve upon current security processes. Utilizing CredShields' continuous audit feature allows both The HumanPlus Inc.'s internal security and development teams to not only identify specific vulnerabilities but also gain a deeper understanding of the current security threat landscape.

To ensure that vulnerabilities are not introduced when new features are added, or code is refactored, we recommend conducting regular security assessments. Additionally, by analyzing the root cause of resolved vulnerabilities, the internal teams at The HumanPlus Inc. can implement both manual and automated procedures to eliminate entire classes of vulnerabilities in the future. By taking a proactive approach, The HumanPlus Inc. can future-proof its security posture and protect its assets.

2. Methodology

The HumanPlus Inc. engaged CredShields to perform a Smart Contract audit. The following sections cover how the engagement was put together and executed.

2.1 Preparation phase

The CredShields team meticulously reviewed all provided documents and comments in the smart-contract code to gain a thorough understanding of the contract's features and functionalities. They meticulously examined all functions and created a mind map to systematically identify potential security vulnerabilities, prioritizing those that were more critical and business-sensitive for the refactored code. To confirm their findings, the team deployed a self-hosted version of the smart contract and performed verifications and validations during the audit phase.

A testing window from July 26th, 2023, to July 30th, 2023, was agreed upon during the preparation phase.

2.1.1 Scope

During the preparation phase, the following scope for the engagement was agreed-upon:

IN SCOPE ASSETS
https://github.com/hupayx-com/nft-market_place_contract/tree/53d797896f68e85db6cb4a861437734d79e21992

Table: List of Files in Scope

2.1.2 Documentation

Documentation was not required as the code was self-sufficient for understanding the project.

2.1.3 Audit Goals

CredShields uses both in-house tools and manual methods for comprehensive smart contract security auditing. The majority of the audit is done by manually reviewing the contract source code, following SWC registry standards, and an extended industry standard self-developed checklist. The team places emphasis on understanding core concepts, preparing test cases, and evaluating business logic for potential vulnerabilities.

2.2 Retesting phase

The HumanPlus Inc. is actively partnering with CredShields to validate the remediations implemented towards the discovered vulnerabilities.

2.3 Vulnerability Classification and severity

CredShields follows OWASP's Risk Rating Methodology to determine the risk associated with discovered vulnerabilities. This approach considers two factors - Likelihood and Impact - which are evaluated with three possible values - **Low**, **Medium**, and **High**, based on factors such as Threat agents, Vulnerability factors, Technical and Business Impacts. The overall severity of the risk is calculated by combining the likelihood and impact estimates.

Overall Risk Severity				
Impact	HIGH	Medium	High	Critical
	MEDIUM	Low	Medium	High
	LOW	Note	Low	Medium
		LOW	MEDIUM	HIGH
	Likelihood			

Overall, the categories can be defined as described below -

1. **Informational**

   We prioritize technical excellence and pay attention to detail in our coding practices. Our guidelines, standards, and best practices help ensure software stability and reliability. Informational vulnerabilities are opportunities for improvement and do

not pose a direct risk to the contract. Code maintainers should use their own judgment on whether to address them.

2. Low

Low-risk vulnerabilities are those that either have a small impact or can't be exploited repeatedly or those the client considers insignificant based on their specific business circumstances.

3. Medium

Medium-severity vulnerabilities are those caused by weak or flawed logic in the code and can lead to exfiltration or modification of private user information. These vulnerabilities can harm the client's reputation under certain conditions and should be fixed within a specified timeframe.

4. High

High-severity vulnerabilities pose a significant risk to the Smart Contract and the organization. They can result in the loss of funds for some users, may or may not require specific conditions, and are more complex to exploit. These vulnerabilities can harm the client's reputation and should be fixed immediately.

5. Critical

Critical issues are directly exploitable bugs or security vulnerabilities that do not require specific conditions. They often result in the loss of funds and Ether from Smart Contracts or users and put sensitive user information at risk of compromise

or modification. The client's reputation and financial stability will be severely impacted if these issues are not addressed immediately.

6. **Gas**

   To address the risk and volatility of smart contracts and the use of gas as a method of payment, CredShields has introduced a "Gas" severity category. This category deals with optimizing code and refactoring to conserve gas.

2.4 CredShields staff

The following individual at CredShields managed this engagement and produced this report:

- **Shashank, Co-founder CredShields**
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Please feel free to contact this individual with any questions or concerns you have around the engagement or this document.

3. Findings

This chapter contains the results of the security assessment. Findings are sorted by their severity and grouped by the asset and SWC classification. Each asset section will include a summary. The table in the executive summary contains the total number of identified security vulnerabilities per asset per risk indication.

3.1 Findings Overview

3.1.1 Vulnerability Summary

During the security assessment, Nine (9) security vulnerabilities were identified in the asset.

VULNERABILITY TITLE	SEVERITY	SWC | Vulnerability Type
Use safeTransfer/safeTransferFrom instead of transfer/transferFrom	Low	Missing best practices
Floating and Outdated Pragma	Low	Floating Pragma (SWC-103)
Missing Events in Functions	Low	Missing Best Practices
Variables should be Immutable	Gas	Gas Optimization
Require Instead of If and Revert	Informational	Best Practices
Missing NatSpec Comments	Informational	Missing best practices
Use Call instead of Transfer	Informational	Best Practices
Functions should be declared External	Gas	Gas Optimization

Gas Optimization in Require Statements	Gas	Gas Optimization

Table: Findings in Smart Contracts

3.1.2 Findings Summary

SWC ID	SWC Checklist	Test Result	Notes
SWC-100	Function Default Visibility	Not Vulnerable	Not applicable after v0.5.X (Currently using solidity v >= 0.8.6)
SWC-101	Integer Overflow and Underflow	Not Vulnerable	The issue persists in versions before v0.8.X.
SWC-102	Outdated Compiler Version	Not Vulnerable	Version 0^.8.0 and above is used
SWC-103	Floating Pragma	Not Vulnerable	Contract uses floating pragma
SWC-104	Unchecked Call Return Value	Not Vulnerable	call() is not used
SWC-105	Unprotected Ether Withdrawal	Not Vulnerable	Appropriate function modifiers and require validations are used on sensitive functions that allow token or ether withdrawal.
SWC-106	Unprotected SELFDESTRUCT Instruction	Not Vulnerable	selfdestruct() is not used anywhere
SWC-107	Reentrancy	Not Vulnerable	No notable functions were vulnerable to it.
SWC-108	State Variable Default Visibility	Not Vulnerable	Not Vulnerable
SWC-109	Uninitialized Storage Pointer	Not Vulnerable	Not vulnerable after compiler version, v0.5.0

SWC-110	Assert Violation	Not Vulnerable	Asserts are not in use.
SWC-111	Use of Deprecated Solidity Functions	Not Vulnerable	None of the deprecated functions like block.blockhash(), msg.gas, throw, sha3(), callcode(), suicide() are in use
SWC-112	Delegatecall to Untrusted Callee	Not Vulnerable	Not Vulnerable.
SWC-113	DoS with Failed Call	Not Vulnerable	No such function was found.
SWC-114	Transaction Order Dependence	Not Vulnerable	Not Vulnerable.
SWC-115	Authorization through tx.origin	Not Vulnerable	tx.origin is not used anywhere in the code
SWC-116	Block values as a proxy for time	Not Vulnerable	Block.timestamp is not used
SWC-117	Signature Malleability	Not Vulnerable	Not used anywhere
SWC-118	Incorrect Constructor Name	Not Vulnerable	All the constructors are created using the constructor keyword rather than functions.
SWC-119	Shadowing State Variables	Not Vulnerable	Not applicable as this won't work during compile time after version 0.6.0
SWC-120	Weak Sources of Randomness from Chain Attributes	Not Vulnerable	Random generators are not used.
SWC-121	Missing Protection against Signature Replay Attacks	Not Vulnerable	No such scenario was found

SWC-122	Lack of Proper Signature Verification	Not Vulnerable	Not used anywhere
SWC-123	Requirement Violation	Not Vulnerable	Not vulnerable
SWC-124	Write to Arbitrary Storage Location	Not Vulnerable	No such scenario was found
SWC-125	Incorrect Inheritance Order	Not Vulnerable	No such scenario was found
SWC-126	Insufficient Gas Griefing	Not Vulnerable	No such scenario was found
SWC-127	Arbitrary Jump with Function Type Variable	Not Vulnerable	Jump is not used.
SWC-128	DoS With Block Gas Limit	Not Vulnerable	Not Vulnerable.
SWC-129	Typographical Error	Not Vulnerable	No such scenario was found
SWC-130	Right-To-Left-Override control character (U+202E)	Not Vulnerable	No such scenario was found
SWC-131	Presence of unused variables	Not Vulnerable	No such scenario was found
SWC-132	Unexpected Ether balance	Not Vulnerable	No such scenario was found
SWC-133	Hash Collisions With Multiple Variable Length Arguments	Not Vulnerable	abi.encodePacked() or other functions are not used.
SWC-134	Message call with hardcoded gas amount	Not Vulnerable	Not used anywhere in the code
SWC-135	Code With No Effects	Not Vulnerable	No such scenario was found
SWC-136	Unencrypted Private Data On-Chain	Not Vulnerable	No such scenario was found

4. Remediation Status

The HumanPlus Inc. is actively partnering with CredShields from this engagement to validate the discovered vulnerabilities' remediations. **A retest was performed on Aug 2nd, 2023, and all the issues have been addressed.**

Also, the table shows the remediation status of each finding.

VULNERABILITY TITLE	SEVERITY	REMEDIATION STATUS
Use safeTransfer/safeTransferFrom instead of transfer/transferFrom	Low	**Fixed [02/08/2022]**
Floating and Outdated Pragma	Low	**Fixed [02/08/2022]**
Missing Events in Functions	Low	**Won't Fix**
Variables should be Immutable	Gas	**Fixed [02/08/2022]**
Require Instead of If and Revert	Informational	**Fixed [02/08/2022]**
Missing NatSpec Comments	Informational	**Won't Fix**
Use Call instead of Transfer	Informational	**Won't Fix**
Functions should be declared External	Gas	**Fixed [02/08/2022]**
Gas Optimization in Require Statements	Gas	**Fixed [02/08/2022]**

Table: Summary of findings and status of remediation

5. Bug Reports

Bug ID#1 [Fixed]

Use safeTransfer/safeTransferFrom instead of transfer/transferFrom

Vulnerability Type
Missing best practices

Severity
Low

Description
The transfer() and transferFrom() method is used instead of safeTransfer() and safeTransferFrom(), presumably to save gas however OpenZeppelin's documentation discourages the use of transferFrom(), use safeTransferFrom() whenever possible because safeTransferFrom auto-handles boolean return values whenever there's an error.

Affected Code

- https://github.com/hupayx-com/nft-market_place_contract/blob/53d797896f68e85db6cb4a861437734d79e21992/SFLStaking.sol#L83
- https://github.com/hupayx-com/nft-market_place_contract/blob/53d797896f68e85db6cb4a861437734d79e21992/SFLStaking.sol#L207
- https://github.com/hupayx-com/nft-market_place_contract/blob/53d797896f68e85db6cb4a861437734d79e21992/TRIStaking.sol#L80
- https://github.com/hupayx-com/nft-market_place_contract/blob/53d797896f68e85db6cb4a861437734d79e21992/TRIStaking.sol#L89
- https://github.com/hupayx-com/nft-market_place_contract/blob/53d797896f68e85db6cb4a861437734d79e21992/TRIStaking.sol#L182

- https://github.com/hupayx-com/nft-market_place_contract/blob/53d797896f68e85db6cb4a861437734d79e21992/TRIStaking.sol#L212

Impacts

Using safeTransferFrom has the following benefits -

- It checks the boolean return values of ERC20 operations and reverts the transaction if they fail,
- at the same time allowing you to support some non-standard ERC20 tokens that don't have boolean return values.
- It additionally provides helpers to increase or decrease an allowance, to mitigate an attack possible with vanilla approve.

Remediation

Consider using safeTransfer() and safeTransferFrom() instead of transfer() and transferFrom().

Retest

Bug ID #2 [Fixed]

Floating and Outdated Pragma

Vulnerability Type
Floating Pragma (SWC-103)

Severity
Low

Description
Locking the pragma helps ensure that the contracts do not accidentally get deployed using an older version of the Solidity compiler affected by vulnerabilities.
The contract was allowing floating or unlocked pragma to be used, i.e., **^0.8.0.**
This allows the contracts to be compiled with all the solidity compiler versions above the limit specified. The following contracts were found to be affected -

Impacts
If the smart contract gets compiled and deployed with an older or too recent version of the solidity compiler, there's a chance that it may get compromised due to the bugs present in the older versions or unidentified exploits in the new versions.
Incompatibility issues may also arise if the contract code does not support features in other compiler versions, therefore, breaking the logic.
The likelihood of exploitation is really low therefore this is only informational.

Remediation
Keep the compiler versions consistent in all the smart contract files. Do not allow floating pragmas anywhere. It is suggested to use the 0.8.19 pragma version
Reference: https://swcregistry.io/docs/SWC-103

Retest:
Pragma has been fixed to 0.8.19

Bug ID#3 [Won't Fix]

Missing Events in Functions

Vulnerability Type
Missing Best Practices

Severity
Low

Description
Events are inheritable members of contracts. When you call them, they cause the arguments to be stored in the transaction's log—a special data structure in the blockchain. These logs are associated with the address of the contract which can then be used by developers and auditors to keep track of the transactions.

The contract was found to be missing these events on certain critical functions which would make it difficult or impossible to track these transactions off-chain.

Affected Code
The following functions were affected -

- https://github.com/hupayx-com/nft-market_place_contract/blob/53d797896f68e85db6cb4a861437734d79e21992/SFLStaking.sol#L86-L94
- https://github.com/hupayx-com/nft-market_place_contract/blob/53d797896f68e85db6cb4a861437734d79e21992/SFLStaking.sol#L96-L99
- https://github.com/hupayx-com/nft-market_place_contract/blob/53d797896f68e85db6cb4a861437734d79e21992/SFLStaking.sol#L112-L116
- https://github.com/hupayx-com/nft-market_place_contract/blob/53d797896f68e85db6cb4a861437734d79e21992/SFLStaking.sol#L118-L122
- https://github.com/hupayx-com/nft-market_place_contract/blob/53d797896f68e85db6cb4a861437734d79e21992/SFLStaking.sol#L124-L126
- https://github.com/hupayx-com/nft-market_place_contract/blob/53d797896f68e85db6cb4a861437734d79e21992/SFLStaking.sol#L78-L84

- https://github.com/hupayx-com/nft-market_place_contract/blob/53d797896f68e85db6cb4a861437734d79e21992/TRIStaking.sol#L93-L101
- https://github.com/hupayx-com/nft-market_place_contract/blob/53d797896f68e85db6cb4a861437734d79e21992/TRIStaking.sol#L103-L106
- https://github.com/hupayx-com/nft-market_place_contract/blob/53d797896f68e85db6cb4a861437734d79e21992/TRIStaking.sol#L119-L123
- https://github.com/hupayx-com/nft-market_place_contract/blob/53d797896f68e85db6cb4a861437734d79e21992/TRIStaking.sol#L125-L128
- https://github.com/hupayx-com/nft-market_place_contract/blob/53d797896f68e85db6cb4a861437734d79e21992/TRIStaking.sol#L130-L132

Impacts

Events are used to track the transactions off-chain, and missing these events on critical functions makes it difficult to audit these logs if they're needed at a later stage.

Remediation

Consider emitting events for the functions mentioned above. It is also recommended to have the addresses indexed.

Retest

Events are already added wherever needed.

Bug ID #4 [Fixed]

Variables should be Immutable

Vulnerability Type
Gas Optimization

Severity
Gas

Description:
Declaring state variables that are not updated following deployment as immutable can save gas costs in smart contract deployments and function executions. Immutable state variables are those that cannot be changed once they are initialized, and their values are set permanently.

By declaring state variables as immutable, the compiler can optimize their storage in a way that reduces gas costs. Specifically, the compiler can store the value directly in the bytecode of the contract, rather than in storage, which is a more expensive operation.

Affected Code:

- https://github.com/hupayx-com/nft-market_place_contract/blob/53d797896f68e85db6cb4a861437734d79e21992/SFLStaking.sol#L33
- https://github.com/hupayx-com/nft-market_place_contract/blob/53d797896f68e85db6cb4a861437734d79e21992/SFLStaking.sol#L40C20-L40C47
- https://github.com/hupayx-com/nft-market_place_contract/blob/53d797896f68e85db6cb4a861437734d79e21992/TRIStaking.sol#L32
- https://github.com/hupayx-com/nft-market_place_contract/blob/53d797896f68e85db6cb4a861437734d79e21992/TRIStaking.sol#L39

Impacts:
Gas usage is increased if the variables that are not updated outside of the constructor are not set as immutable.

Remediation:
An "`immutable`" attribute should be added in the parameters that are never updated outside of the constructor to save the gas.

Retest
Immutable has been added to the above-mentioned variables.

Bug ID #5 [Fixed]

Require Instead of If and Revert

Vulnerability Type
Best Practices

Severity
Informational

Description:
The “require()” Solidity function guarantees the validity of the condition(s) passed as a parameter that cannot be detected before execution. It checks inputs, and contract state variables, and returns values from calls to external contracts.
Using require instead of revert improves the overall readability of the contract code.

Affected Code:

- https://github.com/hupayx-com/nft-market_place_contract/blob/53d797896f68e85db6cb4a861437734d79e21992/TRIStaking.sol#L153-L155
- https://github.com/hupayx-com/nft-market_place_contract/blob/53d797896f68e85db6cb4a861437734d79e21992/SFLStaking.sol#L148-L150

Impacts:
Using require instead of if and revert makes the code more readable and it’s only a matter of code writing style and usability.

Remediation:
Depending on the contract's validation checks, it is recommended to use the “require()” statement to handle input validations.

Retest
This is fixed. If and revert have been updated to require statements.

Bug ID#6 [Won't Fix]

Missing NatSpec Comments

Vulnerability Type
Missing best practices

Severity
Informational

Description
Solidity contracts use a special form of comments to document code. This special form is named the Ethereum Natural Language Specification Format (NatSpec).
The document is divided into descriptions for developers and end-users along with the title and the author.
The contracts were missing NatSpec comments in the code which makes it difficult for the auditors and future developers to understand the code.

Impacts
Missing NatSpec comments and documentation about a library or a contract affect the audit and future development of the smart contracts.

Remediation
Add necessary NatSpec comments inside the library along with documentation specifying what it's for and how it's implemented.

Retest
This is not fixed.

Bug ID #7 [Won't Fix]

Use Call instead of Transfer

Vulnerability Type
Best Practices

Severity
Informational

Description:
Using Solidity's transfer function has some notable shortcomings when the withdrawer is a smart contract, which can render ETH deposits impossible to withdraw. Specifically, the withdrawal will inevitably fail when:

- The withdrawer smart contract does not implement a payable fallback function.
- The withdrawer smart contract implements a payable fallback function which uses more than 2300 gas units.
- The withdrawer smart contract implements a payable fallback function which needs less than 2300 gas units but is called through a proxy that raises the call's gas usage above 2300.

Affected Code

- https://github.com/hupayx-com/nft-market_place_contract/blob/53d797896f68e85db6cb4a861437734d79e21992/SFLStaking.sol#L206

Impacts
The transfer function has some restrictions when it comes to sending ETH to contracts in terms of gas which could lead to transfer failure in some cases.

Remediation
It is recommended to transfer ETH using the call() function, handle the return value using require statement, and use the nonreentrant modifier wherever necessary to prevent reentrancy.
Ref: https://solidity-by-example.org/sending-ether/

Retest

This is not fixed but will be considered later.

Bug ID#8 [Fixed]

Functions should be declared External

Vulnerability Type
Gas Optimization

Severity
Gas

Description
Public functions that are never called by a contract should be declared external in order to conserve gas.
The following functions were declared as public but were not called anywhere in the contract, making public visibility useless.

Affected Code
The following functions were affected -

- https://github.com/hupayx-com/nft-market_place_contract/blob/53d797896f68e85db6cb4a861437734d79e21992/TRIStaking.sol#L79-L106
- https://github.com/hupayx-com/nft-market_place_contract/blob/53d797896f68e85db6cb4a861437734d79e21992/TRIStaking.sol#L63-L69
- https://github.com/hupayx-com/nft-market_place_contract/blob/53d797896f68e85db6cb4a861437734d79e21992/TRIStaking.sol#L119-L132
- https://github.com/hupayx-com/nft-market_place_contract/blob/53d797896f68e85db6cb4a861437734d79e21992/TRIStaking.sol#L84-L106
- https://github.com/hupayx-com/nft-market_place_contract/blob/53d797896f68e85db6cb4a861437734d79e21992/SFLStaking.sol#L62-L68
- https://github.com/hupayx-com/nft-market_place_contract/blob/53d797896f68e85db6cb4a861437734d79e21992/SFLStaking.sol#L78-L99
- https://github.com/hupayx-com/nft-market_place_contract/blob/53d797896f68e85db6cb4a861437734d79e21992/SFLStaking.sol#L112-L126

Impacts

Smart Contracts are required to have effective Gas usage as they cost real money and each function should be monitored for the amount of gas it costs to make it gas efficient.
"**public**" functions cost more Gas than "**external**" functions.

Remediation
Use the "**external**" state visibility for functions that are never called from inside the contract.

Retest
The functions that are not called anywhere from inside the contract are set as external.

Bug ID#9 [Fixed]

Gas Optimization in Require Statements

Vulnerability Type
Gas Optimization

Severity
Gas

Description
The **require()** statement takes an input string to show errors if the validation fails.
The strings inside these functions that are longer than **32 bytes** require at least one additional MSTORE, along with additional overhead for computing memory offset and other parameters. For this purpose, having strings lesser than 32 bytes saves a significant amount of gas.

Vulnerable Code

- https://github.com/hupayx-com/nft-market_place_contract/blob/53d797896f68e85db6cb4a861437734d79e21992/SFLStaking.sol#L79-L82
- https://github.com/hupayx-com/nft-market_place_contract/blob/53d797896f68e85db6cb4a861437734d79e21992/SFLStaking.sol#L88
- https://github.com/hupayx-com/nft-market_place_contract/blob/53d797896f68e85db6cb4a861437734d79e21992/SFLStaking.sol#L149
- https://github.com/hupayx-com/nft-market_place_contract/blob/53d797896f68e85db6cb4a861437734d79e21992/TRIStaking.sol#L85-L88
- https://github.com/hupayx-com/nft-market_place_contract/blob/53d797896f68e85db6cb4a861437734d79e21992/TRIStaking.sol#L95
- https://github.com/hupayx-com/nft-market_place_contract/blob/53d797896f68e85db6cb4a861437734d79e21992/TRIStaking.sol#L154

Impacts
Having longer require strings than 32 bytes costs a significant amount of gas.

Remediation

It is recommended to shorten the strings passed inside **require()** statements to fit under **32 bytes**. This will decrease the gas usage at the time of deployment and at runtime when the validation condition is met.

Retest

This is fixed. The require statements have been reduced to under 32 characters.

6. Disclosure

The Reports provided by CredShields is not an endorsement or condemnation of any specific project or team and do not guarantee the security of any specific project. The contents of this report are not intended to be used to make decisions about buying or selling tokens, products, services, or any other assets and should not be interpreted as such.

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