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MechaChain

Audit

Security Assessment

11. February, 2022

For



MECHACHAIN

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Version	Date	Description
1.0	11. February 2022	<ul style="list-style-type: none">• Layout project• Automated- /Manual-Security Testing• Summary

Network

Ethereum & Polygon

Website

<https://mechachain.io/en/>

Telegram

<https://t.me/mechachain>

Twitter

<https://twitter.com/mechachain>

Discord

<https://discord.gg/kMJCNaWaNz>



Description

MechaChain is a 3D play-to-earn video game about robot combat and space conquest. Each robot, called “Mecha”, is a collection of NFT composed of robot parts, which can be purchased online with the game cryptocurrency called Mechanium, Ethereum, or by card. These parts once assembled give birth to a robot in a PvP fighting video game.

The player earns Mechanium by winning battles, and can trade and buy new parts to become the best MechaChain pilot.

Project Engagement

During the 9th of February 2022, **MechaChain Team** engaged Solidproof.io to audit smart contracts that they created. The engagement was technical in nature and focused on identifying security flaws in the design and implementation of the contracts. They provided Solidproof.io with access to their code repository and whitepaper.

Logo



Contract Link

v1.0

- Github
 - <https://github.com/thibautvdu/MechaChain-Smart-Contracts/tree/develop/contracts>
 - Commit: 678acde6e82a5c049c8e0707cb8095cfa8c3218e

Vulnerability & Risk Level

Risk represents the probability that a certain source-threat will exploit vulnerability, and the impact of that event on the organization or system. Risk Level is computed based on CVSS version 3.0.

Level	Value	Vulnerability	Risk (Required Action)
Critical	9 - 10	A vulnerability that can disrupt the contract functioning in a number of scenarios, or creates a risk that the contract may be broken.	Immediate action to reduce risk level.
High	7 – 8.9	A vulnerability that affects the desired outcome when using a contract, or provides the opportunity to use a contract in an unintended way.	Implementation of corrective actions as soon as possible.
Medium	4 – 6.9	A vulnerability that could affect the desired outcome of executing the contract in a specific scenario.	Implementation of corrective actions in a certain period.
Low	2 – 3.9	A vulnerability that does not have a significant impact on possible scenarios for the use of the contract and is probably subjective.	Implementation of certain corrective actions or accepting the risk.
Informational	0 – 1.9	A vulnerability that have informational character but is not effecting any of the code.	An observation that does not determine a level of risk

Auditing Strategy and Techniques Applied

Throughout the review process, care was taken to evaluate the repository for security-related issues, code quality, and adherence to specification and best practices. To do so, reviewed line-by-line by our team of expert pentesters and smart contract developers, documenting any issues as there were discovered.

Methodology

The auditing process follows a routine series of steps:

1. Code review that includes the following:
 - i) Review of the specifications, sources, and instructions provided to SolidProof to make sure we understand the size, scope, and functionality of the smart contract.
 - ii) Manual review of code, which is the process of reading source code line-by-line in an attempt to identify potential vulnerabilities.
 - iii) Comparison to specification, which is the process of checking whether the code does what the specifications, sources, and instructions provided to SolidProof describe.
2. Testing and automated analysis that includes the following:
 - i) Test coverage analysis, which is the process of determining whether the test cases are actually covering the code and how much code is exercised when we run those test cases.
 - ii) Symbolic execution, which is analysing a program to determine what inputs causes each part of a program to execute.
3. Best practices review, which is a review of the smart contracts to improve efficiency, effectiveness, clarify, maintainability, security, and control based on the established industry and academic practices, recommendations, and research.
4. Specific, itemized, actionable recommendations to help you take steps to secure your smart contracts.

Used Code from other Frameworks/Smart Contracts (direct imports)

Imported packages:

Dependency / Import Path	Count
@openzeppelin/contracts/access/AccessControl.sol	1
@openzeppelin/contracts/token/ERC20/utils/SafeERC20.sol	5
@openzeppelin/contracts/utils/Counters.sol	4
@openzeppelin/contracts/utils/math/SafeMath.sol	3

Tested Contract Files

This audit covered the following files listed below with a SHA-1 Hash.

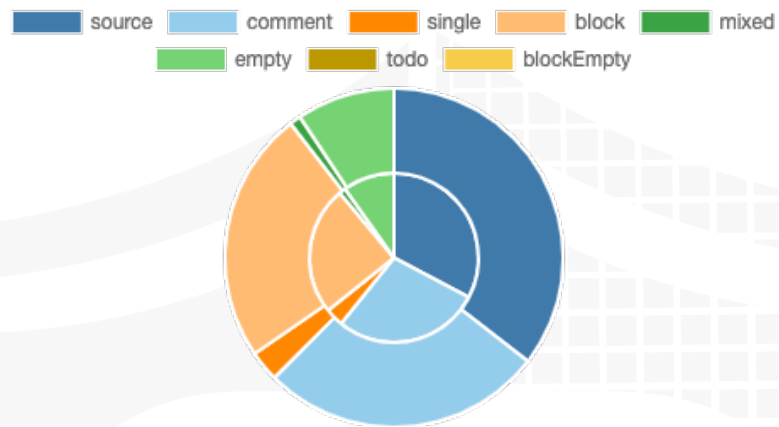
A file with a different Hash has been modified, intentionally or otherwise, after the security review. A different Hash could be (but not necessarily) an indication of a changed condition or potential vulnerability that was not within the scope of this review.

v1.0

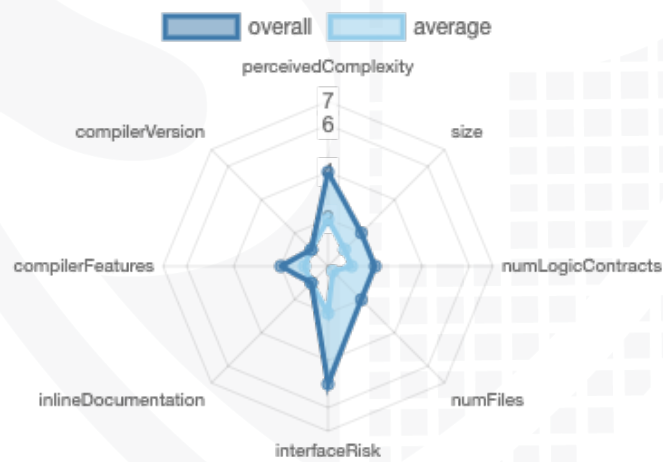
File Name	SHA-1 Hash
contracts/MechaniumTeamDistribution.sol	90cb4cc185119a3d9697215287c0fa9f415697c3
contracts/MechaniumDevDistribution.sol	c8be3324b825d6d8320de4aca4599a31510d21f7
contracts/MechaniumAdvisorsDistribution.sol	d6b6bc15af8fd71c03c8e29a39c29ab2ca90c3c1
contracts/IMechaniumVesting.sol	dcfa96b40c919cf702816e56b8f0a86fe9c46755
contracts/MechaniumPresaleDistribution.sol	595a7a404b3cbeade7d18cb4c1a09937df50926
contracts/MechaniumFoundersDistribution.sol	c5c566826f7dfc9a139d9c7c50b93064c5d63765
contracts/MechaniumVesting.sol	905c4b57c97c5705df1a8c209ad4b87ce407929b

Metrics

Source Lines v1.0



Risk Level v1.0



Capabilities

Components

Version	Contracts	Libraries	Interfaces	Abstract
1.0	5	0	1	1

Exposed Functions

This section lists functions that are explicitly declared public or payable. Please note that getter methods for public stateVars are not included.

Version	Public	Payable
1.0	65	0

Version	External	Internal	Private	Pure	View
1.0	21	28	0	0	49

State Variables

Version	Total	Public
1.0	22	1

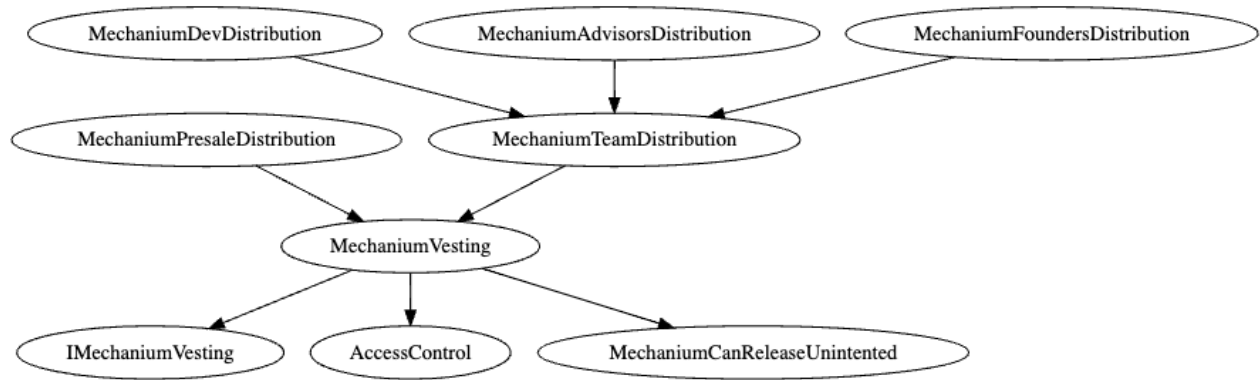
Capabilities

Version	Solidity Versions observed	Experimental Features	Can Receive Funds	Uses Assembly	Has Destroyable Contracts
1.0	^0.8.2				

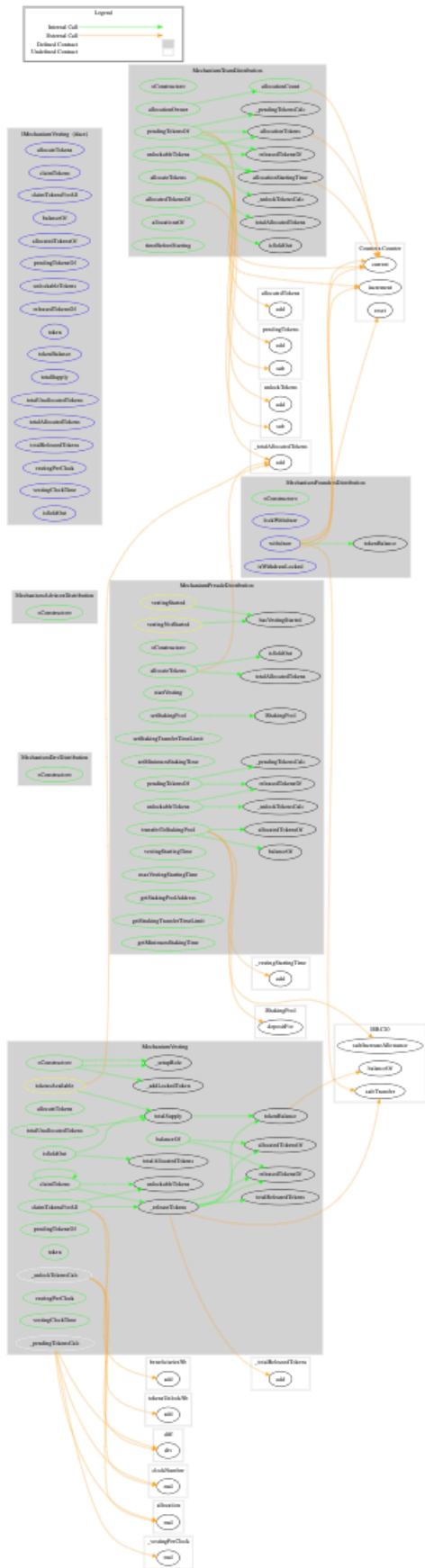
Version	Transfers ETH	Low-Level Calls	DelegateCall	Uses Hash Functions	EC Recover	New/Create/Create2
1.0				yes		

Inheritance Graph

v1.0



CallGraph v1.0



Scope of Work/Verify Claims

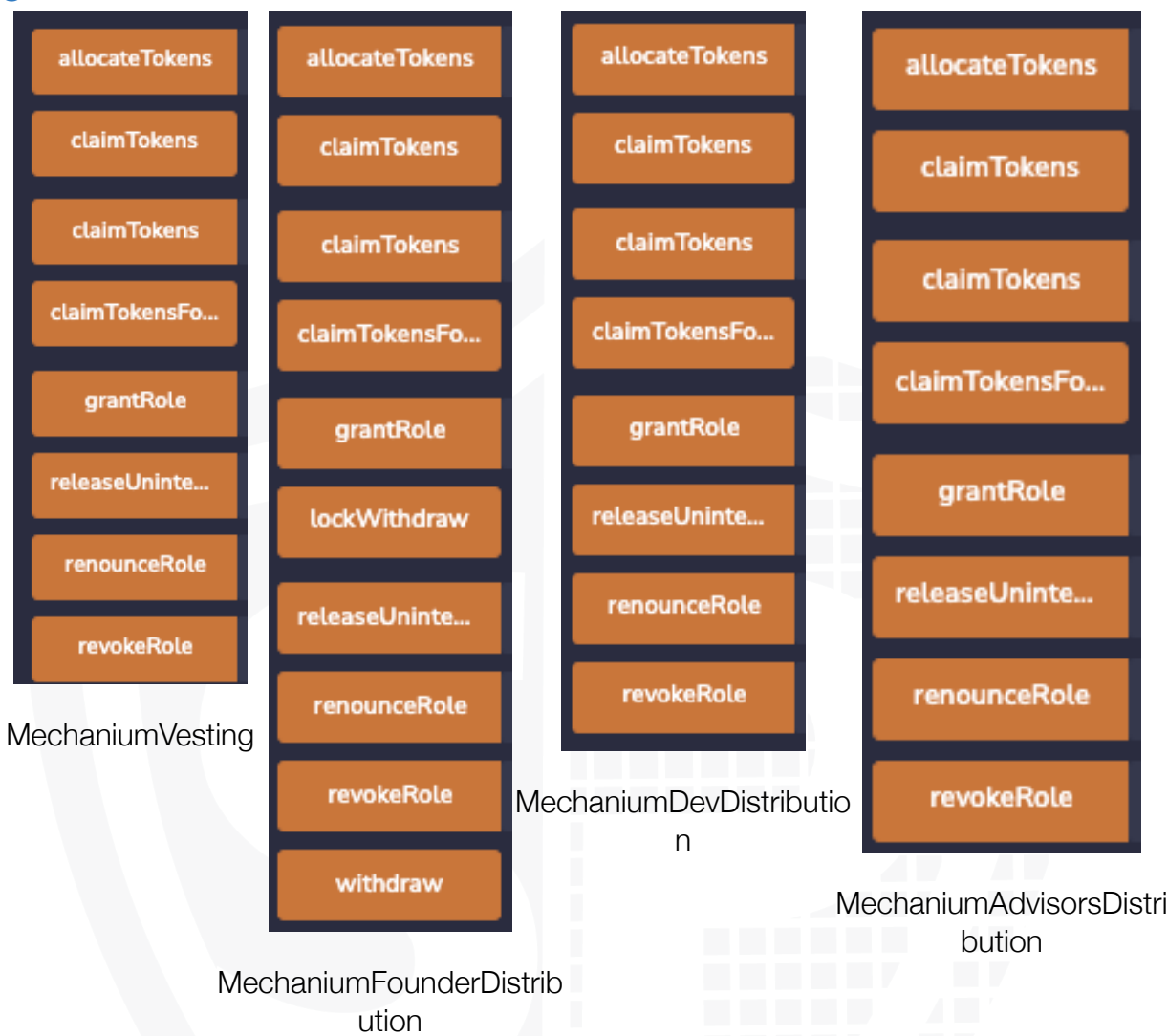
The above token Team provided us with the files that needs to be tested (Github, Bscscan, Etherscan, files, etc.). The scope of the audit is the main contract (usual the same name as team appended with .sol).

We will verify the following claims:

1. Overall checkup (Smart Contract Security)



Write functions of contract
v1.0



Overall checkup (Smart Contract Security)


Tested	Verified
✓	✓




Legend




Attribute	Symbol
Verified / Checked	✓
Partly Verified	⚠
Unverified / Not checked	✗
Not available	—


Modifiers and public functions







v1.0




- ▼  allocateTokens
 - Ⓜ onlyRole
 - Ⓜ tokensAvailable



-  allocateTokens
-  claimTokens
- ▼  claimTokensForAll
 - Ⓜ onlyRole

- ▼  grantRole
 - Ⓜ onlyRole
- ▼  revokeRole
 - Ⓜ onlyRole
-  renounceRole

- ▼  releaseUnintented
 - Ⓜ onlyRole

- ▼  allocateTokens
 - Ⓜ onlyRole
 - Ⓜ tokensAvailable
- ▼  startVesting
 - Ⓜ vestingNotStarted
 - Ⓜ onlyRole
- ▼  setStakingPool
 - Ⓜ onlyRole
- ▼  setStakingTransferTimeLimit
 - Ⓜ onlyRole
- ▼  setMinimumStakingTime
 - Ⓜ onlyRole
-  transferToStakingPool

-  allocateTokens
-  claimTokens
- ▼  claimTokensForAll
 - Ⓜ onlyRole

- ▼  lockWithdraw
 - Ⓜ onlyRole
- ▼  withdraw
 - Ⓜ onlyRole













Comments

- MechaniumFoundersDistribution
 - If `_lockWithdraw` is set to true with `lockWithdraw` function (MechaniumFoundersDistributions L67), you cannot change back to false

Please check if an `OnlyOwner` or similar restrictive modifier has been forgotten.



Source Units in Scope v1.0

Type	File	Logic Contracts	Interfaces	Lines	nLines	nSLOC	Comment Lines	Complex. Score	Capabilities
	contracts/MechaniumTeamDistribution.sol	1	————	251	214	112	74	84	————
	contracts/MechaniumDevDistribution.sol	1	————	28	28	14	14	4	————
	contracts/MechaniumAdvisorsDistribution.sol	1	————	28	28	14	14	4	————
	contracts/IMechaniumVesting.sol	————	1	100	14	3	61	37	————
	contracts/MechaniumPresaleDistribution.sol	1	————	361	315	150	119	96	————
	contracts/MechaniumFoundersDistribution.sol	1	————	124	120	52	53	33	————
	contracts/MechaniumVesting.sol	1	————	389	331	150	154	121	
  	Totals	6	1	1281	1050	495	489	379	

Legend

Attribute	Description
Lines	total lines of the source unit
nLines	normalized lines of the source unit (e.g. normalizes functions spanning multiple lines)
nSLOC	normalized source lines of code (only source-code lines; no comments, no blank lines)
Comment Lines	lines containing single or block comments
Complexity Score	a custom complexity score derived from code statements that are known to introduce code complexity (branches, loops, calls, external interfaces, ...)

Audit Results

AUDIT PASSED

Critical issues

No critical issues

High issues

No high issues

Medium issues

No medium issues

Low issues

Issue	File	Type	Line	Description
#1	IMechaniumCanReleaseUnintended	A floating pragma is set	2	The current pragma Solidity directive is „^0.8.2“.
#2	IMechaniumVesting	A floating pragma is set	2	The current pragma Solidity directive is „^0.8.2“.
#3	MechaniumAdvisorsDistribution	A floating pragma is set	2	The current pragma Solidity directive is „^0.8.2“.
#4	MechaniumCanReleaseUnintended	A floating pragma is set	2	The current pragma Solidity directive is „^0.8.2“.

#5	MechaniumDevDistribution	A floating pragma is set	2	The current pragma Solidity directive is „^0.8.2”.
#6	MechaniumFoundersDistribution	A floating pragma is set	2	The current pragma Solidity directive is „^0.8.2”.
#7	MechaniumPresaleDistribution	A floating pragma is set	2	The current pragma Solidity directive is „^0.8.2”.
#8	MechaniumTeamDistribution	A floating pragma is set	2	The current pragma Solidity directive is „^0.8.2”.
#9	MechaniumVesting	A floating pragma is set	2	The current pragma Solidity directive is „^0.8.2”.
#10	MechaniumPresaleDistribution	Missing Zero Address Validation (missing-zero-check)	201	Check that the address is not zero

Informational issues

Issue	File	Type	Line	Description
#1	IMechaniumCanReleaseUnintended	Misspelling	See description	<p>Change following:</p> <ul style="list-style-type: none"> - Mechanim to Mechanium L5 - IMechaniumCanReleaseUnintented to IMechaniumCanReleaseUnintended L10 - unintended to unintended L12, L12, L13 - releaseUnintented to releaseUnintended L18 <p>Change variables/functions/interfaces/imports etc. everywhere else</p>

#2	IMechaniumVesting	Misspelling	See description	<p>Change following:</p> <ul style="list-style-type: none"> - Mechanim to Mechanium L5 - amont to amount L42 <p>Change variables/functions/interfaces etc. everywhere else</p>
#3	MechaniumCanReleaseUnintented	Misspelling	See description	<p>Change following:</p> <ul style="list-style-type: none"> - IMechaniumCanReleaseUnintented to IMechaniumCanReleaseUnintended L6, L14 - ReleaseUnintentedTokens to ReleaseUnintendedTokens L23, L83 - unintended to unintended L21, L47 - releaseUnintented to releaseUnintended L52 <p>Change variables/functions/interfaces etc. everywhere else</p>
#4	MechaniumFoundersDistribution	Misspelling	See description	<p>Change following:</p> <ul style="list-style-type: none"> - whitdraw to withdraw L10, L72, L84 <p>Change variables/functions/interfaces etc. everywhere else</p>
#5	MechaniumPresaleDistribution	Misspelling	See description	<p>Change following:</p> <ul style="list-style-type: none"> - tokens to tokens L59 - getStrakingTransferTimeLimit to getStakingTransferTimeLimit L351 <p>Change variables/functions/interfaces etc. everywhere else</p>

#6	MechaniumVesting	Misspelling	See description	<p>Change following:</p> <ul style="list-style-type: none"> - MechaniumCanReleaseUnintended to MechaniumCanReleaseUnintended L8, L19 - transfered to transferred L87, L96 <p>Change variables/functions/interfaces etc. everywhere else</p>
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Testing Protocol

MechaniumFoundersDistribution

- ✓ Smart contract should be deployed (139ms)
- ✓ Admin should set allocator role
- ✓ Allocator should allocate to user
 - 1) Allocator should not be able to allocate tokens to smart contract address
 - > No events were emitted
 - ✓ User balance should encrease when allocated tokens
 - ✓ Total unlockable tokens must be 20% of the first allocation (1 year after the first allocation)
 - ✓ Total unlockable tokens must be 20% of the two allocations (1 year after the seconds allocation)
 - ✓ Total unlockable tokens must be 40% of the first allocation + 20% of the seconds (1 year + 6 month)
 - ✓ Total unlockable tokens must be 100% of all allocation
 - ✓ User should be able to claim unlockable tokens
 - ✓ Allocator should allocate new tokens to user
 - ✓ Total unlockable tokens must be 20% of the new allocation (1 year after the new allocation)
 - ✓ Admin should withdraw (39ms)
 - ✓ User should not have unlockable tokens anymore
 - 2) User should not be able to lock withdraw
 - > No events were emitted
 - ✓ Admin should lock withdraw
 - 3) Admin should not be able to relock withdraw
 - > No events were emitted
 - 4) Admin should not be able to withdraw if already locked
 - > No events were emitted
 - 5) User should not be able to withdraw
 - > No events were emitted
 - ✓ Admin can add new tokens supply

- ✓ Allocator should allocate to user
- ✓ User balance should increase when allocated tokens
- ✓ Total unlockable tokens must be 20% of the first allocation (1 year after the first allocation)
- ✓ Total unlockable tokens must be 20% of the two allocations (1 year after the second allocation)
- ✓ Total unlockable tokens must be 40% of the first allocation + 20% of the second (1 year + 6 month)
- ✓ Someone should claim user's unlockable tokens

Mechanism Presale Distribution

- ✓ Smart contract should be deployed (171ms)
- ✓ Allocator account should not have ALLOCATOR_ROLE
- ✓ Admin should be able to set ALLOCATOR_ROLE
- 14) Allocator should not be able to allocate amount superior to balance
 - > No events were emitted
- 15) User should not be able to allocate tokens
 - > No events were emitted
- ✓ Contract should have 10M of balance
- ✓ Vesting should not be started if starting time has not arrived
- ✓ Allocator should be able to allocate tokens to multiple users (62ms)
- ✓ Allocator should be able to allocate tokens to user
- 16) Allocator should not be able to allocate tokens to smart contract address
 - > No events were emitted
- ✓ User balance should increase after allocation
- ✓ User balance should be locked if vesting time not started
- ✓ Admin should be able to change vesting start time
- 17) Admin should not be able to set vesting start time after max start time
 - > No events were emitted
- 18) Admin should not be able to claim user tokens if vesting has not started
 - > No events were emitted
- ✓ Admin should be able to start the vesting immediately
- ✓ Unlockable amount must be 20% of total user balance (first month)
- ✓ Pending tokens must be calculated per seconds
- ✓ Admin should claim user's unlockable tokens (20%)
- 19) Admin should not be able to claim user's tokens in same period
 - > No events were emitted
- 20) User should not be able to transfer to staking pool if the staking pool is not set
 - > No events were emitted
- ✓ Admin should be able to set staking pool address

- 21) User should not be able to transfer if staking time lower than minimum staking time
 - > No events were emitted
- 22) User should not be able to transfer if staking time greater than maximum staking time
 - > No events were emitted
- 23) User should not be able to transfer an amount of 0
 - > No events were emitted
- 24) User should not be able to transfer an amount superior to his allocated tokens
 - > No events were emitted
- 25) User should not be able to set staking pool address
 - > No events were emitted
 - ✓ User should be able to transfer an amount of unlocked tokens to staking pool
 - ✓ Admin can refill the contract
 - ✓ Allocator should be able to allocate tokens a month after the vesting has started (after 30 days)
 - ✓ The new late beneficiary can claim 40% of his allocation
 - ✓ Unlockable amount must be 60% of total allocated tokens (after 60 days)
 - ✓ Admin should claim user's unlockable tokens (60%)
 - ✓ Unlockable amount must be 100% of total user balance (after 5 months)
 - ✓ Admin should claim user's unlockable tokens (100%)
- 26) Admin should not be able to claim user's tokens after they where all claimed
 - > No events were emitted
 - ✓ Allocator should be able to allocate tokens after the end of the vesting period
 - ✓ The new late beneficiary can claim 100% of his allocation
- 27) Admin should claim all users tokens

Audit Comments

11. February 2022:

- Read whole report for more information

SWC Attacks

ID	Title	Relationships	Status
SW C-1 36	Unencrypted Private Data On-Chain	CWE-767: Access to Critical Private Variable via Public Method	PASSED
SW C-1 35	Code With No Effects	CWE-1164: Irrelevant Code	PASSED
SW C-1 34	Message call with hardcoded gas amount	CWE-655: Improper Initialization	PASSED
SW C-1 33	Hash Collisions With Multiple Variable Length Arguments	CWE-294: Authentication Bypass by Capture-replay	PASSED
SW C-1 32	Unexpected Ether balance	CWE-667: Improper Locking	PASSED
SW C-1 31	Presence of unused variables	CWE-1164: Irrelevant Code	PASSED
SW C-1 30	Right-To-Left-Override control character (U+202E)	CWE-451: User Interface (UI) Misrepresentation of Critical Information	PASSED
SW C-1 29	Typographical Error	CWE-480: Use of Incorrect Operator	PASSED
SW C-1 28	DoS With Block Gas Limit	CWE-400: Uncontrolled Resource Consumption	PASSED

SW C-1 27	Arbitrary Jump with Function Type Variable	CWE-695: Use of Low-Level Functionality	PASSED
SW C-1 25	Incorrect Inheritance Order	CWE-696: Incorrect Behavior Order	PASSED
SW C-1 24	Write to Arbitrary Storage Location	CWE-123: Write-what-where Condition	PASSED
SW C-1 23	Requirement Violation	CWE-573: Improper Following of Specification by Caller	PASSED
SW C-1 22	Lack of Proper Signature Verification	CWE-345: Insufficient Verification of Data Authenticity	PASSED
SW C-1 21	Missing Protection against Signature Replay Attacks	CWE-347: Improper Verification of Cryptographic Signature	PASSED
SW C-1 20	Weak Sources of Randomness from Chain Attributes	CWE-330: Use of Insufficiently Random Values	PASSED
SW C-11 9	Shadowing State Variables	CWE-710: Improper Adherence to Coding Standards	PASSED
SW C-11 8	Incorrect Constructor Name	CWE-665: Improper Initialization	PASSED
SW C-11 7	Signature Malleability	CWE-347: Improper Verification of Cryptographic Signature	PASSED

SW C-11 6	Timestamp Dependence	CWE-829: Inclusion of Functionality from Untrusted Control Sphere	PASSED
SW C-11 5	Authorization through tx.origin	CWE-477: Use of Obsolete Function	PASSED
SW C-11 4	Transaction Order Dependence	CWE-362: Concurrent Execution using Shared Resource with Improper Synchronization ('Race Condition')	PASSED
SW C-11 3	DoS with Failed Call	CWE-703: Improper Check or Handling of Exceptional Conditions	PASSED
SW C-11 2	Delegatecall to Untrusted Callee	CWE-829: Inclusion of Functionality from Untrusted Control Sphere	PASSED
SW C-11 1	Use of Deprecated Solidity Functions	CWE-477: Use of Obsolete Function	PASSED
SW C-11 0	Assert Violation	CWE-670: Always-Incorrect Control Flow Implementation	PASSED
SW C-1 09	Uninitialized Storage Pointer	CWE-824: Access of Uninitialized Pointer	PASSED
SW C-1 08	State Variable Default Visibility	CWE-710: Improper Adherence to Coding Standards	PASSED
SW C-1 07	Reentrancy	CWE-841: Improper Enforcement of Behavioral Workflow	PASSED
SW C-1 06	Unprotected SELFDESTRUCT Instruction	CWE-284: Improper Access Control	PASSED

SW C-1 05	Unprotected Ether Withdrawal	CWE-284: Improper Access Control	PASSED
SW C-1 04	Unchecked Call Return Value	CWE-252: Unchecked Return Value	PASSED
SW C-1 03	Floating Pragma	CWE-664: Improper Control of a Resource Through its Lifetime	NOT PASSED
SW C-1 02	Outdated Compiler Version	CWE-937: Using Components with Known Vulnerabilities	PASSED
SW C-1 01	Integer Overflow and Underflow	CWE-682: Incorrect Calculation	PASSED
SW C-1 00	Function Default Visibility	CWE-710: Improper Adherence to Coding Standards	PASSED



The logo features the words "Solid Proofed" in a white, elegant script font. The word "Solid" is positioned above "Proofed". Behind the text is a faint, stylized shield emblem with a grid-like pattern, rendered in a darker shade of blue. The entire composition is set against a solid blue background.

Solid
Proofed

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A small horizontal bar representing the German flag, with black, red, and gold stripes.

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