CHAINPROOF

Audit Report

Autonomi

March 2025

Files	Claims.sol, AutonomiNFT.sol
Commit	b69a9ccc6a485eabec696eadd7e4c884066a04b5
Audited by	© Chainproof

Table of Contents

Risk Classification

The criticality of findings in Chainproof's smart contract audits is determined by evaluating multiple variables. The two primary variables are:

1. **Likelihood of Exploitation**: This considers how easily an attack can be executed, including the economic feasibility for an attacker.
2. **Impact of Exploitation**: This assesses the potential consequences of an attack, particularly in terms of the loss of funds or disruption to the contract's functionality.

Based on these variables, findings are categorized into the following severity levels:

1. **Critical**: Indicates a vulnerability that is both highly likely to be exploited and can result in significant fund loss or severe disruption. Immediate action is required to address these issues.
2. **Medium**: Refers to vulnerabilities that are either less likely to be exploited or would have a moderate impact if exploited. These issues should be addressed in due course to ensure overall contract security.
3. **Minor**: Involves vulnerabilities that are unlikely to be exploited and would have a minor impact. These findings should still be considered for resolution to maintain best practices in security.
4. **Informative**: Points out potential improvements or informational notes that do not pose an immediate risk. Addressing these can enhance the overall quality and robustness of the contract.

Severity	Likelihood / Impact of Exploitation
● Critical	Highly Likely / High Impact
● Medium	Less Likely / High Impact or Highly Likely/ Lower Impact
● Minor / Informative	Unlikely / Low to no Impact

Review

Repository	https://github.com/lajosdeme/autonomi-claims
Commit	b69a9ccc6a485eabec696eadd7e4c884066a04b5

Audit Updates

Initial Audit	28 Feb 2025 https://github.com/Chainproof-io/audits/blob/main/5-ant/v1/audit.pdf
Corrected Phase 2	13 Mar 2025

Source Files

Filename	SHA256
Claims.sol	982ce3ee619a54df6130201fa7eb29735af0b1886d102d174eb0a286f9093feb
AutonomiNFT.sol	5ac037cd61f5ba58da59802ebade3d26c38b8e4866c940e1f8506d7cf3390f46

Overview

Claims Contract

The `Claims` contract facilitates the controlled release and claiming of ANT tokens for holders of Autonomi NFTs through a structured vesting mechanism. The contract defines two key vesting periods, starting from a specific timestamp (`VESTING_START_TIMESTAMP`). The first period releases 50% of the allocated tokens after 90 days, while the second period releases the rest after 180 days. This ensures a gradual distribution of tokens over time.

Claiming Mechanism

The `claim` function allows Autonomi NFT holders to claim their allocated ANT tokens. Holders can claim up to the unlocked amount according to the vesting schedule, but they cannot claim more than their total allocation. The function checks the current claimable amount based on the vesting schedule, and if the requested amount exceeds the available tokens, the transaction is reverted. Additionally, the claim function increments the total amount claimed for each token, preventing over-claiming and ensuring the security of the process. The `getClaimable` function provides a view of the claimable amount for a specific token ID, allowing users to check how much they are entitled to claim based on the vesting schedule. This function helps ensure transparency and allows users to plan their claims accordingly, based on the time that has passed since the vesting started.

Security Measures

The contract employs the nonReentrant modifier in the claim function to prevent reentrancy attacks. This security feature ensures that external calls cannot re-enter the contract and interfere with the ongoing transaction, safeguarding the integrity of the claiming process. It also uses the SafeERC20 library from OpenZeppelin to ensure that ANT token transfers are safe and that no unintended errors or vulnerabilities occur during the token transfer process.

AutonomiNFT Contract

The `AutonomiNFT` contract is responsible for minting and managing the Autonomi NFTs, which grant holders the ability to claim ANT tokens. The contract allows for minting new NFTs with specified ANT token allocations using the mint function. This function takes an address and an allocation for the token ID and mints a new NFT for the specified address, assigning the ANT allocation to the NFT. The contract ensures that each NFT has a unique allocation, granting holders the right to claim a corresponding amount of ANT tokens.

Minting Mechanism

The `mint` and `mintMultiple` functions allow for the minting of NFTs, where each NFT is assigned a specific ANT token allocation. The `mintMultiple` function accepts arrays of addresses and allocations and ensures that both arrays are of the same length. It iterates through the arrays, minting the NFTs and assigning the corresponding token allocations, allowing for efficient batch processing of multiple NFTs.

Modification Mechanism

The `setAntAllocationForTokenId` function enables the contract owner to modify the ANT token allocation for a specific token ID. This function is useful when adjustments need to be made to the token allocation after an NFT has already been minted. It ensures that the allocation is updated securely, and the contract guarantees that only the owner can modify the allocations. The `setAntAllocationsForTokenIds` function allows the contract owner to update the ANT token allocations for multiple token IDs at once.

Token Metadata and URI

The `tokenURI` function generates a unique URI for each token ID, which points to the metadata of the NFT. This function calls the internal `_baseURI` function to get the base URI for the token and appends the token ID to it to form a complete URI for the token's metadata. This ensures that each NFT has a unique metadata URI that can be accessed by users. The `setTokenURI` function allows the contract owner to update the base URI used for generating token URIs. This flexibility ensures that the metadata for the NFTs can be updated as needed, allowing the owner to modify the metadata structure or content at any time.

Roles

Claims Contract

Users

Users (holders of Autonomi NFTs) can interact with the following functions:

- `function claim(uint256 tokenId, uint256 amount)`

Retrieval Functions

The following functions can be used to retrieve information:

- `function getClaimable(uint256 tokenId)`

AutonomiNFT Contract

Owner

The owner of the contract can interact with the following functions:

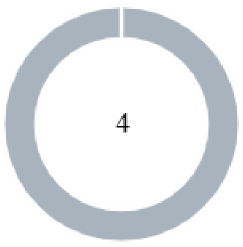
- `function mint(address to, AntAllocation calldata allocation)`
- `function mintMultiple(address[] calldata to, AntAllocation[] calldata allocations)`
- `function setAntAllocationForTokenId(AntAllocation calldata allocation)`
- `function setAntAllocationsForTokenIds(AntAllocation[] calldata allocations)`
- `function setTokenURI(string calldata newTokenURI)`

Retrieval Functions

The following functions can be used to retrieve information:

- `function tokenURI(uint256 tokenId)`
- `function tokenIdToAntAllocation(uint256 tokenId)`

Findings Breakdown



● Critical	0
● Medium	0
● Minor / Informative	4

Severity		Unresolved	Acknowledged	Resolved	Other
●	Critical	0	0	0	0
●	Medium	0	0	0	0
●	Minor / Informative	0	4	0	0

Diagnostics

● Critical ● Medium ● Minor / Informative

Severity	Code	Description	Status
●	CCR	Contract Centralization Risk	Acknowledged
●	MT	Mints Tokens	Acknowledged
●	UTPD	Unverified Third Party Dependencies	Acknowledged
●	L04	Conformance to Solidity Naming Conventions	Acknowledged

CCR - Contract Centralization Risk

Criticality	Minor / Informative
Location	AutonomiNFT.sol#L43,52,65,73,95 Claims.sol#L64
Status	Acknowledged

Description

The contract's functionality and behavior are heavily dependent on external parameters or configurations. While external configuration can offer flexibility, it also poses several centralization risks that warrant attention. Centralization risks arising from the dependence on external configuration include Single Point of Control, Vulnerability to Attacks, Operational Delays, Trust Dependencies, and Decentralization Erosion.

```
function mint(address to, AntAllocation calldata allocation)
external onlyOwner {} function mintMultiple(address[]
calldata to, AntAllocation[] calldata allocations) external
onlyOwner {} function
setAntAllocationForTokenId(AntAllocation calldata
allocation) external onlyOwner {} function
```

```
setAntAllocationsForTokenIds(AntAllocation[] calldata
allocations) external onlyOwner {} function
setTokenURI(string calldata newTokenURI) external onlyOwner
{}
```

Additionally, the `Claims` contract logic works under the assumption that tokens will be held in the contract. However this essentially means that an external party will be responsible for providing the tokens to the contract.

```
ANT_TOKEN.safeTransfer(msg.sender, claimableAmount);
```

Recommendation

To address this finding and mitigate centralization risks, it is recommended to evaluate the feasibility of migrating critical configurations and functionality into the contract's codebase itself. This approach would reduce external dependencies and enhance the contract's self-sufficiency. It is essential to carefully weigh the trade-offs between external configuration flexibility and the risks associated with centralization.

MT - Mints Tokens

Criticality	Minor / Informative
Location	AutonomiNFT.sol#L27,32
Status	Acknowledged

Description

The contract owner has the authority to mint tokens. The owner may take advantage of it by calling the `mint` or `mintMultiple` functions.

```
function mint(address to, AntAllocation calldata
allocation) external onlyOwner {
    _safeMint(to, allocation.tokenId);
    _setAntAllocationForTokenId(allocation.tokenId,
allocation.antAllocation);
}  function mintMultiple(address[] calldata to,
AntAllocation[] calldata allocations) external onlyOwner {
    require(to.length == allocations.length, "Invalid
array length");     for (uint256 i = 0; i <
allocations.length; i++) {
        _safeMint(to[i], allocations[i].tokenId);

_setAntAllocationForTokenId(allocations[i].tokenId,
allocations[i].antAllocation);
    }
}
```

Recommendation

The team should carefully manage the private keys of the owner's account. We strongly recommend a powerful security mechanism that will prevent a single user from accessing the contract admin functions.

Solutions:

- Introduce a time-locker mechanism with a reasonable delay.
- Introduce a multi-signature wallet so that many addresses will confirm the action.
- Introduce a governance model where users will vote about the actions.

Team Update

The team has acknowledged that this is not a security issue and states: *the recommendation will be implemented upon deployment: the owner of the contract will be a multi-signature wallet controlled by multiple addresses.*

UTPD - Unverified Third Party Dependencies

Criticality	Minor / Informative
Location	Claims.sol#L62
Status	Acknowledged

Description

The contract uses an external contract in order to determine the transaction's flow. The external contract is untrusted. As a result, it may produce security issues and harm the transactions.

```
ANT_TOKEN.safeTransfer(msg.sender, claimableAmount);
```

Recommendation

The contract should use a trusted external source. A trusted source could be either a commonly recognized or an audited contract. The pointing addresses should not be able to change after the initialization.

Team Update

The team has acknowledged that this is not a security issue and states: *the ANT token contract is trusted, live and verified on Arbiscan at the following link:* https://arbiscan.io/token/0xa78d8321b20c4ef90ecd72f2588aa985a4bdb684

L04 - Conformance to Solidity Naming Conventions

Criticality	Minor / Informative
Location	Claims.sol#L24,25
Status	Acknowledged

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.

```
IERC20 public immutable ANT_TOKEN
IAutonomiNFT public immutable AUTONOMI_NFT
```

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/stable/style-guide.html#naming-conventions.

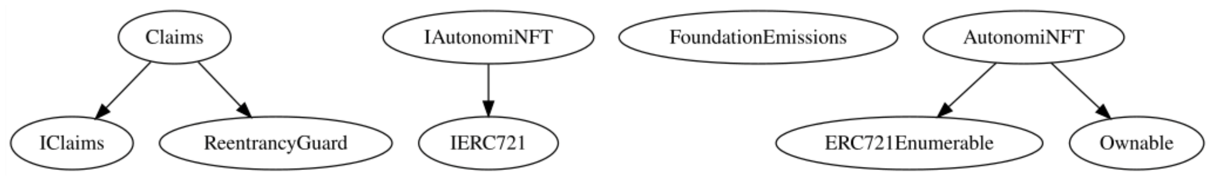
Functions Analysis

Contract	Type	Bases		
	Function Name	**Visibility**	**Mutability**	**Modifiers**

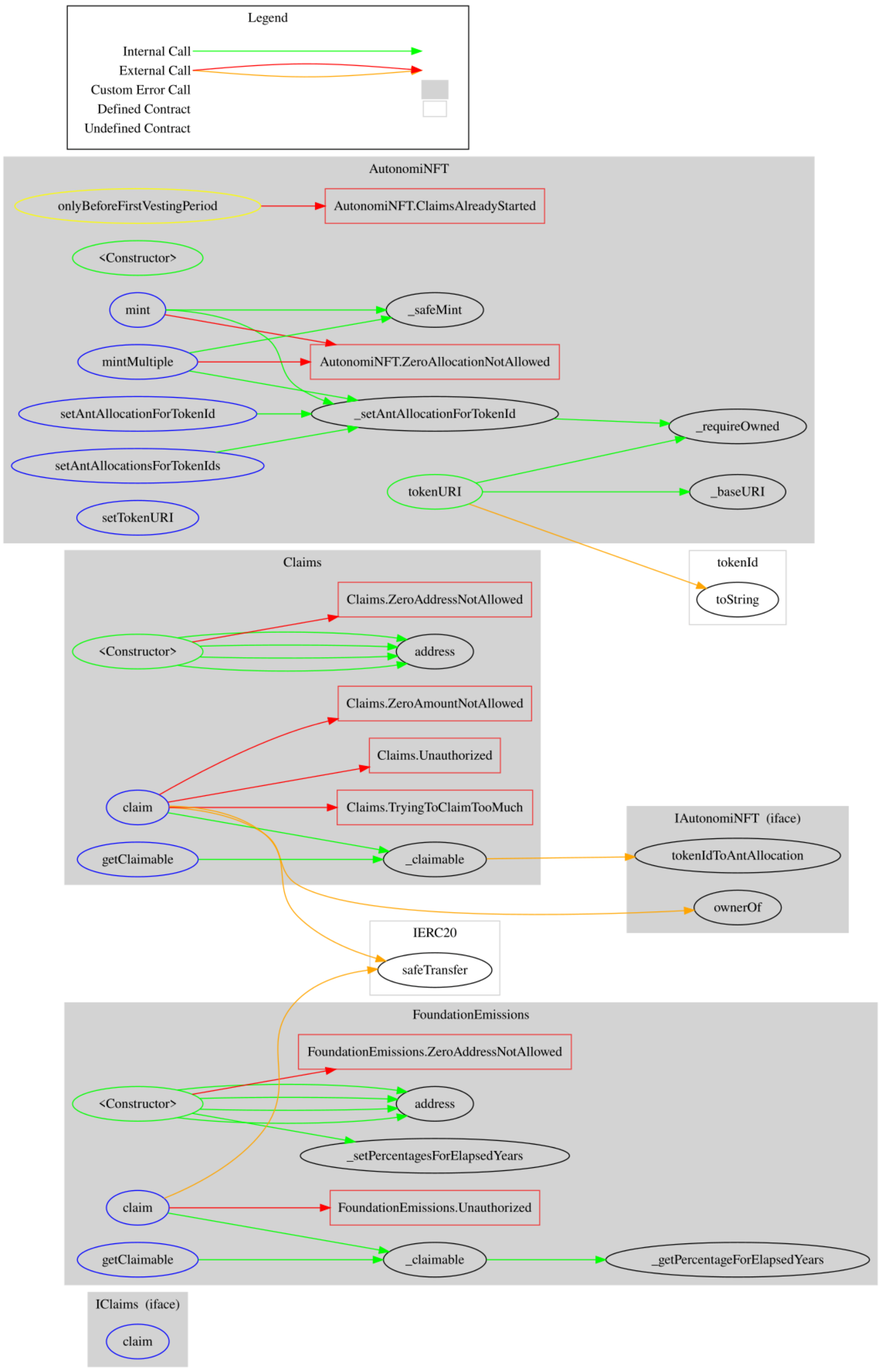
Claims	Implementation	IClaims, ReentrancyGuard		
		Public	✓	-
	claim	External	✓	nonReentrant
	getClaimable	External		-
	_claimable	Private		
AutonomiNFT	Implementation	ERC721Enumerable, Ownable		
		Public	✓	ERC721 Ownable
	mint	External	✓	onlyOwner
	mintMultiple	External	✓	onlyOwner
	setAntAllocationForTokenId	External	✓	onlyOwner onlyBeforeFirstVestingPeriod
	setAntAllocationsForTokenIds	External	✓	onlyOwner onlyBeforeFirstVestingPeriod

	_baseURI	Internal		
	tokenURI	Public		-
	setTokenURI	External	✓	onlyOwner
	_setAntAllocationForTokenId	Internal	✓	

Inheritance Graph



Flow Graph


Legend
Internal Call
External Call
Custom Error Call
Defined Contract
Undefined Contract
AutonomiNFT
onlyBeforeFirstVestingPeriod
AutonomiNFT.ClaimsAlreadyStarted
<Constructor>
mint
_safeMint
mintMultiple
AutonomiNFT.ZeroAllocationNotAllowed
setAntAllocationForTokenId
_setAntAllocationForTokenId
_requireOwned
setAntAllocationsForTokenIds
tokenURI
_baseURI
setTokenURI
Claims
Claims.ZeroAddressNotAllowed
<Constructor>
address
Claims.ZeroAmountNotAllowed
Claims.Unauthorized
claim
Claims.TryingToClaimTooMuch
getClaimable
_claimable
tokenId
toString
IAutonomiNFT (iface)
tokenIdToAntAllocation
ownerOf
IERC20
safeTransfer
FoundationEmissions
FoundationEmissions.ZeroAddressNotAllowed
<Constructor>
address
_setPercentagesForElapsedYears
claim
FoundationEmissions.Unauthorized
getClaimable
_claimable
_getPercentageForElapsedYears
IClaims (iface)
claim

Summary

Autonomi contract implements a nft and vesting mechanism. This audit investigates security issues, business logic concerns and potential improvements. The Smart Contract analysis reported no compiler error or critical issues.

Disclaimer

The information provided in this report does not constitute investment, financial or trading advice and you should not treat any of the document's content as such. This report may not be transmitted, disclosed, referred to or relied upon by any person for any purposes nor may copies be delivered to any other person other than the Company without Chainproof’s prior written consent. This report is not nor should be considered an “endorsement” or “disapproval” of any particular project or team. This report is not nor should be regarded as an indication of the economics or value of any “product” or “asset” created by any team or project that contracts Chainproof to perform a security assessment. This document does not provide any warranty or guarantee regarding the absolute bug-free nature of the technology analyzed, nor do they provide any indication of the technologies proprietors' business, business model or legal compliance. This report should not be used in any way to make decisions around investment or involvement with any particular project. This report represents an extensive assessment process intending to help our customers increase the quality of their code while reducing the high level of risk presented by cryptographic tokens and blockchain technology.

Blockchain technology and cryptographic assets present a high level of ongoing risk Chainproof’s position is that each company and individual are responsible for their own due diligence and continuous security Chainproof’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 Chainproof 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.

About ChainProof

Chainproof is an Audit & KYC firm for Blockchain Projects, aimed at securing the Blockchain and the assets at risk. Chainproof is fueled by Industry grade experienced Blockchain Developers from all around the globe. From finding vulnerabilities, potential scams, malicious code mitigation, improper implementation of the token which can lead to loss of user's fund, you name it and we cover and secure them all.

Security testing and risk mitigation is given the highest priority at ChainProof. The audit process is analyzing and monitoring many aspects of the project. That way, it gives the community a good sense of security using an informative report and a generic score.
ChainProof is aiming to make crypto discoverable and efficient globally. We associate with extremely robust testing and code review, leaving no room for any security risks because, when it comes to user's funds, we need to leave no stone unturned. Cheers!

CHAINPROOF

The ChainProof team

ChainProof.dev