ENTERSOFT

Arexa

Interim Smart Contract Report

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Contents

Revision History & Version Control

Start Date	End Date	Author	Comments/Details
18 May 2024	25 May 2024	Gurkirat	Interim Release for the Client

Reviewed by	Released by
Nishita Palaksha	Nishita Palaksha

Entersoft was commissioned to perform a source code review on Arexa's smart contracts. The review was conducted between May 18, 2024, to May 25, 2024. The report is organized into the following sections.

- Executive Summary: A high-level overview of the security audit findings.
- Technical analysis: Our detailed analysis of the Smart Contract code

The information in this report should be used to understand overall code quality, security, correctness, and meaning that code will work as described in the smart contract.

1.0 Disclaimer

This is a limited audit report on our findings based on our analysis, in accordance with good industry practice as at the date of this report, in relation to: (i) smart contract best coding practices and vulnerabilities in the framework and algorithms based on white paper, code, the details of which are set out in this report, (Smart Contract audit). To get a full view of our analysis, it is crucial for you to read the full report. While we have done our best in conducting our analysis and producing this report, it is important to note that you should not rely on this report and cannot claim against us based on what it says or does not say, or how we produced it, and it is important for you to conduct your own independent investigations before making any decisions. We go into more detail on this in the disclaimer below – please make sure to read it in full.

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2.0 Overview

2.1 Project Overview

During the period of **18 May 2024 to 25 May 2024**, Entersoft performed smart contract security audits for **Arexa**.

2.2 Scope

The scope of this audit was to analyze and document the smart contract codebase for quality, security, and correctness.

The following files were reviewed as part of the scope:

- ArexaTokenACLFacet
- TokenACLFacet
- ArexaTokenAdminFacet
- TokenAdminFacet
- ArexaTokenAMLFacet
- TokenAMLFacet
- ArexaTokenFacet
- uSmartERC20
- ArexaTokenOwnershipFacet
- TokenOwnershipFacet
- ArexaTokenPausableFacet
- TokenPausableFacet

OUT-OF-SCOPE: External contracts, External Oracles, other smart contracts in the repository, or imported smart contracts.

2.3 Project Summary

Project Name	No. of Smart Contract File(s)	Verified	Vulnerabilities
Arexa	12	Yes	As per report. Section 2.6

2.4 Audit Summary

Delivery Date	Method of Audit	Consultants Engaged
27 May 2024	Manual and Automated approach	2

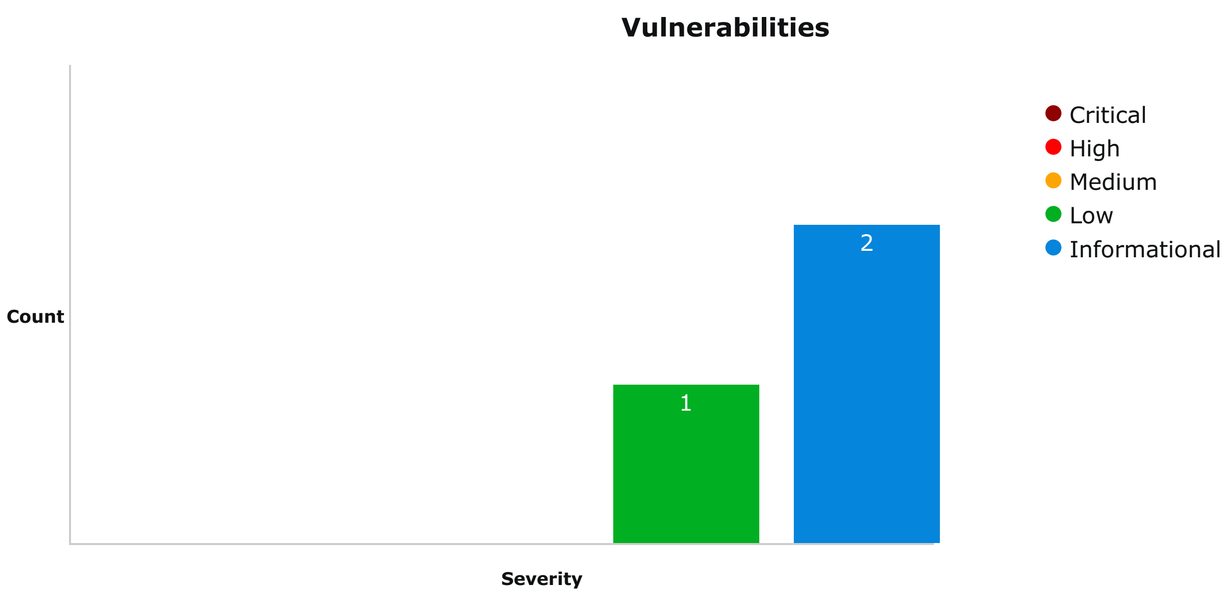
2.5 Security Level References

Every vulnerability in this report was assigned a severity level from the following classification table:

		Impact				
		Minimal	Low	Medium	High	Critical
Likelihood	Critical	Minimal	Low	Medium	High	Critical
	High	Minimal	Low	Medium	High	Critical
	Medium	Minimal	Low	Medium	Medium	High
	Low	Minimal	Low	Low	Low	Medium
	Minimal	Minimal	Minimal	Minimal	Low	

2.6 Vulnerability Summary

Critical	High	Medium	Low	Informational
0	0	0	1	2



3.0 Executive Summary

Entersoft has conducted a comprehensive technical audit of the Arexa smart contracts through a comprehensive smart contract audit approach. The primary objective was to identify potential vulnerabilities and security risks within the codebase, ensuring adherence to industry-leading standards while prioritizing security, reliability, and performance. Our focus was on prompt and efficient identification and resolution of vulnerabilities to enhance the overall robustness of the solidity smart contract.

Importantly, our audit process intentionally avoided reliance solely on automated tools, emphasizing a more in-depth and nuanced approach to security analysis. Conducted from May 18, 2024, to May 25, 2024, our team diligently assessed and validated the security posture of the solidity smart contract, ultimately finding a number of vulnerabilities as per vulnerability summary table.

Testing Methodology:

We have leveraged static analysis techniques extensively to identify potential vulnerabilities automatically with the aid of cutting-edge tools such as Slither and Aderyn. Apart from this, we carried out extensive manual testing to iron out vulnerabilities that could slip through an automated check. This included a variety of attack vectors like reentrancy attacks, overflow and underflow attacks, timestamp dependency attacks, and more.

While going through the due course of this audit, we also ensured to cover edge cases, and built a combination of scenarios to assess the contracts' resilience. Our attempt to leave no stone unturned involved coming up with both negative and positive test cases for the system, and grace handling of stressed scenarios.

Our testing methodology in Solidity adhered to industry standards and best practices, integrating partially implemented OWASP and NIST SP 800 standards for encryption and signatures. Solidity's renowned security practices were complemented by tools such as Solhint for linting, and the Solidity compiler for code optimization. Sol-profiler, Sol-coverage, and Sol-sec were employed to ensure code readability and eliminate unnecessary dependencies.

Tools Used for Audit:

In the course of our audit, we leveraged a suite of tools to bolster the security and performance of our program. While our team drew on their expertise and industry best practices, we also integrated various tools into our development environment. Noteworthy among them are Slither,aderyn. This holistic approach ensures a thorough analysis, uncovering potential issues that automated tools alone might overlook. Entersoft takes pride in utilizing these tools, which significantly contribute to the quality, security, and maintainability of our codebase.

Code Review / Manual Analysis:

Our team conducted a manual analysis of the Solidity smart contracts to identify new vulnerabilities or to verify vulnerabilities found during static and manual analysis. We carefully analyzed every line of code and made sure that all instructions provided during the onboarding phase were followed. Through our manual analysis, we were able to identify potential vulnerabilities that may have been missed by automated tools and

ensure that the smart contract was secure and reliable.
Our team have scanned the smart contracts for some commonly known vulnerabitlies such as Reentrency, Timestamp Dependence, Byte array, Race condition, Exception disorder etc. covered as part of section 5.6.

Auditing Approach and Methodologies Applied:
The solidity smart contract was audited in a comprehensive approach to ensure the highest level of security and reliability. Careful attention was given to the following key areas to ensure the overall quality of code:

- Code quality and structure: We conducted a detailed review of the codebase to identify any potential issues related to code structure, readability, and maintainability. This included analyzing the overall architecture of the solidity smart contract and reviewing the code to ensure it follows best practices and coding standards.
- Security vulnerabilities: Our team used manual techniques to identify any potential security vulnerabilities that could be exploited by attackers. This involved a thorough analysis of the code to identify any potential weaknesses, such as buffer overflows, injection vulnerabilities, Signatures, and deprecated functions.

3.1 Findings

Vulnerability ID	Contract Name	Severity	Status
1	TokenACLFacet, TokenAdminFacet, TokenPausableFacet	● Low	Pending
2	TokenAMLFacet, TokenAdminFacet, TokenOwnershipFacet	● Informational	Pending
3	All Contracts	● Informational	Pending

3.2 Recommendations

Overall, the smart contracts are very well written, and they adhere to best security practices and industry guidelines.

4.0 Technical Analysis

4.1 Void constructor

Severity	Status	Type of Analysis
● Low	Identified	Static

Contract Name:

TokenACLFacet, TokenAdminFacet, TokenPausableFacet

Description:

Detect the call to a constructor that is not implemented

Locations:

TokenACLFacet:
Line no: 23
TokenAdminFacet:
Line no:19
TokenAMLFacet:
Line no: 18
TokenPausableFacet:
Line no: 19

Remediation:

Remove the constructor call.

Impact:

The impact of the void constructor vulnerability includes potential misinterpretation of code behavior and inefficient gas usage due to unnecessary constructor calls.

Code Snippet:

```
        constructor() {}
```

Reference:

https://github.com/crytic/slither/wiki/Detector-Documentation#void-constructor

Proof of Vulnerability:

N.A.

4.2 Conformance to Solidity naming conventions

Severity	Status	Type of Analysis
Informational	Identified	Static

Contract Name:

TokenAMLFacet, TokenAdminFacet, TokenOwnershipFacet

Description:

Solidity defines a naming convention that should be followed.
Rule exceptions:

- Allow constant variable name/symbol/decimals to be lowercase (`ERC20`).
- Allow `_` at the beginning of the `mixed_case` match for private variables and unused parameters.

Locations:

TokenAMLFacet.sol
Line no: 23, 28, 29, 30, 35, 40, 41, 47, 48, 56, 61, 62, 68, 69.
TokenAdminFacet.sol
Line no: 26, 36, 46, 56, 65, 74.
TokenOwnershipFacet.sol
Line no: 17.

Remediation:

Follow the Solidity naming convention.

Impact:

Adhering to Solidity naming conventions ensures consistency and readability across codebases, fostering easier collaboration and maintenance. It also aids in understanding code for developers familiar with Solidity standards, enhancing code quality and reducing potential confusion or errors.

Code Snippet:

```
        TokenAMLFacet.sol:

function getAccountBlackWhiteList(bytes32 _target, address _account) external view returns (bool) {

return LibBlackWhiteList._getAccountBlackWhiteList(_target, _account);

}



TokenAdminFacet.sol:

function setPoolFee(uint16 _PoolFee) external protectedCall whenNotPaused(LibTokenConst.FULL) onlyRole(LibT
okenConst.TOKEN_ADMIN_ROLE) {

LibCustomERC20Extension._setPoolFee(_PoolFee);

}



TokenOwnershipFacet.sol:

function transferOwnership(address _newOwner) public override protectedCall {

}
```

Reference:

https://github.com/crytic/slither/wiki/Detector-Documentation#conformance-to-solidity-naming-conventions

Proof of Vulnerability:

N.A.

4.3 Incorrect versions of Solidity

Severity	Status	Type of Analysis
Informational	Identified	Static

Contract Name:

All Contracts

Description:

`solc` frequently releases new compiler versions. Using an old version prevents access to new Solidity security checks. We also recommend avoiding complex `pragma` statement.

Locations:

All Contracts

Remediation:

Deploy with a recent version of Solidity with no known severe issues. Use a simple pragma version that allows any of these versions. Consider using the latest version of Solidity for testing.

Impact:

Using outdated Solidity compiler versions can lead to security vulnerabilities, compatibility issues, and missed optimizations, underscoring the importance of deploying with recent versions.

Code Snippet:

```
        pragma solidity ^0.8.9;

pragma solidity ^0.8.17;
```

Reference:

https://github.com/crytic/slither/wiki/Detector-Documentation#incorrect-versions-of-solidity

Proof of Vulnerability:

N.A.

5.0 Auditing Approach and Methodologies applied

Throughout the audit of the smart contract, care was taken to ensure:

- Overall quality of code
- Use of best practices.
- Code documentation and comments match logic and expected behavior.
- Mathematical calculations are as per the intended behavior mentioned in the whitepaper.
- Implementation of token standards.
- Efficient use of gas.
- Code is safe from Re-entrancy and other vulnerabilities.

A combination of manual and automated security testing to balance efficiency, timeliness, practicality, and accuracy regarding the scope of the smart contract audit. While manual testing is recommended to uncover flaws in logic, process, and implementation; automated testing techniques help enhance coverage of smart contracts and can quickly identify items that do not follow security best practices. The following phases and associated tools were used throughout the term of the audit:

5.1 Structural Analysis

In this step we have analysed the design patterns and structure of all smart contracts. A thorough check was completed to ensure all Smart contracts are structured in a way that will not result in future problems.

5.2 Static Analysis

Static Analysis of smart contracts was undertaken to identify contract vulnerabilities. In this step, a series of automated tools are used to test the security of smart contracts.

5.3 Code Review / Manual Analysis

Manual Analysis or review of done to identify new vulnerabilities or to verify the vulnerabilities found during the Static Analysis. The contracts were completely manually analysed, and their logic was checked and compared with the one described in the whitepaper. It should also be noted that the results of the automated analysis were verified manually.

5.4 Gas Consumption

In this step, we checked the behaviour of all smart contracts in production. Checks were completed to understand how much gas gets consumed, along with the possibilities of optimisation of code to reduce gas consumption.

5.5 Tools & Platforms Used For Audit

Slither, Aderyn

5.6 Checked Vulnerabilities

We have scanned Arexa smart contracts for commonly known and more specific vulnerabilities. Here are some of the commonly known vulnerabilities that we considered:

- Re-entrancy
- Timestamp Dependence
- Gas Limit and Loops
- DoS with Block Gas Limit
- Transaction-Ordering Dependence
- Use of tx.origin
- Exception disorder
- Gasless send
- Balance equality
- Byte array
- Transfer forwards all gas
- ERC-20 API violation
- Malicious libraries
- Compiler version not fixed
- Redundant fallback function
- Send instead of transfer
- Style guide violation
- Unchecked external call
- Unchecked math
- Unsafe type inference
- Implicit visibility level

6.0 Limitations on Disclosure and Use of this Report

This report contains information concerning potential details of Arexa and methods for exploiting them. Entersoft recommends that special precautions be taken to protect the confidentiality of both this document and the information contained herein. Security Assessment is an uncertain process, based on past experiences, currently available information, and known threats. All information security systems, which by their nature are dependent on human beings, are vulnerable to some degree. Therefore, while Entersoft considers the major security vulnerabilities of the analyzed systems to have been identified, there can be no assurance that any exercise of this nature will identify all possible vulnerabilities or propose exhaustive and operationally viable recommendations to mitigate those exposures. In addition, the analysis set forth herein is based on the technologies and known threats as of the date of this report. As technologies and risks change over time, the vulnerabilities associated with the operation of the Smart Contract described in this report, as well as the actions necessary to reduce the exposure to such vulnerabilities will also change. Entersoft makes no undertaking to supplement or update this report based on changed circumstances or facts of which Entersoft becomes aware after the date hereof, absent a specific written agreement to perform the supplemental or updated analysis. This report may recommend that Entersoft use certain software or hardware products manufactured or maintained by other vendors. Entersoft bases these recommendations upon its prior experience with the capabilities of those products. Nonetheless, Entersoft does not and cannot warrant that a particular product will work as advertised by the vendor, nor that it will operate in the manner intended. This report was prepared by Entersoft for the exclusive benefit of Arexa and is proprietary information. The Non-Disclosure Agreement (NDA) in effect between Entersoft and Arexa governs the disclosure of this report to all other parties including product vendors and suppliers.