CERTIK

# Security Assessment

# K4 Rally

Jun 2nd, 2022

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# Summary

This report has been prepared for K4 Rally to discover issues and vulnerabilities in the source code of the K4 Rally project as well as any contract dependencies that were not part of an officially recognized library. A comprehensive examination has been performed, utilizing Static Analysis and Manual Review techniques.

The auditing process pays special attention to the following considerations:

- Testing the smart contracts against both common and uncommon attack vectors.
- Assessing the codebase to ensure compliance with current best practices and industry standards.
- Ensuring contract logic meets the specifications and intentions of the client.
- Cross referencing contract structure and implementation against similar smart contracts produced by industry leaders.
- Thorough line-by-line manual review of the entire codebase by industry experts.

The security assessment resulted in findings that ranged from critical to informational. We recommend addressing these findings to ensure a high level of security standards and industry practices. We suggest recommendations that could better serve the project from the security perspective:

- Enhance general coding practices for better structures of source codes;
- Add enough unit tests to cover the possible use cases;
- Provide more comments per each function for readability, especially contracts that are verified in public;
- Provide more transparency on privileged activities once the protocol is live.

# Overview

## Project Summary

| | |
|---|---|
| Project Name | K4 Rally |
| Platform | EVM Compatible |
| Language | Solidity |
| Codebase | https://github.com/gawoonimetalabs/k4rally-contracts/blob/main/K4RallyToken.sol |

## Audit Summary

| | |
|---|---|
| Delivery Date | Jun 02, 2022 UTC |
| Audit Methodology | Static Analysis, Manual Review |

## Vulnerability Summary

| Vulnerability Level | Total | Pending | Declined | Acknowledged | Mitigated | Partially Resolved | Resolved |
|---|---|---|---|---|---|---|---|
| Critical | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Major | 2 | 0 | 0 | 2 | 0 | 0 | 0 |
| Medium | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| Minor | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Optimization | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Informational | 3 | 0 | 0 | 3 | 0 | 0 | 0 |
| Discussion | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

# Audit Scope

| ID | File | SHA256 Checksum |
| --- | --- | --- |
| KRT | projects/k4/K4RallyToken.sol | 70b76c98f81b3113c985d000fc7bea237f3518e7d276424ff227b48a13694f45 |

# Findings


| | |
|---|---|
| **Critical** | **0** (0.00%) |
| **Major** | **2** (33.33%) |
| **Medium** | **1** (16.67%) |
| **Minor** | **0** (0.00%) |
| **Informational** | **3** (50.00%) |
| **Discussion** | **0** (0.00%) |

| ID | Title | Category | Severity | Status |
|---|---|---|---|---|
| **KRT-01** | Initial Token Distribution | **Centralization / Privilege** | **Major** | Acknowledged |
| **KRT-02** | Centralization Risks In K4RallyToken.sol | **Centralization / Privilege** | **Major** | Acknowledged |
| KRT-03 | Unable To Call `initialize()` | Inconsistency | Medium | Resolved |
| KRT-04 | Unlocked Compiler Version | Language Specific | Informational | Acknowledged |
| KRT-05 | Improper Usage Of `public` And `external` Type | Gas Optimization | Informational | Acknowledged |
| KRT-06 | Too Many Digits | Coding Style | Informational | Acknowledged |

# KRT-01 | Initial Token Distribution

| Category | Severity | Location | Status |
| --- | --- | --- | --- |
| **Centralization / Privilege** | **Major** | projects/k4/K4RallyToken.sol: 19 | Acknowledged |

## Description

All of the `K4R` tokens are sent to the contract deployer when deploying the contract. This could be a centralization risk as the deployer can distribute `K4R` tokens without obtaining the consensus of the community.

## Recommendation

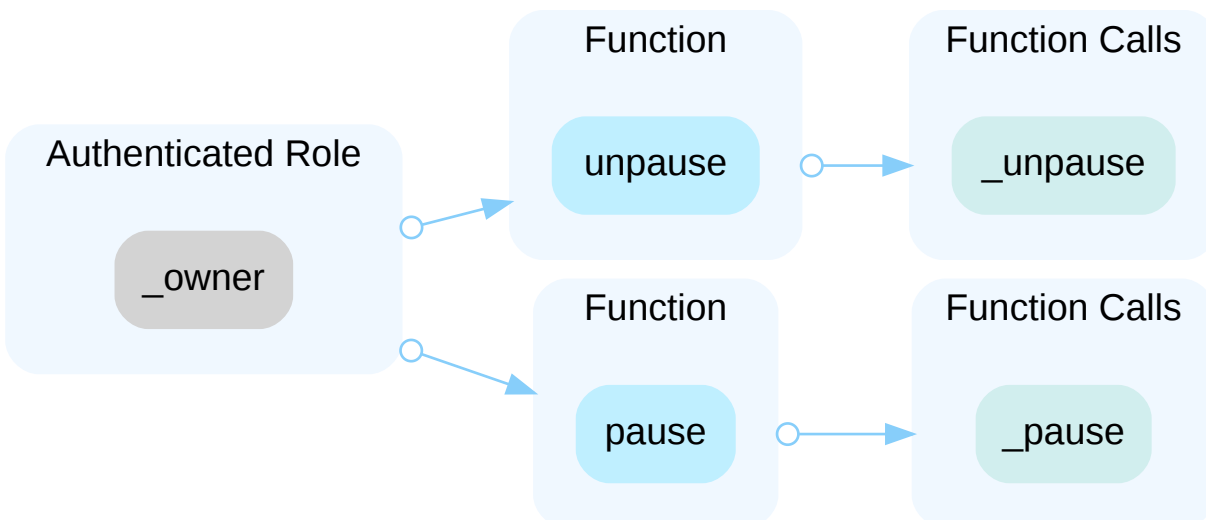
We recommend the team to be transparent regarding the initial token distribution process, and the team shall make enough efforts to restrict the access of the private key.

# KRT-02 | Centralization Risks In K4RallyToken.sol

| Category | Severity | Location | Status |
| --- | --- | --- | --- |
| **Centralization / Privilege** | **Major** | projects/k4/K4RallyToken.sol: 22, 26 | Acknowledged |

## Description

In the contract `K4RallyToken` the role `_owner` has authority over the functions shown in the diagram below. Any compromise to the `_owner` account may allow the hacker to take advantage of this authority and pause or unpause the contract anytime.




## Recommendation

The risk describes the current project design and potentially makes iterations to improve in the security operation and level of decentralization, which in most cases cannot be resolved entirely at the present stage. We advise the client to carefully manage the privileged account's private key to avoid any potential risks of being hacked. In general, we strongly recommend centralized privileges or roles in the protocol be improved via a decentralized mechanism or smart-contract-based accounts with enhanced security practices, e.g., multisignature wallets. Indicatively, here are some feasible suggestions that would also mitigate the potential risk at a different level in terms of short-term, long-term and permanent:

## Short Term:

Timelock and Multi sign (⅔, ⅗) combination *mitigate* by delaying the sensitive operation and avoiding a single point of key management failure.

- Time-lock with reasonable latency, e.g., 48 hours, for awareness on privileged operations;
  AND
- Assignment of privileged roles to multi-signature wallets to prevent a single point of failure due to the private key compromised;
  AND
- A medium/blog link for sharing the timelock contract and multi-signers addresses information with the public audience.

## Long Term:

Timelock and DAO, the combination, *mitigate* by applying decentralization and transparency.

- Time-lock with reasonable latency, e.g., 48 hours, for awareness on privileged operations;
  AND
- Introduction of a DAO/governance/voting module to increase transparency and user involvement.
  AND
- A medium/blog link for sharing the timelock contract, multi-signers addresses, and DAO information with the public audience.

## Permanent:

Renouncing the ownership or removing the function can be considered *fully resolved*.

- Renounce the ownership and never claim back the privileged roles.
  OR
- Remove the risky functionality.

## KRT-03 | Unable To Call `initialize()`

| Category | Severity | Location | Status |
| --- | --- | --- | --- |
| Inconsistency | Medium | projects/k4/K4RallyToken.sol: 12, 14 | Resolved |

### Description

The constructor has the `initializer` modifier, the `initialized` variable from the `Initializable.sol` module is going to be `true` before being able to call `initialize()`. Therefore, the `constructor` should call `initialize` or not have the `initializer` modifier.

### Recommendation

We recommend the team to apply the changes.

### Alleviation

The client indicated that the `K4RallyToken` smart contract would be used as an implementation of a transparent upgradeable proxy and this issue would not have any effect. This was verified as observed in https://bscscan.com/address/0x807766fb29e098b5d932609a80265a0c8f60e1a4#code and https://bscscan.com/address/0x1b18a28bfd3a859c83859510ed775dce775b28ac#code)

# KRT-04 | Unlocked Compiler Version

| Category | Severity | Location | Status |
| --- | --- | --- | --- |
| Language Specific | Informational | projects/k4/K4RallyToken.sol: 2 | Acknowledged |

## Description

The contract has unlocked compiler version. An unlocked compiler version in the source code of the contract permits the user to compile it at or above a particular version. This, in turn, leads to differences in the generated bytecode between compilations due to differing compiler version numbers. This can lead to an ambiguity when debugging as compiler specific bugs may occur in the codebase that would be hard to identify over a span of multiple compiler versions rather than a specific one.

## Recommendation

We advise that the compiler version is instead locked at the lowest version possible that the contract can be compiled at. For example, for version `v0.8.10` the contract should contain the following line:

```
pragma solidity 0.8.10;
```

## KRT-05 | Improper Usage Of `public` And `external` Type

| Category | Severity | Location | Status |
| --- | --- | --- | --- |
| Gas Optimization | Informational | projects/k4/K4RallyToken.sol: 14, 22, 26 | Acknowledged |

### Description

`public` functions that are never called by the contract could be declared as `external`. `external` functions are more efficient than `public` functions.

### Recommendation

Consider using the external attribute for public functions that are never called within the contract.

# KRT-06 | Too Many Digits

| Category | Severity | Location | Status |
| --- | --- | --- | --- |
| Coding Style | Informational | projects/k4/K4RallyToken.sol: 19 | Acknowledged |

## Description

Literals with many digits are difficult to read and review.

## Recommendation

We advise the client to use the scientific notation to improve readability.

# Appendix

## Finding Categories

### Centralization / Privilege

Centralization / Privilege findings refer to either feature logic or implementation of components that act against the nature of decentralization, such as explicit ownership or specialized access roles in combination with a mechanism to relocate funds.

### Gas Optimization

Gas Optimization findings do not affect the functionality of the code but generate different, more optimal EVM opcodes resulting in a reduction on the total gas cost of a transaction.

### Language Specific

Language Specific findings are issues that would only arise within Solidity, i.e. incorrect usage of private or delete.

### Coding Style

Coding Style findings usually do not affect the generated byte-code but rather comment on how to make the codebase more legible and, as a result, easily maintainable.

### Inconsistency

Inconsistency findings refer to functions that should seemingly behave similarly yet contain different code, such as a constructor assignment imposing different require statements on the input variables than a setter function.

## Checksum Calculation Method

The "Checksum" field in the "Audit Scope" section is calculated as the SHA-256 (Secure Hash Algorithm 2 with digest size of 256 bits) digest of the content of each file hosted in the listed source repository under the specified commit.

The result is hexadecimal encoded and is the same as the output of the Linux "sha256sum" command against the target file.

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