CERTIK

Security Assessment

Irena Coin

May 7th, 2022

Table of Contents

Summary

This report has been prepared for Irena Coin to discover issues and vulnerabilities in the source code of the Irena Coin 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	Irena Coin
Platform	BSC
Language	Solidity
Codebase	https://bscscan.com/token/0x9eeb6c5ff183e6001c65a12d70026b900ae76781
Commit	

Audit Summary

Delivery Date	May 07, 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	0	0	0	0	0	0	0
Minor	2	0	0	2	0	0	0
Informational	6	0	0	6	0	0	0
Discussion	0	0	0	0	0	0	0

Audit Scope

ID	File	SHA256 Checksum
CTC	CoinToken.sol	263533caa72e05edb5b9e6f76acc617e31d0cda84a7a0277f742637317dc87b3

Understandings

IRENA has implemented a deflationary token. The contract has been deployed at the address 0x9eeb6c5ff183e6001c65a12d70026b900ae76781 by deployer 0x3ee42e5e41aa543eb7b95a3473a393e03561ccba

Privileged Functions

There are a few privileged roles that are adopted in the Project:

- The role `_owner` is adopted to update the configurations of the contract.

We summarized the contract role-related event below:

As Initial distribution **IRENA** tokens are sent to the deployer address in the tx as initial distribution.

The deployer was set as the fee address in tx

The owner address is transfered to 0x0000000000000000000000000000000000000000 in the tx

In April 27th 2022, the balance of the deployer address 0x3ee42e5e41aa543eb7b95a3473a393e03561ccba is 214020348326034389.

To improve the trustworthiness of the project, dynamic runtime updates in the project should be notified to the community. Any plan to invoke the aforementioned functions should be also considered to move to the execution queue of the `Timelock` contract.

Findings

Critical	**0** (0.00%)
Major	**2** (20.00%)
Medium	**0** (0.00%)
Minor	**2** (20.00%)
Informational	**6** (60.00%)
Discussion	**0** (0.00%)

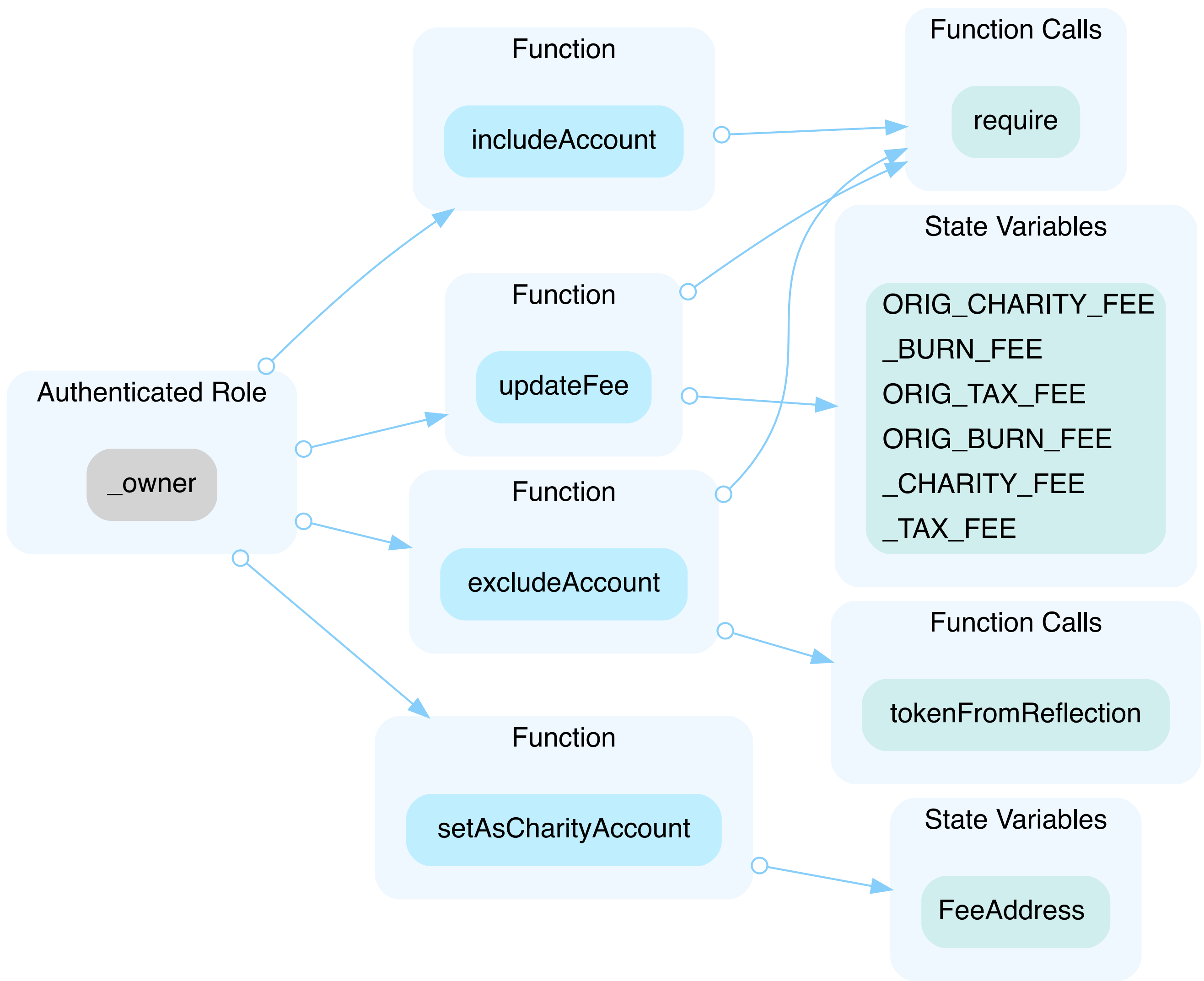
ID	Title	Category	Severity	Status
CTC-01	Centralization Risks In CoinToken.sol	**Centralization / Privilege**	**Major**	Acknowledged
CTC-02	Initial Token Distribution	**Centralization / Privilege**	**Major**	Acknowledged
CTC-03	Usage Of `transfer()` For Sending Ether	Volatile Code	Minor	Acknowledged
CTC-04	Lack Of Check Whether `FeeAddress` Is Excluded	Logical Issue	Minor	Acknowledged
CTC-05	Missing Emit Events	Coding Style	Informational	Acknowledged
CTC-06	Missing Error Messages	Coding Style	Informational	Acknowledged
CTC-07	Variables That Could Be Declared As `constant`	Gas Optimization	Informational	Acknowledged
CTC-08	Variables That Could Be Declared As Immutable	Gas Optimization	Informational	Acknowledged
CTC-09	Unlocked Compiler Version	Language Specific	Informational	Acknowledged
CTC-10	Redundant Code	Logical Issue	Informational	Acknowledged

CTC-01 | Centralization Risks In CoinToken.sol

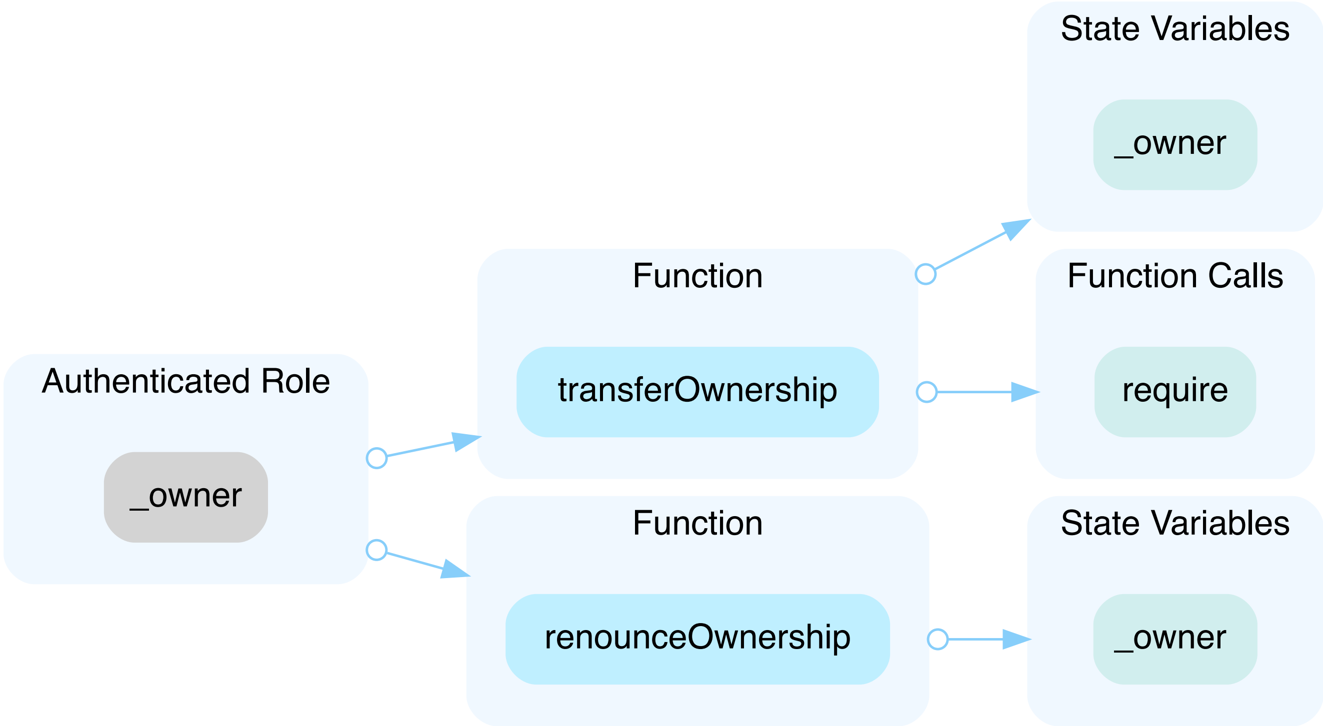
Category	Severity	Location	Status
Centralization / Privilege	Major	CoinToken.sol: 425, 434, 591, 600, 613, 618	Acknowledged

Description

In the contract `CoinToken` 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.



In the contract `Ownable` 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.



As of Apr-27-2022, the `_owner` role is address 0x0000000000000000000000000000000000000000, which is an dead address.

Since the ownership is renounced, it will not cause any actual issue for the contract deployed at the address 0x9eeb6c5ff183e6001c65a12d70026b900ae76781. This finding only serves as a warning and will be marked as resolved in the final report.

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.

Alleviation

[**Irena Coin**]: The team acknowledged this issue and will fix it in the future stage.

CTC-02 | Initial Token Distribution

Category	Severity	Location	Status
Centralization / Privilege	**Major**	CoinToken.sol: 492	Acknowledged

Description

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

According to the tx of the deployment of this contract, all the tokens were transferred to the address 0x3ee42e5e41aa543eb7b95a3473a393e03561ccba.

As of April-27 2022, the balance of the address 0x3ee42e5e41aa543eb7b95a3473a393e03561ccba is 214020348326034389.

More information can be found here.

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.

Alleviation

[**Irena Coin**]: The team acknowledged this issue and will fix it in the future stage.

CTC-03 | Usage Of `transfer()` For Sending Ether

Category	Severity	Location	Status
Volatile Code	Minor	CoinToken.sol: 493	Acknowledged

Description

After EIP-1884 was included in the Istanbul hard fork, it is not recommended to use `.transfer()` or `.send()` for transferring ether as these functions have a hard-coded value for gas costs making them obsolete as they are forwarding a fixed amount of gas, specifically `2300`. This can cause issues in case the linked statements are meant to be able to transfer funds to other contracts instead of EOAs.

Recommendation

We advise that the linked `.transfer()` and `.send()` calls are substituted with the utilization of the `sendValue()` function from the `Address.sol` implementation of OpenZeppelin either by directly importing the library or copying the linked code.

Alleviation

[**Irena Coin**]: The team acknowledged this issue and will fix it in the future stage.

CTC-04 | Lack Of Check Whether `FeeAddress` Is Excluded

Category	Severity	Location	Status
Logical Issue	Minor	CoinToken.sol: 798	Acknowledged

Description

According to the logic of this contract, the `_tOwned` value of an address should only be updated when this address is excluded. In `_sendToCharity` function, there is no validation that the `FeeAddress` is excluded.

Recommendation

Consider checking whether the `FeeAddress` is excluded in `_sendToCharity` function:

```
function _sendToCharity(uint256 tCharity, address sender) private {
      uint256 currentRate = _getRate();
      uint256 rCharity = tCharity.mul(currentRate);
      _rOwned[FeeAddress] = _rOwned[FeeAddress].add(rCharity);
      if(_isExcluded[FeeAddress]){
        _tOwned[FeeAddress] = _tOwned[FeeAddress].add(tCharity);
      }
      emit Transfer(sender, FeeAddress, tCharity);
  }
```

Alleviation

[**Irena Coin**]: The team acknowledged this issue and will fix it in the future stage.

CTC-05 | Missing Emit Events

Category	Severity	Location	Status
Coding Style	Informational	CoinToken.sol: 591, 600, 613, 618	Acknowledged

Description

There should always be events emitted in the sensitive functions that are controlled by centralization roles:

- `excludeAccount()`
- `includeAccount()`
- `setAsCharityAccount()`
- `updateFee()`

Recommendation

It is recommended emitting events for the sensitive functions that are controlled by centralization roles.

Alleviation

[**Irena Coin**]: The team acknowledged this issue and will fix it in the future stage.

CTC-06 | Missing Error Messages

Category	Severity	Location	Status
Coding Style	Informational	CoinToken.sol: 619	Acknowledged

Description

The **require** can be used to check for conditions and throw an exception if the condition is not met. It is better to provide a string message containing details about the error that will be passed back to the caller.

Recommendation

We advise adding error messages to the linked **require** statements.

Alleviation

[**Irena Coin**]: The team acknowledged this issue and will fix it in the future stage.

CTC-07 | Variables That Could Be Declared As `constant`

Category	Severity	Location	Status
Gas Optimization	● Informational	CoinToken.sol: 457, 459	ⓘ Acknowledged

Description

The linked variables could be declared as `constant` since these state variables are never modified.

Recommendation

We recommend to declare these variables as `constant`.

Alleviation

[**Irena Coin**]: The team acknowledged this issue and will fix it in the future stage.

CTC-08 | Variables That Could Be Declared As Immutable

Category	Severity	Location	Status
Gas Optimization	Informational	CoinToken.sol: 454, 458	Acknowledged

Description

The linked variables assigned in the constructor can be declared as `immutable`. Immutable state variables can be assigned during contract creation but will remain constant throughout the lifetime of a deployed contract. A big advantage of immutable variables is that reading them is significantly cheaper than reading from regular state variables since they will not be stored in storage.

Recommendation

We recommend declaring these variables as immutable. Please note that the `immutable` keyword only works in Solidity version `v0.6.5` and up.

Alleviation

[**Irena Coin**]: The team acknowledged this issue and will fix it in the future stage.

CTC-09 | Unlocked Compiler Version

Category	Severity	Location	Status
Language Specific	Informational	CoinToken.sol: 3	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 `v0.8.2` the contract should contain the following line:

```
pragma solidity 0.8.2;
```

Alleviation

[**Irena Coin**]: The team acknowledged this issue and will fix it in the future stage.

CTC-10 | Redundant Code

Category	Severity	Location	Status
Logical Issue	Informational	CoinToken.sol: 659	Acknowledged

Description

The condition `!_isExcluded[sender] && !_isExcluded[recipient]` can be included in `else` .

Recommendation

The following code can be removed:

```
... else if (!_isExcluded[sender] && !_isExcluded[recipient]) {
    _transferStandard(sender, recipient, amount);
} ...
```

Alleviation

[**Irena Coin**]: The team acknowledged this issue and will fix it in the future stage.

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.

Logical Issue

Logical Issue findings detail a fault in the logic of the linked code, such as an incorrect notion on how block.timestamp works.

Volatile Code

Volatile Code findings refer to segments of code that behave unexpectedly on certain edge cases that may result in a vulnerability.

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.

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.

Disclaimer

This report is subject to the terms and conditions (including without limitation, description of services, confidentiality, disclaimer and limitation of liability) set forth in the Services Agreement, or the scope of services, and terms and conditions provided to you ("Customer" or the "Company") in connection with the Agreement. This report provided in connection with the Services set forth in the Agreement shall be used by the Company only to the extent permitted under the terms and conditions set forth in the Agreement. 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 CertiK's prior written consent in each instance.

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 considered, an indication of the economics or value of any "product" or "asset" created by any team or project that contracts CertiK to perform a security assessment. This report 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 in no way provides investment advice, nor should be leveraged as investment advice of any sort. This report represents an extensive assessing 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. CertiK's position is that each company and individual are responsible for their own due diligence and continuous security. CertiK'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 CertiK is subject to dependencies and 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.

ALL SERVICES, THE LABELS, THE ASSESSMENT REPORT, WORK PRODUCT, OR OTHER MATERIALS, OR ANY PRODUCTS OR RESULTS OF THE USE THEREOF ARE PROVIDED "AS IS" AND "AS

AVAILABLE" AND WITH ALL FAULTS AND DEFECTS WITHOUT WARRANTY OF ANY KIND. TO THE MAXIMUM EXTENT PERMITTED UNDER APPLICABLE LAW, CERTIK HEREBY DISCLAIMS ALL WARRANTIES, WHETHER EXPRESS, IMPLIED, STATUTORY, OR OTHERWISE WITH RESPECT TO THE SERVICES, ASSESSMENT REPORT, OR OTHER MATERIALS. WITHOUT LIMITING THE FOREGOING, CERTIK SPECIFICALLY DISCLAIMS ALL IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, TITLE AND NON-INFRINGEMENT, AND ALL WARRANTIES ARISING FROM COURSE OF DEALING, USAGE, OR TRADE PRACTICE. WITHOUT LIMITING THE FOREGOING, CERTIK MAKES NO WARRANTY OF ANY KIND THAT THE SERVICES, THE LABELS, THE ASSESSMENT REPORT, WORK PRODUCT, OR OTHER MATERIALS, OR ANY PRODUCTS OR RESULTS OF THE USE THEREOF, WILL MEET CUSTOMER'S OR ANY OTHER PERSON'S REQUIREMENTS, ACHIEVE ANY INTENDED RESULT, BE COMPATIBLE OR WORK WITH ANY SOFTWARE, SYSTEM, OR OTHER SERVICES, OR BE SECURE, ACCURATE, COMPLETE, FREE OF HARMFUL CODE, OR ERROR-FREE. WITHOUT LIMITATION TO THE FOREGOING, CERTIK PROVIDES NO WARRANTY OR UNDERTAKING, AND MAKES NO REPRESENTATION OF ANY KIND THAT THE SERVICE WILL MEET CUSTOMER'S REQUIREMENTS, ACHIEVE ANY INTENDED RESULTS, BE COMPATIBLE OR WORK WITH ANY OTHER SOFTWARE, APPLICATIONS, SYSTEMS OR SERVICES, OPERATE WITHOUT INTERRUPTION, MEET ANY PERFORMANCE OR RELIABILITY STANDARDS OR BE ERROR FREE OR THAT ANY ERRORS OR DEFECTS CAN OR WILL BE CORRECTED.

WITHOUT LIMITING THE FOREGOING, NEITHER CERTIK NOR ANY OF CERTIK'S AGENTS MAKES ANY REPRESENTATION OR WARRANTY OF ANY KIND, EXPRESS OR IMPLIED AS TO THE ACCURACY, RELIABILITY, OR CURRENCY OF ANY INFORMATION OR CONTENT PROVIDED THROUGH THE SERVICE. CERTIK WILL ASSUME NO LIABILITY OR RESPONSIBILITY FOR (I) ANY ERRORS, MISTAKES, OR INACCURACIES OF CONTENT AND MATERIALS OR FOR ANY LOSS OR DAMAGE OF ANY KIND INCURRED AS A RESULT OF THE USE OF ANY CONTENT, OR (II) ANY PERSONAL INJURY OR PROPERTY DAMAGE, OF ANY NATURE WHATSOEVER, RESULTING FROM CUSTOMER'S ACCESS TO OR USE OF THE SERVICES, ASSESSMENT REPORT, OR OTHER MATERIALS.

ALL THIRD-PARTY MATERIALS ARE PROVIDED "AS IS" AND ANY REPRESENTATION OR WARRANTY OF OR CONCERNING ANY THIRD-PARTY MATERIALS IS STRICTLY BETWEEN CUSTOMER AND THE THIRD-PARTY OWNER OR DISTRIBUTOR OF THE THIRD-PARTY MATERIALS.

THE SERVICES, ASSESSMENT REPORT, AND ANY OTHER MATERIALS HEREUNDER ARE SOLELY PROVIDED TO CUSTOMER AND MAY NOT BE RELIED ON BY ANY OTHER PERSON OR FOR ANY PURPOSE NOT SPECIFICALLY IDENTIFIED IN THIS AGREEMENT, NOR MAY COPIES BE DELIVERED TO, ANY OTHER PERSON WITHOUT CERTIK'S PRIOR WRITTEN CONSENT IN EACH INSTANCE.

NO THIRD PARTY OR ANYONE ACTING ON BEHALF OF ANY THEREOF, SHALL BE A THIRD PARTY OR OTHER BENEFICIARY OF SUCH SERVICES, ASSESSMENT REPORT, AND ANY ACCOMPANYING

MATERIALS AND NO SUCH THIRD PARTY SHALL HAVE ANY RIGHTS OF CONTRIBUTION AGAINST CERTIK WITH RESPECT TO SUCH SERVICES, ASSESSMENT REPORT, AND ANY ACCOMPANYING MATERIALS.

THE REPRESENTATIONS AND WARRANTIES OF CERTIK CONTAINED IN THIS AGREEMENT ARE SOLELY FOR THE BENEFIT OF CUSTOMER. ACCORDINGLY, NO THIRD PARTY OR ANYONE ACTING ON BEHALF OF ANY THEREOF, SHALL BE A THIRD PARTY OR OTHER BENEFICIARY OF SUCH REPRESENTATIONS AND WARRANTIES AND NO SUCH THIRD PARTY SHALL HAVE ANY RIGHTS OF CONTRIBUTION AGAINST CERTIK WITH RESPECT TO SUCH REPRESENTATIONS OR WARRANTIES OR ANY MATTER SUBJECT TO OR RESULTING IN INDEMNIFICATION UNDER THIS AGREEMENT OR OTHERWISE.

FOR AVOIDANCE OF DOUBT, THE SERVICES, INCLUDING ANY ASSOCIATED ASSESSMENT REPORTS OR MATERIALS, SHALL NOT BE CONSIDERED OR RELIED UPON AS ANY FORM OF FINANCIAL, TAX, LEGAL, REGULATORY, OR OTHER ADVICE.

About

Founded in 2017 by leading academics in the field of Computer Science from both Yale and Columbia University, CertiK is a leading blockchain security company that serves to verify the security and correctness of smart contracts and blockchain-based protocols. Through the utilization of our world-class technical expertise, alongside our proprietary, innovative tech, we're able to support the success of our clients with best-in-class security, all whilst realizing our overarching vision; provable trust for all throughout all facets of blockchain.

CERTIK