CERTIK

Preliminary Comments

sad baby token

Sept 29th, 2021

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Summary

This report has been prepared for sad baby token to discover issues and vulnerabilities in the source code of the sad baby token project as well as any contract dependencies that were not part of an officially recognized library. A comprehensive examination has been performed, utilizing Manual Review and Static Analysis 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	sad baby token
Description	Deflationary BEP20 token
Platform	BSC
Language	Solidity
Codebase	https://bscscan.com/token/0x3ad405ef7aea80ccb41beef0a74510e18feef190
Commit	N/A

Audit Summary

Delivery Date	Sept 29, 2021
Audit Methodology	Manual Review, Static Analysis
Key Components	

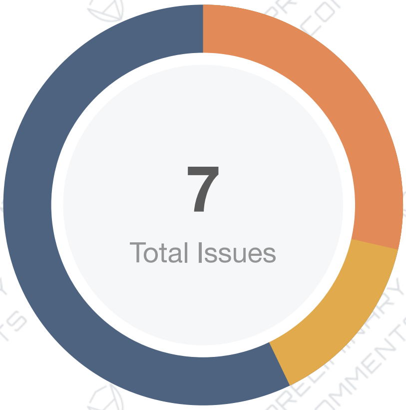
Vulnerability Summary

Vulnerability Level	Total	Pending	Declined	Acknowledged	Partially Resolved	Resolved
Critical	0	0	0	0	0	0
Major	2	2	0	0	0	0
Medium	1	1	0	0	0	0
Minor	0	0	0	0	0	0
Informational	4	4	0	0	0	0
Discussion	0	0	0	0	0	0

Audit Scope

ID	File	SHA256 Checksum
CTC	CoinToken.sol	1a8347acf66ad0d1030b2852d38b34de92c748771e4b3931e0bc6c304085ad11

Findings



Critical	0 (0.00%)
Major	2 (28.57%)
Medium	1 (14.29%)
Minor	0 (0.00%)
Informational	4 (57.14%)
Discussion	0 (0.00%)

ID	Title	Category	Severity	Status
CTC-01	Privileged Ownership	**Centralization / Privilege**	**Major**	Pending
CTC-02	Centralized Token Holding Position	**Centralization / Privilege**	**Major**	Pending
CTC-03	Variable `_rOwned[account]` Not Updated in Function `includeAccount()`	Control Flow	Medium	Pending
CTC-04	Redundant Code	Logical Issue	Informational	Pending
CTC-05	No Need to Use Library `SafeMath`	Language Specific	Informational	Pending
CTC-06	Missing Events Emitting	Coding Style	Informational	Pending
CTC-07	Potential Risks on Approve/TransferFrom Methods	Logical Issue	Informational	Pending

CTC-01 | Privileged Ownership

Category	Severity	Location	Status
Centralization / Privilege	Major	CoinToken.sol (2)	Pending

Description

Based on the record on chain, we could identify the owner as an EOA (externally owned account), and the owner address is 0x1158971539f52e2386Be22df6DAab80D79f15CB2.

In the contract `CoinToken`, the owner has the authority over the following functions:

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

The owner of the contract has significant privileges. For example, address `FeeAddress` can be set by the owner after contract deployment. The `_TAX_FEE`, `_BURN_FEE`, and `_CHARITY_FEE` each has a cap of 100% in the `updateFee()` function. Over time the `FeeAddress` wallet controlled by the owner will be distributed a significant amount of tokens. Any compromise to the owner or the `FeeAddress`'s private key may allow the hacker to take advantage of this, gaining access to funds and jeopardize the project.

Recommendation

We advise the client to carefully manage the owner's and `FeeAddress`'s private key to avoid any potential risks of being hacked. We recommend setting a reasonable cap on the `_TAX_FEE`, `_BURN_FEE`, and `_CHARITY_FEE`, as well as letting the community monitor the activities of the `FeeAddress` to ensure it is operating in accordance with the whitepaper.

In general, we strongly recommend centralized privileges or roles in the protocol to be improved via a decentralized mechanism or smart-contract-based accounts with enhanced security practices, e.g., Multisignature wallets.

Indicatively, here is some feasible suggestions that would also mitigate the potential risk at the different level in term of short-term and long-term:

- Time-lock with reasonable latency, e.g., 48 hours, for awareness on privileged operations;
- Assignment of privileged roles to multi-signature wallets to prevent a single point of failure due to the private key;

- Introduction of a DAO/governance/voting module to increase transparency and user involvement.

CERTIK PRELIMINARY COMMENTS

CTC-02 | Centralized Token Holding Position

Category	Severity	Location	Status
Centralization / Privilege	Major	CoinToken.sol (2): 496	Pending

Description

```
_rOwned[tokenOwner] = _rTotal;
```

All of the tokens are distributed to the contract owner when deploying the contract. And the owner can distribute tokens without obtaining the consensus of the community.

Recommendation

Once the token goes live, we assume many transactions would involve the wallet unlock of the owner address and the team shall make enough efforts to restrict the access of the private key.

CTC-03 | Variable `_rOwned[account]` Not Updated in Function `includeAccount()`

Category	Severity	Location	Status
Control Flow	Medium	CoinToken.sol (2): 604~615	Pending

Description

```
function includeAccount(address account) external onlyOwner() {
    require(_isExcluded[account], "Account is already included");
    for (uint256 i = 0; i < _excluded.length; i++) {
        if (_excluded[i] == account) {
            _excluded[i] = _excluded[_excluded.length - 1];
            _tOwned[account] = 0;
            _isExcluded[account] = false;
            _excluded.pop();
            break;
        }
    }
}
```

The `_rOwned` variable is not updated within the function `includeAccount()`. This could cause a potential discrepancy in account balance if an address is excluded, and subsequently included again. When an account is excluded, the return value of the `_getRate()` function could change. If the `_rOwned[account]` value is not updated on inclusion, `balanceOf(account)` could change as a result. This appears to be inconsistent with the business logic, as an account balance shouldn't change during the period of exclusion. Theoretically, the `_owner` is able to exclude its address or any arbitrary address and later include the same address, siphoning tokens from other holders.

A detailed explanation and example are shown in the link below:
https://perafinance.medium.com/safemoon-is-it-safe-though-a-detailed-explanation-of-frictionless-yield-bug-338710649846

Recommendation

We recommend recalculating the value of `_rOwned[account]` in function `includeAccount()`.

```
function includeAccount(address account) external onlyOwner() {
    require(_isExcluded[account], "Account is already included");
    for (uint256 i = 0; i < _excluded.length; i++) {
        if (_excluded[i] == account) {
            _excluded[i] = _excluded[_excluded.length - 1];
```

```
                _rOwned[account] = _tOwned[account].mul(_getRate());    //recalculate
_rOwned
                _tOwned[account] = 0;
                _isExcluded[account] = false;
                _excluded.pop();
                break;
            }
        }
    }
```

CTC-04 | Redundant Code

Category	Severity	Location	Status
Logical Issue	● Informational	CoinToken.sol (2): 658~668	ⓘ Pending

Description

A code snippet in function `_transfer()`:

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

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

Recommendation

We recommend removing the following code:

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

CTC-05 | No Need to Use Library `SafeMath`

Category	Severity	Location	Status
Language Specific	● Informational	CoinToken.sol (2): 108~249, 446	ⓘ Pending

Description

Solidity v0.8.0 and later versions check underflow/overflow by default, and therefore the library `SafeMath` is not necessary.

Source: link

Recommendation

We recommend using the default arithmetic check instead of the library `SafeMath`.

CTC-06 | Missing Events Emitting

Category	Severity	Location	Status
Coding Style	Informational	CoinToken.sol (2)	Pending

Description

When a function affects the status of sensitive variables, it should be able to emit events to notify users of the contract. The following functions in contract `CoinToken` should emit events:

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

Recommendation

We recommend adding events for the sensitive actions of the above functions and emitting them accordingly.

CTC-07 | Potential Risks on Approve/TransferFrom Methods

Category	Severity	Location	Status
Logical Issue	● Informational	CoinToken.sol (2): 531~534	ⓘ Pending

Description

```
function approve(address spender, uint256 amount) public override returns (bool) {
    _approve(_msgSender(), spender, amount);
    return true;
}
```

The function `approve()` could be used in a front-running attack that allows a spender to transfer more tokens than the owner of the tokens ever wanted to allow the spender to transfer.

Here is a possible attack scenario:

Alice allows Bob to transfer N of Alice's tokens (N>0) by calling approve method on a Token smart contract passing Bob's address and N as method arguments. After some time, Alice decides to change from N to M (M>0) number of her tokens that Bob is allowed to transfer, so she calls the `approve()` method again, this time passing Bob's address and M as method arguments. Bob notices Alice's second transaction before it is mined and quickly sends another transaction that calls `transferFrom()` method to transfer N Alice's tokens to somewhere. If Bob's transaction is executed before Alice's, Bob will successfully transfer N Alice's tokens and gain the ability to transfer another M tokens.

So, Alice's attempt to change Bob's allowance from N to M (N>0 and M>0) made it possible for Bob to transfer N+M of Alice's tokens, while Alice never wanted to allow so many of her tokens to be transferred by Bob.

Recommendation

We recommend using functions `increaseAllowance()` and `decreaseAllowance()` instead.

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.

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.

Control Flow

Control Flow findings concern the access control imposed on functions, such as owner-only functions being invoke-able by anyone under certain circumstances.

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.

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