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Summary

This report has been prepared for Koala Finance smart contracts, LYPTUS Masterchef, YPTUS Token and libs to discover issues and vulnerabilities in the source code as well as any 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 security experts.

The security assessment resulted in 9 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:

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

Overview

Project Summary

| | |
|-------------|---|
| Name | Koala Finance |
| Codebase | https://github.com/koaladefi/ |
| Commit Hash | 4554fef2e727fa1c2f96856f2368e6d9ff564fb8 |

Engagement Summary

| | |
|-----------------------|-----------------------------------|
| Delivery Date | April 2nd, 2021 |
| Methodology | Static analysis and manual review |
| Contracts in Scope | 2 |
| Contract - Token | LYPTUSToken |
| Contract - MasterChef | MasterChef |

Finding Summary

| | |
|---------------|---|
| Total | 9 |
| Critical | 1 |
| Medium | 0 |
| Minor | 3 |
| Informational | 5 |

Findings

| ID | Title | Severity | Response |
|-------------|---|---------------|--------------|
| CTK-KOALA-1 | Unchanged Function/Variable Names | Informational | Resolved |
| CTK-KOALA-2 | Time Check Relies on Timestamp | Minor | Acknowledged |
| CTK-KOALA-3 | Checks Effects Interaction Pattern Not Used | Minor | Resolved |
| CTK-KOALA-4 | Function Return Value Ignored | Informational | Resolved |
| CTK-KOALA-5 | Missing Emit Events | Informational | Resolved |
| CTK-KOALA-6 | add() Function Not Restricted | Critical | Resolved |
| CTK-KOALA-7 | Missing zero address validation | Minor | Resolved |
| CTK-KOALA-8 | Privileged Ownerships on MasterChef | Informational | Acknowledged |
| CTK-KOALA-9 | Privileged Ownerships on LYPTUSToken | Informational | Acknowledged |

CTK-KOALA-1 | Unchanged Function/Variable Names

| Type | Severity | Location |
|--------------|---------------|-----------------------|
| Coding Style | Informational | LYPTUSMasterChef L253 |

Description

It seems LYPTUSMasterChef is forked from PancakeSwap, such that there are unchanged comments and variable names.

Recommendation

Recommend replacing the showings of `cake` with the LYPTUS namings.

Alleviation

The update is applied at a later [commit](#).

CTK-KOALA-2 | Time Check Relies on Timestamp

| Type | Severity | Location |
|---------------|----------|-------------------|
| Volatile Code | Minor | LYPTUSToken: L129 |

Description

Any comparison should avoid using `now` or any other timestamp as any powerful miner can dominate the mining and thus manipulate the timestamp, which will eventually lead to vulnerability as deny delegation in certain situations.

Recommendation

Avoiding relying on `now` or any type of timestamp in the function `delegateBySig()` instead of using block number.

Update

As we mentioned above, In the case of `block.timestamp`, malicious miners can alter the timestamp of their blocks. As for `block.number`, considering the block time on Binance smart contract is generally about 3 seconds, it's possible to predict the time delta between blocks.

Code example:

```
require(block.number <= expiry, "LYPTUS::delegateBySig: signature expired");
```

`expiry` is the estimated block number based on the time delta of delegate expiration time.

CTK-KOALA-3 | Checks Effects Interaction Pattern Not Used

| Type | Severity | Location |
|-------------|----------|------------------------|
| Logic Issue | Minor | LYPTUSMasterChef: L193 |

Description

In function `add()`, `lpToken` is pointing to a smart contract that is implemented based on a BEP20 interface. This smart contract can only be passed into function `add()` by `owner` as one of the parameters while the implementation of `lpToken` is unknown statically, even if `lpToken` strictly followed the BEP20 interface.

Due to the unknown implementation of contract `lpToken`, the implementation of function `safeTransfer()` is also unknown and may have a malicious logical implementation that calls back to the function `deposit()`, which can lead to another invocation of `safeTransfer()` in L193 without updating `user.amount` in L194. This is dangerous to the `user.amount` and will incorrectly calculate the user's balance eventually.

Recommendation

We advise developers to swap `pool.lpToken.safeTransfer(feeAddress, depositFee);` and `user.amount = user.amount.add(_amount).sub(depositFee);` to follow the [Checks-Effects-Interactions Pattern](#).

```
function deposit(uint256 _pid, uint256 _amount) public {
    ...
    if(_amount > 0) {
        pool.lpToken.safeTransferFrom(address(msg.sender), address(this), _amount);
        if(pool.depositFeeBP > 0){
            uint256 depositFee = _amount.mul(pool.depositFeeBP).div(10000);
            user.amount = user.amount.add(_amount).sub(depositFee);
            pool.lpToken.safeTransfer(feeAddress, depositFee);
        }else{
            user.amount = user.amount.add(_amount);
        }
    }
    ...
}
```

Alleviation

The update is applied at a later [commit](#).

CTK-KOALA-4 | Function Return Value Ignored

| Type | Severity | Location |
|---------------|---------------|-----------------------------|
| Volatile Code | Informational | LYPTUSMasterChef: L236, 238 |

Description

The return values of `lyptus.transfer(_to, lyptusBal)`, `lyptus.transfer(_to, _amount)`; are ignored in the function `safeLyptusTransfer()`.

Recommendation

We advise developers to handle the return value of `transfer()` to check if the transfer is executed without any error. Or using `lyptus.safeTransfer()` Instead of `lyptus.transfer()`.

Alleviation

The update is applied at a later [commit](#).

CTK-KOALA-5 | Missing Emit Events

| Type | Severity | Location |
|---------------|---------------|------------------|
| Volatile Code | Informational | LYPTUSMasterChef |

Description

Functions that affect the status of sensitive variables should be able to emit events as notifications to customers.

MasterChef:

```
dev(), setFeeAddress(), updateEmissionRate()
```

Recommendation

Consider adding events for sensitive actions, and emit them in the function like below.

```
event SetFeeAddress(address indexed user, address indexed _feeAddress);
...
function setFeeAddress(address _feeAddress) public{
    require(msg.sender == feeAddress, "setFeeAddress: FORBIDDEN");
    feeAddress = _feeAddress;
    emit SetFeeAddress(msg.sender, _feeAddress)
}
```

Alleviation

The update is applied at a later [commit](#).

CTK-KOALA-6 | add() Function Not Restricted

| Type | Severity | Location |
|---------------|----------|------------------------|
| Volatile Code | Critical | LYPTUSMasterChef: L105 |

Description

The comment in L104, mentioned `// XXX DO NOT add the same LP token more than once. Rewards will be messed up if you do.`

The total amount of reward `LyptusReward` in function `updatePool()` will be incorrectly calculated if the same LP token is added into the pool more than once in function `add()`.

However, the code is not reflected in the comment behaviors as there isn't any valid restriction on preventing this issue.

The current implementation is relying on the trust of the owner to avoid repeatedly adding the same LP token to the pool, as the function will only be called by the owner.

Recommendation

Using mapping of `addresses -> bools`, which can restrict the same address being added twice.

Alleviation

The update is applied at a later [commit](#).

CTK-KOALA-7 | Missing Zero Address Validation

| Type | Severity | Location |
|---------------|----------|--|
| Volatile Code | Minor | LYPTUSMasterChef: L93, L94, L245, L250 |

Description

The assigned value to `devaddr`, `feeAddress` should be verified as non zero value to prevent being mistakenly assigned as `address(0)` in `dev()` function and `setFeeAddress()`. Violation of this may cause losing ownership of `devaddr`, `feeAddress`.

Recommendation

Check that the address is not zero by adding checks in function `dev()` and `setFeeAddress()`.

Alleviation

The update is applied at a later [commit](#).

CTK-KOALA-8 | Privileged Ownerships on MasterChef

| Type | Severity | Location |
|----------------|---------------|------------------------------------|
| Business Model | Informational | LYPTUSMasterChef: L105, L122, L254 |

Description

The owner of MasterChef has permission to add and set pools that could update the parameters on rewards without obtaining the consensus of the community.

Recommendation

Renounce ownership when it is the right timing, or gradually migrate to a timelock plus multisig governing procedure and let the community monitor in respect of transparency considerations.

Alleviation

The team confirmed that the owner of masterchef is a timelock contract.

Timelock contract was deployed at

<https://bscscan.com/address/0x4fdbd2982bdb512b293c7cd14a6b580eb80cb552>.

CTK-KOALA-9 | Privileged Ownerships on LyptusToken

| Type | Severity | Location |
|----------------|---------------|-------------|
| Business Model | Informational | LyptusToken |

Description

LyptusToken is the standard BEP20 implementation that contains the mint functionality with ownership controls, which means whoever obtained access to the owner account would be able to tamper with the integrity of the token economics.

Recommendation

Renounce ownership when it is the right timing, or gradually migrate to a timelock plus multisig governing procedure and let the community monitor in respect of transparency considerations.

Alleviation

The team confirmed that the token owner is the MasterChef.

Appendix | Finding Categories

Gas Optimization

Refer to exhibits that do not affect the functionality of the code but generate different, more optimal EVM opcodes resulting in a reduction in the total gas cost of a transaction.

Mathematical Operations

Refer to exhibits that relate to mishandling of math formulas, such as overflows, incorrect operations, etc.

Logical Issue

Refer to exhibits that detail a fault in the logic of the linked code, such as an incorrect notion on how `block.timestamp` works.

Control Flow

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

Volatile Code

Refer to segments of code that behave unexpectedly on certain edge cases that may result in a vulnerability.

Data Flow

Describe faults in the way data is handled at rest and in memory, such as the result of a `struct` assignment operation affecting an in-memory `struct` rather than an in-storage one.

Language Specific

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

Coding Style

Usually do not affect the generated byte-code and comment on how to make the codebase more legible and as a result easily maintainable.

Inconsistency

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.

Magic Numbers

Refer to numeric literals that are expressed in the codebase in their raw format and should otherwise be specified as `constant` contract variables aiding in their legibility and maintainability.

Compiler Error

Refer to an error in the structure of the code that renders it impossible to compile using the specified version of the project.

Dead Code

Code that otherwise does not affect the functionality of the codebase and can be safely omitted.

Business Model

Refer to contract or function logics that are debatable or not clearly implemented according to the design intentions.

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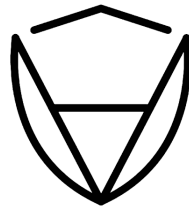
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Blockchain technology and cryptographic assets present a high level of ongoing risk. CertiK's position is that each company and individual are responsible for their own due diligence and continuous security. CertiK's goal is to help reduce the attack 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.

About CertiK

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
Provable Trust For All