CERTIK

Security Assessment

ButterSwap IV

Aug 17th, 2021

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Summary

This report has been prepared for ButterSwap to discover issues and vulnerabilities in the source code of the ButterSwap IV 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	ButterSwap IV
Platform	Heco
Language	Solidity
Codebase	https://github.com/butter-swap/butterswap-nft/blob/master/ButterNFTAuctionChef.sol
Commit	5186145ff9b589d4f8281d4efcef40ecb3901fca aaeb82956b20cc79f4887df7782bab9b984a5842 a78a3bc048b76b89d01aa0fa779ec2e2a1a89168

Audit Summary

Delivery Date	Aug 17, 2021
Audit Methodology	Static Analysis, Manual Review
Key Components	

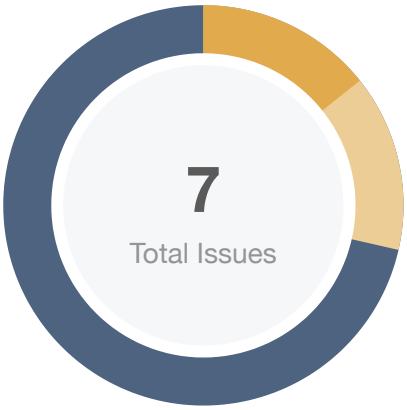
Vulnerability Summary

Vulnerability Level	Total	Pending	Declined	Acknowledged	Partially Resolved	Resolved
Critical	0	0	0	0	0	0
Major	0	0	0	0	0	0
Medium	1	0	0	1	0	0
Minor	1	0	0	0	0	1
Informational	5	0	0	0	0	5
Discussion	0	0	0	0	0	0

Audit Scope

ID	File	SHA256 Checksum
BNF	ButterNFTAuctionChef.sol	a49e605a3b3d7bba088f9b26452012a49d8f099c797d415b85a320fcc9f74ce6

Findings



Critical	**0** (0.00%)
Major	**0** (0.00%)
Medium	**1** (14.29%)
Minor	**1** (14.29%)
Informational	**5** (71.43%)
Discussion	**0** (0.00%)

ID	Title	Category	Severity	Status
BNF-01	Privileged Ownership	**Centralization / Privilege**	**Medium**	Acknowledged
BNF-02	Lack of reasonable boundary	Volatile Code	Minor	Resolved
BNF-03	Function optimization	Gas Optimization	Informational	Resolved
BNF-04	Lack of Event Emission for Significant Transactions	Coding Style	Informational	Resolved
BNF-05	Transfer can be merged into one	Gas Optimization	Informational	Resolved
BNF-06	Variable could be declared as `constant`	Gas Optimization	Informational	Resolved
BNF-07	Questionable cancel cost	Logical Issue	Informational	Resolved

BNF-01 | Privileged Ownership

Category	Severity	Location	Status
Centralization / Privilege	**Medium**	ButterNFTAuctionChef.sol	Acknowledged

Description

The owner of contract `BoardToken` has the permission to:

1. change the `admin` address via the function `setAdmin()`,
2. change the `pool` address via the function `setPool()`,
3. change the `treasury` address via the function `setTreasury()`,
4. change the `developer` address via the function `setDeveloper()`

without obtaining the consensus of the community.

The addresses `pool`, `treasury` and `developer` can receive auction fee.

The address `admin` has the permission to:

1. change the value of `burnRate` via `setBurnRate()`,
2. change the value of `poolRate` via `setPoolRate()`,
3. change the value of `treasuryRate` via `setTreasuryRate()`,
4. change the value of `developerRate` via `setDeveloperRate()`,
5. change the value of `minAuctionPrice` via `setMinAuctionPrice()`,
6. change the value of `minDuration` via `setMinDuration()`,
7. change the value of `minIncrementRate` via `setMinIncrementRate()`,
8. change the value of `formerBidderProfitRate` via `setFormerBidderProfitRate()`,
9. change the value of `setTriggerDelayBlocks` via `triggerDelayBlocks()`

without obtaining the consensus of the community.

Recommendation

We advise the client to carefully manage the `owner` account's private key to avoid any potential risks of being hacked. In general, we strongly recommend centralized privileges or roles in the protocol to be improved via a decentralized mechanism or via smart-contract-based accounts with enhanced security practices, e.g. Multisignature wallets.

Indicatively, here are some feasible solutions that would also mitigate the potential risk:

- Time-lock with reasonable latency, i.e. 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.

Alleviation

The team acknowledged this issue and they stated that they will use timelock or multi-signature wallet to control all the owner functions in the future.

BNF-02 | Lack of reasonable boundary

Category	Severity	Location	Status
Volatile Code	Minor	ButterNFTAuctionChef.sol	Resolved

Description

Variables `minAuctionPrice`, `minDuration` and `triggerDelayBlocks` do not have reasonable upper boundaries. Also, `minDuration` is too small comparing to `MAX_DURATION`.

Recommendation

We recommend adding reasonable upper and lower boundaries to all the configuration variables.

Alleviation

The team heeded our advice and resolved this issue in commit `aaeb82956b20cc79f4887df7782bab9b984a5842`.

BNF-03 | Function optimization

Category	Severity	Location	Status
Gas Optimization	Informational	ButterNFTAuctionChef.sol	Resolved

Description

Since only the user with highest price can win the bid, we can just record the highest price and buyer in the struct `AuctionInfo`. Then the function `bid` can directly check whether the new bid price is greater than the current highest price. If the new price is not higher than the current price, codes in L248-L259 can just be skipped, to save gas.

```
    require(price_ >=
formerPrice.add(auction.initialPrice.mul(minIncrementRate).div(100)), "bid price too
low");
```

Recommendation

We recommend recording the highest price and buyer in the struct `AuctionInfo` and removing the complex logic.

Alleviation

The team heeded our advice and resolved this issue in commit `aaeb82956b20cc79f4887df7782bab9b984a5842`.

BNF-04 | Lack of Event Emission for Significant Transactions

Category	Severity	Location	Status
Coding Style	Informational	ButterNFTAuctionChef.sol	Resolved

Description

The function that affects the status of sensitive variables should be able to emit events as notifications to customers.

- `setAdmin()`
- `setPool()`
- `setTreasury()`
- `setDeveloper()`
- `setBurnRate()`
- `setPoolRate()`
- `setTreasuryRate()`
- `setDeveloperRate()`
- `setMinAuctionPrice()`
- `setMinDuration()`
- `setMinIncrementRate()`
- `setFormerBidderProfitRate()`
- `startAuction()`
- `bid()`
- `finishAuction()`
- `cancelAuction()`

Recommendation

We advise the client to consider adding events for the above-mentioned sensitive actions and emit them in the function.

```
    event SetAdmin(address indexed oldAdmin, address indexed newAdmin);

    function setAdmin(address admin_) external onlyOwner {
        require(admin_ != address(0), "invalid admin address");
        emit SetAdmin(admin, admin_);
        admin = admin_;
    }
```

Alleviation

The team heeded our advice and resolved this issue in commit `a78a3bc048b76b89d01aa0fa779ec2e2a1a89168`.

BNF-05 | Transfer can be merged into one

Category	Severity	Location	Status
Gas Optimization	Informational	ButterNFTAuctionChef.sol: 278~279	Resolved

Description

Since the linked two calls to function `money.safeTransfer()` are to same address (the former bider), they can be merged into one to save gas.

```
money.safeTransfer(formerAddress, formerPrice);
money.safeTransfer(formerAddress, formerProfit);
```

Recommendation

We recommend first calculating the total amount to be sent and then call function `money.safeTransfer()` just once.

Alleviation

The team heeded our advice and resolved this issue in commit `a78a3bc048b76b89d01aa0fa779ec2e2a1a89168`.

BNF-06 | Variable could be declared as `constant`

Category	Severity	Location	Status
Gas Optimization	Informational	ButterNFTAuctionChef.sol: 18, 24, 25, 26, 27, 44, 49	Resolved

Description

Variables `BURN_ADDRESS`, `MAX_BURN_RATE`, `MAX_DEVELOPER_RATE`, `MAX_DURATION`, `MAX_FORMER_BIDDER_PROFIT_RATE`, `MAX_POOL_RATE` and `MAX_TREASURY_RATE` could be declared as `constant` since these state variables are never to be changed.

Recommendation

We recommend declaring those variables as `constant`.

Alleviation

The team heeded our advice and resolved this issue in commit `a78a3bc048b76b89d01aa0fa779ec2e2a1a89168`.

BNF-07 | Questionable cancel cost

Category	Severity	Location	Status
Logical Issue	Informational	ButterNFTAuctionChef.sol: 371	Resolved

Description

In the function `cancleAuction()`, the seller's profit is set to the auction `initialPrice`.

```
    uint256 finalProfit = auction.initialPrice;
```

However, since there is no bid occurring, the seller actually has no profit yet. Also because the cancel cost is in proportion to the `initialPrice`, it may be too large for the seller.

We would like to confirm with the client if the current implementation aligns with the original project design.

Recommendation

We recommend using a reasonable constant cancel fee.

Alleviation

The team heeded our advice and resolved this issue in commit `a78a3bc048b76b89d01aa0fa779ec2e2a1a89168`.

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.

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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