CERTIK

Security Assessment

Metaracers

Dec 9th, 2021

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Summary

This report has been prepared for Metaracers to discover issues and vulnerabilities in the source code of the Metaracers 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.

Additionally, this audit is based on a premise that all external contracts were implemented safety.

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	Metaracers
Platform	bsc
Language	Solidity
Codebase	https://github.com/MetaRacers/MRS/commit/6b66a9e9c8b6b3fcd5c0557c8fb262f9543f91fd
Commit	6b66a9e9c8b6b3fcd5c0557c8fb262f9543f91fd

Audit Summary

Delivery Date	Dec 09, 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	2	0	0	2	0	0
● Medium	0	0	0	0	0	0
● Minor	1	0	0	0	0	1
● Informational	8	0	0	0	0	8
● Discussion	0	0	0	0	0	0

Audit Scope

ID	File	SHA256 Checksum
MRS	MRS.sol	a1b8cb0825e241d11cb5738fee85c9fb3dff6f1776ec6844e836d1de29d4df14

Understandings

Overview

The `Metaracers` Protocol is an ERC20 token deployed on the Binance smart chain.

There is no transaction fee. Those who are in blacklist can not send or receive tokens. Those who are in whitelist can exclude from `antiWhale`. The owner can update the blacklist and whitelist. When `antiWhale` is enabled by owner, transaction amount is limited and only one sell transaction is allowed in a period time set by owner.

The owner can withdraw ERC20 tokens of contract address in case of emergency.

Privileged Functions

The contract contains the following privileged functions that are restricted by some modifiers. They are used to modify the contract configurations and address attributes. We grouped these functions below:

The `onlyOwner` modifier:

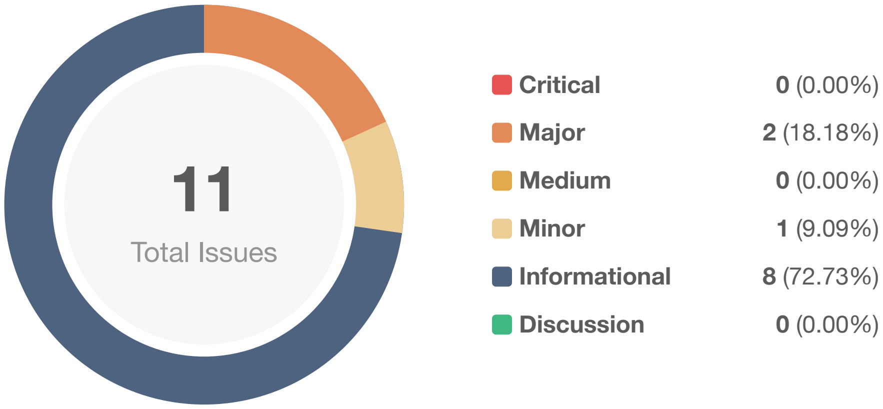
Contract `Ownable`:

- renounceOwnership()
- transferOwnership()

Contract `MRS`:

- addWhitelist()
- multiBlacklist()
- multiRemoveFromBlacklist()
- setAntiWhale()
- setMaxSell()
- setAntiWhaleEnd()
- rescueStuckErc20()

Findings



ID	Title	Category	Severity	Status
GLOBAL-01	Centralization Risk	**Centralization / Privilege**	● **Major**	ⓘ Acknowledged
GLOBAL-02	Missing Emit Events	Coding Style	● Informational	✓ Resolved
MRS-01	Unlocked Compiler Version	Language Specific	● Informational	✓ Resolved
MRS-02	Too Many Digits	Coding Style	● Informational	✓ Resolved
MRS-03	Useless Variable	Language Specific, Gas Optimization	● Informational	✓ Resolved
MRS-04	Token Minted To Centralized Address	**Centralization / Privilege**	● **Major**	ⓘ Acknowledged
MRS-05	Ambiguous Function Name	Coding Style	● Informational	✓ Resolved
MRS-06	Lack of Input Validation	Volatile Code	● Minor	✓ Resolved
MRS-07	Missing Error Messages	Coding Style	● Informational	✓ Resolved
MRS-08	Unreachable `else-clause` in Function `antiWhale()`	Coding Style	● Informational	✓ Resolved
MRS-09	Function `burnFrom()` Available for Everyone	Inconsistency	● Informational	✓ Resolved

GLOBAL-01 | Centralization Risk

Category	Severity	Location	Status
Centralization / Privilege	● Major	Global	ⓘ Acknowledged

Description

In the contract `Ownable`, the role `owner` has the authority over the following function:

- renounceOwnership()
- transferOwnership()

In the contract `MRS`, the role `owner` has the authority over the following function:

- addWhitelist()
- multiBlacklist()
- multiRemoveFromBlacklist()
- setAntiWhale()
- setMaxSell()
- setAntiWhaleEnd()
- rescueStuckErc20()

Any compromise to the `owner` account may allow the hacker to take advantage of this.

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 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.

Alleviation

The team acknowledged.

GLOBAL-02 | Missing Emit Events

Category	Severity	Location	Status
Coding Style	● Informational	Global	✓ Resolved

Description

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

- setAntiWhale()
- setMaxSell()
- setAntiWhaleEnd()

Recommendation

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

Alleviation

The team heeded our advice and changed related codes. Code change was applied in commit 5f2e1a008d8c6e445de26886a59b19a0102d23f8.

MRS-01 | Unlocked Compiler Version

Category	Severity	Location	Status
Language Specific	● Informational	MRS.sol: 2	✓ Resolved

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

The team heeded our advice and changed related codes. Code change was applied in commit 5f2e1a008d8c6e445de26886a59b19a0102d23f8.

MRS-02 | Too Many Digits

Category	Severity	Location	Status
Coding Style	● Informational	MRS.sol: 1023, 1028	✓ Resolved

Description

Literals with many digits are difficult to read and review.

Recommendation

We recommend modifying as below:

```
1023  uint256 private _totalSupply = 3 * 10**8 * 10**uint256(_decimals);
```

```
1028  uint256 public maxSell = 3000 * 10**uint256(_decimals);
```

Alleviation

The team heeded our advice and changed related codes. Code change was applied in commit 5f2e1a008d8c6e445de26886a59b19a0102d23f8.

MRS-03 | Useless Variable

Category	Severity	Location	Status
Language Specific, Gas Optimization	● Informational	MRS.sol: 1024	✓ Resolved

Description

The variable `_tFeeTotal` is never used in this contract.

Recommendation

We advise to remove the useless variables.

Alleviation

The team heeded our advice and changed related codes. Code change was applied in commit 5f2e1a008d8c6e445de26886a59b19a0102d23f8.

MRS-04 | Token Minted To Centralized Address

Category	Severity	Location	Status
Centralization / Privilege	● **Major**	MRS.sol: 1040	ⓘ Acknowledged

Description

The amount of `_totalSupply` tokens that are minted to the centralized address `msg.sender` who is `owner`, may raise the community's concerns about the centralization issue.

Recommendation

We advise the client to carefully manage the `owner` account's private key and avoid any potential risks of being hacked. We also advise the client to adopt Multisig, Timelock, and/or DAO in the project to manage this specific account in this case.

Alleviation

The team acknowledged.

MRS-05 | Ambiguous Function Name

Category	Severity	Location	Status
Coding Style	● Informational	MRS.sol: 1044	✓ Resolved

Description

The function name `addWhitelist` is ambiguous, since it also can remove accounts from whitelist.

Recommendation

We recommend changing the name `addWhitelist` to `setWhitelist`.

Alleviation

The team heeded our advice and changed related codes. Code change was applied in commit 5f2e1a008d8c6e445de26886a59b19a0102d23f8.

MRS-06 | Lack of Input Validation

Category	Severity	Location	Status
Volatile Code	● Minor	MRS.sol: 1064~1070	✓ Resolved

Description

The length of array `receivers[]` and `amounts[]` should be the same. Function `multiTransfer()` misses the validation.

Recommendation

We recommend adding the validation of array's length.

Alleviation

The team heeded our advice and changed related codes. Code change was applied in commit 5f2e1a008d8c6e445de26886a59b19a0102d23f8.

MRS-07 | Missing Error Messages

Category	Severity	Location	Status
Coding Style	● Informational	MRS.sol: 1173, 1190~1191	✓ Resolved

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 providing a string message containing details about the error.

Alleviation

The team heeded our advice and changed related codes. Code change was applied in commit 5f2e1a008d8c6e445de26886a59b19a0102d23f8.

MRS-08 | Unreachable `else-clause` in Function `antiWhale()`

Category	Severity	Location	Status
Coding Style	● Informational	MRS.sol: 1214~1240	✓ Resolved

Description

The `traders[_sender]["SELL"].lastTrade` is either 0 or bigger than 0. As a result, the last `else-clause` at Line 1233~1238 is unreachable.

```
1221  if (_amount > maxSell) {
1222    revert("Anti whale sell");
1223  }
1224  else if (traders[_sender]["SELL"].lastTrade == 0) {
1225      traders[_sender]["SELL"] = TraderInfo({
1226          lastTrade: curTime,
1227          amount: _amount
1228      });
1229  } else if (
1230      traders[_sender]["SELL"].lastTrade  > 0
1231  ) {
1232      revert("Wait for next trade");
1233  } else {
1234      traders[_sender]["SELL"] = TraderInfo({
1235          lastTrade: curTime,
1236          amount: _amount
1237      });
1238  }
```

Recommendation

We recommend changing as blew:

```
if (_amount > maxSell) {
  revert("Anti whale sell");
} else if (traders[_sender]["SELL"].lastTrade == 0) {
    traders[_sender]["SELL"] = TraderInfo({
        lastTrade: curTime,
        amount: _amount
    });
} else {
    revert("Wait for next trade");
}
```

Alleviation

The team heeded our advice and changed related codes. Code change was applied in commit 5f2e1a008d8c6e445de26886a59b19a0102d23f8.

MRS-09 | Function `burnFrom()` Available for Everyone

Category	Severity	Location	Status
Inconsistency	● Informational	MRS.sol: 498, 1185	✓ Resolved

Description

The function `burn()` in abstract contract `ERC20Burnable` is `override` in contract `MRS`, so that only owner can call the `burn()` successfully. It seems that you do not want users burn their tokens on their own. However, the public function `burnFrom()` is not `override` in contract `MRS` and is still available for everyone. This means users still can burn tokens from other accounts with approval. Please make sure whether you allow users to burn tokens or not.

Alleviation

The team removed all the related codes about `burn`. Code change was applied in commit 5f2e1a008d8c6e445de26886a59b19a0102d23f8.

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.

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.

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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