



SMART CONTRACT AUDIT



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PREPARED FOR

MAGE WARS



INTRODUCTION

Auditing Firm	InterFi Network
Client Firm	Mage Wars
Methodology	Automated Analysis, Manual Code Review
Language	Solidity
Contract	0x6e170c1C645c34b766a683C6a1eBF9D5758D4765
Blockchain	Binance Smart Chain
Centralization	Active ownership
Commit	da6dab55321c78f2ce19d2f5e8319d1d84dd14a1
Website	https://magewars.io/
Telegram	https://t.me/MageWarsbnb/ https://t.me/magewars_chat/
Twitter	https://twitter.com/magewars_io/
Preliminary Report	February 21, 2023
Final Report	February 26, 2023

 Verify the authenticity of this report on our website: <https://www.github.com/interfinetwork>



EXECUTIVE SUMMARY

InterFi has performed the automated and manual analysis of solidity codes. Solidity codes were reviewed for common contract vulnerabilities and centralized exploits. Here's a quick audit summary:

Status	Major 🟠	Medium 🟡	Minor 🟢	Unknown 🟤	Informational 🟡
Open	0	1	2	0	0
Acknowledged	0	2	1	1	1
Resolved	1*	0	0	0	0
Noteworthy Functions	Withdraw/Collect/Swap Money, Add Runes, Create Arena				

i Please note that smart contracts deployed on blockchains aren't resistant to exploits, vulnerabilities and/or hacks. Blockchain and cryptography assets utilize new and emerging technologies. These technologies present a high level of ongoing risks. For a detailed understanding of risk severity, source code vulnerability, and audit limitations, kindly review the audit report thoroughly.

i Please note that centralization privileges regardless of their inherited risk status - constitute an elevated impact on smart contract safety and security.



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SCOPE OF WORK

InterFi was consulted by Mage Wars to conduct the smart contract audit of their solidity source codes.

The audit scope of work is strictly limited to mentioned solidity file(s) only:

- MageWars.sol

i If source codes are not deployed on the main net, they can be modified or altered before main-net deployment. Verify the contract's deployment status below:

Public Contract Link	
https://bscscan.com/address/0x6e170c1c645c34b766a683c6a1ebf9d5758d4765#code	
Contract Name	MageWars
Compiler Version	0.8.17
License	UNLICENSED



AUDIT METHODOLOGY

Smart contract audits are conducted using a set of standards and procedures. Mutual collaboration is essential to performing an effective smart contract audit. Here's a brief overview of InterFi's auditing process and methodology:

CONNECT

- The onboarding team gathers source codes, and specifications to make sure we understand the size, and scope of the smart contract audit.

AUDIT

- Automated analysis is performed to identify common contract vulnerabilities. We may use the following third-party frameworks and dependencies to perform the automated analysis:
 - Remix IDE Developer Tool
 - Open Zeppelin Code Analyzer
 - SWC Vulnerabilities Registry
 - DEX Dependencies, e.g., Pancakeswap, Uniswap
- Simulations are performed to identify centralized exploits causing contract and/or trade locks.
- A manual line-by-line analysis is performed to identify contract issues and centralized privileges.

We may inspect below mentioned common contract vulnerabilities, and centralized exploits:

Centralized Exploits	<ul style="list-style-type: none">○ Token Supply Manipulation○ Access Control and Authorization○ Assets Manipulation○ Ownership Control○ Liquidity Access○ Stop and Pause Trading○ Ownable Library Verification
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Common Contract Vulnerabilities

- Integer Overflow
- Lack of Arbitrary limits
- Incorrect Inheritance Order
- Typographical Errors
- Requirement Violation
- Gas Optimization
- Coding Style Violations
- Re-entrancy
- Third-Party Dependencies
- Potential Sandwich Attacks
- Irrelevant Codes
- Divide before multiply
- Conformance to Solidity Naming Guides
- Compiler Specific Warnings
- Language Specific Warnings

REPORT

- The auditing team provides a preliminary report specifying all the checks which have been performed and the findings thereof.
- The client's development team reviews the report and makes amendments to solidity codes.
- The auditing team provides the final comprehensive report with open and unresolved issues.

PUBLISH

- The client may use the audit report internally or disclose it publicly.

 It is important to note that there is no pass or fail in the audit, it is recommended to view the audit as an unbiased assessment of the safety of solidity codes.



RISK CATEGORIES

Smart contracts are generally designed to hold, approve, and transfer tokens. This makes them very tempting attack targets. A successful external attack may allow the external attacker to directly exploit. A successful centralization-related exploit may allow the privileged role to directly exploit. All risks which are identified in the audit report are categorized here for the reader to review:

Risk Type	Definition
Major 🟠	These risks can be exploited easily and can lead to asset loss, data loss, asset, or data manipulation. They should be fixed right away.
Medium 🟡	These risks are very important to fix, they carry an elevated risk of smart contract exploitation, which can lead to major-risk severity.
Minor 🟢	These risks do not pose a considerable risk to the contract or those who interact with it. They are code-style violations and deviations from standard practices. They should be highlighted and fixed nonetheless.
Unknown 🟤	These risks pose uncertain severity to the contract or those who interact with it. They should be fixed immediately to mitigate the risk uncertainty.
Informational ⚪	These risks do not pose any risk to the contract or those who interact with it. These are compiler version, optimization and gas-related issues.

All statuses which are identified in the audit report are categorized here for the reader to review:

Status Type	Definition
Open	Risks are open.
Acknowledged	Risks are acknowledged, but not fixed.
Resolved	Risks are acknowledged and fixed.



CENTRALIZED PRIVILEGES

Centralization risk is the most common cause of cryptography asset loss. When a smart contract has a privileged role, the risk related to centralization is elevated.

There are some well-intended reasons have privileged roles, such as:

- Privileged roles can be granted the power to pause() the contract in case of an external attack.
- Privileged roles can use functions like, include(), and exclude() to add or remove wallets from fees, swap checks, and transaction limits. This is useful to run a presale and to list on an exchange.

Authorizing privileged roles to externally-owned-account (EOA) is dangerous. Lately, centralization-related losses are increasing in frequency and magnitude.

- The client can lower centralization-related risks by implementing below mentioned practices:
- Privileged role's private key must be carefully secured to avoid any potential hack.
- Privileged role should be shared by multi-signature (multi-sig) wallets.
- Authorized privilege can be locked in a contract, user voting, or community DAO can be introduced to unlock the privilege.
- Renouncing the contract ownership, and privileged roles.
- Remove functions with elevated centralization risk.


















 Understand the project's initial asset distribution. Assets in the liquidity pair should be locked. Assets outside the liquidity pair should be locked with a release schedule.



AUTOMATED ANALYSIS

Symbol	Definition
	Function modifies state
	Function is payable
	Function is internal
	Function is private
	Function is important

```

| **MageWars** | Implementation | |||
| L | addRunes | Public ! |  |NO ! |
| L | withdrawMoney | Public ! |  |NO ! |
| L | collectMoney | Public ! |  |NO ! |
| L | swapMoney | Public ! |  |NO ! |
| L | upgradeTower | Public ! |  |NO ! |
| L | upgradeAltar | Public ! |  |NO ! |
| L | upgradeSpells | Public ! |  |NO ! |
| L | sellTower | Public ! |  |NO ! |
| L | getMages | Public ! | |NO ! |
| L | syncTower | Internal  |  | |
| L | getUpgradeTowerPrice | Internal  | | |
| L | getUpgradeSpellPrice | Internal  | | |
| L | getUpgradeAltarPrice | Internal  | | |
| L | getTowerYield | Internal  | | |
| L | getLeaderBonusPercent | Internal  | | |
| L | getSpellYield | Internal  | | |
| L | getAltarHours | Internal  | | |

```

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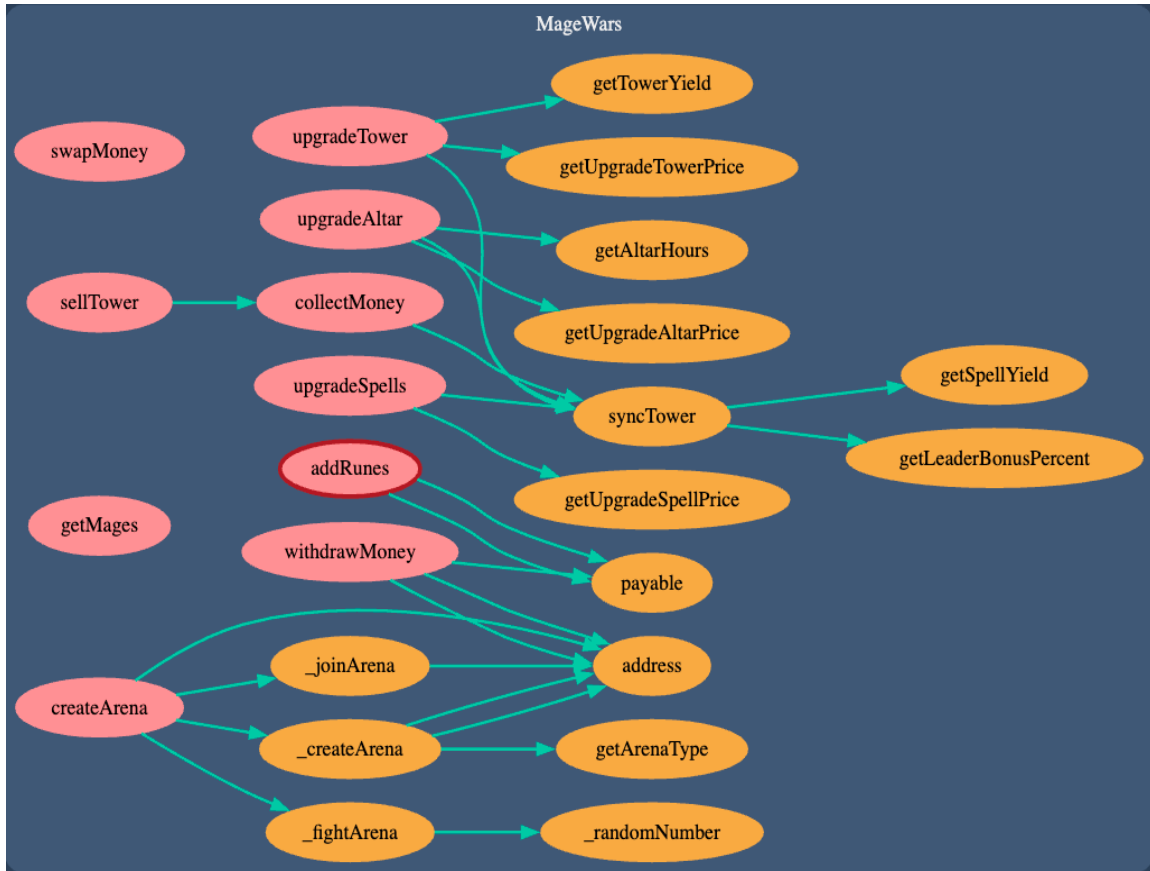
	^		createArena		Public	!		🔴		NO	!	
	^		getArenaType		Internal	🔒						
	^		_randomNumber		Internal	🔒						
	^		_createArena		Internal	🔒		🔴				
	^		_joinArena		Internal	🔒		🔴				
	^		_fightArena		Internal	🔒		🔴				

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CALLOUT GRAPH



MANUAL REVIEW

Identifier	Definition	Severity
CEN-01	Centralized risks of Magewars	Medium ●
MAG-00	Lack of access control	

The `addRunes()` function sends 5% of the investment to two different addresses (`manager1` and `manager2`). These central point of control poses some risks, as these addresses may be able to influence the game significantly by collecting a large portion of the funds.

```
address public manager1 = 0x395F6B9597c30D5143142379c38940200Bfa72aB;
address public manager2 = 0xa6B6615A6A3562BaF5FEB52fc86A7D9aAe86d3fE;
```

The `defaultRef` variable specifies a default referral address that will be used if the user's referral address is not set. This creates a central point of control.

```
address public defaultRef = 0x23c35894340cb2D881f8022E15C73A5df41aECCF;
```

RECOMMENDATION

Privileged roles' private keys should be secured carefully to deter unauthorized use. Please refer to PAGE-09 CENTRALIZED PRIVILEGES for a detailed understanding.

Define access control to restrict access to important functions in the code.



Identifier	Definition	Severity
LOG-03	Re-entrancy	Major 🟡

Below mentioned functions are used without re-entrancy guard:

```
addRunes()
withdrawMoney()
```

Below mentioned functions should be verified for Checks Effects Interactions and/or should be provided adequate access control:

```
collectMoney()
swapMoney()
upgradeTower()
upgradeAltar()
upgradeSpells()
sellTower()
createArena()
```

RECOMMENDATION

Use Checks Effects Interactions pattern when handing over the flow to an external entity and/or guard functions against re-entrancy attacks. Re-entrancy guard is used to prevent re-entrant calls. Learn more: <https://consensys.github.io/smart-contract-best-practices/attacks/reentrancy/>

PARTIAL RESOLUTION*

Mage Wars team has added check to `withdrawMoney()`. However, no other changes are made to the code, Mage Wars team has agreed to keep the rest of the code as-is.



Identifier	Definition	Severity
LOG-07	Lack of event logging	Minor ●

There are no events being logged in the contract, which makes it difficult to track and analyze the contract's activities.

RECOMMENDATION

Events should be used to log important contract events, such as tower upgrades, battles, and arena results.



Identifier	Definition	Severity
MAG-01	block.timestamp for random number generation	Medium 🟡

Be aware that the timestamp of the block can be manipulated by a miner. When the contract uses the timestamp to seed a random number, the miner can actually post a timestamp within 15 seconds of the block being validated, effectively allowing the miner to precompute an option more favorable to their chances.

RECOMMENDATION

Use a secure random number generator, such as Chainlink's VRF (Verifiable Random Function) or Oracles for random number generation.

ACKNOWLEDGEMENT

Mage Wars team has acknowledged this finding, and has agreed to keep the code as-is.



Identifier	Definition	Severity
COD-01	Authorization through tx.origin	Medium 🟡

Using tx.origin for authorization could make the contract vulnerable as it refers to the original external account that started the transaction.


RECOMMENDATION

Avoid authorizations via global variables wherever necessary.

ACKNOWLEDGEMENT

Mage Wars team has acknowledged this finding, and has agreed to keep the code as-is.



Identifier	Definition	Severity
COD-10	Gas consumption	Minor 

Use of the keccak256 hash function multiple times in `_randomNumber()` can result in high gas costs, which could be a concern for users.


RECOMMENDATION

Make a single call to keccak256 and pass all of the relevant variables in one `abi.encodePacked()` call.

ACKNOWLEDGEMENT

Mage Wars team has acknowledged this finding, and has agreed to keep the code as-is.



Identifier	Definition	Severity
COD-06	Hardcoded addresses	Minor 

Mentioned addresses are hardcoded in the contract.


```
address public manager1 = 0x395F6B9597c30D5143142379c38940200Bfa72aB;  
address public manager2 = 0xa6B6615A6A3562BaF5FEB52fc86A7D9aAe86d3fE;  
address public defaultRef = 0x23c35894340cb2D881f8022E15C73A5df41aECCF;
```

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RECOMMENDATION

To increase contract flexibility, provide access control to change aforementioned addresses in an event of a hack.



Identifier	Definition	Severity
COD-08	Lack of fallback function	Informational 

Fallback functions are usually executed in one of the following cases: If a function identifier doesn't match any of the available functions in a smart contract. If there was no data supplied along with the function call.

RECOMMENDATION

Use fallback function with empty data, and mark it external, and payable.

ACKNOWLEDGEMENT

Mage Wars team has acknowledged this finding, and has agreed to keep the code as-is.



Identifier	Definition	Severity
COD-10	Third Party Dependencies	Unknown 🟤

Smart contract is interacting with third party protocols. The scope of the audit treats third party entities as black boxes and assumes their functional correctness. However, in the real world, third parties can be compromised, and exploited. Moreover, upgrades in third parties can create severe impacts, e.g., increased transactional fees, deprecation of previous routers, etc.

RECOMMENDATION

Inspect third party dependencies regularly, and mitigate severe impacts whenever necessary.

ACKNOWLEDGEMENT

Mage Wars team has acknowledged this finding, and has agreed to keep the code as-is.



DISCLAIMERS

InterFi Network provides the easy-to-understand audit of solidity source codes (commonly known as smart contracts).

The smart contract for this particular audit was analyzed for common contract vulnerabilities, and centralization exploits. This audit report makes no statements or warranties on the security of the code. This audit report does not provide any warranty or guarantee regarding the absolute bug-free nature of the smart contract analyzed, nor do they provide any indication of the client's business, business model or legal compliance. This audit report does not extend to the compiler layer, any other areas beyond the programming language, or other programming aspects that could present security risks. Cryptographic tokens are emergent technologies, they carry high levels of technical risks and uncertainty. 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. This audit report could include false positives, false negatives, and other unpredictable results.

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ABOUT INTERFI NETWORK

InterFi Network provides intelligent blockchain solutions. We provide solidity development, testing, and auditing services. We have developed 150+ solidity codes, audited 1000+ smart contracts, and analyzed 500,000+ code lines. We have worked on major public blockchains e.g., Ethereum, Binance, Cronos, Doge, Polygon, Avalanche, Metis, Fantom, Bitcoin Cash, Velas, Oasis, etc.

InterFi Network is built by engineers, developers, UI experts, and blockchain enthusiasts. Our team currently consists of 4 core members, and 6+ casual contributors.

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