InterFi NETWORK

SMART CONTRACT AUDIT

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PREPARED FOR

GEMPAD LOCK CONTRACT

INTRODUCTION

Auditing Firm	InterFi Network
Client Firm	GemPad
Methodology	Automated Analysis, Manual Code Review
Language	Solidity
Contract#1	0x21A7dC46958fc6939E1E53d386e26dbef4Cb8a92
Blockchain#1	Ethereum Chain
Contract#2	0xDE87C31111a48721CF8C4B12E65fdaf7dde72971
Blockchain#2	Binance Smart Chain
Centralization	Active ownership
Commit	e2f6980865780e217ebe0bfc043622b499be6710
Website	https://gempad.app/
Telegram	https://t.me/TheGemPad
Twitter	https://twitter.com/thegempad
Report Date	January 30, 2022
Amend Date	August 14, 2023

ℹ 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	Critical 🔴	Major 🟠	Medium 🟡	Minor 🟢	Unknown 🟤
Open	0	0	0	2	0
Acknowledged	1	1	1	0	1
Resolved	0	0	0	2	0

ℹ️ 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.

ℹ️ 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 GemPad 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:

- Lock.sol
- ILock.sol

ℹ️ If source codes are not deployed on the main net, they can be modified or altered before main-net deployment.

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	○ Token Supply Manipulation ○ Access Control and Authorization ○ Assets Manipulation ○ Ownership Control ○ Liquidity Access ○ Stop and Pause Trading ○ Ownable Library Verification

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.

ℹ️ 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
Critical 🔴	These risks could be exploited easily and can lead to asset loss, data loss, asset, or data manipulation. They should be fixed right away.
Major 🟠	These risks are hard to exploit but very important to fix, they carry an elevated risk of smart contract manipulation, which can lead to high-risk severity.
Medium 🟡	These risks should be fixed, as they carry an inherent risk of future exploits, and hacks which may or may not impact the smart contract execution. Low-risk re-entrancy-related vulnerabilities should be fixed to deter exploits.
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.

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.

ℹ️ 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

Lock	Implementation	ILock		
└	add	External !	🛑	NO!
└	unlockLiquidity	External !	🛑	NO!
└	unlockToken	External !	🛑	NO!
└	extendLock	External !	🛑	NO!
└	getLiquidityAddresses	Public !		NO!
└	getTokenAddresses	Public !		NO!
└	getTokenDetails	Public !		NO!
└	getLiquidityDetails	Public !		NO!
└	getLiquiditySearch	Public !		NO!
IERC20MetadataUpgradeable	Interface	IERC20Upgradeable		
└	name	External !		NO!
└	symbol	External !		NO!
└	decimals	External !		NO!
IPancakePair	Interface			
└	name	External !		NO!

| └ | symbol | External ❗ | | NO❗ |

| └ | decimals | External ❗ | | NO❗ |

| └ | totalSupply | External ❗ | | NO❗ |

| └ | balanceOf | External ❗ | | NO❗ |

| └ | allowance | External ❗ | | NO❗ |

| └ | approve | External ❗ | 🛑 | NO❗ |

| └ | transfer | External ❗ | 🛑 | NO❗ |

| └ | transferFrom | External ❗ | 🛑 | NO❗ |

| └ | DOMAIN_SEPARATOR | External ❗ | | NO❗ |

| └ | PERMIT_TYPEHASH | External ❗ | | NO❗ |

| └ | nonces | External ❗ | | NO❗ |

| └ | permit | External ❗ | 🛑 | NO❗ |

| └ | MINIMUM_LIQUIDITY | External ❗ | | NO❗ |

| └ | factory | External ❗ | | NO❗ |

| └ | token0 | External ❗ | | NO❗ |

| └ | token1 | External ❗ | | NO❗ |

| └ | getReserves | External ❗ | | NO❗ |

| └ | price0CumulativeLast | External ❗ | | NO❗ |

| └ | price1CumulativeLast | External ❗ | | NO❗ |

| └ | kLast | External ❗ | | NO❗ |

| └ | mint | External ❗ | 🛑 | NO❗ |

| └ | burn | External ❗ | 🛑 | NO❗ |

| └ | swap | External ❗ | 🛑 | NO❗ |

| └ | skim | External ❗ | 🛑 | NO❗ |

| └ | sync | External ❗ | 🛑 | NO❗ |

| └ | initialize | External ❗ | 🛑 | NO❗ |

||||||

| **ILock** | Interface | |||

| └ | liquidities | External ❗ | | |NO❗ |

| └ | tokens | External ❗ | | |NO❗ |

| └ | add | External ❗ | 🛑 | |NO❗ |

| └ | unlockLiquidity | External ❗ | 🛑 | |NO❗ |

| └ | unlockToken | External ❗ | 🛑 | |NO❗ |

| └ | extendLock | External ❗ | 🛑 | |NO❗ |

||||||

| **SafeERC20Upgradeable** | Library | | |||

| └ | safeTransfer | Internal 🔒 | 🛑 | | |

| └ | safeTransferFrom | Internal 🔒 | 🛑 | | |

| └ | safeApprove | Internal 🔒 | 🛑 | | |

| └ | safeIncreaseAllowance | Internal 🔒 | 🛑 | | |

| └ | safeDecreaseAllowance | Internal 🔒 | 🛑 | | |

| └ | _callOptionalReturn | Private 🔐 | 🛑 | | |

||||||

| **IERC20Upgradeable** | Interface | | |||

| └ | totalSupply | External ❗ | | |NO❗ |

| └ | balanceOf | External ❗ | | |NO❗ |

| └ | transfer | External ❗ | 🛑 | |NO❗ |

| └ | allowance | External ❗ | | |NO❗ |

| └ | approve | External ❗ | 🛑 | |NO❗ |

| └ | transferFrom | External ❗ | 🛑 | |NO❗ |

||||||

| **AddressUpgradeable** | Library | | |||

| └ | isContract | Internal 🔒 | | | |

| └ | sendValue | Internal 🔒 | 🛑 | | |

| └ | functionCall | Internal 🔒 | 🛑 | | |

| └ | functionCall | Internal 🔒 | 🛑 | | |

| └ | functionCallWithValue | Internal 🔒 | 🛑 | |

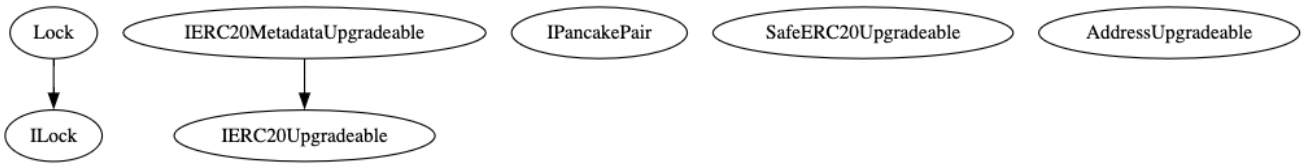
| └ | functionCallWithValue | Internal 🔒 | 🛑 | |

| └ | functionStaticCall | Internal 🔒 | | |

| └ | functionStaticCall | Internal 🔒 | | |

| └ | verifyCallResult | Internal 🔒 | | |

INHERITANCE GRAPH



MANUAL REVIEW

Identifier	Definition	Severity
CEN-01	Lack of centralized privileges and role-based access controls	Major
LOG-01	Unrestricted operations	

Smart contract lacks clear ownership mechanism or access control to set administrative values. Access control is a fundamental security measure in smart contracts to prevent unauthorized state changes.

`add` function lets any user lock tokens on behalf of any other address by specifying the `_owner` parameter. This may be manipulated without proper checks.

Both `unlockLiquidity` and `unlockToken` can be called by any user for any `liquidityId` or `tokenId`, respectively. Without checks, these functions may be vulnerable.

Smart contract logic that deletes items from the `liquidityList` and `tokenList` arrays is unrestricted.

Any address, whether it's owner of the contract or arbitrary external actor, can call `extendLock`.

RECOMMENDATION

Add access control restrictions wherever necessary.

ACKNOWLEDGEMENT

GemPad team argued that lock smart contracts require minimal centralized intervention, therefore, there's no clear ownership mechanism or access control.

Identifier	Definition	Severity
CEN-09	Use of proxy and upgradeable contracts	Critical 🔴

Privileged role can initiate contract implementation. Contract upgradeability allows privileged roles to change current contract implementation.

```
contract Lock is ILock {
  using SafeERC20Upgradeable for IERC20MetadataUpgradeable;

_authorizeUpgrade()
```


RECOMMENDATION

Test and validate current contract thoroughly before deployment. Project team should add `_disableInitializers` in upgradeable implementation to add a safety measure that prevents initializer functions from being called more than once, reducing the risk of unintended behavior or vulnerabilities.

While proxy contracts are great for robust deployments while maintaining the upgradeable flexibility, *proxy codes are prone to new security or logical issues that will compromise the project.*

ACKNOWLEDGEMENT

GemPad team iterated that contract uses proxy mechanism to have future contract upgradeability, and contract flexibility.

Identifier	Definition	Severity
LOG-02	Potential front-running	Minor

Front-running risk exists because an attacker can observe the pending transactions in the `mempool` and submit a transaction with a higher gas price to have their transaction executed before the original one. Due to the transparent nature of blockchain transactions, malicious actors can observe pending transactions and try to front-run them. For instance, in `add` function, someone can observe a transaction and try to interact with the contract before that transaction is mined.

RECOMMENDATION

Functions responsible for transfer should be provided reasonable minimum output amounts, instead of zero.

RESOLUTION

Since these are lock contracts, owners with appropriate allowance of their own tokens can lock. Front-running these operations should not be a viable outcome.

Identifier	Definition	
LOG-03	Re-entrancy	

Re-entrancy occurs when, before a function completes execution, the control flow is transferred to an external contract which then calls back into the original function.

NOTE

Use of the `SafeERC20Upgradeable` library to handle token transfers mitigates re-entrancy risks for token operations. *OpenZeppelin* Re-entrancy Guard can be added as required.

Identifier	Definition	Severity
LOG-04	Logical oversight	Minor

User can add to an existing lock with the same `_endDateTime`. A user can keep adding to a lock that's near unlock time, extending the lock's size without extending its duration.

Deleting tokens from the `liquidities` and `tokens` arrays may not prevent multiple deletions of the same entry.

NOTE

This is not a vulnerability itself per se, it's an oversight that can be reviewed.

Identifier	Definition	Severity
COD-02	Timestamp manipulation via `block.timestamp`	Minor

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

NOTE

Ensure that minor deviations in timing aren't critical to the contract's operation.

RESOLUTION

Since locks are set for days, ideally, timestamp manipulation within seconds is not possible.

Identifier	Definition	
COD-04	Potential flash loan scenario	

Smart contracts do not appear to have direct flash loan vulnerabilities. Flash loan attacks typically exploit functions that rely on external data, e.g., oracles or functions that can be gamed within a single transaction.

NOTE

Due to the interconnected nature of DeFi contracts, one contract's vulnerability can be exploited using another contract. Be cautious while interacting with third-party tokens.

Identifier	Definition	
COD-09	Lack of emergency stop mechanism	

Add functions like `pause()` and `emergencyWithdraw()` to halt certain functions or allow users to withdraw their tokens in certain scenarios.

Identifier	Definition	Severity
COD-10	Direct and indirect dependencies	Unknown

Smart contracts are interacting with third party protocols e.g., Token Contracts, External Contracts and Interfaces, Web 3 Applications, Open Zeppelin tools, etc. The scope of the audit treats these entities as black boxes and assumes their functional correctness. However, in the real world, all of them can be compromised, and exploited. Moreover, upgrades in these entities can create severe impacts, e.g., increased transactional fees, deprecation of previous routers pairs, etc. It's crucial to be aware that the token contract (or any entity with control of it) may have a high degree of power over the assets which are being locked.

RECOMMENDATION

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

ACKNOWLEDGEMENT

GemPad team will inspect third party dependencies to minimize downtime from third-party intervention. Since smart contract is upgradeable, project team can push updates when required.

Identifier	Definition	Severity
COM-04	Potential resource exhaustion errors	Minor

Below mentioned functions may throw out of gas errors, if arrays grow too large:

`liquidityList`
`tokenList`

RECOMMENDATION

Set max bound for arrays.

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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SMART CONTRACT AUDITS | SOLIDITY DEVELOPMENT AND TESTING

RELENTLESSLY SECURING PUBLIC AND PRIVATE BLOCKCHAINS