

SMART CONTRACT AUDIT



interfinetwork



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PREPARED FOR


MIRROR PROTOCOL – XRP CONTRACT



INTRODUCTION

Auditing Firm	InterFi Network
Client Firm	The Mirror Protocol
Methodology	Automated Analysis, Manual Code Review
Language	Solidity
Proxy	0x03D4C4faBdE3192E7dec00EeC1F526E0898E2EB7
Implementation	0xC527056Ac41028A9d4950139D71373cca9F1357
Blockchain	Binance Smart Chain
Centralization	Active ownership
Commit	52519c31951af480b108971d3be4b4a7dbb72de8
Website	https://themirrorprotocol.com/
Report Date	September 12, 2023

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


 Contract upgradeability allows privileged roles to change current contract implementation. New implementation is prone to security and logical issues which can compromise the project.



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	1	6	0
Acknowledged	1	1	0	3	1
Resolved	0	0	0	0	0
Major ● Privileges	Initialize Upgrade, Toggle Trading, Set Admin and Distributor Contracts, Airdrop, Clear Contract Balance, Change Launch Settings, Update Routers				

 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.


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



TABLE OF CONTENTS

TABLE OF CONTENTS	4
SCOPE OF WORK.....	5
AUDIT METHODOLOGY	6
RISK CATEGORIES	8
CENTRALIZED PRIVILEGES	9
AUTOMATED ANALYSIS.....	10
MANUAL REVIEW.....	17
DISCLAIMERS	34
ABOUT INTERFI NETWORK	37

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SCOPE OF WORK

InterFi was consulted by The Mirror Protocol 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:**

- MirrorProtocol.sol
- MirrorProtocolAdmin.sol

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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	<ul style="list-style-type: none"> ○ 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
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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
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.

 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





BBTFDynamicMultiDistributor.sol





| ****BBTFDynamicMultiDistributor**** | Implementation | IBBTFMultiDistributor, Initializable, OwnableUpgradeable, LockableFunction |




|  | <Constructor> | Public  |  | NO  |




|  | __BBTFDynamicMultiDistributor_init | Internal  |  | onlyInitializing |




|  | __BBTFDynamicMultiDistributor_init_unchained | Internal  |  | onlyInitializing |




|  | <Receive Ether> | External  |  | NO  |

|  | deposit | Public  |  | NO  |

|  | excludeFromRewards | External  |  | onlyOwnerOrToken |




|  | setShares | Public  |  | onlyToken |

|  | setShare | Public  |  | onlyToken |




|  | _setShare | Internal  |  | |

|  | process | External  |  | NO  |

|  | _process | Private  |  | lockFunction |

|  | _assignBNB | Internal  |  | |

|  | _swapTokenForBNB | Internal  |  | lockTheSwap |

|  | _processBNBSwap | Internal  |  | |

|  | _distributeDividend | Internal  |  | |



```

|  L | getCumulativeDividends | Internal 🔒 |  |  |
|  L | addShareholder | Internal 🔒 | 🔴 |  |
|  L | removeShareholder | Internal 🔒 | 🔴 |  |
|  L | _updateExclusions | Private 🗝️ | 🔴 |  |
|  L | claimDividend | External ! | 🔴 | NO ! |
|  L | _claimDividend | Internal 🔒 | 🔴 | lockFunction |
|  L | getUnpaidEarnings | Public ! |  | NO ! |
|  L | updateMinIterationGas | External ! | 🔴 | onlyOwner |
|  L | updateGasForProcessing | External ! | 🔴 | onlyOwnerOrToken |
|  L | updateDynamicIterationGasAccuracy | External ! | 🔴 | onlyOwner |
|  L | setParentToken | External ! | 🔴 | onlyOwner |
|  L | clearStuckTokens | External ! | 🔴 | onlyOwner |
|  L | setBNBThreshold | External ! | 🔴 | onlyOwner |
|  L | updateRewardToken | External ! | 🔴 | onlyOwner |
|  L | addRewardToken | Public ! | 🔴 | onlyOwner |
|  L | removeRewardToken | External ! | 🔴 | onlyOwner |
|||||

```

BBTFDynamicMultiDistributorStakingSupport,sol

```

| **BBTFDynamicMultiDistributorStakingSupport** | Implementation |
BBTFDynamicMultiDistributor |||
|  L | initialize | Public ! | 🔴 | initializer |
|  L | __BBTFDynamicMultiDistributorStakingSupport_init | Internal 🔒 | 🔴 | onlyInitializing |
|
|  L | __BBTFDynamicMultiDistributorStakingSupport_init_unchained | Internal 🔒 | 🔴 |
onlyInitializing |
|  L | setShare | Public ! | 🔴 | onlyToken |
|  L | setShares | Public ! | 🔴 | onlyToken |

```



| ^L | `updateStakingContract` | External ! | 🔴 | onlyOwner |

MirrorProtocol.sol

| ****MirrorProtocol**** | Implementation | Initializable, IERC20MetadataUpgradeable, LPSwapSupportUpgradeable |||

| ^L | <Constructor> | Public ! | 🔴 | NO ! |

| ^L | `initialize` | Public ! | 🔴 | initializer |

| ^L | `__MirrorProtocol_init` | Internal 🔒 | 🔴 | onlyInitializing |

| ^L | `__MirrorProtocol_init_unchained` | Internal 🔒 | 🔴 | onlyInitializing |

| ^L | <Fallback> | External ! | 🏠 | NO ! |

| ^L | <Receive Ether> | External ! | 🏠 | NO ! |

| ^L | `decimals` | Public ! | | NO ! |

| ^L | `balanceOf` | Public ! | | NO ! |

| ^L | `_balanceOf` | Internal 🔒 | | |

| ^L | `transfer` | Public ! | 🔴 | NO ! |

| ^L | `allowance` | Public ! | | NO ! |

| ^L | `approve` | Public ! | 🔴 | NO ! |

| ^L | `transferFrom` | Public ! | 🔴 | NO ! |

| ^L | `increaseAllowance` | Public ! | 🔴 | NO ! |

| ^L | `decreaseAllowance` | Public ! | 🔴 | NO ! |

| ^L | `updateGasForProcessing` | Public ! | 🔴 | onlyOwner |

| ^L | `_approve` | Internal 🔒 | 🔴 | |

| ^L | `_transfer` | Private 🔒 | 🔴 | |

| ^L | `pushSwap` | External ! | 🔴 | NO ! |

| ^L | `selectSwapEvent` | Private 🔒 | 🔴 | lockTheSwap |

| ^L | `_transferStandard` | Private 🔒 | 🔴 | |

| ^L | `toggleTrading` | External ! | 🔴 | onlyOwner |

| ^L | `toggleLaunchSettings` | External ! | 🔴 | onlyOwner |

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```

| L | updateLaunchSettings | External ! | ● | onlyOwner |
| L | updateDistributorContract | External ! | ● | onlyOwner |
| L | excludeFromRewards | External ! | ● | onlyOwner |
| L | setAdminContract | External ! | ● | onlyOwner |
| L | batchAirdrop | External ! | ● | NO ! |
| L | _batchAirdrop | Private 🔒 | ● | lockTheSwap |
| L | clearStuckTokens | External ! | ● | onlyOwner |
| L | clearStuckBNB | External ! | ● | onlyOwner |

```

MirrorProtocolAdmin.sol

```

| **MirrorProtocolAdmin** | Implementation | IMirrorProtocolAdmin, Initializable,
OwnableUpgradeable, UUPSAccessControlUpgradeable |||
| L | <Constructor> | Public ! | ● | NO ! |
| L | initialize | Public ! | ● | initializer |
| L | __MirrorProtocolAdmin_init | Internal 🔒 | ● | onlyInitializing |
| L | __MirrorProtocolAdmin_init_unchained | Internal 🔒 | ● | onlyInitializing |
| L | updateProcessExempt | External ! | ● | onlyOwner |
| L | updateBlacklist | External ! | ● | onlyOwner |
| L | updatePauseExempt | External ! | ● | onlyOwner |
| L | updateLaunchSettingExempt | External ! | ● | onlyOwner |
| L | updateBatchTransferEnabledAddresses | External ! | ● | onlyOwner |
| L | setLI0 | External ! | ● | onlyOwner |
| L | setOperationsWallet | External ! | ● | onlyOwner |
| L | setStakingAddress | External ! | ● | onlyOwner |
| L | setStakingPoolAddress | External ! | ● | onlyOwner |
| L | setRewardTreasuryWallet | External ! | ● | onlyOwner |
| L | excludeFromFee | External ! | ● | onlyOwner |
| L | getAMMPairs | External ! | | NO ! |

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```

|  L | updateBuyFees | External ! | ● | onlyOwner |
|  L | updateSellFees | External ! | ● | onlyOwner |
|  L | updateTransferFees | External ! | ● | onlyOwner |
|  L | _updateFees | Internal 🔒 | ● | |
|  L | registerPairAddress | Public ! | ● | onlyOwner |
|  L | getAMMPairLength | External ! | ● | NO ! |
|  L | getAMMPairAtIndex | External ! | ● | NO ! |
|  L | isAMMPair | External ! | ● | NO ! |
|  L | processTransfer | External ! | | NO ! |
|  L | _calculateFees | Private 🔒 | | |
|  L | clearStuckTokens | External ! | ● | onlyOwner |
|  L | clearStuckBNB | External ! | ● | onlyOwner |

```

Supporting

```

| **IMirrorProtocolAdmin** | Interface | |||
|  L | canBatchTransfer | External ! | | NO ! |
|  L | isPauseExempt | External ! | | NO ! |
|  L | isLaunchSettingExempt | External ! | | NO ! |
|  L | getAMMPairs | External ! | | NO ! |
|  L | isAMMPair | External ! | ● | NO ! |
|  L | lio | External ! | | NO ! |
|  L | operationsWallet | External ! | | NO ! |
|  L | stakingAddress | External ! | | NO ! |
|  L | stakingPoolAddress | External ! | | NO ! |
|  L | rewardTreasury | External ! | | NO ! |
|  L | processTransfer | External ! | | NO ! |
|||||
| **IBBTFMultiDistributor** | Interface | |||

```



```

|  L | deposit | External ! | 🚫 |NO ! |
|  L | process | External ! | 🔴 |NO ! |
|  L | excludeFromRewards | External ! | 🔴 |NO ! |
|  L | setShares | External ! | 🔴 |NO ! |
|  L | setShare | External ! | 🔴 |NO ! |
|  L | updateGasForProcessing | External ! | 🔴 |NO ! |
|||||
| **LPSwapSupportUpgradeable** | Implementation | OwnableUpgradeable |||
|  L | __LPSwapSupport_init | Internal 🚫 | 🔴 | onlyInitializing |
|  L | __LPSwapSupport_init_unchained | Internal 🚫 | 🔴 | onlyInitializing |
|  L | _approve | Internal 🚫 | 🔴 | |
|  L | _balanceOf | Internal 🚫 | | |
|  L | getSwapRouters | External ! | |NO ! |
|  L | getSwapRouterAtIndex | External ! | |NO ! |
|  L | getSwapRouterCount | External ! | |NO ! |
|  L | updateRouters | Public ! | 🔴 | onlyOwner |
|  L | updateMainRouter | Public ! | 🔴 | onlyOwner |
|  L | updateLiquidityReceiver | External ! | 🔴 | onlyOwner |
|  L | setSwapAndLiquifyEnabled | Public ! | 🔴 | onlyOwner |
|  L | setBuybackAndLiquifyEnabled | Public ! | 🔴 | onlyOwner |
|  L | swapAndLiquify | Internal 🚫 | 🔴 | |
|  L | swapTokensForCurrency | Internal 🚫 | 🔴 | |
|  L | swapTokensForCurrencyUnchecked | Private 🚫 | 🔴 | |
|  L | swapTokensForCurrencyAdv | Internal 🚫 | 🔴 | |
|  L | _swapTokensForCurrencyAdv | Private 🚫 | 🔴 | |
|  L | addLiquidity | Private 🚫 | 🔴 | |
|  L | swapCurrencyForTokens | Internal 🚫 | 🔴 | |
|  L | swapCurrencyForTokensAdv | Internal 🚫 | 🔴 | |

```

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```

|  L | swapCurrencyForTokensUnchecked | Internal  |  |  |  |
|  L | _swapCurrencyForTokensAdv | Private  |  |  |  |
|  L | buybackAndLiquify | Internal  |  |  |  |
|  L | forceBuybackAndLiquify | External  |  |  | onlyOwner |
|  L | updateTokenSwapRange | External  |  |  | onlyOwner |
|  L | updateCurrencySwapRange | External  |  |  | onlyOwner |

|||||

| **LockableFunction** | Implementation |  |||

|||||

```

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MANUAL REVIEW

Identifier	Definition	Severity
CEN-01	Centralized privileges	Major 🟡
CEN-03	Privileged role can perform blacklist	
CEN-05	Privileged role can allow transfer before trading is set to true	
XRM-01	Privileged role can halt trading	
XRM-02	Privileged role can withdraw native token from contract	

Important only owner centralized privileges are listed below:

BBTFDynamicMultiDistributor

excludeFromRewards
 updateMinIterationGas
 updateGasForProcessing
 updateDynamicIterationGasAccuracy
 setParentToken
 clearStuckTokens
 setBNBThreshold
 updateRewardToken
 addRewardToken
 removeRewardToken

BBTFDynamicMultiDistributorStakingSupport

updateStakingContract

MirrorProtocol

updateGasForProcessing
 toggleTrading
 toggleLaunchSettings
 updateLaunchSettings
 updateDistributorContract
 excludeFromRewards



setAdminContract
batchAirdrop
clearStuckTokens
clearStuckBNB

MirrorProtocolAdmin

updateProcessExempt
updateBlacklist
updatePauseExempt
updateLaunchSettingExempt
updateBatchTransferEnabledAddresses
setLIO
setOperationsWallet
setStakingAddress
setStakingPoolAddress
setRewardTreasuryWallet
excludeFromFee
updateBuyFees
updateSellFees
updateTransferFees
registerPairAddress
clearStuckTokens
clearStuckBNB

LPSwapSupportUpgradeable

updateRouters
updateMainRouter
updateLiquidityReceiver
setSwapAndLiquifyEnabled
setBuybackAndLiquifyEnabled
forceBuybackAndLiquify
updateTokenSwapRange
updateCurrencySwapRange

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RECOMMENDATION

Deployers, contract owners, administrators, access controlled, and all other privileged roles' private-keys/access-keys/admin-keys should be secured carefully. These entities can have a single point of failure that compromises the security of the project. Manage centralized and privileged roles carefully, review PAGE 09 for more information.


Implement multi-signature wallets: Require multiple signatures from different parties to execute certain sensitive functions within contracts. This spreads control and reduces the risk of a single party having complete authority.

Use a decentralized governance model: Implement a governance model that enables token holders or other stakeholders to participate in decision-making processes. This can include voting on contract upgrades, parameter changes, or any other critical decisions that impact the contract's functioning.

ACKNOWLEDGEMENT

Mirror Protocol team has argued that privileged roles are used as intended, and agreed to use multi-signature wallets to manage centralization wherever feasible.



Identifier	Definition	Severity
CEN-02	Initial asset distribution of Mirror Protocol token	Minor 

All of the initially minted assets are sent to the project owner when deploying the contract. This can be an issue as the project owner can distribute tokens without consulting the community.

```
totalSupply = _totalSupply;
_balances[_tokenOwner] = totalSupply;
emit Transfer(address(0), _tokenOwner, totalSupply);
```


RECOMMENDATION

Project must communicate with stakeholders and obtain the community consensus while distributing assets.

ACKNOWLEDGEMENT

Mirror Protocol confirmed to distribute tokens as per their pre-determined tokenomics.



Identifier	Definition	Severity
CEN-04	Privileged role receiving LP tokens	Minor 

Smart contract function `addLiquidity()` sends liquidity to `liquidityReceiver`.

```
function addLiquidity(uint256 tokenAmount, uint256 cAmount) private {
    uint256 routerIndex = (++_currentRouterIndex) % swapRouters.length();
    _currentRouterIndex = routerIndex;
    IUniswapV2Router02 swapRouter = IUniswapV2Router02(swapRouters.at(routerIndex));


    // approve token transfer to cover all possible scenarios
    _approve(address(this), address(swapRouter), tokenAmount);

    // add the liquidity
    swapRouter.addLiquidityETH{value: cAmount}(
        address(this),
        tokenAmount,
        0, // slippage is unavoidable
        0, // slippage is unavoidable
        liquidityReceiver,
        block.timestamp
    );
}
```

RECOMMENDATION

Send LP tokens to dead address or unreachable address.



Identifier	Definition	Severity
CEN-06	Privileged role modifying pair and router	Minor 

Privileged role can call `registerPairAddress()`, `updateRouters()`, and `updateMainRouter()`

RECOMMENDATION

The current trading pair, e.g., Pancakeswap or Uniswap pair should not be removed from automated market makers.



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

Privileged role can initiate smart contract implementation. Contract upgradeability allows privileged roles to change current contract implementation. Below mentioned codes can be re-initialized to push upgrades:

BBTFDynamicMultiDistributor.sol
 BBTFDynamicMultiDistributorStakingSupport.sol
 MirrorProtocol.sol
 MirrorProtocolAdmin.sol

Mirror Protocol team has added `_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.


RECOMMENDATION

Test and validate current contract thoroughly before deployment. While proxy contracts are great for robust deployments while maintaining the upgradeable flexibility, proxy codes are prone to new security or logical issues that may compromise the project.

ACKNOWLEDGEMENT

Mirror Protocol confirmed that contract uses proxy mechanism to have future contract upgradeability, and contract flexibility.



Identifier	Definition	Severity
LOG-01	Lack of appropriate arbitrary boundaries	Minor 

Below mentioned functions are set without any arbitrary boundaries.

updateMinIterationGas
updateGasForProcessing
setBNBThreshold
updateBuyFees
updateSellFees
updateTransferFees

RECOMMENDATION

These functions should be provided appropriate upper and lower boundaries, e.g., fees should only be allowed to change within pre-set values.



Identifier	Definition	Severity
LOG-02	Potential front-running	Minor 

Potential front-running also classified as – sandwich attack happens when an attacker observes a transaction swapping tokens or adding liquidity without setting restrictions on slippage or minimum output amount. The attacker can manipulate the exchange rate by front-running a transaction to purchase assets and make profits by back-running a transaction to sell assets. Below mentioned functions are called without setting restrictions on slippage or minimum output:

```
addLiquidityETH
swapExactETHForTokensSupportingFeeOnTransferTokens
swapExactTokensForETHSupportingFeeOnTransferTokens
```

RECOMMENDATION

These functions should be provided reasonable minimum output amounts, instead of zero.



Identifier	Definition	Severity
LOG-03	Re-entrancy and access control	Medium 🟡

Although contracts use a `lockTheSwap` modifier, it is not sufficient as it only sets a boolean flag, but does not prevent any re-entrancy attacks in a standard way.

In addition to the above comment, below mentioned functions are used without a re-entrancy guard or a proper access control:

```
deposit
claimDividend
pushSwap
```

`processTransfer` in `MirrorProtocolAdmin` is marked `external` for gas savings purpose. It can be marked `internal`.

Some functions in `LPSwapSupportUpgradeable` like `swapTokensForCurrencyUnchecked`, `addLiquidity`, and `_swapCurrencyForTokensAdv` are declared as `private`. If the contract is intended to be inherited and those functions are meant to be used or overridden in child contracts, consider changing their visibility to `internal`.

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/>



Identifier	Definition	Severity
COD-02	Timestamp manipulation via <code>block.timestamp</code>	Minor 

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.

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RECOMMENDATION

To maintain block integrity, follow 15 seconds rule, and scale time dependent events accordingly.



Identifier	Definition	Severity
COD-04	Missing or inaccurate error messages	

Some require statements in BBTFDynamicMultiDistributor are not provided error messages for users.

RECOMMENDATION

Provide accurate information strings for require related errors.



Identifier	Definition	Severity
COD-10	Third Party Dependencies	Unknown 🟡

Smart contract is interacting with third party protocols e.g., market makers, parent token, staking token, UUPS upgradeable contracts, front-end applications, Open Zeppelin tools. 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.

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RECOMMENDATION

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

ACKNOWLEDGEMENT

Mirror Protocol team will inspect these dependencies to minimize downtime from external intervention.



Identifier	Definition	Severity
COD-12	Lack of event-driven architecture	Minor ●


Smart contract uses function calls to update state, which can make it difficult to track and analyze changes to the contract over time.

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RECOMMENDATION

Use events to track state changes. Events improve transparency and provide a more granular view of contract activity.



Identifier	Definition	Severity
VOL-01	Irrelevant code	Minor 

Redundant code is found, e.g.

In the `buybackAndLiquify`, there's no need to approve the transfer from the `buybackEscrowAddress` to the current contract since the current contract is the token itself. Instead, you can use the `_transfer` function.

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RECOMMENDATION

Remove redundant code.



Identifier	Definition	Severity
COM-01	Floating compiler status	

Compilers are set to ^0.8.19

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RECOMMENDATION

Pragma should be fixed to the version that you're indenting to deploy your contracts with.



Identifier	Definition	Severity
COM-04	Potential resource exhaustion errors	Minor ●

Below mentioned loops may throw out of gas errors upon executing:

`_rewardsTokens`

`rewardTokenAddresses`

`rewardTokenArray`

`ammPairs`

`arraySize` in `batchAirdrop`

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RECOMMENDATION

Set upper bounds for multi-address calls.



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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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