

Audit Report BinoStake

March 2024

Network BSC

binoStakeBNB 0x9B99d43C545380922346950Ca11C997E111f5ed5

BinoStakeManager 0x14082dBAcE7E826fac4178cD6538ac2b3074a48f

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Table of Contents

Table of Contents	1
Review	3
Audit Updates	3
Source Files	4
Overview	5
Upgradability	6
Findings Breakdown	7
Diagnostics	8
SUP - Stops Undelegation Process	10
Description	10
Recommendation	10
BT - Burns Tokens	11
Description	11
Recommendation	11
CR - Code Repetition	13
Description	13
Recommendation	13
CCR - Contract Centralization Risk	14
Description	14
Recommendation	14
DPI - Delegation Process Inconsistency	16
Description	16
Recommendation	17
MT - Mints Tokens	18
Description	18
Recommendation	18
MEM - Misleading Error Messages	20
Description	20
Recommendation	20
MCFD - Missing Claim Function Distinction	21
Description	21
Recommendation	21
MSC - Missing Sanity Check	22
Description	22
Recommendation	22
PMF - Potential Missing Funds	23
Description	23
Recommendation	23
PTRP - Potential Transfer Revert Propagation	24



Description	24
Recommendation	24
RVU - Redundant Variable Usage	25
Description	25
Recommendation	25
RC - Repetitive Calculations	26
Description	26
Recommendation	26
SVII - State Variable Iterable Increase	27
Description	27
Recommendation	27
L04 - Conformance to Solidity Naming Conventions	28
Description	28
Recommendation	29
L07 - Missing Events Arithmetic	30
Description	30
Recommendation	30
L19 - Stable Compiler Version	31
Description	31
Recommendation	31
Functions Analysis	32
Inheritance Graph	35
Flow Graph	36
Summary	37
Audit, 20 March 2024	37
Disclaimer	38
About Cyberscope	39



Review

Contract Name	binoStakedBNB, BinoStakeManager
Compiler Version	v0.8.24+commit.e11b9ed9
Optimization	200 runs
Explorer	https://bscscan.com/address/0x9b99d43c545380922346950ca 11c997e111f5ed5 https://bscscan.com/address/0x14082dbace7e826fac4178cd65 38ac2b3074a48f
Address	0x9b99d43c545380922346950ca11c997e111f5ed5 0x14082dbace7e826fac4178cd6538ac2b3074a48f
Network	BSC
Symbol	bsBNB
Decimals	18

Audit Updates

Initial Audit	07 Mar 2024
Corrected Phase 2	20 Mar 2024



Source Files

Filename	SHA256
binoStakedBNB.sol	4a51c0fcdc8482ba3118a4ad3e1e0629eb b3df40072ff2bcabd52e5cfa322c07
BinoStakeManager.sol	dc71e7c86314312a39dc29ed2b23a0b1ab c7deb29b278a59d0b1d748f60e3220
interfaces/IStakeManager.sol	0fc044bce42ebf1eabce81037317e09eb31 20f41f0de664e1df4295404c8c97e
interfaces/INativeStaking.sol	ff40e30f96ede65d4fa42e603974d7b0ee25 5fe6c5bee7221f30106d79a050f9
interfaces/IBinoStakedBNB.sol	15c88bd835d1b049ffd6c00790a7b235ac 7f89e90e81d06ea295e0da5eda3d41



Overview

Cyberscope audited two contracts of the BinoStake ecosystem, bimoStakedBNB, BinoStakeManager. The first is a common ERC20 token with additional burn and mint functionality. The latter is designed to manage the staking of BNB on the Binance Smart Chain (BSC). It serves as an intermediary layer between users and the native staking contract. The core functionalities of the contract include depositing BNB, delegating funds to the native staking contract, compounding rewards, requesting withdrawals, undelegating funds, and managing the reserve amount for delegation.

Upon initialization, the BinoStakeManager contract allows for the setting of essential parameters such as the BsBnb token address, admin, manager, bot address, reward fee, revenue pool, and validator. Users can deposit BNB into the contract, which in turn mints BsBnb tokens for the user. The bot role is responsible for delegating users' funds to the native staking contract, either with or without reserved BNB.

Additionally, the contract provides functionalities for compound rewards, requesting and claiming withdrawals, undelegating funds, and managing the reserve amount. It also includes features for proposing and accepting a new manager, setting the validator address, adjusting the reward fee, and managing the revenue pool and redirect address.

Overall, the BinoStakeManager contract facilitates the efficient management and interaction of users' staked BNB assets with the native staking contract on the Binance Smart Chain, providing a secure and flexible staking solution.



Upgradability

In addition to their core functionalities, both contracts are upgradeable, allowing for the potential modification and enhancement of their implementation and functionality over time. This upgradeability feature enables developers to adapt the contracts to changing requirements, fix bugs, and introduce new features without disrupting its deployed instances or requiring users to migrate to a new contract address.

By leveraging upgradeable contracts, the BinoStake ecosystem can evolve alongside advancements in technology and best practices, ensuring its long-term viability and effectiveness in managing staking activities on the Binance Smart Chain. This flexibility underscores the commitment to maintaining and improving the contracts' capabilities to meet the needs of its users and stakeholders in the dynamic blockchain ecosystem.



Findings Breakdown



Sev	erity	Unresolved	Acknowledged	Resolved	Other	
•	Critical	0	0	0	0	
•	Medium	1	0	0	0	
	Minor / Informative	16	0	0	0	



Diagnostics

CriticalMediumMinor / Informative

Severity	Code	Description	Status
•	SUP	Stops Undelegation Process	Unresolved
•	ВТ	Burns Tokens	Unresolved
•	CR	Code Repetition	Unresolved
•	CCR	Contract Centralization Risk	Unresolved
•	DPI	Delegation Process Inconsistency	Unresolved
•	MT	Mints Tokens	Unresolved
•	MEM	Misleading Error Messages	Unresolved
•	MCFD	Missing Claim Function Distinction	Unresolved
•	MSC	Missing Sanity Check	Unresolved
•	PMF	Potential Missing Funds	Unresolved
•	PTRP	Potential Transfer Revert Propagation	Unresolved
•	RVU	Redundant Variable Usage	Unresolved
•	RC	Repetitive Calculations	Unresolved
•	SVII	State Variable Iterable Increase	Unresolved



•	L04	Conformance to Solidity Naming Conventions	Unresolved
•	L07	Missing Events Arithmetic	Unresolved
•	L19	Stable Compiler Version	Unresolved



SUP - Stops Undelegation Process

Criticality	Medium
Location	BinoStakeManager.sol#L335,398
Status	Unresolved

Description

The manager role has the authority to menipulate the reserveAmount parameter. By manipulating the reserveAmount parameter to a substantial value, the undelegate method could ask for an amount higher than the current delegated value. This exploitation could disrupt the functionality of the staking platform.

```
IStaking(NATIVE_STAKING).undelegate{value: msg.value}(validator, _amount +
reserveAmount);

function setReserveAmount(uint256 amount) external override onlyManager {
    reserveAmount = amount;
    emit SetReserveAmount(amount);
}
```

Recommendation

The contract could implement a process tha guarantees the correct operation of the undelegate method. The maximum value that should be asked by the undelegate method should be total delegated amount.



BT - Burns Tokens

Criticality	Minor / Informative
Location	binoStakedBNB.sol#L46
Status	Unresolved

Description

The contract stake manager has the authority to burn tokens from a specific address. The stake manager is intented to be the BinoStakeManager contract. However, the contract's admin can modify the stake manager's address to any address. The stake manager may take advantage of it by calling the burn function. As a result, the targeted address will lose the corresponding tokens.

We state that admin and stakeManager privileges are necessary and required for proper protocol operations. Thus, we emphasize the admins to be extra careful with the credentials.

```
function burn(address _account, uint256 _amount)
    external
    override
    onlyStakeManager
{
    _burn(_account, _amount);
}
```

Recommendation

The team should carefully manage the private keys of the stake manager's account. We strongly recommend a powerful security mechanism that will prevent a single user from accessing the contract admin functions.

Temporary Solutions:

These measurements do not decrease the severity of the finding

- Introduce a time-locker mechanism with a reasonable delay.
- Introduce a multi-signature wallet so that many addresses will confirm the action.

• Introduce a governance model where users will vote about the actions.

Permanent Solution:

• Renouncing the ownership, which will eliminate the threats but it is non-reversible.



CR - Code Repetition

Criticality	Minor / Informative
Location	BinoStakeManager.sol#L139,168,194,307
Status	Unresolved

Description

The contract contains repetitive code segments. There are potential issues that can arise when using code segments in Solidity. Some of them can lead to issues like gas efficiency, complexity, readability, security, and maintainability of the source code. It is generally a good idea to try to minimize code repetition where possible.

```
uint256 relayFee = IStaking(NATIVE_STAKING).getRelayerFee();
uint256 relayFeeReceived = msg.value;
require(relayFeeReceived == relayFee, "Insufficient RelayFee");
```

Recommendation

The team is advised to avoid repeating the same code in multiple places, which can make the contract easier to read and maintain. The authors could try to reuse code wherever possible, as this can help reduce the complexity and size of the contract. For instance, the contract could reuse the common code segments in an internal function in order to avoid repeating the same code in multiple places.



CCR - Contract Centralization Risk

Criticality	Minor / Informative
Location	binoStakedBNB.sol#L54 BinoStakeManager.sol#L424,439,634
Status	Unresolved

Description

The contract's functionality and behavior are heavily dependent on external parameters or configurations. While external configuration can offer flexibility, it also poses several centralization risks that warrant attention. Centralization risks arising from the dependence on external configuration include Single Point of Control, Vulnerability to Attacks, Operational Delays, Trust Dependencies, and Decentralization Erosion.

```
function setStakeManager(address _address)
    external
    override
    onlyRole(DEFAULT_ADMIN_ROLE)
{
    require(stakeManager != _address, "Old address == new address");
    require(_address != address(0), "zero address provided");

    stakeManager = _address;

    emit SetStakeManager(_address);
}
function setBotRole(address _address) external override {
    require(_address != address(0), "zero address provided");

    grantRole(BOT, _address);
}
...
```

Recommendation

To address this finding and mitigate centralization risks, it is recommended to evaluate the feasibility of migrating critical configurations and functionality into the contract's codebase itself. This approach would reduce external dependencies and enhance the contract's



self-sufficiency. It is essential to carefully weigh the trade-offs between external configuration flexibility and the risks associated with centralization.



DPI - Delegation Process Inconsistency

Criticality	Minor / Informative
Location	BinoStakeManager.sol#L131,160,299
Status	Unresolved

Description

The contract includes two functions for delegating funds to the native staking contract:

delegate and delegateWithReserve. While the delegateWithReserve function incorporates the reserveAmount in the delegation process, the delegate function does not. However, there is only one undelegate function, which includes the reserveAmount. This discrepancy may lead to potential transaction reversion if funds were not delegated with the delegateWithReserve function, yet the contract attempts to undelegate them with the undelegate function.

```
function delegate()
    external
    payable
   override
   whenNotPaused
   onlyRole(BOT)
   returns (uint256 _amount)
function delegateWithReserve()
    external
    payable
    override
    whenNotPaused
    onlyRole(BOT)
   returns (uint256 _amount)
function undelegate()
    external
    payable
    override
   whenNotPaused
   onlyRole(BOT)
   returns (uint256 _uuid, uint256 _amount)
{}
```

Recommendation

To ensure consistency and prevent transaction reversion, align the delegation and undelegation processes regarding the reserveAmount parameter. Consider modifying the delegate function to either include the reserveAmount or create a separate undelegate function that does not require the reserveAmount parameter. By implementing these adjustments, the contract can maintain coherence and integrity in both delegation and undelegation operations, enhancing the overall user experience and contract functionality.



MT - Mints Tokens

Criticality	Minor / Informative
Location	binoStakedBNB.sol#L38
Status	Unresolved

Description

The contract stake manager has the authority to mint tokens. The stake manager is intented to be the BinoStakeManager contract. However, the contract's admin can modify the stake manager's address to any address. Additionally, the contract has no cap for the totalSupply. The stake manager may take advantage of it by calling the mint function. As a result, the contract tokens will be highly inflated.

We state that admin and stakeManager privileges are necessary and required for proper protocol operations. Thus, we emphasize the admins to be extra careful with the credentials.

```
function mint(address _account, uint256 _amount)
    external
    override
    onlyStakeManager
{
    _mint(_account, _amount);
}
```

Recommendation

The team should carefully manage the private keys of the stake manager's account. We strongly recommend a powerful security mechanism that will prevent a single user from accessing the contract admin functions.

Temporary Solutions:

These measurements do not decrease the severity of the finding

- Introduce a time-locker mechanism with a reasonable delay.
- Introduce a multi-signature wallet so that many addresses will confirm the action.

• Introduce a governance model where users will vote about the actions.

Permanent Solution:

• Renouncing the ownership, which will eliminate the threats but it is non-reversible.



MEM - Misleading Error Messages

Criticality	Minor / Informative
Location	BinoStakeManager.sol#L457
Status	Unresolved

Description

The contract is using misleading error messages. These error messages do not accurately reflect the problem, making it difficult to identify and fix the issue. As a result, the users will not be able to find the root cause of the error.

```
require(_synFee <= TEN_DECIMALS, "_synFee must not exceed 10000 (100%)");</pre>
```

Recommendation

The team is suggested to provide a descriptive message to the errors. This message can be used to provide additional context about the error that occurred or to explain why the contract execution was halted. This can be useful for debugging and for providing more information to users that interact with the contract.



MCFD - Missing Claim Function Distinction

Criticality	Minor / Informative
Location	BinoStakeManager.sol#L340,361
Status	Unresolved

Description

Within the contract, the functions claimUndelegated and claimFailedDelegation both interact with the native staking contract to claim amounts, but their purposes and consequences differ significantly. However, the contract does not provide a clear way to differentiate between these functions, potentially leading to invalid calls and loss of sequence integrity, particularly with the nextUndelegateUUID.

```
function claimUndelegated()
    external
    override
    whenNotPaused
    onlyRole(BOT)
    returns (uint256 _uuid, uint256 _amount)
{}
function claimFailedDelegation(bool withReserve)
    external
    override
    whenNotPaused
    onlyRole(BOT)
    returns (uint256 _amount)
{}
```

Recommendation

To mitigate confusion and ensure the correct usage of these functions, the team could implement clearer differentiation mechanisms. The team should consider updating the function names and/or adding additional functionality that clearly indicates their intended purpose. For instance, not allowing the execution of the claimFailedDelegation if there is no actual failure during the execution. By enhancing clarity and differentiation, the contract can maintain sequence integrity and minimize the risk of invalid calls or unintended consequences.



MSC - Missing Sanity Check

Criticality	Minor / Informative
Location	BinoStakeManager.sol#L313,394
Status	Unresolved

Description

The contract is processing variables that have not been properly sanitized and checked that they form the proper shape. These variables may produce vulnerability issues.

- The reserveAmount must be less than or equal to totalReserveAmount.
- The undegelate function should be executed only when the totalBsBnbToBurn is greater than 0.

```
reserveAmount = amount;
uint256 totalBsBnbToBurn_ = totalBsBnbToBurn; // To avoid Reentrancy attack
_amount = convertBsBnbToBnb(totalBsBnbToBurn_);
```

Recommendation

The team is advised to properly check the variables according to the required specifications.



PMF - Potential Missing Funds

Criticality	Minor / Informative
Location	BinoStakeManager.sol#L180,335
Status	Unresolved

Description

The delegateWithReserve and undelegate functions incorporate a reserveAmount parameter intended to facilitate additional BNB delegation or undelegation. However, inconsistencies arise between these functions if the stake manager modifies the reserveAmount after a delegation process. This inconsistency results in potential transaction reversion during undelegation, as the increased reserveAmount may not be available in the native staking contract.

```
IStaking(NATIVE_STAKING).delegate{value: _amount + msg.value +
reserveAmount}(validator, _amount + reserveAmount);
IStaking(NATIVE_STAKING).undelegate{value: msg.value}(validator, _amount +
reserveAmount);
```

Recommendation

To ensure consistency and prevent transaction reversion, it is essential to synchronize the reserveAmount adjustments between the delegation and undelegation processes. The team is advised to revise the code segments and rewrite them, so the reserveAmount is consistent throughout the process. By addressing these inconsistencies, the contract can maintain reliability and prevent disruptions to stake delegation and undelegation operations.



PTRP - Potential Transfer Revert Propagation

Criticality	Minor / Informative
Location	BinoStakeManager.sol#L224
Status	Unresolved

Description

The contract sends funds to a revenuePool as part of the compound rewards flow. This address can either be a wallet address or a contract. If the address belongs to a contract then it may revert from incoming payment. As a result, the error will propagate to the staking manager contract and revert the transaction.

```
AddressUpgradeable.sendValue(payable(revenuePool), fee);
```

Recommendation

The contract should tolerate the potential revert from the underlying contracts when the interaction is part of the compound rewards flow. This could be achieved by not allowing set contract addresses or by sending the funds in a non-revertable way.



RVU - Redundant Variable Usage

Criticality	Minor / Informative
Location	BinoStakeManager.sol#L35,299,340
Status	Unresolved

Description

As part of the undelegation process, the contract incorporates the reserveAmount parameter to request an additional BNB amount from the native staking contract, including the user's staked amount. However, in the claimUndelegated function, the reserveAmount is not utilized, indicating redundancy in its inclusion.

```
uint256 public reserveAmount;
```

Recommendation

To streamline the contract logic and eliminate redundancy, consider removing the reserveAmount parameter from the claimUndelegated function. Since it is not utilized within this function, its presence serves no functional purpose and may lead to confusion. By removing the redundant parameter, the contract becomes more concise, easier to understand, and less prone to potential errors or misinterpretations.



RC - Repetitive Calculations

Criticality	Minor / Informative
Location	BinoStakeManager.sol#L174,180
Status	Unresolved

Description

The contract contains methods with multiple occurrences of the same calculation being performed. The calculation is repeated without utilizing a variable to store its result, which leads to redundant code, hinders code readability, and increases gas consumption. Each repetition of the calculation requires computational resources and can impact the performance of the contract, especially if the calculation is resource-intensive.

_amount + reserveAmount

Recommendation

To address this finding and enhance the efficiency and maintainability of the contract, it is recommended to refactor the code by assigning the calculation result to a variable once and then utilizing that variable throughout the method. By storing the calculation result in a variable, the contract eliminates the need for redundant calculations and optimizes code execution.

Refactoring the code to assign the calculation result to a variable has several benefits. It improves code readability by making the purpose and intent of the calculation explicit. It also reduces code redundancy, making the method more concise, easier to maintain, and gas effective. Additionally, by performing the calculation once and reusing the variable, the contract improves performance by avoiding unnecessary computations



SVII - State Variable Iterable Increase

Criticality	Minor / Informative
Location	BinoStakeManager.sol#L353
Status	Unresolved

Description

Gas optimization refers to the process of reducing the amount of gas required to execute a transaction. Gas is the unit of measurement used to calculate the fees paid to miners for including a transaction in a block on the blockchain.

The confirmedUndelegatedUUID variable is incremented within a loop that iterates over undelegated UUIDs. However, this variable could be incremented once after the loop's completion, reducing gas consumption without affecting functionality.

Recommendation

The team is advised to take these segments into consideration and rewrite them so the runtime will be more performant. That way it will improve the efficiency and performance of the source code and reduce the cost of executing it.



L04 - Conformance to Solidity Naming Conventions

Criticality	Minor / Informative
Location	BinoStakeManager.sol#L72,73,74,75,76,77,78,238,268,403,424,431,439, 452,464,477,510,524,541,594,614 binoStakedBNB.sol#L9,12,14,21,38,46,54
Status	Unresolved

Description

The Solidity style guide is a set of guidelines for writing clean and consistent Solidity code. Adhering to a style guide can help improve the readability and maintainability of the Solidity code, making it easier for others to understand and work with.

The followings are a few key points from the Solidity style guide:

- 1. Use camelCase for function and variable names, with the first letter in lowercase (e.g., myVariable, updateCounter).
- 2. Use PascalCase for contract, struct, and enum names, with the first letter in uppercase (e.g., MyContract, UserStruct, ErrorEnum).
- 3. Use uppercase for constant variables and enums (e.g., MAX_VALUE, ERROR_CODE).
- 4. Use indentation to improve readability and structure.
- 5. Use spaces between operators and after commas.
- 6. Use comments to explain the purpose and behavior of the code.
- 7. Keep lines short (around 120 characters) to improve readability.



```
address _bsBnb
address _admin
address _manager
address _bot
uint256 _bsFee
address _revenuePool
address _validator
uint256 _amountInBsBnb
uint256 _idx
address _address
uint256 _uuid
address _user
uint256 _amount
```

Recommendation

By following the Solidity naming convention guidelines, the codebase increased the readability, maintainability, and makes it easier to work with.

Find more information on the Solidity documentation

https://docs.soliditylang.org/en/v0.8.17/style-guide.html#naming-convention.



L07 - Missing Events Arithmetic

Criticality	Minor / Informative
Location	BinoStakeManager.sol#L389,394
Status	Unresolved

Description

Events are a way to record and log information about changes or actions that occur within a contract. They are often used to notify external parties or clients about events that have occurred within the contract, such as the transfer of tokens or the completion of a task.

It's important to carefully design and implement the events in a contract, and to ensure that all required events are included. It's also a good idea to test the contract to ensure that all events are being properly triggered and logged.

```
totalReserveAmount += amount
totalReserveAmount -= amount
```

Recommendation

By including all required events in the contract and thoroughly testing the contract's functionality, the contract ensures that it performs as intended and does not have any missing events that could cause issues with its arithmetic.



L19 - Stable Compiler Version

Criticality	Minor / Informative
Location	BinoStakeManager.sol#L2 binoStakedBNB.sol#L2
Status	Unresolved

Description

The symbol indicates that any version of Solidity that is compatible with the specified version (i.e., any version that is a higher minor or patch version) can be used to compile the contract. The version lock is a mechanism that allows the author to specify a minimum version of the Solidity compiler that must be used to compile the contract code. This is useful because it ensures that the contract will be compiled using a version of the compiler that is known to be compatible with the code.

```
pragma solidity ^0.8.0;
```

Recommendation

The team is advised to lock the pragma to ensure the stability of the codebase. The locked pragma version ensures that the contract will not be deployed with an unexpected version. An unexpected version may produce vulnerabilities and undiscovered bugs. The compiler should be configured to the lowest version that provides all the required functionality for the codebase. As a result, the project will be compiled in a well-tested LTS (Long Term Support) environment.



Functions Analysis

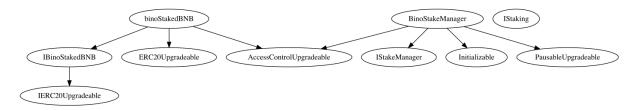
Contract	Туре	Bases		
	Function Name	Visibility	Mutability	Modifiers
binoStakedBNB	Implementation	IBinoStaked BNB, ERC20Upgra deable, AccessContr olUpgradeab le		
		Public	✓	-
	initialize	External	✓	initializer
	name	Public		-
	symbol	Public		-
	mint	External	1	onlyStakeMana ger
	burn	External	✓	onlyStakeMana ger
	setStakeManager	External	✓	onlyRole
BinoStakeMana ger	Implementation	IStakeManag er, Initializable, PausableUp gradeable, AccessContr olUpgradeab le		
		Public	✓	-
	initialize	External	✓	initializer
	deposit	External	Payable	whenNotPause d



delegate	External	Payable	whenNotPause d onlyRole
delegateWithReserve	External	Payable	whenNotPause d onlyRole
redelegate	External	Payable	whenNotPause d onlyManager
compoundRewards	External	✓	whenNotPause d onlyRole
requestWithdraw	External	✓	whenNotPause d
claimWithdraw	External	✓	whenNotPause d
undelegate	External	Payable	whenNotPause d onlyRole
claimUndelegated	External	✓	whenNotPause d onlyRole
claimFailedDelegation	External	✓	whenNotPause d onlyRole
depositReserve	External	Payable	whenNotPause d onlyRedirectAd dress
withdrawReserve	External	1	whenNotPause d onlyRedirectAd dress
setReserveAmount	External	✓	onlyManager
proposeNewManager	External	✓	onlyManager
acceptNewManager	External	✓	-
setBotRole	External	✓	-
revokeBotRole	External	✓	-
setValidator	External	✓	onlyManager
setBsFee	External	✓	onlyRole
setRedirectAddress	External	✓	onlyRole

setRevenuePool	External	✓	onlyRole
getTotalPooledBnb	Public		-
getContracts	External		-
getBotUndelegateRequest	External		-
getUserWithdrawalRequests	External		-
getUserRequestStatus	External		-
getBsBnbWithdrawLimit	External		-
getTokenHubRelayFee	Public		-
convertBnbToBsBnb	Public		-
convertBsBnbToBnb	Public		-
togglePause	External	✓	onlyRole
	External	Payable	-

Inheritance Graph





Flow Graph



Summary

BinoStake contract implements a token and staking mechanism. This audit investigates security issues, business logic concerns, and potential improvements.

Audit, 20 March 2024

At the time of the audit report:

- The binoStakedBNB contract with address
 0x9B99d43C545380922346950Ca11C997E111f5ed5 is pointed out by the following proxy address: 0x56061645EC8Be3D15a247F5328fa8CD417b94C35.
- The BinoStakeManager contract with address
 0x14082dBAcE7E826fac4178cD6538ac2b3074a48f is pointed out by the following proxy address: 0x980A8F25751A840FB152Ad2c97ad4e9fac31545D.



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Blockchain technology and cryptographic assets present a high level of ongoing risk Cyberscope's position is that each company and individual are responsible for their own due diligence and continuous security Cyberscope's goal is to help reduce the attack vectors and the high level of variance associated with utilizing new and consistently changing technologies and in no way claims any guarantee of security or functionality of the technology we agree to analyze. The assessment services provided by Cyberscope are subject to dependencies and are under continuing development. 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 Cryptographic tokens are emergent technologies and carry with them high levels of technical risk and uncertainty. The assessment reports could include false positives false negatives and other unpredictable results. The services may access and depend upon multiple layers of third parties.

About Cyberscope

Cyberscope is a blockchain cybersecurity company that was founded with the vision to make web3.0 a safer place for investors and developers. Since its launch, it has worked with thousands of projects and is estimated to have secured tens of millions of investors' funds.

Cyberscope is one of the leading smart contract audit firms in the crypto space and has built a high-profile network of clients and partners.



The Cyberscope team

https://www.cyberscope.io