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SMART CONTRACT

Security Audit Report

Project:	Wrapped BNB
Website:	bnbchain.org
Platform:	Binance Network
Language:	Solidity
Date:	April 3rd, 2025

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Introduction

As part of EtherAuthority's community smart contract audit initiatives, the smart contract of the Wrapped BNB Token from bnbchain.org was audited. The audit has been performed using manual analysis as well as using automated software tools. This report presents all the findings regarding the audit performed on April 3rd, 2025.

The purpose of this audit was to address the following:

- Ensure that all claimed functions exist and function correctly.
- Identify any security vulnerabilities that may be present in the smart contract.

Project Background

This is a Solidity smart contract implementing a Wrapped BNB (WBNB) token, which allows users to wrap and unwrap Binance Coin (BNB) into an ERC-20 compatible token.

Core Features:

- **Deposit & Withdraw BNB:** Users can deposit BNB into the contract to receive WBNB (1:1 ratio) and withdraw WBNB back into BNB.
- **ERC-20 Functionality:** Supports transfer, approve, and transferFrom methods for token transfers and allowances.
- **Event Logging:** Emits events for deposits, withdrawals, approvals, and transfers.
- **Security Enhancements:** Uses modern Solidity best practices, including reentrancy protection and safe call for BNB withdrawals.

Audit scope

Name	**Code Review and Security Analysis Report for Wrapped BNB Token Smart Contract**
Platform	**Binance Network**
File	WBNB.sol
Smart Contract Code	0xbb4CdB9CBd36B01bD1cBaEBF2De08d9173bc095c
Audit Date	April 3rd, 2025

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Claimed Smart Contract Features

Claimed Feature Detail	Our Observation
Tokenomics: • Name: Wrapped BNB • Symbol: WBNB • Decimals: 18	**YES, This is valid.**
Key Features: • **BNB Wrapping & Unwrapping:** Deposit BNB to receive WBNB, withdraw WBNB to get BNB. • **ERC-20 Compatible:** Supports transfer, approve, and transferFrom. • **Event Logging:** Emits Deposit, Withdrawal, Transfer, and Approval events. • **Security:** Reentrancy protection, safe math (Solidity 0.8+), and allowance checks. • **Gas Efficient:** Uses type(uint256).max for unlimited approvals.	

Audit Summary

According to the standard audit assessment, the Customer's solidity-based smart contract is **"Secured."** This token contract does not have any ownership control, hence it is **100% decentralized**.

We used various tools like Slither, Solhint, and Remix IDE. At the same time, this finding is based on a critical analysis of the manual audit.

All issues found during automated analysis were manually reviewed, and applicable vulnerabilities are presented in the Audit overview section. The general overview is presented in the AS-IS section, and all identified issues can be found in the Audit overview section.

We found 0 critical, 0 high, 2 medium, 1 low, and 3 very low-level issues.

Investors' Advice: A Technical audit of the smart contract does not guarantee the ethical nature of the project. Any owner-controlled functions should be executed by the owner with responsibility. All investors/users are advised to do their due diligence before investing in the project.

Technical Quick Stats

Main Category	Subcategory	Result
Contract Programming	Solidity version not specified	Passed
	Solidity version too old	Moderated
	Integer overflow/underflow	Passed
	Function input parameters lack of check	Passed
	Function input parameters check bypass	Passed
	Function access control lacks management	Passed
	Critical operation lacks event log	Moderated
	Human/contract checks bypass	Passed
	Random number generation/use vulnerability	N/A
	Fallback function misuse	Passed
	Race condition	Passed
	Logical vulnerability	Passed
	Features claimed	Passed
	Other programming issues	Moderated
Code Specification	Function visibility not explicitly declared	Passed
	Var. storage location not explicitly declared	Passed
	Use keywords/functions to be deprecated	Passed
	Unused code	Passed
Gas Optimization	“Out of Gas” Issue	Passed
	High consumption ‘for/while’ loop	Passed
	High consumption ‘storage’ storage	Passed
	Assert() misuse	Passed
Business Risk	The maximum limit for mintage is not set	Passed
	“Short Address” Attack	Passed
	“Double Spend” Attack	Passed

Overall Audit Result: **PASSED**

Code Quality

This audit scope has 1 smart contract. Smart contracts contain Libraries, Smart contracts, inheritance, and Interfaces. This is a compact and well-written smart contract.

The libraries in Wrapped BNB Token are part of its logical algorithm. A library is a different type of smart contract that contains reusable code. Once deployed on the blockchain (only once), it is assigned a specific address, and its properties/methods can be reused many times by other contracts in the Wrapped BNB Token.

The EtherAuthority team has no scenario and unit test scripts, which would have helped to determine the integrity of the code in an automated way.

Code parts are well commented on in the smart contract. Ethereum's NatSpec commenting style is recommended.

Documentation

We were given a Wrapped BNB Token smart contract code in the form of a bscscan web link.

As mentioned above, code parts are well commented on. And the logic is straightforward. So it is easy to quickly understand the programming flow as well as complex code logic. Comments are very helpful in understanding the overall architecture of the protocol.

Use of Dependencies

As per our observation, the libraries used in this smart contract infrastructure that is based on well-known industry standard open-source projects.

Apart from libraries, its functions are not used in external smart contract calls.

AS-IS overview

WBNB.sol : Functions

Sl.	Functions	Type	Observation	Conclusion
1	withdraw	write	Lack of Error Messages in `require()` Statements,Reentrancy Vulnerability in `withdraw()`	Refer Audit Findings
2	deposit	write	Missing `emit` Keyword for Events	Refer Audit Findings
3	totalSupply	read	`this.balance` Deprecated in `totalSupply()`	Refer Audit Findings
4	approve	write	Passed	No Issue
5	transfer	write	Passed	No Issue
6	transferFrom	write	Hardcoded `uint(-1)` for Maximum Allowance	Refer Audit Findings

Severity Definitions

Risk Level	Description
Critical	Critical vulnerabilities are usually straightforward to exploit and can lead to token loss, etc.
High	High-level vulnerabilities are difficult to exploit; however, they also have a significant impact on smart contract execution, e.g., public access to crucial
Medium	Medium-level vulnerabilities are important to fix; however, they can't lead to tokens being lost
Low	Low-level vulnerabilities are mostly related to outdated, unused etc. code snippets, that can't have a significant impact on execution
Lowest / Code Style / Best Practice	Lowest-level vulnerabilities, code style violations, and info statements can't affect smart contract execution and can be ignored.

Audit Findings

Critical Severity

No Critical severity vulnerabilities were found.

High Severity

No High severity vulnerabilities were found.

Medium

(1) Reentrancy Vulnerability in `withdraw()` :

The `withdraw()` function uses `msg.sender.transfer(wad)`, which is vulnerable to reentrancy attacks since it sends funds before updating the balance. A malicious contract could repeatedly call `withdraw()` before the balance is updated.

Resolution: Use the Checks-Effects-Interactions pattern by updating the balance before sending BNB, or use `call{value: wad}("")` with proper reentrancy protection.

(2) Outdated Solidity Syntax (`function() public payable`) :

The contract uses the deprecated fallback function `function() public payable`, which is not supported in Solidity 0.6+.

Resolution: Replace it with the modern `receive()` function.

```
receive() external payable {
    deposit();
}
```

Low

(1) Missing `emit` Keyword for Events:

The contract does not use the `emit` keyword when triggering events (e.g., `Deposit(msg.sender, msg.value);`). This is required in Solidity 0.5+.

Resolution: Use `emit` before event calls.

emit Deposit(msg.sender, msg.value);

Very Low / Informational / Best practices:

(1) `this.balance` Deprecated in `totalSupply()` :

The contract uses `this.balance`, which is not recommended in modern Solidity.

Resolution: Replace `this.balance` with `address(this).balance`.

```
function totalSupply() public view returns (uint) {
    return address(this).balance;
}
```

(2) Lack of Error Messages in `require()` Statements:

The contract uses `require(balanceOf[msg.sender] >= wad);` without an error message, making debugging harder.

Resolution: Add meaningful error messages.

```
require(balanceOf[msg.sender] >= wad, "Insufficient balance");
```

(3) Hardcoded `uint(-1)` for Maximum Allowance:

The contract uses `uint(-1)`, which is outdated.

Resolution: Use `type(uint256).max` for clarity and compatibility.

```
if (src != msg.sender && allowance[src][msg.sender] != type(uint256).max) {}
```

Centralization Risk

The WBNB Token smart contract does not have any ownership control, hence it is 100% decentralized.

Therefore, there is **no** centralization risk.

Conclusion

We were given a contract code in the form of bscscan web links. We have used all possible tests based on the given objects as files. We observed 3 low and 3 informational issues in the smart contract, and those issues are not critical. So, **it's good to go for production**.

Since possible test cases can be unlimited for such smart contract protocols, we provide no such guarantee of future outcomes. We have used all the latest static tools and manual observations to cover the maximum possible test cases to scan everything.

Smart contracts within the scope were manually reviewed and analyzed with static analysis tools. Smart Contract's high-level description of functionality was presented in the As-is overview section of the report.

The audit report contains all found security vulnerabilities and other issues in the reviewed code.

The security state of the reviewed smart contract, based on standard audit procedure scope, is **"Secured".**

Our Methodology

We like to work with a transparent process and make our reviews a collaborative effort. The goals of our security audits are to improve the quality of systems we review and aim for sufficient remediation to help protect users. The following is the methodology we use in our security audit process.

Manual Code Review:

In manually reviewing all of the code, we look for any potential issues with code logic, error handling, protocol and header parsing, cryptographic errors, and random number generators. We also watch for areas where more defensive programming could reduce the risk of future mistakes and speed up future audits. Although our primary focus is on the in-scope code, we examine dependency code and behavior when it is relevant to a particular line of investigation.

Vulnerability Analysis:

Our audit techniques included manual code analysis, user interface interaction, and whitebox penetration testing. We look at the project's website to get a high-level understanding of what functionality the software under review provides. We then meet with the developers to gain an appreciation of their vision of the software. We install and use the relevant software, exploring the user interactions and roles. While we do this, we brainstorm threat models and attack surfaces. We read design documentation, review other audit results, search for similar projects, examine source code dependencies, skim open issue tickets, and generally investigate details other than the implementation.

Documenting Results:

We follow a conservative, transparent process for analyzing potential security vulnerabilities and seeing them through successful remediation. Whenever a potential issue is discovered, we immediately create an Issue entry for it in this document, even though we have not yet verified the feasibility and impact of the issue. This process is conservative because we document our suspicions early, even if they are later shown not to represent exploitable vulnerabilities. We generally follow a process of first documenting the suspicion with unresolved questions, then confirming the issue through code analysis, live experimentation, or automated tests. Code analysis is the most tentative, and we strive to provide test code, log captures, or screenshots demonstrating our confirmation. After this we analyze the feasibility of an attack in a live system.

Suggested Solutions:

We search for immediate mitigations that live deployments can take, and finally we suggest the requirements for remediation engineering for future releases. The mitigation and remediation recommendations should be scrutinized by the developers and deployment engineers, and successful mitigation and remediation is an ongoing collaborative process after we deliver our report, and before the details are made public.

Disclaimers

EtherAuthority.io Disclaimer

EtherAuthority team has analyzed this smart contract in accordance with the best industry practices at the date of this report, in relation to: cybersecurity vulnerabilities and issues in smart contract source code, the details of which are disclosed in this report, (Source Code); the Source Code compilation, deployment and functionality (performing the intended functions).

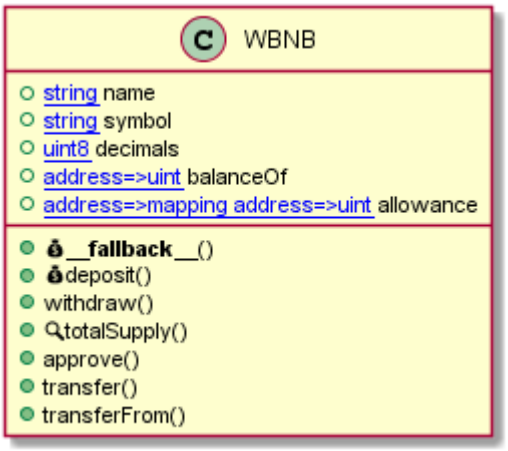
Due to the fact that the total number of test cases is unlimited, the audit makes no statements or warranties on the security of the code. It also cannot be considered as a sufficient assessment regarding the utility and safety of the code, bug-free status, or any other statements of the contract. While we have done our best in conducting the analysis and producing this report, it is important to note that you should not rely on this report only. We also suggest conducting a bug bounty program to confirm the high level of security of this smart contract.

Technical Disclaimer

Smart contracts are deployed and executed on the blockchain platform. The platform, its programming language, and other software related to the smart contract can have their own vulnerabilities that can lead to hacks. Thus, the audit can't guarantee explicit security of the audited smart contracts.

Appendix

Code Flow Diagram - Wrapped BNB Token



Slither Results Log

Slither is a Solidity static analysis framework that uses vulnerability detectors, displays contract details, and provides an API for writing custom analyses. It helps developers identify vulnerabilities, improve code comprehension, and prototype custom analyses quickly. The analysis includes a report with warnings and errors, allowing developers to quickly prototype and fix issues.

We did the analysis of the project altogether. Below are the results.

Slither Log >> WBNB.sol

```
INFO:Detectors:
Version constraint ^0.4.18 contains known severe issues
(https://solidity.readthedocs.io/en/latest/bugs.html)
	- DirtyBytesArrayToStorage
	- ABIDecodeTwoDimensionalArrayMemory
	- KeccakCaching
	- EmptyByteArrayCopy
	- DynamicArrayCleanup
	- ImplicitConstructorCallvalueCheck
	- TupleAssignmentMultiStackSlotComponents
	- MemoryArrayCreationOverflow
	- privateCanBeOverridden
	- SignedArrayStorageCopy
	- ABIEncoderV2StorageArrayWithMultiSlotElement
	- DynamicConstructorArgumentsClippedABIV2
	- UninitializedFunctionPointerInConstructor_0.4.x
	- IncorrectEventSignatureInLibraries_0.4.x
	- ExpExponentCleanup
	- EventStructWrongData
	- NestedArrayFunctionCallDecoder.
It is used by:
	- ^0.4.18 (WBNB.sol#9)
solc-0.4.18 is an outdated solc version. Use a more recent version (at least 0.8.0), if possible.
Reference:
https://github.com/crytic/slither/wiki/Detector-Documentation#incorrect-versions-of-solidity
INFO:Detectors:
Reentrancy in WBNB.withdraw(uint256) (WBNB.sol#31-36):
	External calls:
	- msg.sender.transfer(wad) (WBNB.sol#34)
	Event emitted after the call(s):
	- Withdrawal(msg.sender,wad) (WBNB.sol#35)
```

```
Reference:
https://github.com/crytic/slither/wiki/Detector-Documentation#reentrancy-vulnerabilities-4
INFO:Detectors:
WBNB.decimals (WBNB.sol#14) should be constant
WBNB.name (WBNB.sol#12) should be constant
WBNB.symbol (WBNB.sol#13) should be constant
Reference:
https://github.com/crytic/slither/wiki/Detector-Documentation#state-variables-that-could-be-declared-constant
INFO:Slither:WBNB.sol analyzed (1 contracts with 93 detectors), 6 result(s) found
```

Solidity Static Analysis

Static code analysis is used to identify many common coding problems before a program is released. It involves examining the code manually or using tools to automate the process. Static code analysis tools can automatically scan the code without executing it.

WBNB.sol

```
Check-effects-interaction:
Potential violation of Checks-Effects-Interaction pattern in WBNB.withdraw(uint256): Could potentially lead to re-entrancy vulnerability.
Pos: 31:4:

Gas costs:
Gas requirement of function WBNB.withdraw is infinite: If the gas requirement of a function is higher than the block gas limit, it cannot be executed. Please avoid loops in your functions or actions that modify large areas of storage (this includes clearing or copying arrays in storage)
Pos: 31:4:

Guard conditions:
Use "assert(x)" if you never ever want x to be false, not in any circumstance (apart from a bug in your code). Use "require(x)" if x can be false, due to e.g. invalid input or a failing external component.
Pos: 32:8:
```

Solhint Linter

Solhint Linters are the utility tools that analyze the given source code and report programming errors, bugs, and stylistic errors. For the Solidity language, there are some linter tools available that a developer can use to improve the quality of their Solidity contracts.

WBNB.sol

```
Compiler version ^0.4.18 does not satisfy the ^0.5.8 semver
requirement
Pos: 1:8
Provide an error message for require
Pos: 9:31
Provide an error message for require
Pos: 9:55
Provide an error message for require
Pos: 13:58
```

Software analysis result:

This software reported many false positive results and some are informational issues. So, those issues can be safely ignored.

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