BWB Staking Smart Contract

SMART CONTRACT AUDIT REPORT

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ExVul

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1. EXECUTIVE SUMMARY

Exvul Web3 Security was engaged by bwb staking to review smart contract implementation. The assessment was conducted in accordance with our systematic approach to evaluate potential security issues based upon customer requirement. The report provides detailed recommendations to resolve the issue and provide additional suggestions or recommendations for improvement.

Low risk findings are primarily related to the race condition and priviledge role .

Informational risk finding is primarily related to token transfer logic.

The outcome of the assessment outlined in chapter 3 provides the system's owners a full description of the vulnerabilities identified, the associated risk rating for each vulnerability, and detailed recommendations that will resolve the underlying technical issue.

1.1 Methodology

To standardize the evaluation, we define the following terminology based on OWASP Risk Rating Methodology [10] which is the gold standard in risk assessment using the following risk models:

- Likelihood: represents how likely a particular vulnerability is to be uncovered and exploited in the wild.
- Impact: measures the technical loss and business damage of a successful attack.
- Severity: determine the overall criticality of the risk.

Likelihood can be: High, Medium and Low and impact are categorized into for: High, Medium, Low, Informational. Severity is determined by likelihood and impact and can be classified into five categories accordingly, Critical, High, Medium, Low, Informational shown in table 1.1.

Likelihood \ IMPACT	Informational	Low	Medium	High
High	Informational	Medium	High	Critical
Medium	Informational	Low	Medium	High
Low	Informational	Low	Low	Medium

Table 1.1 Overall Risk Severity

To evaluate the risk, we will be going through a list of items, and each would be labelled with a severity category. The audit was performed with a systematic approach guided by a comprehensive assessment list carefully designed to identify known and impactful security issues. If our tool or analysis does not identify any issue, the contract can be considered safe regarding the assessed

item. For any discovered issue, we might further deploy contracts on our private test environment and run tests to confirm the findings. If necessary, we would additionally build a PoC to demonstrate the possibility of exploitation. The concrete list of check items is shown in Table 1.2.

- Basic Coding Bugs: We first statically analyze given smart contracts with our proprietary static code analyzer for known coding bugs, and then manually verify (reject or confirm) all the issues found by our tool.
- Code and business security testing: We further review business logics, examine system operations, and place DeFi-related aspects under scrutiny to uncover possible pitfalls and/or bugs.
- Additional Recommendations: We also provide additional suggestions regarding the coding and development of smart contracts from the perspective of proven programming practices.

Category	Assessment Item
Basic Coding Assessment	Apply Verification Control
	Authorization Access Control
	Forged Transfer Vulnerability
	Forged Transfer Notification
	Numeric Overflow
	Transaction Rollback Attack
	Transaction Block Stuffing Attack
	Soft Fail Attack
	Hard Fail Attack
	Abnormal Memo
	Abnormal Resource Consumption
	Secure Random Number
Advanced Source Code Scrutiny	Asset Security
	Cryptography Security
	Business Logic Review
	Source Code Functional Verification
	Account Authorization Control
	Sensitive Information Disclosure
	Circuit Breaker
	Blacklist Control
	System API Call Analysis
	Contract Deployment Consistency Check

Category	Assessment Item
Additional Recommendations	Semantic Consistency Checks
	Following Other Best Practices

Table 1.2: The Full List of Assessment Items

To better describe each issue we identified, we categorize the findings with Common Weakness Enumeration (CWE-699) [14], which is a community-developed list of software weakness types to better delineate and organize weaknesses around concepts frequently encountered in software development.

2. FINDINGS OVERVIEW

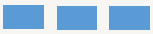
2.1 Project Info And Contract Address

Project Name: Bwb Staking

Audit Time: May13th, 2024 – May17th, 2024

Language: solana

2.2 Summary

Severity	Found	
Critical	0	
High	0	
Medium	0	
Low	3	
Informational	1	

2.3 Key Findings

Low risk findings are primarily related to the race condition and priviledge role .

Informational risk finding is primarily related to token transfer logic.

ID	Severity	Findings Title	Status	Confirm
NVE-001	Low	There might be a race condition in initialization	Fixed	Confirmed
NVE-002	Low	Privileged roles can modify multiple variables	Mitigated	Confirmed
NVE-003	Low	There is no maximum limit set for duration	Fixed	Confirmed
NVE-004	Info	The logic for transferring funds should be placed after the variable updates	Fixed	Confirmed

Table 2.1: Key Audit Findings

3. DETAILED DESCRIPTION OF FINDINGS

3.1 There might be a race condition in initialization.

ID:	NVE-001	Location:	Lib.rs
Severity:	Low	Category:	Business Issues
Likelihood:	Low	Impact:	High

Description:

In the staking contract, the initialize method can be used to perform initialization, but there is a time gap between the deployment and initialization of the contract, which may lead to the possibility of being pre-empted in initialization. It is recommended to add restrictive conditions.

```
#[program]
pub mod bwb_stake {
    use super::*;
    const ONE_DAY: u64 = 86400;

    pub fn initialize(
        ctx: Context<Initialize>,
        cosigner: Pubkey,
        admin: Pubkey,
        receiver: Pubkey,
        operator: Pubkey,
        pool_admin: Pubkey
    ) -> Result<()> {
        msg!("Instruction: Initialize");
        let admin_info : &mut Account<AdminInfo> = &mut ctx.accounts.admin_info;
        admin_info.cosigner = cosigner;
        admin_info.admin = admin;
        admin_info.receiver = receiver;
        admin_info.operator = operator;
        admin_info.pool_admin = pool_admin;

        admin_info.stake_token_mint = ctx.accounts.stake_token_mint.key();

        Ok(())
    }
```

Recommendations:

ExVul Web3 Labs recommends add restrictive conditions.

Result: Confirmed

Fix Result:

fixed at: 0db675795f456a80b70de11e56a68a0a27200124

BWB-staking has use `authority` to avoid race condition

3.2 Privileged roles can modify multiple variables

ID:	NVE-003	Location:	Lib.rs
Severity:	Low	Category:	Business Issues
Likelihood:	Low	Impact:	High

Description:

Privileged roles can modify multiple variables, and if the admin privileged role key is lost or stolen, it could lead to serious security issues. It is recommended to use multi-signature to manage privileged roles.

Key contract variables are modified by special roles, it is advised to use a multi-signature wallet.

```
pub fn update_cosigner(ctx: Context<UpdateAdminRole>, new_cosigner: Pubkey) -> Result<()> {
    let admin_info :&mut Account<AdminInfo> = &mut ctx.accounts.admin_info;
    msg!("old cosigner is {:?}", admin_info.cosigner);
    admin_info.cosigner = new_cosigner;
    msg!("new cosigner is {:?}", admin_info.cosigner);
    Ok(())
}
```

Recommendations:

ExVul Web3 Labs recommends to use a multi-signature wallet

Result: Confirmed

Fix Result: Mitigated

BWB Staking Solana confirms that some privileged roles have been managed using multi-signatures, and some privileged roles have been managed using cold wallets.

3.3 There is no maximum limit set for duration

ID:	NVE-003	Location:	Lib.rs
Severity:	Low	Category:	Business Issues
Likelihood:	Low	Impact:	High

Description:

The duration and the start time determine the staking period of the order, but since there is no maximum limit for duration, if it is too large, it might prevent users from retrieving their funds.

```rust
pub fn create_new_pool(
    ctx: Context<CreateNewPool>,
    stake_cap: u64,
    reward_cap: u64,
    stake_start_at: i64,
    stake_end_at: i64,
    duration: u64,
) -> Result<()> {
    msg!("Instruction: create_new_pool");
    require!(stake_start_at > 0, ErrorCode::StartTimeNeedGT0);
    require!(duration > 0, ErrorCode::DurationNeedGT0);
    require!(stake_end_at > stake_start_at, ErrorCode::StartTimeNeedLTEndTime);
```

Recommendations:

ExVul Web3 Labs recommends add max duration limit for this vlaue.

Result: Confirmed

Fix Result:

fixed at: 0db675795f456a80b70de11e56a68a0a27200124

Sponser had add param `duration_days` to make sure duration value is accurate

3.4 The logic for transferring funds should be placed after the variable updates

ID:	NVE-004	Location:	Lib.rs
Severity:	Info	Category:	Business Issues
Likelihood:	Low	Impact:	Low

Description:

In the logic of unstaking, some of the variable updates occur after the token transfer. To prevent potential reentrancy vulnerabilities, it is recommended that the logic for transferring funds should be placed after the variable updates.

```
token::transfer(
    CpiContext::new(
        ctx.accounts.token_program.to_account_info(),
        token::Transfer {
            from: ctx.accounts.vault_token_account.to_account_info(),
            to: ctx.accounts.user_token_wallet.to_account_info(),
            authority: ctx.accounts.admin_info.to_account_info(),
        },
    )
    .with_signer(&[&seeds[..]]),
    withdraw_amount,
)?;

let after_vault_bal = ctx.accounts.vault_token_account.amount;
let after_user_bal = ctx.accounts.user_token_wallet.amount;

require!(after_user_bal - before_user_bal == withdraw_amount, ErrorCode::WithdrawAmountCheckFail);
require!(before_vault_bal - after_vault_bal == withdraw_amount, ErrorCode::WithdrawAmountCheckFail);

// update order
order.last_claimed_time = clock.unix_timestamp;
order.claimed_reward = order.reward_amount ;
msg!("order.claimed_reward is {:?}", order.claimed_reward);
```

Recommendations:

ExVul Web3 Labs recommends change varaible logic before token transfer .

Result: Confirmed

Fix Result: Fixed

fixed at: 0db675795f456a80b70de11e56a68a0a27200124

Bwb staking solana had changed variable after token transfer.

4. CONCLUSION

In this audit, we thoroughly analyzed Bwb Staking smart contract implementation. The problems found are described and explained in detail in Section 3. The problems found in the audit have been communicated to the project leader. We therefore consider the audit result to be PASSED. To improve this report, we greatly appreciate any constructive feedbacks or suggestions, on our methodology, audit findings, or potential gaps in scope/coverage.

5. APPENDIX

5.1 Basic Coding Assessment

5.1.1 Apply Verification Control

- Description: The security of apply verification
- Result: Not found
- Severity: Critical

5.1.2 Authorization Access Control

- Description: Permission checks for external integral functions
- Result: Not found
- Severity: Critical

5.1.3 Forged Transfer Vulnerability

- Description: Assess whether there is a forged transfer notification vulnerability in the contract
- Result: Not found
- Severity: Critical

5.1.4 Transaction Rollback Attack

- Description: Assess whether there is transaction rollback attack vulnerability in the contract.
- Result: Not found
- Severity: Critical

5.1.5 Transaction Block Stuffing Attack

- Description: Assess whether there is transaction blocking attack vulnerability.
- Result: Not found
- Severity: Critical

5.1.6 Soft Fail Attack Assessment

- Description: Assess whether there is soft fail attack vulnerability.
- Result: Not found
- Severity: Critical

5.1.7 Hard Fail Attack Assessment

- Description: Examine for hard fail attack vulnerability
- Result: Not found
- Severity: Critical

5.1.8 Abnormal Memo Assessment

- Description: Assess whether there is abnormal memo vulnerability in the contract.
- Result: Not found
- Severity: Critical

5.1.9 Abnormal Resource Consumption

- Description: Examine whether abnormal resource consumption in contract processing.
- Result: Not found
- Severity: Critical

5.1.10 Random Number Security

- Description: Examine whether the code uses insecure random number.
- Result: Not found
- Severity: Critical

5.2 Advanced Code Scrutiny

5.2.1 Cryptography Security

- Description: Examine for weakness in cryptograph implementation.
- Results: Not Found
- Severity: High

5.2.2 Account Permission Control

- Description: Examine permission control issue in the contract
- Results: Not Found
- Severity: Medium

5.2.3 Malicious Code Behavior

- Description: Examine whether sensitive behavior present in the code
- Results: Not found
- Severity: Medium

5.2.4 Sensitive Information Disclosure

- Description: Examine whether sensitive information disclosure issue present in the code.
- Result: Not found
- Severity: Medium

5.2.5 System API

- Description: Examine whether system API application issue present in the code
- Results: Not found
- Severity: Low

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Blockchain technology and cryptographic assets present a high level of ongoing risk. ExVul's position is that each company and individual are responsible for their own due diligence and continuous security. ExVul'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.

7. REFERENCES

[1] MITRE. CWE- 191: Integer Underflow (Wrap or Wraparound).

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[2] MITRE. CWE- 197: Numeric Truncation Error.

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[3] MITRE. CWE-400: Uncontrolled Resource Consumption.

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[4] MITRE. CWE-440: Expected Behavior Violation.

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[5] MITRE. CWE-684: Protection Mechanism Failure.

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[9] MITRE. CWE CATEGORY: Resource Management Errors.

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