Bitget solana-swap v3

SMART CONTRACT AUDIT REPORT

December 2024

ExVul

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Table of Contents

1. EXECUTIVE SUMMARY

Exvul Web3 Security was engaged by Bitget solana-swap v3 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.

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
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: Bitget solana-swap v3

Audit Time: December 20, 2024 – December 31, 2024

Language: Rust

File Name	Link
solana-swap	https://github.com/bitgetwallet/solana-swap/commit/aabe668cbf14e307903560624e38116ceaa40718
solana-swap	https://github.com/bitgetwallet/solana-swap/commit/32bc9b6f115407a7bbc559d267e93df60a3af590

2.2 Summary

Severity	Found	
Critical	0	
High	0	
Medium	2	
Low	1	
Informational	1	

2.3 Key Findings

ID	Severity	Findings Title	Status	Confirm
NVE-001	Medium	There is no judgment on the relationship between the maximum and minimum values	Fixed	Confirmed
NVE-002	Medium	is_paused Not used	Fixed	Confirmed
NVE-003	Low	The AmountNeedGtPredeductAmount error code in Bkswapv3 is not introduced	Fixed	Confirmed
NVE-004	Informational	If prededuct_amount is zero, no calculation is required	Fixed	Confirmed

Table 2.3: Key Audit Findings

3. DETAILED DESCRIPTION OF FINDINGS

3.1 There is no judgment on the relationship between the maximum and minimum values

ID:	NVE-001	Location:	bkswapv3/src/instructions/set_admin_infos.rs
Severity:	Medium	Category:	Business Issues
Likelihood:	Low	Impact:	High

Description:

In the method of setting the maximum and minimum values, only the two values are judged not to be greater than MAX_PROTOCOL_FEE_RATE, but the maximum value max_fee_rate_limit must be greater than the minimum value min_fee_rate_limit. If min_fee_rate_limit is greater than max_fee_rate_limit, the collect_fee method cannot be executed and any call will fail.

Method for setting maximum and minimum values.

```
63  pub fn set_min_fee_rate_limit(ctx: Context<SetAdminInfo>, min_fee_rate_limit: u16) -> Result<()> {
64      require!(min_fee_rate_limit <= MAX_PROTOCOL_FEE_RATE, ErrorCode::FeeRateTooHigh);
65
66      let admin_info = &mut ctx.accounts.admin_info;
67      require!(min_fee_rate_limit != admin_info.min_fee_rate_limit, ErrorCode::ValueCannotBeEqual);
68
69      msg!("old min_fee_rate_limit is {:?}", admin_info.min_fee_rate_limit);
70      admin_info.min_fee_rate_limit = min_fee_rate_limit;
71      msg!("new min_fee_rate_limit is {:?}", admin_info.min_fee_rate_limit);
72
73      Ok(())
74  }
75
76  pub fn set_max_fee_rate_limit(ctx: Context<SetAdminInfo>, max_fee_rate_limit: u16) -> Result<()> {
77      require!(max_fee_rate_limit <= MAX_PROTOCOL_FEE_RATE, ErrorCode::FeeRateTooHigh);
78
79      let admin_info = &mut ctx.accounts.admin_info;
80      require!(max_fee_rate_limit != admin_info.max_fee_rate_limit, ErrorCode::ValueCannotBeEqual);
81
82      msg!("old max_fee_rate_limit is {:?}", admin_info.max_fee_rate_limit);
83      admin_info.max_fee_rate_limit = max_fee_rate_limit;
84      msg!("new max_fee_rate_limit is {:?}", admin_info.max_fee_rate_limit);
85
86      Ok(())
87  }
```

The positions used for the maximum and minimum values.

```
41  pub fn collect_fee(
42      ctx: Context<CollectFee>,
43      amount: u64,
44      prededuct_amount: u64,
45      fee_rate: u16
46  ) -> Result<u64> {
47      let admin_info = &mut ctx.accounts.admin_info;
48      require!(!admin_info.is_paused, ErrorCode::ProtocolPaused);
49      require!(ctx.accounts.user_owner.key() != Pubkey::default(), ErrorCode::UserCannotBeZeroAddress);
50      require!(amount > prededuct_amount, ErrorCode::AmountNeedGtPredeductAmount);
51      require!(amount <= ctx.accounts.user_source_token_account.amount, ErrorCode::AmountOverBalance);
52
53      require!(
54          admin_info.min_fee_rate_limit <= fee_rate && fee_rate <= admin_info.max_fee_rate_limit, ErrorCode::FeeRateTooLowOrTooHigh
55      );
56
```

Recommendations:

It is recommended to determine the relationship between the maximum and minimum values to avoid the minimum value being greater than the maximum value.

Result: Confirmed

Fix Result: Fixed

Added max_fee_rate_limit must be smaller than min_fee_rate_limit.

Fixed version: 32bc9b6f115407a7bbc559d267e93df60a3af590

3.2 is_paused Not used

ID:	NVE-002	Location:	raydium-amm-router-v3/src/instructions/proxy_swap_base_in.rs
Severity:	Medium	Category:	Business Issues
Likelihood:	Low	Impact:	High

Description:

The Pause status character is defined, but there is no verification in the actual proxy_route_swap_base_in and proxy_swap_base_in whether the Pause status character is used, resulting in these two swaps not being restricted by the Pause status character.

```
398  /// swap_base_in instruction
399  pub fn proxy_swap_base_in(
400      ctx: Context<ProxySwapBaseIn>,
401      amount_in: u64,
402      minimum_amount_out: u64,
403
404      prededuct_amount: u64,
405      fee_rate: u16,
406  ) -> Result<u64> {
407
408      let cpi_accounts = CollectFee{
409          admin_info: ctx.accounts.bkswap_admin_info.to_account_info(),
```

Recommendations:

It is recommended to add a Pause status symbol during the swap process.

Result: Confirmed

Fix Result: Fixed

Pause status symbol has been added to the method.

Fixed version: 32bc9b6f115407a7bbc559d267e93df60a3af590

3.3 The AmountNeedGtPredeductAmount error code in Bkswapv3 is not introduced

ID:	NVE-003	Location:	programs/bkswapv3/src/instructions/collect_fee.rs
Severity:	Low	Category:	Business Issues
Likelihood:	Low	Impact:	Low

Description:

AmountNeedGtPredeductAmount has not been introduced. Make sure AmountNeedGtPredeductAmount is defined and introduced in errors.rs.

```
41  pub fn collect_fee(
42      ctx: Context<CollectFee>,
43      amount: u64,
44      prededuct_amount: u64,
45      fee_rate: u16
46  ) -> Result<u64> {
47      let admin_info = &mut ctx.accounts.admin_info;
48      require!(!admin_info.is_paused, ErrorCode::ProtocolPaused);
49      require!(ctx.accounts.user_owner.key() != Pubkey::default(), ErrorCode::UserCannotBeZeroAddress);
50      require!(amount > prededuct_amount, ErrorCode::AmountNeedGtPredeductAmount);
51      require!(amount <= ctx.accounts.user_source_token_account.amount, ErrorCode::AmountOverBalance);
52
53      require!(
```

Recommendations:

Make sure AmountNeedGtPredeductAmount is defined and imported in errors.rs.

Result: Confirmed

Fix Result: Fixed

Added AmountNeedGtPredeductAmount error code.

Fixed version: 32bc9b6f115407a7bbc559d267e93df60a3af590

3.4 If prededuct_amount is zero, no calculation is required

ID:	NVE-004	Location:	programs/bkswapv3/src/instructions/collect_fee.rs
Severity:	Informational	Category:	Business Issues
Likelihood:	Low	Impact:	Informational

Description:

Currently, the contract will determine whether prededuct_amount is zero and then perform calculations. However, no matter what the value is, the amount.checked_sub(prededuct_amount) operation will continue. If it is zero, no calculation is required.

```
76    // Collect all transfer amounts and destinations
77    let mut transfer_amounts: Vec<u64> = vec![];
78    let mut transfer_destinations: Vec<AccountInfo<'_>> = vec![];
79    if prededuct_amount > 0 {
80        transfer_amounts.push(prededuct_amount);
81        transfer_destinations.push(ctx.accounts.prededuct_to_token_account.to_account_info());
82    }
83
84    let amount_in = amount.checked_sub(prededuct_amount).ok_or(ErrorCode::ArithmeticError)?;
85    let mut fee_amount: u64 = ((amount_in as u128) * (fee_rate as u128) / PROTOCOL_FEE_RATE_MUL_VALUE).try_into().unwrap();
86    if !ctx.accounts.admin_info.users.contains(&ctx.accounts.user_owner.key()) {
87        transfer_amounts.push(fee_amount);
88        transfer_destinations.push(ctx.accounts.fee_to_token_account.to_account_info());
89
90    } else {
91        fee_amount = 0u64;
92    }
```

Recommendations:

It is recommended that if prededuct_amount is zero, it can be omitted.

Result: Confirmed

Fix Result: Fixed

If prededuct_amount is 0, no calculation will be performed.

Fixed version: 32bc9b6f115407a7bbc559d267e93df60a3af590

4. CONCLUSION

In this audit, we thoroughly analyzed Bitget solana-swap v3 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

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

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[10] OWASP. Risk Rating Methodology.

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