NUMEN

Smart Contract Audit Report

Althena Smart Contract

9 Feb 2023

Numen Cyber Labs - Security Services

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1 Executive Summary

Numen Cyber Technology was engaged by Althena 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.

One Medium severity finding is related to owner authority, centralized risk.

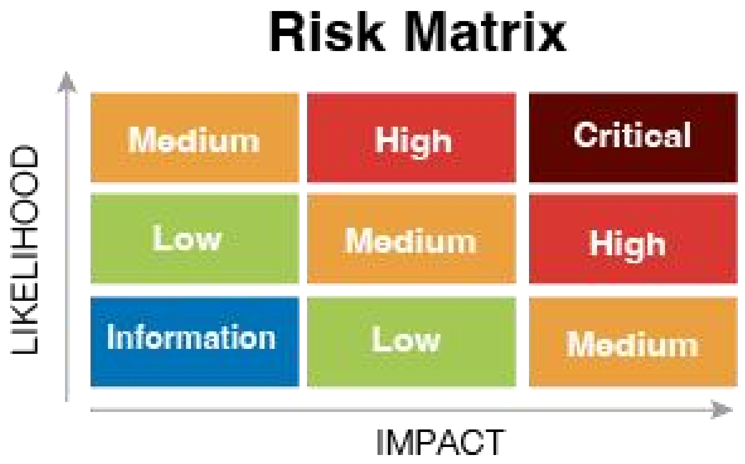
The outcome of the assessment outlined in chapter 3 provides the system's owners a full description of the vulnerabilities identified, the associated risk rating for each vulnerability, and detailed recommendations that will resolve the underlying technical issue.

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 and impact are categorized into three ratings: High, Medium and Low. Severity is determined by likelihood and impact and can be classified into four categories accordingly, Critical, High, Medium, Low shown in table 1.1.



Risk Matrix

LIKELIHOOD	Medium	High	Critical
	Low	Medium	High
	Information	Low	Medium
	IMPACT		

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: Althena

Project URL: https://www.althena.io/

Audit Time: 2023/2.7 - 2023/2.9

Language: python

Contract Name	Smart Contract Address
threshold_contracts.py	https://testnet.algoexplorer.io/application/102480478

2.2 Summary

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

2.3 Key Findings

One Medium severity finding is related to owner authority, centralized risk.

ID	Severity	Findings Title	Status	Confirm
NVE-001	Medium	Admin has higher authority	Ignore	Confirmed

Table 2.1: Key Audit Findings

3 Detailed Description of Findings

3.1 Admin has higher authority

ID: NVE-001

Location: threshold_contracts.py

Severity: Medium

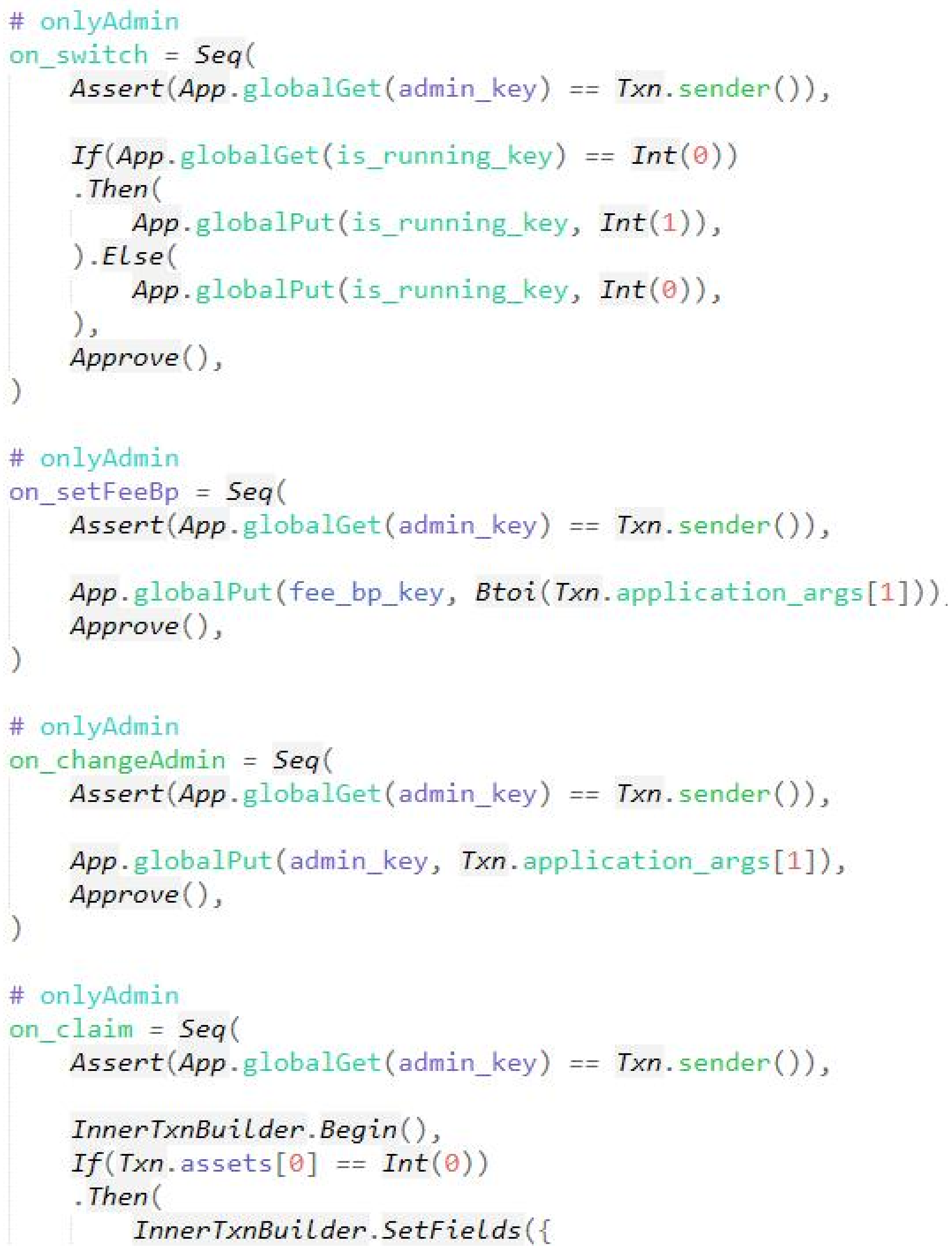
Category: Authority Issues

Likelihood: Medium

Impact: Medium

Description:

The global variable admin is written during contract initialization_ Key, on_ switch，on_ setFeeBp，on_ changeAdmin，on_ claim function is authenticated when it is called. The caller must be admin. These functions can change some key parameters of the current contract, such as is_ running_ key，fee_ bp_ Key, so we think there is a risk of centralization.



```
# onlyAdmin
on_switch = Seq(
    Assert(App.globalGet(admin_key) == Txn.sender()),

    If(App.globalGet(is_running_key) == Int(0))
    .Then(
        App.globalPut(is_running_key, Int(1)),
    ).Else(
        App.globalPut(is_running_key, Int(0)),
    ),
    Approve(),
)

# onlyAdmin
on_setFeeBp = Seq(
    Assert(App.globalGet(admin_key) == Txn.sender()),

    App.globalPut(fee_bp_key, Btoi(Txn.application_args[1])),
    Approve(),
)

# onlyAdmin
on_changeAdmin = Seq(
    Assert(App.globalGet(admin_key) == Txn.sender()),

    App.globalPut(admin_key, Txn.application_args[1]),
    Approve(),
)

# onlyAdmin
on_claim = Seq(
    Assert(App.globalGet(admin_key) == Txn.sender()),

    InnerTxnBuilder.Begin(),
    If(Txn.assets[0] == Int(0))
    .Then(
        InnerTxnBuilder.SetFields({
```

Figure 1 part of the code

Recommendations:

Numen Cyber Lab recommends to reasonable use of Admin permissions and keep the private key properly.

Result: **Pass**

Fix Result:

Ignore (After communicating with the project party, this permission is required for the project design and is only used in special circumstances.)

4 Conclusion

In this audit, we thoroughly analyzed Althena smart contract implementation. The problems found are described and explained in detail in Section 3. The problems found in the audit have been brought up to the project party, ignored issues are in line with the project design, and permissions are only used for the project to properly function. We therefore deem the audit result to be a **PASS.** 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 Behaviour

- Description: Examine whether sensitive behaviour 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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REFERENCES

[1] MITRE. CWE- 191: Integer Underflow (Wrap or Wraparound). https://cwe.mitre.org/data/ definitions/191.html.

[2] MITRE. CWE- 197: Numeric Truncation Error. https://cwe.mitre.org/data/definitions/197. html.

[3] MITRE. CWE-400: Uncontrolled Resource Consumption. https://cwe.mitre.org/data/ definitions/400.html.

[4] MITRE. CWE-440: Expected Behavior Violation. https://cwe.mitre.org/data/definitions/440. html.

[5] MITRE. CWE-684: Protection Mechanism Failure. https://cwe.mitre.org/data/definitions/ 693.html.

[6] MITRE. CWE CATEGORY: 7PK - Security Features. https://cwe.mitre.org/data/definitions/ 254.html.

[7] MITRE. CWE CATEGORY: Behavioral Problems. https://cwe.mitre.org/data/definitions/438. html.

[8] MITRE. CWE CATEGORY: Numeric Errors. https://cwe.mitre.org/data/definitions/189.html.

[9] MITRE. CWE CATEGORY: Resource Management Errors. https://cwe.mitre.org/data/ definitions/399.html.

[10] OWASP. Risk Rating Methodology. https://www.owasp.org/index.php/OWASP_Risk_Rating_Methodology

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