SIFCHAIN & PEGGY

Smart Contract Security Audit

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DOCUMENT REVISION HISTORY

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0.1	Document Creation	01/12/2021	Gabi Urrutia
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1.1 INTRODUCTION

Sifchain engaged Halborn to conduct a security assessment on their all smart contracts that implement the protocol on the Sifchain node and his bridge, Peggy. Sifchain is a decentralized exchange (DEX) based on Cosmos and Thorchain infrastructure for cross-chain integration. The security assessment was scoped to all the smart contracts and an audit of the security risk and implications regarding the changes introduced by the development team at Sifchain prior to its production release shortly following the assessments deadline.

No major vulnerabilities have been found in the audit. Overall, the smart contract code is extremely well documented, follows a high-quality software development standard, contains many utilities and automation scripts to support continuous deployment / testing / integration, and does NOT contain any obvious exploitation vectors that Halborn was able to leverage within the timeframe of testing allotted.

Though the outcome of this security audit is satisfactory; due to time and resource constraints, only testing and verification of essential properties were performed to achieve objectives and deliverables set in the scope. It is important to remark the use of the best practices for secure smart contract development. Halborn recommends performing further testing to validate extended safety and correctness in context to the whole set of contracts. External threats, such as economic attacks, oracle attacks, and inter-contract functions and calls should be validated for expected logic and state.

1.2 TEST APPROACH & METHODOLOGY

Halborn performed a combination of manual and automated security testing to balance efficiency, timeliness, practicality, and accuracy regarding the scope of the smart contract audit. While manual testing is recommended to uncover flaws in logic, process, and implementation; automated testing techniques help enhance coverage of smart contracts and can quickly identify items that do not follow security best practices. The following phases and associated tools were used throughout the term of the audit:

- Research into architecture and purpose
- Smart Contract manual code read and walkthrough
- Graphing out functionality and contract logic/connectivity/functions (solgraph)
- Manual Assessment of use and safety for the critical solidity variables and functions in scope to identify any arithmetic related vulnerability classes.
- Scanning of solidity files for vulnerabilities, security hotspots, or bugs. (MythX)
- Static Analysis of security for scoped contract, and imported functions. (Slither)
- Smart Contract analysis and automatic exploitation (teEther)
- Symbolic Execution / EVM bytecode security assessment (Manticore)

1.3 SCOPE

Code related to:

- BridgeRegistry.sol
- CosmosBridge.sol
- CosmosBridgeStorage.sol
- Oracle.sol
- OracleStorage.sol
- Valset.sol
- ValsetStorage.sol
- BankStorage.sol

- BridgeBank.sol
- BridgeToken.sol
- CosmosBank.sol
- CosmosBankStorage.sol
- CosmosWhiteList.sol
- CosmosWhiteListStorage.sol
- EthereumBank.sol
- EthereumBankStorage.sol
- EthereumWhitelist.sol

Specific commit of contract: Commit ID:
f0ad4c72ad67e1891186b1fff188f4db26607411

OUT-OF-SCOPE:

External contracts, External Oracles, other smart contracts in the repository or imported by Sifchain contracts, economic attacks

2. ASSESSMENT SUMMARY & FINDINGS OVERVIEW

CRITICAL	HIGH	MEDIUM	LOW
0	0	0	0

SECURITY ANALYSIS	RISK LEVEL
FOR LOOP OVER DYNAMIC ARRAY	Informational
STATIC ANALYSIS	Informational
AUTOMATED SECURITY SCAN	Informational
SYMBOLIC EXECUTION SECURITY ASSESSMENT	Informational
SECURITY TESTING EXPLOITATION	Informational

FINDINGS & TECH DETAILS

3.1 FOR LOOP OVER DYNAMIC ARRAY - INFORMATIONAL

Description

Calls inside a loop might lead to a denial-of-service attack. The function discovered is a for loop on variable `i` that iterates up to the _validators.length variable. If this integer is evaluated at extremely large numbers, or `i` is reset by external calling functions, this can cause a DoS.

Code Location

Valset.sol Line #161-166

```
161         for (uint256 i = 0; i < _validators.length; i = i.add(1)) {
162             addValidatorInternal(_validators[i], _powers[i]);
163         }
164 
165         emit LogValsetUpdated(currentValsetVersion, validatorCount, totalPower);
166     }
167 
```

Recommendation:

Because the number of validators is reduced, the possibility of a DoS occurring are highly unlikely.

3.2 STATIC ANALYSIS - INFORMATIONAL

Description

Halborn used automated testing techniques to enhance coverage of certain areas of the scoped contract. Among the tools used was Slither, a Solidity static analysis framework. After Halborn verified all the contracts in the repository and was able to compile them correctly into their abi and binary formats, Slither was run on all contracts.

Results

CosmosBridge.sol

```
Reentrancy in CosmosBridge.newProphecyClaim(CosmosBridgeStorage.ClaimType,bytes,uint256,address,string,uint256) (contracts/CosmosBridge.sol#108-168):
        External calls:
        - BridgeBank(bridgeBank).createNewBridgeToken(symbol) (contracts/CosmosBridge.sol#133)
        State variables written after the call(s):
        - claimComplete = newOracleClaim(_prophecyID,msg.sender) (contracts/CosmosBridge.sol#148)
                - oracleClaimValidators[_prophecyID] = oracleClaimValidators[_prophecyID].add(this.getValidatorPower(validatorAddress)) (contracts/Oracle.sol#80-82)
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#reentrancy-vulnerabilities-1
INFO:Detectors:
CosmosBridge.newProphecyClaim(CosmosBridgeStorage.ClaimType,bytes,uint256,address,string,uint256).symbol (contracts/CosmosBridge.sol#121) is a local variable never initialized
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#uninitialized-local-variables
INFO:Detectors:
CosmosBridge.newProphecyClaim(CosmosBridgeStorage.ClaimType,bytes,uint256,address,string,uint256) (contracts/CosmosBridge.sol#108-168) ignores return value by BridgeBank(bridgeBank).c
reateNewBridgeToken(symbol) (contracts/CosmosBridge.sol#133)
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#unused-return
```

Analysis

No major vulnerabilities have been found in the contracts. The possible reentrancy in CosmosBridge.sol can be considered as a

3.3 AUTOMATED SECURITY SCAN - INFORMATIONAL

Description

Halborn used automated security scanners to assist with detection of well-known security issues, and to identify low-hanging fruit on the targets for this engagement. Among the tools used was MythX, a security analysis service for Ethereum smart contracts. MythX performed a scan on the testers machine and sent the compiled results to the analyzers to locate any vulnerabilities.

Results

Mainly, all issues founded by MythX are related to mark functions as external instead of public.

OracleStorage.sol	0 H	0 M	1 L
Oracle.sol	0 H	43 M	1 L
CosmosBridgeStorage.sol	0 H	0 M	4 L
CosmosBridge.sol	0 H	45 M	3 L
BridgeRegistry.sol	0 H	1 M	1 L

FINDINGS & TECH DETAILS

Recommendation

Consider as much as possible declaring external variables instead of public variables. As for best practices, you should use external if you expect that the function will only ever be called externally and use public if you need to call the function internally. Mainly, marking both function as external can save gas.

3.4 SYMBOLIC EXECUTION SECURITY ASSESSMENT - INFORMATIONAL

Description

The tool used to perform the symbolic execution for analyzing Smart Contract is Manticore. In general, obtaining all possible states of a Smart Contract by symbolic execution is the main goal for using this tool. Briefly, concrete values are replaced by symbolic values and variables which are used to generate path conditions which are logic formulas that represent the state of the program and the transformations between program states. Some detectors were used in the audit to find some vulnerabilities such as: Integer Overflow, Simple and Advance Reentrancy and Delegate calls.

Results

After performing the symbolic execution, vulnerabilities are placed in global.findings file. No vulnerabilities were founded in any contract.

```
ethsec@4d4fee104088:/share/smart-contracts/mcore_naqsnhz0$ ls -ll | grep global
-rw-r--r-- 1 ethsec ethsec   8734 Jan 17 22:44 global_BridgeRegistry.init_asm
-rw-r--r-- 1 ethsec ethsec      0 Jan 17 22:44 global_BridgeRegistry.init_visited
-rw-r--r-- 1 ethsec ethsec   8412 Jan 17 22:44 global_BridgeRegistry.runtime_asm
-rw-r--r-- 1 ethsec ethsec      0 Jan 17 22:44 global_BridgeRegistry.runtime_visited
-rw-r--r-- 1 ethsec ethsec    725 Jan 17 22:44 global_BridgeRegistry.sol
-rw-r--r-- 1 ethsec ethsec      0 Jan 17 22:44 global.findings
-rw-r--r-- 1 ethsec ethsec     74 Jan 17 22:44 global.summary

ethsec@4d4fee104088:/share/smart-contracts/mcore_naqsnhz0$ cat global.summary
Global runtime coverage:
58093d2f2148ad53fc8a8671c6012245da1fba2c: 95.22%
ethsec@4d4fee104088:/share/smart-contracts/mcore_naqsnhz0$ wc global.findings
0 0 0 global.findings
```

3.5 SECURITY TESTING EXPLOITATION - INFORMATIONAL

Description:

teEther is a tool to perform analysis and automatic exploitation over smart contracts. teEther try to exploit the most common Contracts in the Bytecode level.

Results:

- BridgeRegistry.sol

```
INFO:root:Finished all paths
INFO:root:Finished all paths
INFO:root:Finished all paths
INFO:root:Finished all paths
INFO:root:Finished all paths
INFO:root:Finished all paths
INFO:root:No CALL instructions
INFO:root:No DELEGATECALL instructions
INFO:root:No CALLCODE instructions
INFO:root:No SELFDESTRUCT instructions
```

- CosmosBridge.sol

```
INFO:root:Finished all paths
INFO:root:Finished all paths
INFO:root:Finished all paths
INFO:root:Finished all paths
INFO:root:Finished all paths
INFO:root:Finished all paths
INFO:root:Finished all paths
INFO:root:Finished all paths
INFO:root:Finished all paths
INFO:root:Finished all paths
INFO:root:No CALL instructions
INFO:root:No DELEGATECALL instructions
INFO:root:No CALLCODE instructions
INFO:root:No SELFDESTRUCT instructions
```

- CosmosBridgeStorage.sol

```
INFO:root:Finished all paths
INFO:root:Finished all paths
INFO:root:No CALL instructions
INFO:root:No DELEGATECALL instructions
INFO:root:No CALLCODE instructions
INFO:root:No SELFDESTRUCT instructions
```

- Oracle.sol

```
INFO:root:Finished all paths
INFO:root:Finished all paths
INFO:root:No CALL instructions
INFO:root:No DELEGATECALL instructions
INFO:root:No CALLCODE instructions
INFO:root:No SELFDESTRUCT instructions
```

- OracleStorage.sol

```
INFO:root:No CALL instructions
INFO:root:No DELEGATECALL instructions
INFO:root:No CALLCODE instructions
INFO:root:No SELFDESTRUCT instructions
```

- Valset.sol

```
INFO:root:Finished all paths
INFO:root:No CALL instructions
INFO:root:No DELEGATECALL instructions
INFO:root:No CALLCODE instructions
INFO:root:No SELFDESTRUCT instructions
```

- ValsetStorage.sol

```
INFO:root:No CALL instructions
INFO:root:No DELEGATECALL instructions
INFO:root:No CALLCODE instructions
INFO:root:No SELFDESTRUCT instructions
```

- BankStorage.sol

```
INFO:root:No CALL instructions
INFO:root:No DELEGATECALL instructions
INFO:root:No CALLCODE instructions
INFO:root:No SELFDESTRUCT instructions
```

- BridgeBank.sol

```
INFO:root:No CALL instructions
INFO:root:No DELEGATECALL instructions
INFO:root:No CALLCODE instructions
INFO:root:No SELFDESTRUCT instructions
```

- CosmosBankStorage.sol

```
INFO:root:No CALL instructions
INFO:root:No DELEGATECALL instructions
INFO:root:No CALLCODE instructions
INFO:root:No SELFDESTRUCT instructions
```

- CosmosWhiteList.sol

```
INFO:root:No CALL instructions
INFO:root:No DELEGATECALL instructions
INFO:root:No CALLCODE instructions
INFO:root:No SELFDESTRUCT instructions
```

- CosmosWhiteListStorage.sol

```
INFO:root:No CALL instructions
INFO:root:No DELEGATECALL instructions
INFO:root:No CALLCODE instructions
INFO:root:No SELFDESTRUCT instructions
```

- EthereumBankStorage.sol

```
INFO:root:No CALL instructions
INFO:root:No DELEGATECALL instructions
INFO:root:No CALLCODE instructions
INFO:root:No SELFDESTRUCT instructions
```

- EthereumWhitelist.sol

```
INFO:root:No CALL instructions
INFO:root:No DELEGATECALL instructions
INFO:root:No CALLCODE instructions
INFO:root:No SELFDESTRUCT instructions
```

It was not possible to perform the attacks over BridgeToken.sol, CosmosBank.sol and EthereumBank.sol due to the complexity of the binary code. Otherwise, no vulnerabilities were founded in smart contracts.

THANK YOU FOR CHOOSING

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