Quantstamp

Venus Oracle

Executive Summary

This audit report was prepared by Quantstamp, the leader in blockchain security.

Type	Oracle
Timeline	2024-05-20 through 2024-05-23
Language	Solidity
Methods	Architecture Review, Unit Testing, Functional Testing, Computer-Aided Verification, Manual Review
Specification	SFrxETHOracle_Audit_Scope.pdf
Source Code	• VenusProtocol/oracle #b24ef72
Auditors	• Julio Aguilar Auditing Engineer • Danny Aksenov Senior Auditing Engineer • Jennifer Wu Auditing Engineer

Documentation quality	Medium
Test quality	High
Total Findings	2 Fixed: 2
High severity findings	0
Medium severity findings	0
Low severity findings	1 Fixed: 1
Undetermined severity findings	0
Informational findings	1 Fixed: 1

Summary of Findings

The Venus team has updated their `SFrxETHOracle`, designed to fetch the USD price for `sfrxETH`. It shall be integrated as the `main` oracle within their existing `ResilientOracle`. The `SFrxETHOracle` incorporates a mechanism to validate the price variations between its low and high data points, ensuring the high-to-low ratio remains within a specified threshold, which can be updated by the team. Finally, the oracle returns the average between the low and high prices. This audit revealed no major concerns within the smart contract, highlighting the strength and reliability of the Venus team's development process including their test suite.

Update: The Venus team addressed all issues as recommended.

ID	DESCRIPTION	SEVERITY	STATUS
VEN-1	`maxAllowedPriceDifference` **Not Initialized**	• Low	Fixed
VEN-2	**Missing Inheritance Reduces Consistency**	• Informational	Fixed

Assessment Breakdown

Quantstamp's objective was to evaluate the repository for security-related issues, code quality, and adherence to specification and best practices.

Disclaimer

Only features that are contained within the repositories at the commit hashes specified on the front page of the report are within the scope of the audit and fix review. All features added in future revisions of the code are excluded from consideration in this report.

Possible issues we looked for included (but are not limited to):

- Transaction-ordering dependence
- Timestamp dependence
- Mishandled exceptions and call stack limits

- Unsafe external calls
- Integer overflow / underflow
- Number rounding errors
- Reentrancy and cross-function vulnerabilities
- Denial of service / logical oversights
- Access control
- Centralization of power
- Business logic contradicting the specification
- Code clones, functionality duplication
- Gas usage
- Arbitrary token minting

Methodology

1. Code review that includes the following
    1. Review of the specifications, sources, and instructions provided to Quantstamp to make sure we understand the size, scope, and functionality of the smart contract.
    2. Manual review of code, which is the process of reading source code line-by-line in an attempt to identify potential vulnerabilities.
    3. Comparison to specification, which is the process of checking whether the code does what the specifications, sources, and instructions provided to Quantstamp describe.
2. Testing and automated analysis that includes the following:
    1. Test coverage analysis, which is the process of determining whether the test cases are actually covering the code and how much code is exercised when we run those test cases.
    2. Symbolic execution, which is analyzing a program to determine what inputs cause each part of a program to execute.
    3. Best practices review, which is a review of the smart contracts to improve efficiency, effectiveness, clarity, maintainability, security, and control based on the established industry and academic practices, recommendations, and research.
4. Specific, itemized, and actionable recommendations to help you take steps to secure your smart contracts.

Scope

The scope consists of only one file inside the contracts folder involving an update to the `SFrxETHOracle` contract.

Files Included

contracts/oracles/SFrxETHOracle.sol

Files Excluded

Everything else inside the contracts folder.

Findings

VEN-1 `maxAllowedPriceDifference` Not Initialized

Low Fixed

Update
The initial fix required additional attention from the client, and it was finally fixed in the commit: `f76cf1e0e5e29051ad7e9aace4a576321edeb8e6`.

Update
Marked as "Fixed" by the client.
Addressed in: `0cd68b2148a20733c3d74fa8f74016ee9156c9e2`.

File(s) affected: `contracts/oracles/SFrxETHOracle.sol`

Description: The `maxAllowedPriceDifference` variable is not initialized in the initialize function. It is important to set a default value for this variable to avoid unexpected behavior.

Recommendation: Initialize the `maxAllowedPriceDifference` variable in the `initialize()` function with a suitable default value. This will ensure that the variable has a known value from the start and prevent any unintended consequences arising from an uninitialized state.

VEN-2 Missing Inheritance Reduces Consistency

Informational Fixed

Update

Marked as "Fixed" by the client.
Addressed in: `6374a844a89c874887da7349a094b5f982daba95` .

File(s) affected: `contracts/oracles/SFrxETHOracle.sol`

Description: Since the `SFrxETHOracle` contract is going to be deployed as the main oracle in the existing `ResilientOracle`, it should inherit from `OracleInterface` to be consistent since the resilient oracle calls the `SFrxETHOracle.getPrice()` function through the mentioned interface.

Recommendation: Consider adding the OracleInterface to the inheritance list of SFrxETHOracle.

Definitions

- **High severity** – High-severity issues usually put a large number of users' sensitive information at risk, or are reasonably likely to lead to catastrophic impact for client's reputation or serious financial implications for client and users.
- **Medium severity** – Medium-severity issues tend to put a subset of users' sensitive information at risk, would be detrimental for the client's reputation if exploited, or are reasonably likely to lead to moderate financial impact.
- **Low severity** – The risk is relatively small and could not be exploited on a recurring basis, or is a risk that the client has indicated is low impact in view of the client's business circumstances.
- **Informational** – The issue does not post an immediate risk, but is relevant to security best practices or Defence in Depth.
- **Undetermined** – The impact of the issue is uncertain.
- **Fixed** – Adjusted program implementation, requirements or constraints to eliminate the risk.
- **Mitigated** – Implemented actions to minimize the impact or likelihood of the risk.
- **Acknowledged** – The issue remains in the code but is a result of an intentional business or design decision. As such, it is supposed to be addressed outside the programmatic means, such as: 1) comments, documentation, README, FAQ; 2) business processes; 3) analyses showing that the issue shall have no negative consequences in practice (e.g., gas analysis, deployment settings).

Appendix

File Signatures

The following are the SHA-256 hashes of the reviewed files. A file with a different SHA-256 hash has been modified, intentionally or otherwise, after the security review. You are cautioned that a different SHA-256 hash could be (but is not necessarily) an indication of a changed condition or potential vulnerability that was not within the scope of the review.

Files

- `e8c...c6f ./oracles/SFrxETHOracle.sol`

Tests

- `d69...cee ./test/SFrxETHOracle.ts`

Toolset

The notes below outline the setup and steps performed in the process of this audit.

Setup

Tool Setup:
- Slither v0.10.1

Steps taken to run the tools:
1. Install the Slither tool: `pip3 install slither-analyzer`
2. Run Slither from the project directory: `slither .`

Automated Analysis

Slither

Slither was used to get a static analysis of the repository. All the issues and recommendations are discussed in this report or classified as false positives.

Test Suite Results

The test suite is generally very robust, having tests for both happy and unhappy paths. To get the test results, run the following commands:

```
yarn install
npx hardhat test
```

```
  AnkrBNBOracle unit tests
    deployment
      ✔ revert if ankrBNB address is 0
      ✔ revert if ResilientOracle address is 0
      ✔ should deploy contract
    getPrice
      ✔ revert if ankrBNB address is wrong
      ✔ should get correct price

  BNBxOracle unit tests
    deployment
      ✔ revert if stakeManager address is 0
      ✔ revert if BNBx address is 0
      ✔ revert if resilientOracle address is 0
      ✔ should deploy contract
    getPrice
      ✔ revert if BNBx address is wrong
      ✔ should get correct price

  Binance Oracle unit tests
    ✔ set price
    ✔ set BNB price
    ✔ fetch price (51ms)
    ✔ fetch BNB price
    ✔ price expired (75ms)
    ✔ set WBETH price
    ✔ fetch WBETH price
    ✔ revert when setting feed registry address and sid already available
    ✔ revert when feed registry address is zero (63ms)
    ✔ fetch price from direct feed registry  (47ms)

  bound validator
    add validation config
      ✔ length check
      ✔ validation config check
      ✔ config added successfully & event check
    validate price
      ✔ validate price (92ms)

  Oracle unit tests
    set token config
      ✔ cannot set feed to zero address
      ✔ sets a token config
    batch set token configs
      ✔ cannot set feed or vtoken to zero address
      ✔ parameter length check
      ✔ set multiple feeds
    getPrice
      ✔ gets the price from Chainlink for vBNB
      ✔ gets the price from Chainlink for USDC
      ✔ gets the price from Chainlink for USDT
      ✔ gets the price from Chainlink for DAI
      ✔ gets the direct price of a set asset
      ✔ reverts if no price or feed has been set
    setDirectPrice
      ✔ sets the direct price
    stale price validation
```

```
    ✔ stale price period cannot be 0
    ✔ modify stale price period will emit an event
    ✔ revert when price stale (41ms)
    ✔ if updatedAt is some time in the future, revert it
    ✔ the chainlink anwser is 0, revert it

OneJumpOracle unit tests
  deployment
    ✔ revert if correlated token address is 0
    ✔ revert if underlying token address is 0
    ✔ revert if resilient oracle address is 0
    ✔ revert if intermediate oracle address is 0
    ✔ should deploy contract
  getPrice
    ✔ revert if address is not valid LDO address
    ✔ should get correct price of LDO

PendleOracle unit tests
  deployment
    ✔ revert if market address is 0
    ✔ revert if ptOracle address is 0
    ✔ revert if ptWeETH address is 0
    ✔ revert if eETH address is 0
    ✔ revert if ResilientOracle address is 0
    ✔ revert if TWAP duration is 0
    ✔ revert if invalid TWAP duration
    ✔ should deploy contract
  getPrice
    ✔ revert if wstETH address is wrong
    ✔ should get correct price

Oracle plugin frame unit tests
  admin check
    ✔ transfer owner
  token config
    add single token config
      ✔ token can"t be zero & maxStalePeriod can't be zero
      ✔ token config added successfully & events check
    batch add token configs
      ✔ length check
      ✔ token config added successfully & data check
  get underlying price
    ✔ revert when asset not exist
    ✔ revert when price is expired
    ✔ revert when price is not positive (just in case Pyth return insane data) (50ms)
    ✔ price should be 18 decimals (78ms)
  validation
    ✔ validate price (136ms)
    ✔ validate BNB price (100ms)

Oracle plugin frame unit tests
  token config
    add single token config
      ✔ vToken can"t be zero & main oracle can't be zero
      ✔ reset token config (80ms)
      ✔ token config added successfully & events check (48ms)
    batch add token configs
      ✔ length check
      ✔ token config added successfully & data check (152ms)
  change oracle
    set oracle
      ✔ null check (79ms)
      ✔ existance check
      ✔ oracle set successfully & data check (70ms)
  get underlying price
    ✔ revert when protocol paused (62ms)
    ✔ revert price when main oracle is disabled and there is no fallback oracle
    ✔ revert price main oracle returns 0 and there is no fallback oracle
    ✔ revert if price fails checking
    ✔ check price with/without pivot oracle (43ms)
    ✔ disable pivot oracle
    ✔ enable fallback oracle (99ms)
```

```
    ✔ Return fallback price when fallback price is validated successfully with pivot oracle
    ✔ Return main price when fallback price validation failed with pivot oracle

SFraxOracle unit tests
  deployment
    ✔ revert if FRAX address is 0
    ✔ revert if sFRAX address is 0
    ✔ should deploy contract
  getPrice
    ✔ revert if address is not valid sFrax address
    ✔ should get correct price of sFrax

SFrxETHOracle unit tests
  deployment
    ✔ revert if SfrxEthFraxOracle address is 0
    ✔ revert if sfrxETH address is 0
    ✔ should deploy contract (58ms)
  getPrice
    ✔ revert if address is not valid sfrxETH address
    ✔ revert if price difference is more than allowed
    ✔ should get correct price of sfrxETH

SequencerChainlinkOracle
  ✔ Should revert if sequencer is down
  ✔ Should revert if sequencer is up, but GRACE_PERIOD has not passed
  ✔ Should return price

SlisBNBOracle unit tests
  deployment
    ✔ revert if SynclubManager address is 0
    ✔ revert if slisBNB address is 0
    ✔ revert if resilientOracle address is 0
    ✔ should deploy contract
  getPrice
    ✔ revert if slisBNB address is wrong
    ✔ should get correct price

StkBNBOracle unit tests
  deployment
    ✔ revert if stakePool address is 0
    ✔ revert if stkBNB address is 0
    ✔ revert if resilientOracle address is 0
    ✔ should deploy contract
  getPrice
    ✔ revert if ankrBNB address is wrong
    ✔ should get correct price

WBETHOracle unit tests
  deployment
    ✔ revert if WBETH address is 0
    ✔ revert if ETH address is 0
    ✔ revert if resilientOracle address is 0
    ✔ should deploy contract
  getPrice
    ✔ revert if WBETH address is wrong
    ✔ should get correct price

WeETHOracle unit tests
  deployment
    ✔ revert if liquidity pool address is 0
    ✔ revert if weETH address is 0
    ✔ revert if eETH address is 0
    ✔ revert if resilient oracle address is 0
    ✔ should deploy contract
  getPrice
    ✔ revert if address is not valid weETH address
    ✔ should get correct price of weETH

WstETHOracleV2 unit tests
  deployment
    ✔ revert if wstETH address is 0
    ✔ revert if stETH address is 0
```

```
      ✔ revert if ResilientOracle address is 0
      ✔ should deploy contract
    getPrice
      ✔ revert if wstETH address is wrong
      ✔ should get correct price


  132 passing (8s)
```

Code Coverage

The coverage of the file in scope is excellent except for the branch coverage. We recommend adding more tests to make the test suite more robust. To get the coverage results run the following commands:

```
yarn install
npx hardhat coverage
```

File	% Stmts	% Branch	% Funcs	% Lines	Uncovered Lines
SFrxETHOracle.sol	100	75	100	100	

Changelog

- 2024-05-23 - Initial report
- 2024-05-29 - Final report

About Quantstamp

Quantstamp is a global leader in blockchain security. Founded in 2017, Quantstamp's mission is to securely onboard the next billion users to Web3 through its best-in-class Web3 security products and services.

Quantstamp's team consists of cybersecurity experts hailing from globally recognized organizations including Microsoft, AWS, BMW, Meta, and the Ethereum Foundation. Quantstamp engineers hold PhDs or advanced computer science degrees, with decades of combined experience in formal verification, static analysis, blockchain audits, penetration testing, and original leading-edge research.

To date, Quantstamp has performed more than 500 audits and secured over $200 billion in digital asset risk from hackers. Quantstamp has worked with a diverse range of customers, including startups, category leaders and financial institutions. Brands that Quantstamp has worked with include Ethereum 2.0, Binance, Visa, PayPal, Polygon, Avalanche, Curve, Solana, Compound, Lido, MakerDAO, Arbitrum, OpenSea and the World Economic Forum.

Quantstamp's collaborations and partnerships showcase our commitment to world-class research, development and security. We're honored to work with some of the top names in the industry and proud to secure the future of web3.

Notable Collaborations & Customers:

- Blockchains: Ethereum 2.0, Near, Flow, Avalanche, Solana, Cardano, Binance Smart Chain, Hedera Hashgraph, Tezos
- DeFi: Curve, Compound, Maker, Lido, Polygon, Arbitrum, SushiSwap
- NFT: OpenSea, Parallel, Dapper Labs, Decentraland, Sandbox, Axie Infinity, Illuvium, NBA Top Shot, Zora
- Academic institutions: National University of Singapore, MIT

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