

0.7

Anchor Protocol Process Quality Review

Score: 75%

Overview

This is a [Anchor Protocol](#) Process Quality Review completed on July 7th 2021. It was performed using the Process Review process (version 0.7.3) and is documented [here](#). The review was performed by Nic of DeFiSafety. Check out our [Telegram](#).

The final score of the review is 75%, a good pass. The breakdown of the scoring is in [Scoring Appendix](#). For our purposes, a pass is 70%.

Summary of the Process

Very simply, the review looks for the following declarations from the developer's site. With these declarations, it is reasonable to trust the smart contracts.

- **Here are my smart contracts on the blockchain**
- **Here is the documentation that explains what my smart contracts do**
- **Here are the tests I ran to verify my smart contract**
- **Here are the audit(s) performed on my code by third party experts**
- **Here are the admin controls and strategies**

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Chain

This section indicates the blockchain used by this protocol.

✓ **Chain: Ethereum/Terra**

Guidance:

Ethereum

Binance Smart Chain

Polygon

Note: Anchor is its own blockchain but they have something called EthAnchor which is what we'll be looking at for smart contract evaluation.

Code and Team

This section looks at the code deployed on the Mainnet that gets reviewed and its corresponding software repository. The document explaining these questions is [here](#). This review will answer the questions;

- 1) Are the executing code addresses readily available? (%)
- 2) Is the code actively being used? (%)
- 3) Is there a public software repository? (Y/N)
- 4) Is there a development history visible? (%)
- 5) Is the team public (not anonymous)? (Y/N)

1) Are the executing code addresses readily available? (%)

✓ **Answer: 100%**

They are available at website <https://docs.anchorprotocol.com/ethanchor/ethanchor-contracts/deployed-contracts> as indicated in the [Appendix](#).

Guidance:

- | | |
|------|--|
| 100% | Clearly labelled and on website, docs or repo, quick to find |
| 70% | Clearly labelled and on website, docs or repo but takes a bit of looking |
| 40% | Addresses in mainnet.json, in discord or sub graph, etc |
| 20% | Address found but labelling not clear or easy to find |
| 0% | Executing addresses could not be found |

2) Is the code actively being used? (%)

✓ Answer: 100%

Activity is more than 10 transactions a day on contract [Router.sol](#), as indicated in the [Appendix](#).

Note: This is Router V1, and it is currently inactive. Once Router V2 comes out, we will update this section.

Percentage Score Guidance

| | |
|------|-----------------------------------|
| 100% | More than 10 transactions a day |
| 70% | More than 10 transactions a week |
| 40% | More than 10 transactions a month |
| 10% | Less than 10 transactions a month |
| 0% | No activity |

3) Is there a public software repository? (Y/N)

✓ Answer: Yes

GitHub: <https://github.com/Anchor-Protocol>.

Is there a public software repository with the code at a minimum, but normally test and scripts also (Y/N). Even if the repo was created just to hold the files and has just 1 transaction, it gets a Yes. For teams with private repos, this answer is No.

4) Is there a development history visible? (%)

✓ Answer: 100%

With 246 commits and 2 branches, this is a robust software repository.

This checks if the software repository demonstrates a strong steady history. This is normally demonstrated by commits, branches and releases in a software repository. A healthy history demonstrates a history of more than a month (at a minimum).

Guidance:

| | |
|------|--|
| 100% | Any one of 100+ commits, 10+branches |
| 70% | Any one of 70+ commits, 7+branches |
| 50% | Any one of 50+ commits, 5+branches |
| 30% | Any one of 30+ commits, 3+branches |
| 0% | Less than 2 branches or less than 30 commits |

5) Is the team public (not anonymous)? (Y/N)

✓ Answer: Yes

Public team info found at <https://www.cypherhunter.com/en/p/anchor-protocol/>.

For a yes in this question the real names of some team members must be public on the website or other documentation. If the team is anonymous and then this question is a No.

Documentation

This section looks at the software documentation. The document explaining these questions is [here](#).

Required questions are;

- 6) Is there a whitepaper? (Y/N)
- 7) Are the basic software functions documented? (Y/N)
- 8) Does the software function documentation fully (100%) cover the deployed contracts? (%)
- 9) Are there sufficiently detailed comments for all functions within the deployed contract code (%)
- 10) Is it possible to trace from software documentation to the implementation in code (%)

6) Is there a whitepaper? (Y/N)

✓ Answer: Yes

Location: <https://docs.anchorprotocol.com/>.

7) Are the basic software functions documented? (Y/N)

✓ Answer: Yes

Basic software functions are covered in the <https://docs.anchorprotocol.com/protocol/overview> section.

8) Does the software function documentation fully (100%) cover the deployed contracts? (%)

⚠ Answer: 40%

A small amount of the deployed contract functions are loosely described in the

<https://docs.anchorprotocol.com/protocol/overview> section.

Guidance:

- 100% All contracts and functions documented
- 80% Only the major functions documented
- 79-1% Estimate of the level of software documentation
- 0% No software documentation

How to improve this score

This score can improve by adding content to the requirements document such that it comprehensively covers the requirements. For guidance, refer to the [SecurEth System Description Document](#) . Using tools that aid traceability detection will help.

9) Are there sufficiently detailed comments for all functions within the deployed contract code (%)

 Answer: 0%

Code examples are in the [Appendix](#). As per the [SLOC](#), there is 14% commenting to code (CtC).

The Comments to Code (CtC) ratio is the primary metric for this score.

Guidance:

- 100% CtC > 100 Useful comments consistently on all code
- 90-70% CtC > 70 Useful comment on most code
- 60-20% CtC > 20 Some useful commenting
- 0% CtC < 20 No useful commenting

How to improve this score

This score can improve by adding comments to the deployed code such that it comprehensively covers the code. For guidance, refer to the [SecurEth Software Requirements](#).

10) Is it possible to trace from software documentation to the implementation in code (%)

 Answer: 40%

The documentation lists some of the functions and describes their functions.

Guidance:

- 100% Clear explicit traceability between code and documentation at a requirement level for all code
- 60% Clear association between code and documents via non explicit traceability
- 40% Documentation lists all the functions and describes their functions
- 0% No connection between documentation and code

How to improve this score


This score can improve by adding traceability from requirements to code such that it is clear where each requirement is coded. For reference, check the SecurEth guidelines on [traceability](#).

Testing

This section looks at the software testing available. It is explained in this [document](#). This section answers the following questions;

- 11) Full test suite (Covers all the deployed code) (%)
- 12) Code coverage (Covers all the deployed lines of code, or explains misses) (%)
- 13) Scripts and instructions to run the tests (Y/N)
- 14) Report of the results (%)
- 15) Formal Verification test done (%)
- 16) Stress Testing environment (%)

11) Is there a Full test suite? (%)

 Answer: 40%

Code examples are in the [Appendix](#). As per the [SLOC](#), there is 61% testing to code (TtC).

This score is guided by the Test to Code ratio (TtC). Generally a good test to code ratio is over 100%. However the reviewers best judgement is the final deciding factor.


Guidance:

- 100% TtC > 120% Both unit and system test visible
- 80% TtC > 80% Both unit and system test visible
- 40% TtC < 80% Some tests visible
- 0% No tests obvious

How to improve this score

This score can improve by adding tests to fully cover the code. Document what is covered by traceability or test results in the software repository.

12) Code coverage (Covers all the deployed lines of code, or explains misses) (%)

 Answer: 0%

No evidence of code coverage was found in Anchor's audit or GitHub repository.


Guidance:

| | |
|--------|--|
| 100% | Documented full coverage |
| 99-51% | Value of test coverage from documented results |
| 50% | No indication of code coverage but clearly there is a reasonably complete set of tests |
| 30% | Some tests evident but not complete |
| 0% | No test for coverage seen |

How to improve this score

This score can improve by adding tests achieving full code coverage. A clear report and scripts in the software repository will guarantee a high score.

13) Scripts and instructions to run the tests (Y/N)

 Answer: Yes

Scripts and tests can be found at <https://github.com/Anchor-Protocol/eth-anchor-contracts>.

14) Report of the results (%)

 Answer: 0%

No test report was found in their GitHub repository.

Guidance:

| | |
|------|---|
| 100% | Detailed test report as described below |
| 70% | GitHub Code coverage report visible |
| 0% | No test report evident |

How to improve this score

Add a report with the results. The test scripts should generate the report or elements of it.

15) Formal Verification test done (%)

 Answer: 0%

No evidence of a Anchor Protocol Formal Verification test was found.

Note: Anchor claims that it is formally verified but there is no evidence of it provided.

16) Stress Testing environment (%)

✓ Answer: 100%

There is evidence of extensive test-net usage at <https://docs.anchorprotocol.com/ethanchor/ethanchor-contracts/deployed-contracts>.

Security

This section looks at the 3rd party software audits done. It is explained in this [document](#). This section answers the following questions;

17) Did 3rd Party audits take place? (%)

18) Is the bounty value acceptably high?

17) Did 3rd Party audits take place? (%)

✓ Answer: 90%

[Cryptonics published a Anchor Protocol audit report on March 8th 2021.](#)

Note: Anchor Protocol was launched on March 17th 2021.

Note 2: Most fix recommendations were implemented.

Guidance:

100% Multiple Audits performed before deployment and results public and implemented or not required

90% Single audit performed before deployment and results public and implemented or not required

70% Audit(s) performed after deployment and no changes required. Audit report is public

50% Audit(s) performed after deployment and changes needed but not implemented

20% No audit performed

0% Audit Performed after deployment, existence is public, report is not public and no improvements deployed OR smart contract address' not found, question

Deduct 25% if code is in a private repo and no note from auditors that audit is applicable to deployed code

18) Is the bounty value acceptably high (%)

i Answer: 70%

Active Bug Bounty program was found at <https://docs.anchorprotocol.com/security#anchor-bug-bounty-program>.

Guidance:

- 100% Bounty is 10% TVL or at least \$1M AND active program (see below)
- 90% Bounty is 5% TVL or at least 500k AND active program
- 80% Bounty is 5% TVL or at least 500k
- 70% Bounty is 100k or over AND active program
- 60% Bounty is 100k or over
- 50% Bounty is 50k or over AND active program
- 40% Bounty is 50k or over
- 20% Bug bounty program bounty is less than 50k
- 0% No bug bounty program offered


Active program means a third party actively driving hackers to the site. Inactive program would be static mention on the docs.

Access Controls

This section covers the documentation of special access controls for a DeFi protocol. The admin access controls are the contracts that allow updating contracts or coefficients in the protocol. Since these contracts can allow the protocol admins to "change the rules", complete disclosure of capabilities is vital for user's transparency. It is explained in this [document](#). The questions this section asks are as follow;

- 19) Can a user clearly and quickly find the status of the admin controls?
- 20) Is the information clear and complete?
- 21) Is the information in non-technical terms that pertain to the investments?
- 22) Is there Pause Control documentation including records of tests?

19) Can a user clearly and quickly find the status of the access controls (%)

 Answer: 100%

Access controls were quickly found at <https://docs.anchorprotocol.com/protocol/anchor-governance>.

Guidance:

- 100% Clearly labelled and on website, docs or repo, quick to find
- 70% Clearly labelled and on website, docs or repo but takes a bit of looking
- 40% Access control docs in multiple places and not well labelled
- 20% Access control docs in multiple places and not labelled
- 0% Admin Control information could not be found

20) Is the information clear and complete (%)

✓ Answer: 90%

- a) Contracts are clearly labelled as upgradeable
- b) Ownership is clearly indicated (Gov Contracts is OnlyOwner)
- c) The capabilities for change are indicated in each contract subsection.

Guidance:

All the contracts are immutable -- 100% OR

- a) All contracts are clearly labelled as upgradeable (or not) -- 30% AND
- b) The type of ownership is clearly indicated (OnlyOwner / MultiSig / Defined Roles) -- 30% AND
- c) The capabilities for change in the contracts are described -- 30%

21) Is the information in non-technical terms that pertain to the investments (%)

✓ Answer: 90%

Non-complicated language use.

Guidance:

- 100% All the contracts are immutable
- 90% Description relates to investments safety and updates in clear, complete non-software I language
- 30% Description all in software specific language
- 0% No admin control information could not be found

How to improve this score

Create a document that covers the items described above in plain language that investors can understand. An [example](#) is enclosed.

22) Is there Pause Control documentation including records of tests (%)

✓ Answer: 100%

A similar function to Pause Control is explained and documented at <https://github.com/Anchor-Protocol/money-market-contracts/tree/main/contracts/overseer>.

Guidance:

- 100% All the contracts are immutable or no pause control needed and this is explained OR
- 100% Pause control(s) are clearly documented and there is records of at least one test within 3 months
- 80% Pause control(s) explained clearly but no evidence of regular tests
- 40% Pause controls mentioned with no detail on capability or tests
- 0% Pause control not documented or explained

Appendices

Author Details

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I started with Ethereum just before the DAO and that was a wonderful education. It showed the importance of code quality. The second Parity hack also showed the importance of good process. Here my aviation background offers some value. Aerospace knows how to make reliable code using quality processes.

I was coaxed to go to EthDenver 2018 and there I started [SecuEth.org](#) with Bryant and Roman. We created guidelines on good processes for blockchain code development. We got [EthFoundation funding](#) to assist in their development.

Process Quality Reviews are an extension of the SecurEth guidelines that will further increase the quality processes in Solidity and Vyper development.

DeFiSafety is my full time gig and we are working on funding vehicles for a permanent staff.

Scoring Appendix

| | Total | Anchor Protocol | |
|---|--------|-----------------|--------|
| PQ Audit Scoring Matrix (v0.7) | Points | Answer | Points |
| Total | 260 | | 196 |
| Code and Team | | | 75% |
| 1) Are the executing code addresses readily available? (%) | 20 | 100% | 20 |
| 2) Is the code actively being used? (%) | 5 | 100% | 5 |
| 3) Is there a public software repository? (Y/N) | 5 | Y | 5 |
| 4) Is there a development history visible? (%) | 5 | 100% | 5 |
| 5) Is the team public (not anonymous)? (Y/N) | 15 | Y | 15 |
| Code Documentation | | | |
| 6) Is there a whitepaper? (Y/N) | 5 | Y | 5 |
| 7) Are the basic software functions documented? (Y/N) | 10 | Y | 10 |
| 8) Does the software function documentation fully (100%) cover the deployed contracts? (%) | 15 | 40% | 6 |
| 9) Are there sufficiently detailed comments for all functions within the deployed contract code (%) | 5 | 0% | 0 |
| 10) Is it possible to trace from software documentation to the implementation in code (%) | 10 | 40% | 4 |
| Testing | | | |
| 11) Full test suite (Covers all the deployed code) (%) | 20 | 40% | 8 |
| 12) Code coverage (Covers all the deployed lines of code, or explains misses) (%) | 5 | 0% | 0 |
| 13) Scripts and instructions to run the tests? (Y/N) | 5 | Y | 5 |
| 14) Report of the results (%) | 10 | 0% | 0 |
| 15) Formal Verification test done (%) | 5 | 0% | 0 |
| 16) Stress Testing environment (%) | 5 | 100% | 5 |
| Security | | | |
| 17) Did 3rd Party audits take place? (%) | 70 | 90% | 63 |
| 18) Is the bug bounty acceptable high? (%) | 10 | 70% | 7 |
| Access Controls | | | |
| 19) Can a user clearly and quickly find the status of the admin controls | 5 | 100% | 5 |

| | | | |
|---|----|------|----|
| 20) Is the information clear and complete | 10 | 90% | 9 |
| 21) Is the information in non-technical terms | 10 | 90% | 9 |
| 22) Is there Pause Control documentation including records of tests | 10 | 100% | 10 |
| Section Scoring | | | |
| Code and Team | 50 | 100% | |
| Documentation | 45 | 56% | |
| Testing | 50 | 36% | |
| Security | 80 | 88% | |
| Access Controls | 35 | 94% | |

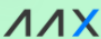

Executing Code Appendix

| Contract | Contract Address |
|-----------------------|--|
| Router | 0xcEF9E167d3f8806771e9bac1d4a0d568c39a9388 |
| ExchangeRateFeeder | 0xd7c4f5903De8A256a1f535AC71CeCe5750d5197a |
| ConversionPool - DAI | 0x83dd0a8E6F3A51c4cCA6c3f95721f9926DD9e7E7 |
| ConversionPool - USDT | 0xEd8C41774E71f9BF0c2C223d3a3554F496656D16 |
| ConversionPool - USDC | 0x53fD7e8fEc0ac80cf93aA872026EadF50cB925f3 |
| ConversionPool - BUSD | 0x242876001d04D5782aEE4f69fB26Ee6264Cc1d21 |

Code Used Appendix



















etherscan.io/address/0xcEF9E167d3f8806771e9bac1d4a0d568c39a9388/advanced#internaltx









Ad


Predict the BTC & AAB price Win up to 5000 USDT


Transactions
Internal Txns
Erc20 Token Txns
Contract
Events
Analytics
Comments

Advanced
Latest 25 internal transaction

| Parent Txn Hash | Block | Age | From | To |
|--|--------------------------|------------------|---|--|
| 0x479dac722f1f3301100... | 12813667 | 1 day 1 hr ago |  0xcEF9E167d3f8806771e... |  0x18c17fb8bc6e718a2b... |
| 0x479dac722f1f3301100... | 12813667 | 1 day 1 hr ago |  0xcEF9E167d3f8806771e... |  0xa47c8bf37f92abed4a1... |
| 0x479dac722f1f3301100... | 12813667 | 1 day 1 hr ago |  0xcEF9E167d3f8806771e... |  0xa47c8bf37f92abed4a1... |
| 0x479dac722f1f3301100... | 12813667 | 1 day 1 hr ago |  0xcEF9E167d3f8806771e... |  0x280ac4f337a11d35a7f... |
| 0x479dac722f1f3301100... | 12813667 | 1 day 1 hr ago |  0xcEF9E167d3f8806771e... |  0x280ac4f337a11d35a7f... |
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| 0x479dac722f1f3301100... | 12813667 | 1 day 1 hr ago |  0x53fD7e8fEc0ac80cf93a... |  0xcEF9E167d3f8806771e... |
| 0xbf2dee2d1c590ba302... | 12811286 | 1 day 10 hrs ago |  0xcEF9E167d3f8806771e... |  0xf4524c6491b441a9fc0... |
| 0xbf2dee2d1c590ba302... | 12811286 | 1 day 10 hrs ago |  0xcEF9E167d3f8806771e... |  0xa47c8bf37f92abed4a1... |

| | | | | |
|-------------------------|----------|------------------|--|--|
| 0xbf2dee2d1c590ba302... | 12811286 | 1 day 10 hrs ago |  0xcef9e167d3f8806771e... |  0xa47c8bf37f92abed4a1... |
| 0xbf2dee2d1c590ba302... | 12811286 | 1 day 10 hrs ago |  0xcef9e167d3f8806771e... |  0x280ac4f337a11d35a7f... |
| 0xbf2dee2d1c590ba302... | 12811286 | 1 day 10 hrs ago |  0xcef9e167d3f8806771e... |  0x280ac4f337a11d35a7f... |
| 0xbf2dee2d1c590ba302... | 12811286 | 1 day 10 hrs ago |  0xcef9e167d3f8806771e... |  0xec0e6b7892dea03d42... |

Example Code Appendix

```

1 // SPDX-License-Identifier: MIT
2 pragma solidity >=0.6.0 <0.8.0;
3 pragma experimental ABIEncoderV2;
4
5 import {SafeMath} from "@openzeppelin/contracts/math/SafeMath.sol";
6 import {IERC20} from "@openzeppelin/contracts/token/ERC20/IERC20.sol";
7 import {SafeERC20} from "@openzeppelin/contracts/token/ERC20/SafeERC20.sol";
8 import {Context} from "@openzeppelin/contracts/utils/Context.sol";
9 import "@openzeppelin/contracts-upgradeable/proxy/Initializable.sol";
10
11 import {Ownable} from "../utils/Ownable.sol";
12 import {StdQueue} from "../utils/Queue.sol";
13 import {IOperation} from "../operations/Operation.sol";
14 import {IOperationStore} from "../operations/OperationStore.sol";
15 import {IOperationFactory} from "../operations/OperationFactory.sol";
16
17 interface IRouter {
18     // ===== common ===== //
19
20     function init(
21         IOperation.Type _type,
22         address _operator,
23         uint256 _amount,
24         address _swapper,
25         address _swapDest,
26         bool _autoFinish
27     ) external;
28
29     function finish(address _operation) external;
30
31     // ===== deposit stable ===== //
32
33     function depositStable(uint256 _amount) external;
34
35     function depositStable(address _operator, uint256 _amount) external;
36
37     function initDepositStable(uint256 _amount) external;
38
39     function finishDepositStable(address _operation) external;
40
41     // ===== redeem stable ===== //
42
43     function redeemStable(uint256 _amount) external;
44

```

```

45     function redeemStable(address _operator, uint256 _amount) external;
46
47     function initRedeemStable(uint256 _amount) external;
48
49     function finishRedeemStable(address _operation) external;
50 }
51
52 interface IConversionRouter {
53     // ===== deposit stable ===== //
54
55     function depositStable(
56         address _operator,
57         uint256 _amount,
58         address _swapper,
59         address _swapDest
60     ) external;
61
62     function initDepositStable(
63         uint256 _amount,
64         address _swapper,
65         address _swapDest
66     ) external;
67
68     // ===== redeem stable ===== //
69
70     function redeemStable(
71         address _operator,
72         uint256 _amount,
73         address _swapper,
74         address _swapDest
75     ) external;
76
77     function initRedeemStable(
78         uint256 _amount,
79         address _swapper,
80         address _swapDest
81     ) external;
82 }
83
84 contract Router is IRouter, IConversionRouter, Context, Ownable, Initializable {
85     using SafeMath for uint256;
86     using SafeERC20 for IERC20;
87
88     // operation
89     address public optStore;
90     uint256 public optStdId;
91     address public optFactory;
92
93     // constant
94     address public wUST;
95     address public aUST;
96

```

```

97     // flags
98     bool public isDepositAllowed = true;
99     bool public isRedemptionAllowed = true;
100
101     function initialize(
102         address _optStore,
103         uint256 _optStdId,
104         address _optFactory,
105         address _wUST,
106         address _aUST
107     ) public initializer {
108         optStore = _optStore;
109         optStdId = _optStdId;
110         optFactory = _optFactory;
111         wUST = _wUST;
112         aUST = _aUST;
113         setOwner(msg.sender);
114     }
115
116     function setOperationStore(address _store) public onlyOwner {
117         optStore = _store;
118     }
119
120     function setOperationId(uint256 _optStdId) public onlyOwner {
121         optStdId = _optStdId;
122     }
123
124     function setOperationFactory(address _factory) public onlyOwner {
125         optFactory = _factory;
126     }
127
128     function setDepositAllowance(bool _allow) public onlyOwner {
129         isDepositAllowed = _allow;
130     }
131
132     function setRedemptionAllowance(bool _allow) public onlyOwner {
133         isRedemptionAllowed = _allow;
134     }
135
136     function _init(
137         IOperation.Type _typ,
138         address _operator,
139         uint256 _amount,
140         address _swapper,
141         address _swapDest,
142         bool _autoFinish
143     ) internal {
144         IOperationStore store = IOperationStore(optStore);
145         if (store.getAvailableOperation() == address(0x0)) {
146             address instance = IOperationFactory(optFactory).build(optStdId);
147             store.allocate(instance);
148         }
149         IOperation operation = IOperation(store.init(_typ, _operator, _amount, _swapper, _swapDest, _autoFinish));

```

```

149         operation.operation = operation(store.info(_authorinfo)),
150
151         // check allowance
152         if (IERC20(wUST).allowance(address(this), address(operation)) == 0) {
153             IERC20(wUST).safeApprove(address(operation), type(uint256).max);
154             IERC20(aUST).safeApprove(address(operation), type(uint256).max);
155         }

```

SLOC Appendix

Solidity Contracts

| Language | Files | Lines | Blanks | Comments | Code | Complex |
|----------|-------|-------|--------|----------|------|---------|
| Solidity | 34 | 3707 | 623 | 373 | 2711 | 203 |

Comments to Code 373/2711 = 14%

Javascript Tests

| Language | Files | Lines | Blanks | Comments | Code | Complex |
|------------|-------|-------|--------|----------|------|---------|
| JavaScript | 15 | 1982 | 297 | 29 | 1656 | 40 |

Tests to Code 1656/2711 = 61%