Bancor Process Quality Review

Score 96%

This is a Process Quality Review of Bancor completed on 3 November 2020. It was performed using the Process Review process (version 0.6) and is documented here. The review was performed by ShinkaRex of Caliburn Consulting. Check out our Telegram.

The final score of the review is 96%, an excellent score. The breakdown of the scoring is in Scoring Appendix.

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**

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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? (Y/N)
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)

Are the executing code addresses readily available? (Y/N)

> Answer: Yes

They are available at website https://docs.bancor.network/ethereum-contracts/addresses as indicated in the Appendix. This review only covers the contract ContractRegistry.sol.

How to improve this score

Make the Ethereum addresses of the smart contract utilized by your application available on either your website or your GitHub (in the README for instance). Ensure the addresses is up to date. This is a very important question wrt to the final score.

Is the code actively being used? (%)

> Answer: 100%

Activity is well in excess of 10 transactions a day, as indicated in the Appendix. This uses 0x2F9EC37d6CcFFf1caB21733BdaDEdE11c823cCB0 (Bancor Network) token.

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

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

> Answer: Yes

Location: https://github.com/bancorprotocol/

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.

Is there a development history visible? (%)

> Answer: 100%

With 5 branches and 3640 commits, this is a healthy 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 10 commits

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

> Answer: Yes

The names of the team members can be found in their Whitepaper.

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 seems a No.

Documentation

This section looks at the software documentation. The document explaining these

questions is here.

Required questions are;

1. Is there a whitepaper? (Y/N)
2. Are the basic software functions documented? (Y/N)
3. Does the software function documentation fully (100%) cover the deployed contracts? (%)
4. Are there sufficiently detailed comments for all functions within the deployed contract code (%)
5. Is it possible to trace from software documentation to the implementation in codee (%)

Is there a whitepaper? (Y/N)

> Answer: Yes

Location: Their whitepaper is both their Documentation, as well as the Whitepaper.

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

> Answer: Yes

Location: https://docs.bancor.network/ethereum-contracts/ethereum-api-reference

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

> Answer: 100%

The requirements are extremely well explained in the Bancor API. All of the specific contracts have detailed explanations with reference to the code within them. This is extremely well organized, and well written documentation.

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

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

> Answer: 80%

There are detailed comments documenting the functions on all level of code.

Code examples are in the Appendix. As per the SLOC, there is 73% 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.

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

> Answer: 100%

The API specifically defines all parts of the code. there is clear traceability throughout all of the documentation.

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

Testing

This section looks at the software testing available. It is explained in this document. This section answers the following questions;

1. Full test suite (Covers all the deployed code) (%)
2. Code coverage (Covers all the deployed lines of code, or explains misses) (%)
3. Scripts and instructions to run the tests (Y/N)
4. Packaged with the deployed code (Y/N)
5. Report of the results (%)
6. Formal Verification test done (%)
7. Stress Testing environment (%)

Is there a Full test suite? (%)

Answer: 100%

As per the Appendix, The test to code ratio is 319%.

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.

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

Answer: 50%

As there is no indication of code coverage, a 50% score is given.

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.

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

> Answer: Yes

Instructions on how to run the testing is found in Bancor's documentation.

Packaged with the deployed code (Y/N)

> Answer: Yes

The testing is packaged with the deployed code.

Report of the results (%)

> Answer: 90%

A test report is found at : https://github.com/bancorprotocol/solidity-test-reports. The report lists all test complete on a standard run but does not indicate coverage (this ran previously but did not run when generated for this report. It may be added in the future.

How to improve this score

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

Formal Verification test done (%)

Answer: 0%

There is no evidence of formal verification testing having been done in their external documentation.

Stress Testing environment (%)

Answer: 100%

There is evidence of stress testing done on the Roptsen network.

Audits

Answer: 100%

There are 5 different audits published. Links can be found in the Security Page.

Guidance:

1. Multiple Audits performed before deployment and results public and implemented or not required (100%)
2. Single audit performed before deployment and results public and implemented or not required (90%)
3. Audit(s) performed after deployment and no changes required. Audit report is public. (70%)
4. No audit performed (20%)
5. Audit Performed after deployment, existence is public, report is not public and no improvements deployed OR smart contract address' not found, question 1 (0%)

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.

Career wise I am a business development manager for an avionics supplier.

Scoring Appendix

	Total	Bancor	
PQ Audit Scoring Matrix (v0.6)	**Points**	**Answer**	**Points**
Total	240		229.5
Code and Team			**96%**
1. Are the executing code addresses readily available? (Y/N)	30	Y	30
2. Is the code actively being used? (%)	10	100%	10
3. Is there a public software repository? (Y/N)	5	Y	5
4. Is there a development history visible? (%)	5	100%	5
Is the team public (not anonymous)? (Y/N)	20	Y	20
Code Documentation			
1. Is there a whitepaper? (Y/N)	5	Y	5
2. Are the basic software functions documented? (Y/N)	10	Y	10
3. Does the software function documentation fully (100%) cover the deployed contracts? (%)	15	100%	15
4. Are there sufficiently detailed comments for all functions within the deployed contract code (%)	10	80%	8
5. Is it possible to trace from software documentation to the implementation in code (%)	5	100%	5
Testing			
1. Full test suite (Covers all the deployed code) (%)	20	100%	20
2. Code coverage (Covers all the deployed lines of code, or explains misses) (%)	5	50%	2.5
3. Scripts and instructions to run the tests? (Y/N)	5	Y	5
4. Packaged with the deployed code (Y/N)	5	Y	5
5. Report of the results (%)	10	90%	9
6. Formal Verification test done (%)	5	0%	0

7. Stress Testing environment (%)	5	100%	5
Audits			
Audit done	70	100%	70
Section Scoring			
Executing Code Verification	70	100%	
Documentation	45	96%	
Testing	55	85%	
Audits	70	100%	

Executing Code Appendix

https://docs.bancor.network/ethereum-contracts/addresses

Addresses

This section contains the list of the deployed contract addresses on both the Ethereum mainnet and Ropsten testnet.

Below are the core Bancor Network contract addresses that are required to initiate any interaction with the network:

Mainnet

Contract Name	Contract Address
ContractRegistry	0x52Ae12ABe5D8BD778BD5397F99cA900624CfADD4
BNT Token	0x1F573D6Fb3F13d689FF844B4cE37794d79a7FF1C
ETH Token	0xEeeeeEeeeEeEeeEeEeEeeEEEeeeeEeeeeeeeEEeE
EtherToken (Deprecated)	0xc0829421C1d260BD3cB3E0F06cfE2D52db2cE315

As of version 28 (released June 16, 2020), EtherToken has been deprecated and replaced with ETH.

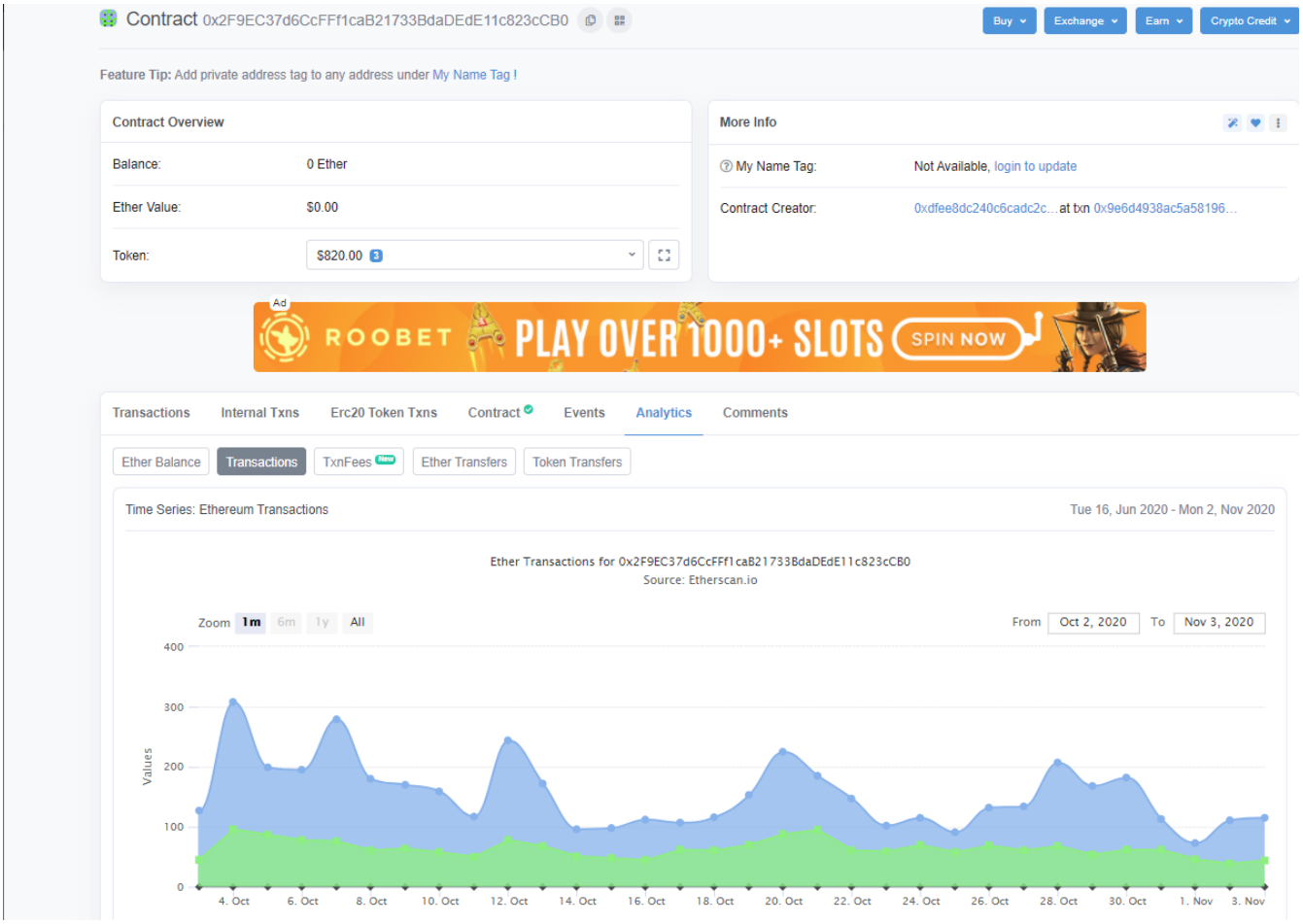
Follow the "Working with Bancor Network" guide to have a full view of the relevant contracts that make the network.

Ropsten

Contract Name	Contract Address
ContractRegistry	0xA6DB4B0963C37Bc959CbC0a874B5bDDf2250f26F
BNT Token	0xF35cCfbcE1228014F66809EDaFCDB836BFE388f5

Code Used Appendix

etherscan.io/address/0x2F9EC37d6CcFFf1caB21733BdaDEdE11c823cCB0#analytics



Example Code Appendix

```
// SPDX-License-Identifier: SEE LICENSE IN LICENSE
pragma solidity 0.6.12;
import "./interfaces/IBancorXUpgrader.sol";
import "./interfaces/IBancorX.sol";
import "../utility/ContractRegistryClient.sol";
import "../utility/SafeMath.sol";
import "../utility/TokenHandler.sol";
import "../utility/TokenHolder.sol";

/**
  * @dev The BancorX contract allows cross chain token transfers.
  *
  * There are two processes that take place in the contract -
  * - Initiate a cross chain transfer to a target blockchain (locks token
  * - Report a cross chain transfer initiated on a source blockchain (rel
  *
  * Reporting cross chain transfers works similar to standard multisig co
  * callers are required to report a transfer before tokens are released
*/
contract BancorX is IBancorX, TokenHandler, TokenHolder, ContractRegistry
    using SafeMath for uint256;

```

```
    // represents a transaction on another blockchain where tokens were d
    struct Transaction {
        uint256 amount;
        bytes32 fromBlockchain;
        address to;
        uint8 numOfReports;
        bool completed;
    }

    uint16 public constant version = 4;

    uint256 public maxLockLimit;            // the maximum amount of toke
    uint256 public maxReleaseLimit;         // the maximum amount of toke
    uint256 public minLimit;                // the minimum amount of toke
    uint256 public prevLockLimit;           // the lock limit *after* the
    uint256 public prevReleaseLimit;        // the release limit *after* 
    uint256 public limitIncPerBlock;        // how much the limit increas
    uint256 public prevLockBlockNumber;     // the block number of the la
    uint256 public prevReleaseBlockNumber;  // the block number of the la
    uint8 public minRequiredReports;        // minimum number of required

    IERC20Token public override token;      // erc20 token

    bool public xTransfersEnabled = true;   // true if x transfers are en
    bool public reportingEnabled = true;    // true if reporting is enabl

    // txId -> Transaction
    mapping (uint256 => Transaction) public transactions;

    // xTransferId -> txId
    mapping (uint256 => uint256) public transactionIds;

    // txId -> reporter -> true if reporter already reported txId
    mapping (uint256 => mapping (address => bool)) public reportedTxs;

    // address -> true if address is reporter
    mapping (address => bool) public reporters;

    /**
      * @dev triggered when tokens are locked in smart contract
      *
      * @param _from    wallet address that the tokens are locked from
      * @param _amount  amount locked
    */
    event TokensLock(
        address indexed _from,
        uint256 _amount
    );

    /**
      * @dev triggered when tokens are released by the smart contract
      *
```

```
     * @param _to      wallet address that the tokens are released to
     * @param _amount  amount released
    */
    event TokensRelease(
        address indexed _to,
        uint256 _amount
    );

    /**
     * @dev triggered when xTransfer is successfully called
     *
     * @param _from            wallet address that initiated the xtransf
     * @param _toBlockchain    target blockchain
     * @param _to              target wallet
     * @param _amount          transfer amount
     * @param _id              xtransfer id
    */
    event XTransfer(
        address indexed _from,
        bytes32 _toBlockchain,
        bytes32 indexed _to,
        uint256 _amount,
        uint256 _id
    );

    /**
     * @dev triggered when report is successfully submitted
     *
     * @param _reporter        reporter wallet
     * @param _fromBlockchain  source blockchain
     * @param _txId            tx id on the source blockchain
     * @param _to              target wallet
     * @param _amount          transfer amount
     * @param _xTransferId     xtransfer id
    */
    event TxReport(
        address indexed _reporter,
        bytes32 _fromBlockchain,
        uint256 _txId,
        address _to,
        uint256 _amount,
        uint256 _xTransferId
    );

    /**
     * @dev triggered when final report is successfully submitted
     *
     * @param _to  target wallet
     * @param _id  xtransfer id
    */
    event XTransferComplete(
        address _to,
```

```
        uint256 _id
    );

    /**
      * @dev initializes a new BancorX instance
      *
      * @param _maxLockLimit          maximum amount of tokens that can b
      * @param _maxReleaseLimit       maximum amount of tokens that can b
      * @param _minLimit              minimum amount of tokens that can b
      * @param _limitIncPerBlock      how much the limit increases per bl
      * @param _minRequiredReports    minimum number of reporters to repo
      * @param _registry              address of contract registry
      * @param _token                 erc20 token
     */
    constructor(
        uint256 _maxLockLimit,
        uint256 _maxReleaseLimit,
        uint256 _minLimit,
        uint256 _limitIncPerBlock,
        uint8 _minRequiredReports,
        IContractRegistry _registry,
        IERC20Token _token
    )   ContractRegistryClient(_registry)
        public
        greaterThanZero(_maxLockLimit)
        greaterThanZero(_maxReleaseLimit)
        greaterThanZero(_minLimit)
        greaterThanZero(_limitIncPerBlock)
        greaterThanZero(_minRequiredReports)
        validAddress(address(_token))
        notThis(address(_token))
    {
        // validate input
        require(_minLimit <= _maxLockLimit && _minLimit <= _maxReleaseLim

        // the maximum limits, minimum limit, and limit increase per bloc
        maxLockLimit = _maxLockLimit;
        maxReleaseLimit = _maxReleaseLimit;
        minLimit = _minLimit;
        limitIncPerBlock = _limitIncPerBlock;
        minRequiredReports = _minRequiredReports;

        // previous limit is _maxLimit, and previous block number is curr
        prevLockLimit = _maxLockLimit;
        prevReleaseLimit = _maxReleaseLimit;
        prevLockBlockNumber = block.number;
        prevReleaseBlockNumber = block.number;

        token = _token;
    }

    // validates that the caller is a reporter
```

```
    modifier reporterOnly {
        _reporterOnly();
        _;
    }

    // error message binary size optimization
    function _reporterOnly() internal view {
        require(reporters[msg.sender], "ERR_ACCESS_DENIED");
    }

    // allows execution only when x transfers are enabled
    modifier xTransfersAllowed {
        _xTransfersAllowed();
        _;
    }

    // error message binary size optimization
    function _xTransfersAllowed() internal view {
        require(xTransfersEnabled, "ERR_DISABLED");
    }

    // allows execution only when reporting is enabled
    modifier reportingAllowed {
        _reportingAllowed();
        _;
    }
```

SLOC Appendix

Solidity Contracts

Language	Files	Lines	Blanks	Comments	Code	Complexity
Solidity	14	6663	744	2517	3402	396

Comments to Code 2517/ 3402 = 73%

Javascript Tests

Language	Files	Lines	Blanks	Comments	Code	Complexity
JavaScript	45	13798	2773	171	10854	731

Tests to Code 10854 / 3402 = 319%