Public Blockchain Security Audit Report
Audit Number: 202109221821

Public Blockchain Name: QITCOIN

Source Code Link: https://github.com/qitchain/qitcoin

Initial commit: fd519d9d598da3e385a2ca14b47256d228d24900

Final commit: 5db1aa996dc019c378d504c341f31da51cb9d415

Start Date: 2021.09.06

Completion Date: 2021.09.22

Overall Result: Pass (Distinction)

Audit Team: Beosin Technology Co. Ltd.

Audit Categories and Results:

<table>
<thead>
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<th>Categories</th>
<th>Subitems</th>
<th>Results</th>
</tr>
</thead>
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<tr>
<td>1</td>
<td>Language Coding Security Audit</td>
<td>Language Feature Security</td>
<td>Pass</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Arithmetic Operation</td>
<td>Pass</td>
</tr>
<tr>
<td>2</td>
<td>RPC Security Audit</td>
<td>RPC Sensitive Interface Permissions</td>
<td>Pass</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Traditional Web Security</td>
<td>Pass</td>
</tr>
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<td></td>
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<td>RPC Interface Security</td>
<td>Pass</td>
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<td>3</td>
<td>Wallet Module &amp; Account Security Audit</td>
<td>Private Key / Mnemonic Word Storage Security</td>
<td>Pass</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Private Key / Mnemonic Word Usage Security</td>
<td>Pass</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Wallet Module Code Security</td>
<td>Pass</td>
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<tr>
<td>4</td>
<td>Transaction Model Security Audit</td>
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<td>Pass</td>
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<td>Transaction Replay</td>
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<td>Transaction Processing Logic</td>
<td>Pass</td>
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<tr>
<td>5</td>
<td>Consensus Security</td>
<td>Design Of Consensus Mechanism</td>
<td>Pass</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Implementation Of Consensus Verification</td>
<td>Pass</td>
</tr>
<tr>
<td></td>
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<td>Incentive Mechanism Audit</td>
<td>Pass</td>
</tr>
<tr>
<td>6</td>
<td>Third-party Library Vulnerability Detection</td>
<td>Dependent library Security Audit</td>
<td>Pass</td>
</tr>
</tbody>
</table>
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The final interpretation of this statement belongs to Beosin.
## Basic information of the chain:

<table>
<thead>
<tr>
<th>Name</th>
<th>QITCOIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symbol</td>
<td>QTC</td>
</tr>
<tr>
<td>Decimals</td>
<td>8</td>
</tr>
<tr>
<td>Block Size</td>
<td>2MB</td>
</tr>
<tr>
<td>Block Generation Time</td>
<td>3 min</td>
</tr>
<tr>
<td>Total Supply</td>
<td>105 Million</td>
</tr>
<tr>
<td>Initial Block Reward</td>
<td>75 QTC per block</td>
</tr>
<tr>
<td>Block Reward Halve Period</td>
<td>The first halving time is 420,000 block height, and will be halved every 700,000 blocks later, and the maximum number of halving is 64 times</td>
</tr>
<tr>
<td>Consensus Algorithm</td>
<td>Conditioned-Proof of Capacity, CPoC</td>
</tr>
</tbody>
</table>

### Token distribution

20% (21000000) is allocated to the preset address, and the remaining 80% to the mining rewards and POS income.

According to the project owner, the QITCOIN main chain will use the pre-allocated tokens respectively for the Foundation (5%) and Search Lab (15%).

The on-chain data shows that the Foundation address (3BvLuBGM4JoAhBEbiuRKs8hjDk2VCFQEGgu) has about 5.25 million tokens and has not been released; the Search Lab address (3LPuNd6j48NWL7J8c2bZZ8rv45u2f2TY) initially has 15.75 million, and 3.15 million have been released linearly as of September 15, 2021.

Table 1 Basic information of the QITCOIN
Detailed explanations of the Audit Results:

1. Language coding security audit

Through static scanning of the public chain source code and manual analysis of dangerous functions, no major security vulnerabilities were found.

(1) Memory leak

**Description:** As shown in the figure below, walletInstance is not explicitly released in some branches, and system resources will not be recycled and reused, thereby reducing the future availability of resources. However, the program will exit shortly after entering this branch and has less impact.

![Image of code snippet](image-url)

**Figure 1** Pointers that are not explicitly released

**Suggestion:** Use smart pointers such as std::shared_ptr<CWallet> to manage the instance (walletInstance).

(2) Null pointer reference

**Description:** As shown in the figure below, frand may be null during execution, and according to the code logic, it is normal for frand to be empty, but then fclose on the null pointer will cause an abnormal crash. But because the code is in the test code of secp256k1, the impact is very small.
Suggestion: Before fclose, judge whether frand is NULL.

(3) Use variables that are not explicitly initialized

Description: As shown in the figure below, during the execution of the constructor of the Stats class, the uninitialized start_ is set to last_op_finish_. This will cause the value of last_op_finish_ to be unexpected, which has certain safety risks. However, this problem also exists in the latest BTC source code. And the impact and scope are not large.
**Suggestion:** When defining the class, set the initial value of `start_` to 0.0.
2. RPC Security Audit

(1) rpc request permission control

Like Bitcoin, if users need to open http RPC interface, manually opening it with -server parameter and setting the rpcuser & rpcpassword are required. Each time when calling RPC interface, the authentication is required. If failed in check, this calling will be failed.

(2) rpc interface security

- Node crash caused by the assert keyword

As shown in the figure below, when the getplottermininginfo and getactivebindplotteraddress interfaces are called to obtain data in the cli, the following errors will appear:

![Figure 4 The result of calling the getplottermininginfo interface](image)

The corresponding node will also crash accordingly:

![Figure 5 Node information](image)

The relevant codes involved are as follows:

![Figure 6 The relevant codes](image)

In addition, the addsignprivkey interface does not check the validity of the added private key. If the private key passed in is an invalid private key, it will also cause the node to crash.

![Figure 7 The result of calling the addsignprivkey interface](image)

![Figure 8 Node information](image)

The relevant codes involved are as follows:
Figure 9 The relevant codes

**Suggestion:** Check the use of assert in the project to avoid the termination of the main program caused by incorrect parameters.

**Fixed Result:** Fixed.

- Wrong help message

As shown in the figure below, the help message of the decodebindplotterdata interface prompts that two parameters need to be passed in: address and hexdata, but in fact only one parameter hexdata needs to be passed in.

Figure 10 Help message of the decodebindplotterdata interface

**Suggestion:** Modify the help message.

**Fixed Result:** Fixed.
3. Wallet Module & Account Security Audit

The same as Bitcoin, QITCOIN use UTXO model, and support encrypt/decrypt interface to encrypt/decrypt local wallet. Manual lock & unlock wallet are supported. The local wallet files are stored encrypted.

![Figure 11 local wallet file](image1)

In addition, according to QTICOIN's consensus mechanism, miners need to meet a certain pointReceived before they can get a high percentage of miner rewards; at the same time, the top 10 on the staking-list can get mining dividends based on the amount of staking. QITCOIN provides related interfaces for this function for users to operate QTC assets to obtain higher returns.

![Figure 12 QITCOIN's unique interface](image2)

After testing, the new interface function of this part is in line with the design, and there are no security issues.
4. Transaction model security

4.1 Transaction replay audit

According to the current UTXO model of QITCOIN and its only one main chain, it is not possible to perform replay attacks where transactions are executed on different chains. However, if there are subsequent fork chains, please pay attention to the version control of the chain to avoid replay attacks.

4.2 Double-spending attack audit

For ordinary transactions on the QITCOIN chain, a pre-check will be carried out to update the coin status and check the transaction double-spending.

In addition to ordinary transactions, the team conducted a double-spending attack test for special transactions in QITCOIN: sendpointtoaddress, sendstakingtoaddress, withdrawpoint, withdrawstaking, etc., and found that none of the attacks were successful.
5. Consensus Security

The consensus algorithm used by QITCOIN is CPoC (Conditioned-Proof of Capacity), that is, conditional capacity proof. Participants get different profit coefficients according to different conditions. This consensus is an upgraded and improved algorithm of PoC2 (Proof of Capacity) consensus. On the basis of PoC consensus, a POS consensus mechanism that requires miners to use QTC as the stake is added.

In the current version of the consensus mechanism, the block reward is divided into two parts: miner income and POS income. If the point amount that miners received meets the mining required balance, they will receive 80% of the block rewards, and the remaining 20% will be obtained by the top 10 of the staking list in proportion to the amount; if the point amount do not meet the mining required balance, they will only receive 5% of the block rewards, and the remaining 95% will be obtained by the top 10 of the staking list.

![Figure 14 Block reward calculation function](image)

Currently, there are two types for miners to increase the point amount: lock-up for 540 days and 360 days. The number of effective records for point amount with a lock-up period of 540 days is the number of user’s QTC locked; while the number of effective records for a 360-day point amount is half the number of QTC locked. In addition, the chain itself requires that the amount of lock-up no less than 10 QTC each time and that the user has sufficient QTC balance.
For miners, the mining required balance required is the product of the user’s bound hard drive capacity and the mining pledge ratio, where the mining pledge ratio is initially 5 QTC/TiB and will be halved in tandem with the halving of the block reward.

For the miner part of the reward, the miner will first get a one-time 20%, and the remaining 80% will be released linearly at 5% per 5,400 blocks within 180 days; for the top ten users of staking, the rewards and dividends are sent at one time.

Addresses participating in the staking ranking can receive staking from themselves or other addresses, and their lock-up period and valid staking quantity are recorded in the same way as miners’ stake (540 days of lock-up is recorded by QTC quantity; 360 days of lock-up is recorded by half of QTC quantity), and the corresponding table is maintained in the database. In each block reward distribution, the node will pull the staking data from the database, sort and extract the top 10 to distribute the reward in proportion to the number of staking.
The following are the stages of change in the mining consensus:

(1) **Genesis stage**

Block range: 1

Block reward: No reward, allocate initial tokens to the preset address. Distribute 10500000 QTC to 3LX1uGfaDm6LGj6gy7aFJc7azpyzKhUaRs and 3JSgHDJzDSHr1o5Lx2b1Fe6AwfFn8LNSX addresses.

(2) **Condition-free mining stage**

Block range: 2-3359 (About 1 week)

Block reward: 75QTC/Block (Miners get 100% block rewards without any staking)

(3) **Conditional mining stage (CPoC)**

Block range: 3360+

Block reward: The initial reward is 75 QTC per block. The block height for the first halving time is 420,000, after that every 700,000 blocks are halved, and there is no reward after 64 halving times.
6. Dependent library security audit

Some dependent versions are updated rapidly and the latest version information may be delayed. Please refer to the actual situation.

(1) berkeley-db

<table>
<thead>
<tr>
<th>Current version: 18.1.32</th>
<th>Latest version: 18.1.40</th>
</tr>
</thead>
<tbody>
<tr>
<td>Historical vulnerabilities: None</td>
<td></td>
</tr>
<tr>
<td>Security recommendations: None</td>
<td></td>
</tr>
</tbody>
</table>

(2) Boost

<table>
<thead>
<tr>
<th>Current version: 1.70.0</th>
<th>Latest version: 1.77</th>
</tr>
</thead>
<tbody>
<tr>
<td>Historical vulnerabilities: None</td>
<td></td>
</tr>
<tr>
<td>Security recommendations: None</td>
<td></td>
</tr>
</tbody>
</table>

(3) expat

<table>
<thead>
<tr>
<th>Current version: 2.2.7</th>
<th>Latest version: 2.4.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Historical vulnerabilities: CVE-2019-15903, CVE-2021-40439</td>
<td></td>
</tr>
<tr>
<td>Security recommendations: None. Historical vulnerabilities do not affect the security of the chain for the time being.</td>
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</tbody>
</table>

(4) fontconfig

<table>
<thead>
<tr>
<th>Current version: 2.12.1</th>
<th>Latest version: 2.13.94</th>
</tr>
</thead>
<tbody>
<tr>
<td>Historical vulnerabilities: None</td>
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</tr>
<tr>
<td>Security recommendations: None</td>
<td></td>
</tr>
</tbody>
</table>

(5) freetype

| Current version: 2.7.1 | Latest version: 2.11.0 |
Historical vulnerabilities: None
Security recommendations: None

(6) libevent
Current version: 2.1.8-stable
Latest version: 2.1.12-stable
Historical vulnerabilities: Integer overflow
Security recommendations: None. Historical vulnerabilities will not affect the security of the chain for the time being.

(7) MiniUPnPc
Current version: 2.0.20180203
Latest version: 2.2.3
Historical vulnerabilities: None
Security recommendations: None

(8) openssl
Current version: 1.0.1k
Latest version: Openssl 3.0
Security recommendations: None. Historical vulnerabilities will not affect the security of the chain for the time being.

(9) protobuf
Current version: 2.6.1
Latest version: 3.18.1
Historical vulnerabilities: CVE-2021-30179, CVE-2021-3121
Security recommendations: None. Historical vulnerabilities will not affect the security of the chain for the time being.

(10) qrencode
Current version: 3.4.4
Latest version: 4.1.1
Historical vulnerabilities: None
Security recommendations: None

(11) QT
Current version: 5.9.7
Latest version: 6.2
Security recommendations: None. Historical vulnerabilities will not affect the security of the chain for the time being.

(12) ZeroMQ
Current version: 4.3.1
Latest version: 4.3.2
Historical vulnerabilities: CVE-2019-6250, CVE-2020-15166, CVE-2021-20234 etc.
Security recommendations: None. Historical vulnerabilities will not affect the security of the chain for the time being.

(13) zlib
Current version: 1.2.11
Latest version: 1.2.11
Historical vulnerabilities: None
Security recommendations: None
7. Audit Conclusion

Beosin Technology has used a simulated attack to conduct multi-dimensional and comprehensive security audit on aspects of the module security and business logic security of the public blockchain QITCOIN. The public blockchain QITCOIN passed all audit items. The overall result is Pass.
Official Website
https://lianantech.com

E-mail
market@lianantech.com

Twitter
https://twitter.com/Beosin_com