Trezarcoin

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Abstract

Introducing Trezarcoin, an extremely secure and energy efficient cryptocurrency. Trezarcoin combines the best features of both Proof-of-Work and Proof-of-Stake mining. Its central innovation developed by Ghostlander, 0% Proof-of-Stake, is by far the most advanced implementation of this technology to date. Trezarcoin supports multiple algorithms to achieve enhanced security. With these features, Trezarcoin is targeting users who place a high value on security.

1 NeoScrypt

NeoScrypt is a further development of Scrypt and will increase security and improve performance on general purpose computer hardware, while maintaining comparable costs and requirements. Although a very innovative design for its day, Scrypt has developed vulnerabilities. The first announced differential cryptanalysis of Salsa20/8 by Tsunoo et al. [1] in 2007 did not deliver any advantage over 256-bit brute force attack, but the following research by Aumasson et al. [2] reduced time complexity to break it from 2 255 to 2 251 with 50% success probability. It was improved by Shi et. al [3] in 2012 to 2 250 . Although this is not critical yet, improved attacks on Salsa20/8 may be developed in the future. NeoScrypt uses Salsa20 and ChaCha20 to improve on Scrypt security. There are no known successful attacks on non-reduced Salsa20 and ChaCha20, other than exhaustive brute force hacks. NeoScrypt replaces SHA-256 with BLAKE2s [4] which is a further development of BLAKE-256 [5], one of 5 NIST SHA-3 contest finalists. Based upon ChaCha20 , NeoScrypt operates with a lower round count of 10, supports keyed hashing, is native little endian and faster significantly than SHA-256 and even BLAKE-256. It could be interfaced directly to PBKDF2 with no need of HMAC. However PBKDF2 constructs derived keys using blocks. This means a minor change in an input datum, such as nonce increment, may not result in an entirely different derived key. A replacement KDF has been developed to address this issue.

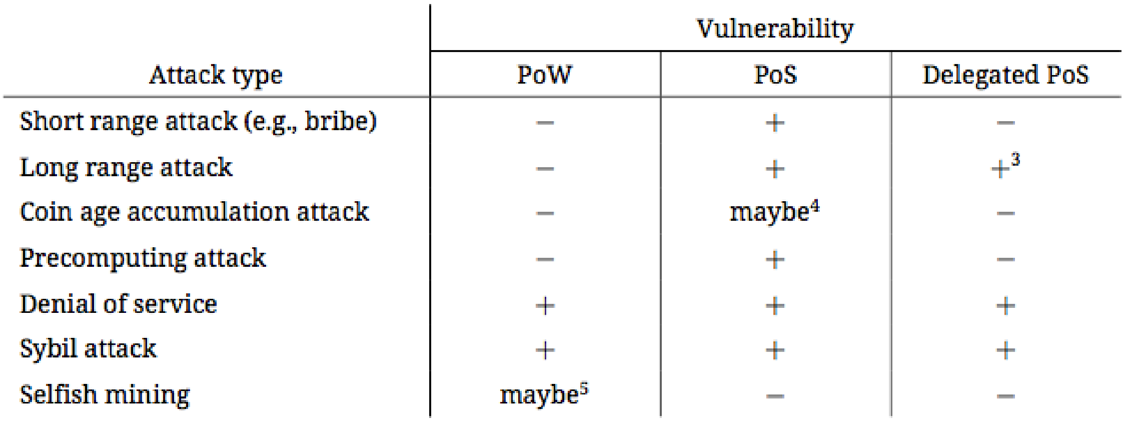
2 Proof-of-Stake & Proof-of-Work

The underlying database structure for transactions of Bitcoin and other digital currencies is a decentralized ledger, called the blockchain, which stores the entire transaction history. The name stems from the fact that transactions are bundled into blocks; each block in the blockchain (except for the first i.e. genesis block) references a previous block. Each node participating in the Bitcoin network has its own copy of the blockchain, which is synchronized with other nodes using a peer-to-peer protocol. Any implementation of digital currency must have a way to secure its blockchain against attacks. The blockchain prevents an attacker from spending a cryptocurrency, and then reversing the spending transaction by broadcasting their own version of the blockchain without their transaction. Security of the blockchain does not rely on a single authority, instead it uses a network of contributors to agree on all transactions. Users have no prior knowledge as to which version of the ledger is valid, so cannot change the information it contains. In Bitcoin, the security of the network relies on a proof-of-work (PoW) algorithm in the form of block mining. Each node participating in mining is required to solve a computationally difficult problem to ensure the validity of the newly mined block; solutions are rewarded with bitcoins. The protocol is fair in the sense that a miner with p fraction of the total computational power can win the reward and create a block with the probability p. An attacker is required to solve the same tasks as the rest of the Bitcoin network, so an attack on Bitcoin will only be successful if the attacker can bring significant computational resources greater than the rest of the network combined. Operation of the Bitcoin protocol is such that security of the network is supported by physically scarce resources:

- specialized hardware needed to run computations
- electricity spent to power the hardware

This makes Bitcoin inefficient from a resource standpoint. To increase their share of rewards, Bitcoin miners are compelled to participate in an arms race to continuously deploy more resources in mining. While this makes the cost of an attack on Bitcoin prohibitively high, the ecological unfriendliness of the Bitcoin protocol has resulted in proposals to build similar systems that are much less resource intensive. One possible decentralized ledger implementation with security not based on expensive computations relies on proof-of-stake (PoS) algorithms. The idea behind proof-of-stake is simple: instead of mining power, the probability to create a block and receive the associated reward is proportional to the users ownership stake in the system. An individual stakeholder who has p fraction of the total number of coins in circulation creates a new block with p probability. The rationale behind PoS is the following: users with the highest stakes in the system have the most interest to maintain a secure network, as they will suffer the most if the reputation and price of the cryptocurrency would diminish because of the attacks. To mount a successful attack, an outside attacker would need to acquire most of the currency, which would be prohibitively expensive for a popular system.

Table 2: Vulnerability of proof of work and proof of stake consensus mechanisms to attack vectors



	Vulnerability		
Attack type	PoW	PoS	Delegated PoS
Short range attack (e.g., bribe)	−	+	−
Long range attack	−	+	+[3]
Coin age accumulation attack	−	maybe[4]	−
Precomputing attack	−	+	−
Denial of service	+	+	+
Sybil attack	+	+	+
Selfish mining	maybe[5]	−	−

This is one of many reasons why a combination of Proof-of-Stake and Proof-of-Work is implemented in Trezarcoin.

3 Advanced checkpointing

Advanced checkpointing is a feature originally invented and implemented by Feathercoin and its developer Peter Bushnell. Its purpose is to defend the blockchain of Trezarcoin from 51% Attacks. The advanced checkpointing (ACP) feature will remove the need for changes to client software by publishing a feed of checkpoints via a central node. Checkpointing is an infrequently utilized feature of cryptocurrencies. Its a way to maintain the integrity of the block chain by recording blocks out of it. In bitcoin, checkpoints are stored in the code of the client. This enables it to verify its checkpoints against the copy of the block chain it has downloaded, ensuring that block chain has not been retroactively rewritten in a 51% attack. This means that as the block chain grows, client software has to be updated to store new checkpoints within its code. This leaves clients not having been updated for a long time vulnerable to attacks on the block chain. The Trezarcoin team intends to solve this problem by separating the checkpoint record from the client software. The team has created a master node and updated its client, which will publish the series of checkpoints for Trezarcoin clients to verify against.

4 Orbitcoin Super Shield

The difficulty of Trezarcoin for PoS and PoW blocks is defined by Orbitcoin Super Shield (OSS), which uses various inputs to retarget the difficulty. To retarget every block, OSS takes the two averaging windows of 5 and 20 blocks, 0.25 damping and further oscillation limiting. The idea behind OSS is the protection of the network from multipool-mining, which creates higher difficulty for everyone. Leaving a blockchain on a difficulty-trap is a common attack on blockchains which havent implemented an intelligent retarget-algorithm. The basic advantage of OSS is it regulates the difficulty according to a few significant measurements, instead of only through the average of the last 2016 blocks like bitcoin does.

5 0% Proof-of-Stake

0% Proof-of-Stake adds an additional layer of security to the Trezarcoin protocol. Essentially your Coins start staking after a one day period. This period starts from the moment your incoming transaction was broadcast, including previous PoS block. It is not possible to generate PoS for inputs that are younger than one day and you cannot predict how much time it will take to generate PoS afterwards. This is quite similar to traditional solomining with a GPU. It depends on:

- it depends on the current difficulty (which in turn depends on the amount and activity of the ”competitors” - other miners)
- your mining power (but with PoS your mining power not megahashes of mining hardware but amount of coins-days you accumulate in your wallet)
- time which you spend at mining (but with PoS it is not time of GPU/ASIC work, but time while you running wallet online with ”old” coins staking)
- your luck

The staking power, usually called ”weight” is calculated in the following way: (amount of Coins)*(Coinage - 1) = Coinweight. The Coinage is counted for each input transaction individually. As explained above inputs with an age smaller than one day have zero weight, although according to the formula they would have a negative value, but the protocol just accounts all this inputs as 0 weight, and aren't staking at all. For example incoming 25 TZC transaction that is one week old have weight = 25 (7-1) = 150 coin-days, increasing continuously with time until generating a PoS finally.After a successful PoS generation coin age reset to zero (so weight = 0 too) and the process starts from the beginning.Maximum possible weight is reached after 16 days, so maximum weight = input size x 15. It is still not possible to calculate the exact time when an individual input will generate a PoS, because it is a stochastic procedure and heavily dependent on luck. Sometimes very ”lucky” inputs may generate PoS blocks only a few hours after reaching minimum age. In case of bad luck the exact opposite, a transaction staking a few days or even weeks before generating a PoS reward is possibly as well. Of course having many inputs staking at the same time reduces the luck factor and the timing of rewards becomes more predictable. The main difference between the Trezarcoin PoS and other PoS systems is best explained in an example. You have 1000 coins and want to stake them for profit continuously, in traditional PoS you can launch your wallet, say, once a month, synchronise, generate a single big stake quickly and shut down the wallet until the next month. You are not motivated to keep it online as much as possible and support the network. In case of TZC, doing the same means losing most of the potential profit. First of all, you want to split these 1000 TZC into smaller parts like 20 to 50 TZC each, so they can stake independently (a process your wallet will take care of automatically, but it is still the fastest way to do it yourself). Second, you want them to stake as soon as possible, and the best way is to keep your wallet online as much as possible. You produce a number of PoS blocks in the process rather than a single one, also you constantly replay blocks, transactions, messages and in short help securing and maintaining the network.

6 Conclusion

The primarily advantages and features of Trezarcoin compared to standard Scrypt Coins have been described and evaluated above without going into much detail, so everyone can understand the vast topic of cryptocurrency mining. For more details please refer to the source code of Trezarcoin.

7 References

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