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<h1 align="center">
Sugarchain: a PoW blockchain with fast transaction and accurate block reward halving with no rounding errors
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Abstract. Sugarchain is the world's fastest PoW blockchain, that has the first Native SegWit (Bech32) built-in by default. Unlike Bitcoin. Sugarchain has no rounding errors when the block reward is halved. It launched fairly and follows Nakamoto's one-CPU-one-vote.

1. Introduction

Sugarchain is a decentralized, peer-to-peer (P2P) digital currency and payment network supported by an open-source blockchain protocol, launched by Zenny Kim and Volodymyr Biloshytskyi on August 24, 2019 ^[1]. Through Sugarchain, users can make payments to anyone in the world at the highest speeds in 5 seconds, and the lowest costs compared to other digital assets. For example, the transaction speed of Sugarchain is 120 times faster than Bitcoin, 30 times faster than Litecoin and 12 times faster than Dogecoin.

The Sugarchain Project emerged as an alternative solution to Bitcoin in light of early concerns over Bitcoin's wait times in confirming block transactions and rounding errors in block reward halving. By introducing minor technical modifications to the original Bitcoin source code, Sugarchain allowed for much faster transaction speeds, even lower processing fees and has the most accurate block reward halving and total supply than any other digital asset, including Bitcoin. Sugarchain also launched following the one-CPU-one-vote idea proposed by Satoshi Nakamoto himself, thus making YespowerSugar GPU and ASIC resistant. It has also launched as being the first blockchain to have Native SegWit (Bech32) enabled by default.

As one of the successful derivatives of Bitcoin, Sugarchain is establishing its position as the world's fastest PoW blockchain, complementing and reinforcing Bitcoin in purpose, function, and utility, and challenging our traditional notions of money. The Sugarchain Project has never been funded through an ICO or premine, making it a fair launch. Sugarchain is an entirely community and voluntarily driven project, with no external company or funding supporting it apart from community funding

<small>** [1]: [1]: [1] topic=5177722.0) </small>

2. Specifications

Block time: 5 Seconds

Block reward: 42.94967296 SUGAR

Halving interval: 12,500,000 Blocks (approx. 2 years)

Total supply: 1,073,741,824 SUGAR

PoW algorithm: YespowerSugar (based on Yespower 1.0.1)

Difficulty: SugarShield-N510 (based on Zcash's modification of Digishield)

Port: 34230 / RPC 34229

None: NO ICO, NO Presale, NO Founder's rewards Premine:

3. The world's fastest PoW blockchain

- 5 seconds transaction speed ^[2] :
 - 120x faster than Bitcoin
 - 30x faster than Litecoin
 - 12x faster than Dogecoin
- Transaction speed comparison

^[3]

^[4]

^[5]

^[6]

^[7]

:

- · Don't worry about orphan blocks:
 - According to the testnet results, the average orphan rate is under 3% and no problems occur.

<small>** [2]: Github: SUGAR speed (https://github.com/sugarchainproject/sugarchain/blob/d2d13cacd9e7c2640a02e6392978a26df06f9eb8/src/chainparams.cpp#L187)

** [3]: DGB speed

(https://github.com/digibyte/digibyte/blob/82414be2e78bd136daeb91f55c72768a9b700957/src/chainparams.cpp#L88)

** [4]: XVG speed

* [5]: DOGE speed

(https://github.com/dogecoin/dogecoin/blob/0b46a40ed125d7bf4b5a485b91350bc8bdc48fc8/src/chainparams.cpp#L89) in the complex of the complex

** [6]: LTC speed (https://github.com/litecoin-

project/litecoin/blob/81c4f2d80fbd33d127ff9b31bf588e4925599d79/src/chainparams.cpp#L74)

** [7]: BTC speed

(https://github.com/bitcoin/bitooin/blob/48c1083632687a42ac603d4f241e70616a1d3815/src/chainparams.cpp#L77) in the property of the property o</small>

4. Native SegWit (Bech32)

- The first blockchain to have Native SegWit (Bech32) built-in by default.
- · Significantly faster and lower cost than legacy transaction.
- · Very high probability of detection guaranteed.

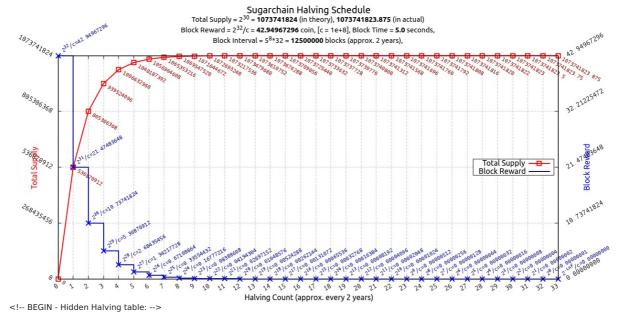
- Structure^[8]^[9]
 - ^[10]
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- <small>** [8]: Github: BIP-173 (https://github.com/bitcoin/bips/blob/master/bip-0173.mediawiki)
- ** [9]: Youtube: New Address Type for SegWit Addresses by Pieter Wuille (https://www.youtube.com/watch? v=NqiN9VFE4CU)
- ** [10]: File: Keynote Document (https://prezi.com/gwnjkqjqjjjbz/bech32-a-base32-address-format/)
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5. Exact halving and total supply

Halving is everything about limiting the total supply. Bitcoin is valuable because its total supply has been strictly limited, unlike traditional currencies. This total supply is controlled only by that halving. There is nothing else. We made this halving better.

- The formula of Sugarchain's total money supply (in satoshis)
 - ^[11]
 - ^[12]
 -
- Block reward:
 - The block reward should be to a **power of two**, so that it halves correctly.
 - 2^32/1e+8 = 42.94967296 SUGAR ^[13]
- · Halving schedule:
 - Interval 12500000 blocks (5^8*32) ^[14] which is approx. 2 years (62,500,000 seconds).
 - The total number of times halving will occur is 33 times, over the span of approx. 66 years (34,375,000 minutes).
- Total supply:
 - 1073741824 SUGAR ^[15] ^[16] in theory, and 1073741823.875 SUGAR ^[17] ^[18] in actual.
 - The difference is 0.125 SUGAR. One Satoshi (0.00000001) limitation makes this difference. In addition, this number is meaningful. FYI: 1 GB = 1073741824 Byte (2^30).
 - The total supply of Sugarchain is around 51 times greater than Bitcoin.
- Halving chart:



 $\bullet \quad <\!\! \mathsf{details} \!\! > \!\! <\!\! \mathsf{summary} \!\! > \!\! \mathsf{Halving \ table} \! : <\!\! \mathsf{i} \!\! > \!\! (\mathsf{click \ to \ expand}) \!\! <\!\! \mathsf{i} \!\! > \!\! <\!\! \mathsf{summary} \!\! > \!\! <\!\! \mathsf{br}/\!\! > \!\! >$

Sugarchain Halving Schedule

Yumekawa v0.16.3 - 20190424

Date	Count	Supply	Pow	Reward	Virtual
2019	0	0	2^{32}	42.94967296	
2021	1	536870912	2^{31}	21.47483648	
2023	2	805306368	2^{30}	10.73741824	
2025	3	939524096	2^{29}	5.36870912	
2027	4	1006632960	2^{28}	2.68435456	
2029	5	1040187392	2^{27}	1.34217728	
2031	6	1056964608	2^{26}	0.67108864	
2033	7	1065353216	2^{25}	0.33554432	
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2077 9	2035	I 8	1009547520	301341	0.10///210	
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2041 11		100				
244 12						
2647 14		100		3-35-35		
2047						
2691 15 1677740505 2-(17) 0.0213197 0.021319 0.022319	100000000000000000000000000000000000000	200000				
2011 16 107774240 2-(1-6) 8.0000531 107373072 2-(1-5) 8.0000531 107373772 2-(1-5) 8.0000531 107373772 2-(1-5) 8.0000531 107373772 2-(1-5) 8.0000531 107373772 2-(1-5) 8.0000531 107373077 2-(1-5) 8.0000531 107373077 2-(1-5) 8.0000531 107373077 2-(1-5) 8.0000531 107374511 2-(1-1) 8.0000524 107374511 2-(1-1) 8.0000524 107374511 2-(1-1) 8.0000524 107374511 2-(1-1) 8.0000525 107374510 2-(1-0) 8.0000531 107374510 8.0000531 2-(1-0) 8.0000531 107374510 8.0000531 2-(1-0) 8.0000531 107374510 8.000531 2-(1-0) 8.0000531 107374510 8.0000531 2-(1-0) 8.0000531 107374510 8.0000531 2-(1-0) 8.0000531 107374510 8.0000531 2-(1-0) 8.0000531 107374510 8.000531 2-(1-0) 8.0000531 2-(1-0) 8.0000531 2-(1-0) 8.0000531 2-						
2013 17						None
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2057 19		2000				
2650 26						
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2065 23	100000000	22				
2007 24	2065	23				
2071 26	2067	24	1073741760		0.00000256	
2071 26	2069	25	1073741792		0.00000128	
2073 27	2071	26	1073741808		0.00000064	
2075 28 1073741822 2-(4) 0.00000018 2077 29 1073741822 2-(3) 0.00000018 2081 31 1073741823.5 2-(1) 0.00000012 2081 31 1073741823.5 2-(1) 0.00000012 2083 32 1073741823.75 2-(0) 0.00000012 2085 33 (Actual Total Supply) 1073741823.77 2-(0) 0.00000012 2087 34 1073741823.99375 2-(-3) 1.500000012 2089 35 1073741823.99375 2-(-3) 1.500000012 2091 36 1073741823.994375 2-(-4) 0.520000012 2093 37 1073741823.994375 2-(-5) 3.1250000012 2093 37 1073741823.9921875 2-(-5) 3.1250000012 2099 30 1073741823.9921875 2-(-6) 1.5625000012 2099 40 1073741823.990040875 2-(-6) 1.5625000012 2099 40 1073741823.9990234375 2-(-6) 1.5625000012 2101 41 1073741823.999955859375 2-(-10) 1.9531250012 2105 43 1073741823.999955859375 2-(-10) 1.9531250012 2106 44 1073741823.9999758953975 2-(-10) 1.9531250012 2107 44 1073741823.999998684375 2-(-11) 1.00000012 2109 45 1073741823.999998684375 2-(-11) 1.00000012 2110 46 1073741823.9999980864375 2-(-11) 1.00000012 2111 46 1073741823.99999980802631571875 2-(-13) 1.2207031812 2111 46 1073741823.999999808064375 2-(-13) 1.2207031812 2111 46 1073741823.99999980802631571875 2-(-13) 1.2207031812 2111 46 1073741823.999999808062631571875 2-(-13) 1.2207031812 2111 47 1073741823.999999808062631571875 2-(-13) 1.2207031812 2111 48 1073741823.999999808062651071875 2-(-13) 1.2207031812 2115 48 1073741823.999999808062651071875 2-(-15) 2-(-15) 3.051757815-(-15) 3.05175	2073	27	1073741816		0.00000032	
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2099 40	2095	38	1073741823.99609375	2^{-6}		1.56250000E-10
1.95312506E-	2097	39	1073741823.998046875	2^{-7}		7.81250000E-11
2103 42 1073741823.999755859375 2^{-10} 9.76562506E- 2105 43 1073741823.9998779296875 2^{-11} 4.88281250E- 2107 44 1073741823.9998648375 2^{-12} 2.44140625E- 2109 45 1073741823.9999847412109375 2^{-13} 1.2207313E- 2111 46 1073741823.9999847412109375 2^{-14} 6.10351563E- 2113 47 1073741823.9999847412109375 2^{-15} 3.65175781E- 2115 48 1073741823.9999986836875 2^{-15} 2^{-15} 3.65175781E- 2117 49 1073741823.999996432568359375 2^{-16} 2.6518 3.68175781E- 2119 50 1073741823.999996432568359375 2^{-18} 3.81469727E- 2121 51 1073741823.9999996432568359375 2^{-19} 1.99734683E- 2123 52 1073741823.9999997615814208984375 2^{-19} 1.99734683E- 2125 53 1073741823.9999998879971644921875 2^{-19} 1.97341823.9999998879971644921875 2^{-19} 2.551841859E- 2127 54 1073741823.9999998879971644921875 2^{-19} 2.38418579E- 2129 55 1073741823.99999998697976776123046875 2^{-12} 2.38418579E- 2129 55 1073741823.9999999701976776123046875 2^{-12} 2.38418579E- 2129 55 1073741823.99999998137584857699429875 2^{-12} 2.38418579E- 2129 55 1073741823.999999985898887617375 2^{-12} 2.5518 2.98032324E- 2133 57 1073741823.9999999952549419403076171875 2^{-12} 2.5518 2.98032324E- 2133 57 1073741823.99999999686774057915380859375 2^{-12} 2.5518 2.98032324E- 2133 57 1073741823.99999999513785485076904296875 2^{-12} 2.7628 3.7525908E- 2131 60 1073741823.9999999968797515380859375 2^{-12} 2.7628 3.7525908E- 2134 60 1073741823.99999999513785485076904296875 2^{-12} 2.7628 3.7525908E- 2134 61 1073741823.99999999513785485076904296875 2^{-12} 2.7628 3.7525908E- 2134 61 1073741823.99999999513785485076904296875 2^{-12} 2.7629 3.7525908E- 2134 62 1073741823.999999999513785485076904296875 2^{-12} 2.7629 3.7525908E- 2135 63 1073741823.999999999513785485076904296875 2^{-12} 2.7629 3.7525908E- 2136 63 1073741823.999999999513785485076904296875 2^{-12} 2.7629 3.7525908E- 2136 63 1073741823.999999999513785485076904296875 2^{-12} 2.7629 3.7525908E- 2136 63 1073741823.999999999999999999999999999999999999	2099	40	1073741823.9990234375	2^{-8}		3.90625000E-11
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	inf	inf	(Theoretical Total Supply) 1073741824.0	2^{32-inf}	Reached	0.00E-inf

<!-- END - Hidden Halving table: -->

<small>** [11]: <u>Bitcoin: A Peer-to-Peer Electronic Cash System (https://bitcoin.org/bitcoin.pdf)</u>

project/sugarchain/blob/d2d13cacd9e7c2640a02e6392978a26df06f9eb8/src/validation.cpp#L1155) ** [14]: Halving Interval (https://github.com/sugarchain-

^{** &}lt;a name="BTC_supply">[12]: <u>Bitcoin Wiki: Controlled supply</u> (https://en.bitcoin.it/wiki/Controlled supply)

^{** &}lt;a name="SUGAR_blockreward">[13]: <u>Github: Block Reward (https://github.com/sugarchain-</u>

project/sugarchain/blob/d2d13cacd9e7c2640a02e6392978a26df06f9eb8/src/chainparams.cpp#L135)

^{** &}lt;a name="SUGAR_total_supply">[15]: Total Supply (https://github.com/sugarchain-

project/sugarchain/blob/d2d13cacd9e7c2640a02e6392978a26df06f9eb8/src/validation.cpp#L1147-L1216)

^{** &}lt;a name="SUGAR_total_cap">[16]: Total Cap (https://github.com/sugarchain-

 $\label{lem:project/sugarchain/blob/d2d13cacd9e7c2640a02e6392978a26df06f9eb8/src/amount.h\#L33)} $** [17]: [17]: [18]: <a name="sugarchain/blob/d2d13cacd9e7c2640a02e6392978a26df06f9eb8/src/test/main_tests.cpp#L48-L67)$
 ** [18]: [18]: <a name="sugarchain/blob/d2d13cacd9e7c2640a02e6392978a26df06f9eb8/src/qt/test/paymentrequestdata.h#L437-L468)$
<a name="sugarchain/blob/d2d13cacd9e7c2640a02e6392978a26df06f9eb8/src/qt/test/paymentrequestdata.h#L437-L468}$
<a name="sugarchain/blob/d2d13cacd9e7c2640a02e6392978a26df06f9e$

6. one-CPU-one-vote

"31/Oct/2008 Proof-of-work is essentially one-CPU-one-vote" ^[11]

Satoshi Nakamoto talked about the importance of decentralized mining in his whitepaper. We want to create a blockchain that anyone can do mining easily without any entry barriers.

- CPU mining only
 - YespowerSugar ^[19] (based on Yespower 1.0.1) is only for Sugarchain, not compatible with other Yespower coins.
 - The minimum difficulty (powlimit) is set low enough for two reasons. The first is to handle fast block time; The second is to allow mining on slow CPUs.
- Mining efficiency ^[20] :
 - According to the test results, the most efficient is using *half of threads* on a single CPU.
 - YespowerSugar is more suitable for older CPUs, because it is essentially a multi-threading resistor. Suitable for smartphones and Raspberry Pi.
- Benchmark

 -
- NO GPU: GPU mining is not possible.
- NO ASIC: ASIC mining is not possible.

<small>** [19]: <u>Github: YespowerSugar (https://github.com/sugarchain-project/sugarchain/blob/d2d13cacd9e7c2640a02e6392978a26df06f9eb8/src/primitives/block.cpp#L30-L70)</u>
** [20]: <u>Openwall: yespower - proof-of-work (PoW) scheme (https://www.openwall.com/yespower/)</u>

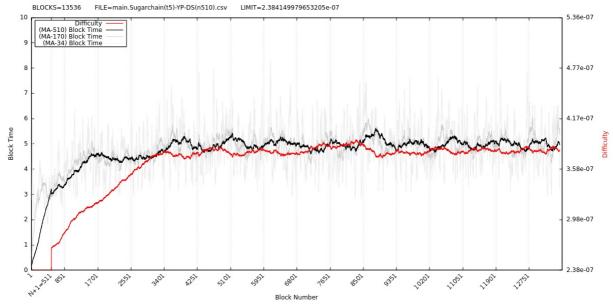
7. Difficulty Adjustment Algorithm (DAA)

SugarShield-N510 is based on Zcash's modification of Digishield. Unlike the Zcash's modification version, we use a moving average of 510 blocks (approx. 42.5 minutes) ^[21]. To keep the block time 5 seconds, SugarShield-N510 adjusts the difficulty level.

• The formula of SugarShield-N510 ^[23]

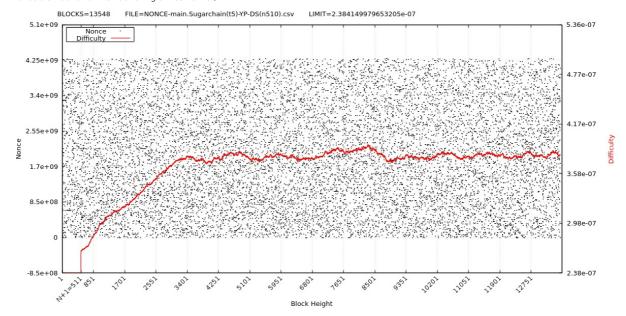
```
t = timestamp, h = height,
T = 5 (target block time in seconds),
N = 510 (window size in blocks)
```


 $\bullet \ \ \, \text{Block time vs difficulty at first launching on testnet} <\!\! \, \text{br/}\!\! >$



It counts from block 1, an adjustment is made at block 511, and the actual control begins at block 512. (log: time-diff)
 (https://raw.githubusercontent.com/sugarchain-project/sugarchain-project.github.io/master/log/time_vs_difficulty-13536.log)

• Nonce distribution at first launching on testnet



• The nonce is randomly well distributed. Difficulty changes but no bias. (log: nonce-diff) (https://raw.githubusercontent.com/sugarchain-project/sugarchain-project.github.io/master/log/nonce_vs_difficulty-13548.log)

 $< small>*** < a name = "SUGAR_sugarshield_n510">[21]: <math display="block"> \underline{Github: SugarShield-N510 \ (https://github.com/sugarchain/project/sugarchain/blob/d2d13cacd9e7c2640a02e6392978a26df06f9eb8/src/chainparams.cpp\#L143-L170)$

** [22]: <u>SugarShield-N510(pow) (https://github.com/sugarchain-project/sugarchain/blob/d2d13cacd9e7c2640a02e6392978a26df06f9eb8/src/pow.cpp)</u>

** [23]: Summary of Difficulty Algorithms (https://github.com/zawy12/difficulty-algorithms/issues/50)

</small> **8. FAQ**

- Disk space requirements:
 - Blockchain size growth is around 10 MB per day and around 3.65 GB per year.
- Network rules:
 - To prevent fraud and timestamp attacks, nodes should be within 70 seconds ^[24] of accurate internet time, or they will be banned.
- Selfish mining & time warp attack:
 - Fraud techniques for manipulating timestamps are already known. We use a future time limit (FTL) to prevent this. Blocks that differ 60 seconds ^[25] or more from the current head will be banned. (credit: zawy12)
- Header indexing:
 - Using sha256d in header indexing, the initial synchronization speed is as fast as Litecoin.

Links

- Website: https://sugarchain.org
- Github: https://github.com/sugarchain-project
- Explorer: https://lexplorer.sugarchain.org
- Explorer(2): https://sugar.wtf
- Explorer(3): https://sugar.wtf/esplora
- Telegram: https://t.me/sugarchain
- Twitter: https://twitter.com/sugarchain_dev
- Bitcointalk: https://bitcointalk.org/index.php?topic=5177722.0