

Autonomous Sidechain Performance Analysis

Testing Methodology

- We tested 1000 tx in batch of 100 tx and recorded time required for the batch of tx to get added in the global state.
- We Started with 0 sidechains and then incremented it by 1 till 5 sidechains.
- Structure

Test-[no]

Chain	Mainchain and [0-5] sidechains
Block size	No of Tx in one block
TX Allotment	Percentage of tx deployed on single chain
Result	Table of Tx (100-1000) vs Time for completion

(Example: Suppose There are Mainchain and 2 sidechains and TX allotment is 33% then in batch of 100, 33 will be posted on Mainchain, 33 on 1st Sidechain and 34 on 2nd Sidechain)

Testing Results

Test-1

Chain	Mainchain only
Block size	10 tx
TX Allotment	100% on chain

Result

Transactions	Time (micro-seconds)
100	35,906
200	64,157
300	98,663
400	131,404
500	158,973
600	187,499
700	214,022
800	239,204
900	268,731
1000	296,532

Test-2

Chain	Mainchain and 1 Sidechain
Block size	10 tx
TX Allotment	50% on chain

Result

Transactions	Time (micro-seconds)
100	22,007
200	40,016
300	60,026
400	80,034
500	104,044
600	128,057
700	151,067
800	175,075
900	202,085
1000	228,096

Test-3

Chain Mainchain and 2 Sidechains
Block size 10 tx mostly (3 tx, 4 tx in special case)*
TX Allotment 33% on each chain.

Result

Transactions	Time (micro-seconds)
100	20,005
200	37,017
300	53,023
400	70,034
500	84,041
600	99,051
700	117,056
800	135,062
900	154,071
1000	175,080

Test-4

Chain Mainchain and 3 Sidechains
Block size 10 tx mostly (5 tx in special case)*
TX Allotment 25% on each chain.

Result

Transactions	Time (micro-seconds)
100	15,008
200	30,014
300	45,038
400	57,046
500	68,052
600	81,058
700	93,098
800	106,109
900	118,115
1000	130,123

Test-5

Chain Mainchain and 4 Sidechains
Block size 10 tx mostly
TX Allotment 20% on each chain.

Result

Transactions	Time (micro-seconds)
100	12,004
200	22,011
300	31,016
400	43,024
500	54,031
600	65,042
700	74,048
800	86,058
900	96,083
1000	106,090

Test-6

Chain Mainchain and 5 Sidechains
Block size 10 tx mostly (6 tx, 7 tx in special case)*
TX Allotment 16% on each chain.

Result

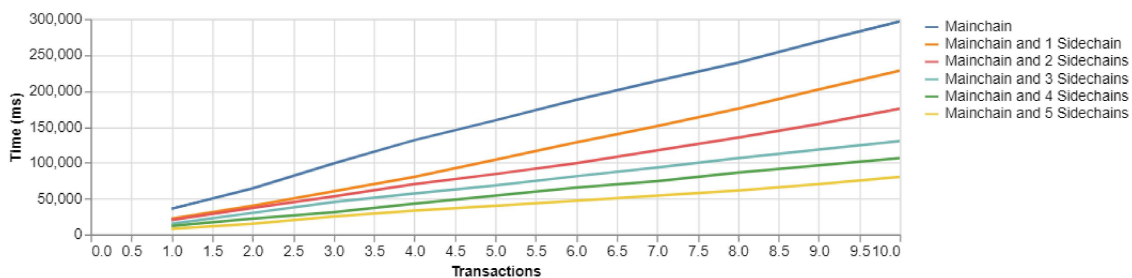
Transactions	Time (micro-seconds)
100	8,005
200	15,011
300	25,039
400	33,047
500	40,053
600	47,084
700	54,119
800	61,126
900	70,135
1000	80,140

Conclusion

• Line-chart: Transactions vs Time

On X axis : 1 unit = 100 tx

On Y axis : 1 unit = 50,000 ms



From chart, We can see that as no of sidechains increase, time required to perform "x" no of tx decreases.
Thus, Its proved that

Time required for "x" tx $\propto 1/(\text{No of sidechains})$

• Transactions per second (TPS)

No of Sidechains	Transactions per second
0	3,372
1	4,384
2	5,711
3	7,685
4	9,425
5	12,478

From this table, we can see that as no of sidechains increase, TPS also increases.

Percentage increase in TPS per sidechain is

29.98%

Throughput \propto TPS \propto No of sidechains

End of the Analysis

[*Video of Test-5](#)

[*Video of Test-6](#)

*Special case arrives when TX allotment is not multiple of 10. in that case at last we have to mine TX allotment%10

Example : Case of TX allotment 33%

We have 1 mainchain and 2 sidechains, we allot 33 tx on main, 33 tx on 1st sidechain and 34 tx on 2nd sidechain

Now focus on any chain, consider 2nd sidechain.(34-tx)

Batch of 10 tx arrive 3 times, and get mined in the respective blocks

and then 4 tx arrive, as we want results in batch of 100

We have to mine this block now only.

That's where special case arrives.

*Testing Environment

Difficulty 1000

Bandwidth 1.2 Mbps

Processor Intel(R) Core(TM) i5-7200U CPU @ 2.50GHz

RAM 12 GB

Operating System Windows 10