AfterEther

White Paper

Blockchain Scalability by Blockchain Clustering

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The debate on blockchain scalability is hardly yeilding results to deliver an effective solution that tackles on-ground realities. Today, blockchain scalability is a tangible issue with exponential growth and adoption of the blockchain technology across every possible sector. This is due to one inherent limitation: Blockchains do not scale.

However, a simple innovative twist called clustering, that has produced results and driven the technology usage to masses earlier, can now be adopted to solve the issue of scale in blockchain.

Introducing clustering concept to blockchain; to drive scalability in this technology.

Welcome to the future; Welcome to AfterEther.

Blockchain is a growing phenomenon affecting the way transactions are being done across the world. Even today, many different sectors continue to acknowledge and adopt its iron clad security and high transparency benefits. However, this new technology first introduced less than a decade ago is still evolving and already facing issues in having to serve the growing number of users.

Today with such populated usage of cryptocurrencies, blockchain faces clogged networks, slowed down transactions, coupled with inflated transaction fees.

Large volume transactions have witnessed transaction fees during peak hours skyrocket.

For instance, an investor in the BAT ICO included a $2,220 transaction fee in order to secure his investment in a project.

This is a very serious problem. If we do not find the solution to blockchain scaling, cryptocurrencies will not be able to replace fiat money.

The Issue of Scalability

The top two players; Ethereum and Bitcoin currently handle 800k and about 500k transactions per day respectively. The ambition is to hit Visa level throughputs of 56,000 transactions per second. The current transaction limit for Ethereum stands at 15 transactions per second. Thus the journey of scale that started since its inception is now steep and high with limited options and proposed alternatives.

This includes:
- Increase gas limit
- Proof of stake
- Sharding
- Plasma & many more.

However most alternatives either delay the inevitable congestion or are work in progress options that need more research and time to upgrade the current technology. But Blockchain technology has had such a huge impact on our lives that scaling it has become a necessity to ensure that growth isn't stifled.


There is no silver bullet to solving this scalability issue, and it is likely that a combination of approaches will ultimately be used, and that the process will continue to change until peak innovation has been achieved. Until such time, re-inventing a proven methodology and approach from another technology breakthrough that ensured technology adoption en-mass could be the only way for now, to true infinite scalability with minimal efforts.

This approach you will appreciate fully, only if you can understand the working of a blockchain and why blockchain do not scale?

The blockchain technology is probably the best invention since the internet itself. It allows value exchange without the need for trust or for a central authority. We can define the blockchain as a system that allows a group of connected computers to maintain a single updated and secure ledger.

To simplify it further, let's see it this way. We have a ledger called the **Blockchain**, and in this ledger each page is a **Block**. We also have a lot of people called **Nodes**, who are trying to gain permission to write transactions on the current page of the ledger. According to the rules, one person called **Miner** is elected. This person obtains permission to feed transactions into the blockchain, blockchain executes them, and rewards the miner with some coins.
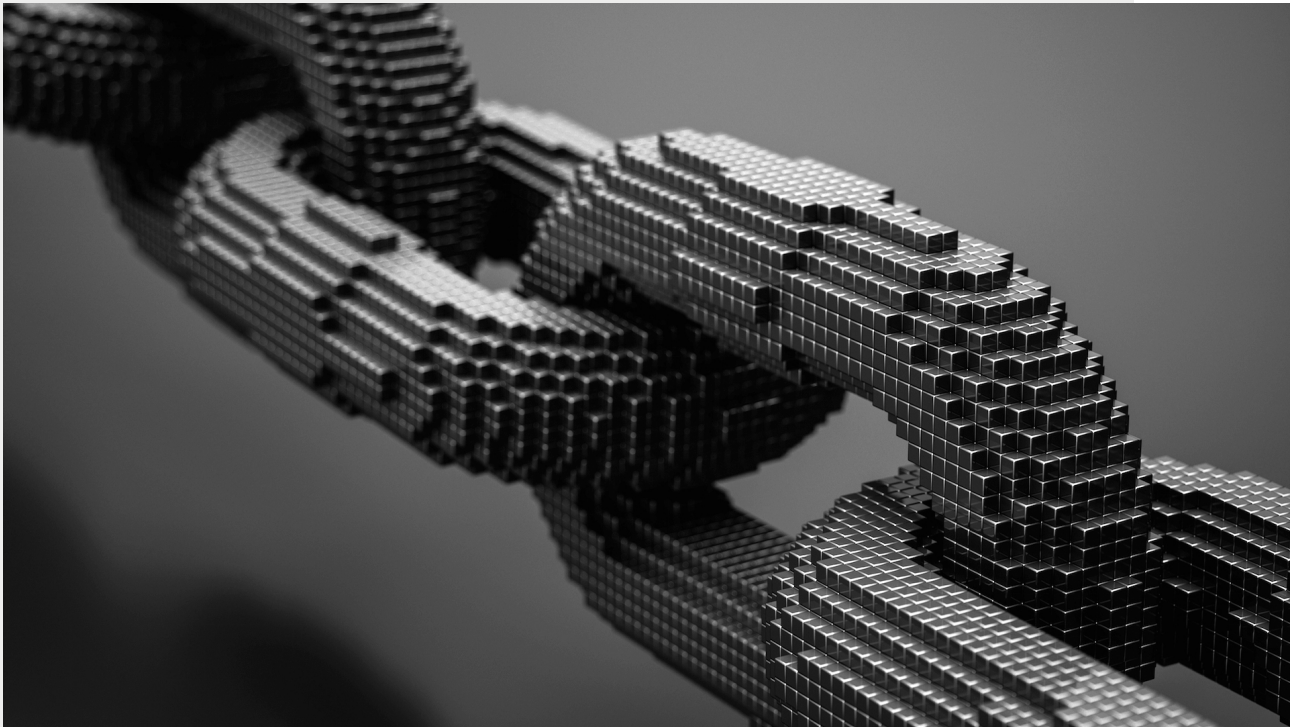
**So, what is the problem with this process, and why can't it be scaled?**
The problem is, that the algorithm to create the chain of blocks requires that only one page of the ledger (*block*) be written at a time. Its irrelevant as to how many nodes the network contains, 1 million or 10.

Imagine a person, (*Mr. Blockchain*), sitting at a desk writing transactions. Then, imagine a line of one million people, wanting to make a transaction. This is what Ethereum's scalability problem looks like, in layman terms. Now, Mr. Blockchain, is the only one who can write transactions, and distribute the money between accounts. His position is permanent and he cannot be fired. If you dismiss Mr. Blockchain (*i.e. replace it with another technology*), you risk losing your money, because the person who replaces him, is not yet known as reliable.

Even if those millions of people make private agreements on how they are going to distribute their money (*i.e. Lightning network, Raiden or Plasma*), they will have to join the other people standing in line, to be attended by Mr. Blockchain at some point in time. So, none can escape from Mr. Blockchain's monopoly, he is the only one who can touch your money, and he always works alone.

However, you can improve Mr. Blockchain's strength, give him super-abilities to write more transactions per second, and you can accelerate his work by fine tuning the process, but this won't be enough to scale infinitely. Mr. Blockchain is already working at the speed of light, but even this is not enough to attend to everyone's request. If you were able to create multiple Mr. Blockchains to write ledger pages, then you would have scaled blockchain technology, infinitely, but since each subsequent page depends upon the previous one, there is no way to speed it up. This problem, in computing science, is termed as "Bottleneck".

This is how it looks, graphically:
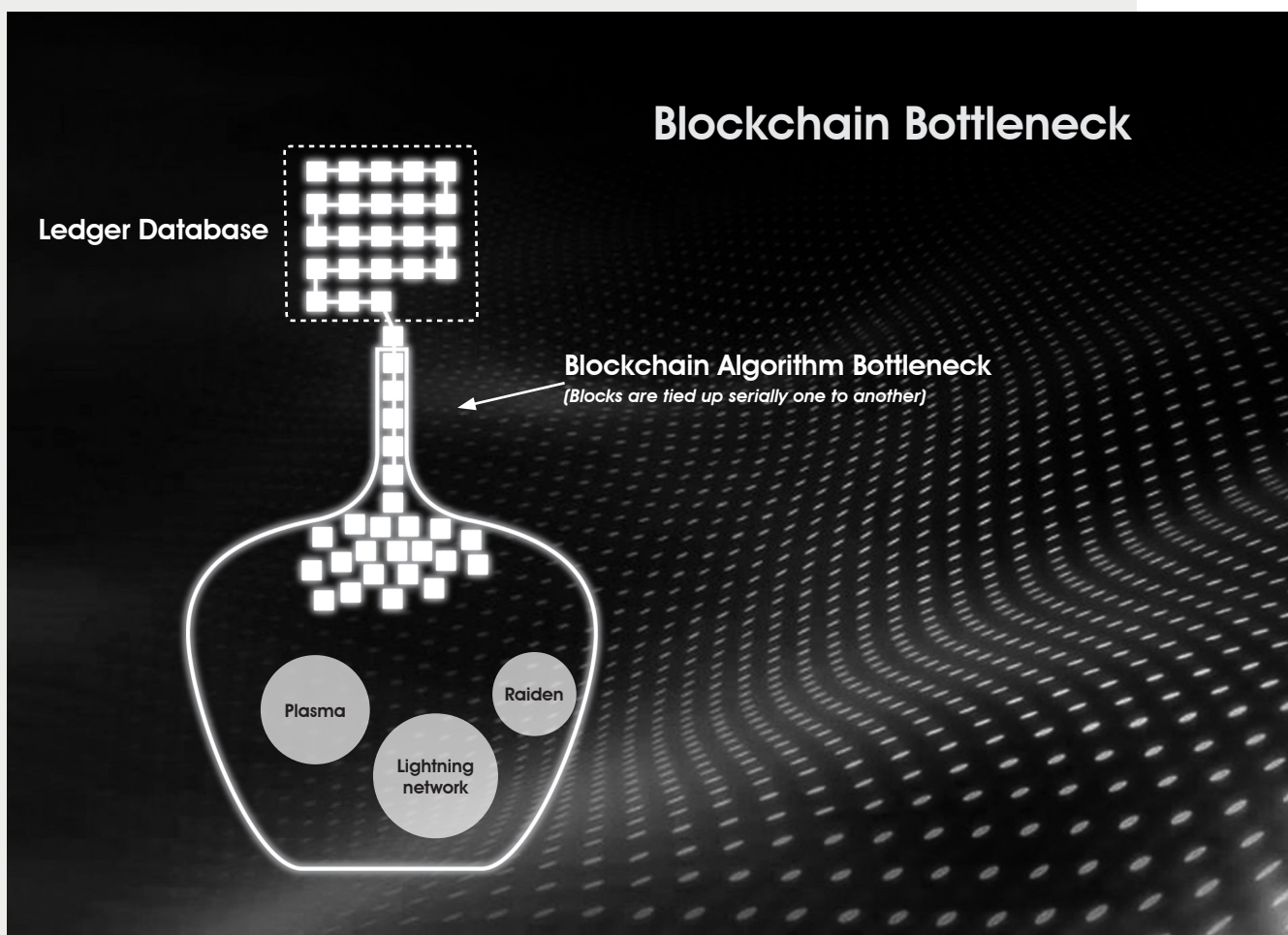
Off-chain implementation (*Plasma, Raiden, Lightning network, etc*) do not escape the bottleneck as they work inside the "Bottle"

The process of creating the blockchain is serial by design, and it can't be parallelized without destroying the integrity of the system. This is why blockchains can not be scaled. Anyone, who claims to create a scalable blockchain algorithm is sure to be judged severely. And someone claiming to scale blockchain by off-chain transfers, is embracing a huge responsibility and accepting experimentation with user's money on a novice, non tested, not verified technology which, by the way, can no longer, be called blockchain itself.

In this paper, we do not intend to debate about proposed solutions to scale Ethereum. We just want to point out that scaling blockchains is a huge problem, and it is not as easy as it appears. However, If you wish to review how this debate is developing, check the references section at the end of this paper. Some of the authors interestingly have detailed a mathematical proof, as to why the process of scaling transactions with an off-chain network won't behave like a peer to peer network. But, this as a subject for discussion, is beyond the scope of this paper.

The solution to unblock this bottleneck has to emerge from our understanding of the issue itself.

Now that we know that blockchain's scalability is limited by its own algorithm, how can we solve this problem?

We suggest, the same way, as it was solved way back in the 90s - when desktop computers started spreading around the world. Those computers were 16, 32, 100 Mhz in speed, and they were very slow, pretty much like Ethereum's Virtual Machine right now.

So, how did they resolve their problem then? How did they increase computing capacity?

Well, They invented computer clustering!

The first cluster was built by employees of NASA, and was called the Beowulf Cluster. They connected commodity grade computers to a network, and provided software to execute tasks in parallel. This idea evolved into what we today call HPC (*High Performance Computing*). It is now being used to create supercomputers; systems composed of many commercial grade computers are connected together to execute different tasks, usually for scientific research.

Cluster Computing

Front-end Node

Switch

Node 1   Node 2   Node 3   •••   Node N
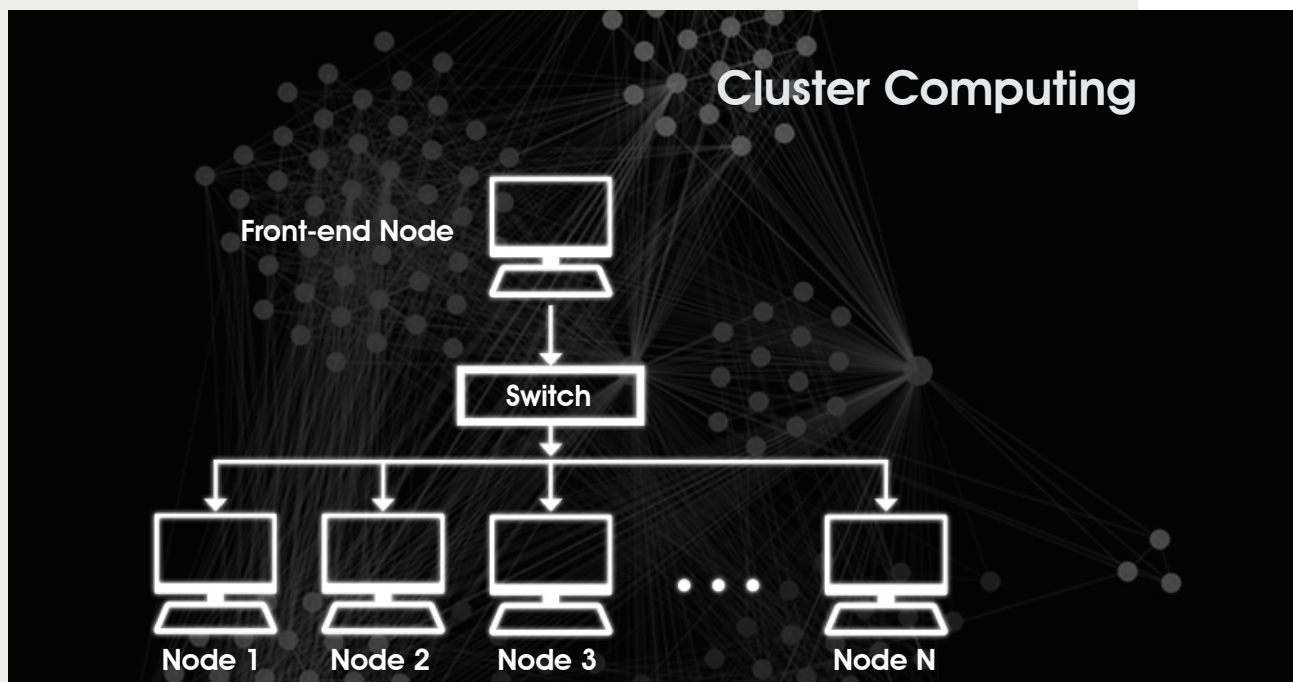
So, how exactly will AfterEther solve the blockchain scalability problem by adopting clustering?

This is how:

We are going to run multiple networks of Ethereum.

We call this method of running multiple networks as Blockchain Clustering, or Currency Clustering - as an alternative non-technical term.

A peer to peer network working with a single blockchain will be called currency-node in our cluster.
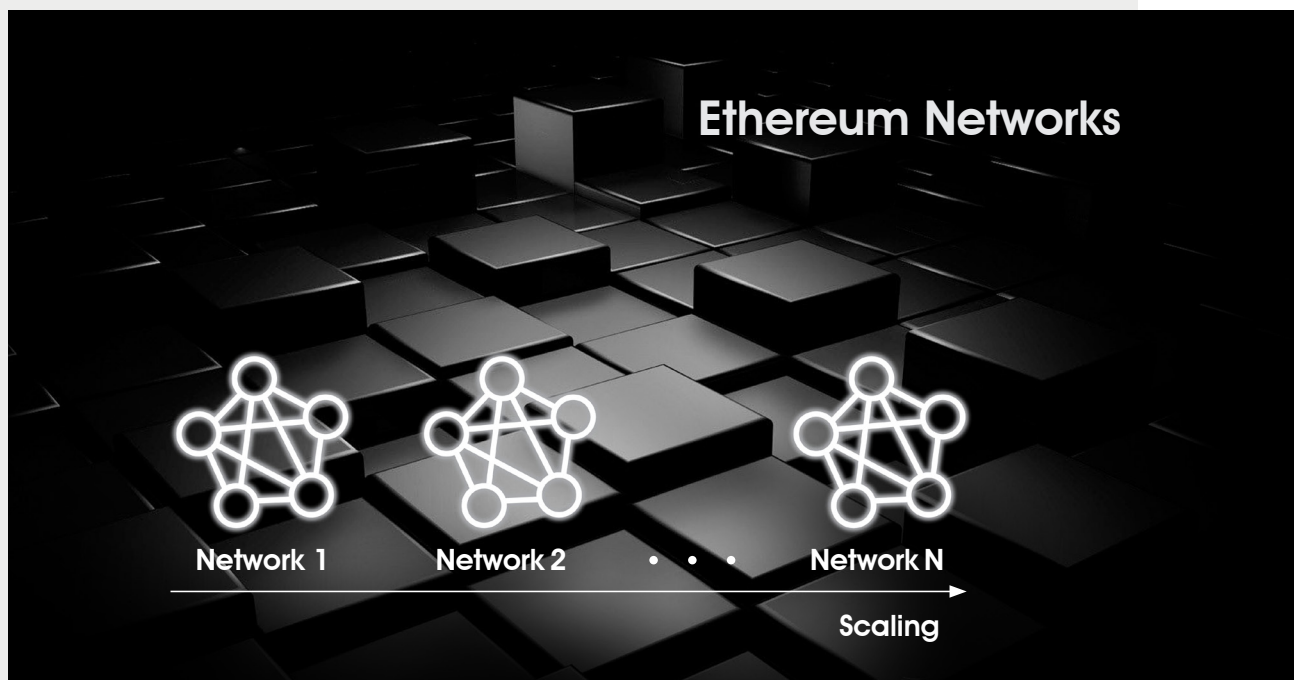
Presently, the instance#1of our currency has been already set-up and it is called AfterEther (*or currency-node AfterEther#1*).

As the network is just beginning and not yet congested, no further action is required. The current execution of transactions here is fast. But, as network becomes saturated and users begin to complain about high transaction fees or slowed down transactions, we will launch a totally new blockchain, the currency-node AfterEther#2 and so on...

Blockchain clustering works in phases.

The instant, a new currency-node (AfterEther#2 or AfterEther#3, etc) is created, this new blockchain will have low usage, but as soon as miners begin to join the network, and start mining it, the chain will become computationally strong, and it will be possible to use it without any fear of attack. This is what we call the "Preparation Phase".

After preparation phase, the exploitation of the blockchain will begin (Operation Phase), it will be used to execute transactions just the same way as you do it in Ethereum's Main Net.
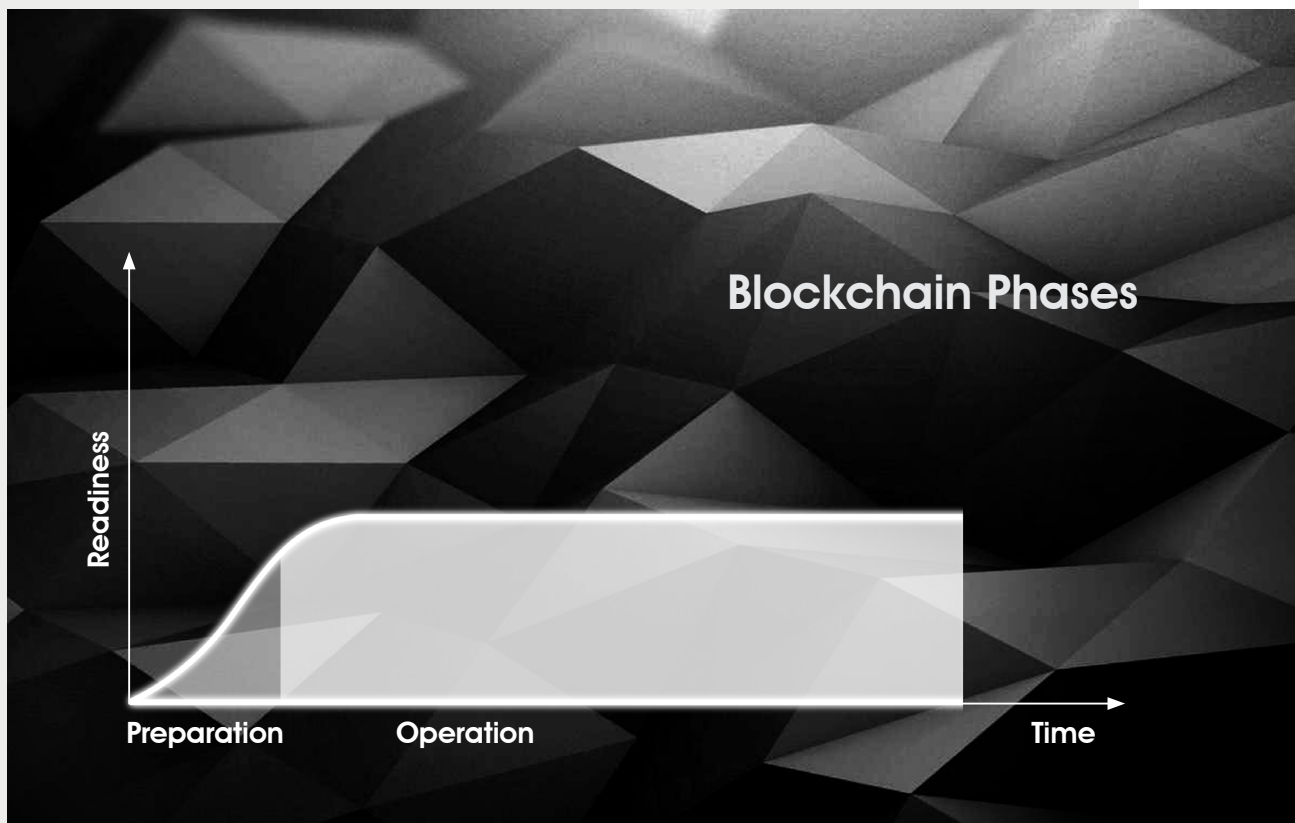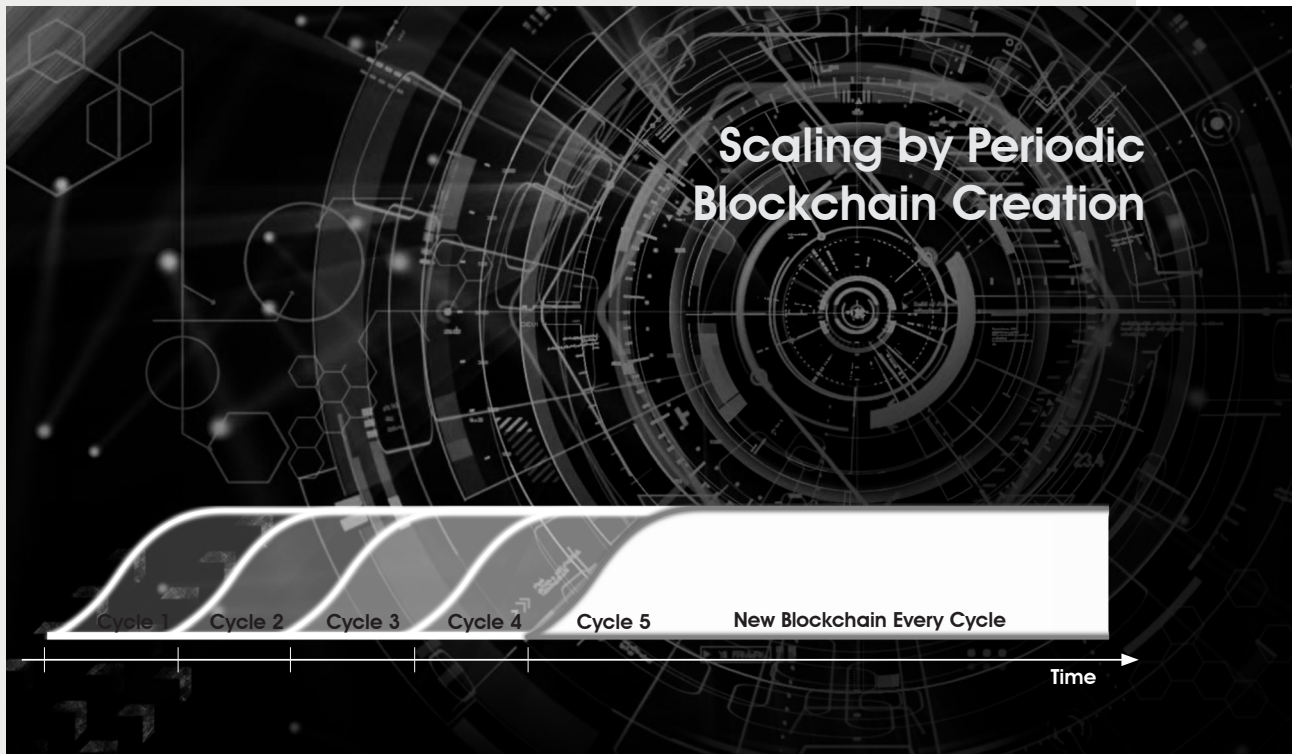
Scaling by Periodic Blockchain Creation

The process of scaling by periodic blockchain is achieved by launching a new blockchain every time we witness a congestion on all the current blockchains. In computing clusters when you need more computing capacity you just add another node.

So, why can't we apply the same method on cryptocurrencies?
Just because, blockchains don't scale...!

Well, not a big deal. A blockchain can be created any time we need to increase transaction rate. Problem solved. Now we can breathe easy and let them research blockchain scalability and conduct newer experiments on new trends and technology, with peace of mind. This coupled with an knowledge and assurance that our systems will still be functioning to deliver on the growing scale of blockchain adoption even tomorrow.

Scaling by Periodic Blockchain Creation

Cycle 1 | Cycle 2 | Cycle 3 | Cycle 4 | Cycle 5 | New Blockchain Every Cycle

Time

And voila, we have just solved the problem of blockchain scalability without writing a single line of code!

The infinite blockchain scalability thus achieved has a more interesting option too multiple block chains per cycle.

A single currency node is unlikely to become popular as user demand is set to be distributed automatically by transaction fee and speed. If one blockchain over a certain period of time wouldn't be enough to cover user demand, we could launch multiple blockchains in one cycle. This means, there would be 2, 3, 4... networks running in parallel, If, each network delivers 15 transactions per second, 2 networks are going to deliver 30 transactions per second and so on.

To manage Visa volume of transactions, which is around 56,000 transactions per second at peak hours (*2,000 on average*), we would need to set up 3,733 networks of Ethereum.

Yes, it looks scary, but in supercomputing, clusters with such volumes of nodes is normal. Such clusters can be created simply by putting online two Ethereum's networks, every day during the next 6 years. It would be our maximum, and it looks realistic.

Multiple Blockchain Per Cycle

Blockchain per Cycle

Cycle 1

Time
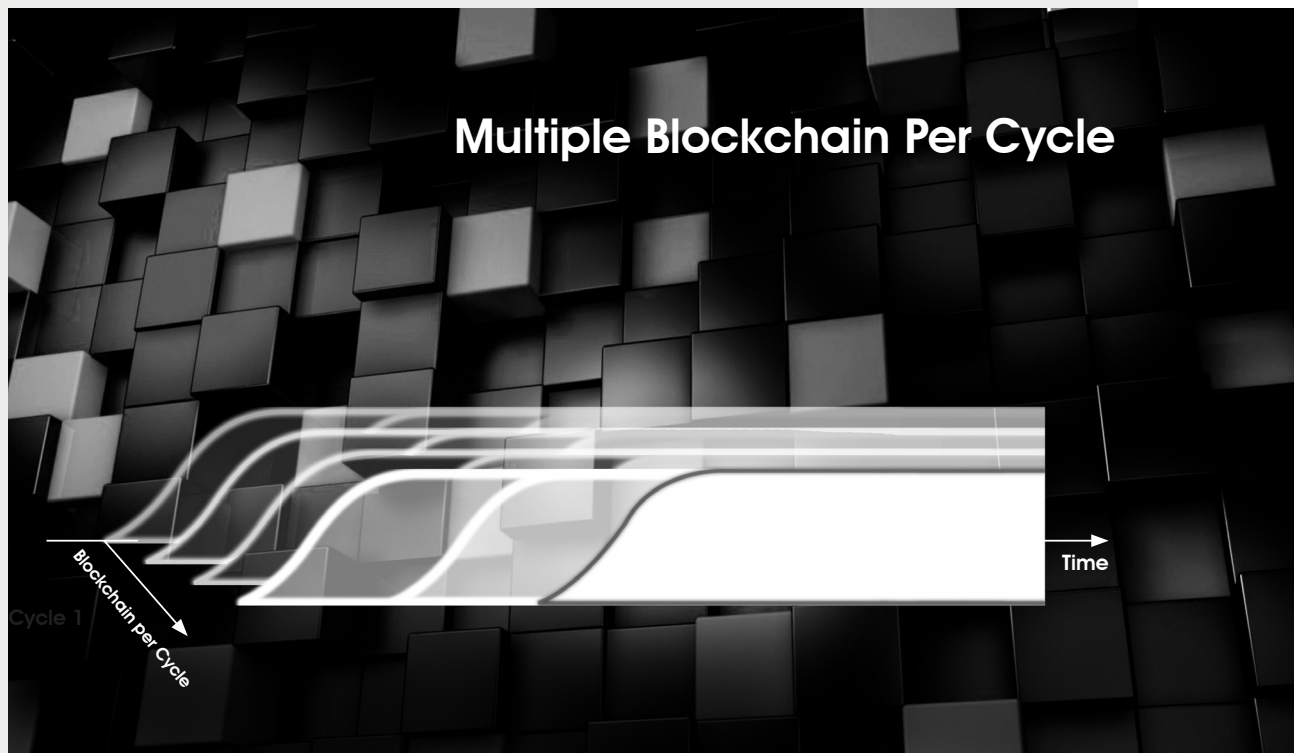
As a DApp developer, you would install your smart contract on the currency-node that has the lowest transaction rate. If the transaction capacity reaches its limit on that node, you would migrate to another node.

Each node will have a different price, so you would only have to adjust the value of your token and that's it. If your DApp needs large amount of transactions you just use multiple clusters, and tell users to pick one of them to make the payment.

Think of AfterEther as a server hosting company, where each currency network would be your "Server" to run DApps. Picking the network with the lowest load average will be possible with dashboard software, like the ones used for monitoring.

And if you don't like the idea of having different prices per blockchain, we can create a single index for all the blockchains by averaging the price, something similar to US Dollar Index, where it is measured as a function of another 5 pairs. But, this is a discussion for a later date.
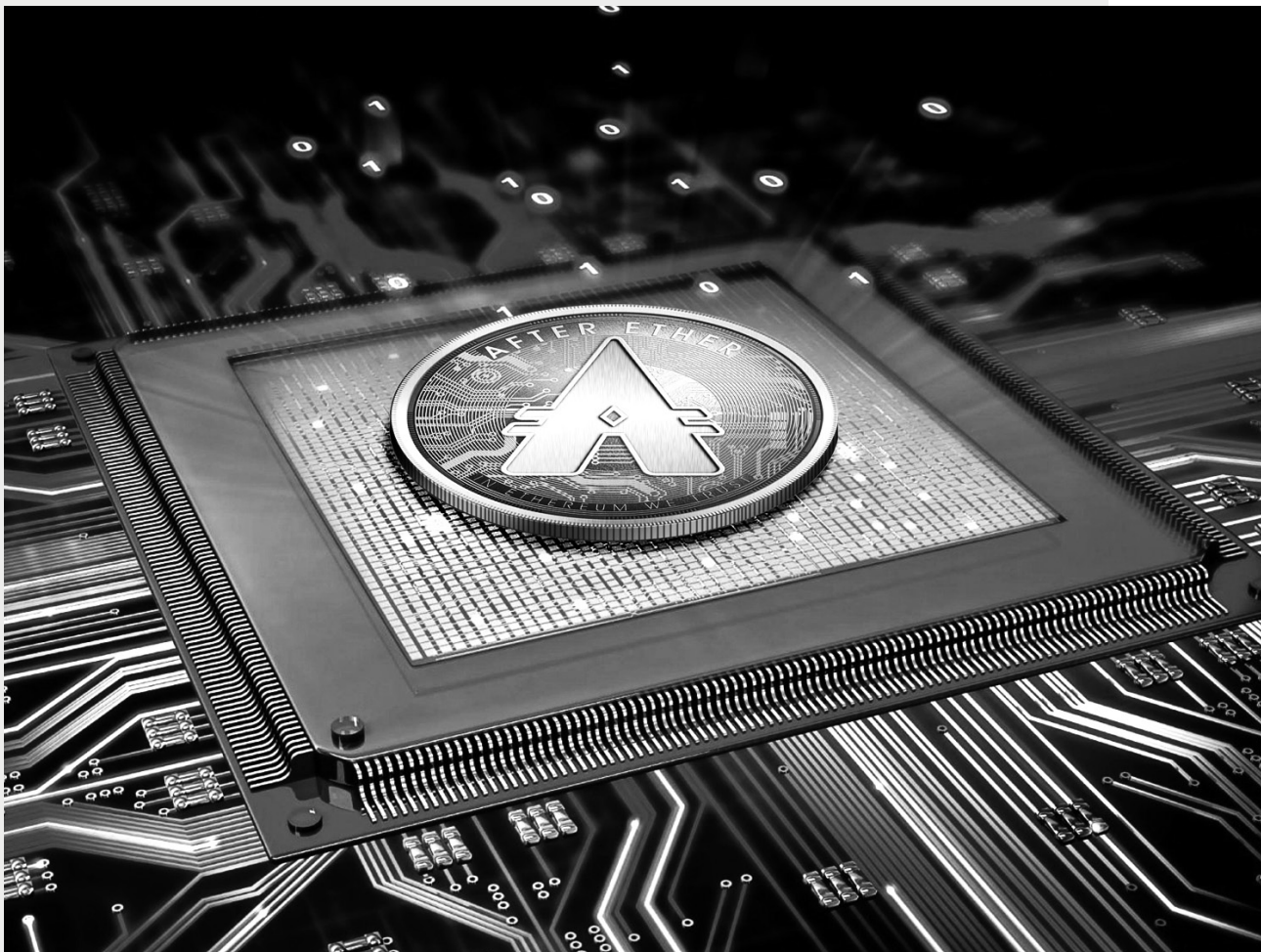
At first glance, its easy to assume our solution to be patched. Having a single currency for everybody seems to be the ideal way. But note that clustering is a common technology in computing and it is now widely accepted and appreciated too.

Simply stated, there is no such hardware, till date, that is capable of writing 56,000 transactions per second on a single node. When the problem can't be solved on a single computer (*and Ethereum is a computer, but virtual*), it has to be distributed between many computers. Our learnings from past assure us that dividing tasks has been a successful strategy for ages, and we are sure, it is not going to fail us now.

In our opinion, inventing a scalable solution for a single blockchain is as impossible, as inventing a perpetual motion machine in the 17th century, which the physicists themselves later confirmed, as indeed impossible. It seems that for now, blockchain technology is in a similar situation. You can try one algorithm after another, but after considerable experimentations, you will discover that it doesn't work.

The road to blockchain scalability through scaling a single blockchain is closed. Multiple parallel blockchains is the way to go. It is simple, it is reliable, it is easy to implement, it is just the pill that we have to swallow right now. Then, why wasn't our solution implemented earlier if it is so easy to do? Because of Inflation.

Splitting Ethereum, into 2 networks would result in loss of value on the first blockchain, depreciating its currency significantly. On the other (*new*) blockchain, the values would have appreciated with 100% inflation instantly. People would sell Ethers off the first network, and buy Ethers on the second network expecting to make profits on the rise in price. Nobody wants to lose money, so this solution is a no-no for a currency that already has high valuation.

But for us, it is not an issue.

We are a (*yet*) unknown project, that was born weeks ago, and we have nothing to lose and everything to win, especially as Ethereum's users seeking cheaper transaction fees. This is why neither Bitcoin nor Ethereum are going to use this strategy to scale their chains.

But do note, you should not consider our project as a threat to Ethereum's price trend: because, Ethereum has already limited itself by the scalability problem. Then how can the price go higher if there is no room to grow? You would probably see a price increase (*if any*) on the linear scale, but not on the logarithmical.

One more important point. Our aim is not to create replicas of Ethereum and flood the market with cheap copies of Ether-like currency. We are committed to grow as a widely accepted network with considerable transaction level. If no transaction bottleneck exists, we are not interested in devaluing our network#1 by creating network#2. But, eventually network#1 will grow and face congestion, and inevitably we will have to create a network for the cycle 2.

Whether you like it or not, there is no other way to scale right now.

Another significant issue is the point about speculative money.

This can flow into our nodes of networks of Ethereum copies. The presence of speculators is not a bad sign for currency, but a good indicator. It proves that the currency is valuable and has potential for appreciation. The speculators also add liquidity to financial instruments.

Thanks to them, you can sell or buy the instrument at any time and you don't have to pay large spreads. The speculators also add stability to the price, by reducing volatility. When the price of the instrument drops, they buy dips, when the price rises, they sell and the price falls. The speculators, sort of, smooth the curve of fluctuation of the currency in times of low or high demand.

Speculative money is healthy for any financial instrument, and it is always welcomed in financial markets. Hence, we believe that speculative money is not going to do harm to our network-nodes, on the contrary, it is a big help. This money will prepare the blockchain in the beginning, making it computationally stronger and help in price rise and contribute to get the network ready for users.

The task of migration from an old blockchain to the new one will also be assisted by the speculators. Speculators will be accepting your coins on the old blockchain for a discount, and give you another currency in exchange, for example, the USD. You will then use the USD to buy AfterEther on the next blockchain. Or, maybe some of them are going to offer a direct exchange, AET-1 ➤ AET-2 and one transaction would be enough.

This is our planned strategic approach to scale Ethereum in the future. While all the proposals to do are only promises on paper, our solution is real, it is already implemented and can be used right now!

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