Whitepaper

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1. Introduction

Satoshi Nakamoto in his landmark paper, "Bitcoin: A Peer-to-Peer Electronic Cash System", outlined a payment system that was based on an encrypted distributed ledger called a blockchain. In Satoshi's system, equipment operators called miners complete functions normally carried out by banks, such as verifying and processing transactions. The goal of Satoshi was to decentralize trust while allowing value to flow to these miners in the form of Bitcoin rewards. As a result, Bitcoin revolutionized the way value is transferred and presents significant opportunity to entrepreneurs that mine or transact on the system.

The blockchain technology that serves as the foundation for Bitcoin has also sparked the redistribution of economic power outside of the financial industry. The catalyst for this redistribution of power stems from second generation blockchain technology, such as Ethereum, that adds the critical function of smart contract deployment. Smart contract utilization broadens the number of ways the blockchain can be employed by allowing companies to create tokens as representations of value that can be easily redeemed for products and services in almost any industry, such as Cloud, AI, Food Logistics and many others.

Bitcoin creates competition by only rewarding the first participant or pool of participants that solve the SHA-256 cryptographic proof that secures the blockchain. Because only the fastest miner to solve the puzzle earns the reward of 25 Bitcoin, an arms race of computational power has ensued. This has led Bitcoin to become the most powerful distributed computing system on earth. All the TOP500 supercomputers on the planet when combined have a measured rate of 1.2 quintillion calculations per second (TOP500 June 2018 List, 2018). The BTC system has a total hash-rate of 48.5 quintillion calculations per second (8/25/2018), or 40x more computing power than the sum of all TOP500 supercomputers.

Bitcoin and cryptocurrency miners that contribute to blockchain systems are situated across the globe ranging from small setups that run-in home basements all the way to hyperscale installations spanning thousands of square feet that rival the largest datacenters currently ran by the big-three Cloud providers: Google Cloud, Microsoft Azure and Amazon Web Services. Imagine if the cryptocurrency miners could compete for rewards by hosting Cloud and AI services instead of running random calculations. The resulting competitive computer network would easily surpass all other cloud providers and have far reaching applications: ranging from reducing latency in self-driving cars, higher processing speeds for Internet-of-things ("IoT") data, serving localized high bandwidth video, diminishing ecological impact, and, most importantly, decreasing the cost to consumer.

The goal of NODE Haven is to create the first competitive Cloud and AI network and services platform based on the very successful Bitcoin mining model. The NODE token will be used as a reward to the Cloud and AI miners contributing their resources to the **Haven Network.** The rewards are paid for by end-users of the **Haven Platform** which is a public facing portal for Cloud and AI services. To ensure a level playing field and ensure miner adoption, the NODE token will also grant access to equipment priced at Cost of Production + 10%. The network effects created by Haven Network, Platform and co-operative hardware model position the NODE token to become the medium of exchange to the largest super-cloud ecosystem capable of seamlessly serving from the core all the way to the far reaches of the edge.

2. Hardware Manufacturer Mediation

Digital currencies are susceptible to a weakness known as double-spending where in which the same digital token is spent more than once. Due to this threat, the transfer of tokens needs to be verified against a ledger that codifies transactions. Originally, the electronic ledgers were held by a centralized third-party mediator, such as a bank, for a fee. Satoshi Nakamoto's motivation behind Bitcoin was to forego fees charged by third-party mediators and neutralize their ability to reverse transactions. Bitcoin eliminated the need for a third-party mediator by creating a trustless, decentralized ledger that is distributed to many network nodes and is secured by a SHA-256 cryptographic Proof-of-Work (PoW) block-chain.

Many of the goals Satoshi set out to accomplish with Bitcoin have been achieved, however, since Bitcoin's inception, new issues have emerged. Initially, Bitcoin could be mined by personal computers (CPUs), but soon thereafter a race to maximize computing (hash) power took off. The first step-change in this race was transitioning from mining with CPUs to video cards (GPUs). Eventually, GPUs were surpassed by vastly more powerful Application Specific Integrated Circuits (ASICs) chips that are designed solely for mining crypto-currency. The speed at which ASIC chips can process crypto calculations is exponentially greater than any previous technology used. To put things in perspective, the Bitmain Antminer S9[1] (ASIC) hashes 13,000 times faster than the best in class NVIDIA GTX 1080[2] (GPU). These extremely powerful ASICs leave us calling into question Satoshi's original vision of, "one CPU one vote".

The engineering cost to develop crypto-mining ASICs has led to the formation of niche manufacturers many of which also have their own crypto-mining operations and pools. Mining is especially advantageous for these Bitcoin ASIC manufacturers because they obtain equipment at production cost. This advantage has allowed certain ASIC manufacturers to control the distribution of mining equipment and influence a large percentage of total hash-rate. Ironically, by deciding how many miners are sold to the market, who they are sold to and how much they are sold for, these ASIC manufacturers are operating as third-party intermediaries. The mediation by banks and institutions that Bitcoin was designed to thwart has resurfaced as hardware manufacturer medication.

NODE Haven poses that profit-motive drives the centralization of power and any decentralized system that is reliant on hardware produced by profit-seeking companies will suffer from the same effects. The manufacturers' financial backing, governance structure and profit-seeking motives drive them to drain value from the associated crypto-currencies that they claim to serve.

The cryptocurrency community is paying a *debt* to the ASIC manufacturers and institutions that invested into the development of the equipment they sell. The service of this *debt* is paid in profit-margin and control of how the ASIC equipment is distributed. To circumvent the control that ASIC manufacturers have, NODE Haven proposes a co-operative business model where the community invests in the development of the advanced mining equipment that they need. This model distributes the control that centralized ASIC manufacturers exploit and facilitates the decentralization of PoW cryptocurrencies as intended.

[1] http://www.dogiecoin.com/bitmain-antminer-s9.html
[2] http://cryptomining-blog.com/tag/gtx-1080-ti-hashrate/

3. Decentralized Compute

In addition to cryptocurrencies, blockchain technology has given rise to multiple decentralized marketplaces for compute and storage. These marketplaces seek to allow individuals and companies to buy and sell compute resources from one another through the exchange of digital tokens recorded on a blockchain. Because the processing of data and computation is done off-chain, it presents a significant opportunity for cryptocurrency miners to host a wide range of resources and "mine" tokens that commoditize those resources.

The wide-scale adoption of these decentralized compute marketplaces depends largely on access to composable computer equipment that is more powerful, efficient, and reliable than Cloud and Artificial Intelligence installations owned by major corporations. Because of this need, NODE Haven is developing an AI and Cloud compute mining system that is inspired by the very successful modular cryptocurrency mining equipment. Our goal is to enable independent miners and datacenter owners to compete in markets whose annual revenue is over 30 times larger than the value of all mined coins in 2018. There are many benefits to applying the competitive cryptocurrency mining model to Cloud and AI, including the ability to take advantage of surplus energy around the world and serve the network edges in sparse markets.

Compute, in the form of Cloud, has gone through a period where centralization has provided a few large companies significant advantages. In recent years, these companies have built a competitive edge over the incumbent compute providers through their use of accelerators. These accelerators come in the form of GPUs, FPGAs, and ASICs, such as TPUs (Tensor Processing Units), that are similar in some ways to modern cryptocurrency mining equipment. In addition to Cloud offerings, accelerators are used in search engines, high performance computing (HPC) as well as artificial intelligence environments. Although some of the equipment is easily accessible in the form of GPUs to consumers, the proprietary applications that integrate the different devices are limited to monopolistic scale installations that seek to maintain their advantage over the competition and maximize profit margin.

As the decentralized Cloud and AI solutions mature and services become more specialized a transformation is predicted in hardware as was seen with Bitcoin. Accelerators (GPU, ASIC and FPGA), because of their speed and efficiency, will replace the server CPUs that traditionally processed data. In this scenario, as seen in Cryptocurrency, the advantages that manufacturers have may allow them to take control of these decentralized systems and institute a form of mediation. The proposed co-operative hardware model has the ability to forego this eventuality by distributing the economic power back to the independent equipment operators.

NODE Haven will address other forms of monopolistic control in the compute market. For example, the compute and storage miners will utilize the consortium-led memory architecture called Gen-Z. Gen-Z allows multiple types of compute resources to access memory in ways that bypass the CPU or more specifically the server processors. This will release the stranglehold that the CPU manufacturers have over the server market and reduce reliance on any one company for the system to function. This follows a fundamental core value of NODE Haven where decisions and incentives are made that encourage competition. This results in geographically diverse hardware deployment, increased speed, ease of software development, and lower cost for the end user which in turn increases adoption of the network.

4. Co-Operative Product Development

NODE Haven will fund development and production of next generation Artificial Intelligence, Cloud and Cryptocurrency equipment using an alternative, novel Product Development Vehicle (**PDV**). The PDV is capitalized by the purchasing of NODE tokens during the Initial Token Sale. NODE Haven will then use the funds generated during Initial Token Sale to pay for engineering costs of the equipment, network and platform. When engineering is complete, the hardware will then be reserved and redeemed using the NODE tokens.

The most immediate benefit of using a token sale is the acceleration of the product development process by quickly funding the high, upfront engineering costs. This method also bypasses the bureaucracy and interest association with traditional financing by going directly to the consumer.

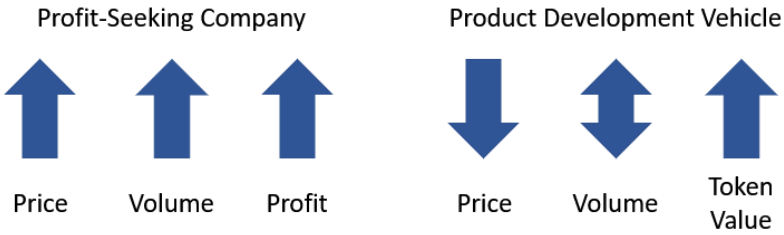
In addition to acceleration of development, the PDV model incentivizes the manufacturer to sell quality goods and services at the lowest cost to the consumer. This is in stark contrast to the Profit Seeking Company (**PSC**) that sells products at the highest price that the market will bear. Why is this? Don't both companies seek to produce products with the most value at the least expense? The difference lies in the relationship between how management is compensated and how products are priced.

Management compensation in a PSC is based on profit-margin in tandem with number of units produced. The profit-margin is the difference between the cost to produce the product and the price the consumer pays for that product. As shown before, the sale price is not considerate of the consumer's needs.

Within the PDV ecosystem, the managers are rewarded with the same tokens that will later be redeemed for products they are producing. Essentially, through the PDV structure, managers are also consumers and are incentivized to always act with the consumer in mind. This is in contrast to PSC managers that are incentivized to exploit market demand for maximum gain.

The buying power of each NODE token is maximized by creating valuable products and services at a lower cost. There is no incentive to charge more tokens for the same product as that decreases the inherent value of the token. Less NODE tokens per product equals more value per NODE token. Consequently, if managers of a PDV were to charge more tokens for the same product, the value of their token position would decrease. By creating a framework where managers are simultaneously consumers, efficiency of capital is encouraged, waste discouraged and quality of product, assured.

The cooperative arrangement of the NODE Haven PDV incentivizes management to act in the best interest of their fellow consumers rather than serve the best interests of a capital provider. The PDV token model effectively distributes the power that financial institutions have over companies and places it back in the consumers' hands. The net result is a quality product delivered at the lowest cost.



5. Haven Network and Platform

To enable the adoption of computer hardware deployed through the NODE Haven PDV, Cloud and AI purposed machines will come pre-configured to operate on the Haven Network and Platform. The Haven Network is a distributed computing system that is accessed through the Haven online platform. The Haven platform is a user-friendly marketplace for compute and storage resources that utilizes the NODE token as exchange for services provided.

The goal with the Haven Network and Platform is to create a compute system that utilizes geographic market dynamics to drive equipment installations and allows public users to access those resources through a competitive and informed marketplace. Equipment owners, using the Haven back-end, set prices for the resources that they own. In places of high demand, rent and electricity cost we would assume that the price set by the equipment owner will be higher. In places of high demand but low rent and electricity there might be higher prices, but once the arbitrage is identified a competitor may build a facility within the area to increase the supply. In this way we expect supply to meet demand efficiently across the network in such a way that a purely centralized company would never be able.

The NODE token effectively commoditizes compute & storage while allowing market demand & economics to choose where the installations are built. In much the same way, Satoshi gave the miners the power to process the transactions for transfer of value, the NODE token removes the mediation and power that these monopolistic Cloud and AI service providers would have over the processing of our data as well as the insights gained. The mediation of intelligence will only allow them to grow and increase in power. Based on recent performance of some Cloud providers their value is beginning to rival the GDP of even some countries. (Wilkons, 2018) The proposed solution distributes the power to the participants and allows the consumer to reap the rewards of the market efficiencies that are introduced.

The Haven Network will map all compute nodes on the system and authenticate every piece of equipment to ensure quality control. The Haven Platform will use this information to optimize applications deployed over the network. This will drive down application owner's costs by serving exactly how, when, and at what redundancy needed. The flexibility provided to the application owner will give them the ability to scale their application as they grow and distribute existing applications globally throughout the network to serve the edge in a way that could not be replicated in any other fashion.

The Haven Platform will be deployed to Haven Network in a distributed manner that will not depend on any one specific machine or geographic area. This gives the opportunity for latent capacity to be used for optimization of the network even while waiting for an application to take advantage of their equipment. The equipment owners that are optimal for the deployment of the platform will be compensated in NODE tokens. This will ensure that the Haven Platform and Network are not subject to outages and are thus more resilient than centralized Cloud providers.

6. Network Effects and Adoption

In the past network effects were primarily used to forgo the commoditization of the product or service so that one company can produce monopoly effects and extract value from the consumer. Token economies, such as one established by the NODE token, are however much different. Network effects within token economies open competition across business processes that were moats protecting monopolies. The Haven Network and Platform would allow entrants to compete for Cloud facility ownership, platform service development as well as hardware manufacturing.

The synergy between the hardware manufacturer and associated network building has been well studied. (Katz & Shapiro, 1994) Some of the most popular video game networks such as Nintendo and Sony have relied on a dual hardware and software model. In recent years, these video game systems have also incorporated online networks to allow their users to play video games with each other. The value of these networks is derived in part from the ability for the manufacturer to build superior equipment at a lower cost.

In addition to the synergy gained by designing the hardware and network together, we also introduce a network of equipment operators in the form of cryptocurrency miners. This added layer of competition will transform the way that cloud hardware is deployed. This complementary user group has caused the Bitcoin system to become larger than all supercomputers combined while they only target a combined $6B worth of total mined coins based on August 28th, 2018 prices. By allowing miners to compete in the Cloud and AI markets that are > $200B market it is presumed that an even greater ramp-up in the computational power will ensue. This will forever change cloud landscape and will have vast effects on humanity as a whole.

Currently, in the case of current Cloud providers, hardware is purchased and then installed using a strategy developed by a centralized corporation. The Haven Network, by introducing the competitive cryptocurrency mining model, relies on the community to build installations based on supply and demand. Whereas the monopolistic company with few competitors is interested in maintaining high profit margin in areas of high demand, the Haven Network promotes competition by allowing individuals and company setting their own prices for resources. Participants will have the ability to identify areas with higher margins to build competing installations to serve in a market efficient manner. This drives more participants on the system increasing the competition. The result is more supply and less cost to the end-user. This in turn drives more end-users to the system creating more demand which is met with more supply.

To drive end-user adoption the platform will be open for third parties to implement their Cloud solutions and sell them on the platform. This has the potential to create a far greater set of tools than even AWS or Azure have on the platform while also incentivizing those companies to sell their solutions packaged with compute and storage on the underlying Haven Network. Ultimately, we believe that these large Cloud providers will move their offering to the Haven Network due to its performance, cost and geographic advantages. It will be difficult to remain independent of the Haven Network when it is mature as they will be competing with thousands of entrepreneurs building facilities across the globe in a way that not feasible for them.

7. NODE Token Utility and Redemption

The design of the NODE token takes a principled approach to make a transparent, co-operative product and platform development apparatus. The sale of the NODE token during the Initial Token Sale (ITS) does not represent an equity stake in NODE Haven. The NODE tokens, in aggregate, function as a product development vehicle (PDV). The purchase of NODE tokens during the Initial Token Sale is a prepayment of goods and services developed through the PDV. For goods produced, the NODE token represents a proportion of the assets in the PDV and may be redeemed for equipment following the set of equations listed below. For platform purposes, the NODE token is used as a medium of exchange between parties that are buying and selling services. The Cost+10% applies to both products and platform services. In the case of the platform, the cost of building the platform will be paid out to the PDV before the 10% reward is given to NODE Haven for proper stewardship of the platform.

Redemption of goods and services developed using the NODE Haven PDV will take place according to the following system of equations:

$$BV = BookValue$$

$$AllocationNRE(Units) > \frac{NRE(Product)}{VariableEx(Unit)}$$

$$BV(NODE) = Assets(PDV)/Circulation(NODE) = \$/NODE$$

$$BV(Unit) = \frac{NRE(Product)}{Count(Units)} + VariableEx(Unit) = \$/Unit$$

$$Z = \frac{BV(Unit)}{BV(NODE)} = \frac{\frac{\$}{Unit}}{\frac{\$}{NODE}} = \frac{NODE}{Unit}$$

$$Reservation_{NODE}(PDV) = 10\%\ of\ Z$$

$$Price_{NODE}(PDV) = Z$$

$$Price_{Currency}(PDV) = Z * BV(NODE)$$

$$Reservation_{Currency}(PDV) = 10\%\ of\ Z * BV(NODE)$$

$$Price_{Currency}(Public) > Price_{Currency}(PDV) * 110\%$$

8. PDV Process

The PDV was designed to give NODE token holders technological and cost advantages that the large manufacturers have with only a portion of the investment. As such, we are dealing with two type of costs, non-recurring Engineering Cost, $NRE(Product)$ or NRE, and variable production cost per unit, $VariableEx(Unit)$. The value that the co-operative model provides to the NODE token holder increases along with the volume of the products increases. $VariableEx(Unit)$ decreases as economies of scale are exploited. NRE does not decrease with increased volume, but by increasing the number of units that the NRE is allocated a lower cost per unit is achieved, $\frac{NRE(Product)}{Count(Units)}$. Because the NODE Haven team is incentivized with NODE tokens, then it is in the best interests of management to minimize the total cost per unit.

The minimum number of units that the NRE is allocated to, $AllocationNRE(Units)$, will be enough to reduce non-recurring engineering cost per unit to less than the variable cost per unit. In addition, the NRE costs will be spread out over as many units as feasible to provide the highest ROI for equipment reserved and purchased with the NODE token. The final run of $AllocationNRE(Units)$ will have the remaining balance of NRE spread over the entire run to make sure that everyone on that run is treated fairly. After NRE is paid off, subsequent units will be priced based only on $VariableEx(Unit)$.

Detailed target specifications for equipment developed through the PDV will be released when engineering is complete. This may take place before or after a prototype and will be at a time when there is very little performance or production risk. A reservation period of one week will be announced that will allow first access to NODE holders to the production run of the equipment. During the reservation period, NODE holders will reserve equipment for $Reservation_{NODE}(PDV)$ in NODE. The reservation fee of $Reservation_{NODE}(PDV)$ is awarded to NODE Haven to ensure proper stewardship of the PDV.

Following the reservation period, a payment period of 2 weeks will take place. Any excess allocation that was not reserved will be offered to the public for currency other than NODE at $Price_{Currency}(Public)$. If any reserved equipment is not paid for during the payment period, the reservation will lapse. If the reservation lapses, the reservation fee in NODE will be reimbursed and the equipment will be offered to the public at $Price_{Currency}(Public)$. A payment of $Price_{Currency}(PDV)$ will be made to the PDV upon sale to replenish the equipment value. The customer will also have the option to pay for the reservation fee in currency other than NODE at $Reservation_{Currency}(PDV)$ to re-purchase the NODE tokens used for reservation otherwise those tokens are awarded to NODE Haven. This option allows the customer to use the same NODE tokens to reserve equipment from run to run.

If the wafer-allocation at the foundry is not enough or there is any other shortage within the supply chain to cover the amount of equipment reserved, then according to the reserved stake of equipment, or % of total reservation, an allocation of units will take place.

$$AllocationEquipment(Units) = Production(Units) * \frac{Reserved(Units)}{TotalReserved(Units)}$$

The allocation must be paid for in full in either NODE tokens or Cash or Cryptocurrency during the payment period to maintain that allocation. To ensure fairness, we will require, starting from the largest orders, the payment of the miner in full. Then, as reserved purchases are not paid for, they will be redistributed according to reservation stake amongst the remaining reservations. In this way the allocation will remain fair throughout the process and gives the chance for further redistribution of the equipment to those that may not have as large a stake in the reservation.

Additional products will be offered for purchase with NODE that are not manufactured by NODE Haven. Products that are not manufactured through the PDV will follow the same pricing model but will not be subject to the $Initial\ Run\ Size$ or reservation rules. $BV(Unit)$ for these products will be the cost paid for the products from the third party. Stock may be limited for these items as they will not follow the reservation system. Examples of products offered that may not be manufactured through the PDV include accessories such as power supplies and NODE Haven branded apparel.

Shipping and handling must be paid in currency other than NODE at time of sale. It is important to note that NODE tokens will not be immediately recirculated once they are used to purchase mining equipment. The $Price_{NODE}(PDV)$ paid in NODE will be taken out of circulation when units have been shipped and only in the case of re-capitalization will the treasury be recirculated.

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