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A Detailed Introduction of Decentralized Network

Original:
https://www.btcc.com/en-US/academy/crypto-basics/a-detailed-introduction-of-decentralized-network

Almost every decentralized network claims to have a very high level of decentralization — but is this always the case?

Following the Infura debacle of Ethereum in 2020 — where its network suffered unexpected outages and an accidental hard fork due to the cloak-and-dagger behavior of its core developers — crypto and blockchain sceptics has once again asked the question: are decentralized networks like Ethereum truly decentralized, or is there still a puppet master or two pulling the strings? What exactly puts the “de” in decentralization?

To answer this, let’s delve into the technology and then make the case for (and against) some of the world’s biggest cryptocurrencies.

What Exactly Are Decentralized Networks?

Decentralized networks are protocols distributed across multiple computing devices, commonly known as nodes. The decentralization factor is enabled by the nodes having the ability to communicate without a monitoring entity. Additionally, each computer on a distributed system has an updated copy of available data.

Notably, decentralized networks use consensus mechanisms to conduct data validation functionalities without the need for a central controller. However, before data is considered a valid record on the system, a certain number of participating nodes need to reach an agreement independently. Therefore, a node does not wait for instructions from a centralized entity, despite being governed by a common rule.

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How Decentralized Actually Are Decentralized Network?

It’s important to note that decentralization is not an exact state, but a spectrum. That is to say, no blockchain network is completely decentralized (or centralized). Networks generally have centralized and decentralized aspects embedded in their architecture.

Although many blockchain systems are more decentralized than centralized, their level of decentralization varies from protocol to protocol. Some networks have even been accused of hiding behind the veil of decentralization despite being relatively centralized under the hood.

Below, we look at some of the largest blockchain networks in use today and how decentralized they actually are.

Bitcoin Network

Many consider Bitcoin as the leading blockchain in terms of decentralization, though a few might argue against this. It employs a proof-of-work (PoW) consensus mechanism, which, unlike other mechanisms, is energy-intensive and requires specialized equipment to participate. This makes it incredibly expensive and nearly impossible to take over now that the network has grown so much over the last decade.

In the Bitcoin blockchain, those who verify transactions are called miners, and they are scattered across the globe. Most miners, however, aren’t independent. They need to participate in large mining pools in order to have consistent income, thereby handing over their mining power to the pool.

This means that whoever controls the pool controls the consensus votes of all its participant miners. With that in mind, the more independent miners there are and the more evenly distributed mining power gets, the more decentralized the Bitcoin network becomes.

In 2014, the network's decentralized nature was under attack when a report emerged that a single mining pool controlled almost half of its hash rate. This presented the possibility of a 51 percent attack, allowing a malicious actor to reverse transactions for his/her own gain. Yet Bitcoin was left unscathed — the Bitcoin network has never been successfully attacked.

Throughout the years, more miners have joined the Bitcoin blockchain, thus boosting its decentralized aspect. In 2020, no single Bitcoin mining pool had more than 25% of the platform's hash rate.

Notably, only four pools had between 10-24% of the hash rate. Nine pools account for a hash rate between 1-1%. Bitcoin was reported to have nearly 100,000 nodes in 2019.

Ethereum Network

Ethereum is the largest network in terms of developer activity and is also the second-largest blockchain, with some purporting it to be even more decentralized than Bitcoin since it is now in transition to proof-of-stake (PoS) with its ultimate upgrade, Ethereum 2.0.

Since it doesn't require specialized equipment, Ethereum proponents claim that PoS is more decentralized in the sense that it has a smaller barrier to entry when it comes to staking (Ethereum 2.0's version of mining). Although independently participating in the network's consensus requires a minimum of 32 ETH to be locked, there are several available services from Coinbase, MyEtherWallet and others that allow you to stake a lower amount. Unfortunately, staking a lower amount through these services means that you won't be a full validator node, but you'll instead be analogous to a small Bitcoin miner participating in a Bitcoin mining pool.

Some community members in the crypto world have expressed skepticism over the protocol's decentralized nature, particularly after the Infura outage earlier in fall 2020.

The question of how decentralized Ethereum really is found its way back to the sub-forums on Nov. 11, 2020, when the network abruptly went offline. The outage was attributed to a chain split triggered by Infura, Ethereum's infrastructure provider, which is owned by ConsenSys, a private company. Crypto proponents pointed out that projects relying on centralized infrastructure for an ironically decentralized ecosystem is the reason for incidents like this.

Analysis also indicated that Infura was using an outdated client software, making it hard to support a stealth deployment of new code by Ethereum developers. But other industry leaders placed the blame on the Ethereum developers for updating the code without proper communication to the community.

As well, towards the last quarter of 2019, over 50% of nodes tapped into cloud services such as Amazon Web Services (AWS) for hosting.

Unfortunately, the collapse of these services would mean the shutting down of Ethereum nodes, which might seem like half of the network's power rests in the hands of Amazon. However, this particular point of failure has not failed yet.

On the flipside, Ethereum intends to upgrade from a PoW to a PoS system, a point in their decentralization favor. Some believe that PoS is more decentralized than other protocols, since it doesn't require mining pools to make staker income more consistent. Furthermore, over 16,000 additional validator nodes for Ethereum were activated at its Dec. 1, 2020 launch, and the more nodes, the stronger the argument of decentralization.

EOS Network

EOS employs the delegated proof of stake (DPoS) consensus mechanism. The delegated functionality allows EOS token holders to vote on 21 entities tasked with transaction confirmation and block production.

As such, block producers (BPs) maintain and support the blockchain. Compared to Bitcoin and Ethereum, the much lower number of network nodes and their proportionately higher voting power can be viewed as making EOS less decentralized as a result.

However, the EOS network places a 15% threshold (or 150 million EOS coins to be staked) for a BP to unlock all the functionalities of the network. Therefore, a BP has to find favor among EOS holders to reach this threshold, by offering the network new benefits such as a desirable geographical territory, or a socio-political or commercial area of expertise it doesn't currently have access to.

EOS's implementation of DPoS gives BPs the power to act on behalf of the larger EOS community.

Block.One, the company behind EOS, drew criticism for further diluting EOS' decentralizing after it purchased the EOS New York BP in March 2020 and allocated part of its 100 million-strong EOS fund to proxy voters (first introduced in 2018) , to help it combat the increasing use of "sock puppet" passive voters used by applicants to gain network influence. This has led to further concerns about EOS's increasingly centralized nature.

Maker Network

Unlike Bitcoin and Ethereum, MakerDAO brings another dimension to decentralization: community governance. In March 2020, the Maker Foundation boosted its governance by releasing the protocol's control to those holding the platform's native currency, MKR. These governors (AKA token holders) are responsible for the decision-making of the platform. Consequently, this ensured that the DeFi network maintained a $1-peg to the DAI stablecoin.

Maker is different in the sense that its consensus is achieved through decentralized governors as opposed to miners/stakers like in Bitcoin and Ethereum. It's still decentralized, but more prone to human neglect/error.

Maker enables users to lend and borrow cryptocurrencies without any third-parties. By combining loans and stablecoins, the platform helps borrowers reliably calculate how much they'll pay back as interest.

The platform's decentralization means that it allows anyone with a MetaMask wallet to borrow or lend money trustlessly. Furthermore, unlocking the loan collateral doesn't require a go-between, since a smart contract handles everything automatically while having the ability to independently monitor the loan amount and collateral provided to initiate a liquidation process if need be.

Most of the popular DeFi platforms like Uniswap, Compound, SushiSwap and yearn.finance operate similarly to Maker.

TRON Network

TRON uses the same consensus mechanism as EOS, albeit with its own variation. Unfortunately, just like EOS, there has also been a public airing of doubts on how decentralized it is. In mid-2019, for example, its co-founder Lucien Chen left the project, citing its centralization aspects.

Its deviation from decentralization came from some TRON "Super Representatives" having more voting powers than others, up to a rumored 90% at times. Consequently, co-founder Chen (among others) sees TRON as centralized, since the community has a minimal say in block production and transaction confirmation.

TRON has 27 Super Representatives that validate blocks. However, to enhance decentralization, the representatives are re-elected every six hours. Apart from securing the network, Super Representatives vote for improvement proposals using their delegated power.

Some proponents have called Tron’s system an on-chain democracy due to its similarity to politicking when engaging in governance activities.

Conclusion

How decentralized are decentralized networks? From the above analysis, it’s clear that blockchain networks, while touting a fully decentralized outlook, sometimes have some elements of centralization at their core.

Bitcoin is viewed as the most decentralized blockchain platform. Ethereum, although sometimes accused of being centralized, is also more decentralized than the vast majority of existing blockchains. And with Ethereum 2.0, its shift from PoW to pure PoS could lead to greater decentralization.

Apart from the big two (Bitcoin and Ethereum), most other chains have decided to make tradeoffs, sacrificing part of their decentralization in exchange for speed, scalability, new functionality, etc.

This is probably why the two largest chains are also the two slowest and most rigid of all decentralized networks. However, decentralization brings fairness and security as well as other benefits that make it a property worth keeping.