21SHARES

Research Primer
Polkadot

This research primer is a guide to understanding the smart contract platform Polkadot and its native token, DOT. This research will explain what Polkadot does and what its main use cases are. Also, we will explain the primary methods by which to value DOT and analyse the primary risks associated with investing in the DOT asset. We hope this primer offers a comprehensive overview of both the DOT asset and the wider Polkadot network.

DATA AS OF MARCH 2021

Polkadot Research Primer

Executive Summary

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At 21Shares, we are excited to have launched the world's first Polkadot ETP on the Swiss stock exchange-regulated segment — SIX Swiss Exchange — on Thursday, February 4, 2021 (ADOT SW - CH0593331561 - PDOT). The demand for the 21Shares Polkadot ETP to-date is a reflection for both retail and institutional interest in Polkadot and the potential of blockchains and smart contracts. The Polkadot network presents itself as the "Internet of Blockchains" and has been one of the most successful cryptoassets of the last year — with its native DOT token returning over 350% since the start of the year. This report offers an overview of the key features of both the Polkadot network and the DOT token.

Polkadot presents itself as a solution to the critical issue of inter-blockchain connectivity by enabling the transfer of data and financial activities between all kinds of blockchains, using the native cryptoasset (DOT) to encourage the right behaviour of different actors of its ecosystem. Polkadot is the flagship project of Web3 Foundation, a Swiss Foundation founded to facilitate a fully functional and user-friendly decentralised web.
To-date Polkadot's native token has returned over 350% since the start of the year, whilst retaining a shape ratio of 1.68 over the last year.

DOT Key Metrics	As of March 10, 2021
Ticker	DOT
Price (USD)	$38.79
Circulating Supply (DOT)	1,071,877,071 DOT
Market Capitalization (USD)	$41,883,169,545
Annual Inflation (%)	13.05%

Figure 1: DOT Key Metrics (Source: Messari)

Figure 2: DOT Performance 1-Year Performance (Source: Messari)

2021

370.71%
YTD Returns

1.68
1–Year Sharpe Ratio

$27.63B
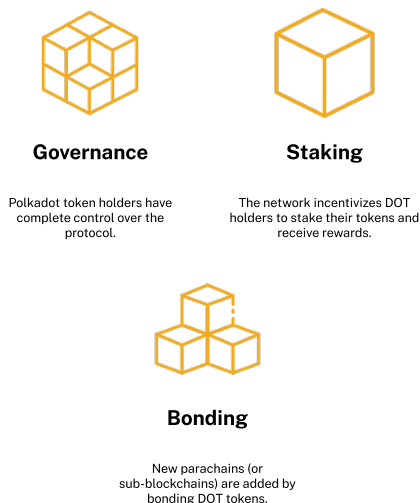YTD Market Capitalization Increase

Polkadot Research Primer
How Polkadot Works

This section will give a brief overview of exactly how the Polkadot blockchain works — its consensus mechanism, how blocks are formed on its blockchain, and how it tackles some of the issues apparent on popular smart contract platforms, such as Ethereum.

The DOT Token

The centerpiece of the Polkadot network is the DOT token which serves three primary functions essential to the network's functionality: governance, staking, and bonding. DOT is the native currency of the Polkadot network and is used to facilitate its network and used by users to pay transaction fees on the blockchain and vote for protocol upgrades and fixes. As we will describe in more detail below, DOT is used to maintain the entire Polkadot network's economic security through Staking and Bonding.

Figure 3: DOT Primary Functions (Source: Polkadot)

Governance

Polkadot token holders have complete control over the protocol.

Staking

The network incentivizes DOT holders to stake their tokens and receive rewards.

Bonding

New parachains (or sub-blockchains) are added by bonding DOT tokens.

Nominated Proof of Stake (NPoS)

As many may know, Bitcoin uses the process of mining to guarantee its economic security where miners use computers and hardware to process and validate transactions and blocks and receive new bitcoins as a reward. Polkadot uses DOT for a process called staking, where DOT is bonded by users (validators) who validate blocks and transactions. The use of staking helps prevent the Polkadot network from being attacked or subject to spam attacks, as validators (those who stake) can have their deposits taken away if they are found to break protocol rules.

Nominated Proof of Stake, a novel version of PoS systems, aims to prevent the potential formation of oligarchies and bad actors nominating network validators with their capital and gives more voices to minorities. As token holders cast votes, the algorithm will fairly divide the votes instead of giving too much weight to a preferred validator — and as such will reward both nominators and validators with inflated DOT[1].

Validators that stake are then able to add new blocks to the blockchain in the Polkadot network, which is a central blockchain (called the Relay Chain) that coordinates and connects to other sub-blockchains in the network, called Parachains. This fact is why Polkadot is often called the Internet of Blockchains, as new applications and projects can build on Parachains whilst receiving the central Relay Chain's economic security.

Polkadot Research Primer
How Polkadot Works

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The Relay Chain and Validators

The Polkadot blockchain consists of a central **Relay Chain** that connects to other networks (parallelised chains or also called Parachains) that may optimise for specific features — decentralised finance or decentralised internet services, for example. Parachains have to submit proofs, or information about their blocks and transactions, to the Relay Chain, which keeps all Parachains in sync with each other and satisfies a singular universal logic.

Validators must stake their DOT which locks up their holdings as a deposit for 28 days. Any user can stake, but there is a limited number of validator slots within 24 hours. Non-validator DOT holders can nominate up to 16 other validators with their DOT holdings. The potential validators with the most amount of DOT staked (or nominated by other DOT holders) are selected to join the set of validators. There are currently 252 validators chosen, and once within the set, they are randomly chosen to submit new blocks in the Polkadot network.

Figure 4: How Polkadot Works Overview (Source: Polkadot)

Connecting the dots

Relay Chain
The heart of Polkadot, responsible for the network's shared security, consensus and cross-chain interoperability.

Parachains
Sovereign blockchains that can have their own tokens and optimize their functionality for specific use cases.

Parathreads
Similar to parachains but with a pay-as-you-go model. More economical for blockchains that don't need continuous connectivity to the network.

Bridges
Allow parachains and parathreads to connect and communicate with external networks like Ethereum and Bitcoin.

Consensus Roles

Nominators
Secure the Relay Chain by selecting trustworty validators and staking dots.

Validators
Secure the relay chain by staking dots, validating proofs from collators and participating in consensus with other validators.

Collators
Maintain shards by collecting shard transactions from users and producing proofs for validator.

Fishermen
Monitor the network and report bad behavior to validators. Collators and any parachain full node can perform the fisherman role.

Polkadot Research Primer
How Polkadot Works

Parachains and Collators

As mentioned, **Parachains** are networks that are connected to the Relay Chain. Similar to how a computer has multiple cores that allow it to compute several different processes at the same time, the use of Parachains allows the Polkadot network to simultaneously handle the transactions of various blockchains at the same time, which improves scalability and reduces the fees of using the network compared to other smart contract blockchains.

Developers have to enter an auction for the right to use a Parachain for up to two years. This process involves depositing DOT from the developers themselves or the community around the developer's application. This contrasts with the situation for Ethereum where developers only have to pay the transaction fees to launch new applications but do not need to rent Parachain (or equivalent) slots. **Collators** are users who communicate the information of transactions that happen on a specific Parachain to the Relay Chain every given block. For example, a developer could integrate the Bitcoin blockchain with a Polkadot Parachain; in this case, the collators would be equivalent to miners' role wherein, in addition to their usual position, they would have to submit the state of the Parachain to the Relay Chain.

Governance and Treasury

Unlike other cryptoassets such as Bitcoin and Ethereum, DOT holders can vote for changes in the protocol and allocate capital from the network's treasury. DOT holders can propose and vote for various modifications to the protocol and elect entities to take leading positions within the protocol's governance.

DOT's inflated supply is paid into the Polkadot treasury when the total amount of staked DOT on the network deviates from the protocol's target figure. In addition, Polkadot validator deposits which have been slashed (or confiscated by the network) are also given to the treasury. **The current value of the Polkadot treasury is over $400M**[2].

Polkadot Research Primer
The State of Polkadot

We borrow from the excellent report "The Polkadot Network: Scaling The Decentralized Internet" by Signum Growth Capital for more information about the relevant entities within the Polkadot ecosystem[3]. There are two key entities within the Polkadot ecosystem: the Web3 Foundation and Parity Technologies.

Web3 Foundation

The Web3 Foundation is a Swiss-based foundation with the aim of advancing the decentralised internet. The foundation was the initial issuer of the DOT token. It led to the development of the Polkadot network between 2017 and 2018 before giving control of development over to the wider network in July 2020. The foundation will now continue to support research and funding efforts for the Polkadot network.

Parity Technologies

Parity Technologies is a for-profit limited company that develops an open-source software tool called Substrate and additional value-added professional services around the tool and the Polkadot network. These tools aim to make it easier for business and developers to build and deploy their blockchains quickly. Also, Parity Technologies developed the first implementation of the Polkadot protocol.

The Polkadot Network, The Polkadot Protocol, and Substrate

It is essential to distinguish between the Polkadot Network, the Polkadot Protocol, and Substrate:

- The Polkadot Protocol is a specification of the technology which provides a guide for a blockchain in the style of Polkadot. Its code has been completed and is open source

- In contrast, the Polkadot Network is a deployed version of the Polkadot protocol launched by the Web3 Foundation alongside the DOT native token. One can view the Polkadot Network as a specific implementation of the Polkadot Protocol

- Finally, Substrate is a blockchain development framework or simply a software tool that aims to reduce the difficulty of launching a new blockchain network

Polkadot Research Primer
The Future of Polkadot

The future of Polkadot lies within efforts to successfully launch Parachains and then build out their functionalities. The successful launch of Parachains and improvements in their implementation will allow developers and entrepreneurs to build more interesting tools and applications on the Polkadot network. Over the last year, Polkadot has moved from a "Proof of Authority" blockchain where users could only claim or stake their tokens to a fully-fledged Nominated Proof of Stake blockchain on the edge of being finalised.

Parachains

The next most immediate and important step in the Polkadot roadmap is the roll-out of Parachains on Polkadot's testnet and the Kusama Network. The latter is a fully-fledged blockchain serving as a testing ground of the Polkadot technology stack. Once this has happened and the code has been thoroughly tested, Polkadot governance will enable Parachains, and users will be able to bid for access to them. Each auction will take around two weeks to complete, and the end of this process will represent the official completion of the original specification of Polkadot. Polkadot is currently testing Parachains on Polkadot's testnet.

Cross-Parachain Messaging (XCMP)

Another crucial part of Polkadot's roadmap following the launch of Parachains is Cross-chain Message Passing (XCMP). This feature will allow one Parachain to directly send messages to other Parachains without having this communication needing to be facilitated by the Relay Chain. This fact will facilitate a higher degree of interoperability between different Parachains, meaning that applications can be built which leverage resources on the different chains.

Parathreads

Parathreads are a particular type of Parachain which are not required to be leased with large capital denominated in DOT for two years in the same way as a Parachain slot. This reduces the barrier of entry for developers who do not have enough capital to secure a Parachain slot while benefiting from the shared security and connectivity of Parachains. In doing so, developers instead pay a fee per executed block. In other words, parathreads are pay-as-you-go Parachains. This, in theory, would solve some of the potential adoption challenges by requiring new applications to have their own Parachain. One can understand parathreads as more similar to how the transaction fee model works in a smart contract platform such as Ethereum.
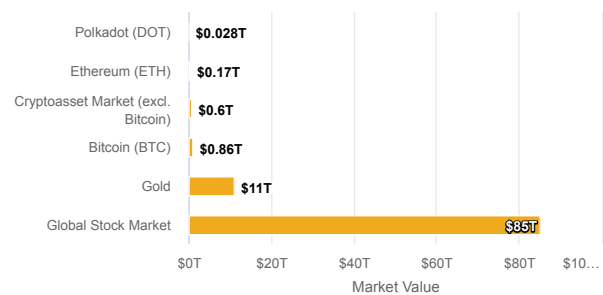
Figure 5: Relay Chain and Parachain (Source: Polkadot)

Relaychain
Shared security
Inter Chain Message Passing

Parachain
Blockchain that has own logic
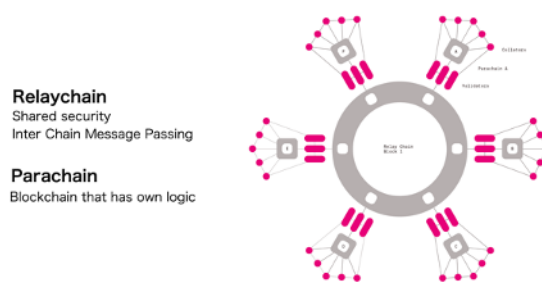
Polkadot Research Primer
# Valuing Polkadot

Market Sizing

This section helps put the Polkadot network's scale in comparison with other leading cryptoassets such as Polkadot and Ethereum, as well as other assets such as Gold and the broader stock market. The bull case for Polkadot is that it acts as the "Internet of Blockchains" connecting other crypto asset networks such as Bitcoin and Ethereum; in a similar way to the internet is a decentralised network that connects individual platforms such as Amazon and Google. The chart below compares DOT's current market value to Bitcoin and Ethereum, and other asset classes. As we can see, DOT would have to increase in value six times to equal the market value of Ethereum. Similarly, DOT would have to increase in value over thirty times to equal the market value of Bitcoin.

If Polkadot were to execute its vision of an "Internet of Blockchains", it is entirely possible that DOT commands a similar market value to Ethereum in the long term. It is also plausible that, as other uses of blockchains command more value such as Decentralized Finance (DeFi), digital art, and Web3.0 technology, the value of an "Internet of Blockchains" comes to rival that of the Store of Value use-case. The chart below would show DOT's performance if it were to capture the market of Ethereum within the next two years and different proportions of the Bitcoin market over the same time frame. As Polkadot scales, we will use other metrics such as transaction fees to value DOT based on the amount of value that the Polkadot network provides to its users, developers, and investors.

Figure 6: DOT Market Sizing

Figure 7: DOT Projections
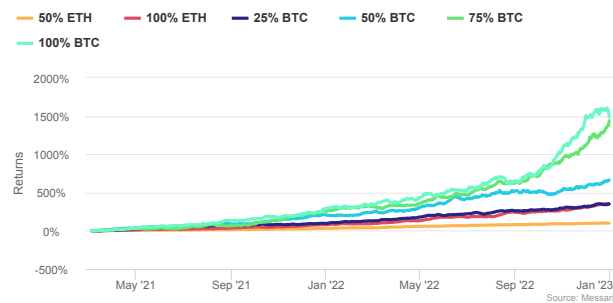
Polkadot Research Primer
Risks

Technological Risks

Polkadot has a limited operating history and has not been validated over the long run. The network launched the genesis block in late May 2020 and, despite rigorous audits such as the Polkadot claims audit, the crypto network is still developing and making significant decisions that will affect the design, functionality, and governance. Implementing new software upgrades and changes to the protocol could introduce bugs, security risks, or adversely affect the crypto network. To mitigate this, for example, the Polkadot network launched in mid-2019, Kusama, a highly-experimental community research and development version of its blockchain to stress test the limits of the Polkadot network. As such, Kusama fulfils the purpose of serving as a proving ground to deploy Parachains and test Polkadot's future governance decisions.

Adoption Risks

Adopting Polkadot is predicated on developers bidding and attempting to launch their Parachains and then users (and developers) then choosing to build and use specific applications on specific Parachains. To date, there has been sizeable amounts of investment and funding put towards projects that are building Polkadot applications or Parachains. Still, actual adoption is limited at the moment and will be until Parachains officially launch. Polkadot's Parachains are currently in their testing phase, but we can assume that there will be sizable demand for them and the applications they facilitate once they are live.

The open question is to what extent applications on Polkadot become popular, especially when compared to applications currently popular on Ethereum.

Regulatory risks

Polkadot was funded initially by a token sale and, as such, is vulnerable to some level of potential regulatory scrutiny due to the suspicion of some jurisdictions, namely the United States, to that particular method of fundraising. As Polkadot continues to further decentralise and build working applications, in a similar vein to what Ethereum has done, the likelihood of serious regulatory scrutiny from any governmental body would likely decrease. It can be argued that Ethereum's "safety" in the eyes of US-based regulators, who stated that Ether is not a security, is one key moat that it has over the other smart contract networks such as Polkadot.
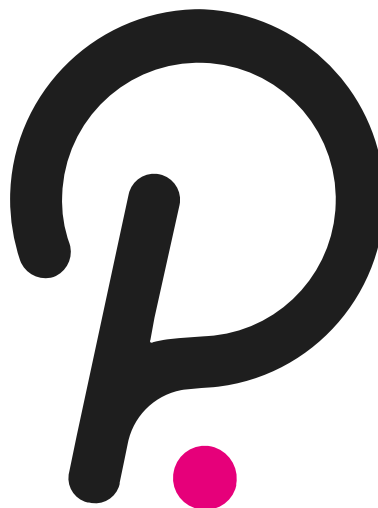
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Footnotes

1) https://medium.com/web3foundation/how-nominated-proof-of-stake-will-work-in-polkadot-377d70c6bd43

2) https://polkascan.io/polkadot/account/13UVJyLnbVp9RBZYFwFGyDvVd1y27Tt8tkntv6Q7JVPhFsTB

3) https://docsend.com/view/huurcgzutrrain3b

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