

POLKADOT'S REVOLUTIONARY JOURNEY:

A Blockchain
Innovation Era



Content

I. Introduction to Polkadot	3
II. DOT token: Driving Decentralization and Enhancing Ecosystem Growth	4
DOT's supply dynamic	4
Decentralized Governance: The Role of DOT and the OpenGov System	6
The Impact of Agile Coretime on DOT Tokenomics and Market Dynamics	7
III. Polkadot Ecosystem Recap: Why build on Polkadot?	8
Polkadot Adoption Metrics	8
Polkadot's Developer Ecosystem and Innovative SDK Framework	11
Project Landscape in the Polkadot Ecosystem	13
IV. Technical Overview: How Does Polkadot Achieve a High Throughput and Reduced Latency?	14
V. Polkadot 2.0 and How it Can Further Enhance the Chain's Performance	16
Asynchronous Backing	16
Agile Coretime	17
Elastic Scaling	18
Polkadot's Transactionless Operation Vision: Join Accumulate Machine (JAM)	18
VI. Conclusion	19
Disclaimer	20

I. Introduction to Polkadot

Developed by Dr. Gavin Wood, a co-founder of Ethereum, Polkadot was created to address the limitations faced by traditional blockchains, particularly in the areas of scalability and interoperability. Polkadot's architecture connects multiple blockchains, allowing them to share information and security seamlessly. This interconnected structure addresses key issues, such as transaction latency and the challenge of integrating diverse smart contract layers.

One of the core strengths of Polkadot lies in its ability to process transactions in parallel through its side chains. Unlike traditional blockchains that process transactions sequentially, leading to potential delays and bottlenecks, Polkadot's parallel processing through its sidechain architecture significantly enhances its throughput.

Recent growth statistics underscore Polkadot's rising prominence. With an 82% increase in the number of unique accounts and an 84.8% growth in transaction count since September 2023, Polkadot demonstrates healthy development and onchain activity. The network has also seen significant adoption, as a large number of new projects launched on its platform.

Polkadot is currently making substantial progress toward its next major upgrade, Polkadot 2.0. The key milestones associated with this upgrade include the launches of Asynchronous Backing in May 2024, which increases the throughput and speed for blocks, and Agile Coretime in September 2024, which lowers the barrier to entry into Polkadot through on-demand purchasing of blockspace. The final piece of Polkadot 2.0, Elastic Scaling, is anticipated in late 2024 or early 2025 and promises to further enhance the network's capacity and performance.

Looking ahead, Polkadot is poised for even greater expansion, with ongoing investments aimed at future developments, such as the JAM project, which we will cover more thoroughly in the report. Furthermore, we will provide an introduction to Polkadot's tokenomics, governance, architecture, and application ecosystem. By analyzing these elements, we explore how Polkadot addresses current challenges in blockchain design and its potential impact on the industry's evolution.

II. DOT token: Driving Decentralization and Enhancing Ecosystem Growth

DOT's supply dynamic

The DOT token's current circulating supply stands at 1.49 Bn with a corresponding market capitalization of \$6.5 Bn. In addition to a non-inflationary redenomination, DOT underwent in 2020, its total supply is currently set to grow at approximately 10% per year as inflation, pending potential governance decisions and staking participation rates.

The distribution of inflation rewards is influenced by the proportion of DOT tokens staked in the network. The expansion of the supply is partially distributed to the Polkadot treasury, which is controlled by the network's onchain governance system as well as network participants.

There is a small spending period (every 24 days) where 1% of the tokens are burned from Polkadot's onchain treasury, which currently holds [21.98m](#) worth of DOT.

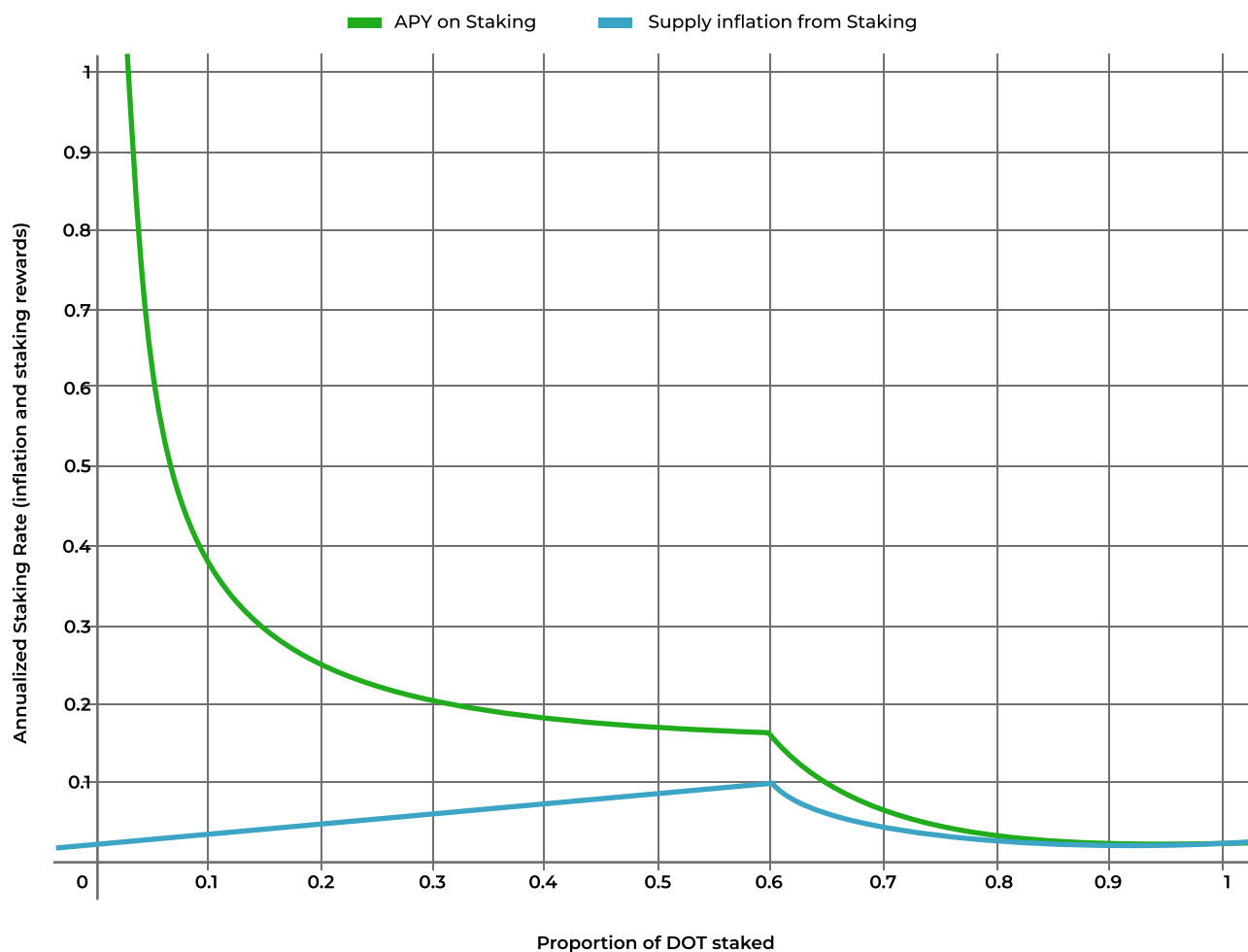
Polkadot aims to maintain [an ideal staking rate](#), which depends on network parameters. The ideal [staking rate](#) is currently influenced by the number of active chains on Polkadot (excluding system chains) and can fluctuate between 55% and 75% (Figure 1).

If the current rate is below the ideal, the rewards for stakers increase at a faster pace, encouraging more participants to stake their DOT. Conversely, if the current rate exceeds the ideal, the rewards for stakers decrease more quickly.

The network also adjusts the allocation of rewards based on how closely the current staking rate tracks the ideal rate. When the actual staking rate matches the ideal rate, all inflation rewards are allocated to validators and nominators.

However, if the current staking rate deviates from the ideal, a portion of the inflation rewards is redirected to the treasury, reflecting what is termed "staking inefficiency." The overall inflation rate ought to remain at the 10% target.

Figure 1: Quantitative Relationship Between Protocol Rewards and Staking Rate



Source: [Polkadot Wiki](#)

In addition, the introduction of Agile Coretime introduces a new revenue stream from tokenized execution time allocation. The [community has decided](#) to burn the respective DOT tokens rather than direct them to the treasury starting in May of 2026 and has thus added a deflationary element to DOT's supply.

This change and discussions to potentially [lower](#) the maximum inflation rate from 10% to 8% would reduce supply pressure on the token.

Decentralized Governance: The Role of DOT and the OpenGov System

A primary function of the DOT token is its use in governance decisions. Polkadot puts greater emphasis than most L0 blockchains on maintaining decentralized governance and managing as much of the process as possible onchain. DOT tokenholders can propose and vote on protocol upgrades, operational changes, and other critical aspects of the network's evolution, which are automatically executed onchain.

This contrasts with Ethereum, where governance decisions are made offchain and are [often influenced](#) by the Ethereum Foundation and core developers. There is no direct voting mechanism on Ethereum. Users and developers can only propose changes through EIPs on GitHub.

While proposals (EIPs) are theoretically open for community input, in practice, a small group of core developers and influential figures within the Ethereum Foundation heavily influences most significant decisions and development directions. The core developers, in collaboration with the community, make the final decision on whether an EIP is accepted and implemented.

For instance, for Ethereum's shift from Proof-of-work to Proof-of-stake, the core developers and Ethereum Foundation established the final implementation details, specifically how the [Beacon Chain would merge with the mainnet](#).

[Polkadot's governance mechanism, OpenGov](#), stands out because of its onchain system for real-time, transparent, and democratic decision-making. Any DOT holder can submit a proposal through [OpenGov](#), but not all proposals automatically go to a referendum. In order to move forward, a proposal must gain enough backing, either through a deposit of DOT or by receiving support from the community or the Council.

The proposal can then enter the referendum stage in which all DOT holders can vote using a system called [conviction voting](#). The weight of a voter's decision increases based on how long they are willing to lock their tokens.

Throughout 2023 and 2024, the Polkadot network saw a significant increase in governance activity and DAO growth. [Over the course of 2023](#), the number of referenda submitted surged by 150%, and the average voter turnout increased by 40% compared to the previous year. More than 1,134 unique voters participated in governance activities [in July 2024 alone](#).

This increase in participation is indicative of the growing engagement of the Polkadot community and has led to new movements in the ecosystem. For example, [Referendum 1104](#), introduced in mid-2024, proposed the conversion of 5.25 million DOT into stablecoins such as USDT and USDC. This marked a shift in Polkadot's treasury management strategy, which was aimed at reducing volatility in treasury funds (which was a tense issue). This referendum provided a more stable financial foundation for ecosystem development.

The referendum saw a high level of voter engagement, and 99.8% of participating DOT holders voted in favor. The referendum saw a significant voter turnout, and over 75% of participating DOT holders voted in favor, initiating a flurry of new funding and development activity on Polkadot.

The Impact of Agile Coretime on DOT Tokenomics and Market Dynamics

Agile Coretime makes the utilization of blockspace more flexible and dynamic. Users can pay for blockspace using the DOT token without having to lock up tokens for extended periods. This resource management model lowers the barrier to entry for developers and projects that seek to deploy or expand their operations on Polkadot. There are three different ways to obtain coretime, each with its own advantages:

1/ Through on-demand short-term flexibility, developers can acquire and use blockspace as needed instead of having to commit large amounts of capital upfront. This flexibility is particularly attractive for projects with fluctuating demands and allows them to scale resources according to their immediate needs.

2/ Through bulk purchases, the risks and exposure associated with price fluctuations are lowered, and future fee fluctuations for larger-scale projects are protected.

3/ Coretime can be purchased through secondary markets.

From a tokenomics perspective, using DOT for Agile Coretime introduces a new utility for the token, as it directly links its demand to the operational requirements of various projects within the Polkadot ecosystem. Unlike staking or governance participation, where DOT tokens are often locked up for extended periods, starting in May 2026, Agile Coretime requires that all of the DOT spent on coretime be burnt.

III. Polkadot Ecosystem

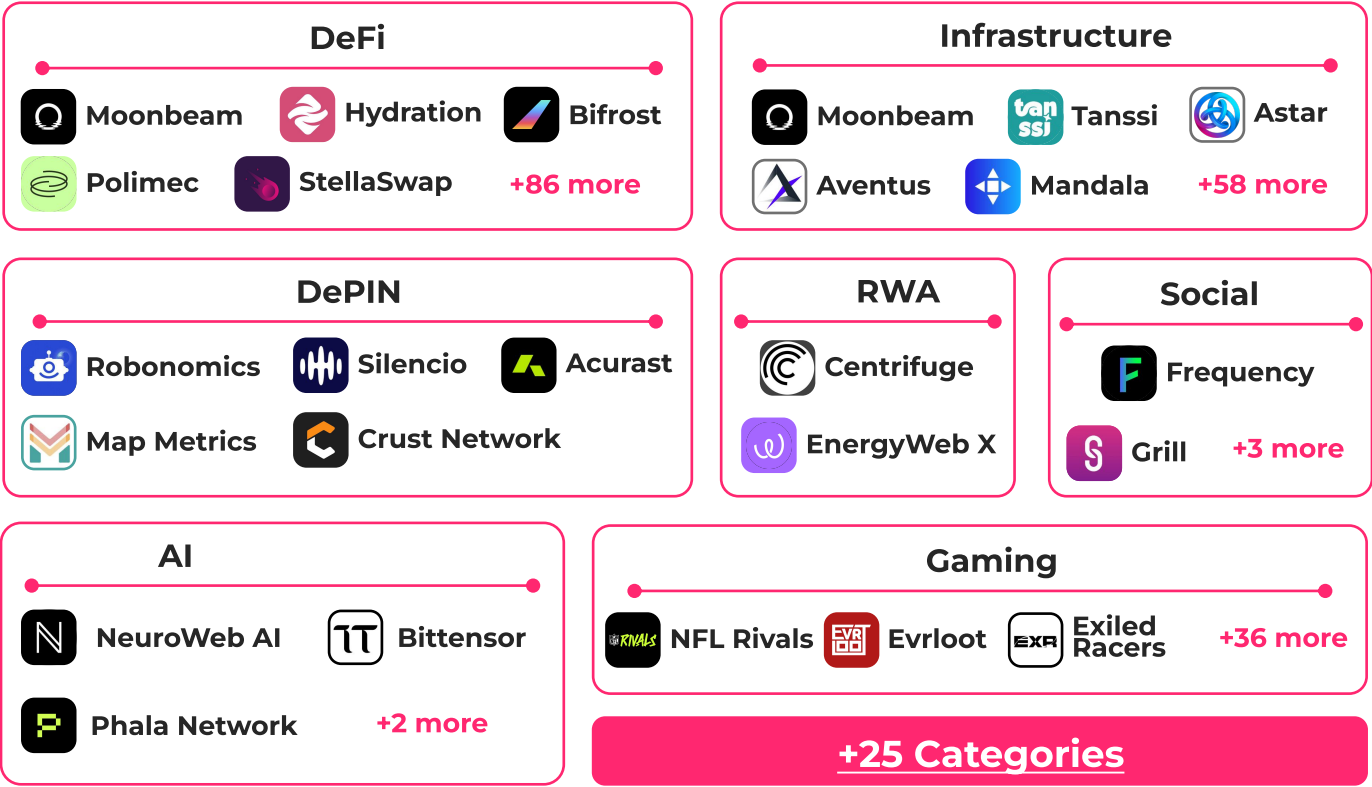
Recap: Why build on Polkadot?

Polkadot Adoption Metrics

Polkadot has emerged as a platform for a diverse array of blockchain projects owing to its robust infrastructure, shared security, scalable and flexible architecture, and community-centric governance model.

The ecosystem boasts a growing list of projects. Across Polkadot and Kusama, there are 69 chains on Polkadot from over 600 ecosystem projects, 170 of which are decentralized applications, and 29 are separate Polkadot SDK-based blockchains (Figure 2).

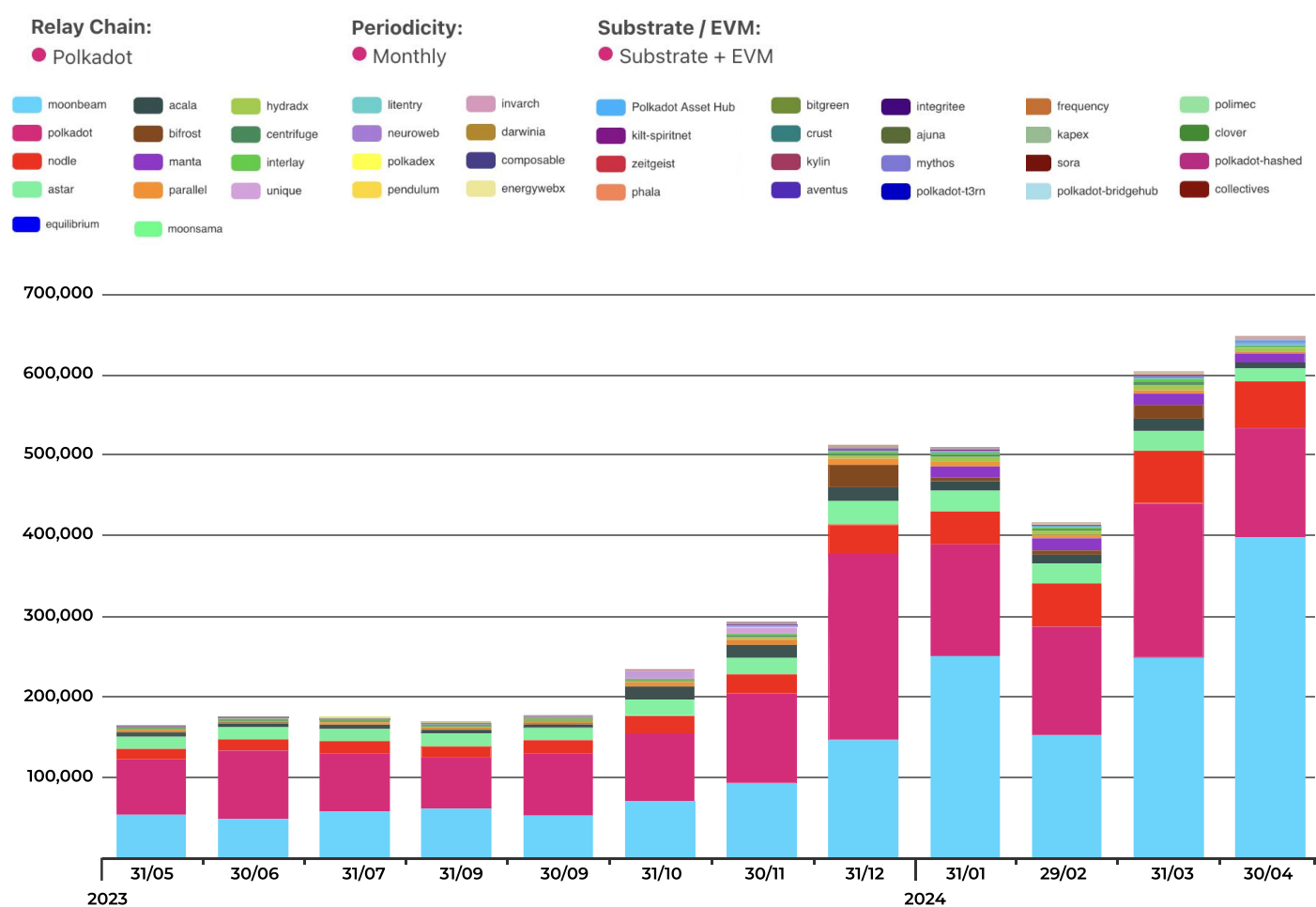
Figure 2: DOT Ecosystem Map



Polkadot's user base has seen remarkable growth, particularly in the 2023-2024 period. Polkadot's active addresses surged and reached over 600,000 in April 2024, with a 25.5% increase since the beginning of 2024 (Figure 3). Over 190,000 of those addresses were active on the Polkadot's Relay Chain during March 2024. The network thus surpassed Ethereum, which had 500,000 active addresses or a 15.2% difference in the same period.

This spike is indicative of the growing use of chains on Polkadot due to decreasing barriers for builders and grant distributions from the Polkadot Treasury. The monthly active addresses on Polkadot's Relay Chain has since then slowed down and currently stands at over 68,500 in August 2024, a 94% decrease since March.

Figure 3: Number of Active Accounts on Polkadot

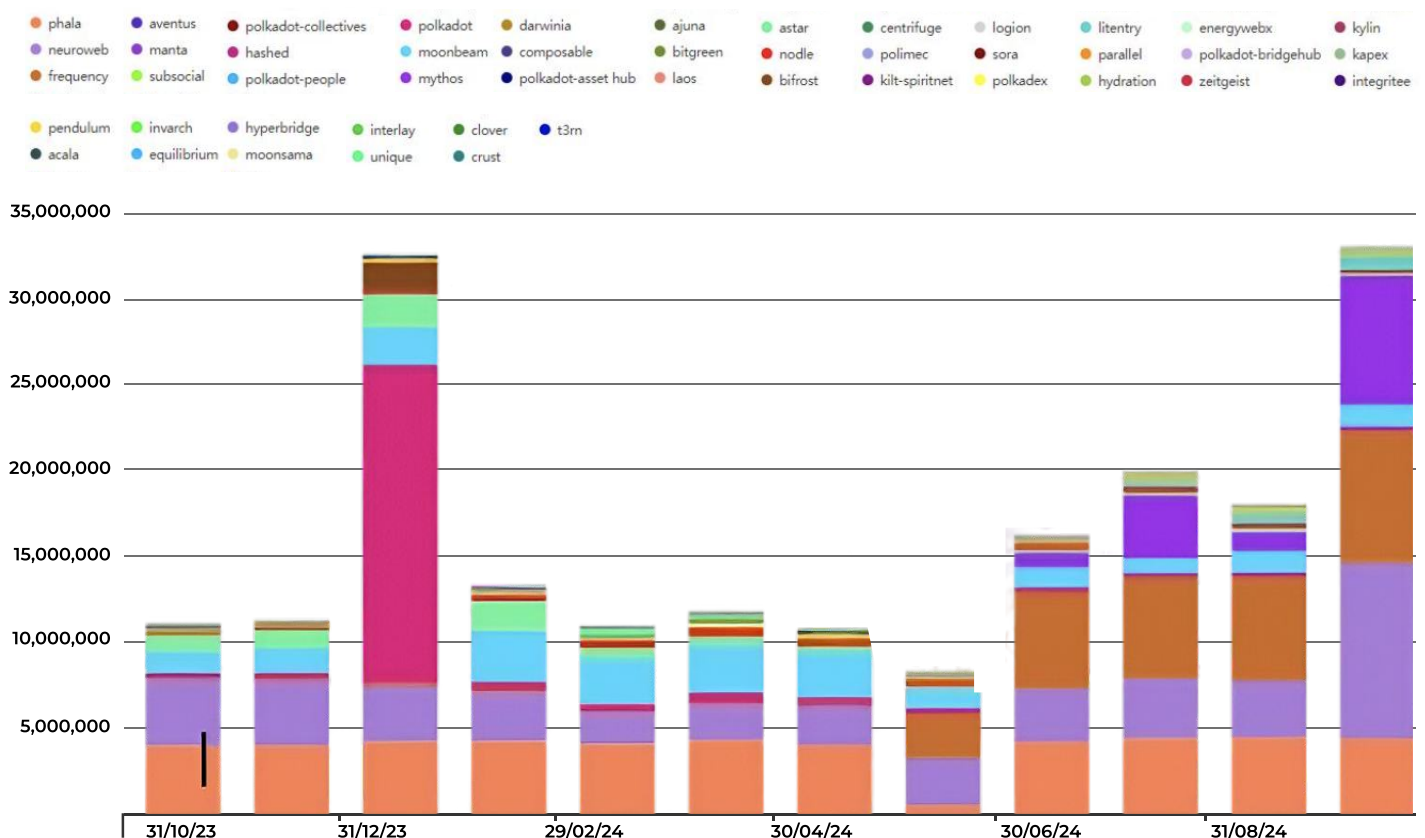


Source: [DotLake](#)

Additionally, the total number of unique addresses holding non-zero balances surpassed 7.95 million by March 2024, reflecting steady user growth. Compared to December 2023's peak of 31.8 million transactions, Polkadot surpassed the previous record with over 32 million

transactions in September 2024 and thus maintained a much healthier level of network activity compared to 2023 (Figure 4).

Figure 4: Number of Transactions on Polkadot



Source: [DotLake](#)

In parallel, Polkadot's DAO ecosystem expanded considerably. By the end of 2023, the number of DAOs operating within the Polkadot network had more than doubled, from 50 to over 120. This growth was supported by the Polkadot SDK as decentralized governance is available through modules and substantial treasury allocations.

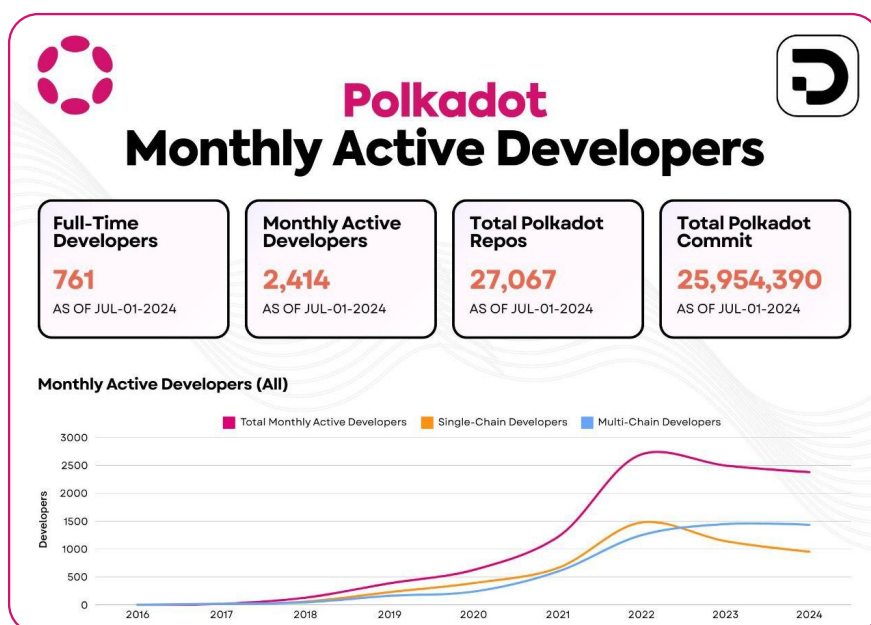
The Polkadot treasury distributed over 1.5 million DOT to DAO-led initiatives in 2023. Notable examples include significant funding for the Astar Network's DAO and the Moonbeam Foundation's DAO, which received 250,000 and 300,000 DOT, respectively, to advance cross-chain and ecosystem expansion projects.

Polkadot's Developer Ecosystem and Innovative SDK Framework

As of July 2024, Polkadot and its canary network Kusama are in the top 15 chains by developer activity among blockchain platforms, with a [30-day developer activity figure of 761](#) for Polkadot, ranking it #4, and a [30-day developer activity figure of 271](#) for Kusama, ranking it #15, according to [DeveloperReport](#). This number is calculated [by tracking the number of GitHub events](#) associated with a project's codebase.

The Polkadot network itself boasts nearly 2,500 developers, with almost 800 of them working full-time on the platform (Figure 5). This robust developer engagement is crucial for ongoing innovation and maintaining the network's competitive edge.

Figure 5: Polkadot Monthly Active Developers



Source: [Developer Report](#)

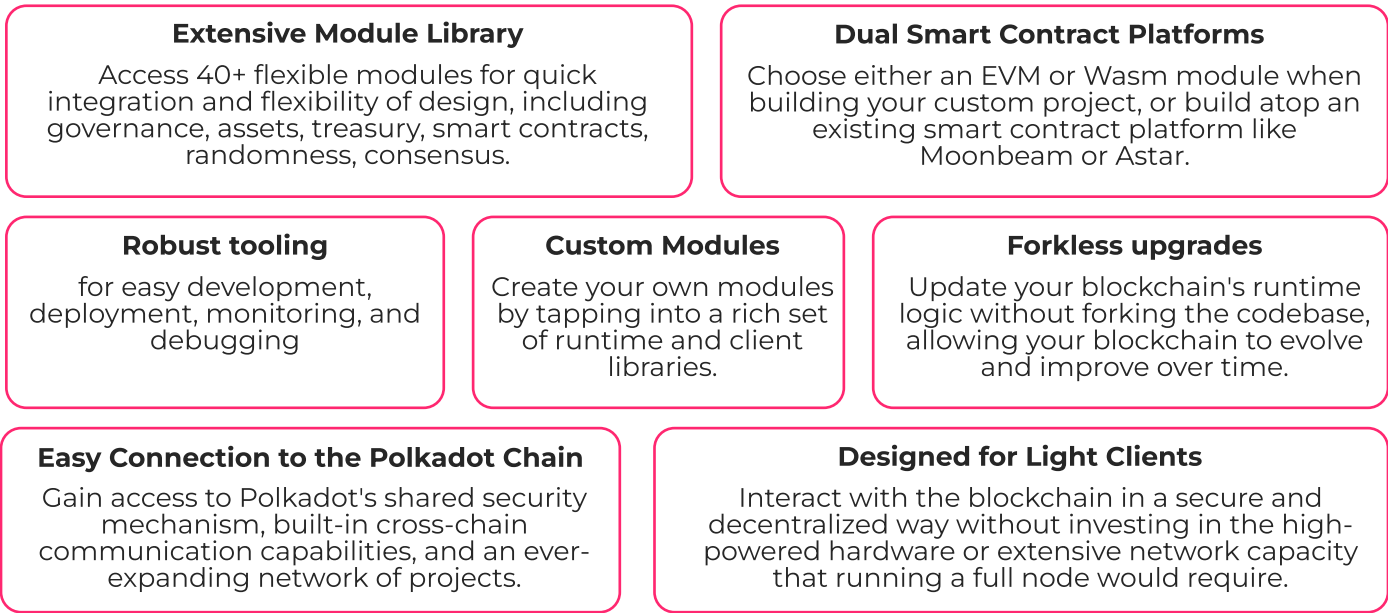
Polkadot's developer tools, especially [the Polkadot SDK](#), are fundamental to its appeal as a robust platform for blockchain development. Polkadot SDK offers a highly modular and flexible environment and extensive libraries that simplify the process of creating customized blockchains.

The framework provides over 40 pre-built modules for essential blockchain components such as consensus mechanisms, governance, and token economics. This modular approach significantly reduces development time and complexity and lets developers focus on building innovative features and applications rather than spend time on creating basic blockchain infrastructure.

In addition to EVM support, the Polkadot SDK offers support for [WebAssembly](#) (WASM). WASM lets developers write smart contracts and runtime logic in multiple programming languages and runs seamlessly across different environments. This compatibility allows for high-performance applications and broadens the range of potential use cases for Polkadot-based projects.

Furthermore, [Polkadot SDK](#) includes built-in tools for testing, benchmarking, and debugging, which streamline the development process and ensure higher quality and more secure code. In addition to its technical features, Polkadot SDK also supports [forkless upgrades](#), allowing blockchains built on Polkadot to implement updates and new features without the need for disruptive hard forks (Figure 6).

Figure 6: Key Polkadot SDK Features



Source: [CoinTelegraph Research](#), [Polkadot.com](#)

As a result of the developer activity, continuous updates and improvements to the Polkadot network have been made. In 2023 alone, there [were 621 forkless upgrades](#) across all Polkadot SDK-based blockchains, including Polkadot and Kusama blockchains.

A major area of focus is the development and enhancement of the [Cross-Consensus Message \(XCM\) format](#), which aims to improve cross-chain communication and interoperability and

allows for seamless interaction between different blockchains within the Polkadot ecosystem.

Another significant improvement was [asynchronous backing](#), a key feature of Polkadot 2.0, which optimizes block production and finality times by 4X to further increase the network's throughput and reduce latency by 2X from the original parablock time.

[Elastic Scaling](#), the third feature of Polkadot 2.0, expected by Q1 2025, further enhances network performance as it enables chains in the Polkadot ecosystem to utilize multiple cores within the same block to amplify transaction throughput even more.

Project landscape in the Polkadot ecosystem

Polkadot has emerged as a significant player in the blockchain ecosystem and is currently expanding into areas such as gaming, DePIN, and AI.

[Mythical Games](#), a well-known name in blockchain gaming, has recently moved from Ethereum to Polkadot.

While established, Ethereum often faces challenges such as network congestion and high gas fees, which can hinder user experience in gaming applications. The founder and CEO of Mythical Games [claimed](#) that even with the existing Ethereum L2 infrastructure, transactions were too slow for Mythical Games' expansion plans.

Mythical Games, regularly [ranked among the top performers](#) in digital asset sales, [processed over 3 million transactions](#) with no issues on its first day on Polkadot. This transition underlines Polkadot's capability to support high-transaction environments more effectively than Ethereum and, arguably, other chains. It positions it as a viable alternative for gaming developers looking for scalable solutions.

The DePIN sector is another area where Polkadot is making strides with the launch of [Peaq](#). DePIN platforms like Peaq enable the decentralized management of physical infrastructure and leverage blockchains to coordinate machines, robots, and other devices. Currently, the [Peaq ecosystem comprises over 45 projects](#) and applications, with more than 850,000 connected devices. Furthermore, [Peaq recently secured \\$20 million](#) through a CoinList launch, the largest in the past two years, underscoring investor confidence in both Peaq and Polkadot's infrastructure.

In the AI sector, Polkadot is hosting projects such as [OriginTrail](#) and [NeuroWeb](#), which are focused on creating decentralized networks for data sharing and AI model management. OriginTrail is known for its decentralized knowledge graph and is currently expanding its capabilities by integrating AI through NeuroWeb. This combination aims to create a network where data and AI models can be exchanged securely and efficiently across different blockchain networks.

IV. Technical Overview:

How Does Polkadot Achieve a High Throughput and Reduced Latency?

The [Polkadot chain's current architecture](#) is designed around the concept of [parallelized chains](#). The Polkadot Chain (otherwise known as the Relay Chain) acts as the backbone of the network and provides the essential functions of security, final consensus and interoperability across all connected blockchains in the ecosystem. By handling the primary consensus and security mechanisms, the Polkadot Chain allows blockchains built on Polkadot to offload these complex processes and focus on their specific tasks.

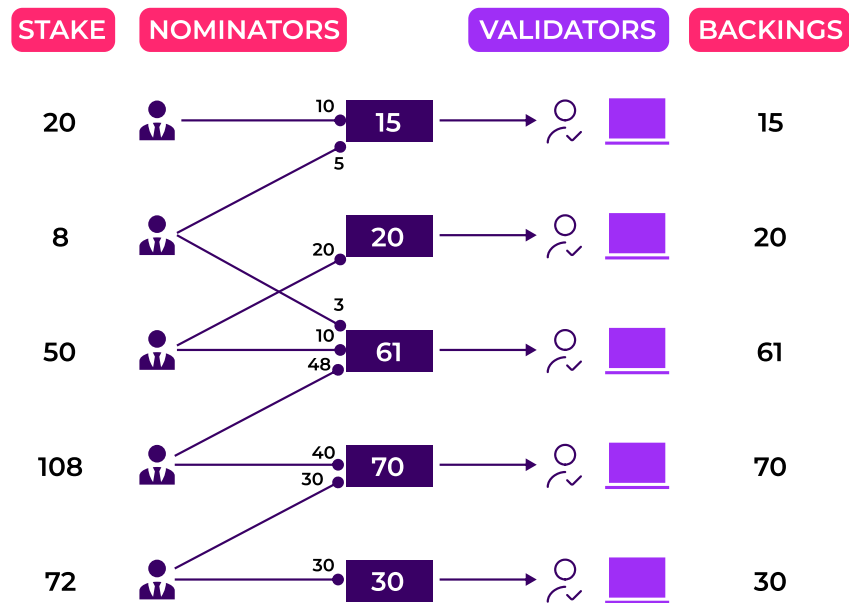
Unlike in homogeneously sharded chains, where each shard is identical, Polkadot's heterogeneous shards allow each blockchain to have its own unique logic, consensus mechanism, and state transition functions.

Polkadot's relay chain utilizes a [Nominated proof-of-stake \(NPoS\)](#) consensus algorithm, which is a variation of traditional [proof-of-stake \(PoS\)](#). DOT holders can either directly participate as validators who maintain the blockchain or as nominators who support validators by staking their tokens (Figure 7).

This makes NPoS similar to delegated proof-of-stake (DPoS), the difference being that in NPoS, both validators and nominators must lock up their tokens.

Also, if validators engage in misconduct or fail to perform their duties, both [the validators and their respective nominators](#) risk having a portion of their staked tokens slashed. Nominators must, therefore, carefully select validators based on factors such as their reputation, reliability, and past performance. Both the security of the network and the nominators' own staked tokens depend on this choice. Validators and nominators earn rewards for their contributions to the network's security and operation in the form of [annually issued DOT tokens](#).

Figure 7: NPoS Consensus Mechanism



Source: [5ire](#)

Validators take turns to produce new blocks in a rotating fashion. The proposed block is then validated by the rest of the active validator set before being finalized and added to the blockchain.

V. Polkadot 2.0 and How it Can Further Enhance the Ecosystem

Polkadot 2.0, named and defined through [community governance](#), is aimed at significantly enhancing the network’s performance, scalability, and efficiency through three key upgrades, namely Asynchronous Backing, Elastic Scaling, and Agile Coretime. These innovations will address the network’s current challenges and limitations to prepare Polkadot for greater adoption and diverse use cases. Moreover, Polkadot 2.0 also paves the way for the Joint Accumulate Machine (JAM), a bold vision for Polkadot that Polkadot Founder and Ethereum Co-Founder Gavin Wood unveiled at Token 2049 Dubai in April 2024.

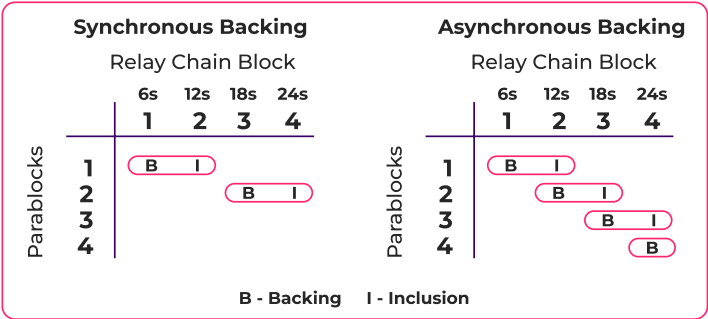
[Asynchronous backing](#) alters how projects built on Polkadot interact with the Polkadot chain, otherwise known as the Relay chain. In Polkadot’s current architecture, chains in the ecosystem propose blocks in fixed time slots that are synchronized with the Polkadot chain.

This limits the network’s overall throughput. Asynchronous backing allows Polkadot blockchains to propose blocks independently of each other and in a staggered fashion (Figure 8).

This decouples the block production schedule of chains in the ecosystem from the Polkadot chain’s cycle and increases the number of sidechain blocks that can be processed in parallel.

It also reduces block latency and time to finality. The table below shows asynchronous backing compared to the synchronous backing Polkadot used in its previous state. The rows represent parablocks (blocks produced by projects built on Polkadot), whereas the columns represent Polkadot chain blocks. ‘B’ stands for backing, which is the stage at which validators have reached a consensus on a Polkadot chain block, whereas ‘I’ represents the inclusion of the block on the Polkadot chain.

Figure 8: Asynchronous Backing Mechanism



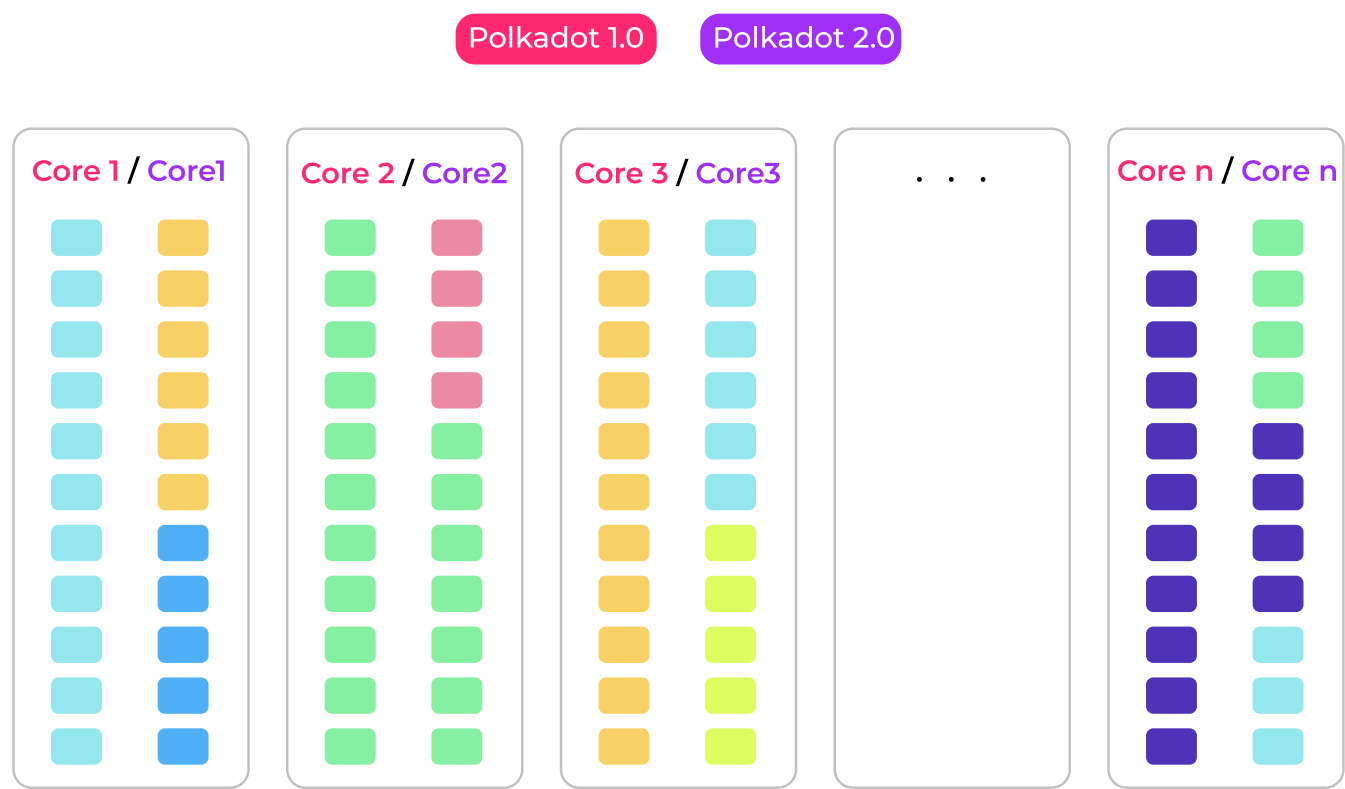
Source: [Polkadot Wiki](#)

Agile Coretime

The [Agile Coretime model](#) allows Polkadot to allocate computational resources to blockchains dynamically. This is a significant change to Polkadot's legacy architecture, where blockchains are locked to a single core. With Agile Coretime, each processor core can now compute for multiple blockchains simultaneously (Figure 9). If a particular blockchain experiences a surge in transaction volume, the Polkadot coretime chain can now allocate more block space and processing power to that chain to ensure smooth operation without bottlenecks. Agile Coretime launched on Sept. 19, 2024.

Agile Coretime also introduces tokenized coretime as a tradable NFT asset. This facilitates the efficient allocation of computational power by making it a liquid, freely traded commodity on the network. Secondary markets facilitate the trading of this coretime, even down to as granular as a single block. This, in turn, creates new economic opportunities for regular users and builders to profit from coretime provision. Excess coretime can be purchased in bulk within the 28-day period from the original purchase date.

Figure 9: Polkadot 1.0 Core Usage Vs. Polkadot 2.0 Agile Coretime Usage



Source: [Polkadot Insider](#)

Elastic Scaling

[Elastic Scaling](#) is another major component of Polkadot 2.0, aimed at dynamically adjusting the network's resources to meet demand. In its current state, the number of chains that Polkadot can support is relatively fixed. Elastic Scaling introduces the ability to dynamically allocate more validators and computational resources as needed. It thus allows Polkadot to support a larger number of chains without compromising security or performance.

This feature works by allowing Polkadot to temporarily increase its validator set in response to higher demand for sidechain slots or increased network activity. As demand decreases, the network can scale back down and optimize resource usage. Elastic Scaling ensures that Polkadot remains efficient and cost-effective, even as the ecosystem grows and the number of applications and chains on Polkadot expands.

Polkadot's Transactionless Operation Vision: Join Accumulate Machine (JAM)

Looking further into the future, [the Join Accumulate Machine \(JAM\)](#) redefines the Polkadot Chain in a way that will enable the deployment of many kinds of applications, including rollups. This upgrade will optimize the way sidechain [transactions are processed and finalized](#). JAM will operate by [accumulating transactions](#) over a set period rather than processing them individually as they arrive.

This mechanism will allow Polkadot to gather and batch transactions efficiently and reduce the overhead associated with continuous, individual transaction execution.

When a chain on Polkadot submits transactions, JAM collects these transactions and waits until a sufficient batch has accumulated. Once the batch reaches an optimal size, the machine processes them collectively and joins them into a single block or a series of blocks for finalization. It is especially effective for side chains with sporadic or unpredictable transaction patterns.

It prevents wasting resources during low-activity periods while simultaneously ensuring timely processing during high-demand phases. The Web3Foundation recently announced the [JAM implementer's prize](#) with a 10 million DOT prize pool, which aims to invite and cultivate development in the JAM protocol. Find out more information about JAM in the [Gray Paper](#).

VI. Conclusion

Polkadot has established itself as a highly adaptable and scalable blockchain platform that addresses many limitations of traditional L0s. With its unique architecture, the network has achieved significant milestones in decentralization, interoperability, and scalability. Polkadot has also evolved a strong focus on community-driven governance, as evidenced by the active participation in the OpenGov system and the dynamic management of the DOT token's inflationary model.

Polkadot's appeal to developers consists of a balance between speed, cost-efficiency, and security, as well as the ease and flexibility of the overall developer environment. These features make Polkadot an attractive option for projects in gaming, DePIN, and AI, where these attributes are particularly important.

Polkadot has thus become one of the networks with the highest developer activity. The platform's potential to scale efficiently and support a wide range of applications positions it to play a significant role in the next phase of the crypto market cycle.

In the immediate future, Polkadot is poised for further growth with the introduction of Polkadot 2.0, which brings several critical upgrades aimed at enhancing network performance and scalability. The upgrades, two of which are live (asynchronous backing and Agile Coretime) and one of which is slated for this coming winter (Elastic Scaling), are designed to address current limitations and prepare the network for a broader range of use cases.

These enhancements will allow it to support a larger number of blockchains and accommodate greater transaction volumes to increase its utility and appeal to developers and enterprises.

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