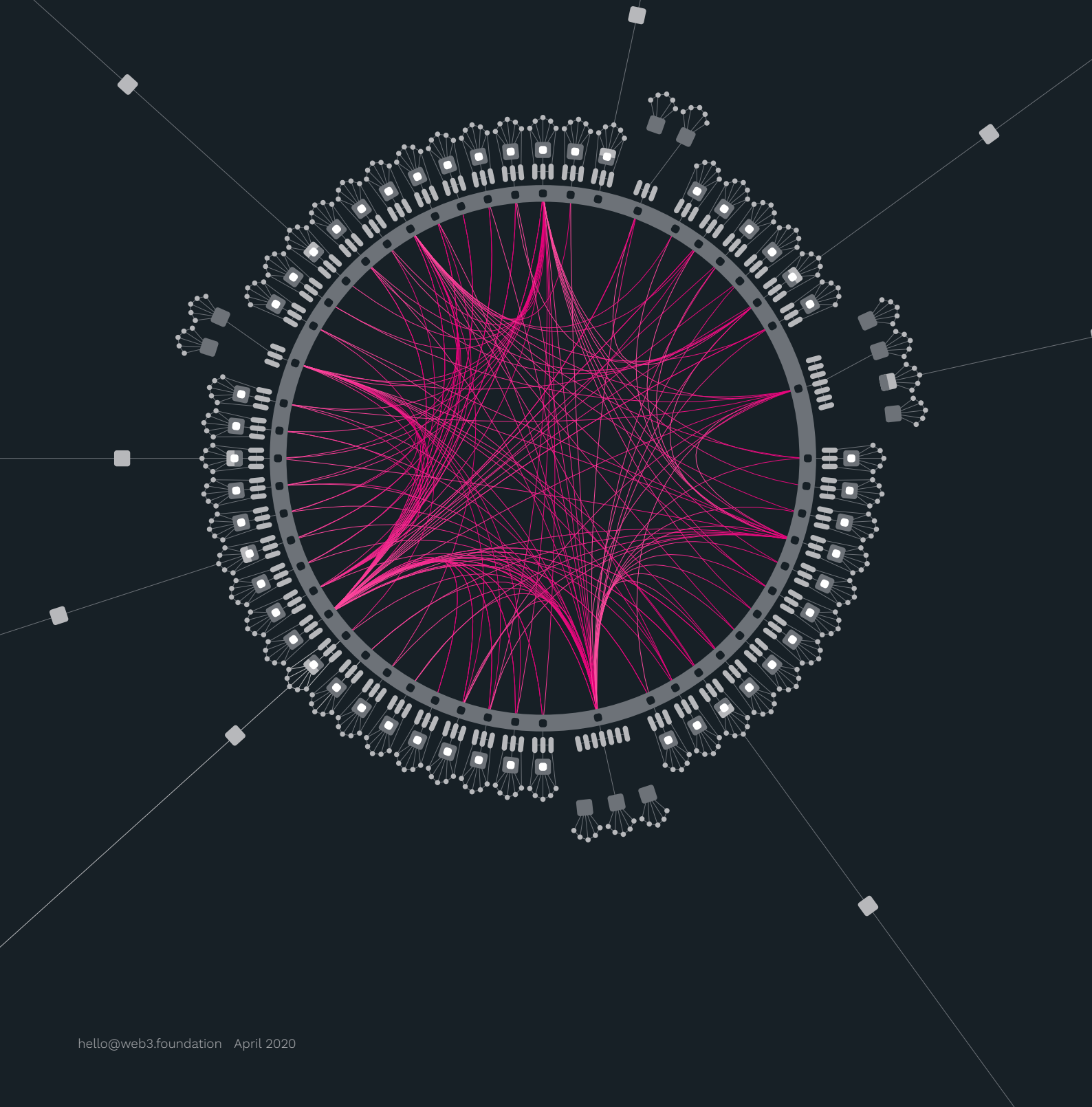
Polkadot. Lightpaper

# An Introduction to Polkadot



hello@web3.foundation April 2020

**“Polkadot empowers the individual against much more powerful corporate and state actors.”**

-Dr. Gavin Wood,
Polkadot Founder

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# LESS TRUST MORE TRUTH

Every day we interact with technologies controlled by a handful of large companies whose interests and incentives often conflict with our own.

If we want the benefits of using their proprietary apps, we're forced to agree to terms that most of us will never read, granting these companies complete control over the data we generate through each interaction with their tools.

Because that data can often paint a detailed picture of our personal lives, it's become a **resource more valuable than oil**. And we're giving it up for free—with no choice but to trust that it won't be lost, stolen or misused.

At the same time, progress in open-source and decentralized technologies like blockchain has shown that we can build systems that prioritize individual sovereignty over centralized control. With these new systems, there's no need to trust any third parties not to be evil.

But blockchain technology, in its current form, isn't ready to break the corporate stranglehold on the web just yet. Despite the promise and the progress made, we have yet to see significant real-world deployment of the technology.

**Polkadot is a next-generation blockchain protocol that unites an entire network of purpose-built blockchains, allowing them to operate seamlessly together at scale.** Because Polkadot allows any type of data to be sent between any type of blockchain, it unlocks a wide range of real-world use cases.

By bringing together the best features from multiple specialized blockchains, Polkadot paves the way for new decentralized marketplaces to emerge, offering fairer ways to access services through a variety of apps and providers.

While blockchains have demonstrated great promise in several fields—Internet of Things (IoT), finance, governance, identity management, web decentralization, and asset-tracking to name a few—design limitations in previous systems have largely hindered large-scale adoption.

Polkadot's design offers several distinct advantages over existing and legacy networks, including *heterogeneous sharding, scalability, upgradeability, transparent governance and cross-chain composability.*

# THIS IS BLOCKCHAIN UNBOUNDED.

# Many chains, one network

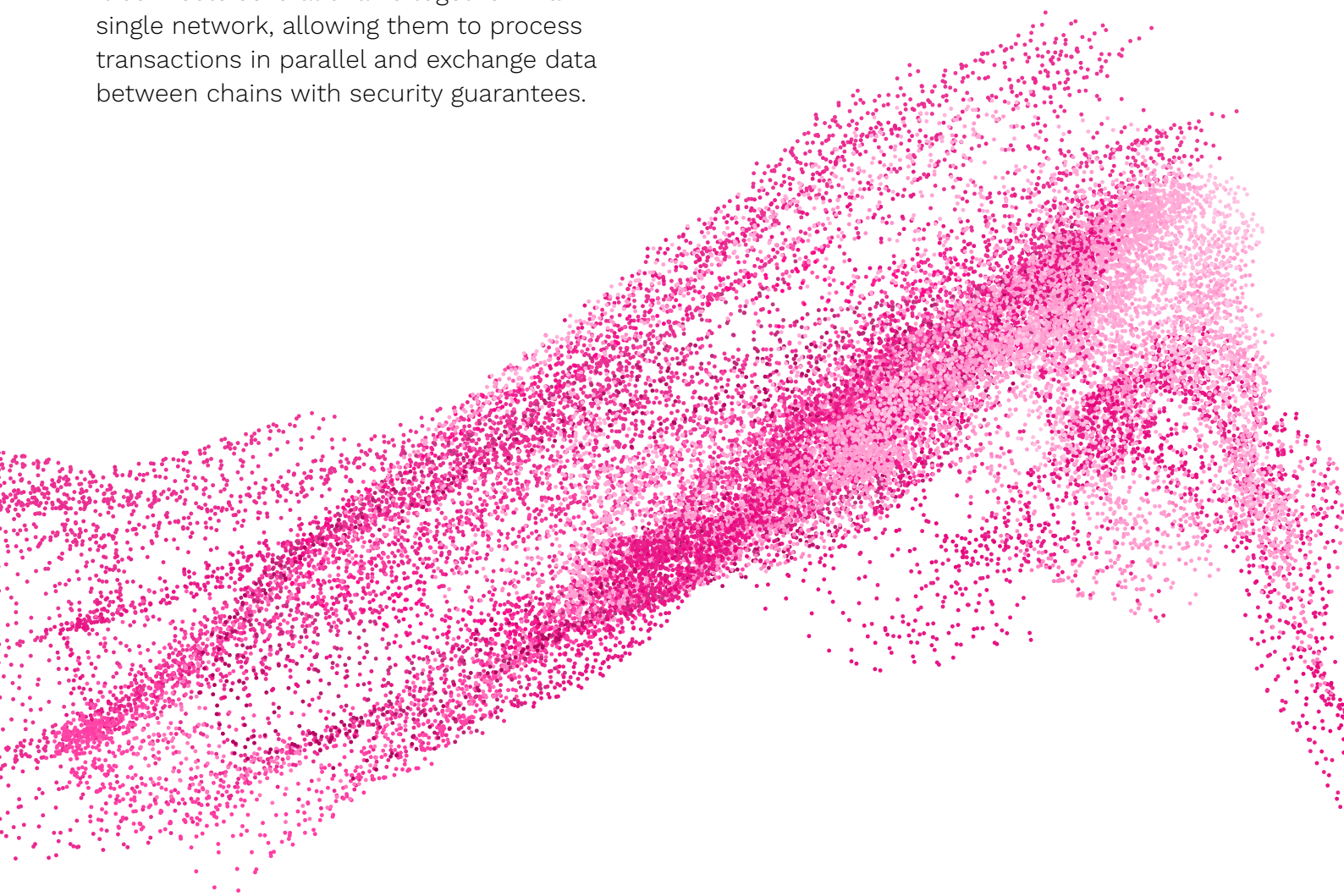
**Will there eventually be one blockchain to rule them all? We don't think so.**

All blockchains make different tradeoffs to support specific features and use cases, and as chain specialization increases, the need to transact between them will only increase over time.

Polkadot is a sharded blockchain, meaning it connects several chains together in a single network, allowing them to process transactions in parallel and exchange data between chains with security guarantees.

Thanks to Polkadot's unique heterogeneous sharding model, each chain in the network can be optimized for a specific use case rather than being forced to adapt to a one-size-fits-all model.

More chains and more specialization means more possibilities for innovation.

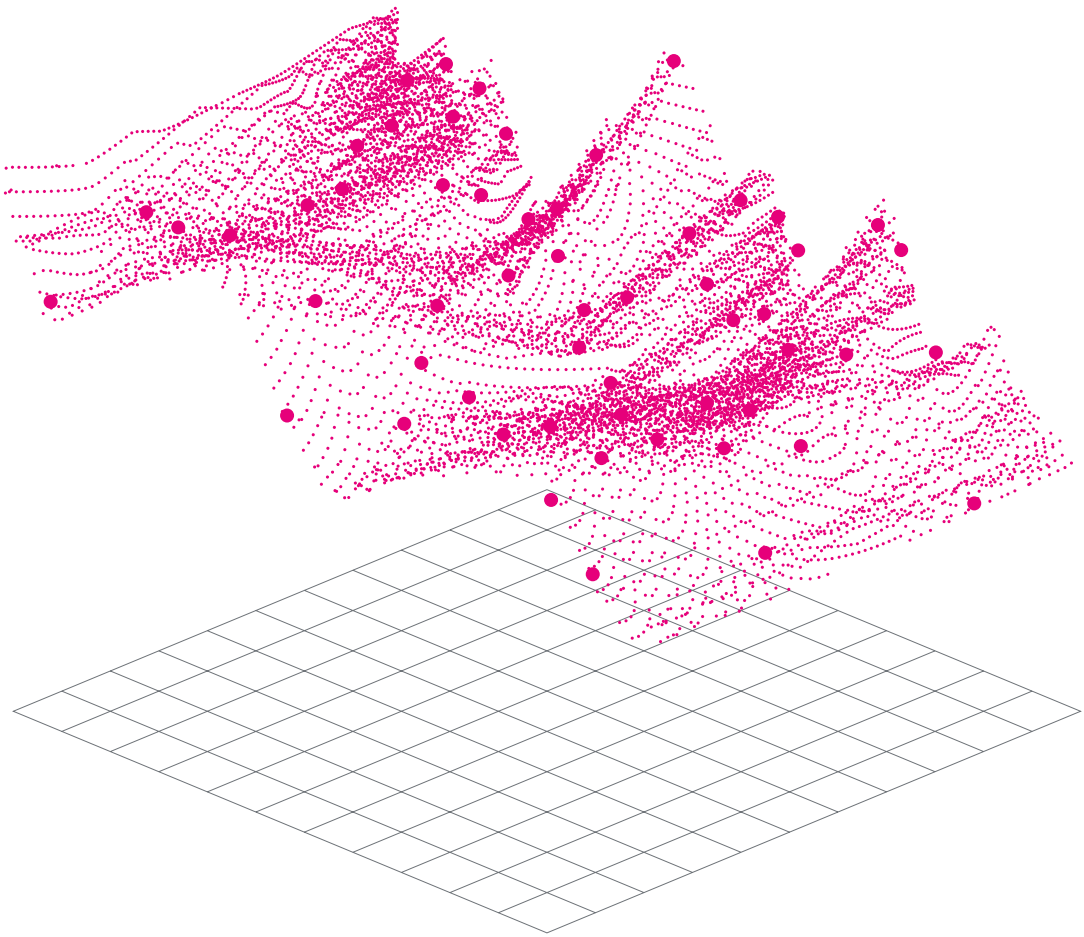


# Blockchains that grow

One blockchain isn't enough to support a bustling future of decentralized applications. The limited throughput and lack of runtime specialization in early blockchains made them impractical for scaling in many real-world use cases.

By bridging multiple specialized chains together into one sharded network, Polkadot allows for multiple transactions to be processed in parallel. This system removes the bottlenecks that occurred on earlier networks that processed transactions one-by-one.

Polkadot will be able to scale even further in the future with a planned feature known as *nested relay chains*, which will increase the number of shards that can be added to the network.



# Future-proof your blockchain with forkless upgrades

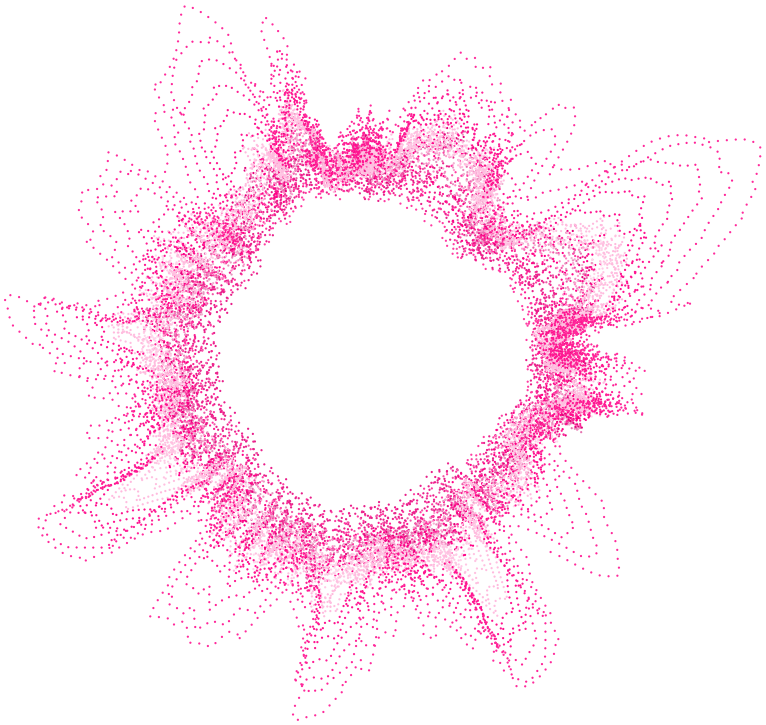
Early computer games were shipped on printed circuit boards known as cartridges. These cartridges were expensive and time-consuming to make as the code was etched onto the chips, leaving no room for error.

These days we're used to our apps, games and browsers updating frequently, even automatically. Developers fix bugs before they can cause problems, and new features are added as better solutions become available.

Like all software, blockchains need upgrades in order to stay relevant. However, it's far more difficult to upgrade a blockchain than an app, game, or browser. Upgrading conventional blockchains requires forking the network, often taking months of work, and particularly contentious hard forks can break apart a community.

Polkadot revolutionizes this process, enabling blockchains to upgrade themselves without the need to fork the chain. These forkless upgrades are enacted through Polkadot's transparent on-chain governance system.

With this feature, Polkadot enables projects to stay agile, adapting and evolving with the pace of technology. It also significantly reduces the risk associated with contentious hard forks—a severe barrier to entry for many organizations.



# Community powered

Early blockchains had no formal governance procedures. Individual stakeholders were powerless to propose or veto protocol changes unless they knew the right people.

Polkadot is different. It's governed by anyone who owns DOTs, Polkadot's native currency, in a fair and transparent way.

All DOT holders are able to propose a change to the protocol or vote on existing proposals. They can also help elect council members who represent passive stakeholders within Polkadot's governance system.

Cross-Chain Composability

# Collaborative by design

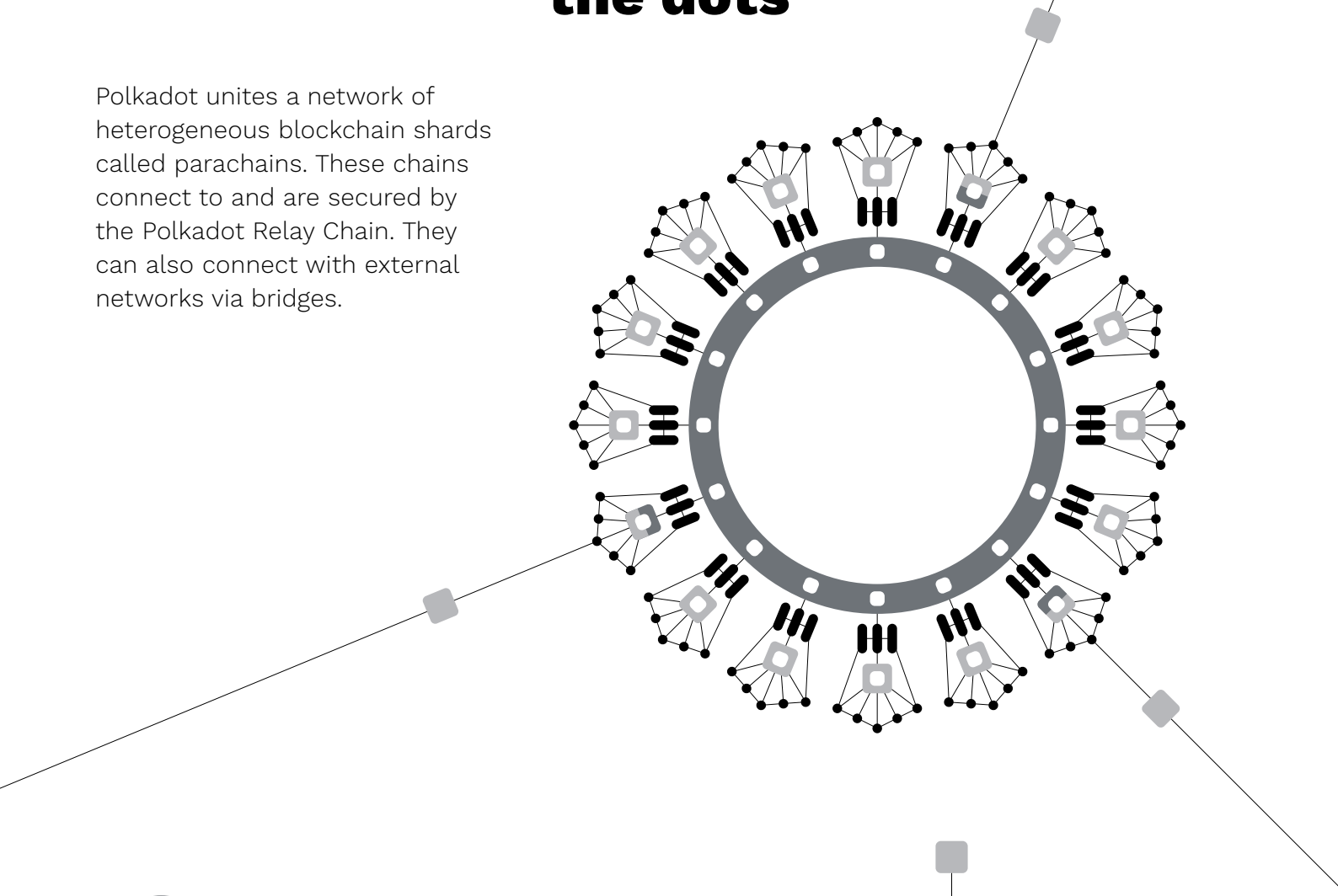
Early blockchains were like walled gardens closed off to other networks. But as the number of chains for specific use cases continues to rise, so does the need for cross-chain communication and interoperability.

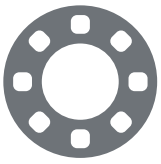
Polkadot's cross-chain composability and message passing allows shards to communicate, exchange value, and share functionality, opening the door to a new wave of innovation.

Thanks to Polkadot's ability to bridge blockchains, Polkadot shards will also be able to interact with popular decentralized-finance protocols and cryptoassets on external networks like Ethereum.

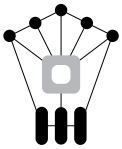
# Connecting the dots

Polkadot unites a network of heterogeneous blockchain shards called parachains. These chains connect to and are secured by the Polkadot Relay Chain. They can also connect with external networks via bridges.

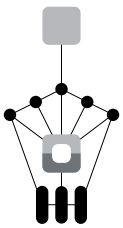




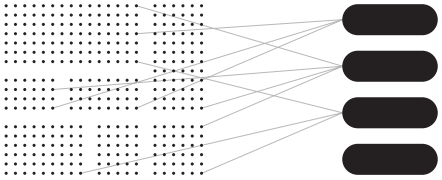
**Relay Chain**
The heart of Polkadot, responsible for the network's security, consensus and cross-chain interoperability.

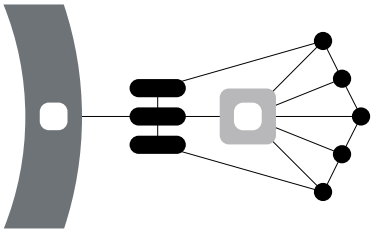


**Parachains**
Sovereign blockchains that can have their own tokens and optimize their functionality for specific use cases. To connect to the Relay Chain, parachains can pay as they go or lease a slot for continuous connectivity.



**Bridges**
Special blockchains that allow Polkadot shards to connect to and communicate with external networks like Ethereum and Bitcoin.





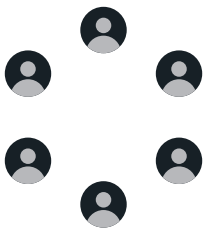
**Validators**
Secure the Relay Chain by staking DOTs, validating proofs from collators and participating in consensus with other validators.

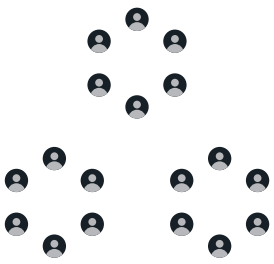
**Nominators**
Secure the Relay Chain by selecting trustworthy validators and staking DOTs.

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

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

## Polkadot Governance Roles



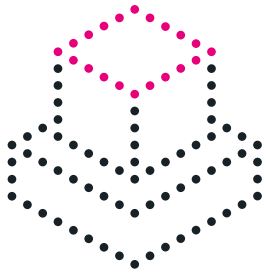


**Council Members**
Elected to represent passive stakeholders in two primary governance roles: proposing referenda and vetoing dangerous or malicious referenda.

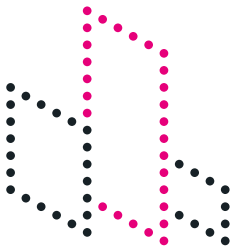
**Technical Committee**
Composed of teams actively building Polkadot. Can propose emergency referenda, together with the council, for fast-tracked voting and implementation.

# The DOT Token

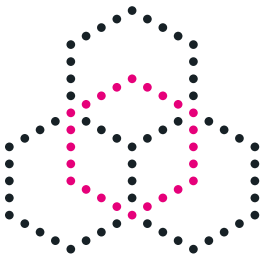
The DOT token serves three distinct purposes: governance over the network, staking and bonding.



**Governance**
Polkadot token holders have complete control over the protocol. All privileges, which on other platforms are exclusive to miners, will be given to the Relay Chain participants (DOT holders), including managing exceptional events such as protocol upgrades and fixes.



**Staking**
Game theory incentivizes token holders to behave in honest ways. Good actors are rewarded by this mechanism whilst bad actors will lose their stake in the network. This ensures the network stays secure.



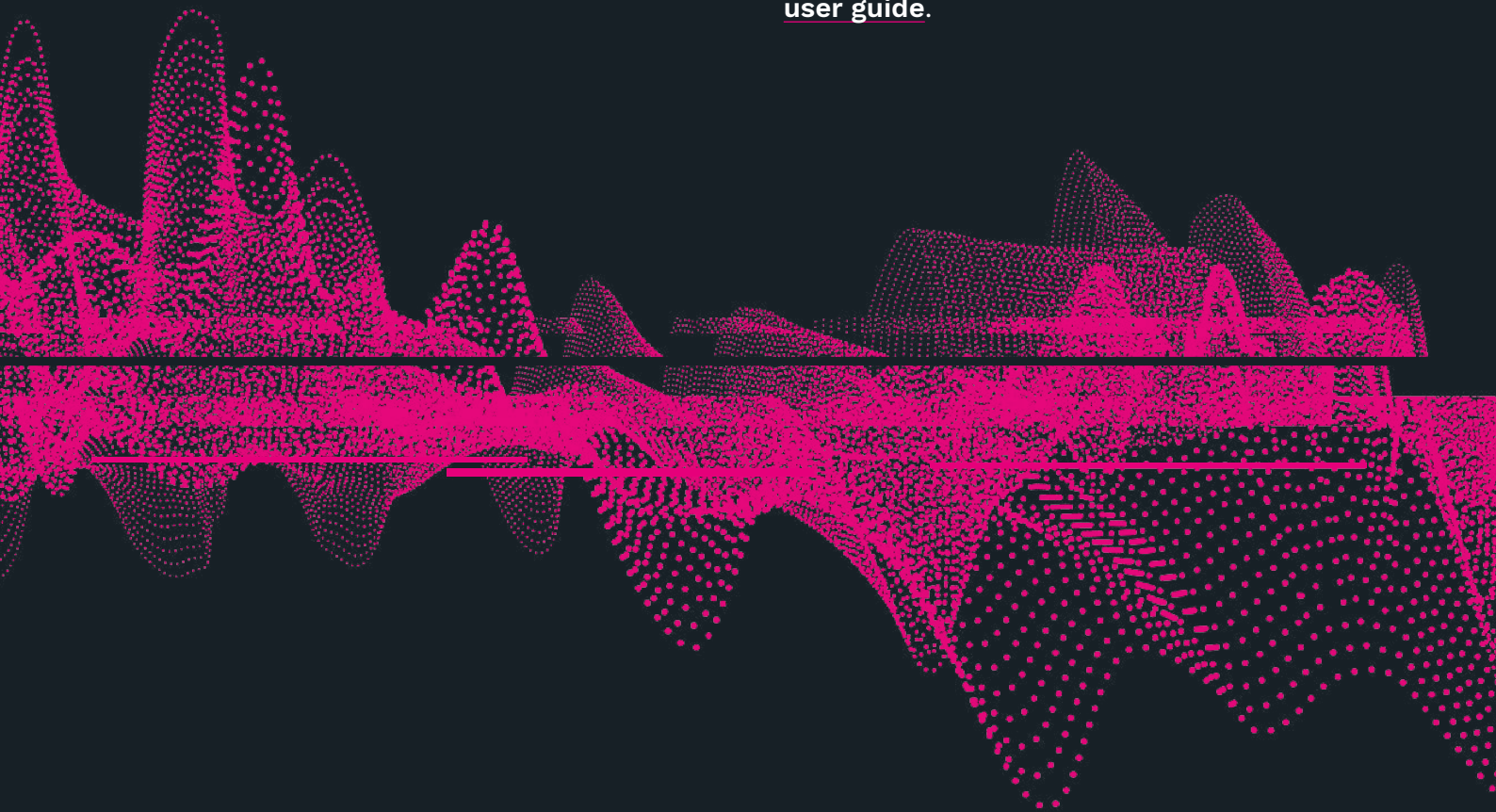
**Bonding**
New parachains are added by bonding tokens. Outdated or non-useful parachains are removed by removing bonded tokens. This is a form of proof of stake.

# Play with chaos on Kusama, Polkadot's wild cousin

Kusama is an early, unaudited and unrefined release of Polkadot created to test the network's technology and economic incentives in a real-world environment. It's also the perfect place for parachain developers to test ideas before deploying to Polkadot.

Kusama is owned and governed by a community of supporters who hold KSM tokens. There is no central kill switch, meaning it will live on as an independent community network.

Ready to break stuff? Find out how to get KSM tokens and start staking, validating and participating in governance by reading the **user guide**.



# Your blockchain builder, Your blockchain upgrader, Your blockchain.

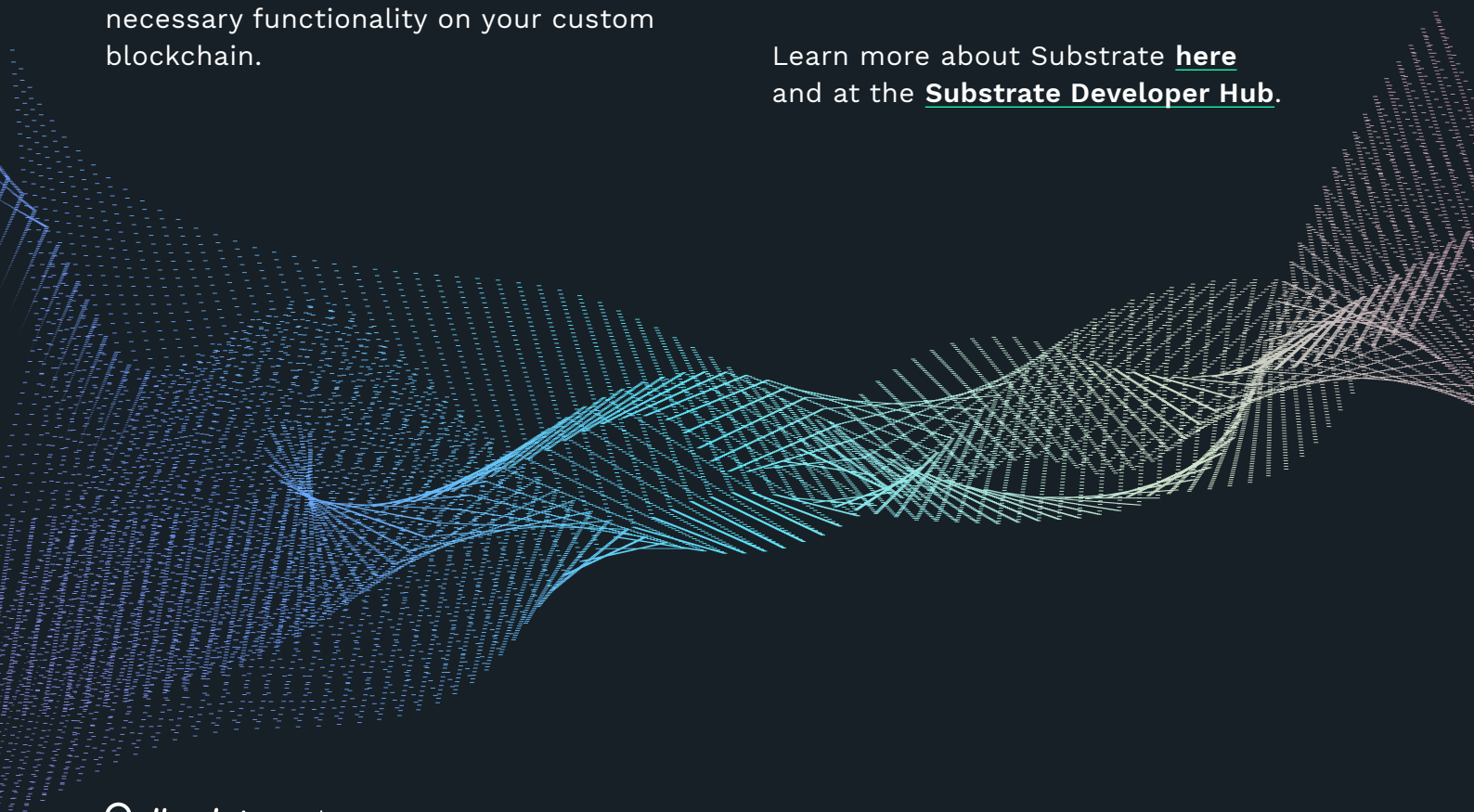
Substrate is your blockchain-building framework, making it easy to create a custom blockchain optimized for your unique use case.

Substrate is fully modular and flexible: mix and match ready-made components and build out your core business logic while leaving the rest to the framework. Plug-and-play modules like consensus, networking and finality give you the freedom to focus on your specific area of expertise, saving you substantial time and effort in the development process. Keep things lean by implementing only the necessary functionality on your custom blockchain.

Thanks to Substrate's forkless upgrades and transparent governance tools, you can add new features over time without fear of splitting the network. Easier, risk-free upgrading means your blockchain can grow and evolve with the pace of innovation and ever-changing market needs.

Substrate also comes with native support for connecting to Polkadot right out of the box. Cumulus, Substrate's tool for connecting your blockchain to a network of blockchains, unlocks interchain communication, collaboration and shared security.

Learn more about Substrate **here** and at the **Substrate Developer Hub**.



# Web3 Foundation

Web3 Foundation was created to nurture and steward technologies and applications in the fields of decentralized web software protocols, particularly those that utilize modern cryptographic methods to safeguard decentralization, to the benefit and for the stability of the Web3 ecosystem. Polkadot is the flagship protocol of Web3 Foundation.

## The future of the foundation

Web3 Foundation seeks to fund or otherwise assist in the development and deployment of projects aligned with its mission:

- Innovative blockchain technologies, cryptographic messaging protocols.
- Peer-to-peer networking infrastructure (such as libp2p and devp2p)
- Crypto-economic mechanisms (such as DAC/DAOsoftware)
- Data publication systems (such as IPFS).

Learn more at **web3.foundation** and on **Twitter** and **YouTube**.

# The development team

Web3 Foundation has commissioned Parity Technologies to build Polkadot.

Founded by Ethereum cofounder Dr. Gavin Wood and former Ethereum Foundation Head of Security Dr. Jutta Steiner, Parity is a global team of top distributed systems engineers, cryptographers, solutions architects and researchers. Parity has fundamentally shaped the blockchain industry, from building the highly-adopted Parity Ethereum client and implementations of Bitcoin and Zcash, to developing the next generation of blockchain technology with Substrate and Polkadot.

Learn more about Parity Technologies at **parity.io** and follow the team on **Twitter**, **Telegram**, **YouTube**, and **Riot**.

# Friends of Polkadot & Substrate

Polkadot is designed to work with public, private and enterprise chains. We are excited to work closely with the following partners to develop the first use cases, and look forward to collaborating with other blockchain projects seeking to adopt this technology:













# Dive deeper, stay connected and get building!

Learn more on the Polkadot → **Website** and → **Wiki**

Subscribe to the Polkadot → **Newsletter**

Get involved by → **joining** the → **Polkadot Ambassador Program**

→ **Join** or → **host** a Polkadot meetup in your area

Chat with the Polkadot team on → **Riot**

Additional resources can be found → **here**

Follow Polkadot on: