waves
ENTERPRISE

WHITE PAPER

Enterprise-grade hybrid blockchain platform

CRYP2NOVA

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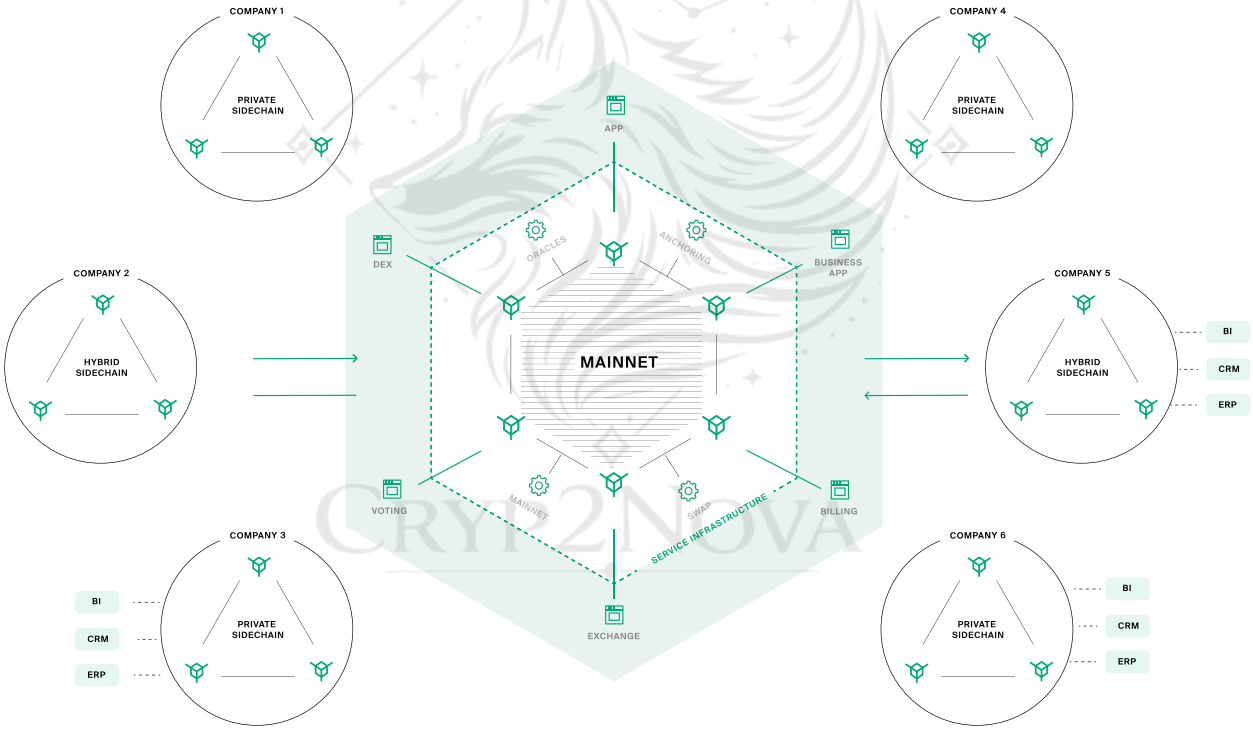
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Introduction

Waves Enterprise is a technology company formed to develop a hybrid enterprise blockchain platform that unites public and private network approaches. Our technologies enable companies to create practical blockchain solutions and integrate them into existing IT infrastructures, offering a reliable alternative to resource-heavy corporate blockchain frameworks.

The platform facilitates data privacy, ease of deployment, management and integration with external IT solutions, as well as high availability and transaction throughput. Containerized smart contracts executed in a Docker container allow users to run complex business logic written in any programming language. Large-scale projects based on Waves Enterprise technologies are implemented through our certified integration partners.



The Waves Enterprise Mainnet is a public LPoS network that guarantees the security of all transactions on the platform and operates as a global arbiter and reference network for custom sidechains. It unites companies, service providers and decentralized applications in a single trustless and secure contour, facilitating the use of public blockchains' advantages for resolving various business tasks.

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Sidechains facilitate the creation of blockchain infrastructures that are independent from Mainnet. They can be customized based on corporate goals, local encryption standards and regulators' requirements. The technology can be used for the creation of private and public infrastructures with a limited number of participants, or hybrid schemes in which data is securely stored on Mainnet as hash sums.

Waves Enterprise System Token (WEST) serves as a token of payment for all Mainnet operations, as well as a means of value transfer.

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Waves Enterprise Mainnet

Waves Enterprise technology is based on a modular approach, which makes integration into existing IT infrastructures easy and relatively fast. The Waves Enterprise blockchain is a fractal network consisting of Mainnet, which supports network operation in general and serves as a global arbiter and reference network, and a number of custom, independent sidechains that can be provisioned and adjusted to implement a specific business task, comply with local encryption standards and meet legislative requirements. In addition, some sidechains can be optimized for higher speeds or higher computation volumes, and connected to other sidechains or Mainnet to form a hybrid infrastructure.

Principles of operation

The Waves Enterprise Mainnet is supported by a decentralized network of miners or nodes – a geographically distributed network of computers with Waves Enterprise software installed. Each node in the network participates in processing data and storing it in blocks. The absence of a central authority to influence decision-making in the network makes the system sustainable and independent, but creates problems with final decision-making and work organization. These problems are addressed via a consensus algorithm, which provides a way to reach agreement between a group of participants. Voting outcomes are implemented in favor of the majority, and although the minority's interests are not observed, the scheme guarantees an agreement that will be beneficial for the entire network.

The Waves Enterprise Mainnet uses the Leased-Proof-of-Stake (LPoS) consensus algorithm. In LPoS-based systems, block generation does not require energy-intensive computations, and the miner's chief task is the creation of a block's digital signature. The mechanism for distributing rights for digitally signing blocks is based on the number of WEST tokens held by a node. The more tokens in a node's balance, the higher the probability that it will be able to create a block.

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Connection to the network

The Waves Enterprise Mainnet is a public permissioned network, to which miners can only connect with permission from the network operator. In addition, a minimum requirement for the number of WEST tokens held in a node's balance is in place (this is discussed in more detail in the section on licensing models). This approach enables the management of the network's participants in the interests of its users.

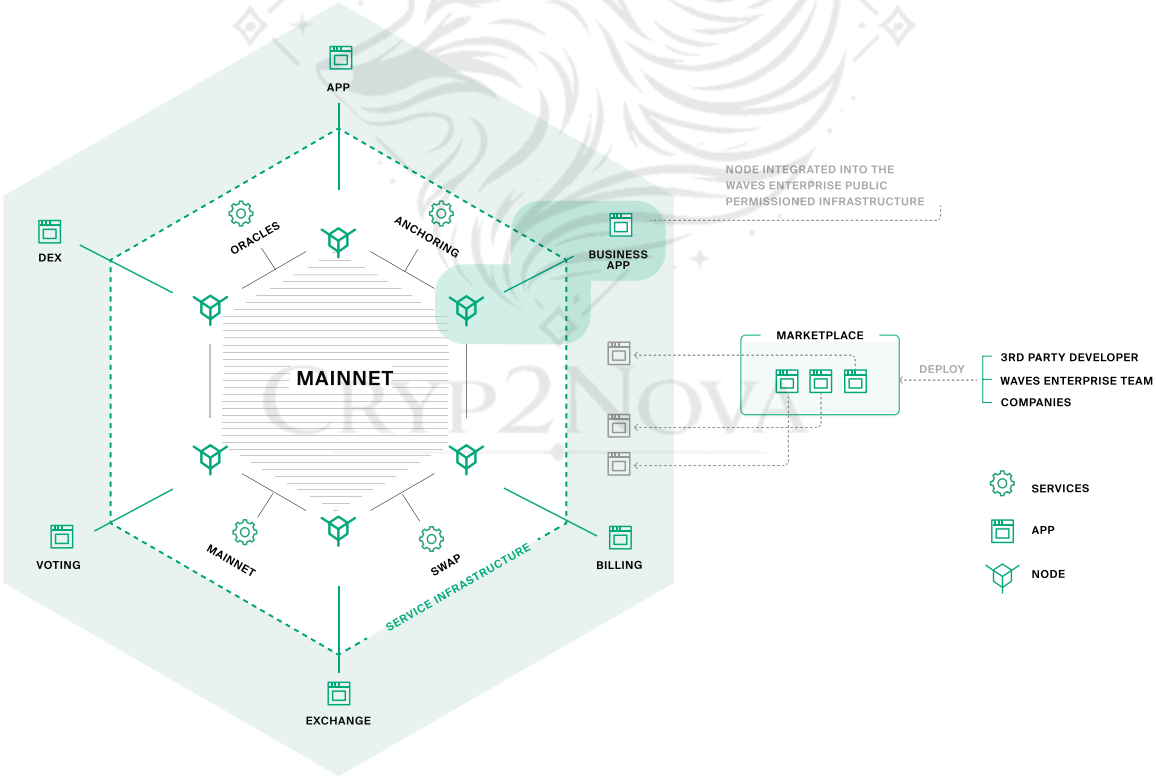
The Waves Enterprise platform offers several options for using the blockchain infrastructure, each of which has its own specific features and advantages.

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Integration with the Waves Enterprise infrastructure

The advantages of integration with the Waves Enterprise blockchain platform's public decentralized infrastructure include:

- **Established infrastructure**. No time or financial expenditures for deployment and maintenance of a blockchain and IT infrastructure; fast start for projects
- **Trustless environment**. Total transparency of transactions and the possibility of a public data audit
- **Control over data**. Participants of a public network can either make their data public or restrict access to it
- **Community**. An active, growing community of ecosystem users simplifies market launch of decentralized applications and other services



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Creating an independent private sidechain

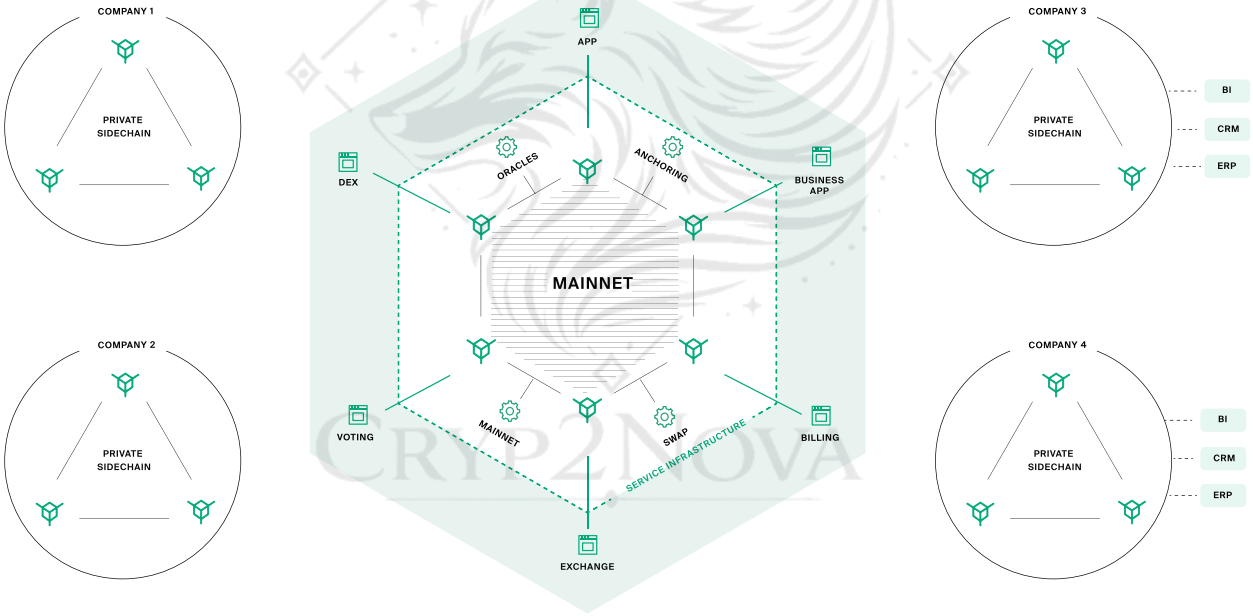
There are several advantages of using Waves Enterprise to create an independent blockchain infrastructure with a limited number of participants:

- **High performance**. The choice of configuration for equipment and operation parameters of the blockchain, including the consensus algorithm, simplifies solving tasks due to a substantial increase in the speed of data processing

- **Confidentiality**. Centralized control of user access, roles and permissions facilitates required confidentiality of processed data

- **Compliance**. Compliance with corporate and government requirements for processing confidential data on the blockchain

- **Compatibility.** Integration of a blockchain with corporate IT systems of any configuration



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Creating a hybrid infrastructure

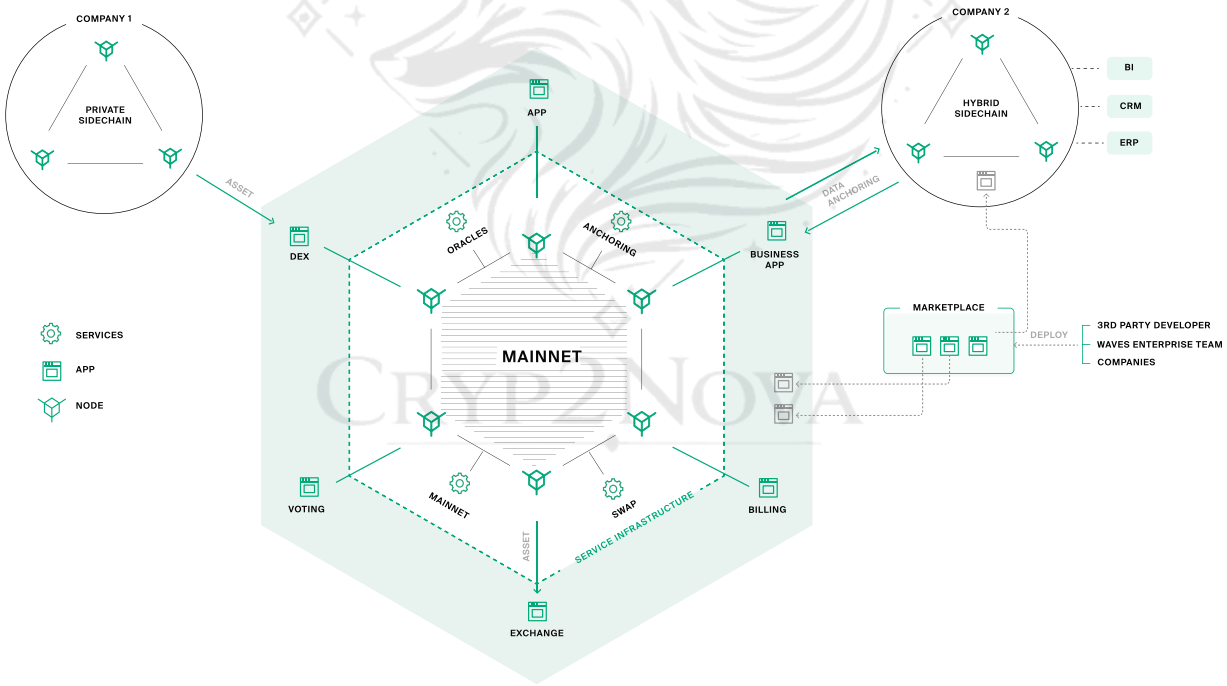
The advantages of creating a hybrid infrastructure based on the Waves Enterprise Mainnet and an independent sidechain include:

- **Independent infrastructure**. Highest performance, confidentiality, compliance and flexibility of blockchain infrastructure

- **Reference data storage**. Storing data hashes on the Waves Enterprise Mainnet facilitates the creation of an absolutely failure-proof infrastructure, with an extra secure contour for backup data storage

- **Intercorporate collaboration**. Secure data exchange between information systems of various companies and government agencies, without the need for protected communication channels or trust between participants

- **Broad opportunities**. Seamless access to Mainnet infrastructure services, enabling broader opportunities and the higher reliability of an independent network



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Services

Waves Enterprise operates as a service network for hybrid solutions. Its decentralized infrastructure enables transfer of various data from a private network to Mainnet and back. Data transfer may be required for the operation of apps or smart contracts in the networks of Waves Enterprise platform users. This functionality substantially broadens possible scenarios for use of the infrastructure by all interested parties, including outside developers and network participants, who can also provide services on the network.

Services provided by the Waves Enterprise network are an integral part of the platform's economics. Each invocation of a service requires payment of a fee in WEST tokens. The fee size depends on the specific case and service provider, but in most scenarios it will correspond to the typical transaction fee of 0.1 WEST.

Waves Enterprise Mainnet services can tentatively be divided into infrastructure services and marketplace apps.

Infrastructure services

Infrastructure services enrich private networks' technology component due to public network features such as decentralization across a large number of participants, which substantially increases the amount of resources needed for an attack, thereby improving network security. Infrastructure services include:

- **Anchoring**, or connecting two or more networks to improve their level of decentralization and, consequently, the security of data storage. From a technical viewpoint, anchoring is the transfer of transaction hashes from one network to another. Transferred data cannot be compromised, since only the hash sums are actually transferred. If hashes of private network data are written to a public blockchain with a more decentralized infrastructure, replacing the data in just one network would not be sufficient; this would have to be conducted across several networks. Some services offer anchoring to the Bitcoin blockchain as the most established network. However, since the original Bitcoin network's throughput is just seven transactions per second, transaction validation can take hours. Our solution features anchoring of private network data to the Waves Enterprise network, offering an incomparable advantage in transaction speeds.

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- **Atomic swaps**, a service for value exchange between networks. This enables transfer of tokenized assets from one private network to another, for exchange and other operations. This technology can only be used for transferring data from one company to another.

- **Data oracles**, a service for transferring data from external information systems to private networks through Mainnet. This service is vital because smart contract scripts are unable to directly obtain data from sources outside the blockchain infrastructure. The availability of data oracles with trustworthy and up-to-date information can significantly broaden the scope of use cases for smart contracts.

Application marketplace

The Waves Enterprise Mainnet envisages a marketplace for applications created by the Waves Enterprise team and outside developers. Apps can run a range of tasks, from providing data to enterprise sidechains for specific operations to launching SaaS services for users outside the Waves Enterprise ecosystem. Use cases for service apps are very diverse: obtaining information on intellectual property rights, authorization and certification centers, KYC services and even organization of online voting.

The marketplace is scheduled for launch in Q4 2020.

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Licensing models

Waves Enterprise technologies are for commercial use. They are primarily intended for large corporations and state agencies under software licensing schemes. Software available for licensing includes the following components:
– **WE Node** module
– **WE Data Service** module
– **WE Corporate Client** module
– **WE Authorization Service** module

To use the software and connect to the Waves Enterprise infrastructure, purchase or rental of a license is required.

Several types of licenses are available:

- **A trial license** allows a user to test the platform and technology
- **A commercial license** allows the use of the technology in private and hybrid networks for commercial projects
- **A non-commercial license** allows the use of the technology in private and hybrid networks for non-commercial projects
- **A special license** allows the use of technology only on Mainnet

! A valid trial, commercial or non-commercial license also allows use of the Waves Enterprise Mainnet.

Any newly-created private network will be able to operate in test mode without a license until reaching block height 30,000, which roughly corresponds to a two-week period. After that, a license must be purchased to continue operation.

Based on their validity periods, license types include:
– Indefinite
– Two-year
– One-year
– Three-month (trial license)
– Rental for the period of use of the technology

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Upon license expiration, the node for which the license was purchased will no longer be able to generate blocks or write new transactions to the network.

Licenses can also be purchased for WEST tokens.

Mainnet license

This type of license allows the owner to connect a node to the Waves Enterprise Mainnet and use the technology for creating projects of any type in a public permissioned network.

A license is issued by the network operator at the time of connecting a node to the network. An application for a license of this type should be directed to tech support. Mainnet licenses are valid indefinitely, so long as the node balance (including leased tokens) contains a minimum required amount of WEST. If the balance falls below this figure, the node will be disconnected from the network.

Tokens are not transferred to the network operator and remain in the possession of the owner, who can use them at their discretion once the node is disconnected from Mainnet.

Renting a license

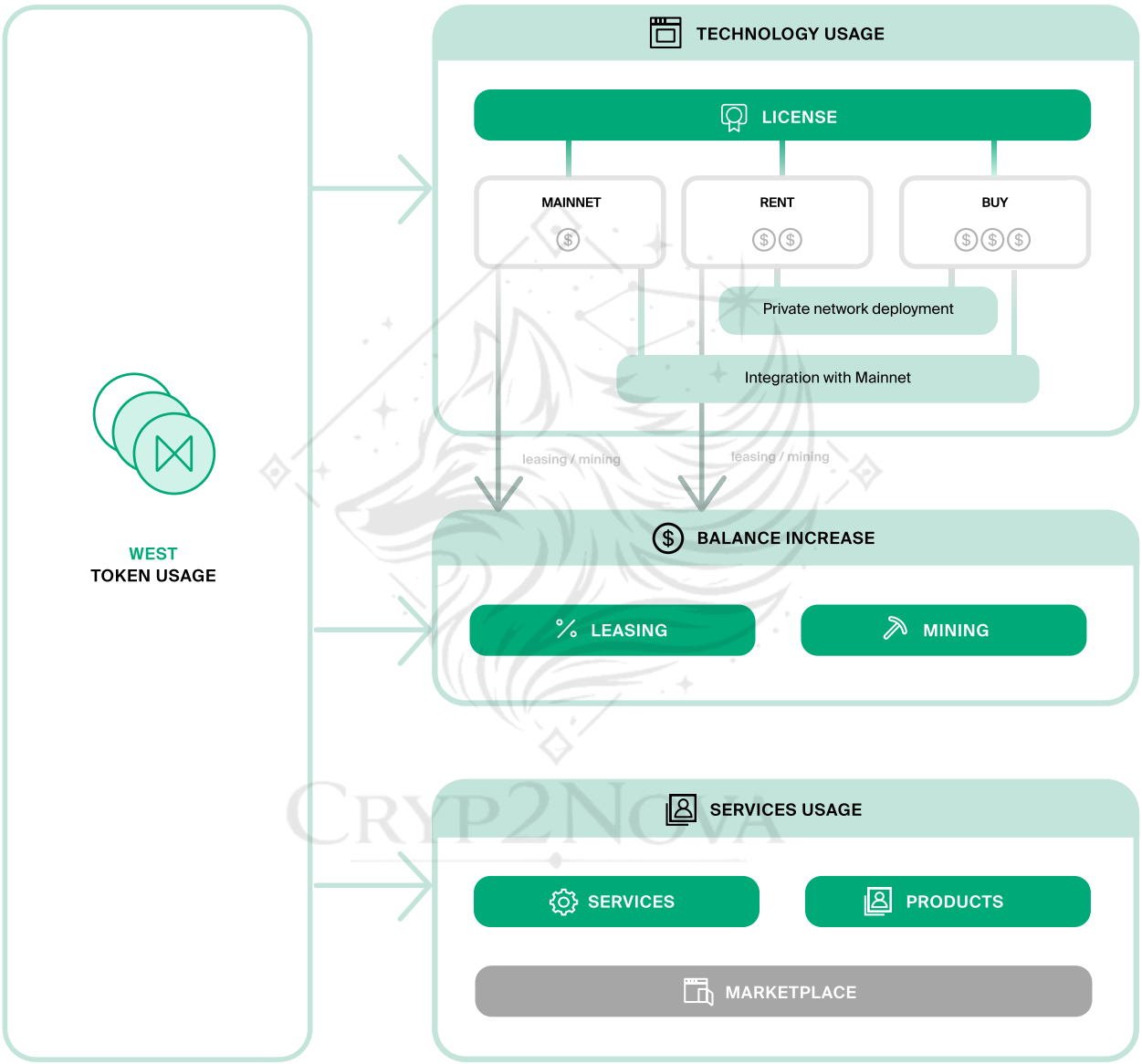
From version 1.3, Waves Enterprise will offer the opportunity to rent licenses. A rented license is considered commercial and allows the use of the platform in private and hybrid networks. To obtain a license, a user must send a request to the support service.

Tokens are not transferred to the network operator and remain in the possession of the owner, who can use them at their discretion once the node is disconnected from Mainnet.

The minimum token balance required for connecting a node to the Waves Enterprise Mainnet or renting a license may be revised based on the current exchange rate for WEST token.

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Waves Enterprise economics



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WEST token

The Waves Enterprise platform's economics are based on Waves Enterprise System Token (WEST), a utility token with a total supply of 400,000,000 WEST. The token is used in the process of reaching consensus on the platform's Mainnet, as an economic incentive for network participants and as a means of payment for transactions between network participants.

On each transaction on the platform's Mainnet, a fee in WEST tokens is charged. In addition, to connect to the Waves Enterprise Mainnet, companies interested in using the infrastructure must purchase a certain amount of tokens (based on the license type) and hold them over the entire period of network use. WEST are also used to pay for support and maintenance services provided by Waves Enterprise's system integrator. Demand for WEST tokens has therefore been active since the launch of the Waves Enterprise Mainnet. This model is attractive not only from a technological viewpoint, but it also accommodates marketing considerations.

The WEST token is required for the following transactions:
– Paying fees for transfer transactions, data storage and calling smart contracts on the network
– Paying service fees
– Purchasing and renting platform licenses
– Increasing token balance by leasing existing tokens

WEST tokens are available for purchase on crypto exchanges Waves.Exchange and TIDEX. In the future, the token is also expected to be listed on other exchanges.

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The token's role in the marketplace

The WEST token will be used as a means of payment for purchases made on the Waves Enterprise app marketplace. Free and paid apps will be available. In the case of free apps, specific actions within the app could require payment of a fee. The price and other payment conditions are set by the supplier of a specific app.

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Investment opportunities

The Waves Enterprise platform's economic model includes tools that allow users to generate extra WEST tokens under a leasing scheme.

A WEST owner can collect additional tokens by leasing out their existing tokens to a network operator's node (a so-called leasing pool), which participates in network maintenance. Based on the amount of leased tokens, the owner will collect a reward - a proportion of the network transaction fees the leasing pool receives.

A user's monthly balance increase (in WEST) from leasing WEST tokens can be calculated using the following formula:

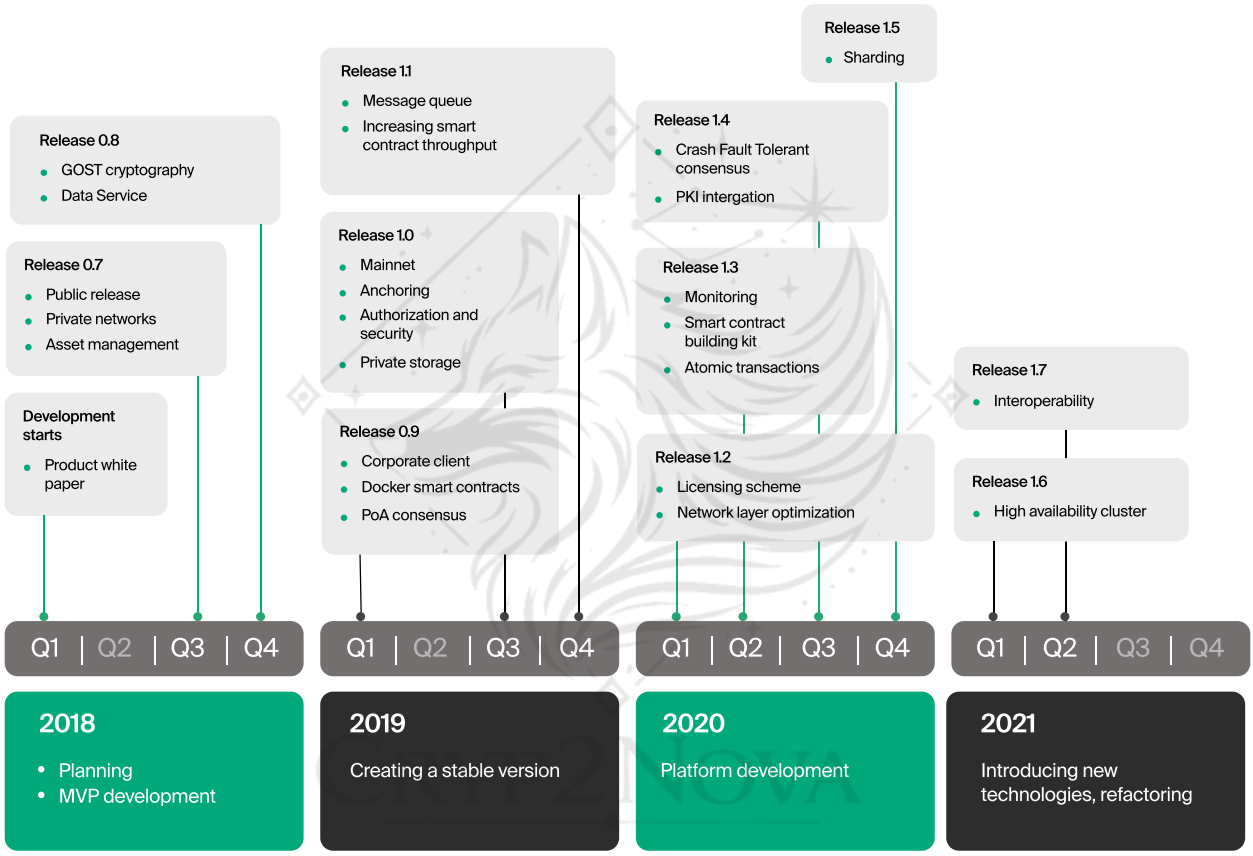
$$\text{Balance increase} = \frac{\text{Number of leased tokens}}{\text{Total generating balance}} * (\text{Number of transactions per month}) * (\text{WEST Price})$$

Launch of the leasing program is expected in early Q2 2020.

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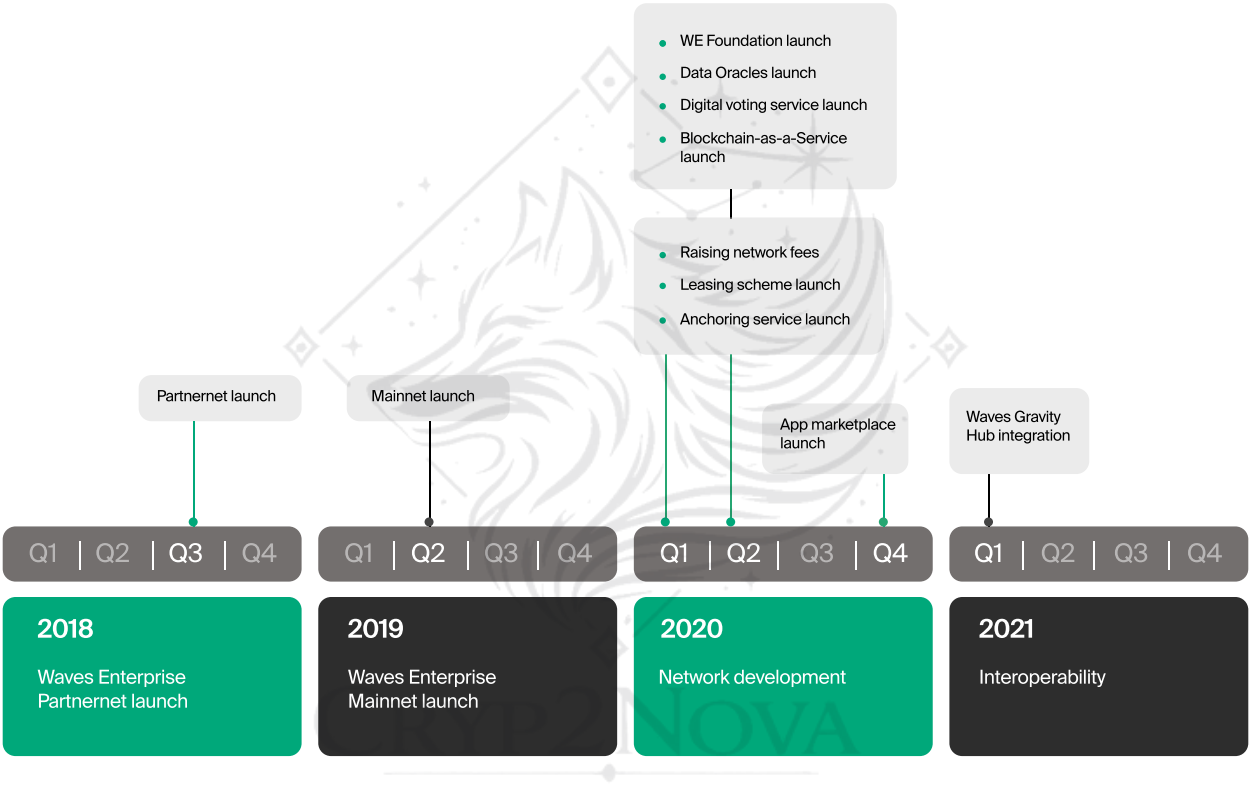
Roadmap for platform development



WAVES ENTERPRISE TECH ROADMAP

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Waves Enterprise Mainnet Roadmap



WAVES ENTERPRISE MAINNET ROADMAP

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Demand for blockchain solutions

Demand for blockchain-based solutions from the corporate and public sectors is high. The relatively slow process of adoption for such solutions is mainly explained by insufficient awareness and the technical issues that earlier technologies faced.

But the situation is changing. Companies such as Waves Enterprise are offering faster, more reliable and secure solutions. At the same time, more and more companies realize the advantages that distributed ledger technologies can bring them and have begun incorporating them in their business processes.

> 53% of enterprises say that blockchain technology has become a critical priority for their organizations in 2019 – a 10-point increase over last year.
>
> — *Deloitte's 2019 Global Blockchain Survey*

Major companies that have adopted or are experimenting with blockchain solutions include Samsung, FedEx, IBM, Carrefour, Royal Dutch Shell, Bank of America and Daimler.

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Conclusion

Blockchain technologies and specifically Waves Enterprise are opening up new opportunities for companies on the road towards digitalization of business processes. Our approach to the development of the platform's technology is based on the corporate sector's requirements for IT systems, such as data privacy and immutability, the network's high throughput and versatility of instruments. A combination of private and public permissioned blockchain approaches facilitates totally new models for interaction between network participants with the option of fine-tuning the list of users who can access data.

The platform's economic model, based on the WEST token, not only supports the sustainability of the network but also offers equal opportunities to participants in terms of access to services and other tools, as well as motivation for outside developers to provide their services for Waves Enterprise users.

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Enabling trustless environments for trust-based businesses

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Get in touch to find out how Waves Enterprise can help you scale and refine your business.

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