

CARTESI

**Lightpaper**

Ver. 01    2020

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All contributions will be applied towards the advancing, promoting the research, design and development of, and advocacy for a bridge between Linux and blockchain, giving DApps massive processing power and industrial-grade programmability. The Company, the Distributor and their respective affiliates would develop, manage and operate Cartesi.

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you will and shall at your own expense ensure compliance with all laws, regulatory requirements and restrictions applicable to you (as the case may be);  
you acknowledge, understand and agree that CTSI may have no value, there is no guarantee or representation of value or liquidity for CTSI, and CTSI is not an investment product including for any speculative investment;

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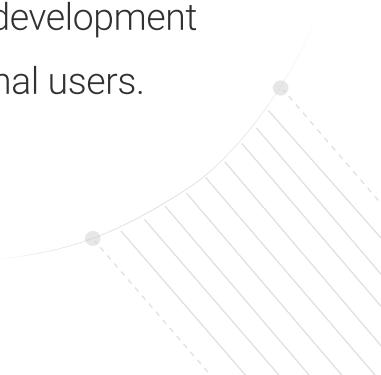
# The Blockchain Adoption Barrier

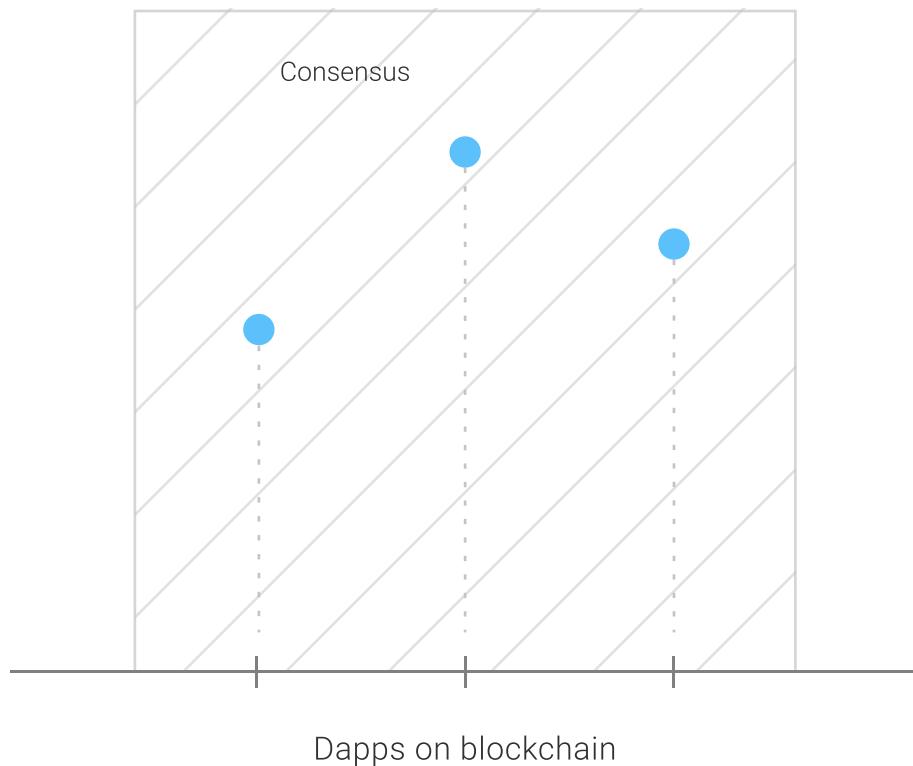


Blockchains supporting smart contracts are often compared to decentralized world computers. In reality, even with immense resources being invested on development and protocol optimizations, even when significant resources are invested in application development, they are far from personal computers or application servers.

Personal computers and application servers run real operating systems, support software that evolved through decades, and do not operate under artificial throughput caps imposed by consensus mechanisms.

As a result, there is a technological abyss between the centralized and decentralized worlds. This can be seen in the power of applications, in the ease of the development process, and in the experience delivered to final users.





While running computations off-chain compromises decentralization, public blockchain computations are too limited in power, even for a relatively simple DApp.

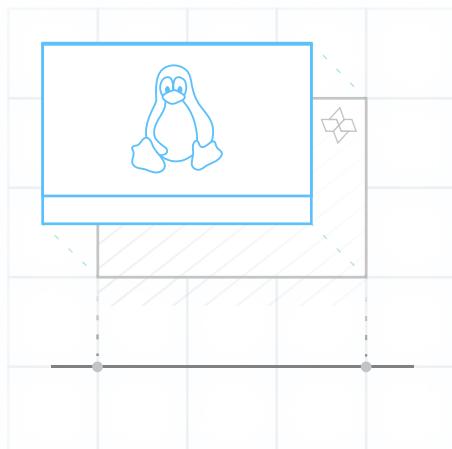
Developers operate with a restricted set of tools to create their DApps, and cannot perform even the simplest operations like opening a compressed file or reading a record from a relational database. These handicaps lead to bad UX and applications with an archaic feeling. They are a formidable barrier for end-user adoption.

Until the abyss between centralized and decentralized software is finally bridged, the decentralized Web will remain an elusive dream.

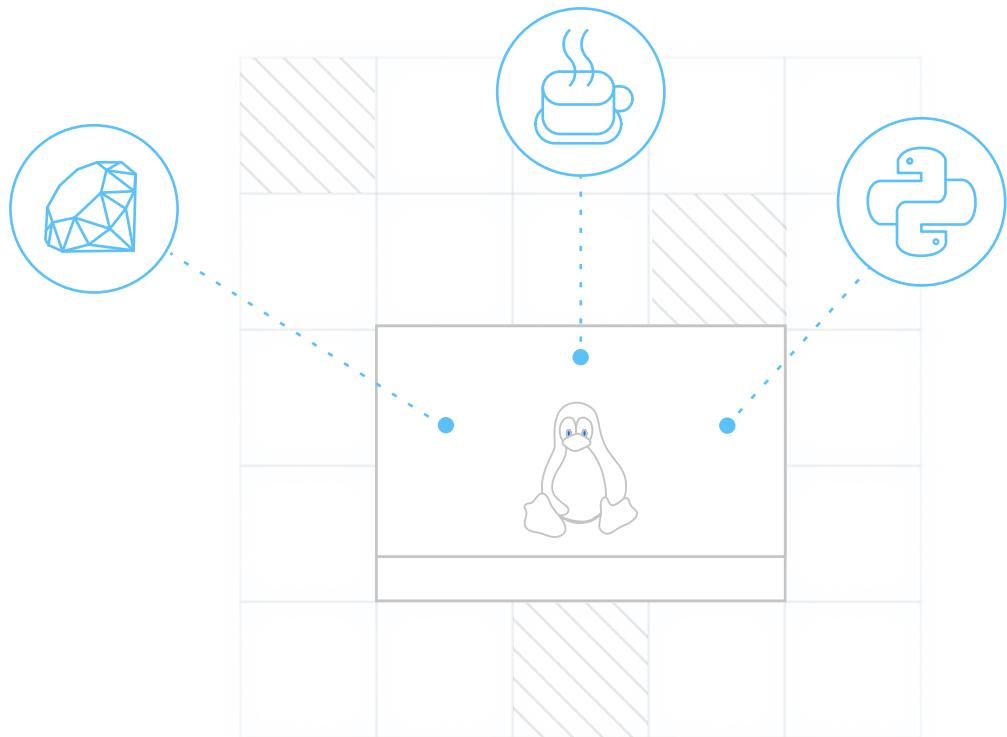
# Mission of Cartesi

Cartesi creates a bridge between Linux and blockchain. It gives DApps massive processing power and industrial-grade programmability.

Cartesi provides a Linux runtime environment for scalable blockchain Dapps. Complex and intensive computations run off-chain, while retaining the security guarantees of the blockchain.



**DApps developed with Cartesi are significantly more powerful and easier to build.**



With Cartesi, developers can continue to use the mature software infrastructure they are already proficient with, supported by Linux. They are free from the hassle of limited idiosyncratic blockchain environments. Instead, they can build on decades of software development and combine existing components to build their blockchain applications. Mainstream developers encounter a welcoming, familiar environment on which to express their ideas.

Cartesi will also make DApps portable across the most relevant blockchains, so developers don't have to worry about the longevity of specific blockchain projects.



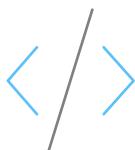
## A Linux Infrastructure for Scalable Dapps



**Scalable:** Intensive computations performed off-chain while retaining the security guarantees of the blockchain



**Expressive:** DApp logic built with a real OS and the option of thousands of open-source software components available for Linux



**Adoptable:** Barriers of adoption removed. Developers use familiar software stacks and popular standards to code DApps



**Fully-Decentralized:** Consensus securely reached on-chain. No reputation protocol, no TEE, or central servers on the cloud

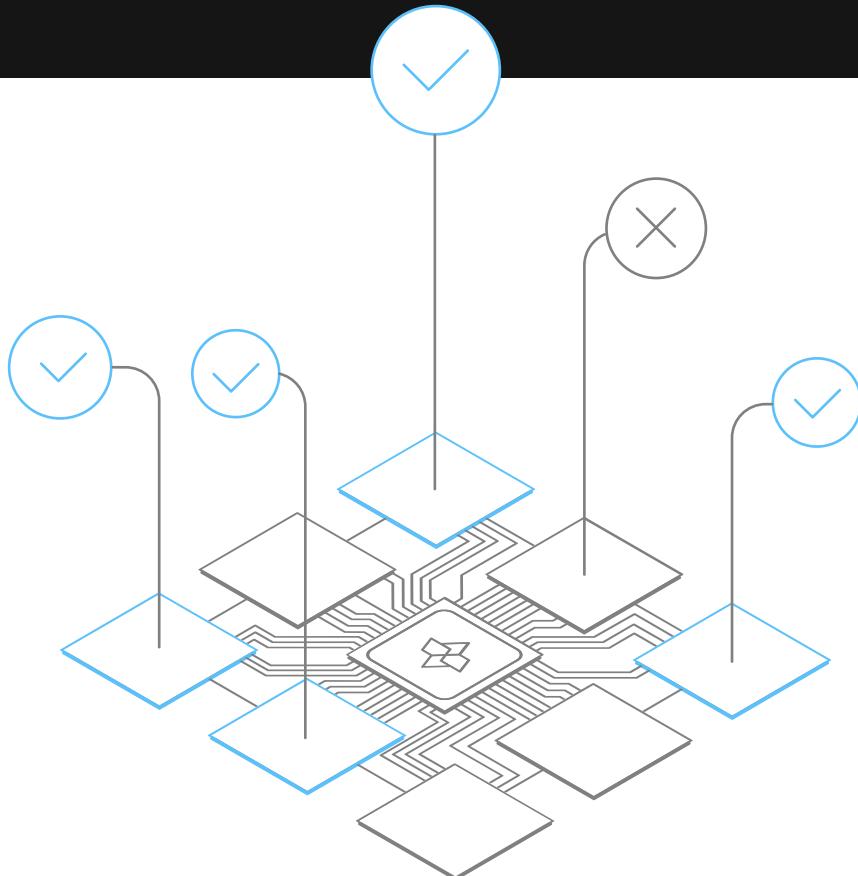


**Portable:** Cartesi will make DApps portable across most important public blockchains that support smart contracts



**Private:** DApp state can be kept private among application participants

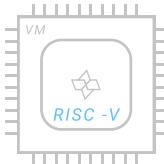
# The Tech



## Cartesi Core

Cartesi Core is an infrastructure comprised of on-chain and off-chain components. In a nutshell, each participant that wants to interact with a Cartesi DApp does so through the off-chain component, which is called the Cartesi Node.

By moving computation off-chain, Cartesi Core removes the processing load from the consensus layer while preserving the security guarantees of the underlying blockchain. That's rendered possible by the combination of three principles.



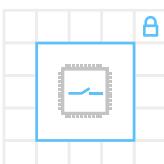
## A Fitting Virtual Machine Architecture

Cartesi includes a custom VM, called the Cartesi Machine, that deterministically emulates a RISC-V microprocessor and runs an embedded Linux distribution. That's where the decentralized logic of the DApp is executed. The Cartesi Machine is self-contained and reproducible. These two properties are necessary for DApp participants to retain verifiability and achieve consensus.



## A Cryptoeconomic Protocol

Cartesi uses economic incentives to encourage DApp participants to engage with the system honestly and in the most efficient way, by responding timely and achieving common agreement on the results of computations that happen off-chain.



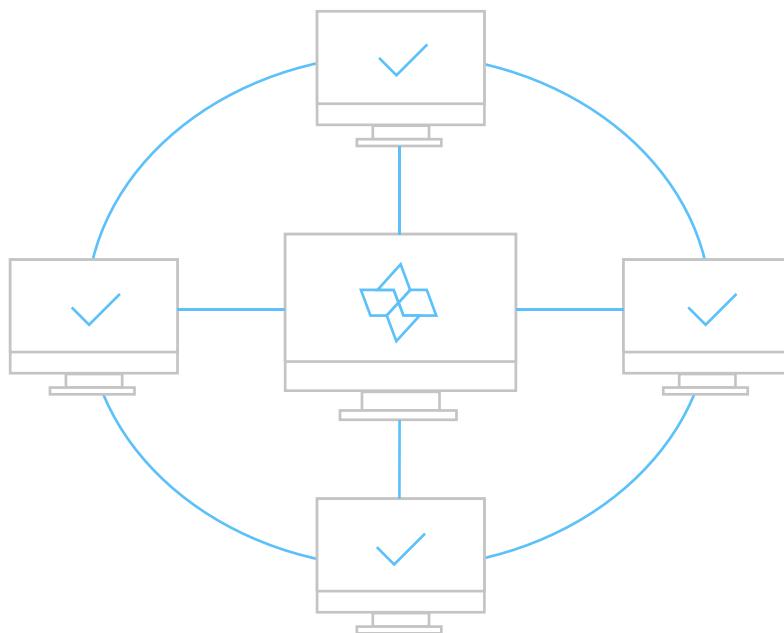
## On-chain Dispute Resolution

If DApp participants fail to achieve agreement off-chain, the blockchain becomes a supreme court mediating a dispute resolution protocol. Bad actors suffer heavy economic punishments, while honest participants are economically compensated by the inconvenience suffered. Even in the rare circumstances when arbitration is needed, the verification process is performed with an interactive protocol that involves a negligible amount of computation and cost for the blockchain.

## Data Ledger

While the Cartesi Nodes greatly expand the computational limits DApps, other scalability problems remain such as the high cost of transactions and the issue of data availability.

To mitigate these problems, while maintaining the system portable across blockchains, Cartesi will develop a decentralized side chain based on Proof of Stake.

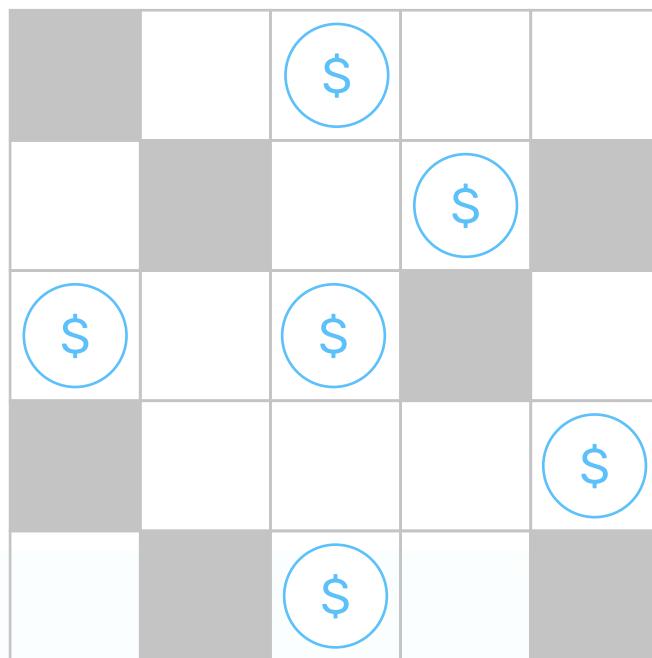


Cartesi's Data Ledger will be optimized to work with the core technology of the Cartesi Machines. It will be built for short term storage, garbage collection, sharding, offchain emulated computations and localized consensus.

Data Ledger will employ a simple and yet robust implementation. This is possible as the main chain will be used in various critical parts of the consensus algorithm, such as random number generation and block ordering.

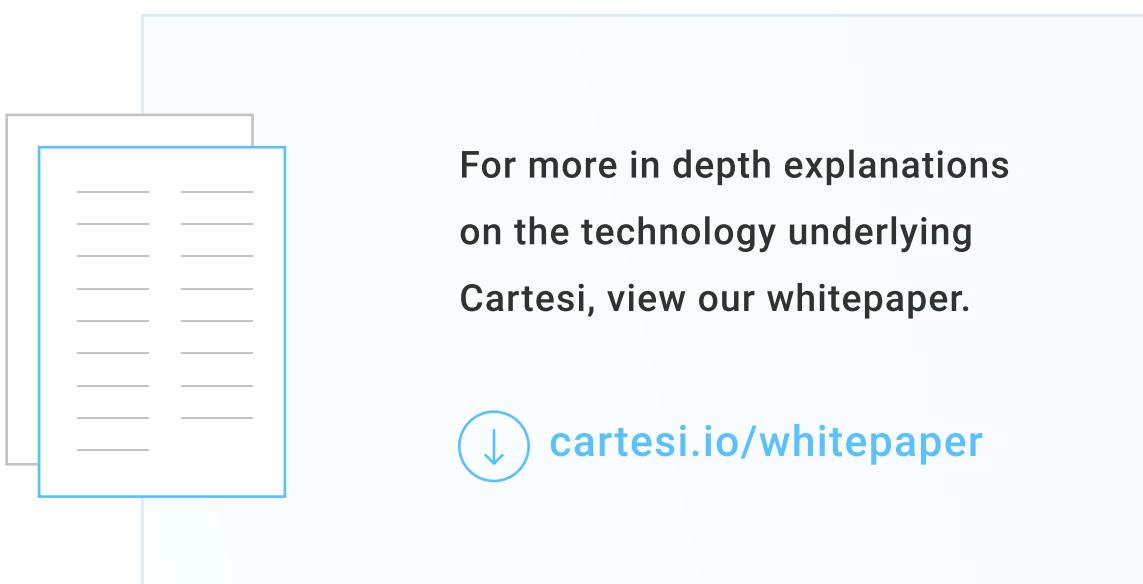
## Mining

Cartesi reserves a 250 million CTSI allocation to a mine. The mine reserve will be used to generate extra incentive for early adopters and miners, helping to bootstrap the Cartesi Network. These tokens will be distributed to Cartesi Nodes being selected by Cartesi Network's PoS algorithm used by the Data Ledger.



The CTSI rewards that miners will obtain from the reserve will gradually reduce with time. That will happen similarly to the way that miners of Bitcoin or Ethereum obtain block rewards, with a geometric decay along the years. These reducing rewards will be offset by the fees collected from Cartesi users for the services provided by the network.

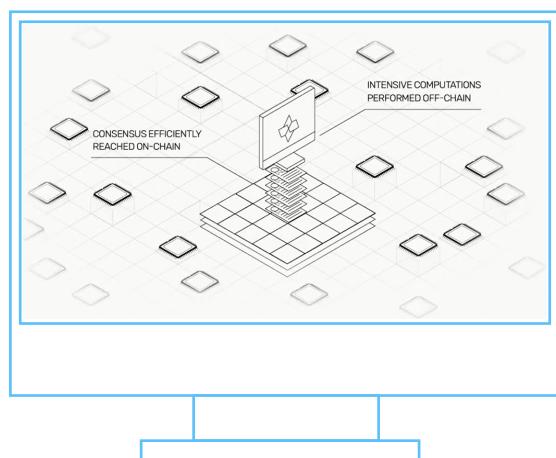
# Whitepaper



For more in depth explanations  
on the technology underlying  
Cartesi, view our whitepaper.



[cartesi.io/whitepaper](https://cartesi.io/whitepaper)



Watch a short summarizing  
video explaining the  
technology behind Cartesi

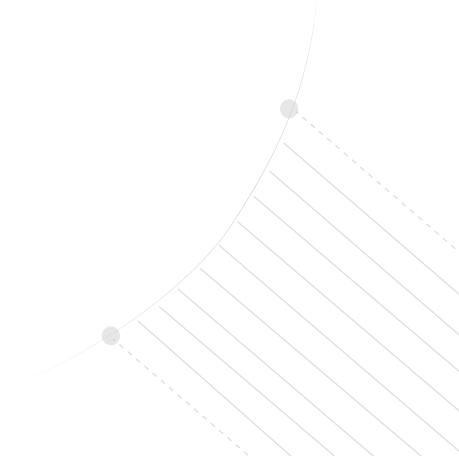


[cartesi.io/video](https://cartesi.io/video)

# Use Cases



Cartesi allows the creation of a vast array of decentralized applications. It greatly expands the possibilities of current technology with benefits such as: use of traditional software stacks, easy and resourceful development environment, high TPS, high computational throughput, native financial settlement layer, portability across the most relevant blockchains and usability conveniences for DApp users. Cartesi aims to be accessed, used, developed-on in the most convenient fashion, ultimately, to become the prevailing DApp platform.

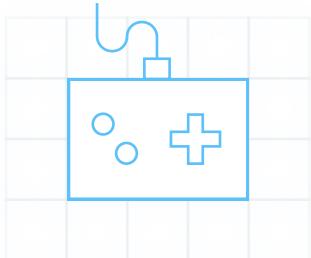


## DeFi



Cartesi applications will be able to read and do complex calculations involving data from multiple sources. This will help interoperability between blockchains and services such as future and insurance markets.

## GAMING



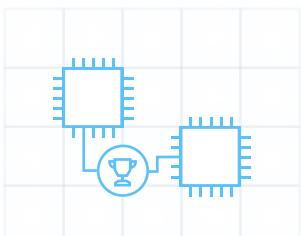
Cartesi will unleash vast new possibilities for blockchain games. Developers will be able to use traditional tools and libraries that can be compiled for Linux. Additionally, game state processing will be free from the computational limits and high fees of blockchains without the need to sacrifice decentralization.

## CREEPS

### Creeps is Cartesi's first use-case and technical demonstration

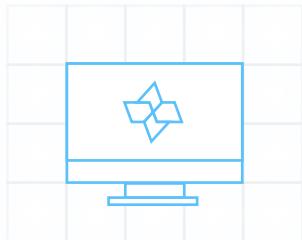
A fully decentralized tournament without the need to develop smart contracts. All while using software stacks that compile for Linux

## MACHINE LEARNING



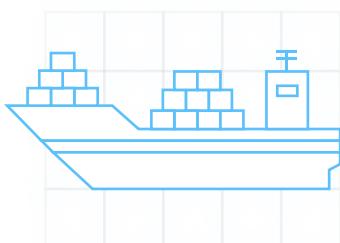
A trustless marketplace for AI and computational tasks. With the power of Cartesi's decentralized automated verification, developers will be able to create services that allow new DApps to outsource and distribute work. This opens new possibilities for lower cost AI, developed by outsourced experts and bots.

## THE FUTURE OF AUTOMATION



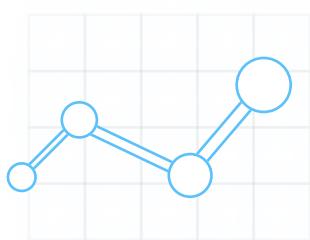
"With the power of Cartesi's decentralized verification, applications will be able to outsource and distribute verifiable work. This opens new possibilities for trustless marketplaces and autonomous systems involving humans and machines, propelling IoT, data science and AI through new business models."

## LOGISTICS & OPTIMIZATION



With Cartesi, professionals in fields such as logistics will be able to offer their services and be hired by enterprises internationally and without the need for intermediaries.

## RESEARCH



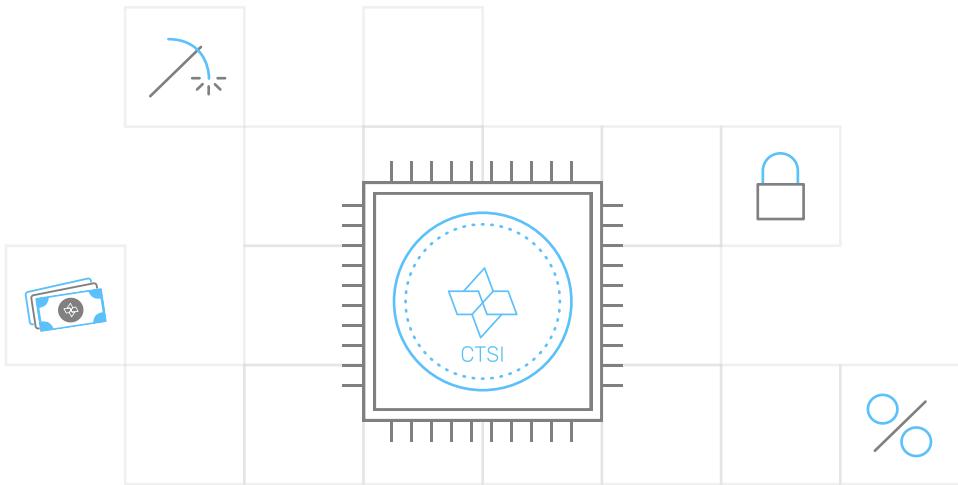
Outsourced computation will allow for millions of users to lend their idle computing power. This will benefit scientific research, 3d rendering, video transcoding and many other computationally intensive tasks in a trustless way, without reputation systems.

# The Cartesi Token (CTSI)

The Cartesi Token economy has been designed to overcome challenges of usability and scalability of blockchain applications.

The native digital cryptographically-secured utility token of Cartesi (CTSI) is a transferable representation of attributed functions specified in the protocol/code of Cartesi, designed to play a major role in the functioning of the ecosystem on Cartesi, and intended to be used solely as the primary utility token on the network. CTSI is an essential ingredient for the proper functioning of Cartesi's Data Ledger, which is a PoS-based side-chain for temporary data storage. Block generators receive CTSI mine rewards and fees paid by parties adding data to the ledger.

The Cartesi Token also plays a fundamental role in Cartesi Core's incentive mechanism. CTSI is a non-refundable functional utility token which will be used as the virtual crypto "fuel" for using certain designed functions on Cartesi, providing the economic incentives which will be consumed to encourage participants to contribute and maintain the ecosystem on Cartesi.



Computational resources are required for validation and verification of additional blocks / information on the blockchain or executing transactions, thus providers of these services / resources would require payment for the consumption of these resources (i.e. "mining" on Cartesi) to maintain network integrity, and CTSI will be used as the medium of exchange to quantify and pay the costs of the consumed computational resources. CTSI is an integral and indispensable part of Cartesi, because without CTSI, there would be no incentive for users to expend resources to participate in activities or provide services for the benefit of the entire ecosystem on Cartesi. Users of Cartesi and/or holders of CTSI which did not actively participate will not receive any CTSI incentives. To disincentivize dishonest behavior, Cartesi Nodes that engage in disputes are required to make collateral deposits in CTSI. This protocol guarantees that if a dispute resolution occurs, honest parties are indemnified while dishonest parties are punished.

CTSI does not in any way represent any shareholding, participation, right, title, or interest in the Company, the Distributor, their respective affiliates, or any other company, enterprise or undertaking, nor will CTSI entitle token holders to any promise of fees, dividends, revenue, profits or investment returns, and are not intended to constitute securities in Singapore or any relevant jurisdiction. CTSI may only be utilised on Cartesi, and ownership of CTSI carries no rights, express or implied, other than the right to use CTSI as a means to enable usage of and interaction within Cartesi.

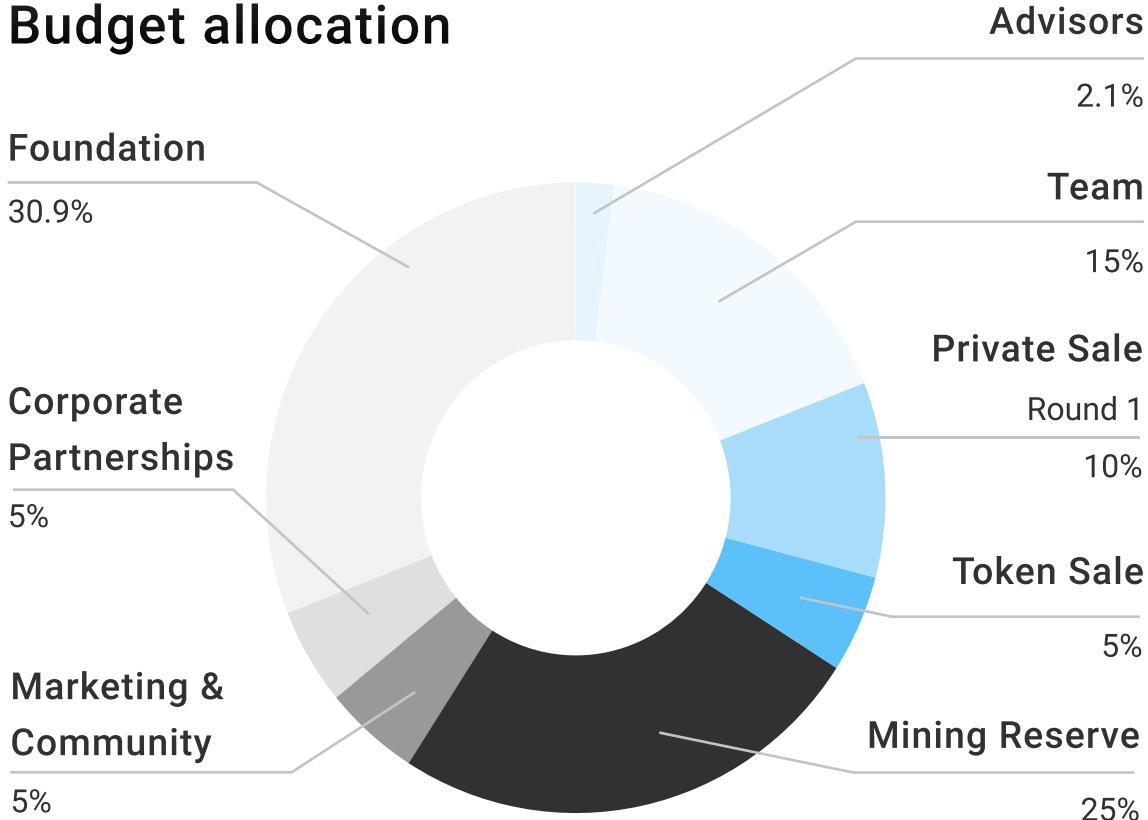
# Crypto Economics

TOKEN NAME	CTSI
TYPE	ERC-20*



HARD CAP	<\$10,000,000
CTSI PRICE	TBA

## Budget allocation



Token economic information is subject to change. This information may or may not reflect accurate information in the future.

In particular, it is highlighted that CTSI: (a) does not have any tangible or physical manifestation, and does not have any intrinsic value (nor does any person make any representation or give any commitment as to its value); (b) is non-refundable and cannot be exchanged for cash (or its equivalent value in any other virtual currency) or any payment obligation by the Company, the Distributor or any of their respective affiliates; (c) does not represent or confer on the token holder any right of any form with respect to the Company, the Distributor (or any of their respective affiliates), or its revenues or assets, including without limitation any right to receive future dividends, revenue, shares, ownership right or stake, share or security, any voting, distribution, redemption, liquidation, proprietary (including all forms of intellectual property or licence rights), right to receive accounts, financial statements or other financial data, the right to requisition or participate in shareholder meetings, the right to nominate a director, or other financial or legal rights or equivalent rights, or intellectual property rights or any other form of participation in or relating to Cartesi, the Company, the Distributor and/or their service providers; (d) is not intended to represent any rights under a contract for differences or under any other contract the purpose or pretended purpose of which is to secure a profit or avoid a loss; (e) is not intended to be a representation of money (including electronic money), security, commodity, bond, debt instrument, unit in a collective investment scheme or any other kind of financial instrument or investment; (f) is not a loan to the Company, the Distributor or any of their respective affiliates, is not intended to represent a debt owed by the Company, the Distributor or any of their respective affiliates, and there is no expectation of profit; and (g) does not provide the token holder with any ownership or other interest in the Company, the Distributor or any of their respective affiliates.

The contributions in the token sale will be held by the Distributor (or their respective affiliate) after the token sale, and contributors will have no economic or legal right over or beneficial interest in these contributions or the assets of that entity after the token sale. To the extent a secondary market or exchange for trading CTSI does develop, it would be run and operated wholly independently of the Company, the Distributor, the sale of CTSI and Cartesi. Neither the Company nor the Distributor will create such secondary markets nor will either entity act as an exchange for CTSI.

# Roadmap

## What We've Achieved

JULY 2017	Research Started
JULY 2018	Cartesi Core's Whitepaper
DECEMBER 2018	Computation Reproducibility
Q2 - 2019	Computation Verifiability
Q3 - 2019	Cartesi Core Open-sourced
Q4 - 2019	Decentralized Tournament Infrastructure
Q1 - 2020	First Dapp

## Up Next

Q2 - 2020	SDK Documentation
Q3 - 2020	PoS Prototype
Q4 - 2020	Mining on Mainnet
Q1 - 2021	Cartesi Rollups
Q2 - 2021	Data Ledger Testnet
Q3 - 2021	Data Ledger Mainnet

# Partners & Backers

SNZ

L|D<sup>CAPITAL</sup>了得资本

SOSV  
THE ACCELERATOR VC



artesian  
VENTURE PARTNERS

Go Block

NEWFANG

ENTERPRISE  
ETHEREUM  
ALLIANCE

Across  
Asia  
Alliance

TAIWAN  
TECH ARENA

TAIWAN  
STARTUP  
STADIUM  
台灣新創競技場

빅뱅엔젤스  
BIGBANG ANGELS

# Team

CORE



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Chief Executive Officer



**Augusto Teixeira, PhD**  
Chief Scientific Officer



**Diego Nehab, PhD**  
Chief Technology Officer



**Colin Steil**  
Chief Operating Officer



**Danilo Tuler**  
Head of Engineering



**Felipe Argento**  
Blockchain Engineer



**Carlo Fragni**  
Software Engineer



**Victor Fusco**  
Senior Software Engineer



**Stephen Chen**  
Software Engineer



**Fabiana Cecin, PhD**  
Software Engineer

# Team

## ADVISORS



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Senior Advisor

Co-Founder of IOTA



**Stas Oskin**

Senior Advisor

Core Dev & Bus Dev of Wings.ai



**Luiz H. de Figueiredo, PhD**

Co-creator of Lua  
programming language



**William Bao Bean**

General Partner at SOSV  
Man. Dir. at Chinaccelerator  
Man. Dir. at MOX



**Boris Povod**

Co-founder of Wings  
Co-founder of Cripti



**Michael Hwang**

Managing Director, Big Bang Angels  
Board Member, Across Asia Alliance



**T.k. Hamed**

6 Year Crypto Veteran  
Growth Hacker & Strategist

# References & Other Links

## Find Out More

<https://cartesi.io>



## Stay In Touch

-  [t.me/cartesiproject](https://t.me/cartesiproject)
-  [twitter.com/cartesiproject](https://twitter.com/cartesiproject)
-  [discordapp.com/invite/Pt2NrnsS](https://discordapp.com/invite/Pt2NrnsS)
-  [medium.com/cartesi](https://medium.com/cartesi)
-  [github.com/cartesi](https://github.com/cartesi)

## Whitepaper

[cartesi.io/cartesi\\_whitepaper.pdf](https://cartesi.io/cartesi_whitepaper.pdf)

## Introduction Video

[youtube.com/watch?v=tYBfDe-14hE](https://youtube.com/watch?v=tYBfDe-14hE)

# Risks

You acknowledge and agree that there are numerous risks associated with purchasing CTSI, holding CTSI, and using CTSI for participation in Cartesi. In the worst scenario, this could lead to the loss of all or part of the CTSI which had been purchased. IF YOU DECIDE TO PURCHASE CTSI, YOU EXPRESSLY ACKNOWLEDGE, ACCEPT AND ASSUME THE FOLLOWING RISKS:

## 1. Uncertain Regulations and Enforcement Actions

The regulatory status of CTSI and distributed ledger technology is unclear or unsettled in many jurisdictions. The regulation of virtual currencies has become a primary target of regulation in all major countries in the world. It is impossible to predict how, when or whether regulatory agencies may apply existing regulations or create new regulations with respect to such technology and its applications, including CTSI and/or Cartesi. Regulatory actions could negatively impact CTSI and/or Cartesi in various ways. The Company, the Distributor (or their respective affiliates) may cease operations in a jurisdiction in the event that regulatory actions, or changes to law or regulation, make it illegal to operate in such jurisdiction, or commercially undesirable to obtain the necessary regulatory approval(s) to operate in such jurisdiction.

After consulting with a wide range of legal advisors and continuous analysis of the development and legal structure of virtual currencies, a cautious approach will be applied towards the sale of CTSI. Therefore, for the token sale, the sale strategy may be constantly adjusted in order to avoid relevant legal risks as much as possible. For the token sale, the Company and the Distributor are working with Lex Advocatus LLC, a boutique corporate law firm in Singapore with a good reputation in the blockchain space.

## 2. Inadequate disclosure of information

As at the date hereof, Cartesi is still under development and its design concepts, consensus mechanisms, algorithms, codes, and other technical details and parameters may be constantly and frequently updated and changed. Although this white paper contains the most current information relating to Cartesi, it is not absolutely complete and may still be adjusted and updated by the Cartesi team from time to time. The Cartesi team has no ability and obligation to keep holders of CTSI informed of every detail (including development progress and expected milestones) regarding the project to develop Cartesi, hence insufficient information disclosure is inevitable and reasonable.

## 3. Competitors

Various types of decentralised applications and networks are emerging at a rapid rate, and the industry is increasingly competitive. It is possible that alternative networks could be established that utilise the same or similar code and protocol underlying CTSI and/or Cartesi and attempt to re-create similar facilities. Cartesi may be required to compete with these alternative networks, which could negatively impact CTSI and/or Cartesi.

## 4. Loss of Talent

The development of Cartesi greatly depends on the continued co-operation of the existing technical team and expert consultants, who are highly knowledgeable and experienced in their respective sectors. The loss of any member may adversely affect Cartesi or its future development. Further, stability and cohesion within the team is critical to the overall development of Cartesi. There is the possibility that conflict within the team and/or departure of core personnel may occur, resulting in negative influence on the project in the future.

## 5. Failure to develop

There is the risk that the development of Cartesi will not be executed or implemented as planned, for a variety of reasons, including without limitation the event of a decline in the prices of any digital asset, virtual currency or CTSI, unforeseen technical difficulties, and shortage of development funds for activities.

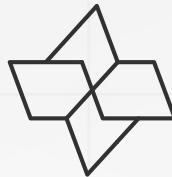
## 6. Security weaknesses

Hackers or other malicious groups or organisations may attempt to interfere with CTSI and/or Cartesi in a variety of ways, including, but not limited to, malware attacks, denial of service attacks, consensus-based attacks, Sybil attacks, smurfing and spoofing. Furthermore, there is a risk that a third party or a member of the Company, the Distributor or their respective affiliates may intentionally or unintentionally introduce weaknesses into the core infrastructure of CTSI and/or Cartesi, which could negatively affect CTSI and/or Cartesi.

Further, the future of cryptography and security innovations are highly unpredictable and advances in cryptography, or technical advances (including without limitation development of quantum computing), could present unknown risks to CTSI and/or Cartesi by rendering ineffective the cryptographic consensus mechanism that underpins that blockchain protocol.

## 7. Other risks

In addition, the potential risks briefly mentioned above are not exhaustive and there are other risks (as more particularly set out in the Terms and Conditions) associated with your purchase, holding and use of CTSI, including those that the Company or the Distributor cannot anticipate. Such risks may further materialise as unanticipated variations or combinations of the aforementioned risks. You should conduct full due diligence on the Company, the Distributor, their respective affiliates, and the Cartesi team, as well as understand the overall framework, mission and vision for Cartesi prior to purchasing CTSI.



CARTESI

[cartesi.io](https://cartesi.io)