



**SDA Bocconi** | **DEVO Lab**  
School of Management | Digital Enterprise  
Value and Organization

**Digital Enterprise Value and Organization**  
Economics, Organization and Technology  
for the Digital Enterprise

## **Blockchain Revolution - Introduzione**

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# WHAT IS THE SDA BOCCONI - DEVO LAB?

**DEVO Lab** is a research center of SDA Bocconi School of Management.

We address coherently and exhaustively the subject of **Digital Transformation of companies and enterprises** offering competencies and capabilities necessary to support digital transformation through **research and analysis on the most relevant subjects for managers** coping with the Digital Transformation of their organizations, processes and offerings.

The aim of DEVO Lab is to **bring together diversified perspectives, experiences and backgrounds** to consistently assess the business implications of technologies and the value generation they can enable.



# DEVO LAB MEMBERS

DEVO research program and activities are assessed and suggested by the DEVO LAB Think Tank.

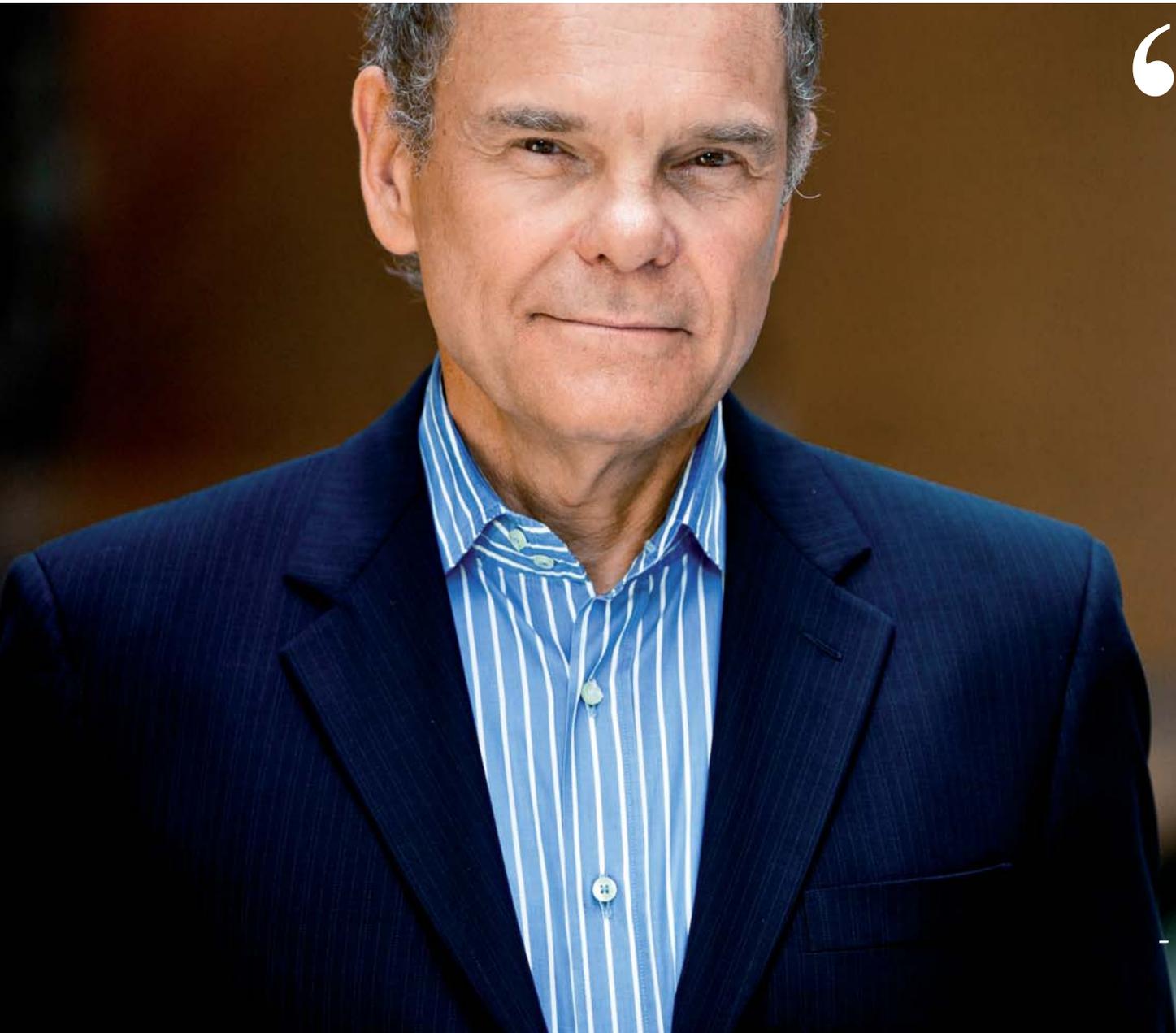
All **Members** have a long-term commitment to the DEVO Lab and are entitled to have a representative in the DEVO LAB's Think Tank.

Other participants could include representatives of sponsors of large research projects and experts in the field with international standing.





# 1. INTRODUCTION



“

*The blockchain is an incorruptible digital ledger of economic transactions that can be programmed to record not just financial transactions but virtually everything of value.*

*- Dan Tapscott, Blockchain expert -*

“

*Bitcoin is better than currency in that you don't have to be physically in the same place and, of course, for large transactions, currency can get pretty inconvenient.*

*- Bill Gates, CEO of Microsoft -*





“

*Blockchain is a remarkable cryptographic achievement and the ability to create something that is not duplicable in the digital world has enormous value.*

*- Eric Schmidt, CEO of Google -*



“

*Bitcoin is not just money for the internet. Yes, it's perfect money for the internet. It's instant, it's safe, it's free. Yes, it is money for the internet, but it's so much more. Bitcoin is the internet of money.*

*- Andreas Antonopoulos, Bitcoin expert -*

“

*I'm not an expert on Blockchain. I don't pretend I know it. If you don't know something, it's not shameful. But if you don't know and you pretend you know, it is very shameful.*

*- Jack Ma, President of Alibaba -*

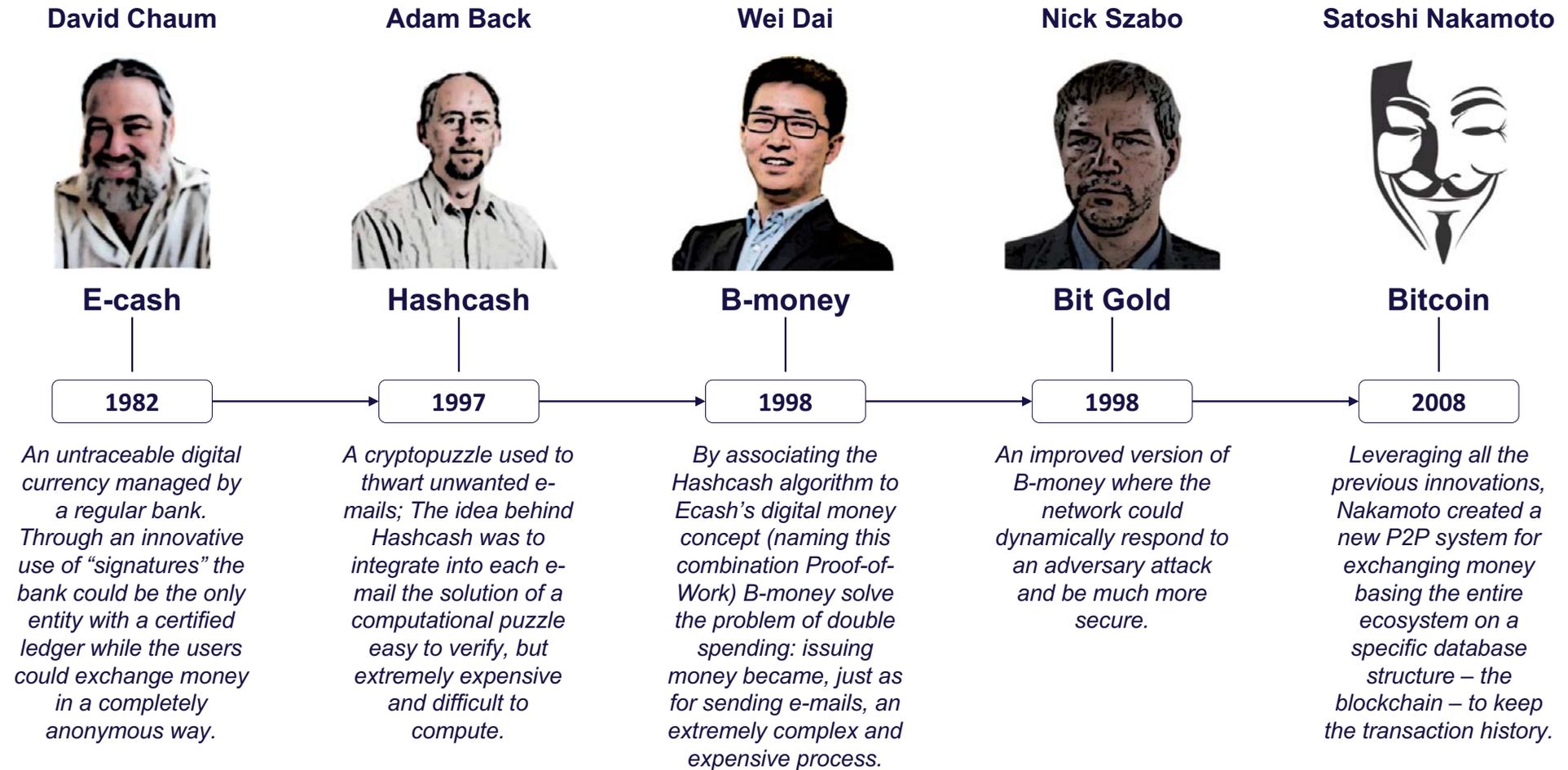




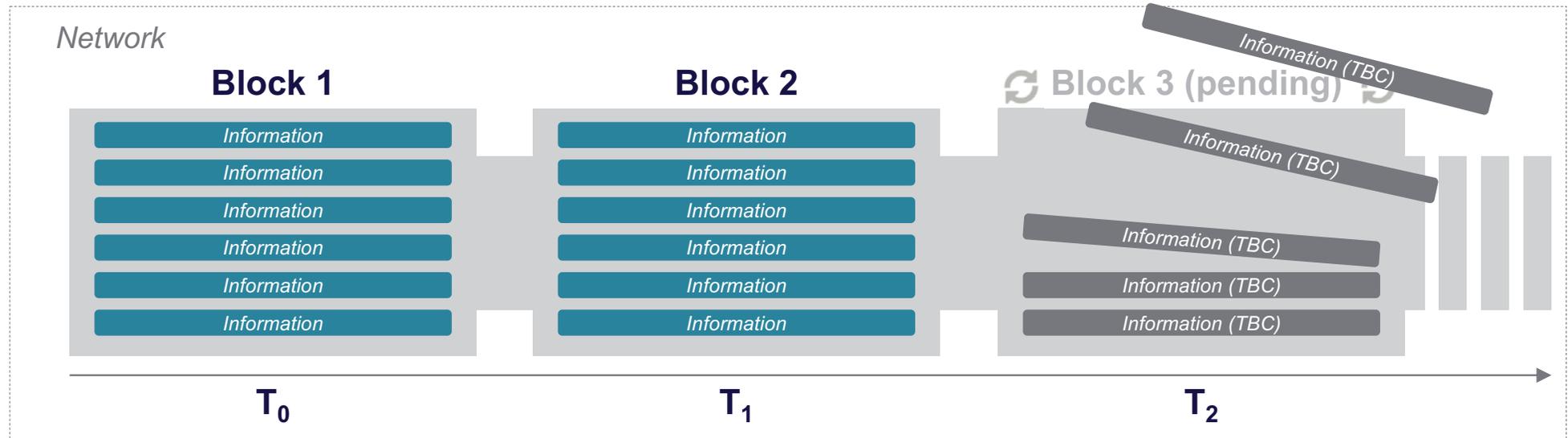
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# 1. WHAT IS A BLOCKCHAIN?

# BLOCKCHAIN: THE HISTORY BEHIND



# DEFINITION



A Blockchain is a **sequence of blocks**, each one containing a **certain amount of information distributed through a chain** (i.e. a ledger) over a network



It is a new **digital way to store any kind of data**, be it a token of value or a crypto money balance, through a network (for example, the Internet)

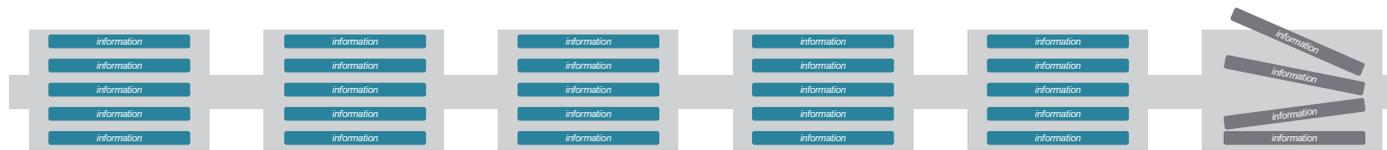
# BLOCKCHAIN INFRASTRUCTURE

Final user - Software



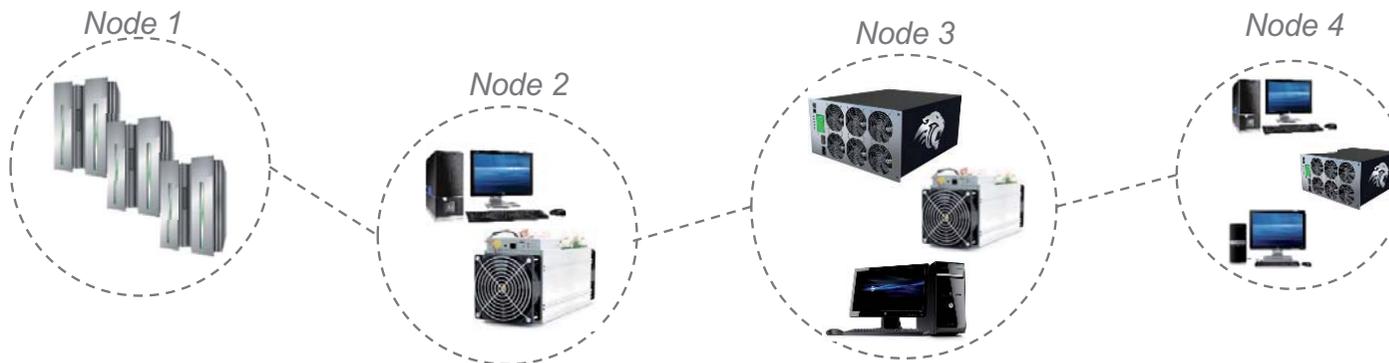
The **software** allows users to **interact with the rest of the network**, making them able to **send and receive** new transactions.

Blockchain



The **blockchain** stores **every information** that has been **confirmed by the network**.

Network



The **network**, according to the protocol's rules, **authorizes any valid transaction**, **updates the ledger** with the new information, and then **propagates a replica** to all of its nodes.

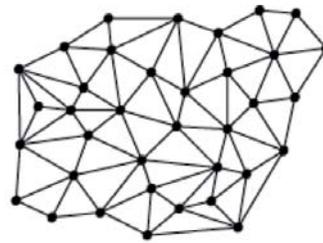
# BLOCKCHAIN: THREE TECHNICAL PILLARS



## Public key Cryptography



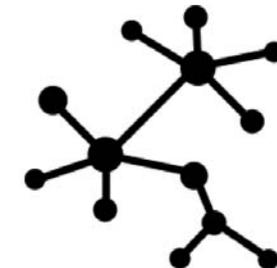
The **encryption scheme** applied to the protocol provides high levels of **transparency** and **security**



## Distributed Computation



The **computational power** is **shared** among **multiple systems**, which may also be in different locations

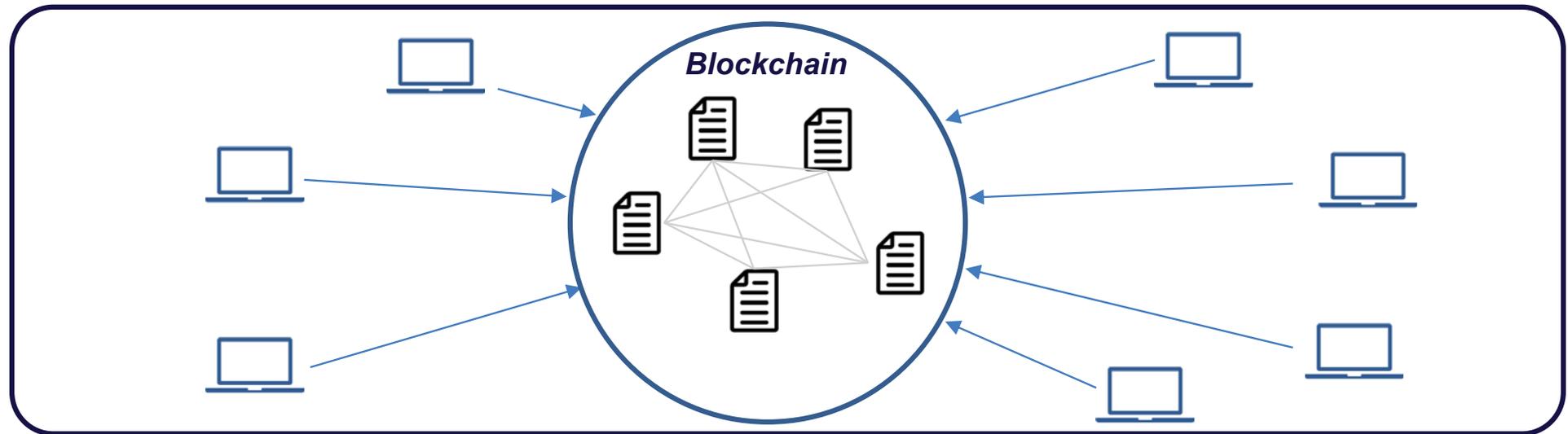


## Decentralized Consensus



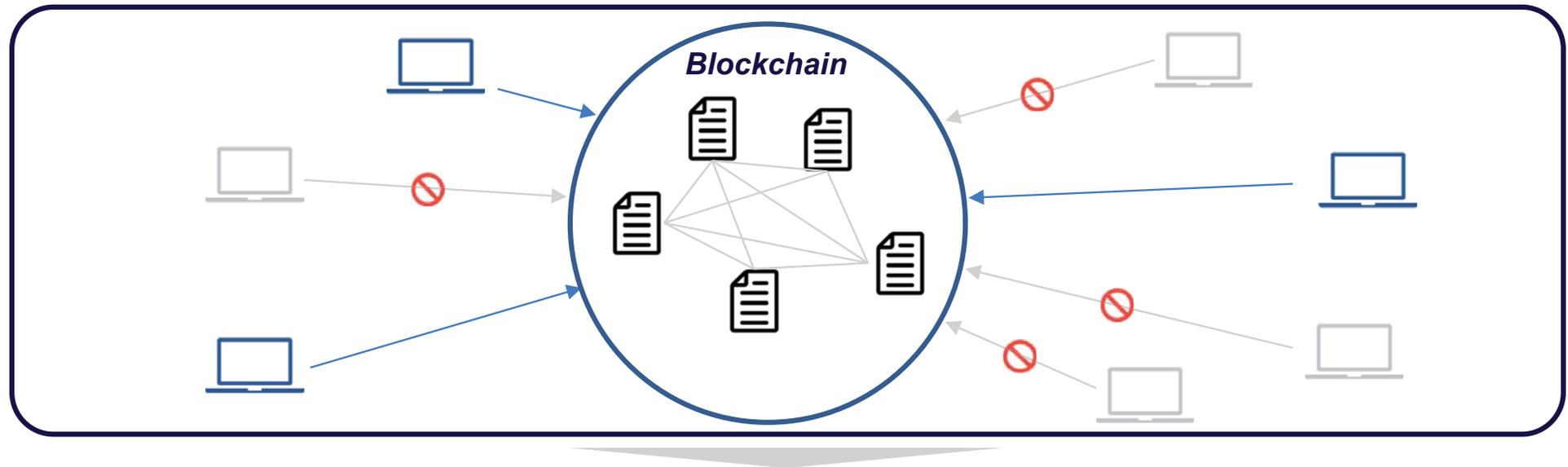
Nodes continuously **record information in blocks** on the basis of the **commonly shared rules** established by the blockchain protocol

# PERMISSIONLESS BLOCKCHAIN



- In a **permissionless blockchain** anyone can **read, send transactions and participate in the consensus** process. Permissionless blockchains are always **open source** – which means that the algorithm is completely public.
- They are mostly appropriate when a **network needs to be decentralized**. They are also suitable to ensure **full transparency of the ledger or individual anonymity**.
- **The costs are higher and the speed is slower** if compared to those of a private chain.
- The two most relevant examples of permissionless blockchains are **Bitcoin** and **Ethereum**.
- For this kind of blockchain, the most appropriate consensus algorithms are **Proof-of-Work** and **Proof-of-Stake**.

# PERMISSIONED BLOCKCHAIN



- A permissioned blockchain is **kept centralized to one - or more - authorized users**.
- In permissioned blockchains, **only the authorized user(s) can confirm transactions**. **Read permissions may be public or restricted to an arbitrary extent**. Likely applications include database management, auditing, and more, that are internal to a single company.
- This kind of blockchain **enables greater efficiency** and allows transactions **to take place much faster**.
- Two significant examples of permissioned blockchains are **Hyperledger** and **Ripple**.
- For this kind of blockchain, the most appropriate consensus algorithm is the **Practical Byzantine Fault Tolerance**.

# THREE MAIN CHARACTERISTICS OF A BLOCKCHAIN



## Immutability

Transactions are immutable, meaning they **cannot be altered or deleted**. While immutability is a relative concept, it can be asserted with certainty that it is extremely **hard to change** a blockchain, and if someone tries, it is extremely **easy to detect the attempt**



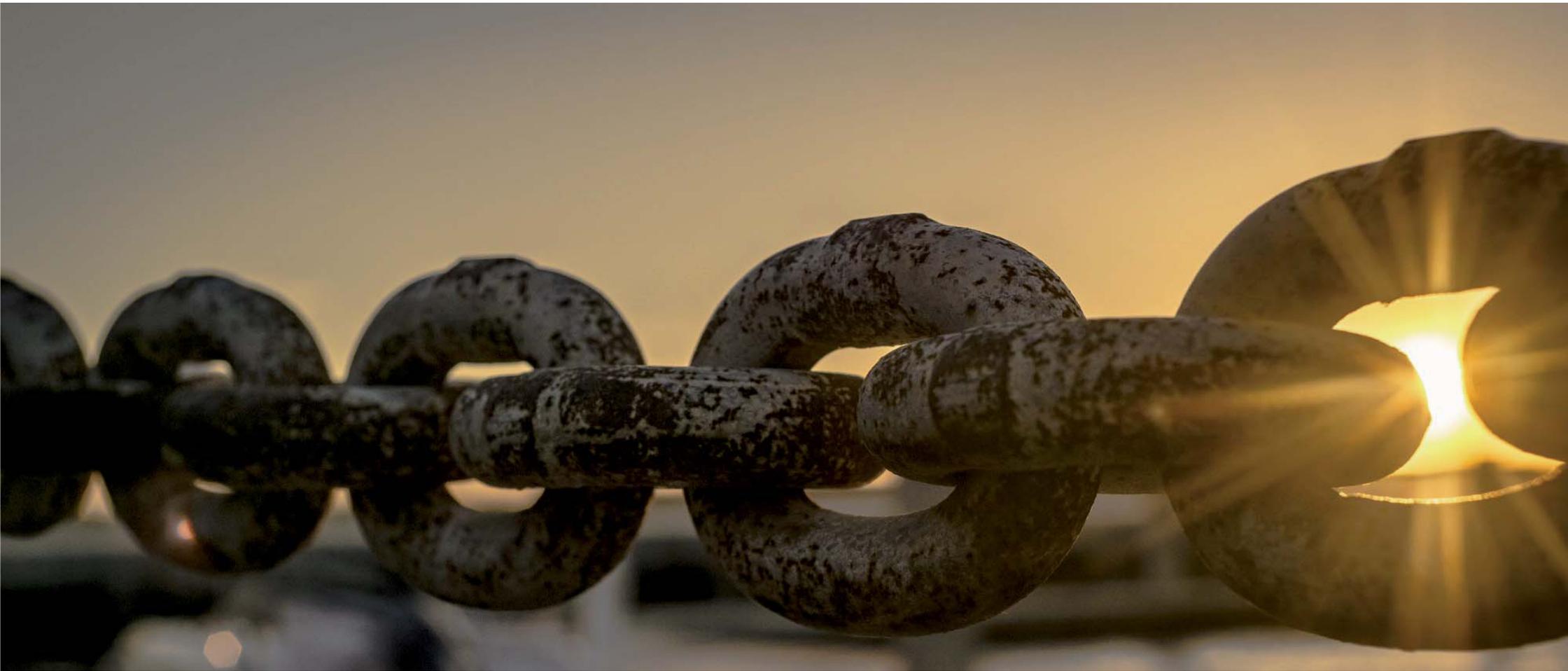
## Transparency

The **participants** in a blockchain network are **always in control of their information and/or transactions**. Moreover, each transaction performed on a blockchain is **viewable by anyone** (only by validators in permissioned chains), **anywhere, and in any moment**



## Security

Users can trust that **transactions** will be executed exactly under some specific rules, removing the **need for a trusted third party**. Moreover, due to its nature of decentralized infrastructure, a blockchain does not **have a central point of failure** and is better able to **withstand malicious attacks**



## **2. TYPES OF BLOCKCHAIN FROM THE APPLICATION PERSPECTIVE**

# CERTIFICATION

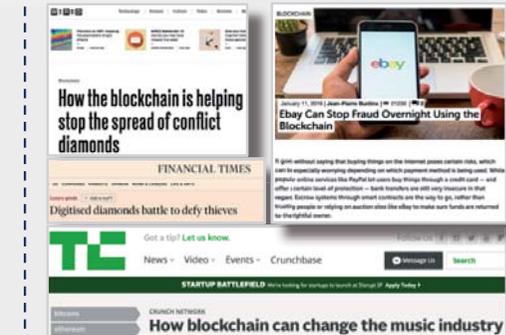
## DESCRIPTION

Blockchain represents one of the best ways to **fight various types of fraud** – such as subsidized housing sales and mileage manipulation in second-hand vehicles. In a blockchain it is (almost) **impossible to rewrite any data already registered**. Thus, it is the perfect tool to develop anti-fraud registries capable of putting an end to fraud schemes such as the ones mentioned above.

**Timestamping data in an unalterable state while maintaining confidentiality is a perfect solution to avoid frauds.** It allows anyone to store a hash of any document into a blockchain, thus proving it existed at the time when a particular block was created.

## SOME EXAMPLES

- Decentraland
- DigixDao
- [Everledger](#)
- GXShares
- Lunyr
- Namecoin
- Revain
- Tierion



## BLOCKCHAIN FACTS

### Pros

- ✓ Frauds/counterfeiting resistance
- ✓ Immutable registers
- ✓ High level of security and transparency

### Cons

- ✗ Certification authorities might be required

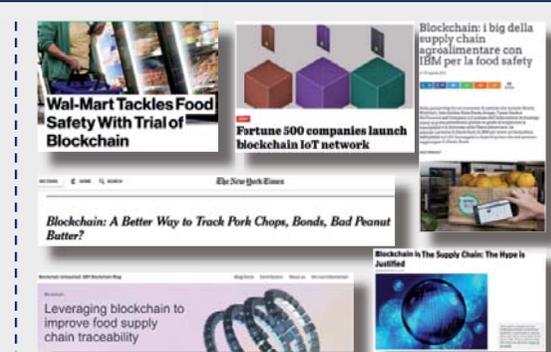
# ADVANCED TRACKING & IOT CONNECTION

## DESCRIPTION

The current IoT ecosystems rely on centralized, brokered communication models, otherwise known as the server/client paradigm. The **decentralized consensus** will create a **more resilient ecosystem for devices to run on**, eliminating a single point of failure. Moreover, the **cryptographic algorithms can guarantee a high level of privacy for the users**. Adopting a standardized peer-to-peer communication model to process the hundreds of billions of transactions between devices will significantly **reduce the costs associated with installing and maintaining large centralized data centres** and will distribute computation and storage needs across the billions of devices that form IoT networks.

## SOME EXAMPLES

- [Chronicled](#)
- [Hyperledger \(Walmart\)](#)
- [Iota](#)
- [Walton](#)
- [IoTappo](#)
- ...



## BLOCKCHAIN FACTS

### Pros

- ✓ Cost reduction (no central data centres involved)
- ✓ Highly resilient ecosystem – no single point of failure
- ✓ High level of security and reliability

### Cons

- ✗ Total dependency upon sensor's data quality
- ✗ Immutable storage might turn into a problem

# CLOUD STORAGE

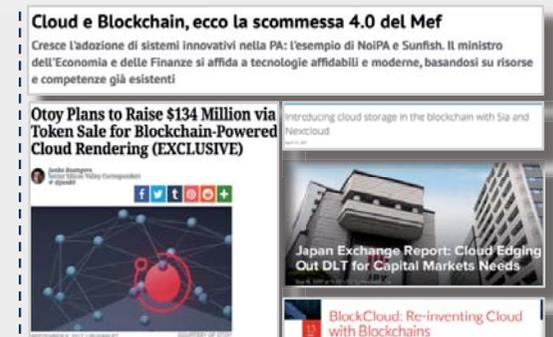
## DESCRIPTION

On a blockchain platform, the same users can **host their surplus storage capacity or purchase this extra-storage from other users and upload files**. Basically, the blockchain could enable:

- **A complete decentralization** basically eliminating the possibility of one-point-of-failure;
- **A high privacy and security level** considering that a node does not control user data nor has a direct access to user files, but **only stores encrypted fragments of user data**;
- **A significant cost reduction**. For instance, blockchain storage costs around 2\$ per terabyte per month, compared with Amazon S3's 25\$ per terabyte per month.

## SOME EXAMPLES

- **Siacoin**
- [Storj](#)
- **MaidSAFE**
- **iEx.ec**
- ...



## BLOCKCHAIN FACTS

### Pros

- ✓ Real redundancy – eliminating one-point-of-failure
- ✓ High level of privacy and security level
- ✓ Cost reduction

### Cons

- ✗ Immutable storage might turn into a problem
- ✗ Possible inefficiencies due to users' internet speed

# CRYPTOCURRENCIES

## DESCRIPTION

Cryptocurrencies are any kind of **electronic money** created using **cryptographic technology**. They **regulate their own issuing and ensure the legitimacy of transactions conducted through them**. They can be considered as the original and first-proven application of blockchain technologies. Cryptocurrencies are **open-source algorithms**, which can (usually) **be programmed by anyone and facilitate peer-to-peer financial networking** without the need for third party arbitration, thereby reducing the dependency on banking systems. The global market of cryptocurrencies is continuously growing and has exceeded **\$440 billion on December 2017**.

## SOME EXAMPLES

- [Bitcoin](#)
- **Dash**
- **Monero**
- **Litecoin**
- **Verge**
- **Zcash**
- ...



## BLOCKCHAIN FACTS

### Pros

- ✓ No central authorities
- ✓ Open access to everyone
- ✓ No country-specific
- ✓ High level of security
- ✓ Censorship resistant
- ✓ Immediate settlement

### Cons

- ✗ High level of volatility
- ✗ Lack of regulation might turn into a problem
- ✗ Both anonymity and lack of anonymity might turn into a problem

# DIGITAL ID

## DESCRIPTION

Issuing identity verification systems through blockchain technology could allow consumers to **verify their identity while there is no centralized storage of identity documents involved**. Moreover, it could empower people in developing countries with recognized identity. Blockchain offers an extremely **efficient way to capture, share and verify information**, and establishes a reliable, secure but relatively easy way for individuals to open a bank account, set up utilities, pay taxes, buy a car or make a purchase requiring personal ID.

## SOME EXAMPLES

- Civic
- Evernym
- Humaniq
- Matchpool
- Patientory
- Pillar
- [Shocard](#)
- ...



## BLOCKCHAIN FACTS

### Pros

- ✓ High level of security (minimize identities frauds)
- ✓ High level of accuracy and accessibility
- ✓ Interesting breakthroughs (Voting, Citizenship, ...)

### Cons

- ✗ Lack of regulation
- ✗ Lack of a commonly recognized standard
- ✗ Reliant on hackable ID data
- ✗ Central authorities might be required

# ENERGY MANAGEMENT & DISTRIBUTION

## DESCRIPTION

Blockchain could be used to develop a **peer-to-peer energy market**, which can guarantee that operational constraints are respected and payments are fairly rendered, **without relying on a centralized utility company or micro-grid aggregator**. Blockchain could be used to develop a digital contract permitting an individual party to **conduct and bill a transaction directly with another party (peer-to-peer)**. Moreover, it could be possible to develop a **decentralized energy trading systems** using blockchain technology, multi-signatures, and anonymous encrypted messaging streams, enabling peers to anonymously negotiate energy prices and securely perform trading transactions.

## SOME EXAMPLES

- **Powerledger**
- **Solarcoin**
- **The Brooklyn microgrid**
- ...



## BLOCKCHAIN FACTS

### Pros

- ✓ Micro grid enabler (less dispersion, lower prices)
- ✓ High level of transparency

### Cons

- ✗ Integration concerns
- ✗ Required interoperability and device standardization
- ✗ It is unlikely that individuals and companies will trade in the same market soon

# FINANCIAL TRANSACTIONS

## DESCRIPTION

Blockchain technologies can potentially allow the entire financial services industry to dramatically **optimize business processes** thanks to a new **secure, transparent and efficient system of data sharing**. The main benefits for the financial services would be: instant settlements, improved capital optimisation, reduced counterparty risk, improved contractual performance, increased transparency and reduced error handling and reconciliation. The most relevant applications could deal with:

- **Remittances**
- **P2P transactions**
- **Cross-border payments**
- **Derivatives**
- **Post-trade processing settlements**

## SOME EXAMPLES

- **0X**
- **Bitshares**
- **OmiseGo**
- **Populous**
- **Ripple**
- **Stellar**
- **Salt**
- ...



## BLOCKCHAIN FACTS

### Pros

- ✓ High level of speed and transparency
- ✓ Possibility of providing banking services to unbanked people

### Cons

- ✗ Lack of regulation
- ✗ High instability of cryptocurrencies underlying the services



FUTURE

FUTURE