



Accélérateur  
de la transformation  
numérique



# BLOCKCHAIN FOR SMART TRANSACTIONS: USE CASES AND CHALLENGES

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- **Who I am**
- **Blockchain@systemX**
  - IRT- SystemX
  - Blockchain@systemX
- **Blockchain: what we have to remember**
- **Blockchain use cases**
  - Energy marketplace
  - Decentralized Identity system
  - Crodfunding with blockchain
- **Technological and scientific challenges**

## Khalifa Toumi



An M.S. (2009) and Dipl.-Ing. (2009) degrees from ENSI  
A Ph.D. (2014) from Telecom SudParis



Cyber-security, Trust mechanism, Monitoring and test, blockchain



Supercloud, Inter-trust, ISER, IDOLE, VESTA, etc

## Me & the blockcahain

2017

### Design and development of blockchain based applications

- Security token offering platform (Ethereum)
- Car book registry (Hyperledger Fabric)
- Energy market place (Parity)
- ICO for a data marketplace (NEO)



### Blockchain trainer

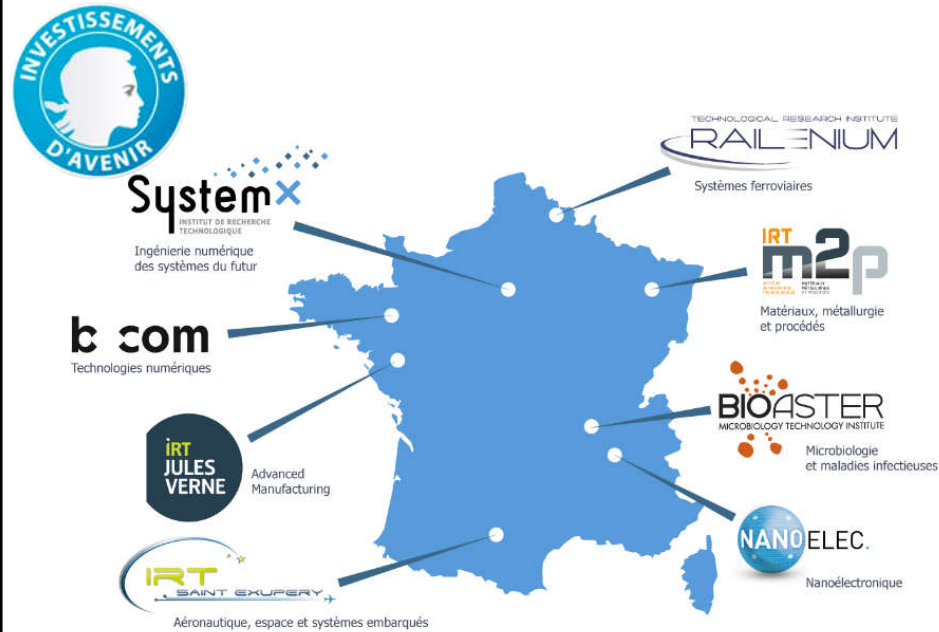
- ESSEC
- Telecom SudParis
- Telecom Paristech
- ESME

### Co-supervising of two phd students

- A novel blockchain framework for industry 4.0
- A new consensus algorithm for IoT



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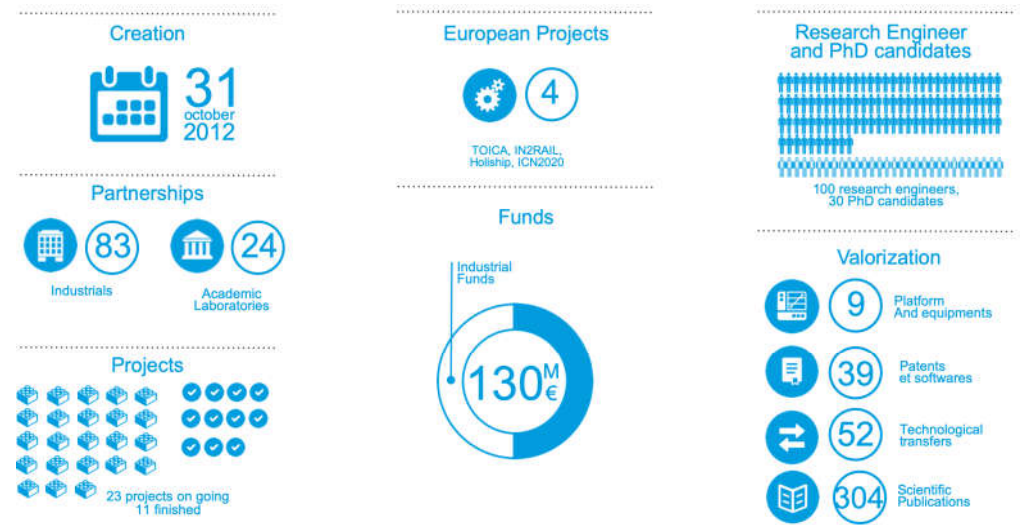
## Digital Transformation Accelerator

- Location: Paris-Saclay, Lyon and Singapore

- Founders :



- Some metrics:



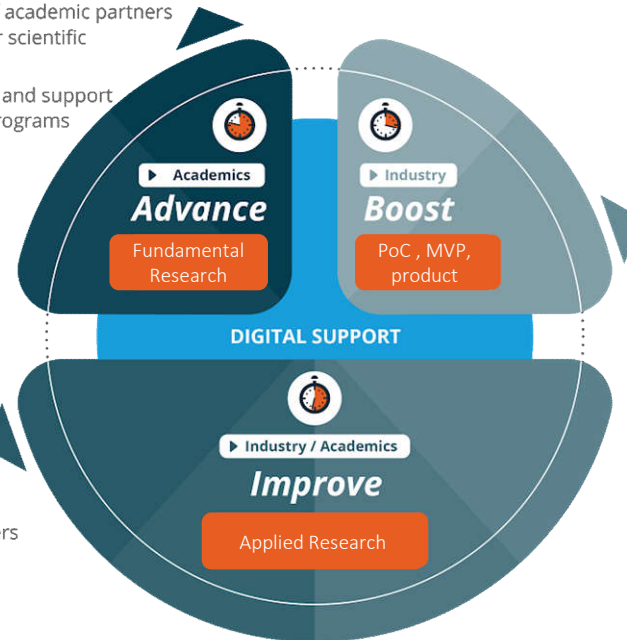
- SystemX: one of the 8 IRT**

- Scientific cooperation foundation created in 2012
- “Plan d’Investissement d’Avenir” initiative of the government
- Focus on computer science
- R&D activities through collaborative research projects



### Stimulate the production of knowledge

- Federation of academic partners around major scientific challenges
- Coordination and support of doctoral programs



## Blockchain Xdev

### Accelerate the use of technology for the value creation:

- Responding to innovation challenges
- Carrying out pre-industrial proofs of concepts





### Strengthen the collaborative R&D capacities of companies

- Resolving scientific and technical obstacles
- Accompanying the rise in skills of partners

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## Smart contracts

- Automate business workflows, rules and processes 
- Logics is executed exactly the same way on all nodes
- Cannot be modified without permissions 

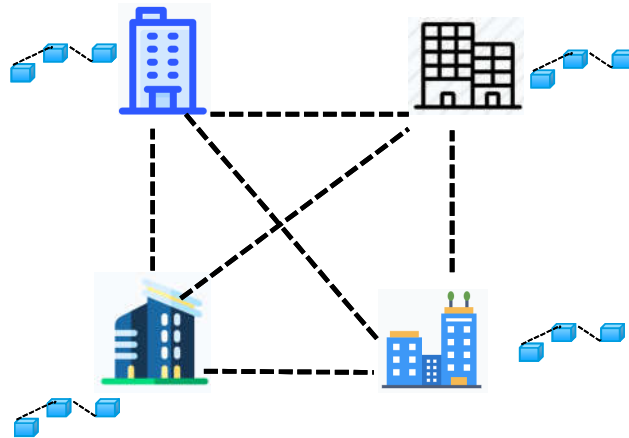
### Technologies

Peer to peer

Consensus  
 algorithm

Cryptography  
 protocols

Smart contract



### Key Benefits

Disintermediation

Resilience

Transparency

Immutability

Security

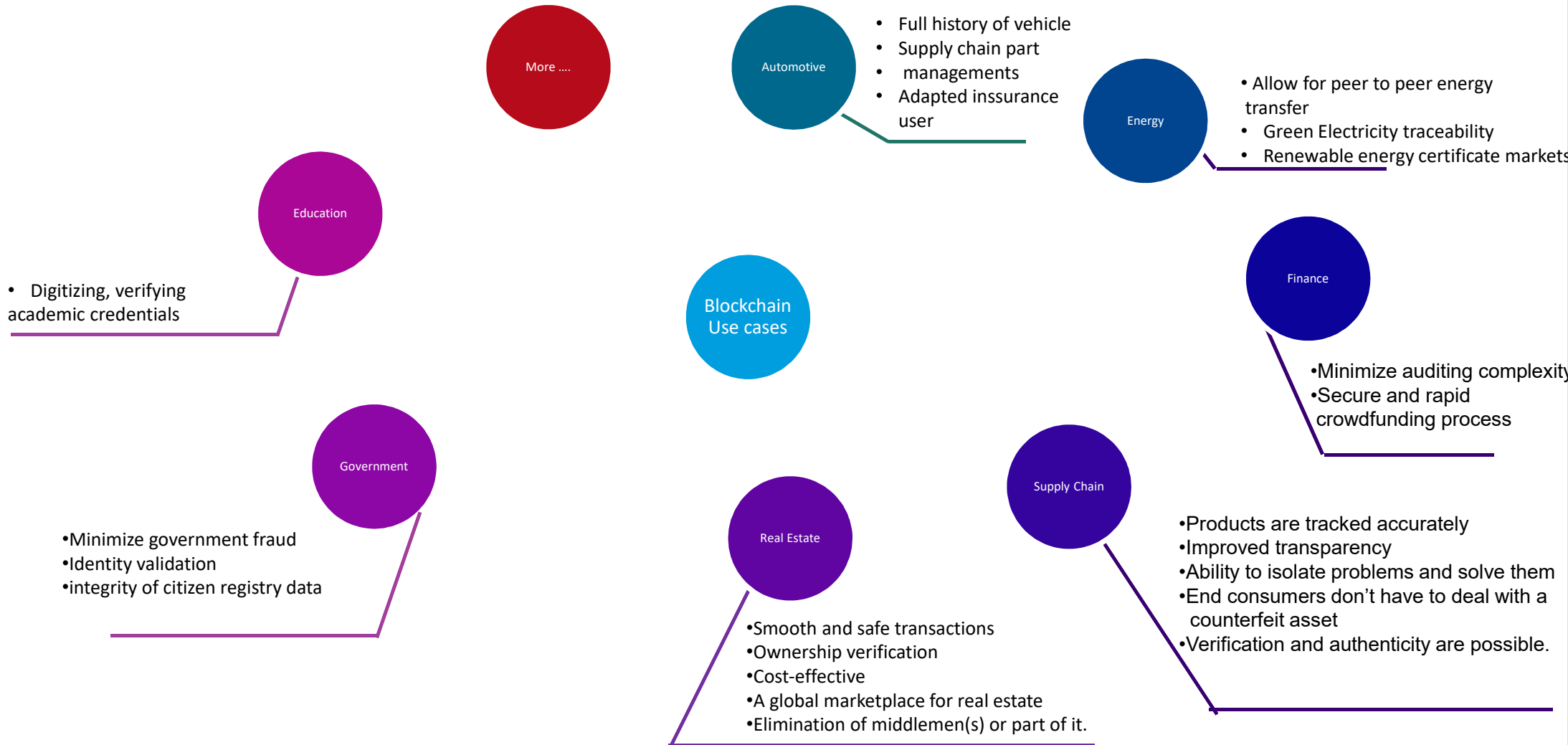
Autonomous

Accurate, always

Secured and fast



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2016-2019

BST project aims to demonstrate the uses and services that can be made possible by a decentralized trustworthy third party (Mobility and Energy)

**Blockchain renewable Energy Marketplace**

**Decentralized digital identity**



Blockchain green bonds market to improve the flow and reliability of exchanges between the many stakeholders involved in the sector (issuers, investors, certifiers, etc.).

**Security token offering (crowdfunding and exploitation)**

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## Socio-Political Context:

- Growing interest toward decentralized production and green energies
- Emergence of Smart Cities



## Economical Context:

- Increasing utility rates for consumers, decreasing rates for producers



## Evolution of Legislation:

- In France, people can exchange energy on local grids  
→ New needs of decentralized energy trading system



## Goals

- **Validate the technical feasibility of a blockchain based Energy Market Place**
- **Study the economical impact of such system**
- **With different real world scenarios**

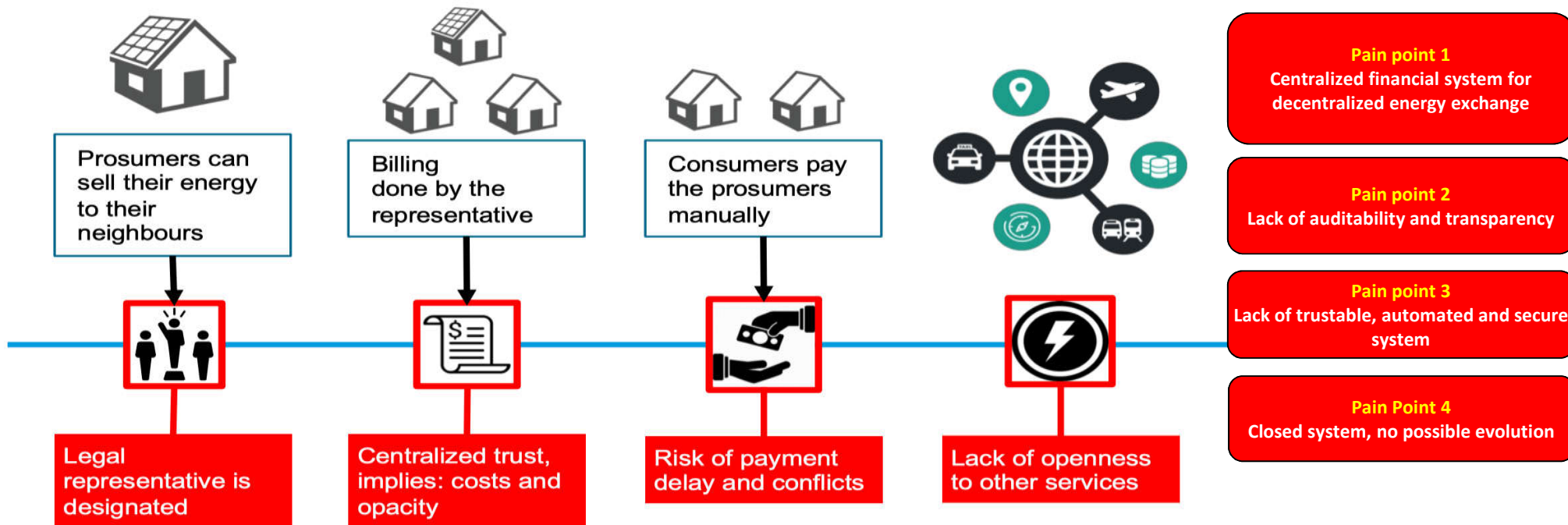
## Challenges

### V1.0

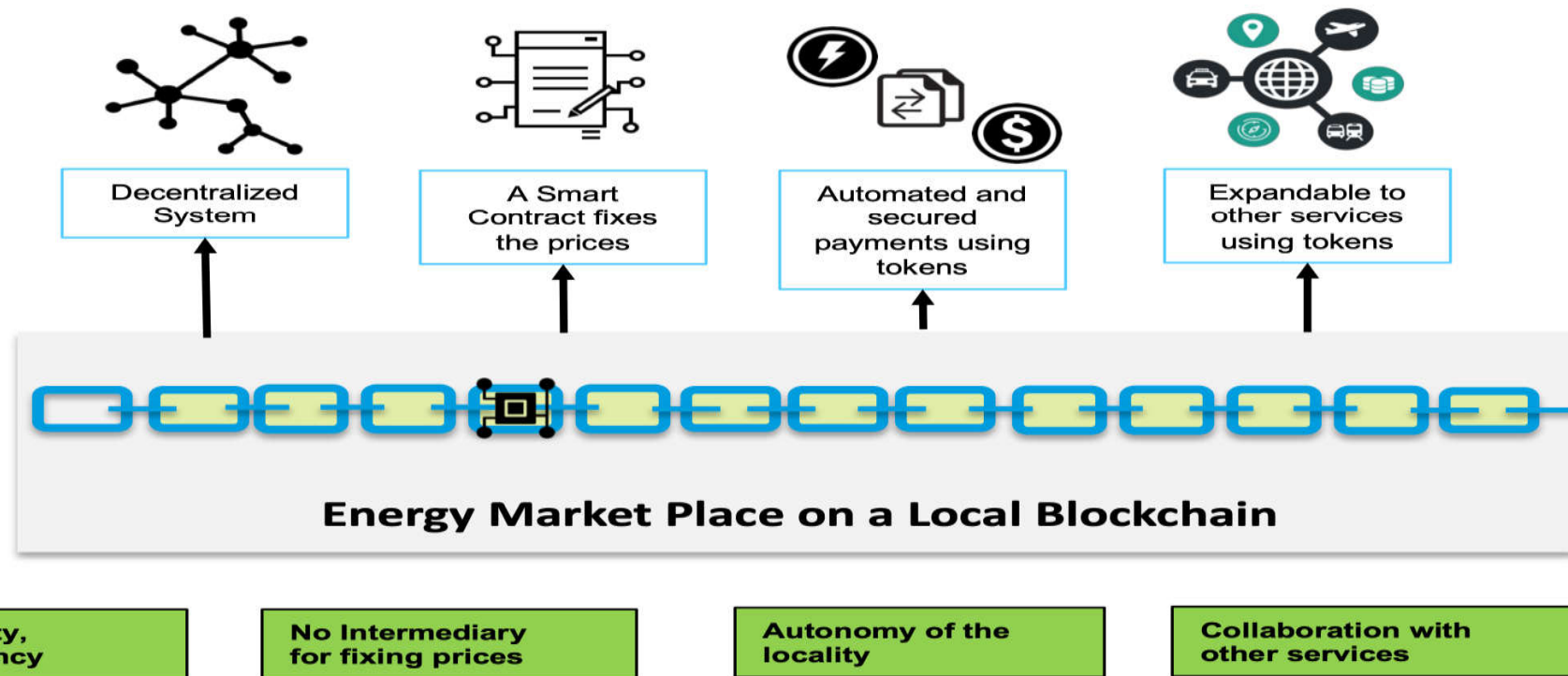
- **Real world data integration**
- **Pricing and bills (Tokenomics)**
- **Multi-agent simulation tools**
- **System performance and scalability**



Current context & pain points



Blockchain solution benefits





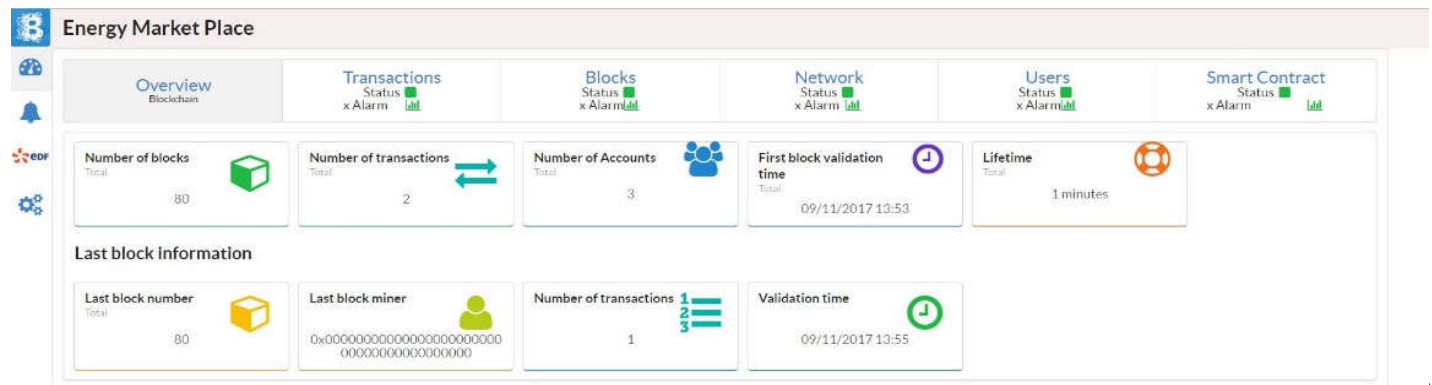


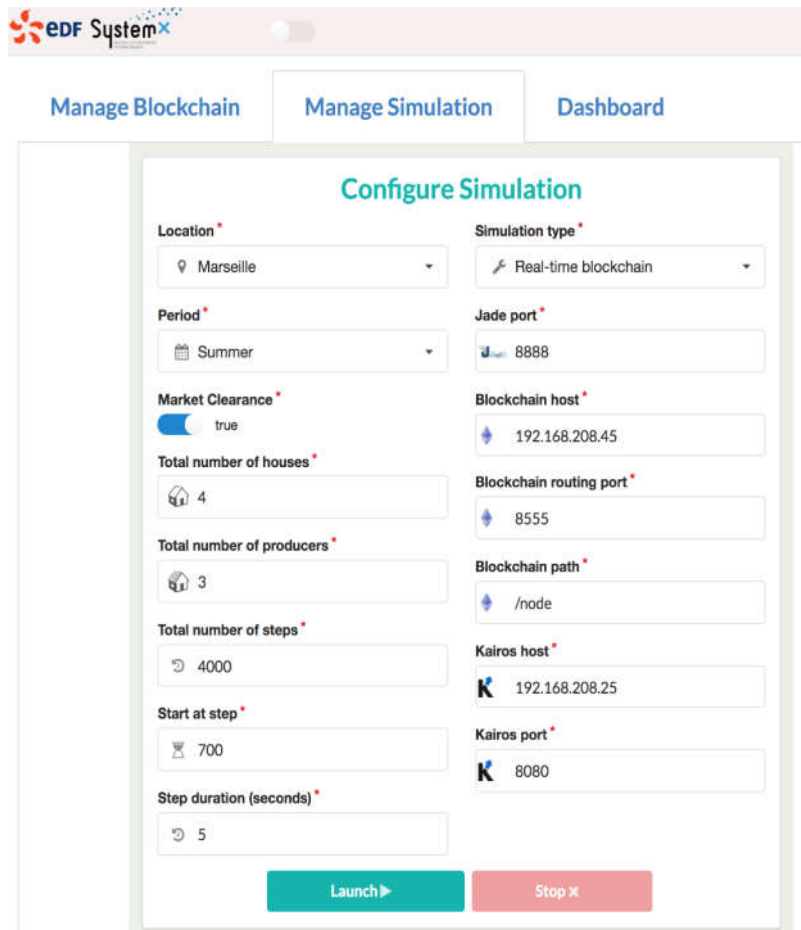
## Results

- PoC (TRL 3-4)
- Physical demonstrator (RPI)
- **Evaluation on terrain with 7 houses (Renardières)**
- Academic Paper
  - Brousmiche, K.L. et al. "Blockchain Energy Market Place Evaluation: an Agent-Based Approach" IEEE IEMCON, Vancouver, 2018
- Performance benchmarking
- Study of network topology effects
  - Dib, O. et al. "Consortium Blockchains: Overview, Applications and Challenges" Journal of International Academy, Research and Industry Association, IARIA, 2018.

## Blockchain monitoring :

- ✓ **Performance** (transactions, blocks, network, etc.)
- ✓ **Activity** (users, smart contracts)
- ✓ Etc.





**Configure Simulation**

Location: Marseille

Simulation type: Real-time blockchain

Period: Summer

Jade port: 8888

Market Clearance:  true

Blockchain host: 192.168.208.45

Total number of houses: 4

Blockchain routing port: 8555

Total number of producers: 3

Blockchain path: /node

Total number of steps: 4000

Kairos host: 192.168.208.25

Start at step: 700

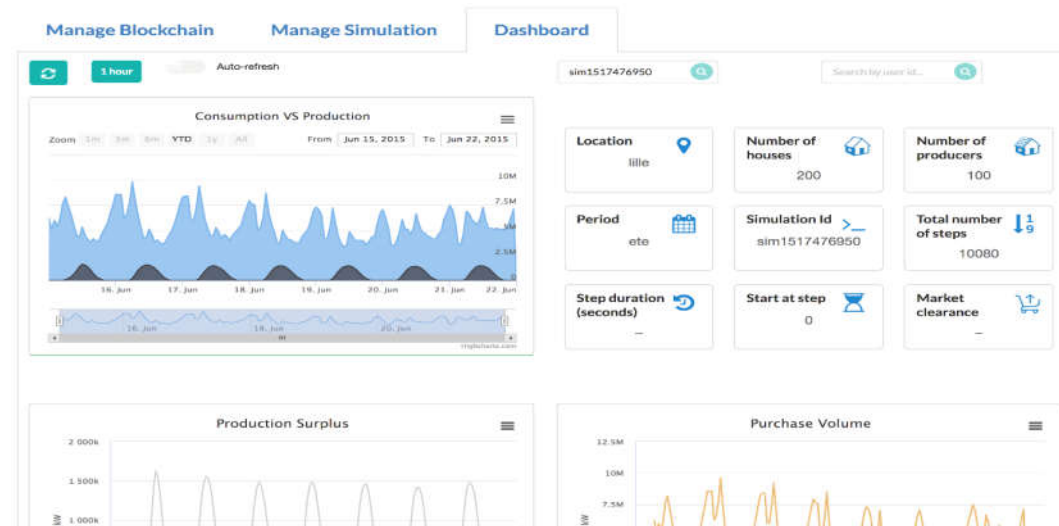
Kairos port: 8080

Step duration (seconds): 5

**Launch** **Stop**

## Results

- Simulation tool
- 200 households
- Location: near Marseille (southern France)
- Period: Summer and Winter
- Producers/Consumers ratio: variable



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## What:

- A permanent collection of an online data about an entity

## Social:

- By 2021, 4 billions of people will be digitally connected

## Security:

- Nearly 60 million Americans were affected by identity theft in 2017 alone
- Over 6,500 incidents that resulted in compromised data were disclosed publicly in 2018

## Cost:

- The average monetary cost of identity fraud is \$263 per person affected
- The yearly total cost of identity theft is above \$16 billion



## What

- A permanent collection of data about you that is online
- A digital representation of an entity

## Can be

- Static, Biometric, Social or Behavioral

## Size

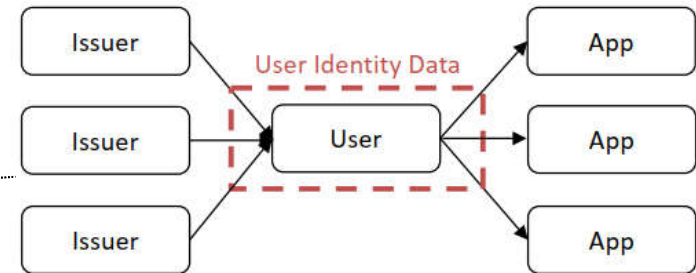
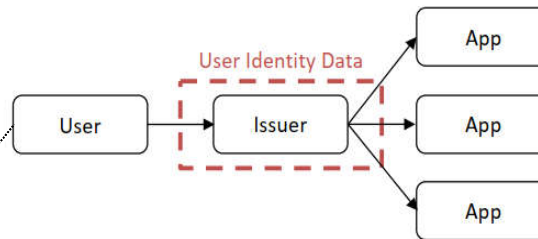
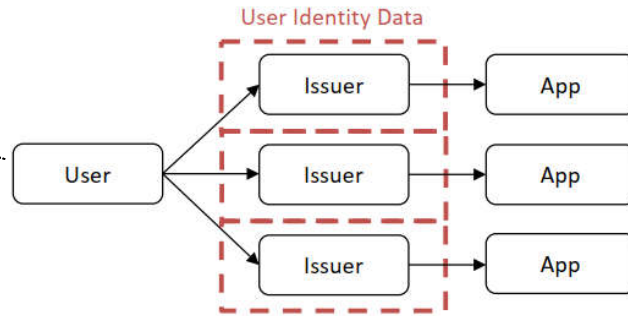
- Limitless potential number of attributes

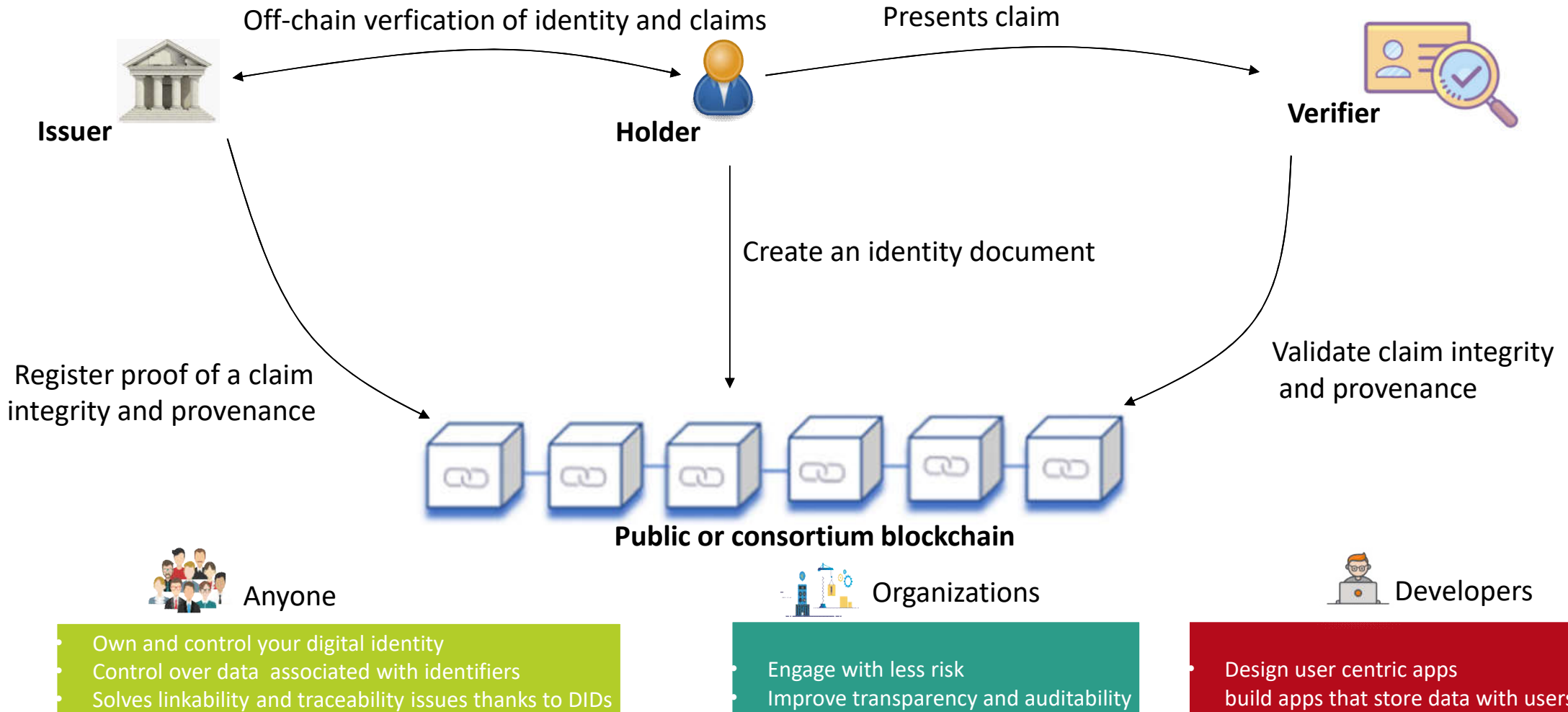
## Evolution

- A constantly growing and evolving collection of data points

# Online Identity

- Centralised
- Federated
- User-centric







Technology  
& Standard



Legal



Performance



Tokenomics



Security & Privacy



Governance



Interoperability



Maintenance