Kick-Off Meeting CNIS 2019

BlockChain

Eudes MOULANIER
(Intel)

Önder GÜRCAN
(CEA LIST)

Discover How MAX can Help Your Organization Harness the Power of Blockchains

Dr. Önder Gürcan

Trustworthy, Smart and Self-Organizing Information Systems Laboratory
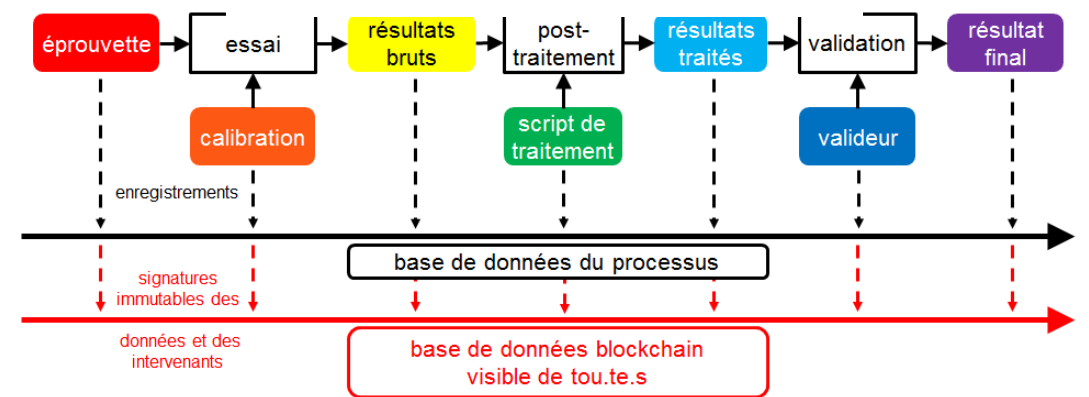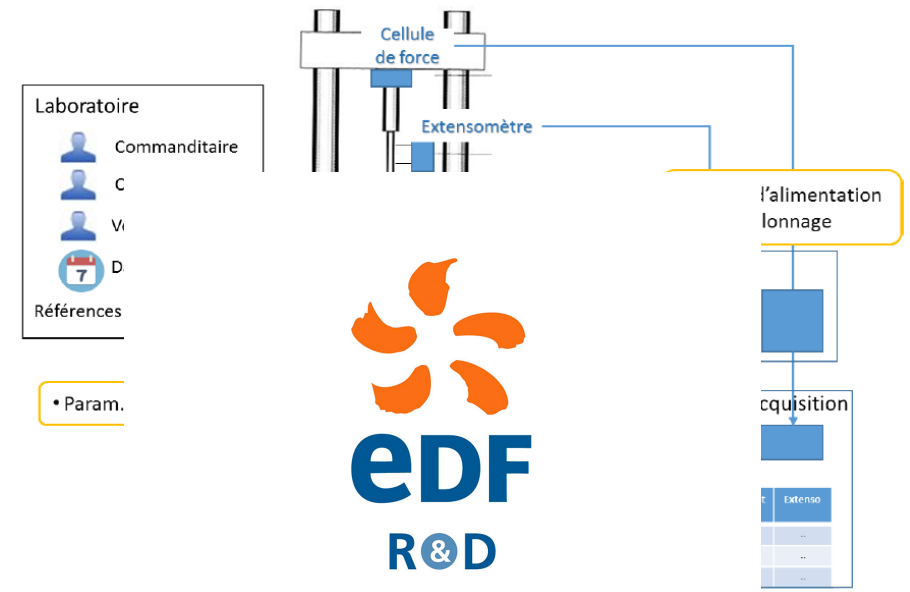CEA LIST

25.09.2019

Challenge

- Companies face highly competitive (and complex) industrial cases

  - that have technical problems: data reliability, confidentiality, archiving, ….

- which are being constantly reshaped by client demands, technology and regulatory requirements.

  - Client demands: e.g., performance (# of transactions/minute), fees …

  - Technology: e.g., blockchain protocol, parameters, cost …

  - Regulations: e.g., standards, laws, GDPR …

- Challenge:

  - Carrying out feasibility analysis in a realistic manner,

  - Rapid prototyping.

Some examples
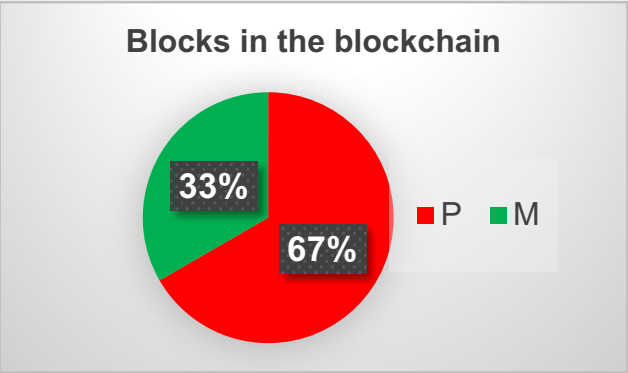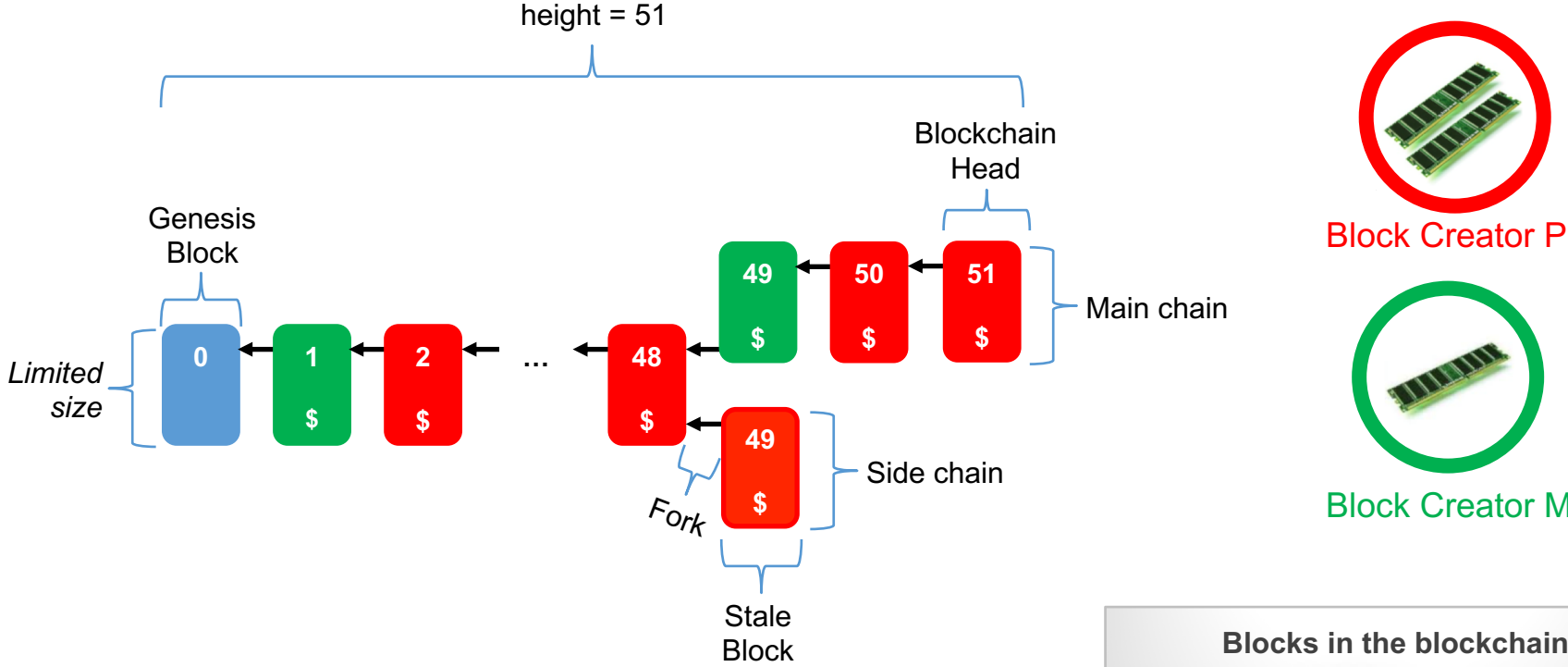
Energy Performance Contracts

Audit of Food Supply-Chain

Certification des essais de traction mécanique

Our Solution: MAX

- Providing a scalable, enterprise ready platform (MAX) that harnesses the power of agent-based modeling (and AI) to unlock the power of advanced simulation for blockchain systems.

  - Optimize **the performance** of your execution systems and algorithms in order to attract and retain participants (e.g., clients, users).

  - Explore **extreme situations**, accurately model their impact and better design your system.

  - Reduce your cost by using a **virtual environment**.

  - Run multiple **what-if scenarios** for a range of use cases to proactively revise your strategy.

Anatomy of a Blockchain

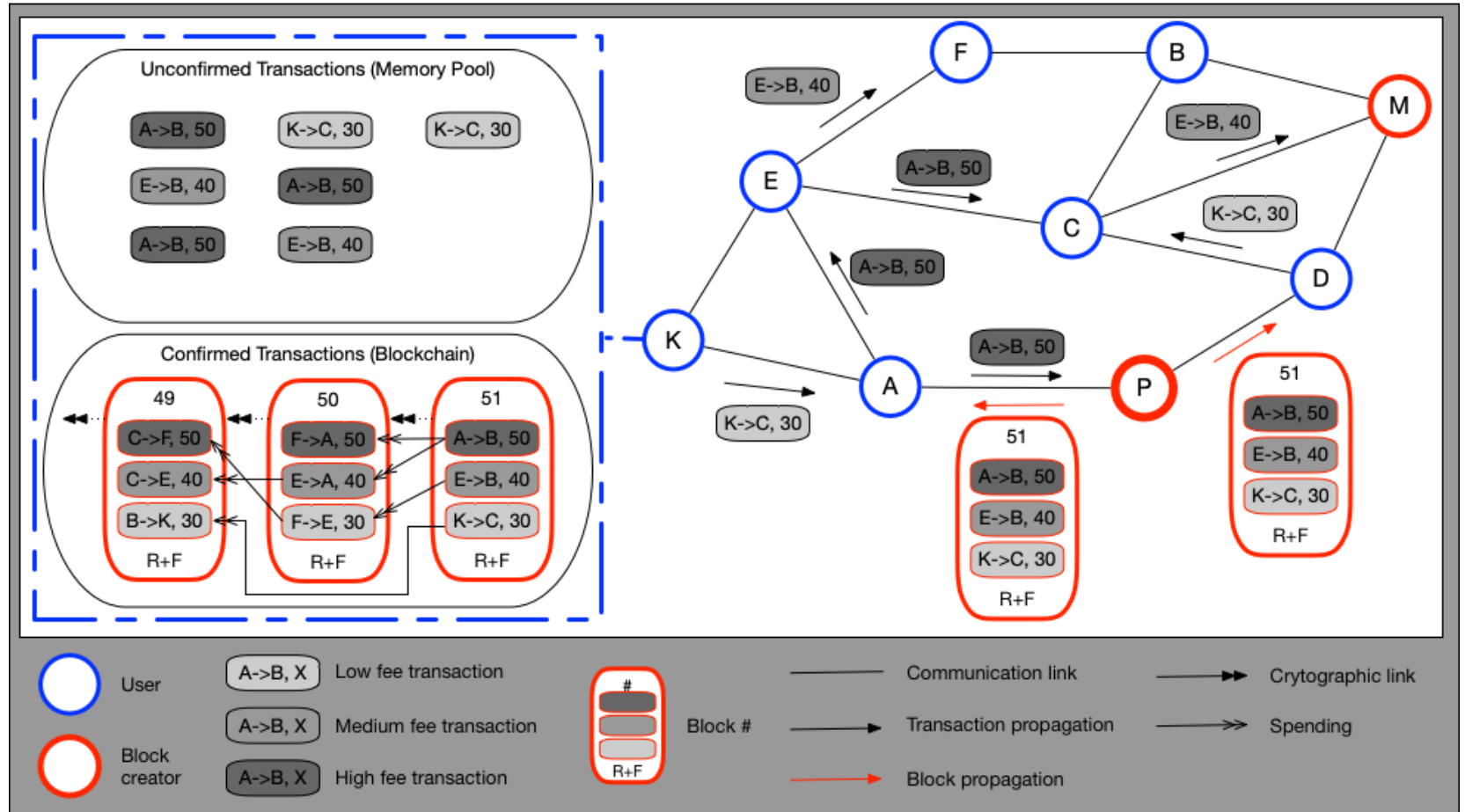height = 51

Blockchain Head

Genesis Block

Main chain

Limited size

0

1 $

2 $

...

48 $

49 $

50 $

51 $

Fork

49 $

Side chain

Stale Block

Block Creator P

Block Creator M

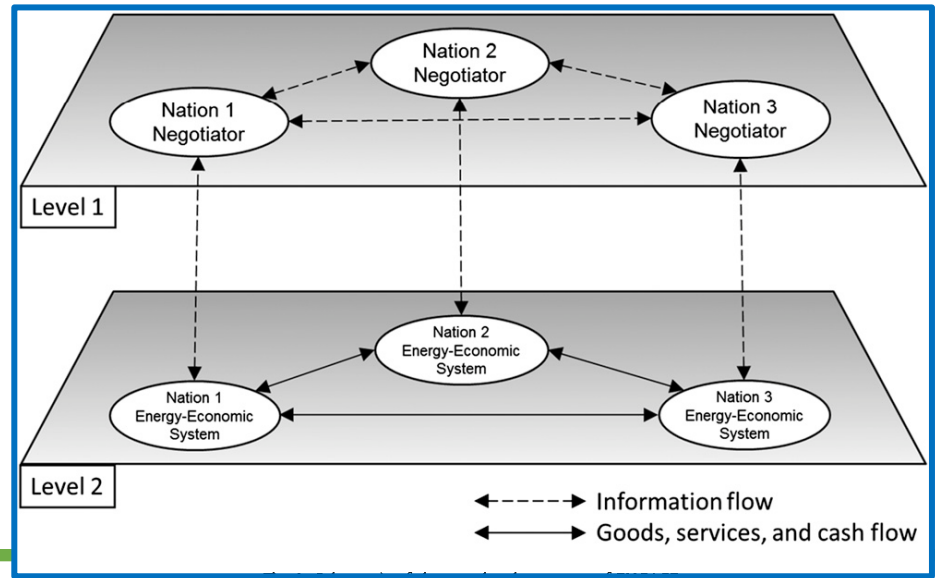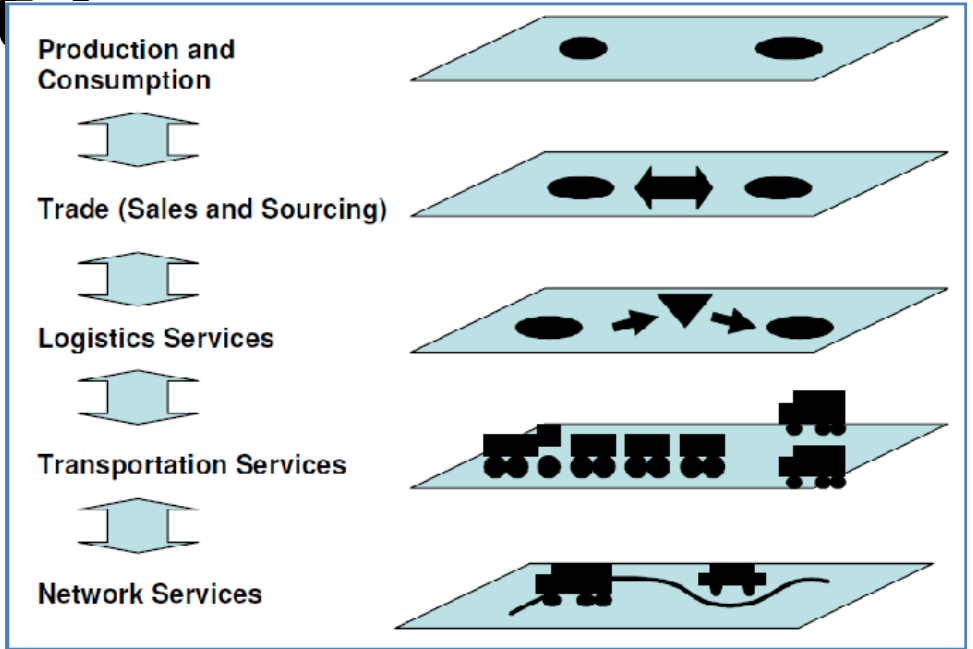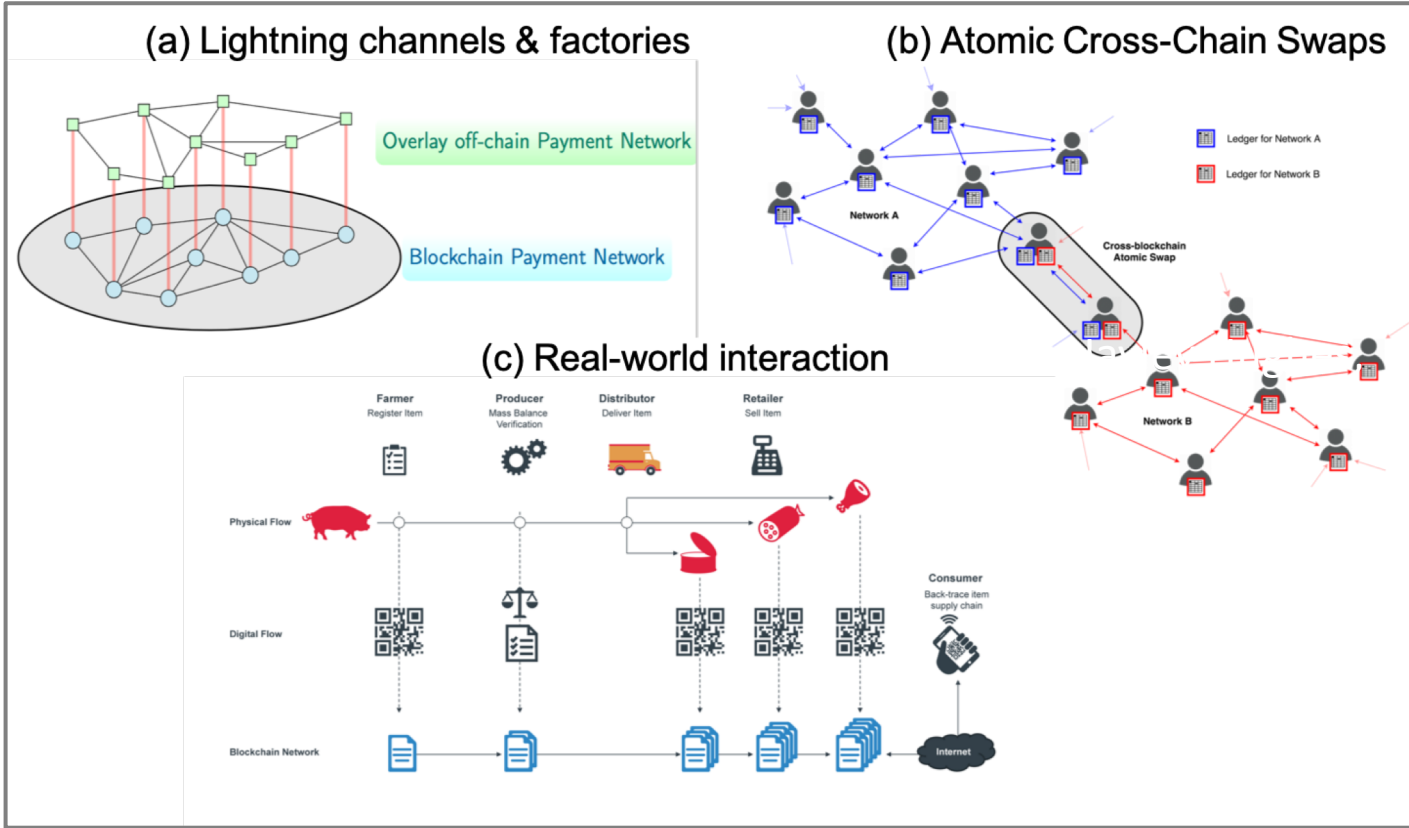**Blocks in the blockchain**

Quality of the chain

33%

67%

P M

Blockchain Systems

- **Open**, **dynamic** and **distributed** system

- **Social** and **economical** system

- **Multiple heterogeneous** layers/environments and **multiple roles**
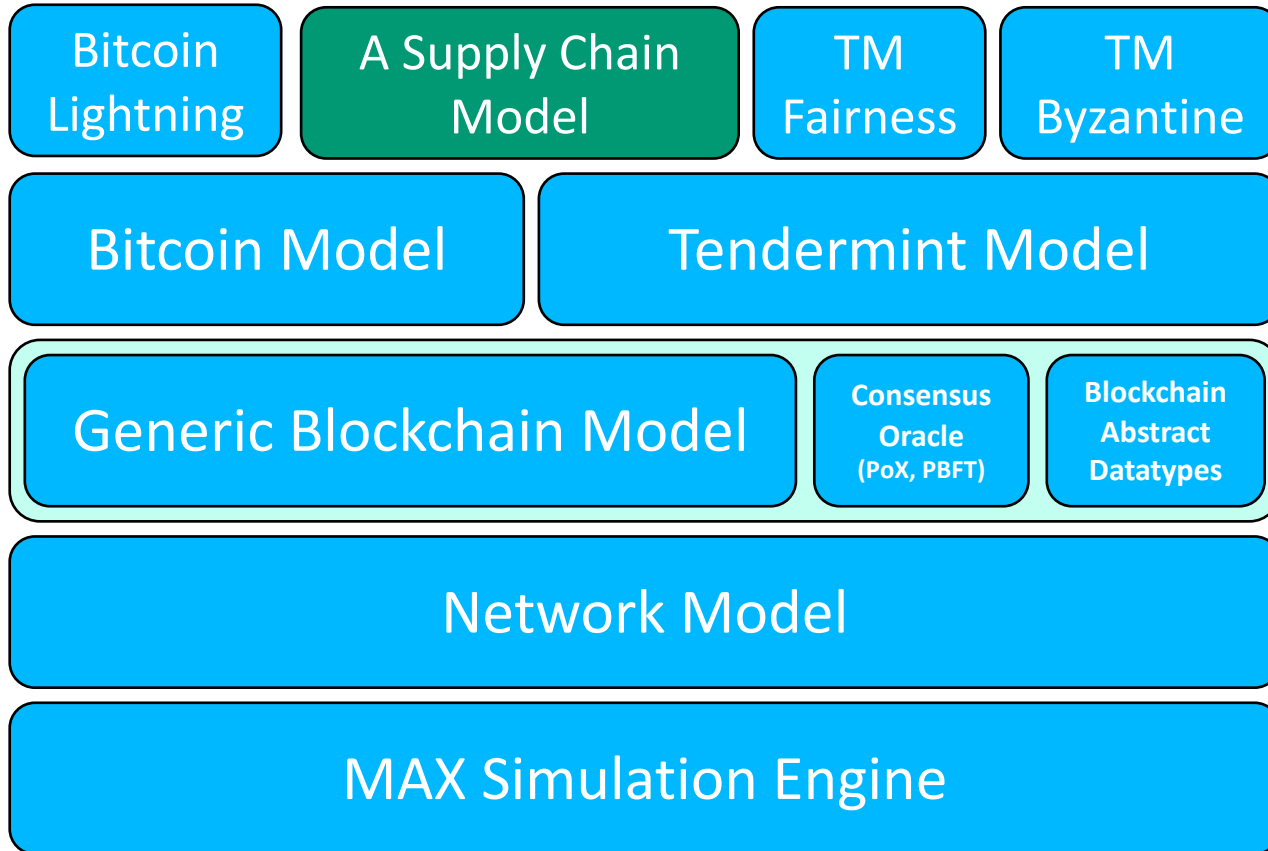
- **Intelligence** can be added!

Blockchain Systems (cont)

(a) Lightning channels & factories

Overlay off-chain Payment Network

Blockchain Payment Network

(b) Atomic Cross-Chain Swaps

Ledger for Network A
Ledger for Network B

Network A

Cross-blockchain Atomic Swap

Network B

(c) Real-world interaction

Farmer — Register Item
Producer — Mass Balance Verification
Distributor — Deliver Item
Retailer — Sell Item

Physical Flow

Consumer — Back-trace item supply chain

Digital Flow

Blockchain Network

Internet

Production and Consumption

Trade (Sales and Sourcing)

Logistics Services

Transportation Services

Network Services

Nation 2 Negotiator
Nation 1 Negotiator
Nation 3 Negotiator

Level 1

Nation 2 Energy-Economic System
Nation 1 Energy-Economic System
Nation 3 Energy-Economic System

Level 2

Information flow
Goods, services, and cash flow

Multi-Agent Experimenter (MAX)

Bitcoin Lightning	A Supply Chain Model	TM Fairness	TM Byzantine

Bitcoin Model	Tendermint Model

Generic Blockchain Model	Consensus Oracle (PoX, PBFT)	Blockchain Abstract Datatypes

Network Model

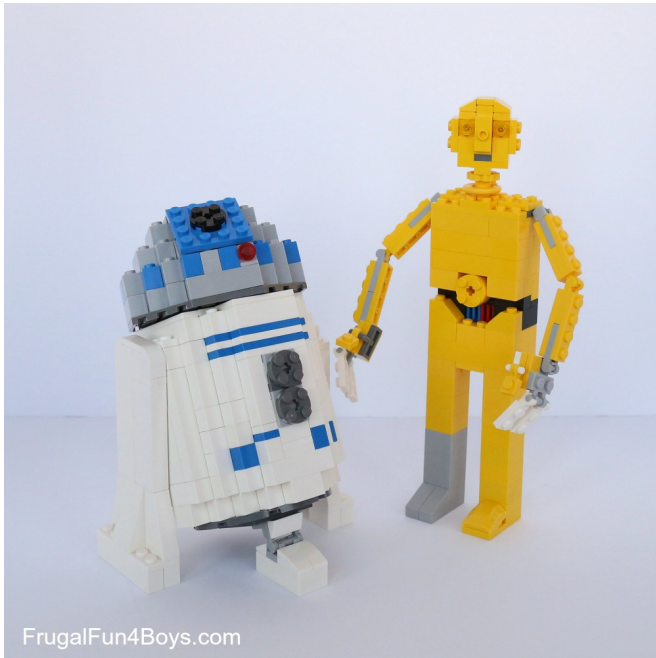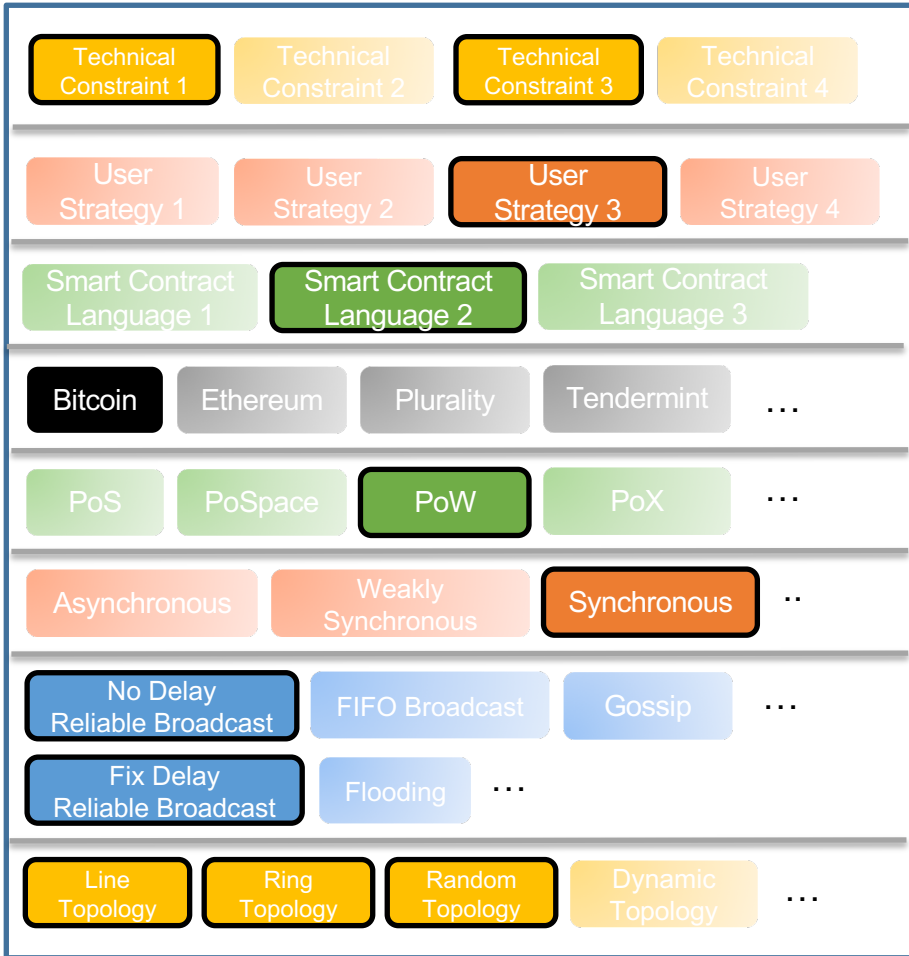**MAX Simulation Engine**

- a **modular framework** for agent-based simulation and agent-based applications building.

- the **objective** is
  - to make **rapid prototyping** of industrial cases and
  - to carry out their **feasibility analysis** in a realistic manner.

- allows automated **verification**, **validation** and **testing** of models.

Multi-Agent Experimenter (MAX)

- Provided **abstractions**: Agent, Environment, Action, Role, Organization, Strategy, Plan, Emergence, …
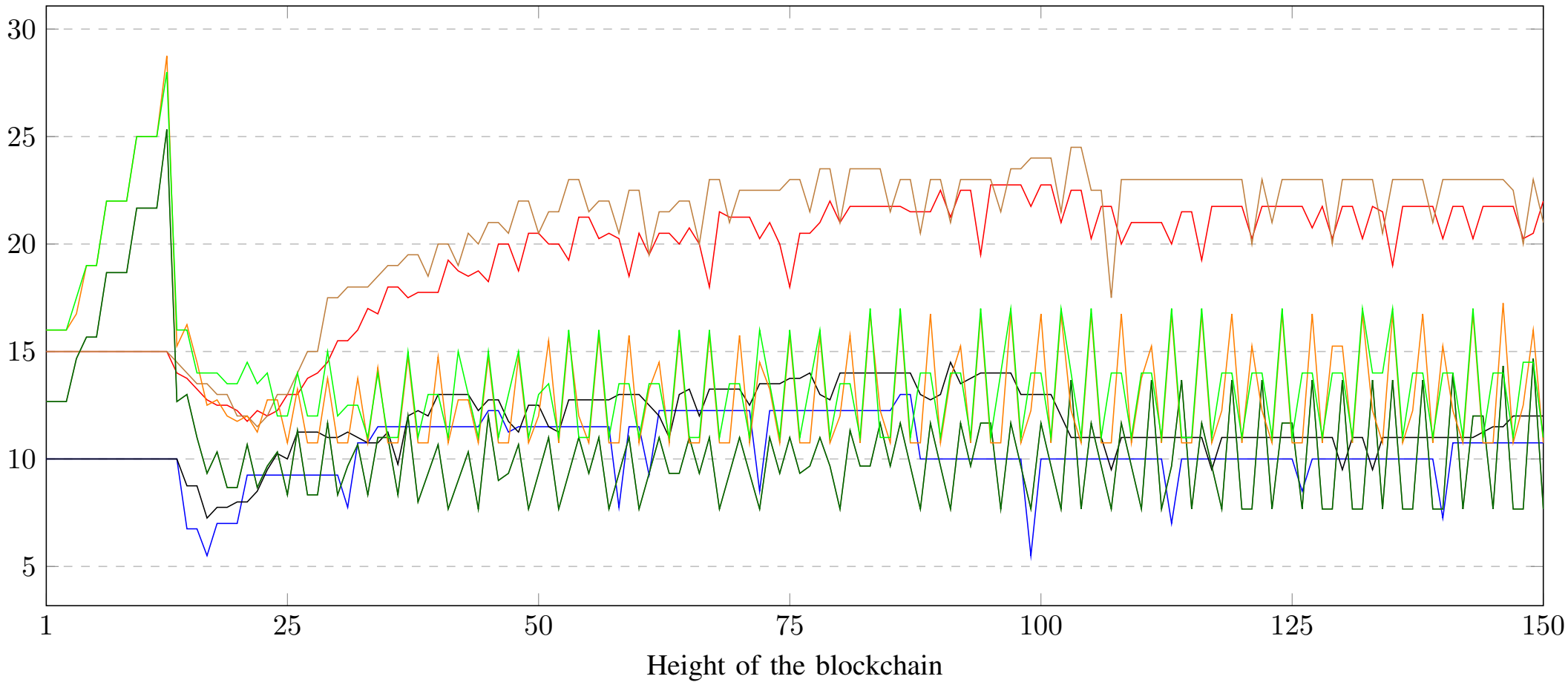
Modeling and Design of Possible Configurations

- Various combinations different bricks.

- Various combinations of system parameters

- Automatic batch execution of all possible scenarios and reporting in a single click.

Analyses of Possible Configurations

Height of the blockchain

Ex 1 — Ex 2 — Ex 3 — Ex 4 — Ex 5 — Ex 6 — Ex 7 — Ex 8

Conclusions

- MAX is an **analytical tool** that

  - aims to foster innovation and experimentation

  - with the use of an AI technique called agent-based modeling,

  - which provides necessary abstractions and properties for **realistic modeling** of blockchain systems,

- Using MAX, it is possible to use/integrate other AI techniques like

  - machine learning and

  - **reinforcement learning**

Thank you!