Rapid Prototyping and Simulation platform for smart contracts connected to sensors

Summary
Smartys is a startup and part of the Weconomics accelerator program 'New Entrepreneurship.' Smartys develops prototypes and simulations to accelerate the adoption of data-driven organizing with the internet of things, blockchain, smart contracts, and artificial intelligence, collectively referred to as the digital assembly line.

An essential condition for using the digital assembly line is not so much the technology but letting go of dominant logic in combination with a new perspective on organizing office work. Because data and a radically new way of organizing are rather abstract and a far-from-their-case for many people, simulations help. To this end, Weconomics is expanding the existing simulations with a Rapid Prototyping Platform for Simulations (RAPS). RAPS can be used primarily by professionals, teachers, and students with a background in or from the following courses of study: purchasing, logistics, supply chain management; business administration, business economics, financing, accountancy; computer science; HR; architecture, build environment, and facility management; marketing and communication.

Introduction
Prototyping and simulations play an important role in adopting new organizational models and data technologies. Data, data-driven organizing, and the digital assembly line are still abstract for many people. That is why Weconomics invests a lot in data wisdom: what is data, and how can you best organize the supply and demand of data? The Smartys simulation platform plays an essential role in this, both for the business community, the government and for educational and research institutions. By simulating a use case (a process in a market, supply chain, or ecosystem) using a real digital assembly line, participants will see for themselves how they can combat not only data waste but also reduce costs and lead times, improve quality, and better guarantee privacy and security. Furthermore, they can experience how to reduce complexity and bureaucracy and reduce the power of tech/platform companies. As a result, we as humans have more time to make our prosperity more sustainable: 'driven by social innovation, empowered by technology.'

Smartys is powerful in its simplicity. The prototyping and simulation platform was designed and built using Ethereum and initially based on a logistics use case for temperature-controlled transport. For the smart contract, the simulation uses data from IoT sensors. Participants in a simulation organize transport in a role play and register the order and transport conditions in several smart contracts. Sensors measure the temperature during the simulated transport. Depending on whether the transport conditions are met, the smart contract distributes the Smartys tokens to the various parties in a fully automated financial settlement.

At the beginning of 2020, Smartys received two EU Horizon grants to develop the platform further. They were selected from 125 blockchain projects. In doing so, they distinguished themselves from other projects because they were the only project without yet another use case to promote blockchain technology. They came with the Smartys simulation to promote education and awareness. Smartys has one message: accelerating the adoption of the blockchain-based digital assembly line. The initial simulation has now been extended to many other applications for all kinds of sectors.

Prototyping and simulations play an essential role in the organizational designs and transformation programs that Weconomics develops for its clients. Weconomics is not a traditional company but is decentralized into a network organization of enterprising professionals. Under the motto: 'not big tech or deep tech, but beyond tech,' Weconomics aims, among other things, to advance ideas, projects, talents, development programs, and

startups faster without the necessary administrative, legal, financial, and tax hassle for entrepreneurs, professionals, and educational institutions.

Developments
Given the poly-crisis in which we find ourselves, we, as humanity, have arrived at a point where we are rethinking the starting points from which we want to shape our society. Thinking about how we organize our work and make our prosperity more sustainable. The next step could be transitioning to a durable, data-driven, decentral society and economy. A society with far fewer local IT systems in which institutions and technology are not leading but serving.

The transformation to a durable, data-driven, and decentral future is necessary and in full swing. What role does your educational curriculum, research program, or organization play in this? More and more organizations are going data-driven. No longer reasoning from the company's perspective but from new entrepreneurship, people, and data. There is no local HR-, CRM-, or accounting system but a digital assembly line within a data-driven ecosystem. We have the technology to make a complex world simple. We have the technology to create a shared, secured and accessible reality. No longer taking IT as a starting point, but data. Even hyped trends like machine learning and artificial intelligence cannot do without rich data. But what exactly are data? And what are the characteristics of rich data, and how do you organize the production and consumption of data?

We all tend to keep reality in our local IT systems, but this is a reality of our own and often not a shared, secured, and accessible reality. The fact that, despite billions of investments, we hardly become more productive and that we often spend more than a third of our time requesting data from other parties says it all. In any case, you must ensure that agreed facts are stored in such a way that they cannot be manipulated unilaterally. Then you organize access to data. So no longer pursuing data ownership but organizing access to data. The GDPR is very clear about this with data minimization.

The future of every organization depends on the answer to the question: how data wise or mature are you, and is your organization data-driven, sustainable, and decentralized? How do you ensure that unnecessary processes in supply chains disappear and that necessary processes run more safely and efficiently? Not always by listening to your IT department, existing software supplier, or consultancy firm. They may have other interests, old factory-DNA and take too little account of the relative simplicity of data and data organization.

We all know the saying: you can make anything with Lego. The same goes for data. What electrification meant to factories, datafication means to offices. What the physical assembly line is to factories, the digital assembly line is to offices. But how will you set up and use the digital assembly line as an organization? How will you let go of your dominant logic and organize it fundamentally differently? What are the consequences for your operating model or educational curriculum? Before you decide on radical changes with high investments, it is wise to make future systems transparent with prototyping and simulations so that people understand, trust and embrace it.

What is Prototyping?
For many, the transformation to a future-proof, data-driven, and decentralized organization is still abstract and a far-from-their-bed show. Prototyping can be used to understand the transition to a new reality better. A prototype for data-driven organizing is a model for future interactions and transactions (value exchanges). The value that is transferred from provider to demand can be a service, product, or, for example, an users right. With a prototype of a digital assembly line, technologies, components, rules, or, more generally, conditions can be tested before a system is actually used in practice.

Rapid prototyping is a collective name for various techniques that make it possible to design and develop prototypes quickly. A platform for prototyping must ensure that you can simulate different detailed use cases with multiple variables, actors, and circumstances with minimal IT knowledge. RAPS uses various components such as oracle

technology, IoT, blockchain, digital twin/tokenization, smart contracts, rich data, data logistics, and AI. Together this is also referred to as the digital assembly line**.**

Sequel to the first Smartys simulation
Smartys is an existing simulation in which a smart contract is connected to a specific transport performance. The simulation consists of three actors: supplier, customer, and transporter, and one variable: temperature. The transporter is paid a predetermined number of tokens based on the determined transport temperature conditions. This use case is now programmed in a certain way where you cannot just add an actor or change a variable. As a result, it is currently impossible for students/teachers, or professionals to quickly simulate other use cases. With RAPS, this becomes possible so that the practical feasibility and applicability of the digital assembly line become more transparent.

Purpose of the RAPS project
The purpose is to develop the current Smartys platform into a rapid prototyping platform for simulations. In the figure below, from use case to simulation. This allows students/teachers, and professionals to realize pilot projects in an accessible manner. This enables the operation of the digital assembly line to be shown, tried, and tested in an experience lab environment. It allows users to do this without any programming knowledge. Users can simulate different use cases with RAPS. This also allows cost and time savings to be calculated. It is not the intention that organizations with RAPS can actually apply a use case in a practical situation (a so-called business case). For now, the only aim is to demonstrate that the concept of the digital assembly line works and brings benefits. RAPS help you to develop a Minimum Viable Product. In combination with other Weconomics tools you als develop a Minimum Viable Ecosystem.

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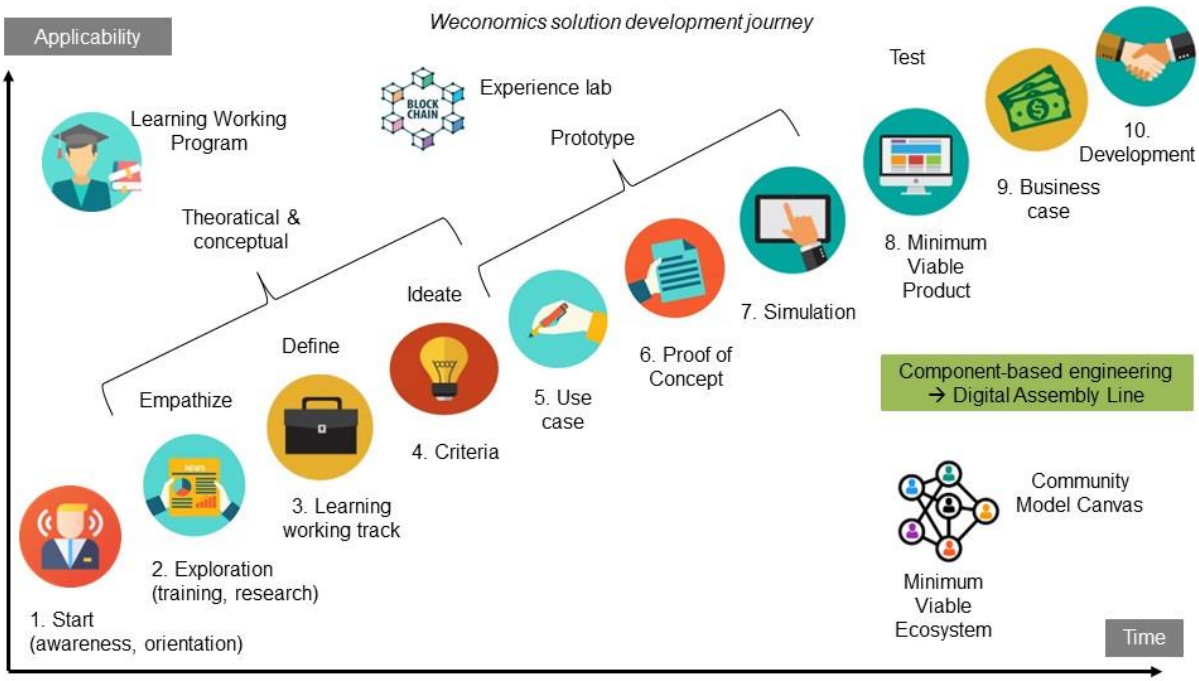

Different actors
A digital assembly line operates within a data-driven ecosystem, not within a single organization. A use case involves different actors who play different roles in interactions and transactions. Examples of actors within different domains/processes are:
- supply chain management: supplier, client, and carrier;
- verifiable claims: issuer, holder verifier;
- building management: owner, landlord, tenant, cleaning services, and maintenance
- education: organizer, participant, trainer, verifier;
- recruitment: employer or client, intermediary, employee or contractor.

Different variables
With RAPS, the current situation can be compared with an ideal situation (digital assembly line with minimal friction) with regard to various variables. Examples of these variables are weight, temperature, delivery time, humidity, CO2 emissions, energy consumption, loading time, unloading time, lead time, damage, completeness of the order, fall detection, cross-dock time, light, age, previous education, safety certificates, and nationality.

Different use cases
Several different use cases can be built within RAPS, here are some examples:

1. Conditioned transport
This case contains three actors: supplier, transporter, and customer. The temperature is measured during the transport of stroopwafels based on calibrated and validated sensors. The measurement results come as an oracle on a blockchain, and a smart contract ensures automatic settlement with the transporter. If the temperature rises above 30 degrees, the transporter will not be paid (entirely) because the stroopwafels can no longer be sold.

2. Blokko
Blokko simulates ordering products via LEGO serious gaming. Participants in the simulation must place orders and arrange transport. The chain from raw material to end product is simulated. They must sell the products, make production schedules, and organize transports. Blokko simulates the complex world of supply chains where different roles, such as purchasing, finance, production, and distribution, work together.

3. Certificates on the blockchain
When a student has followed the Weconomics learning-working program, the certificate is hashed and placed on a blockchain. As a result, the participant and organization can consistently demonstrate that a specific person has followed the training and has successfully completed it with a certificate, theoretical diploma, or diploma.

4. Verifiable claims
To be allowed to participate in a particular course, the student must be at least 18 years old, a resident of the EU, and have at least a higher vocational education diploma. Blockchain technology (Zero Knowledge Proof) can demonstrate that a person meets the conditions without disclosing the underlying data, such as date of birth, education, and nationality.

5. NFT with Copernicus
Copernicus is a simulation to produce, sell and buy non-fungible tokens (NFTs). Once the NFT has been created in the blockchain, you can start trading it on a marketplace. With this use case you understand how wallets, tokens, blockchains en smart contracts work.

6. Transport performance
Validated and calibrated cameras can determine when a truck leaves the loading dock of A and arrives at the loading dock of B. If the agreed transport time deviates by more than twenty percent for example, the transporter will be paid less via a smart contract.

7. Warehouse performance
Using a scale, the total weight of a pallet can be compared with the packing list and the packing list with the order. A more advanced method is to add NFC chips (Near Field Communication) to products: contactless communication technology that uses an NFC chip with a range of about 10 centimeters. For example, it can be determined whether the products on a pallet or in a box match the packing list. Based on the measured values and smart contract, the products can or cannot be taken from a pallet to the warehouse.

8. Safe2Office
Based on CO2 sensors, for example, the maximum number of visitors in a meeting room can be determined. Or, based on the dust filter, it can be determined how many dust

particles there are on average in a particular room, based on which a cleaning service can make an offer or planning faster and cheaper.

Different components
RAPS uses various technical components. Some examples are: Hardwario (sensors), Raspberry PI (single board computer), QR display and scanner technology, NFC tags, and scanner, MQTT (Messaging Queuing Telemetry Transport, a protocol to get sensor data on a blockchain), API (Application Programming Interface), DAPPS (Decentralized Apps), storage platforms (IPFS, Inter Planetary Files Server, SWARM), blockchain platforms (Ethereum Goerly, Polygon, Parity/Substrate/Polkadot), Web3 and storage connectors (Infura, Moralis, own nodes)

Experience lab for data-driven organizing
Weconomics has set up an experience lab for data-driven organizing together with Twice and LCB. Components of the digital assembly line can be simulated in this lab. RAPS is developed for this. The end product will be a user-friendly IT platform in which students/teachers, and professionals will have various options to design and build their prototype without specialized IT knowledge.

On the one hand, the platform serves an educational purpose: to understand and learn how to apply the digital assembly line. On the other hand, the target group consists of professionals from work organizations who, through this platform and, for example, internship assignments with students, are able to redesign their processes with these new technologies and to build pilots in an accessible and cost-efficient manner. In the experience lab, test phases and validation can take place before you use it in the real world.

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What does the platform look like in concrete terms?
RAPS offers a scalable solution for digital assembly line prototyping and experiments. The platform includes several ready-made simulations for different domains and processes. This allows the user to quickly gain practical experience using oracles, sensors, blockchains, tokens, smart contracts an AI. By adjusting the simulations, users without software development experience, can promptly adapt a simulation for their research or pratical application. In addition, the source code of the components that make up the platform and the underlying smart contracts are available to users of the platform. This allows them to quickly and efficiently compile their use cases and develop new areas of application and work processes that are not yet included as standard in the platform.

What can a user expect from RAPS?
RAPS offers both several ready-made simulations and an option to compile non-existent use cases:
- standard: ready-made simulation environment for a digital assembly line;
- variations: easily create a variation of the standard simulations by choosing other parameters, roles, steps, tokens, and sensors (no programming knowledge is required for this);
- customization: with some programming knowledge, other blockchains, smart contracts, and sensors can also be linked to the demo.

What are the ultimate costs of using RAPS?
RAPS will consist of a standard part and a configurable part:
- The ready-made demos on the Smartys blockchain are free for the test group for at least two years.
- The final (license) fee for RAPS will be determined after testing and validation but will be offered to educational institutions at a reduced rate.
- For running own variations, own tokens, and advanced solutions, DApps are generated that the user must run on a web server. For this, the user can easily set up a server at Digital Ocean. After consultation, sensors can be ordered from Hardwario or used in the BrainBloc lab. A quotation is first made for customization.

More information? Please contact us.