



A concerted effort to establish **Blockchain Infrastructure** to fix **Health Data Management** and provide the substrate for **Mechanism Design**

MSD Brown Bag Lunch , Nov 24 2017



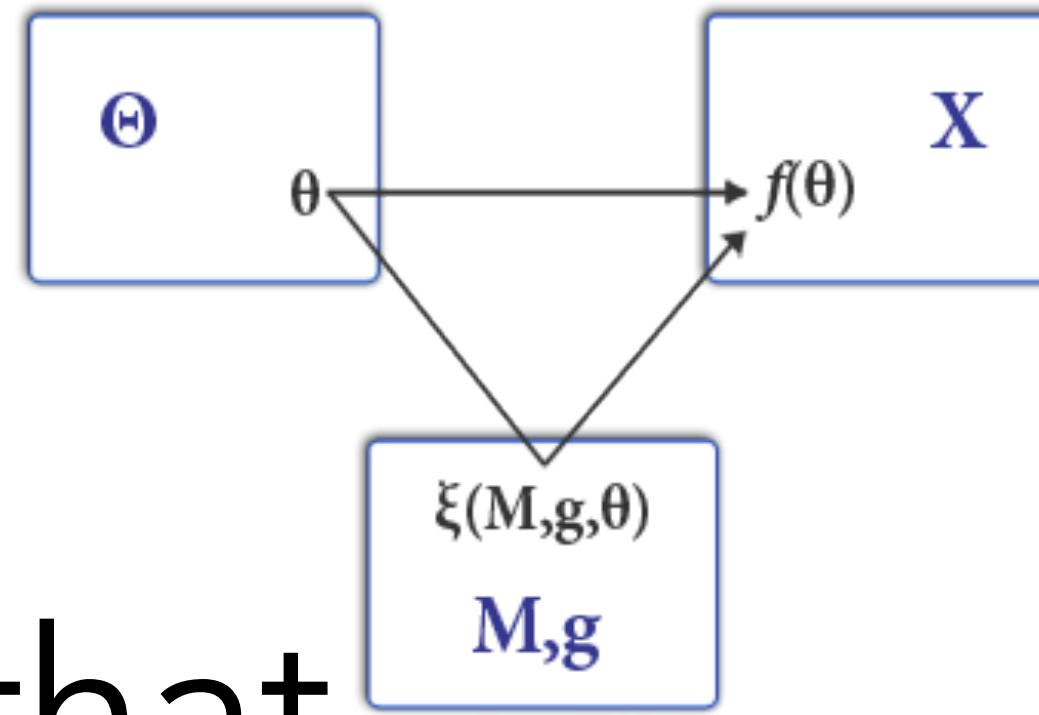
Johan Sellström

# Outline

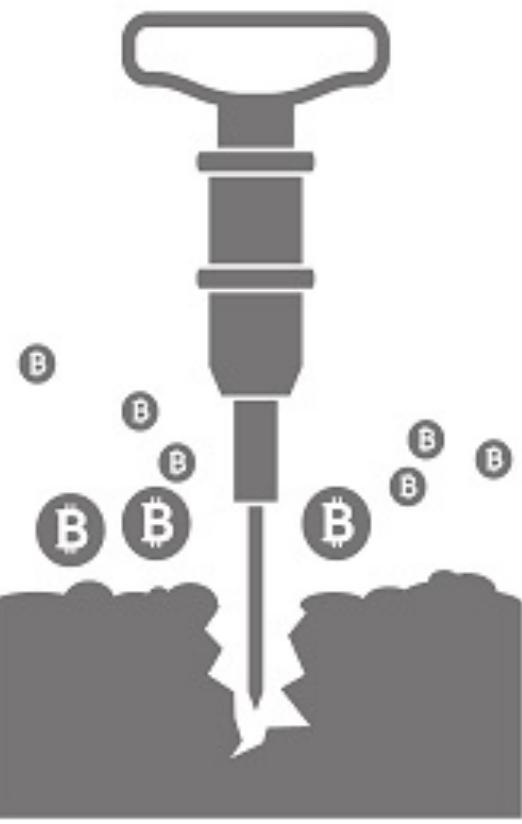
1. Mechanism design & **Cryptoeconomics**
2. **Magic**
3. New design **elements**
4. CareChain as an **example** of Impact Design
5. Impact Tokens as design **pattern**

# Mechanism Design

a field in **economics** and **game theory** that takes an **engineering** approach to designing economic mechanisms or **incentives**, toward desired objectives, in **strategic settings**, where (social) players act **rationally**. Because it starts at the end of the game, then goes backwards, it is also called **reverse game theory**.



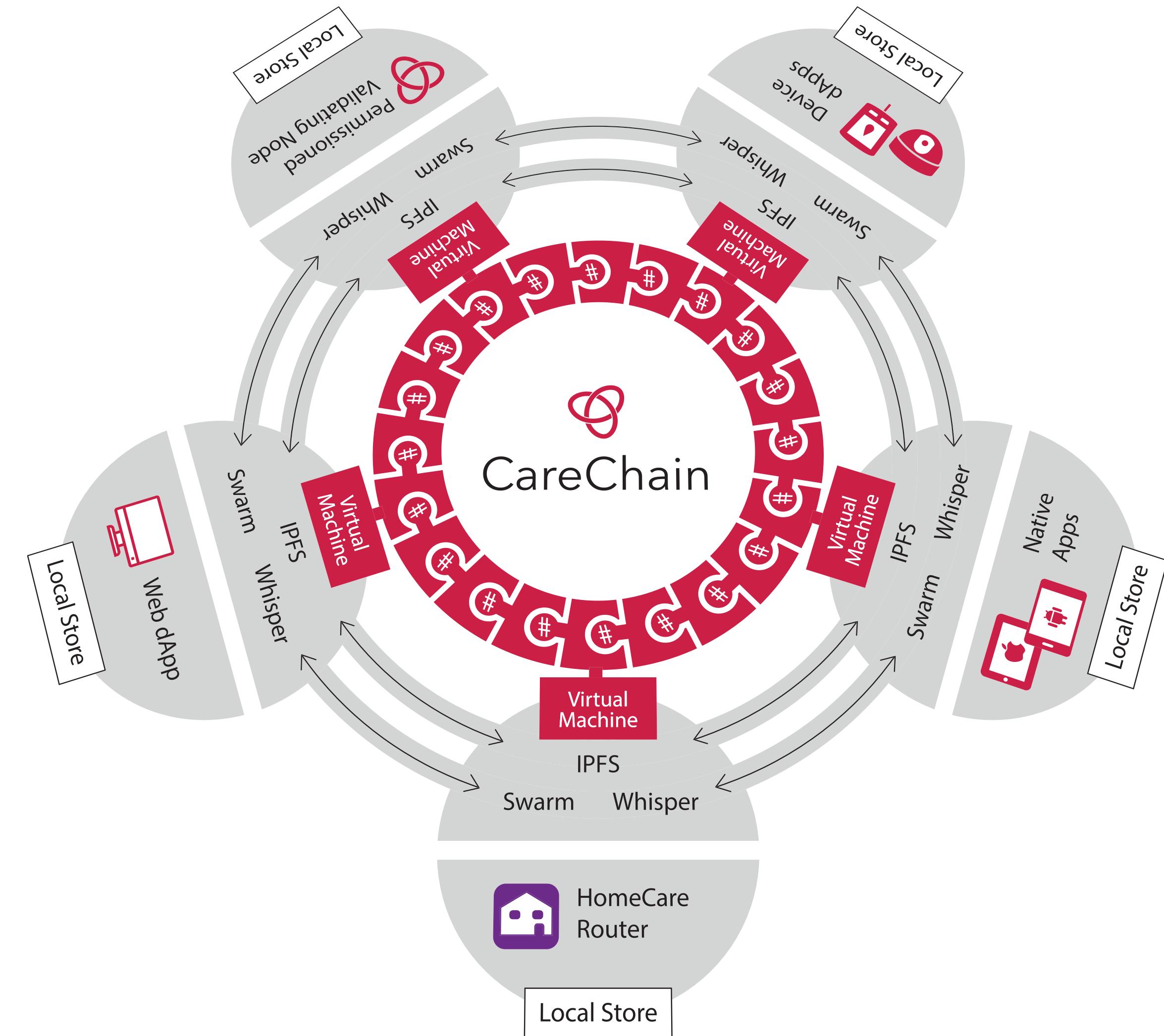
# Cryptoeconomics



- Cryptography is used to prove **properties** established in the **past**, such as account balances, identities and ownership.
- Digital representations of **economic value** become possible, accessible to all, assignable, exchangeable and immune to censorship, able to be **relied upon in the future**.

# Underlying Magic

- Web 3.0 is the **real cloud**
- New protocols enable completely **decentralised** systems where everyone can talk directly to everyone else (peer-to-peer).
- **Security by design** - no single cloud to hack
- Peer to Peer **exchange of value**
- **No intermediary**
- **No SPOF** - single point of failure

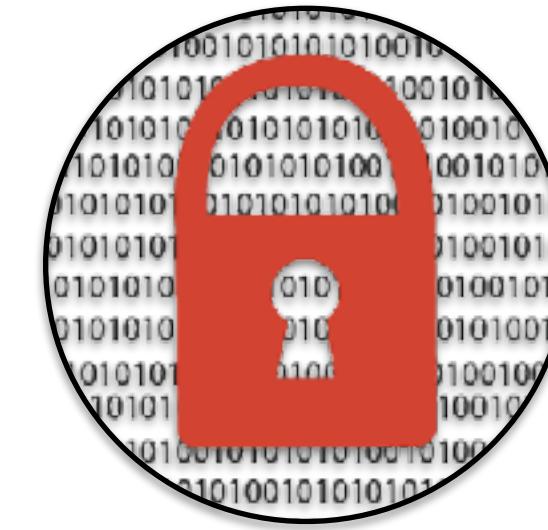


# Why Data on a Blockchain?



## Timestamped

Provable timing for all content



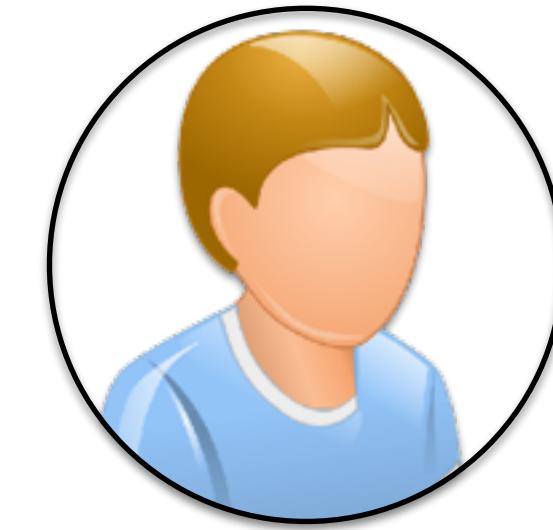
## Encrypted

No data in clear



## No Super-User

No privileged access mode



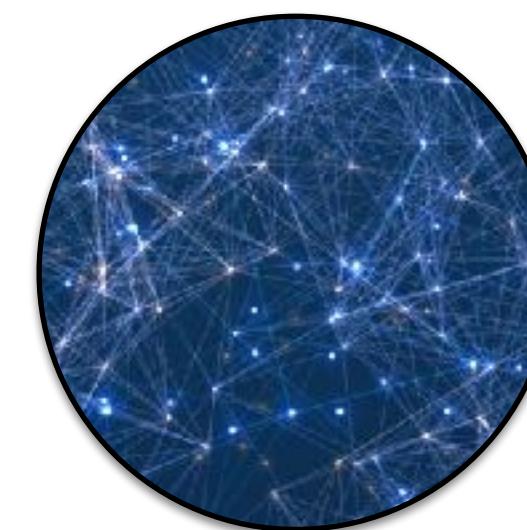
## User in Control

User controls all access



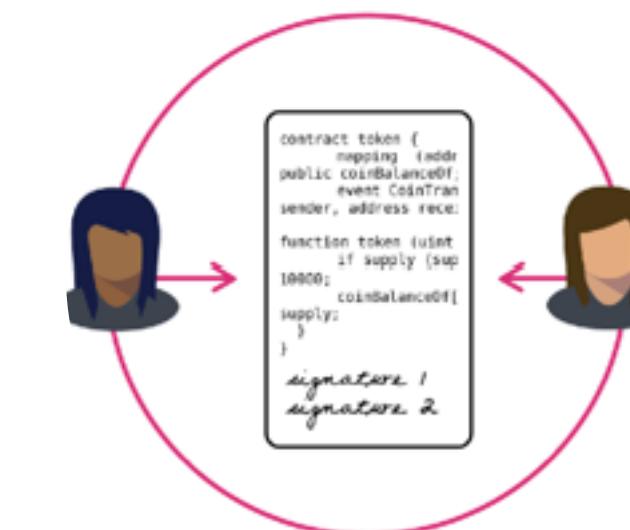
## Immutable

Content cannot be changed



## Distributed

No single point of failure



## Smart Contracts

Programmable functionality

# Digital Currency

# Trustless

# BYO Data Networks

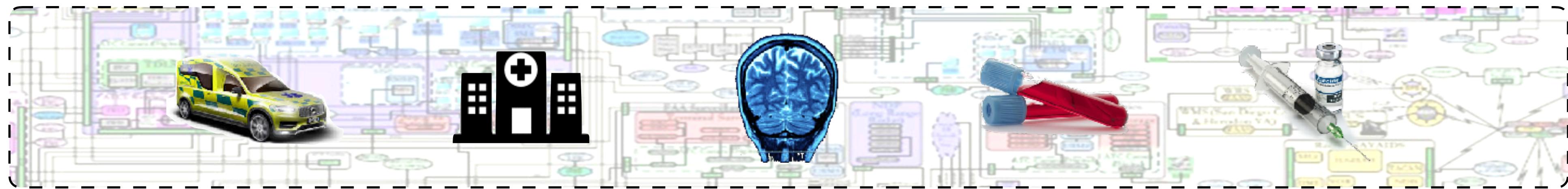
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# Permissionless Money Creation

# Resource Allocation

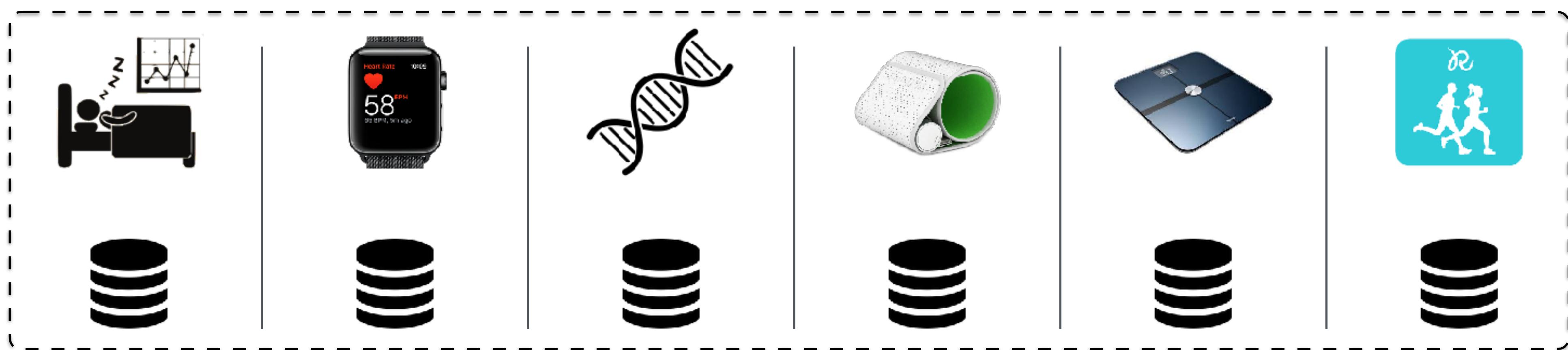
# No Common Data Platform...

Healthcare is a mess of interconnected and antique systems



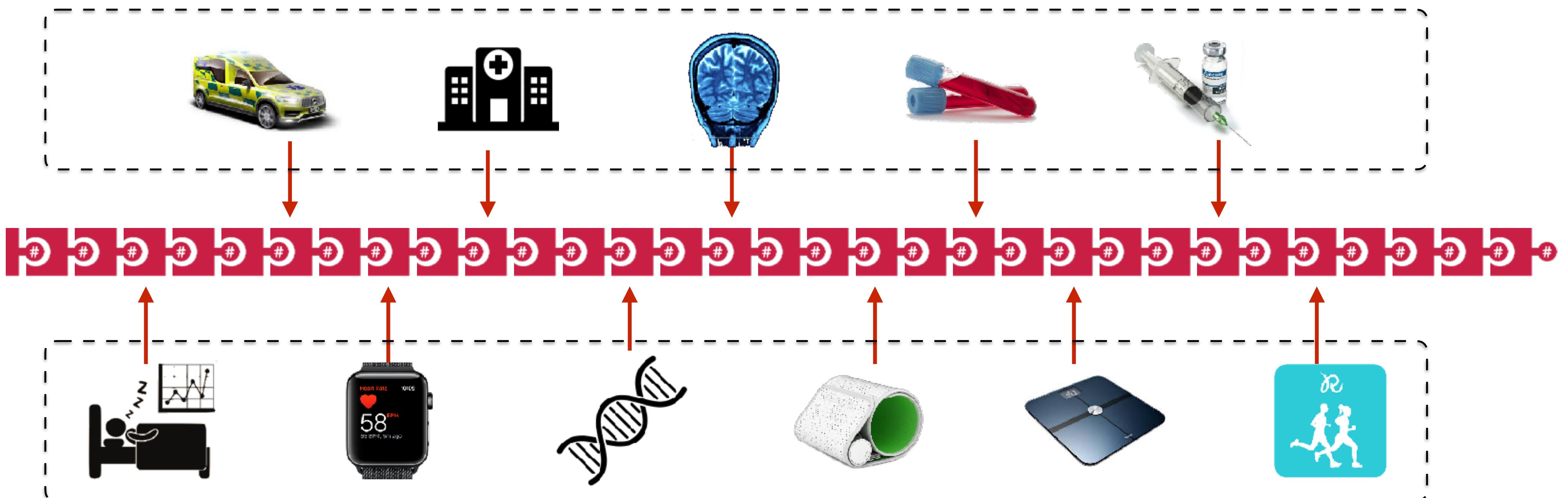
Within Healthcare → Incidents Only

Consumer apps are stove-piped with little or no data sharing/reuse



Self Generated → Continuous

# CareChain - A Blockchain For Health Data



Powered by:  **Ethereum**  **IPFS**

Member of:  **ENTERPRISE  
ETHEREUM  
ALLIANCE**

# A Swedish Innovation Platform

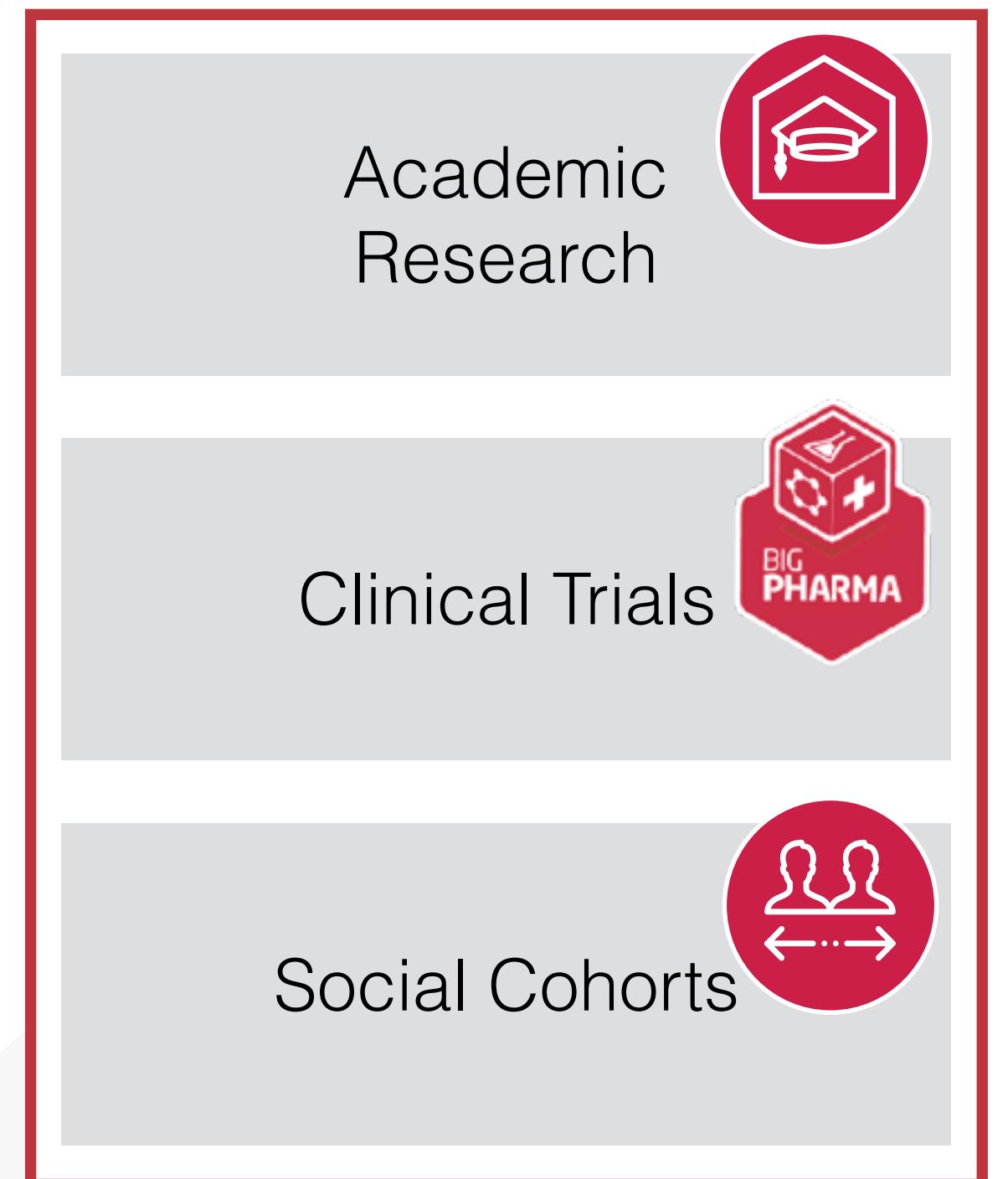
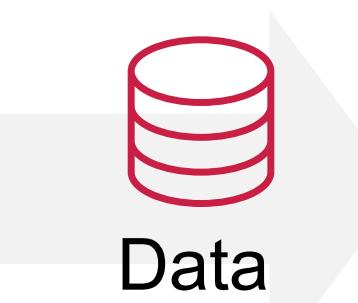
- Establish a **Swedish consortium** to set up the required infrastructure
- **Public Permissioned Model** - a number of well known institutions running a network open for public use; **scalability, privacy and compliance**
- Each organisation **owns, controls and guarantees** the integrity of the Blockchain
- Low risk; **deploy** software developed by EEA



# Why we do it: Research Commons

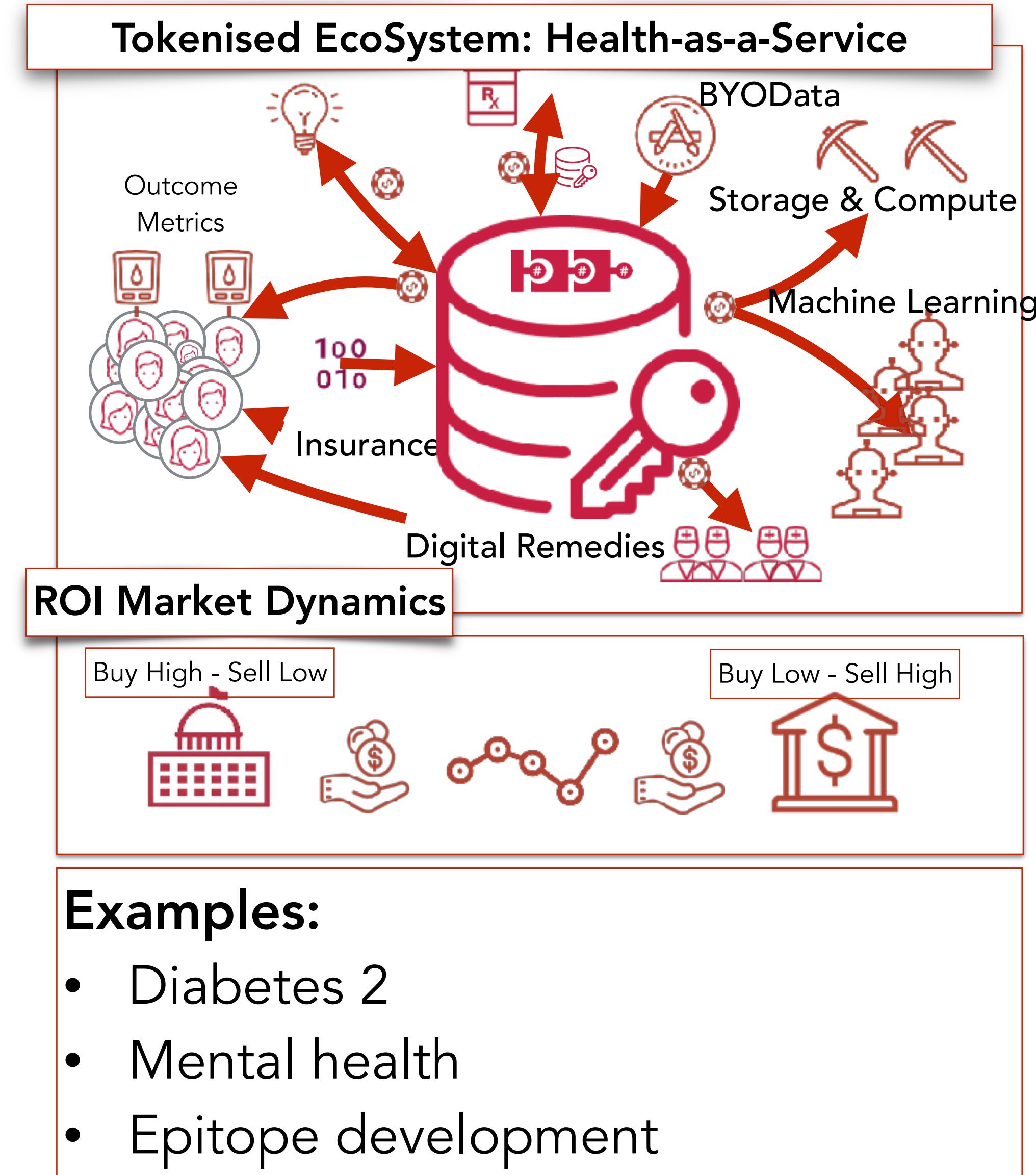
## Establish a research commons

- Anonymous and pseudonymous donation and **investment** of streaming data
- Match up and join **cohorts** to cross reference analytics and share experiences and coping strategies
- Run **machine learning models** and queries in Zero Knowledge on device
- Population Scale **Precision Medicine**

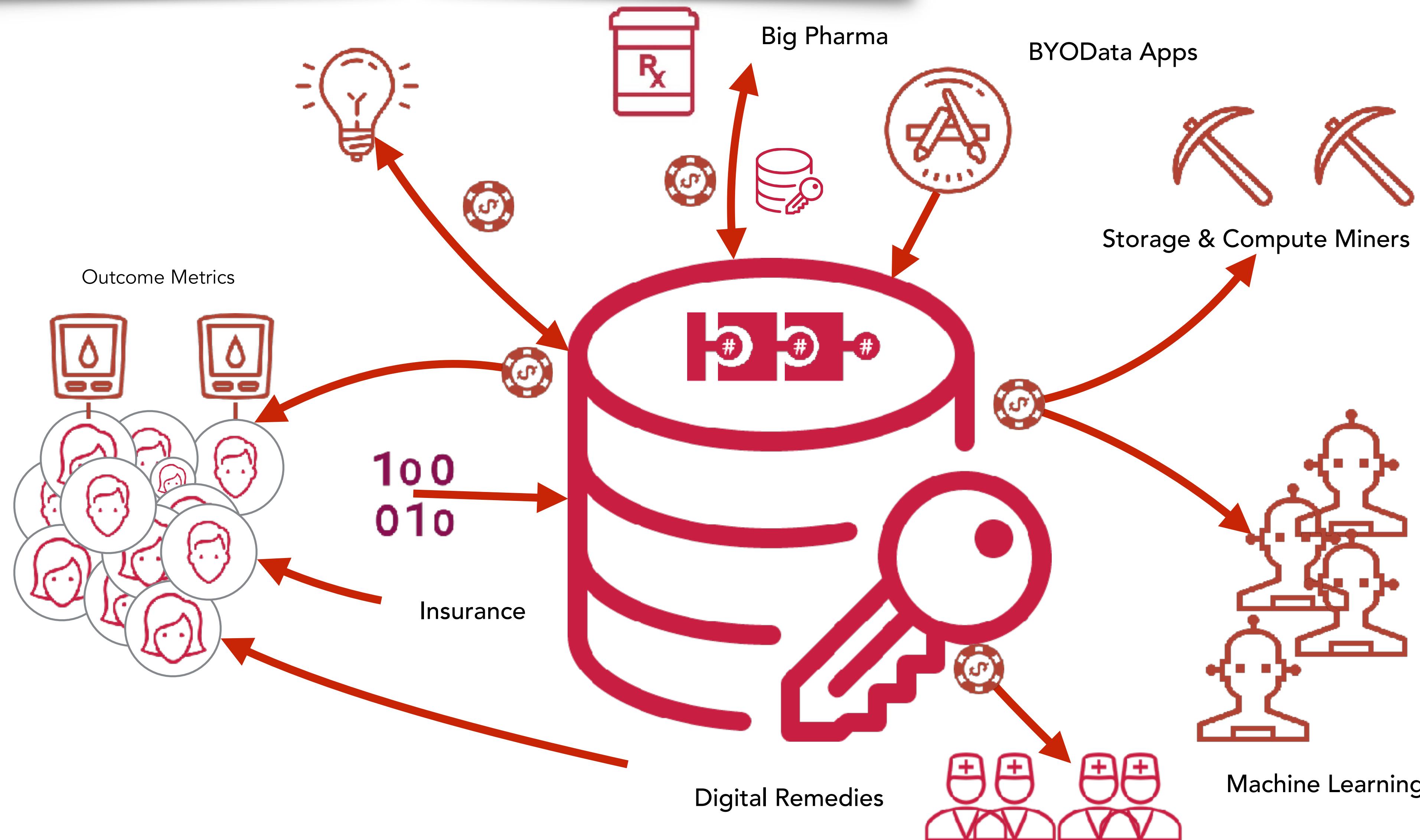


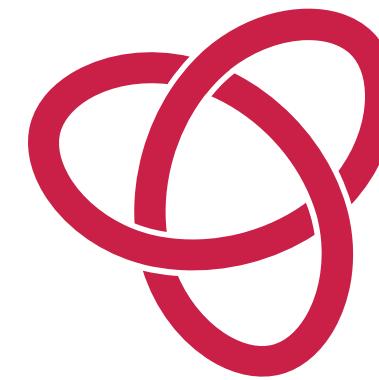
# Design Pattern: Health Impact Bonds Tokens

- Impact Bonds are designed for professional investors, tokens provide strong financial incentive for **large groups** of people to work together towards a **positive social outcome**
- **Permissionless** participation: powerful **network effects** and strong **feedback loops** and **gamification** using mechanism design
- **Sustainable** impact
- **Multi-payer**
  - aggregated, homomorphic **data and insights can be sold** to Pharma for the benefit of the mutual insurance fund
  - **large companies or governments**
  - taxed **citizens**
  - **patients**
- Pre-existing conditions provide valuable data to **offset discriminatory** insurance coverage policies
- In effect **Social Insurance Networks** (non-discriminatory) with a data based **revenue** model



## Tokenised EcoSystem, f.i Health-as-a-Service





# CareChain

We need help with:

- Consortium **members** to **expand** the network!
- Proof-of-Concept **use cases**
- App **testers**
- **Testimonies**

Sign up at [info@carechain.io](mailto:info@carechain.io)

Slides: <http://carechain.io/msd.pdf>

Whitepaper: <http://carechain.io/wp.pdf>

The image consists of three main parts. On the left, a smartphone screen shows a mobile application with a portrait of a man (Johan Sellström), a QR code, and several circular icons representing different health metrics. In the center, a desktop computer screen displays a blockchain transaction history table with columns for hash, timestamp, and transaction details. On the right, a slide from the Enterprise Ethereum Alliance's press release is shown, featuring the CareChain logo and text about the foundation of a healthcare system using blockchain technology.

When laying the foundation for a robust interoperable healthcare system, we need to start at the protocol level and design new infrastructure that is owned and controlled by no one and everyone. We need identity and digital value protocol layers and we need immutable health records controlled by their rightful owners. Due to regional data protection regulations, like GDPR, privacy sensitive information, like health records, must be guaranteed to stay within specific geographic jurisdictions. This is why public chain deployment is not yet an option.

Together with The Enterprise Ethereum Alliance, we want to contribute to the development of required tooling and policy frameworks to run permissioned blockchains as critical infrastructure. Leveraging the decentralized computing platform, we are reinventing data management for the entire healthcare system. We are forming a consortium, CareChain, to deploy Trusted Infrastructure, starting in Sweden and the European Union.<sup>[1]</sup>

Ur pressreleasen i samband med att CareChain gick med i Enterprise Ethereum Alliance [1]

CareChain är ett initiativ och ett konsortium för att åstadkomma en nationell blockkedja för hälsa. En blockkedja gör det för första gången möjligt att ge individen ägarskap och kontroll över sin egen hälsodata.

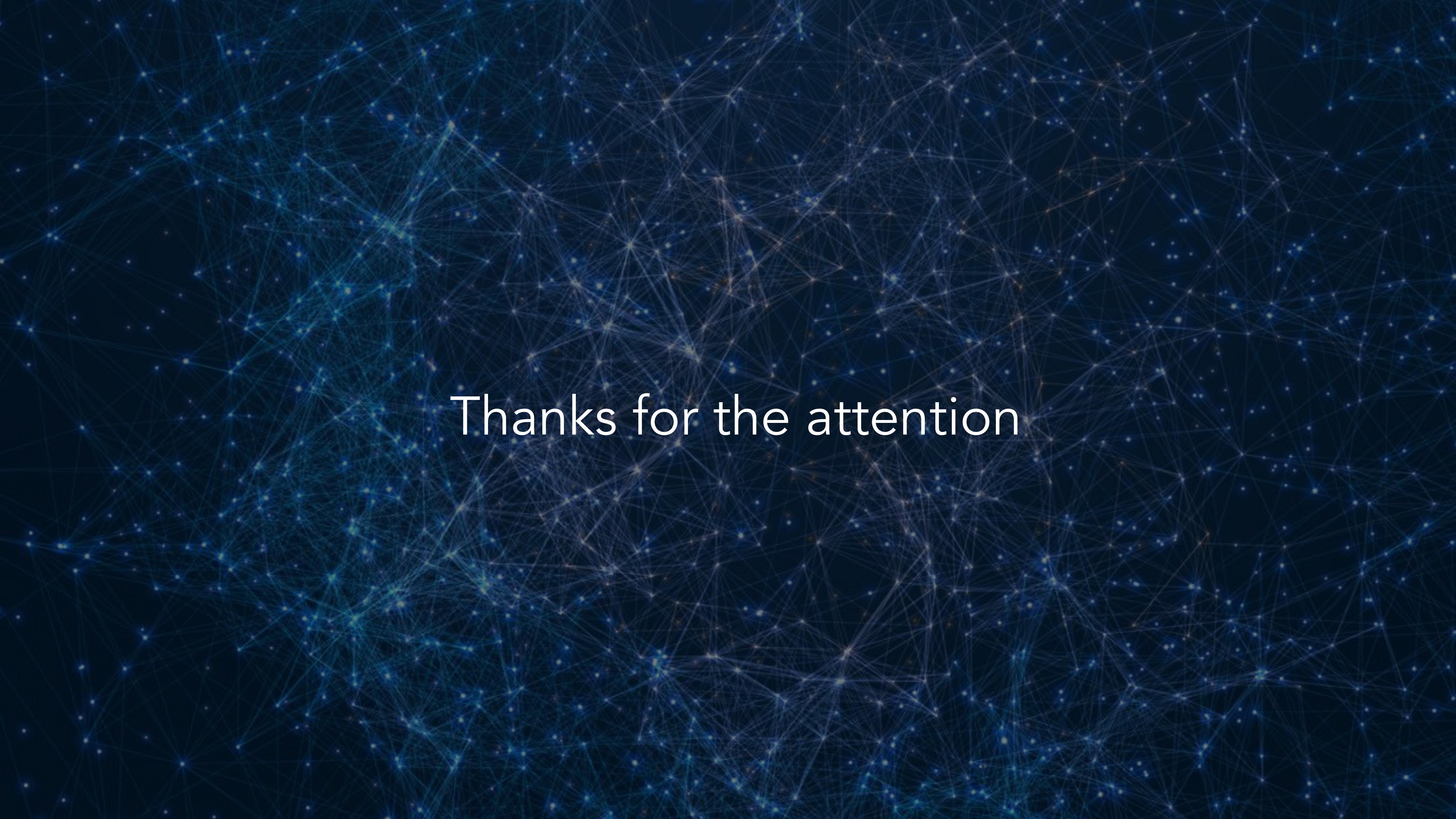
Det är inte längre bara teknikentusiaster som samlar in data om sig själva via egna sensorer (wearables). En studie från 2016<sup>[2]</sup> visar att 32 procent av befolkningen i Sverige registrerar sin vikt och att 26 procent registrerade sin träning. Dessutom har 20 procent delat egengenererad data med vården. Intresset bland medborgarna för att engagera sig i sin egen hälsa och sin vård ökar snabbt samtidigt som den tekniska utvecklingen inom wearables och sensorer för att instrumentera den mänskliga kroppen går oerhört snabbt.

Samtidigt accelererar intresset inom vården och forskningen för att komplettera journal- och forskningsdata med stora mängder egengenererad data för att utvinna de viktiga insikterna som kan fås genom att köra analyser på hela datamängden och den

<https://entethalliance.org/enterprise-ethereum-alliance-release-05-19-2017.pdf>

Future health index 2016 <https://www.futurehealthindex.com/report/2016/chapter/454/country-profile-sweden-se/>

| Hash              | Time    | Value | Delta   |
|-------------------|---------|-------|---------|
| b44923...23609e45 | 196,715 | 0     | +42 ms  |
| b44923...23609e45 | 196,715 | 0     | +70 ms  |
| b44923...23609e45 | 196,715 | 0     | +83 ms  |
| b44923...23609e45 | 196,715 | 0     | +93 ms  |
| b44923...23609e45 | 196,715 | 0     | +102 ms |
| b44923...23609e45 | 196,715 | 0     | +113 ms |
| b44923...23609e45 | 196,715 | 0     | +122 ms |



Thanks for the attention