

# The Road to Trust

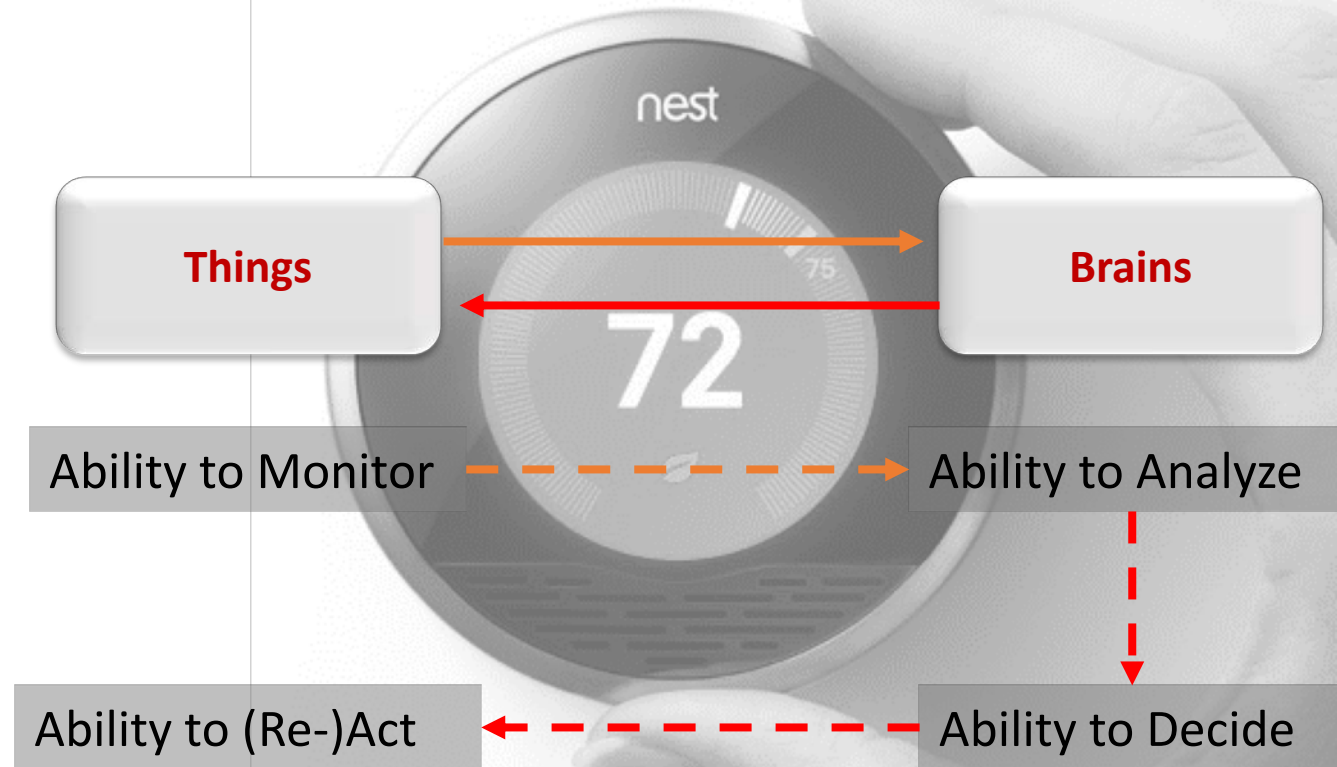


**Merging IoT &  
Blockchain to Create  
Business Value**

February 28<sup>th</sup>, 2019



## Simple Feedback Loops that **Keep Systems in Balance**



The Question is  
Not How it Works,  
but ***What You Do  
with It.***

Self-Regulation

Early Warning

Preventative Action

Integrated Planning

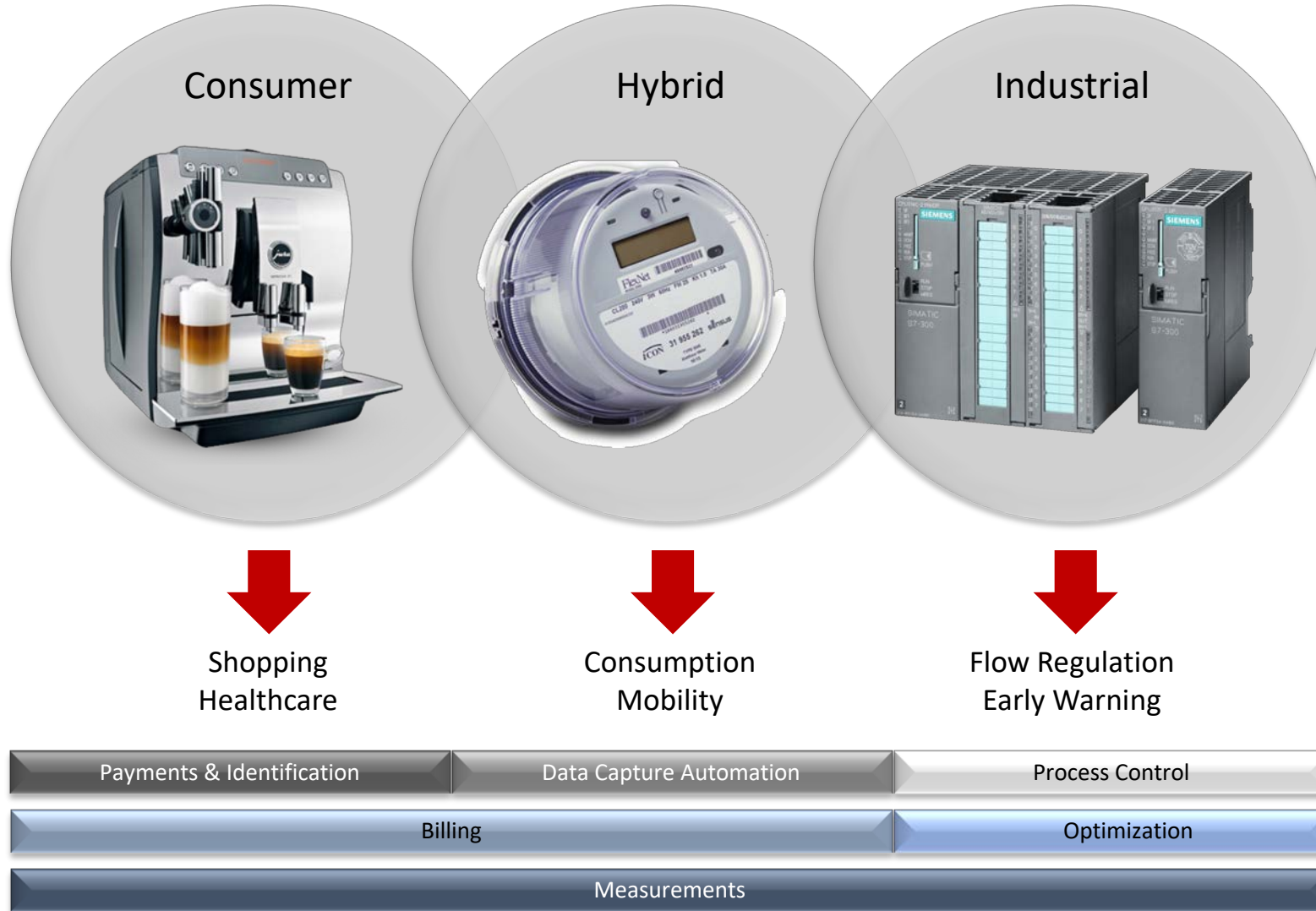
Real-Time Execution

Intelligent Collaboration



**Business Model  
Innovation**

# Types of IoT Applications



**It's more than just IoT, right?**

Many innovative applications are enabled by a confluence of different technologies.

Business Requirement	Technology Capability
Seamless Connectivity	5G
Mobility	Miniaturization
Ease of Use	AR, VR, NLP
Intelligence	AI, Predictive Analysis
Automation	Robotics, RPA
Timeliness	Sensors & Actuators
Validation	Blockchain



# What Exactly Is Blockchain



The basics:

- Popularized along with Bitcoin
- Solves double-spending problem
- Mathematically very elegant
- One of several DLTs
- Very hard to attack over time
- Allows anonymity and privacy
- Higher system resiliency
- Smart contracts available for automation of actions
- Often provides an additional layer of trust
- Possible to use for data exchange
- Often sparks security discussions



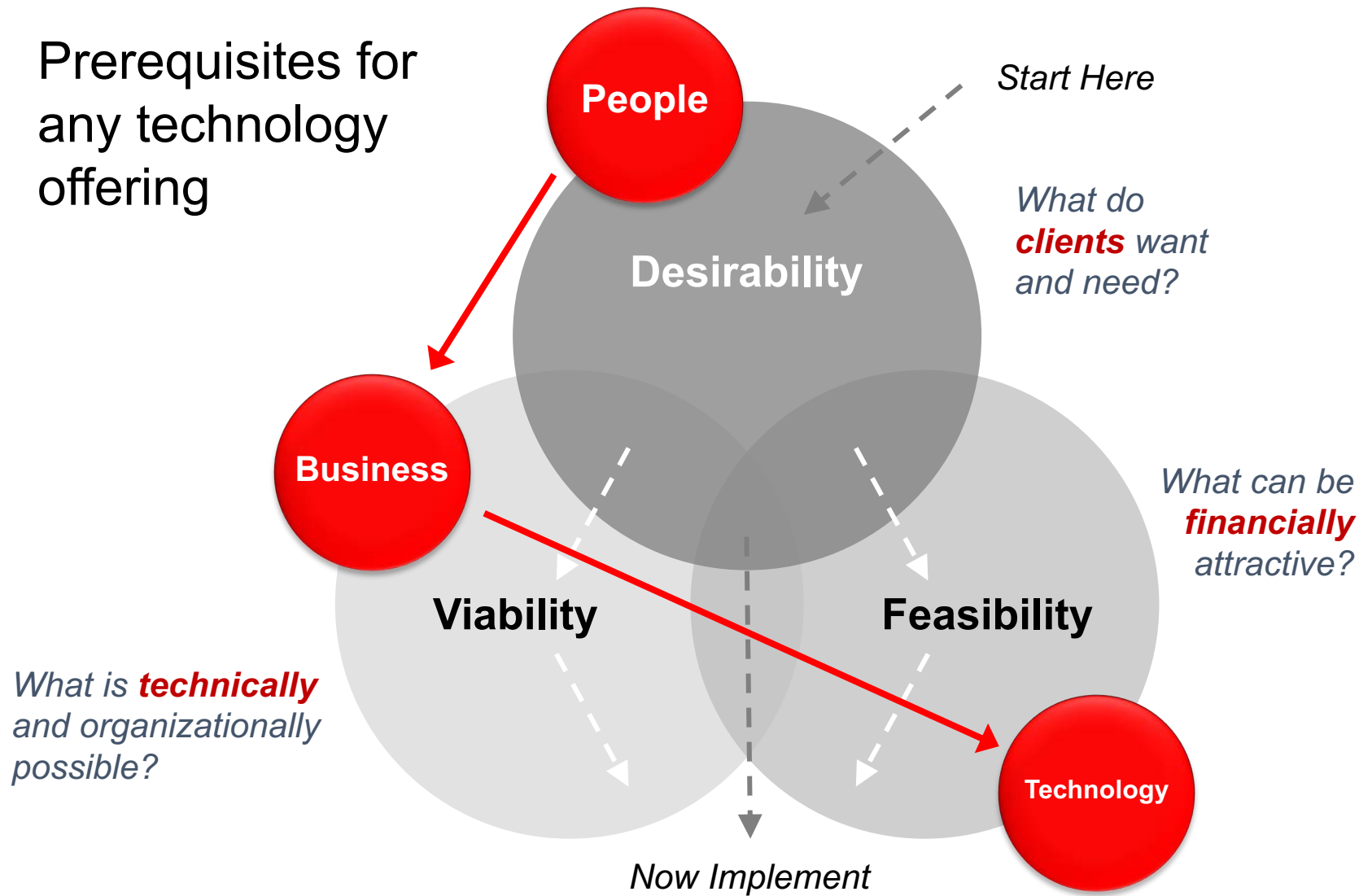
**It's not a *Cowphin*,  
but we still have  
issues ...**

- Self-Serving ICOs
- Talk of "Revolution"
- Lack of Standards
- Often Tied to Currencies
- Number of transactions limited
- Energy-hungry (PoW)
- Data storage limited
- Expensive to develop
- Expensive to use
- Real experts hard to find
- Often a solution in search of problems
- Private and permissioned blockchains can lack core benefits
- Early trials very limited
- Tendency to pave the cow path (pun intended)

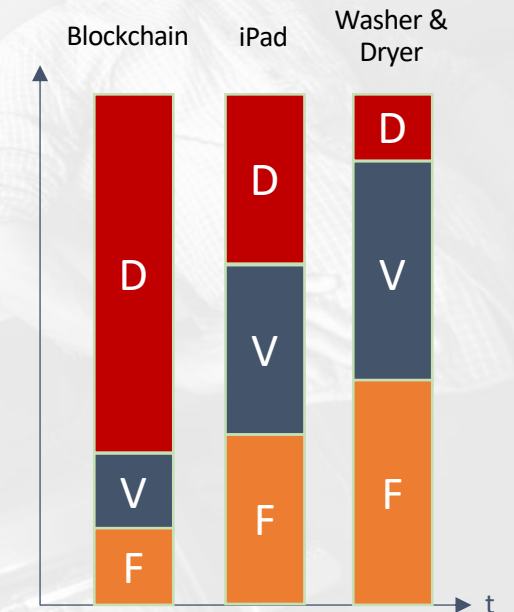
# So, Where Are We Really?



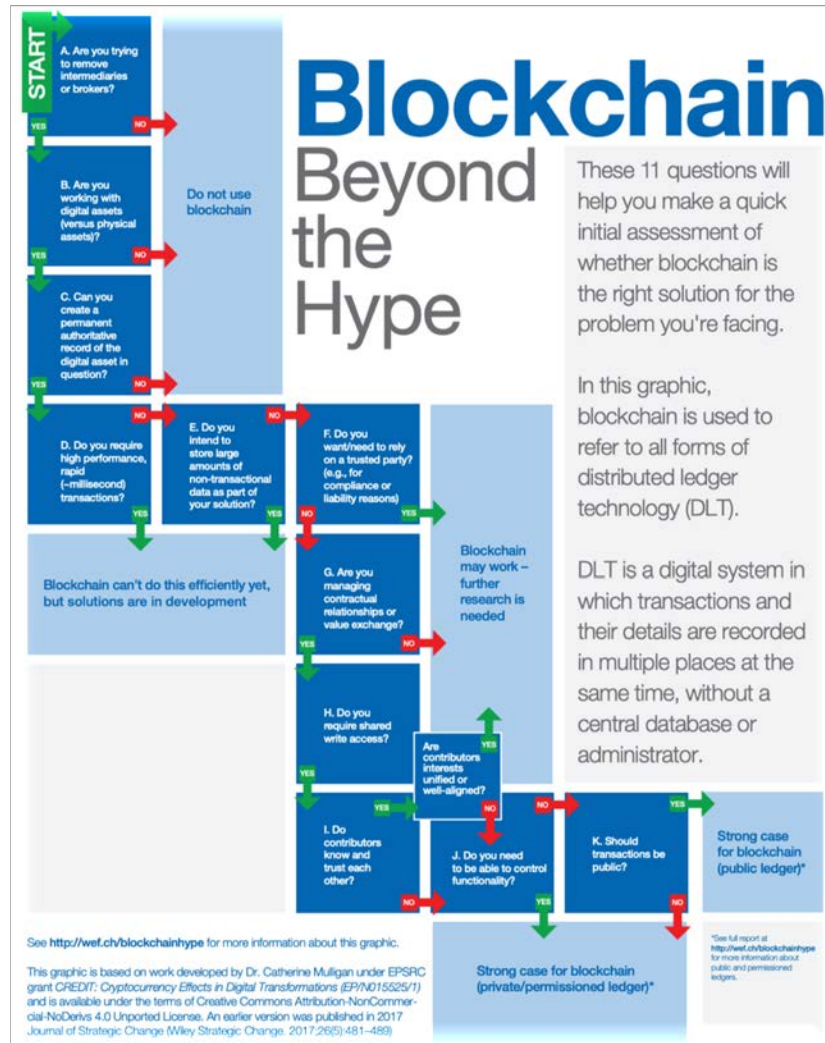
Prerequisites for any technology offering



Today, the world is still mostly **upside-down** as far as blockchain is concerned.

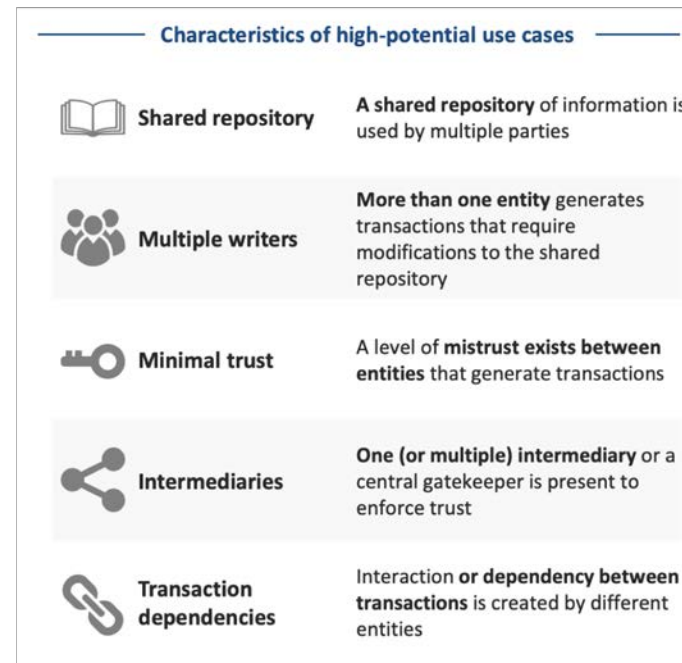


# How Do We Make the Right Decisions?



The **best approach to a classification** and decision-making framework so far comes from the World Economic Forum.

A new series of whitepapers is under way now.



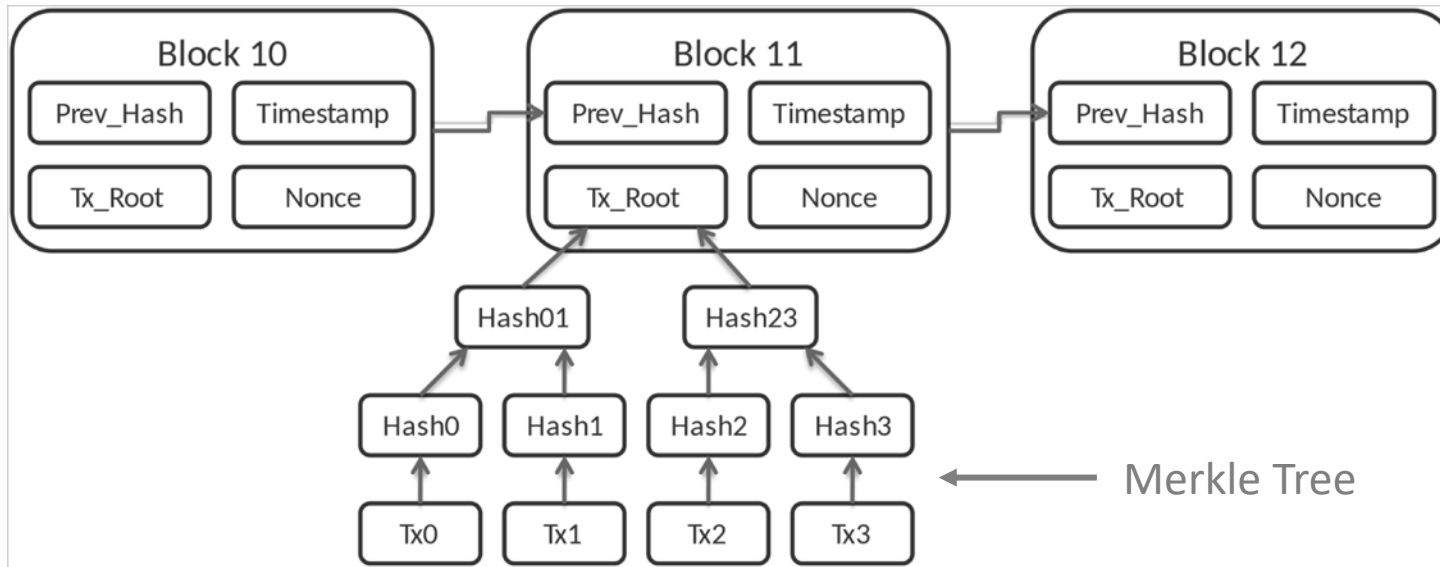
**Why decision-making frameworks are important ...**

- Blockchain is a tool at the end of the day
- You cannot create value without first understanding
- Without a business case, it won't last
- Without desirable features, it won't last
- You need a way to communicate the 'why'
- Serves as a reference guide for business partners



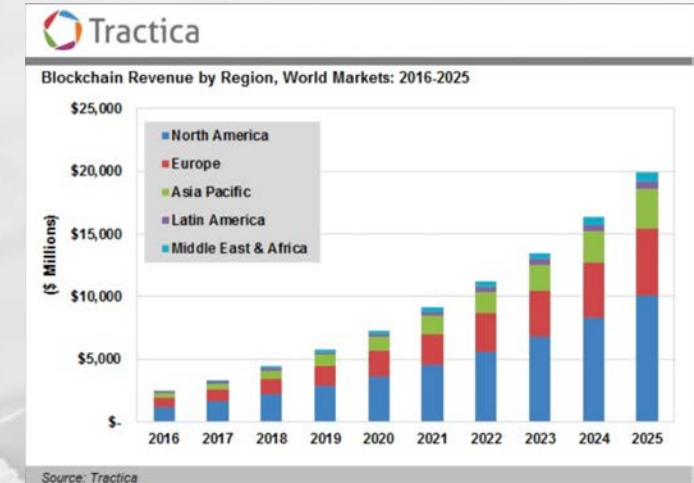


## **Blockchain: Immutable, Anonymous and Secure?**



- **Linked List:** Blocks 10 and 11 are connected through a hash of block 10 embedded in block 11 and so forth.
- **Immutability:** because blocks 10 and 11 exist on many, many different computers, it becomes harder to attack blockchains over time.
- **Pseudo Anonymity:** data can be written as a hash, so that the source remains hidden. Without access to the source, it is mathematically impossible to reverse a hash.
- **Security:** new blocks are written every 10 minutes on Bitcoin for example and an attacker would need to reverse all of the ones coming after the one with falsified data. Over time, the criminal ROI diminishes due to the increasing difficulty of an attack.

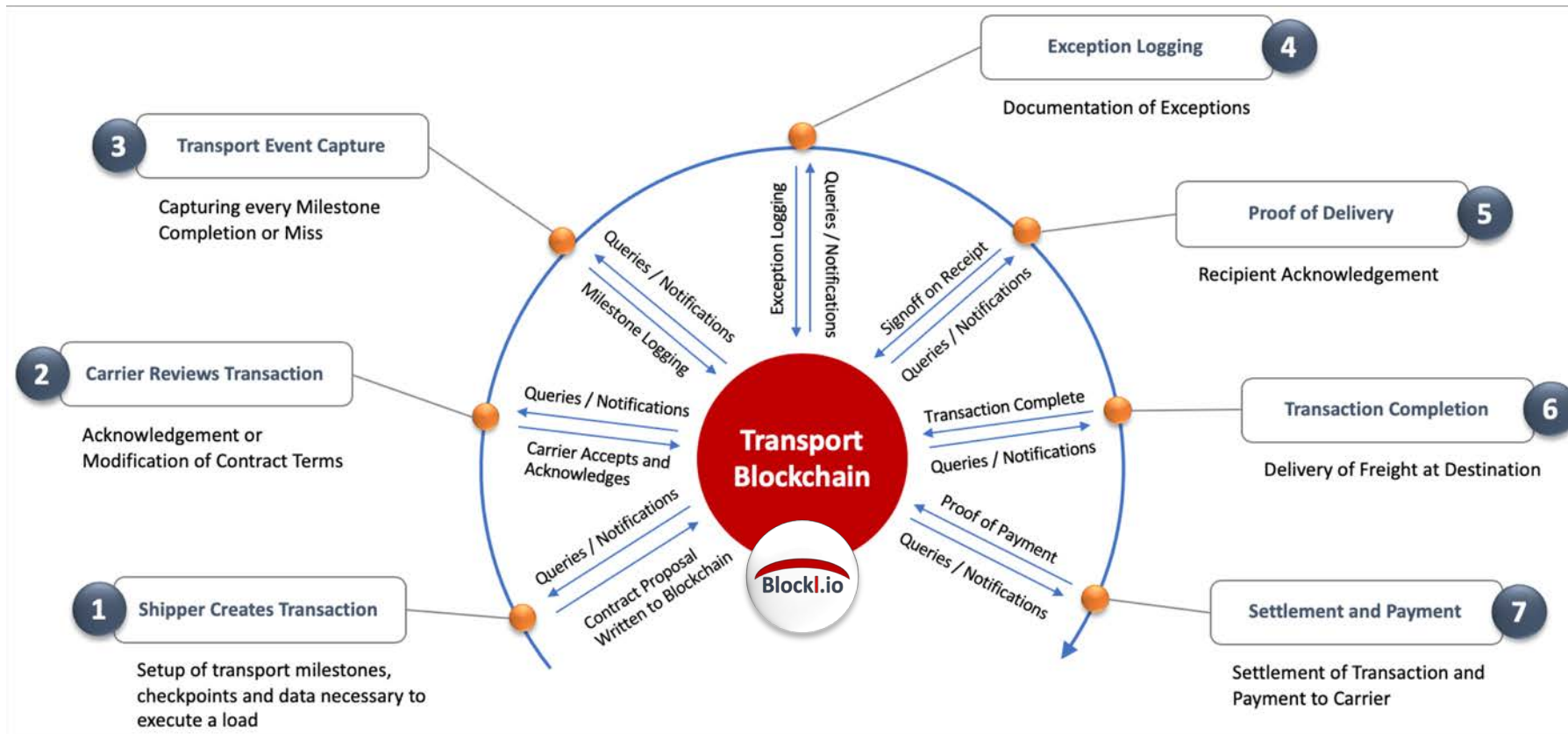
Of course, we're going to get our **act together**:



US revenues for blockchain enterprise applications are projected to rise from under \$2B to over \$10B by 2025. For you, this means:

- Increasingly mature development and engineering platforms
- Access to more talent over time
- Rapid development of global standards
- Better interoperability and interfaces
- More \$\$\$ = better tech = more use cases

# A Typical Transaction in Freight Visibility



- Immutable ledger: “What happens on the blockchain, stays on ...”
- Fewer disputes & less reconciliation
- Instant, automated data sharing

- Process automation through smart contracts and business rules
- Instant exception alerts
- Automation of payments and AR

## Business Value of Blockchain

So, how exactly **does Blockchain help**?

- One version of the truth
- Trustless network
- Cyber security and cryptography spill-over
- Highly resilient
- Global and open to anyone

Here's what **Chicken Little** has to say...

- Supply chains are wide open to attacks
- Security is an afterthought
- Technology not ready
- Consequences can range from temporary disruption to lasting damages

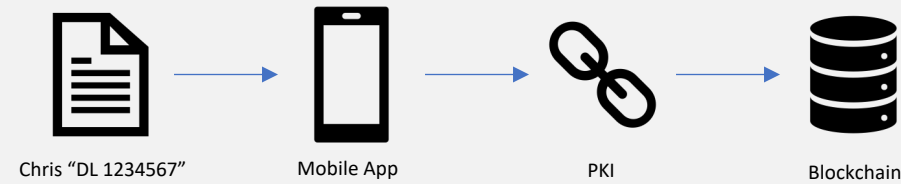


# How Decentralized IDs Work

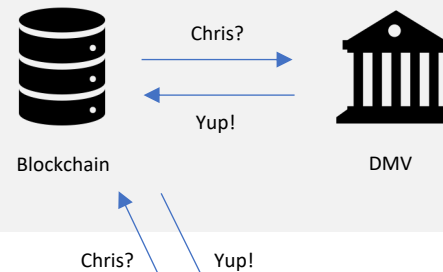


- **Claim:** a user documents information about her ID e.g. “I am over 16 and allowed to drive” on a public blockchain.
- **Proof:** the user adds evidence to support the claim e.g. a photo of a drivers license to the blockchain entry.
- **Attestation:** an independent authority validates the claim and proof on behalf of the user e.g. DMV asserts that the drivers license submitted to the blockchain is authentic.
- **Control:** because the user is in control of her data on the blockchain, she can now determine who is allowed to see it and under which circumstances. This avoids the oversharing issue.
- **Anonymity:** the data can be stored on the blockchain as a hash and only known to the user.

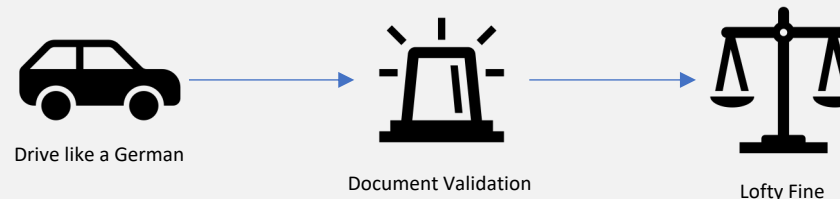
## Establish DID



## Obtain Validation



## Use Information



## DID Capabilities for IoT Applications?

- Authentication of Devices on Network
- Peer-to-Peer Validation
- Prevention of Intruders
- Attestation of Measurements
- Some Anonymity (harder for MitM)



## Example Smart Meters

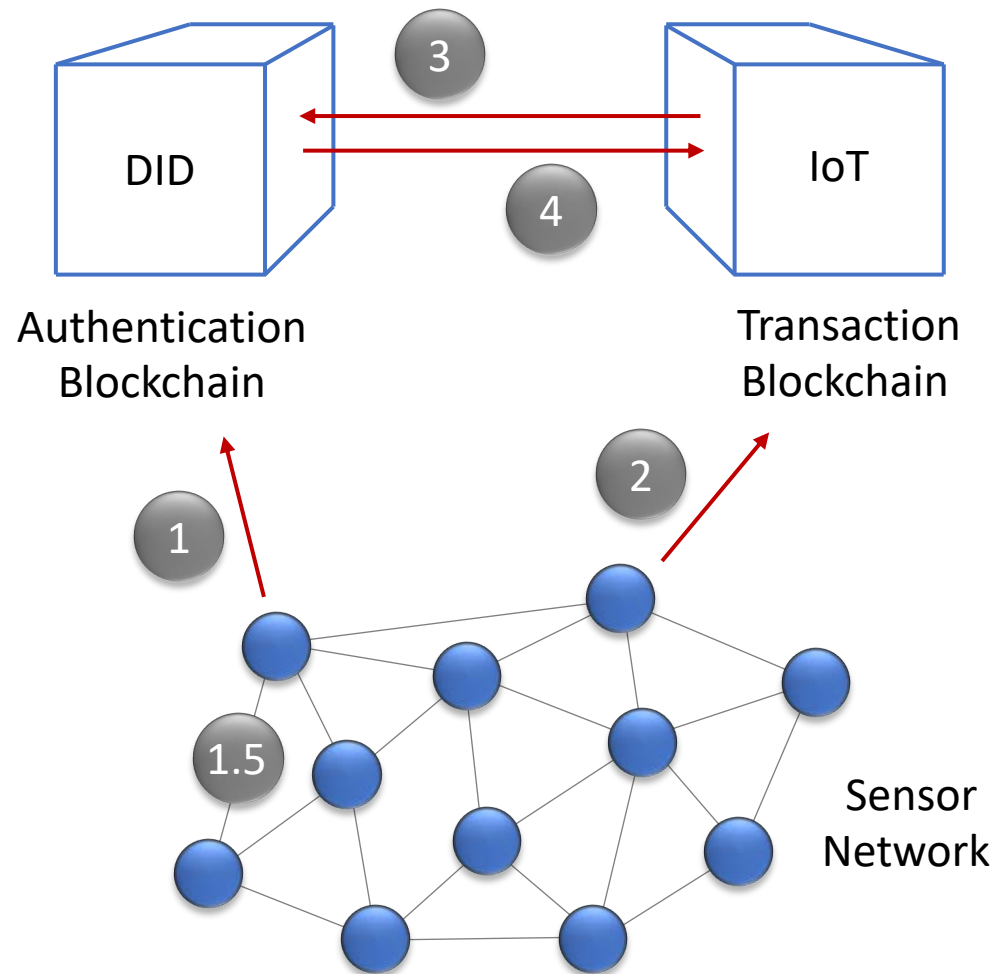
- Harder to attack
- Harder to shut down
- User privacy
- User authentication



## ***Distributed ID: Unique, Secure and Mostly Anonymous***

Say, you want to ensure that only the **Right Things** are **On Your Internet**:

- 1 IoT devices are registered on the DID blockchain
- 1.5 IoT devices can vouch for each other as part of the same network
- 2 IoT devices log transactions on the IoT blockchain
- 3 IoT blockchain requests validation
- 4 DID blockchain authenticates IoT devices

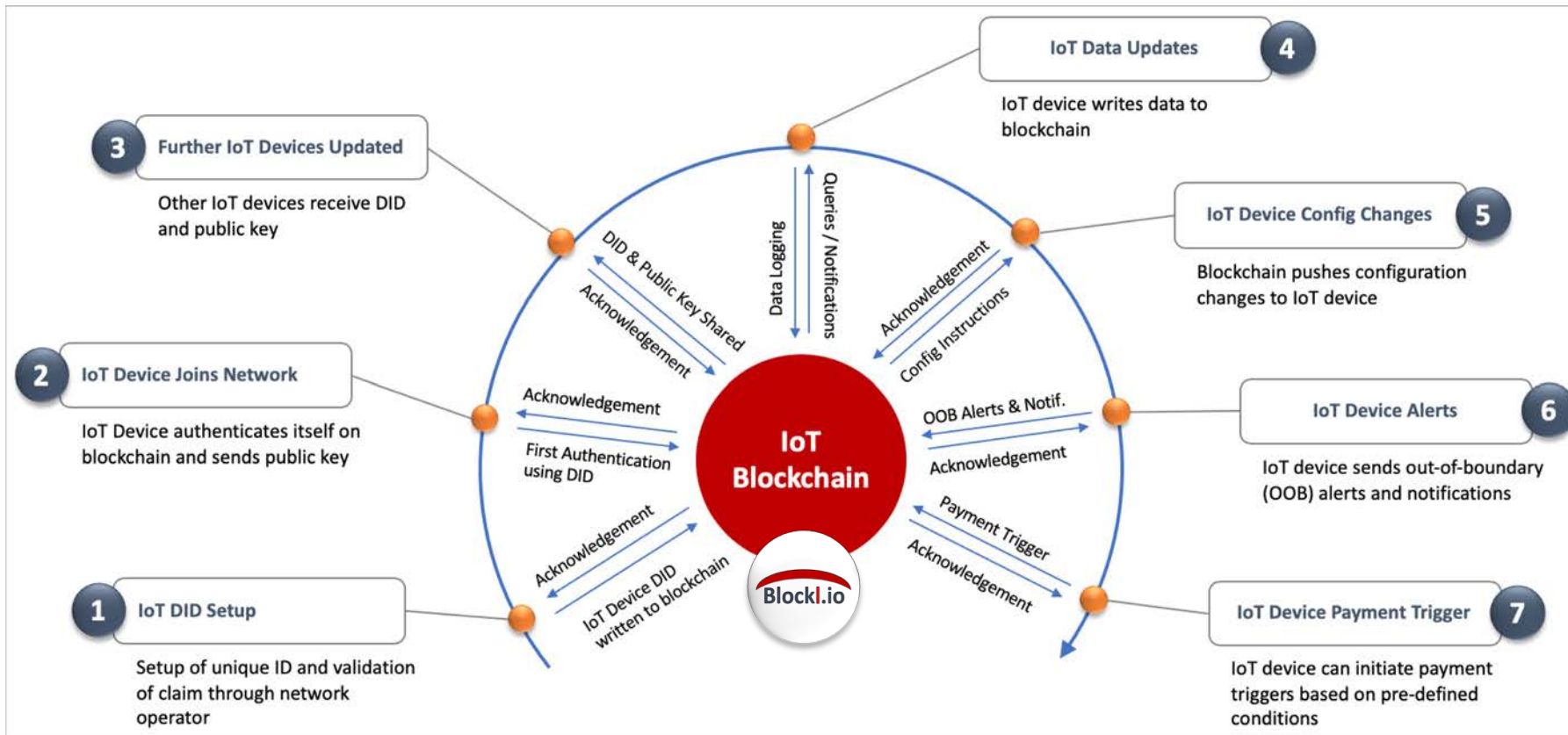


So, what's the Business Value of **DID**?

- Authentication
- Prevention of Breaches and Data Leakage
- Automation of Tx
- Key Management
- Configuration Mgt.
- Payment Automation

Why **Anonymity** is Not Just for Criminals:

- Adds a layer of security for IoT devices
- Protects Users
- Masks Interesting Business Data



## Business Value of Blockchain for IoT

So, how exactly **does Blockchain help**?

- Use of private – public key pairs instead of factory set passwords (“1234”)
- Use device-to-device authentication
- Use of 128-bit encryption

**Chicken Little** may be right this time ...

- IoTroop (not activated, yet)
- Satori Botnet (routers, IoT)
- Mirai (routers, IP cameras)
- Remaiten (IRC comms)
- Bashlite (routers, IoT)
- Darloz (routers, cameras)
- Stuxnet (PLC)

- Autonomous network authentication
- Node to node claim validation
- Advanced cryptography
- Configuration Management

- Better, faster data sharing
- Ability to maintain privacy
- Can prevent DDoS and scraping
- Highly efficient administration





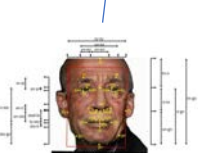
## Sunset at Montmajour Fake or Real? (actually both)



Image Source: Wikipedia, Van Gogh Museum



Barcode  
QR Code  
RFID Tag



Hi-Res  
Imagery



DNA  
Mat Comp.

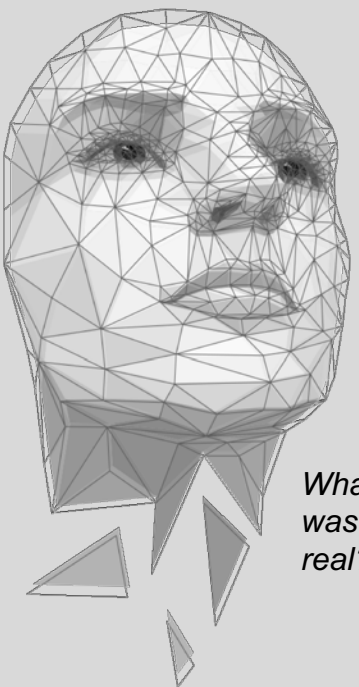


Nanotags  
Micro Tags

## For blockchain to be useful, *you need to first ensure authentication.*



Blockchain can be really dangerous:  
Think **GIGO**.



*What if she was never real?*

After all, it's purpose is to enable trust or at least eliminate reasons for doubt.



**Autonomous vehicles** won't just drive, they also collect a wealth of information ... about *EVERYONE*.

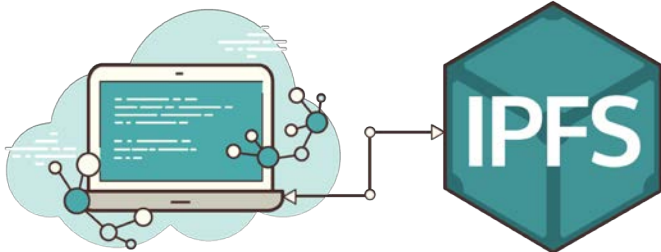
For example, a **University of Michigan** project leverages gait and posture to predict your next move. ([Link](#))

Blockchain allows **secure storage** of vehicle sensor data while things like pedestrian data can be protected and only used in cases of accidents or emergencies.

Key **benefits** include anonymity of the vehicle owner, security and breach protection, immutability of the records and availability of data only when needed.



The UM system uses lidar and stereo cameras to assess gait and pose to ultimately predict everyone's next move.



IPFS HTTP CLIENT LIBRARY

**IPFS** is an implementation of a permanent Internet, based on a distributed hash table, that can be leveraged to store sensor data in conjunction with blockchain.

Data is hashed, each node only stores content it is interested in and searches point users to nodes that contain the requested content.

## Business Value of Blockchain for IoT

Autonomous vehicles are **just the tip of the iceberg**:

- Security cameras
- ATM cameras
- Traffic and safety cameras
- Tourist cameras, etc.

## Data Assurance is Key

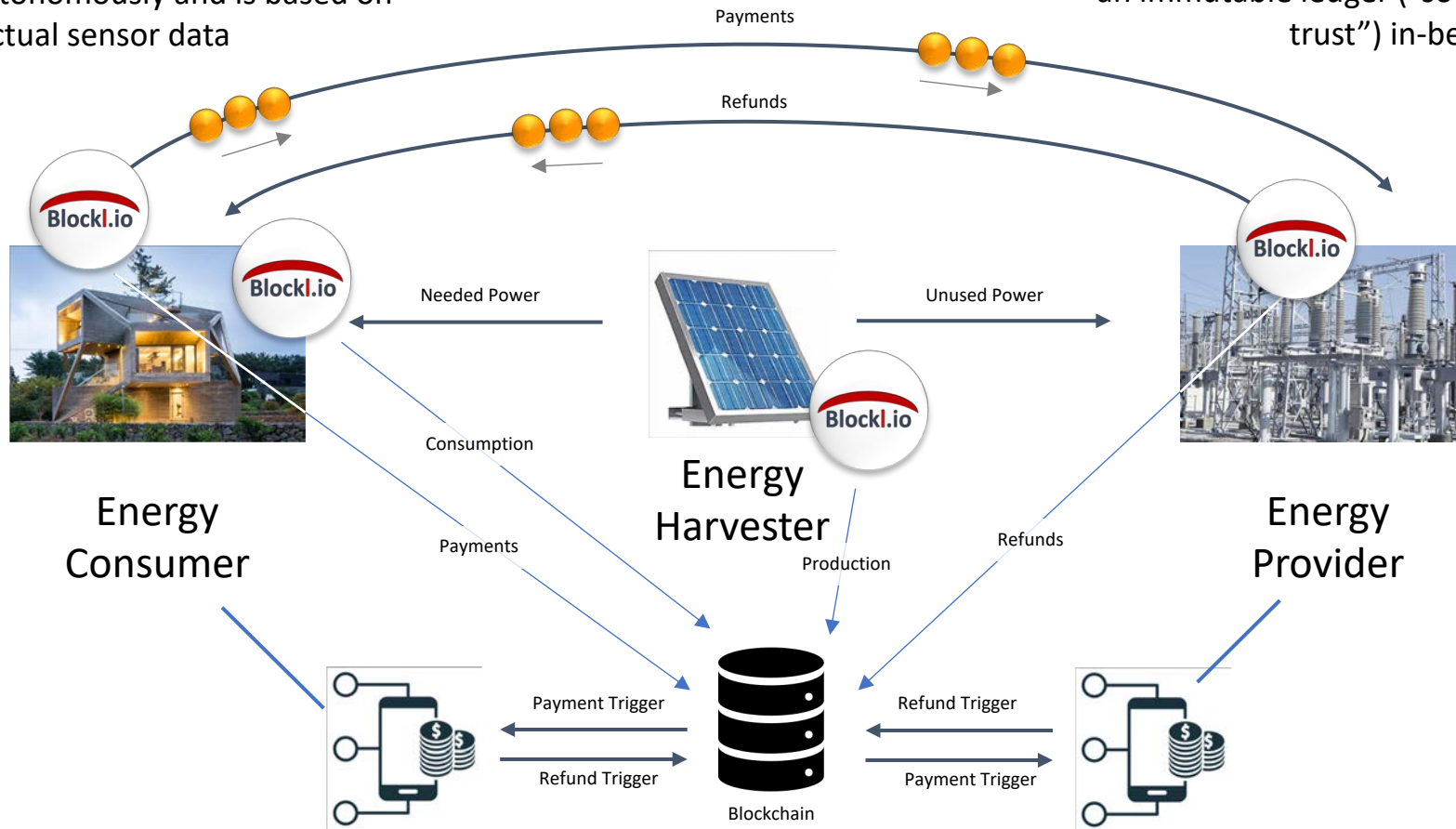
DHS is working on a project to store sensor and camera data at the border on the Factom blockchain backed by the public blockchain to prevent manipulation and attacks.

# Smart Contracts and Tokens Enable Payments



**Why:** each smart contract operates autonomously and is based on factual sensor data

**How:** the key to making it work is an immutable ledger ("source of trust") in-between



**WiifM:** 'no-touch' settlement and payment, obfuscation and privacy, higher security, automated tax reporting (GtHooH)

**WiifM:** less reconciliation, fast processing, cost savings, margin capture, scalability, security, resilience, wide range of use cases

## GRID+



Hardware-based Payment System for Energy (and other applications):

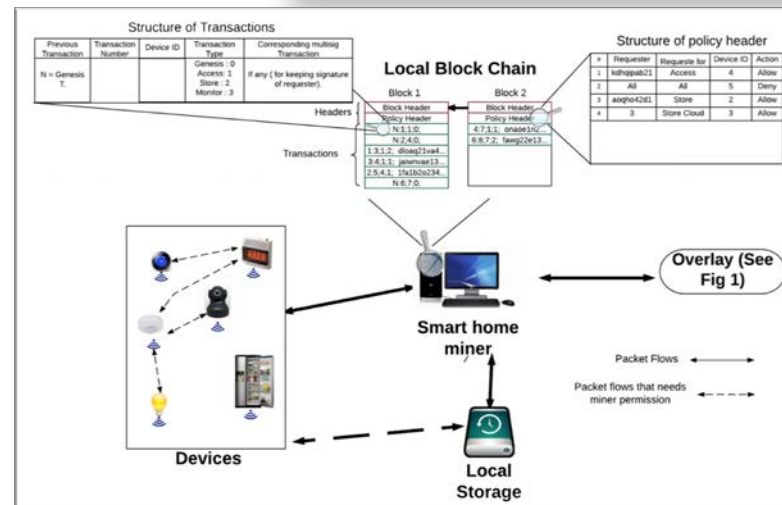
- Public launch in Feb 2019
- Crypto-based payments (transparent to user)
- Based on Ethereum and anticipating fiat-backed stable tokens for payments
- Secure hardware gateway for lots of IoT devices in due time
- Distributed energy very smart starting point
- Buy and sell energy on behalf of users while leveraging AI to help users to bring the cost down
- Long-term vision to enable distributed energy markets





## IoT Consumer Applications: Blockchain Can **Secure a Cluster of Smart Homes.**

- **Concept:** each smart home maintains a blockchain “miner” node that connects all IoT devices in the home.
- **Home Nodes:** each node contains a blockchain that maintains blocks for the whole cluster.
- **Devices:** authenticate themselves to the network when they first connect and are integrated into the network.
- **Security:** each device uses a private key, which corresponds to a public key stored on the blockchain.
- **Operation:** devices handle transactions, which are submitted to the blockchain, validated by miners and added to new blocks.



## Business Value of Blockchain for IoT

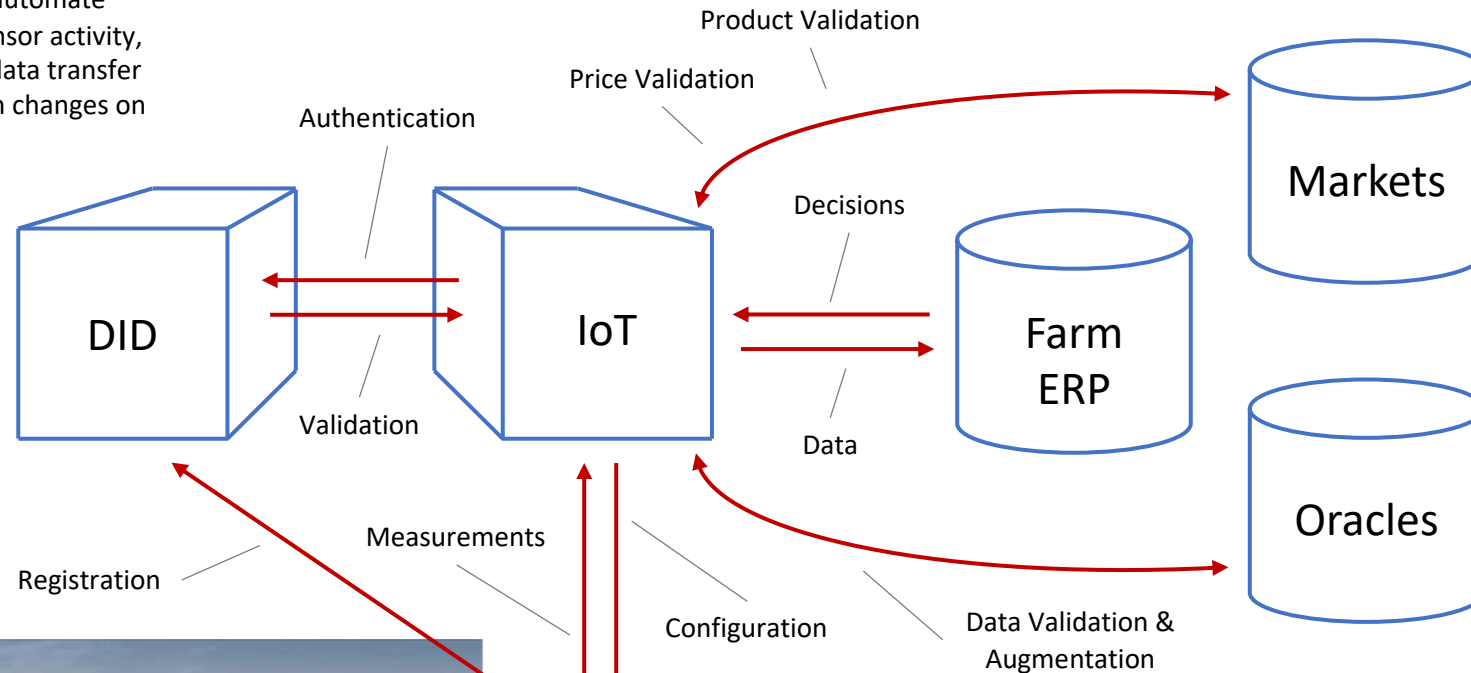
- Secure Connectivity
- Metering and Contract Automation
- Masking of Devices
- Hard to Attack or DDoS
- Immutable Record

## Use Cases:

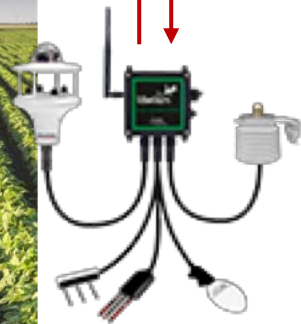
- Home Security & Alarms
- Appliances & Charges
- Smart Metering
- Solar & Sale of Power
- Payments and Credits
- Dynamic Insurance
- Behavior Modelling



Smart contracts automate triggers for of sensor activity, measurements, data transfer and configuration changes on IoT devices.



Product Image: Libelium, 2019



19 Sensors for weather, wind and precipitation, light (Lux), atmospheric pressure, mold & humidity, plant measurements (stem, body, leaf wetness), irrigation, radiation levels, soil morphology, fertilizer presence, frost prevention, daily growth of plants and fruits, etc.

## Business Value of Blockchain for IoT

For example: according to the UN, between 2005 and 2015, natural **disasters cost \$96B** in developing nations. Weather related losses were \$26.5B and life stock losses \$9.5B.

Source: FAO, 2018

### IoT Benefits

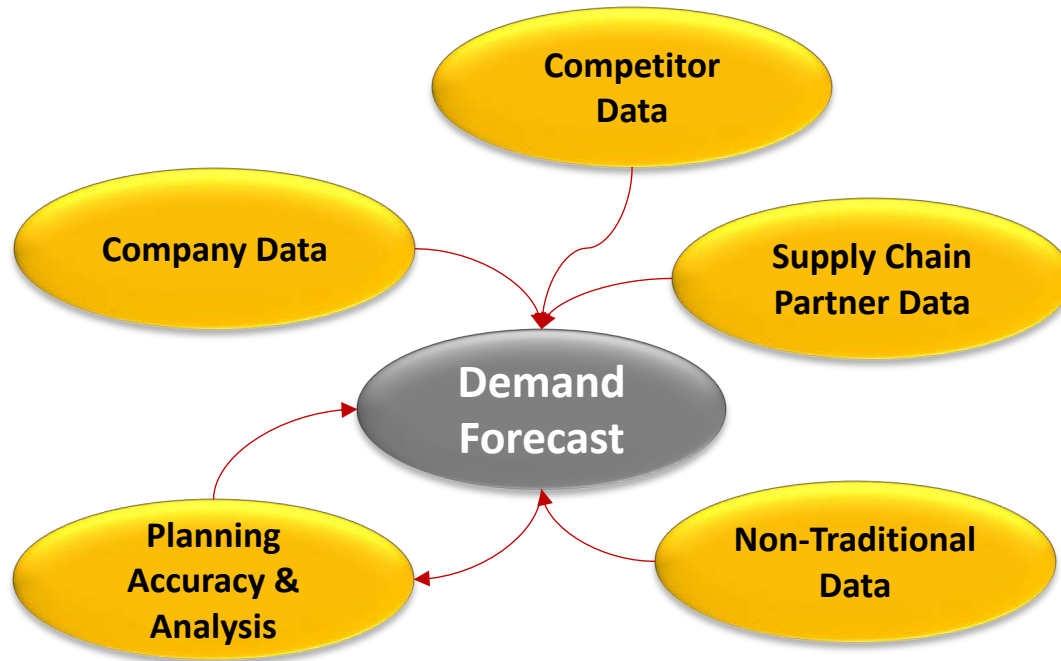
- Counter-Measures
- Better Planning
- Ability to be Proactive

### Blockchain Benefits

- Price Differentiation
- Data Sharing
- Security



**What If** ... you could improve demand planning and forecasting by providing an anonymous, autonomous and globally available data source shared by many industry players?



## So, why blockchain and IoT?

- Optimization is terribly hard w/o data sharing, which requires trust between parties.
- Data collection is terribly hard w/o automation of inputs and transactions.

## How Would You Do It?

- Automate data capture from key sources e.g. business partners and vendors
- Establish trustless network to entice industry participants to share and use data
- Add generally available sensor data and oracles
- Make it available to all participants

## Business Value of Blockchain and IoT

### Inventory is Rampant

In electronics, inventory value hovers just under 10% of gross revenue. The main reason? The inability to plan for trends and demand swings.

### IoT Benefits

- Trusted source of data
- Autonomous
- Scales fast and efficient

### Blockchain Benefits

- Anonymity
- Data Sharing
- Security





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