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Blockchain and Connected Industry: Applications and Implications

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About me

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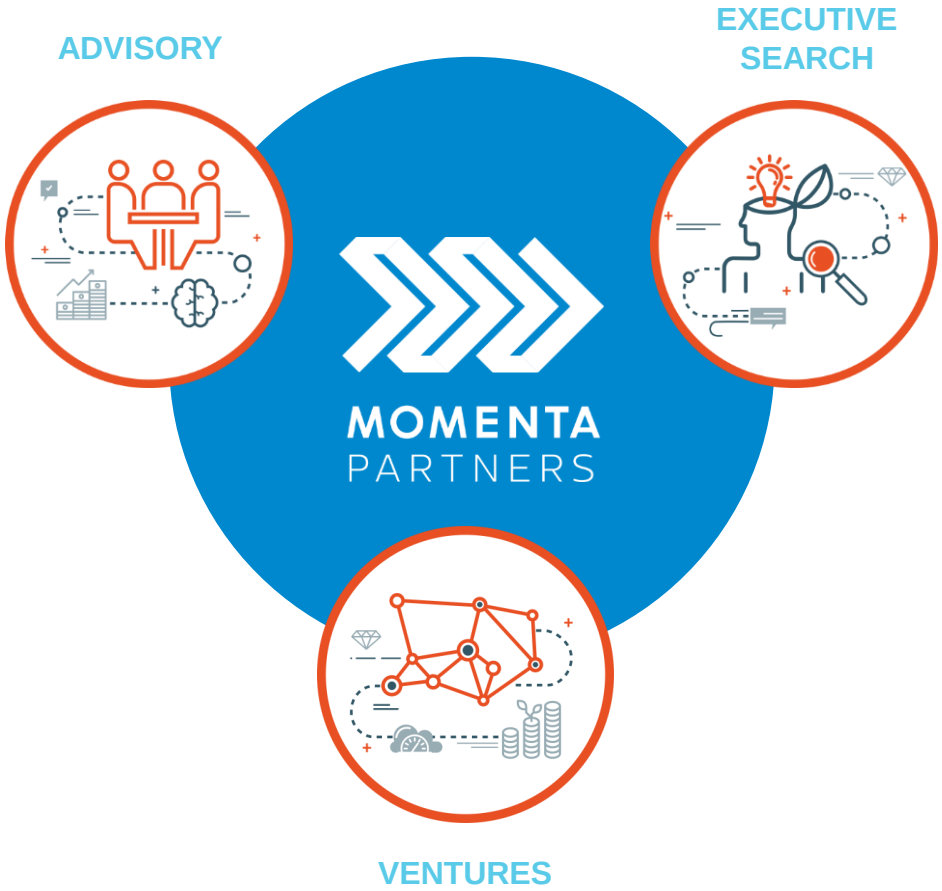
Ed brings more than 17 years of Wall Street experience in equity research and investment banking to Momenta, with deep domain expertise in enterprise software. He has proven success identifying strategic opportunities and articulating actionable insights based on rigorous analysis of technology, operations, competition and markets. Most recently he was senior analyst and managing director at CLSA Americas covering the software industry, technology and innovation.

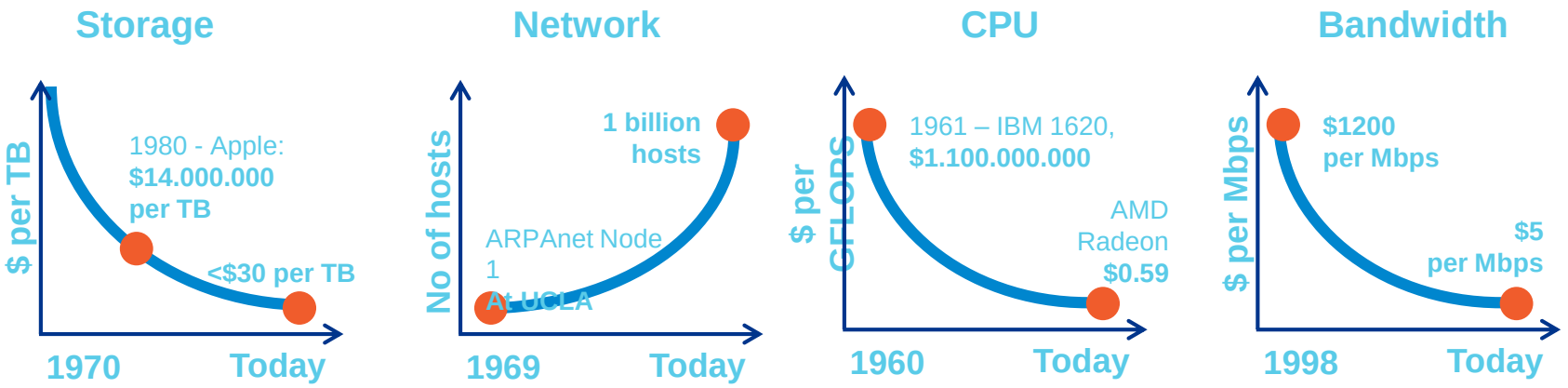
Three Integrated Practices

Hyper-focused on Industrial IoT



Connected Industry continues to progress

Exponential forces power innovation



Source: O'Reilly

- **Innovation catalysts:** Exponential cost curves in storage, CPU and bandwidth combined with network effects
- **Connected devices proliferate:** **2017** - 9 billion TO **2025** – 55 billion
- **Investment is accelerating:** **2017 – 2025** $15 trillion in aggregate IoT investment

Entering the Era of Combinatorial Innovation

Connecting Industry, Innovation, Technology, Business and People

Connected Industry (IoT) is delivering on early promises

- Proof of Concepts begin to generate real ROI
- Industry benefits from declining costs of sensors, connectivity, storage, processing

Moore's Law (compute power) + Koomey's Law (energy efficiency) + Metcalfe's Law (value of the network) make IoT visions cheaper and more powerful every year.

Innovations in hardware, software, networking and connectivity at the IT core

- Declining cost of sensors, components, open source hardware, modules
- Evolving choice of connectivity options, networks and standards
- Availability of cloud services, IoT platforms, open source software

Expect combinations of innovations to define the next wave of startups and services

- IoT + AI + AR + Blockchain
- Robotics, Autonomous Cars, Additive Manufacturing, Clean Energy

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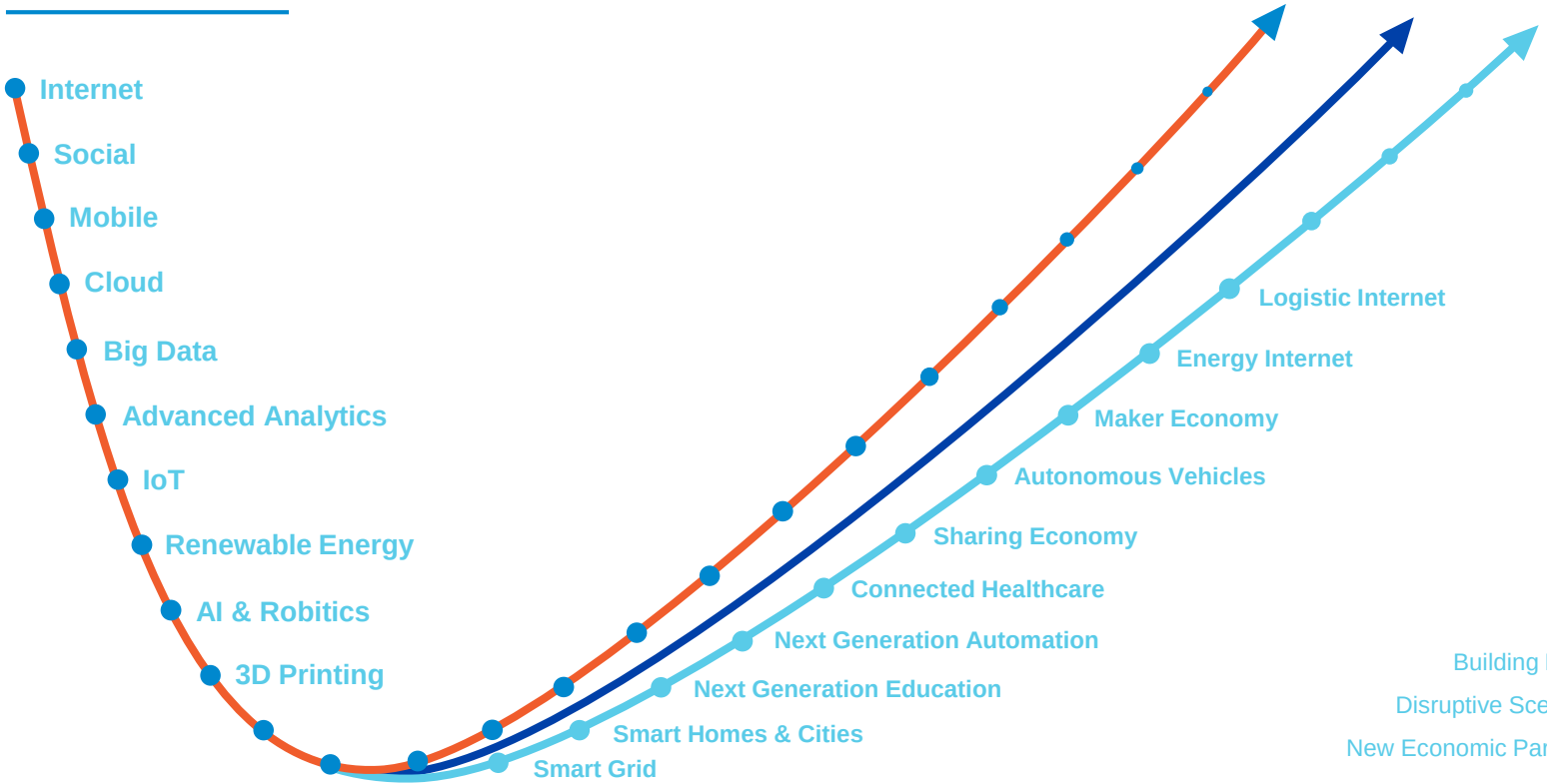


The dynamics of Connected Industry and IoT

IoT connections are scaling

- IDC predicts the worldwide installed base of IoT endpoints will grow from14.9 billion in 2016 to over 82 billion in 2025
- The pace of industrial IoT connections is accelerating according to Verizon's 2017 State of the Market IoT Report

IoT network connections - 2016 vs. 2017 % growth

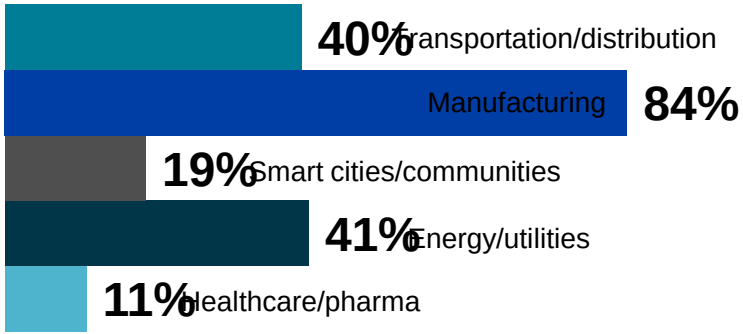


Figure 1: Year-on-year growth in Verizon IoT connections

Systemic challenges as IoT scales

With billions of connected devices coming online, there are systemic challenges to scaling IoT

- Connected devices will need to assure identity, security and interoperability
- Every IoT use case needs to address information security, privacy and regulatory requirements
- The benefits of Blockchain and IoT promises are not yet clear

What's all this we hear about blockchain?

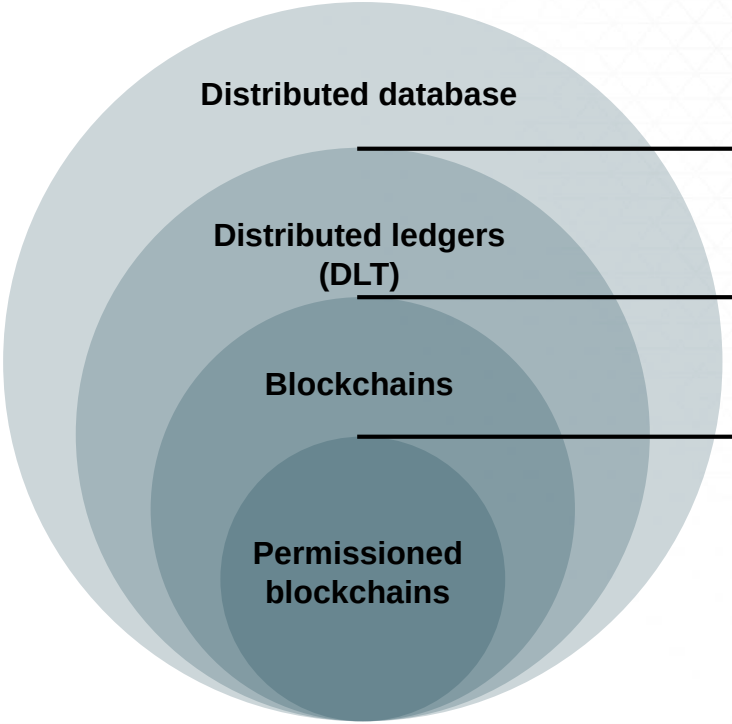
Blockchain or Distributed Ledger?

– **Distributed ledgers** consist of replicated, shared, and synchronized data located across multiple systems.

– **Blockchain** is a consensus algorithm and a type of distributed ledger that contains unchangeable digital data in packages called blocks.

What are Blockchains and Distributed Ledger Technologies?

Blockchains are a subset of Distributed Ledger Technologies



1. ADVERSARIAL MODEL
Precence of malicious nodes assumed

2. DATA STRUCTURE AND DIFFUSION
Chain of cryptographicaly linked blocks, and.or global data broadcast

3. PERMISSION MODEL
Read: public vs. Private
Write/Commit: Permissionless vs. Permissioned

Definition source: Blockchaintechnologies.com

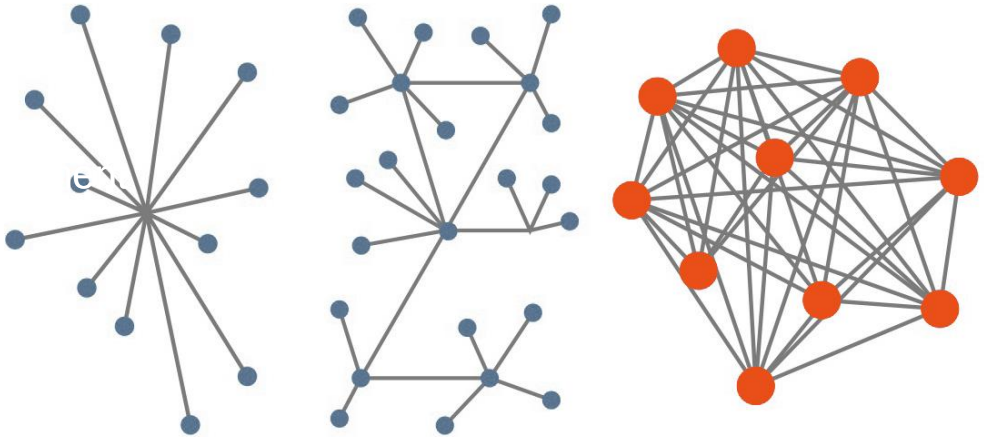
Source: Global Blockchain Benchmarking Study 2017, Dr. Garrick Hileman and Michel Rauchs

Blockchain and Distributed Ledger technologies

A catalyst for broad-reaching innovations

Exploration of potential uses of Blockchain/DLTs evokes the Internet in the early 1990s.

- “Inside-out” networked security model
- Cryptocurrencies
- Decentralized Autonomous Organizations (DAOs)
- Tokenization
- Smart Contracts
- Distributed Applications (DApps)
- ICO’s (Initial Coin Offerings)



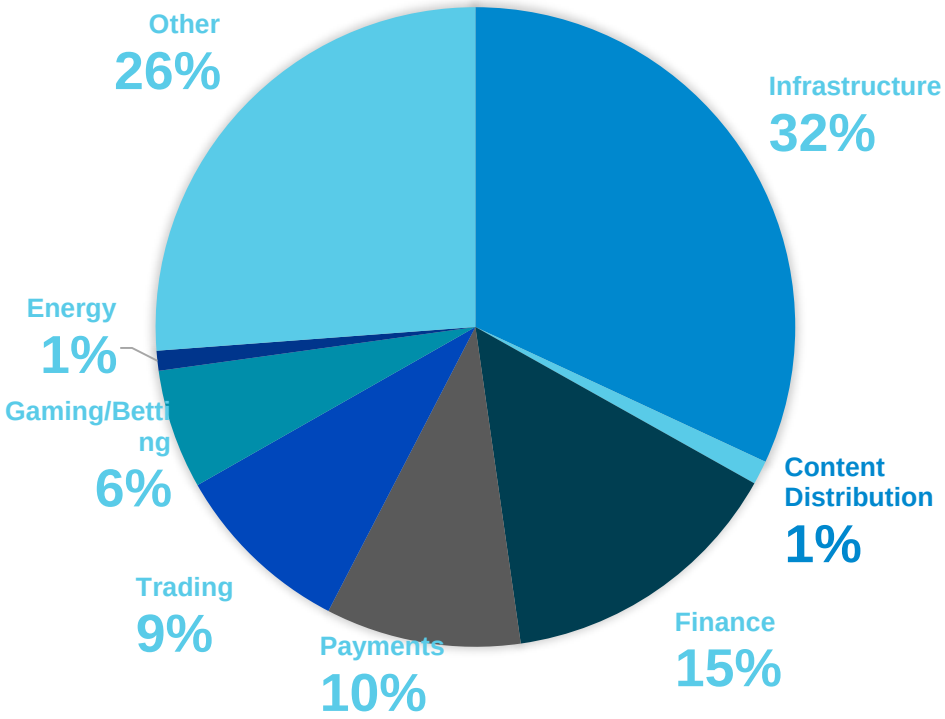
How blockchain works

Distributed Ledger Technologies use cryptography for security

- A blockchain or distributed ledger is a database with copies shared by every member of the network.
- Communications via peer-to-peer networking system.
- A consensus-formation algorithm validates transactions by having a majority of participants agree.
- Validation. Accomplished through Proof of Work or other approach
- A cryptographic token is a string of numbers and letters that enables people to store and transmit value or execute functions

The Blockchain Wave – almost a deluge

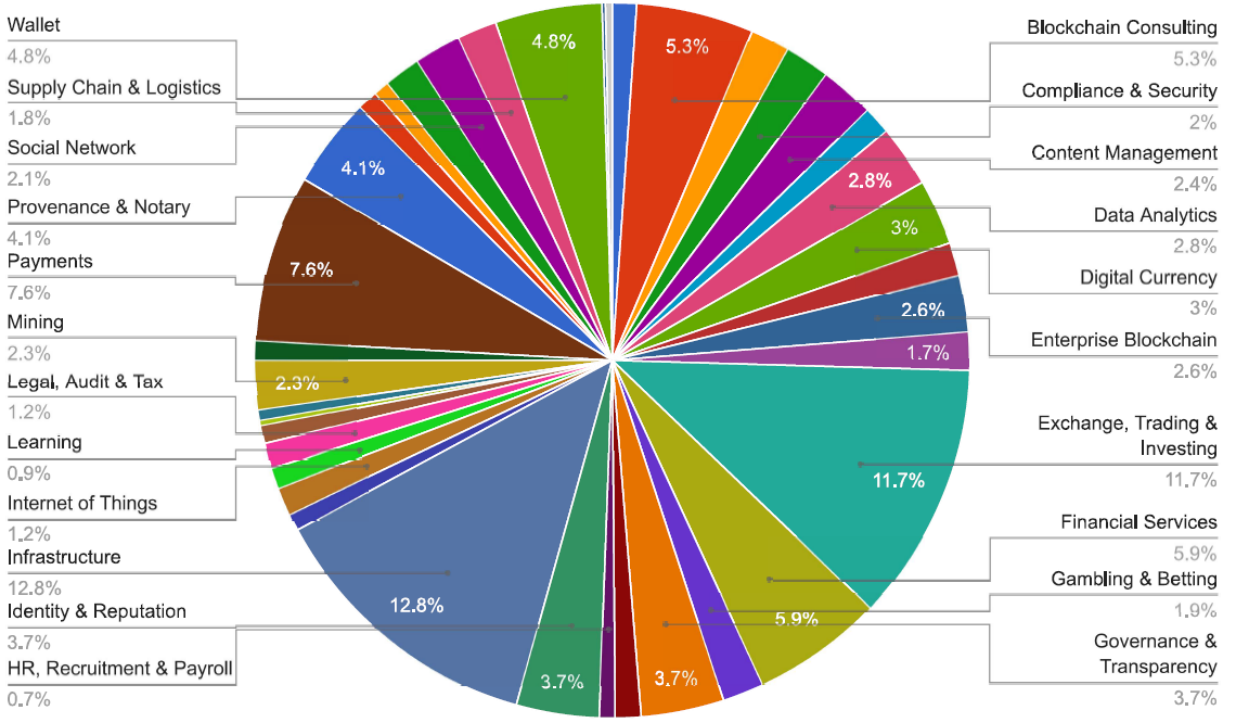
- Massive investment funding for early stage projects
- Initial Coin Offerings (ICO's) have raised over $6bn in 2017, over $1bn so far in 2018
- Close to 1/3 of Blockchain investments are focused on infrastructure – characteristic of an early stage market.
- Blockchain professional services are forecast to grow worldwide at a 71.3% CAGR of from $736mn in 2017 to $10.6bn in 2022 (IDC)



Source: Fabric VC and Token Data

A Cambrian explosion of blockchain startups

Nearly 1,300 companies spanning a wide range of industries and use cases



Source: Outlier Ventures

A cornucopia of uses for blockchain

Potential spans multiple industries

Financial
Trading
Deal origination
POs for new securities
Equities
Fixed income
Derivatives trading
Total Return Swaps (TRS)
2nd generation derivatives
The race to a zero middle office
Collateral management
Settlements
Payments
Transferring of value
Know your client (KYC)Anti money laundering
Crowd Funding
Peer-to-peer lending
Compliance reporting
Trade reporting & risk visualizations
Betting & prediction markets

Insurance
Claim filings
MBS/Property payments
Claims processing & admin
Fraud detection/prediction
Telematics & ratings
Digital authentication
Asset management
Automated underwriting
Self-administered insurance

Media
Digital rights mgmt
Game monetization
Art authentication
Purchase & usage monitoring
Ticket purchases
Fan tracking
Ad click fraud reduction
Resell of authentic assets
Real time auction & ad placements

Software Development
Micronization of work (pay for algorithms, tweets, ad clicks, etc.)
Expanse of marketplace
Disbursement of work
Direct to developer payments
API platform plays
Notarization & certification
P2P storage & compute sharing
DNS

Medical
Records sharing
Prescription sharing
Compliance
Personalized medicine
DNA sequencing

Asset Titles
Diamonds
Designer brands
Car leasing & sales
Home Mortgages & payments
Land title ownership
Digital asset records

Government
Voting
Vehicle registration
WIC, Vet, SS, benefits, distribution
Licensing & identification
Copyrights

Identity
Personal
Objects
Families of objects
Digital assets
Multifactor Auth
Refugee tracking
Education & badging
Employer & Employee reviews
Purchase & review tracking

IoT
Device to Device payments
Device directories
Operations (e.g. water flow)
Grid monitoring
Smart home & office management
Cross-company maintenance markets

Payments
Micropayments (apps, 402)
B2B international remittance
Tax filing & collection
Rethinking wallets & banks

Consumer
Digital rewards
Uber, AirBNB, Apple Pay
P2P selling, craigslist
Cross company, brand, loyalty tracking

Supply Chain
Dynamic ag commodities pricing
Real time auction for supply delivery
Pharmaceutical tracking & purity
Agricultural food authentication
Shipping & logistics management

Source: Laura Lindsay

Blockchains – Permissionless and Permissioned

- **Permissionless blockchain**

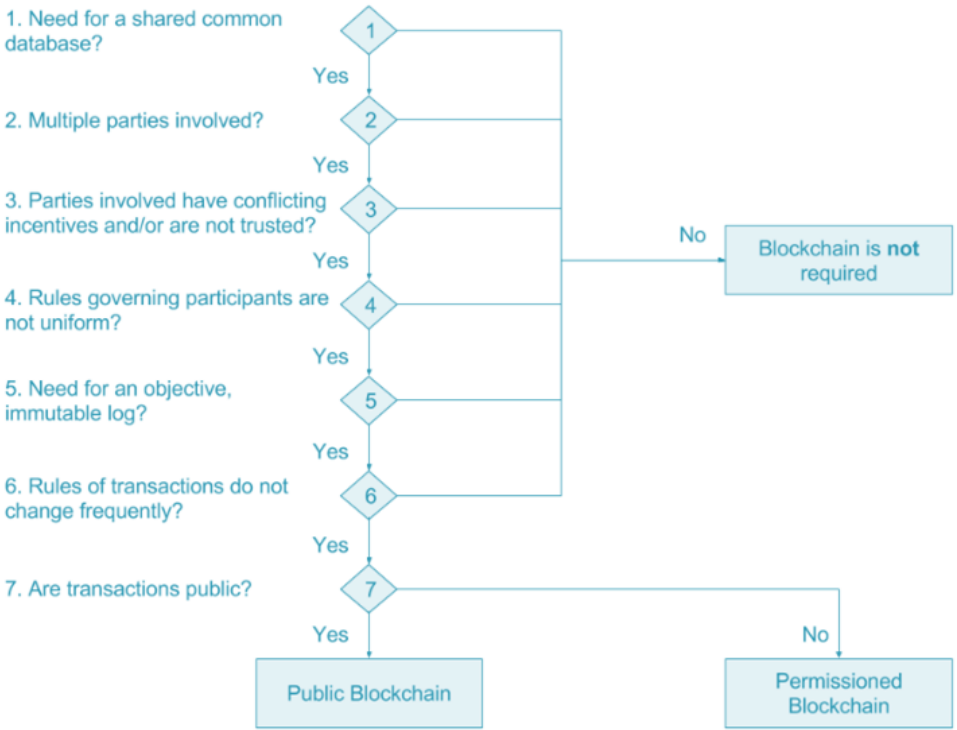
  Examples include Bitcoin, Ethereum, and Monero

- **Permissioned block chains**

  Examples include Hyperledger, Hyperledger Fabric, Corda.

Blockchains/DLT – or database?

Blockchain Decision Path



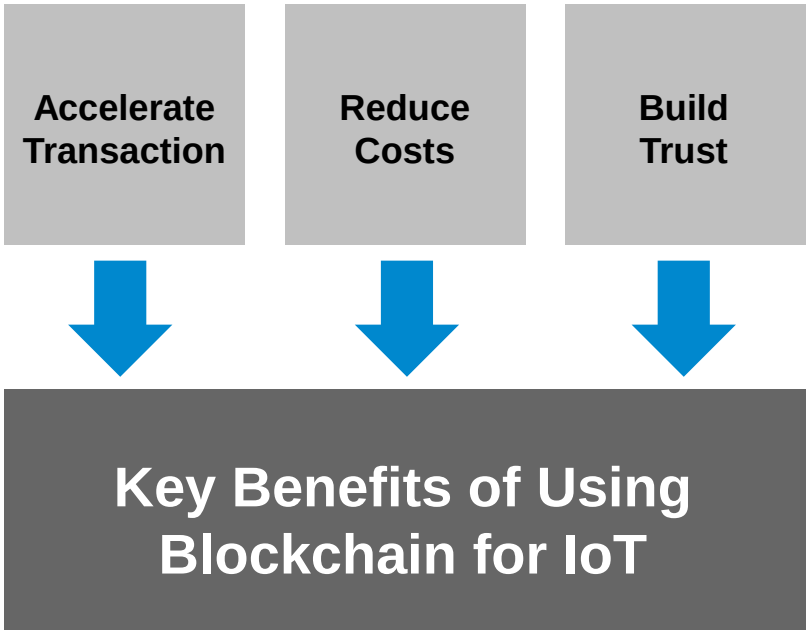
Source: Peter Bergstrom

Advantages of blockchain/DLTs for IoT

Solving IoT challenges of security, compliance, payments, value exchange

Potential business benefits include:

- Identity validation
- Reduced transaction friction
- Lowering compliance overhead
- Accelerating verification processes
- Tracking value exchange
- Enabling autonomous processes



Source: Ahmed Banafa

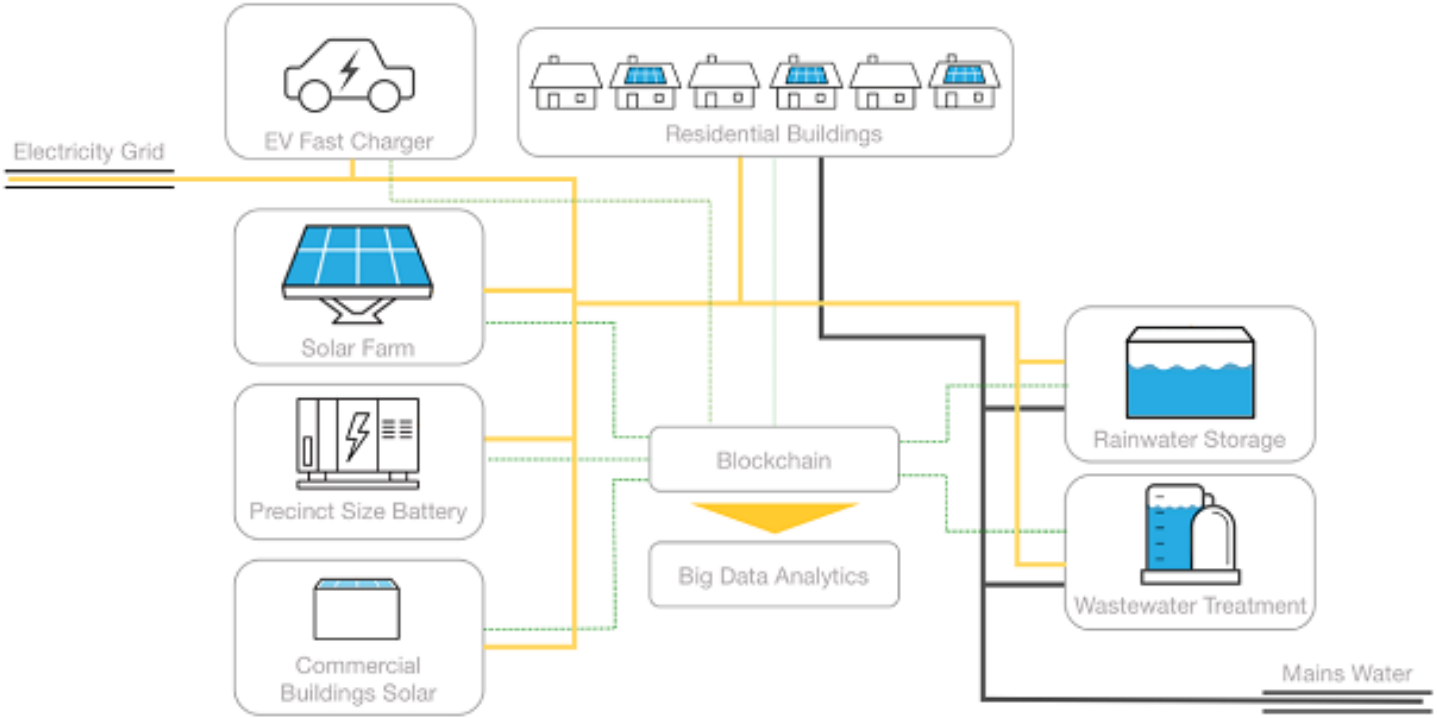
Uses for blockchain - Energy

Reducing transmission bottlenecks

- Tennet partnership with Sonnen
- In response to the challenge of transport bottlenecks
- Blockchain solution was developed by IBM based on Hyperledger Fabric

Uses for blockchain - Energy

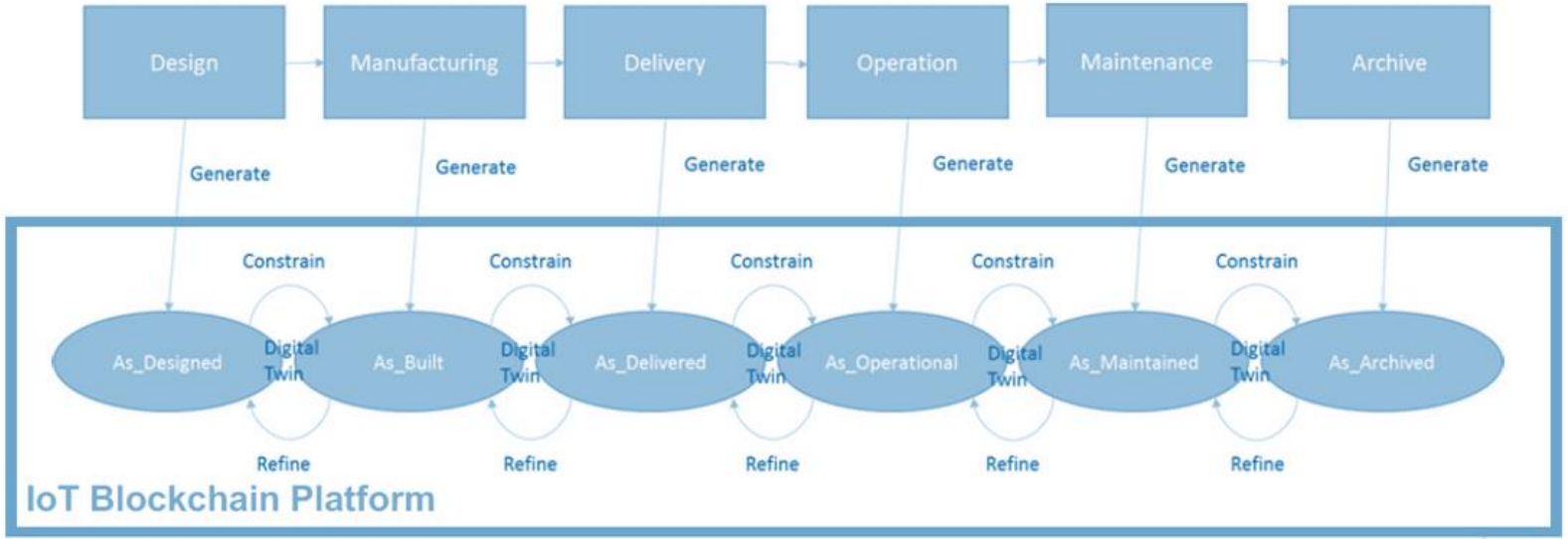
Multi-source Clean Energy systems



Uses for blockchain - Manufacturing

Boeing is Tracking provenance of parts across their supply chain

Leveraging blockchain for Predictive Maintenance



Uses for blockchain – Transportation and Logistics

Shipping

- Blockchain replaces paper-based container tracking.
- The ports of Rotterdam and Antwerp are exploring the use of blockchain technology for logistics automation.

Provenance – Record of Ownership

- A food industry collaboration is using the blockchain technology tracing food safety and contamination.
- A digital ID for high value assets confirms the authenticity throughout their lifetime.

MAERSK

Walmart

everledger

Crossing the divide

The backing of big software is a critical factor to drive broader adoption of blockchain in industry

Blockchain as a Service (BaaS) since 2016 – Focus on Hyperledger and private blockchains

Microsoft

BaaS on Azure offerings supports a range of protocols, while favoring Ethereum

SAP

SAP's BaaS offering was launched in 2017 as part of the Leonardo IoT platform

ORACLE

BaaS on Oracle Cloud with Hyperledger focus in late 2017

Founding Members

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CONSENSYS

IOTA

Still obstacles to corporate blockchain/DLT adoption

Scalability, maturity of technology, ecosystems

- Shortage of developers (35-50k versus 9-10 million Java developers)
- Scalability constraints (Bitcoin, Ethereum)
- Energy efficiency (from Proof of Work to Proof of Stake, Proof of Care, DAG)
- Security of applications
- Consistent Identity framework
- Integration with enterprise systems
- Most production applications today are permissioned blockchains (Hyperledger)

The evolution of Blockchain/DLTs

Rapid innovations address current shortcomings

Blockchain 1.0
– Payments, and monetary store of value
– Bitcoin, Monero, Zcash, Litecoin

Blockchain 2.0
– Use as a network backbone or virtual machine
– Ethereum, NEO

Decentralization 3.0
– Concurrency, scalability, security
– Cardano, EOS, RChain
– Directed Acyclic Graphs (DAGs) IOTA, Hashgraph (Swirlds)

THANK YOU

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