CONNECTED
INTELLIGENCE

Building a Blockchain Government

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What to do with Blockchain?

http://ericsammons.com/what-is-the-blockchain/

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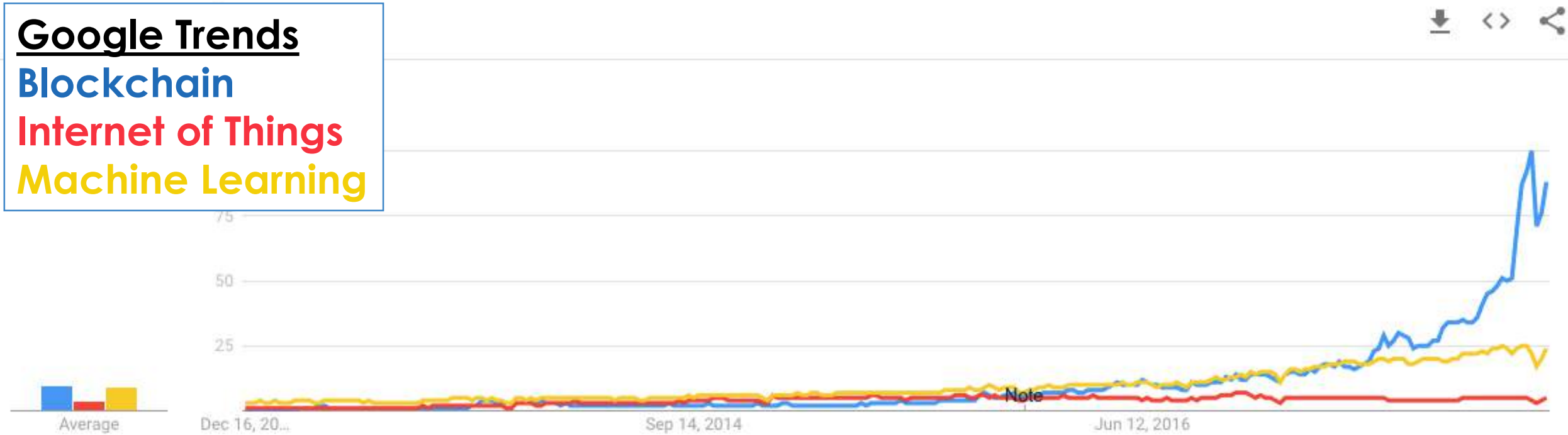
Blockchain : The Tip of the Iceberg

Projected to Grow at 61.5% CAGR to 2021
USD 210.2 million (2016) to USD 2,312.5 million (2021)

http://www.marketwatch.com/story/blockchain-technology-market-growing-at-615-cagr-to-2021-2016-10-13-22203054

Blockchain : The Tip of the Iceberg



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Blockchain : Why the interest?

Digital Mesh*

- The digital mesh is a mesh of people, devices, content, and services.
- New business models and processes are needed to cope with a world that is increasingly connected and blended.

Decentralized Business Networks

- There is a need to automate business transactions via contracts across network participants in an efficient and cost-effective manner.
- The old "B2B exchanges" and third parties reduce speed & agility.

Need for Integrity & Visibility

- Transactions must be conducted openly and securely, with full integrity.
- Many business transactions require an immutable, agreed-upon log.

* https://www.gartner.com/doc/3471559?srcId=1-7484470122#-363727574

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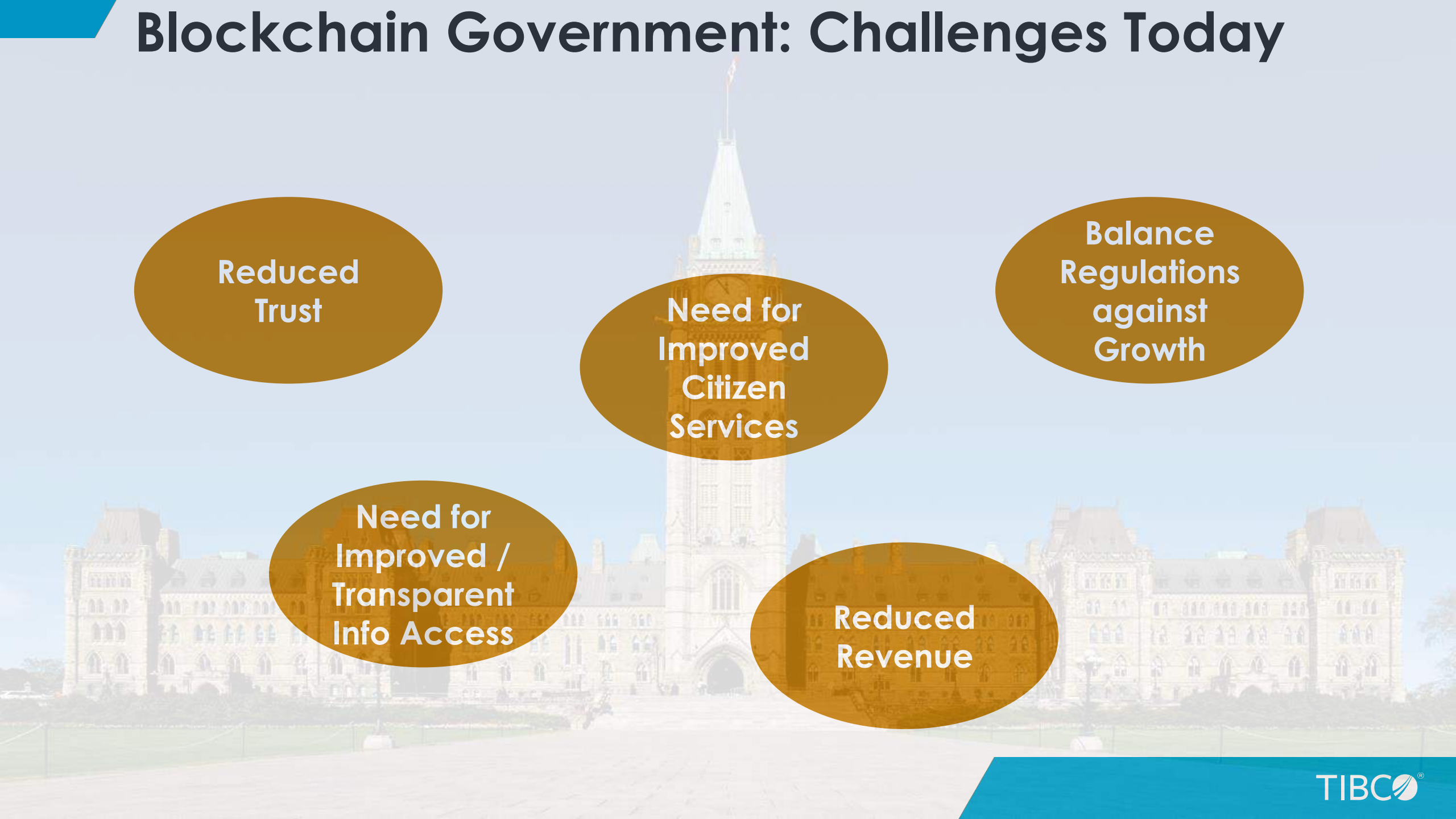
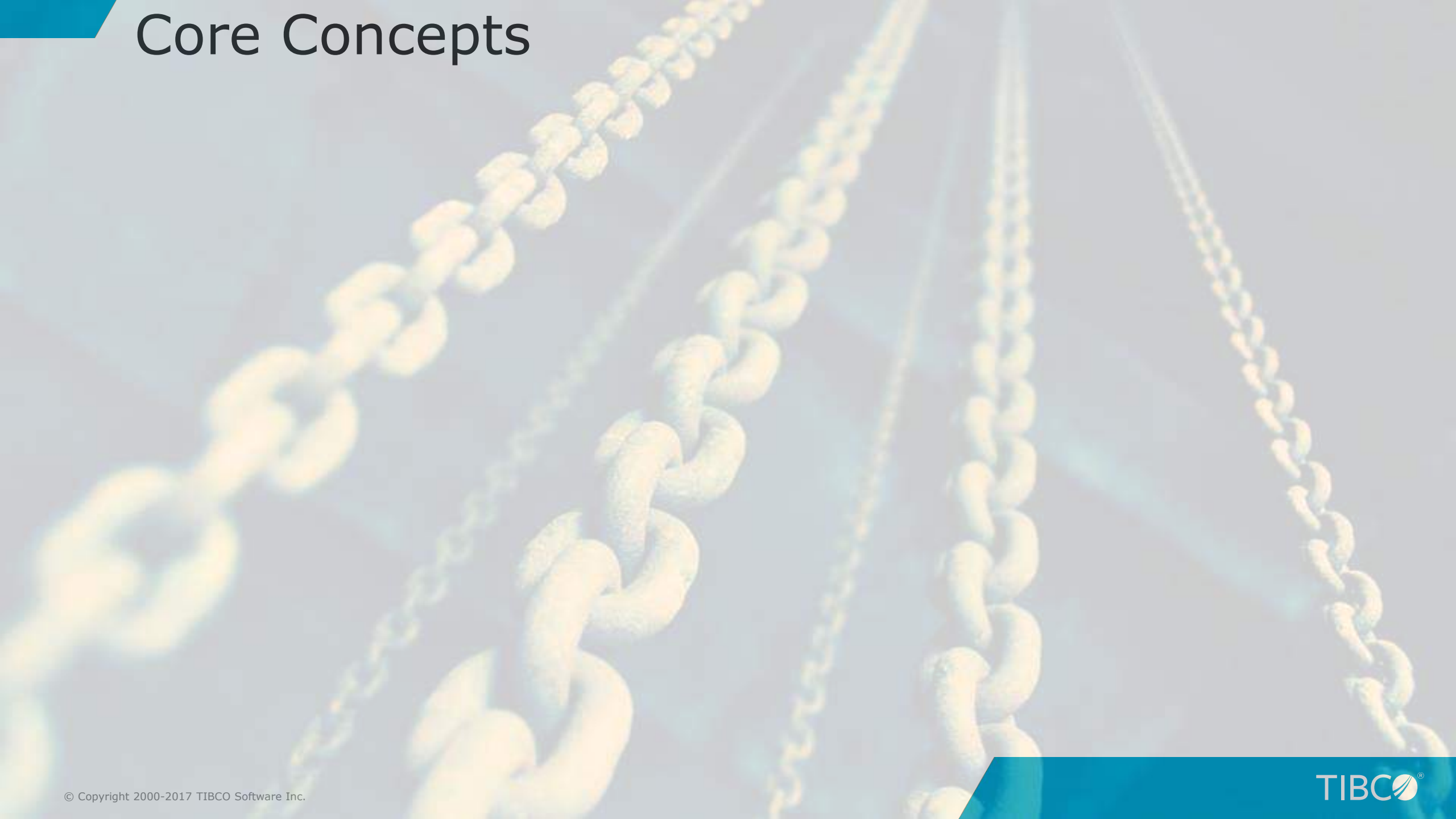
Blockchain Government: Challenges Today



Core Concepts



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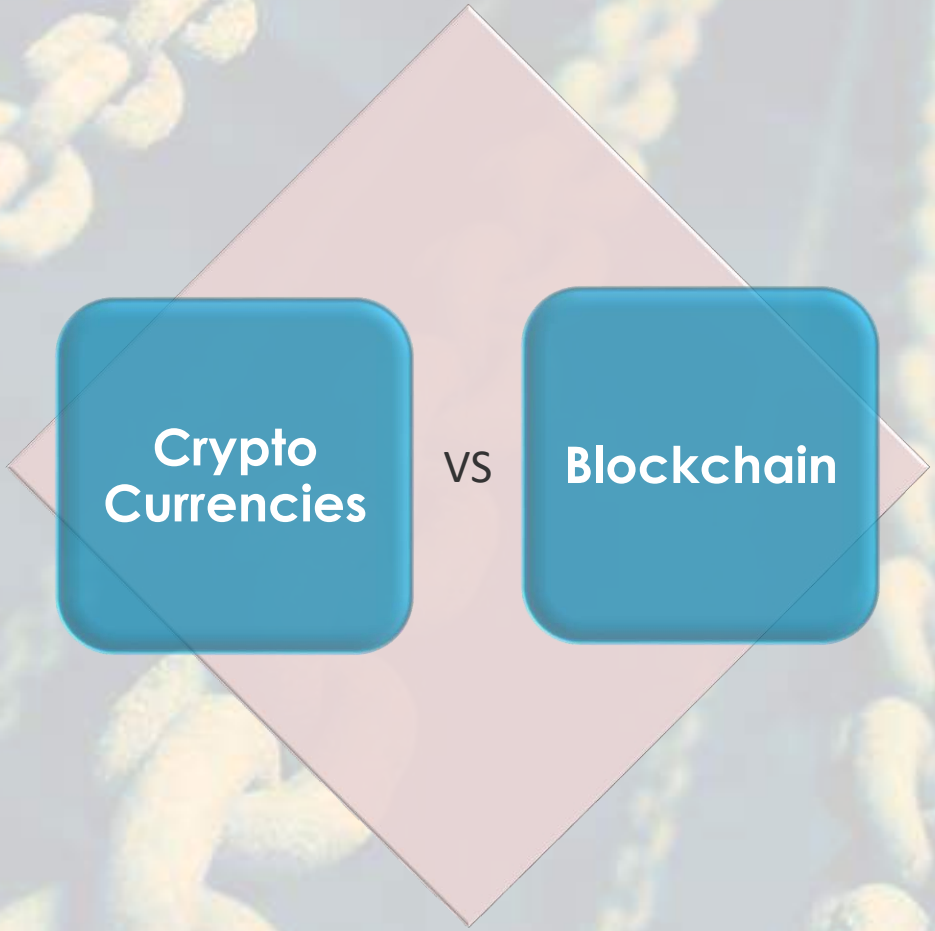
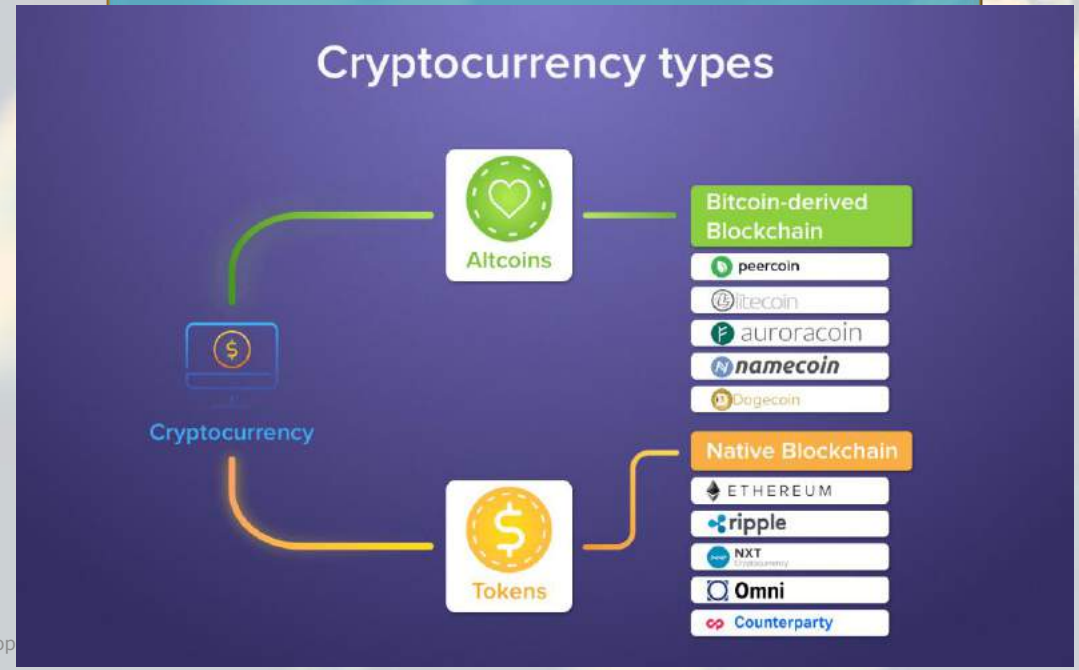
Blockchain : Core Concepts



Core Concepts – Crypto Currencies

Coins (Cryptocurrency)

- Means of Payment e.g. Bitcoin
- Digital/Virtual currency encrypted using cryptography
- Altcoins – coins alternative to Bitcoin
- Majority built from forked variant of Bitcoin



Tokens

- Representation of particular asset or utility
- On top of a blockchain
- Any Asset that is fungible and tradable
- E.g. Commodities, Loyalty Points, Votes in business decisions, Means of Accounting
- Made possible through smart contracts (computer code that is self executing)
- Distributed through Initial Coin Offering (ICO)

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Core Concepts – Crypto Currencies

1384 and growing
Based on familiarity, Market Cap and ease to trade for Fiat currency

- Bitcoin
- Ethereum
- Ripple
- Bitcoin Cash
- Bitcoin Gold
- Litecoin
- Dark Coin (Dash)
- IOTA
- Tether

https://cryptocurrencyfacts.com/list-of-cryptocurrencies/

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Core Concepts – Bitcoin

Bitcoin (BTC)	
Price	$8944
Market Cap	$152 B
Supply Available	$16 M (cap $21 M)
Consensus	Proof of Work
Origin	Satoshi Nakamoto
Private/Public	Public

- It was the first major usable cryptocurrency
- It has the highest market cap
- Its coins trade at the highest cost of all cryptocurrencies
- No Smart Contracts
- Block time 10 minutes per block (1mb per block)
- Secure
- Reason we know about Blockchain
- Power inefficient

Core Concepts – Ethereum

Ethereum (ETH)	
Price	$642
Market Cap	$63.6 B
Supply Available	$98 M (no cap)
Consensus	Proof of Work
Origin	Vitalik Buterin
Private/Public	Both

- Most ICO's use Ethereum as platform
- EEA – 150+ members
- Block time 14-15 per second
- First public blockchain that featured smart contracts
- EVM runtime for Smart contracts (public)
- Errors difficult to fix

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Core Concepts – Ripple

Ripple (XRP)	
Price	$0.88
Market Cap	$34.34 B
Supply Available	$39 M (cap 1T)
Consensus	Ripple Protocol Consensus Algorithm
Origin	Arthur Britto, David Schwartz, Ryan Fugger - Ripple
Private/Public	Public/Private

- Secure, instantly and nearly free global financial transactions of any size with no chargebacks
- Supports tokens representing fiat currency
- More stable alternative to Bitcoin
- Advantage over other – price and security

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Core Concepts – Bitcoin Cash

Bitcoin Cash (BCH)	
Price	$1,430
Market Cap	$24.44 B
Supply Available	$39 M
Consensus	Proof of Work
Origin	Satoshi Nakamoto
Private/Public	Public

- Created after Hard Fork August 1 2017
- 8mb transaction limit from 1bm

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Core Concepts – Litecoin

Litecoin (LTC)	
Price	$152.16
Market Cap	$8.553 B
Supply Available	$55 M (cap $85 M)
Consensus	Scrypt (open source cryptographic protocol)
Origin	Charlie Lee
Private/Public	Public

- Forked from Bitcoin Core
- Open source software project released under the MIT/X11 license
- Inspired by, and in technical details is nearly identical to Bitcoin
- Block time 2.5 minutes per block
- February 2018, one of the major EU online retailer Alza began accepting Litecoin

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Core Concepts – IOTA

IOTA (MIOTA)	
Price	$2.15
Market Cap	$5.97 B
Supply Available	$2.779 B (cap $2.779 M)
Consensus	Monte Carlo algorithm
Origin	Worldwide
Private/Public	Public

- Stores transactions in a directed acyclic graph (DAG) structure called a Tangle
- More energy efficient than Bitcoin POW
- Microtransactions to be made without fees
- IOTA enables secure sale and sharing of data streams
- Designed specifically for the Internet of Things
- Bosch owns significant number of tokens to support business models for IoT

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Core Concepts – Stellar

Stallar (XLM)	
Price	$0.37.7
Market Cap	$6.885 B
Supply Available	$18.5 B (cap $103.7 B)
Consensus	Federated Model for Internet-level Consensus
Origin	Jed McCaleb, Joyce Kim
Private/Public	Private/Public

- Global value exchange network
- Move Money Across Borders Quickly, Reliably, And For Fractions Of A Penny
- Provides a customizable payments infrastructure
- IBM and payments network KlickEx have announced Stellar as the backbone of its new "cross-border payments solution

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Core Concepts – Dash

Dash (DASH)	
Price	$487
Market Cap	$3.9 B
Supply Available	$7.9 M (cap $18.9 M)
Consensus	Special deterministic algorithm
Origin	Evan Duffield
Private/Public	Private

- Open source peer-to-peer cryptocurrency
- On top of Bitcoins feature set
- Provides instant transactions
- Provides private transactions
- Decentralized autonomous organization (DAO)

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Core Concepts – Tether

Tether (USDT)	
Price	$0.999
Market Cap	$2.286 B
Supply Available	$2.580 B
Mining	Omni Protocol
Origin	Brock Pierce
Private/Public	Public

- Based on Bitcoin Blockchain
- Claimed by its creators to be backed by one dollar for each token issued issued
- The primary objective is to facilitate transactions between cryptocurrency exchanges with a rate fixed to the USD

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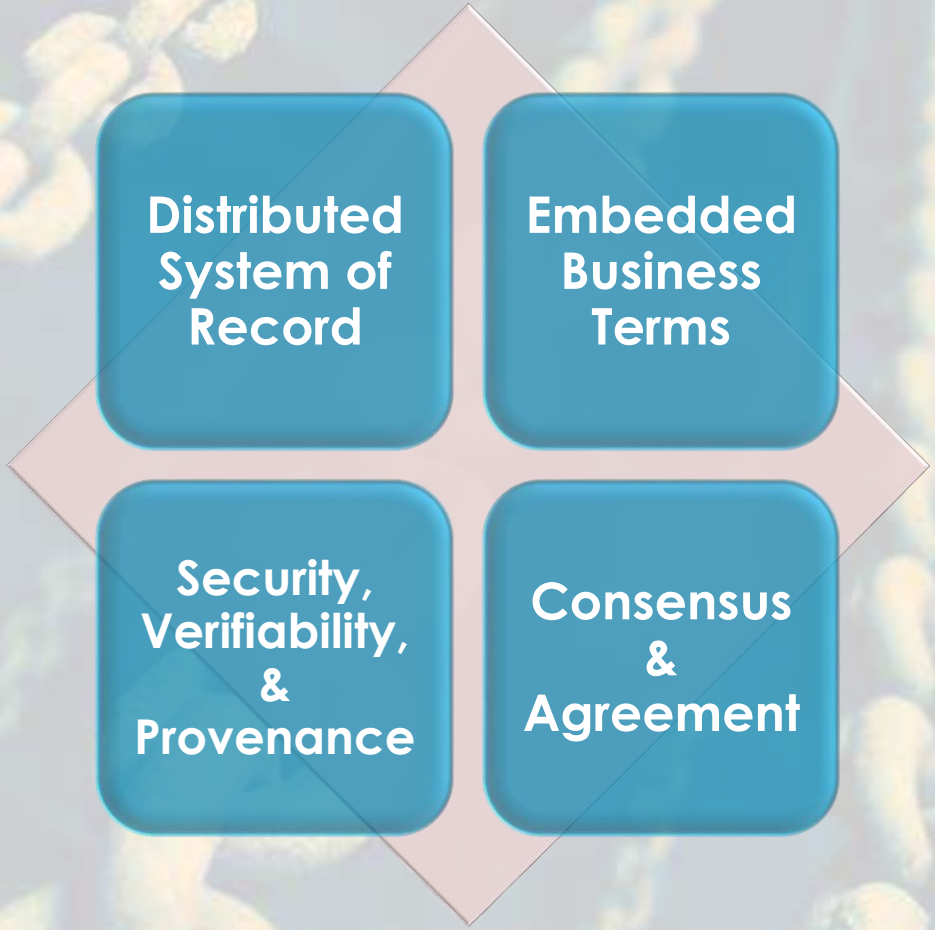
Blockchain : Core Concepts



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Blockchain : Core Concepts

Transaction is added to a "block"

Block is replicated to the participants that need to validate the transactions

All network parties validate the transaction

Block is added to the "chain", creating a tamper-proof audit log

Blockchain : Consensus Algorithms

- Techniques used to build agreement & verify or add transactions to the blockchain
- Proof of Work - Bitcoin
  - Computationally intensive (and thus expensive) "guessing game", now often done on specialized hardware
- Proof of Stake - Ethereum
  - Creator of the block is chosen in deterministic fashion, weighted by stake.
- PoET (Proof of Elapsed Time)
  - "Lottery protocol that builds on trusted execution environments (TEEs) provided by Intel's SGX". Each validator node waits a random amount of time before trying to claim a block. (Intel)

Blockchain : Smart Contracts

- Smart Contracts represent a way to introduce business logic into the blockchain
  - May be triggered by transactions or external events
- Logic may be executed "on-chain" by the participants in the network, with no central coordinator
  - Code is run in parallel
  - All nodes execute the same logic
  - Results are compared and agreed upon
- Could also be executed "off-chain"
  - Computation is secured by the blockchain security model (miners, validators, etc...)
  - Computation is performed outside of the boundaries of the blockchain
  - Security is only provided as settlement layer
  - Examples: Oracles, Side-chains, Payment channels
- Opportunity
  - Reduce risk,
  - Increase efficiency,
  - and automate the execution of business logic across the network without a central party

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Blockchain : Cryptographic Hashes

- Block is a Data structure that contains all transaction submitted for a given time
- Industry standard methods of calculating a digital signature or representation of data
  - e.g. SHA-256
- Comparing 2 hashes of the same data will determine if data has be tampered with
- Nobody should be able to find two different input values that result in the same hash output
- Hashing previous block and adding it to the current block chains the data making it immutable

Blockchain : Digital Wallet

- Manage your identity (Blockchain address)
- Interact with blockchain
  - Send transaction
  - Call smart contract
  - Deploy smart contract
- Types
  - Hardware wallets
  - Software wallets

Blockchain : Decentralized Apps

- Distributed Apps (DApps) are the application stack that sits on top of a blockchain
- No centralized server
- State or reference to state is stored in blockchain
- Part of the logic can be in Smart Contracts

What can we do with it?

- Self Execution of business logic
  - Self enforcement
- Audit Trail
  - Timestamp, rights and ownership proof
- Cryptographically secured
- Blockchains have the potential to
  - Reduce Systemic Risk, Reduce Financial Fraud
- Blockchain protocols facilitate businesses with new methods of processing digital transactions
- Payment system and Digital Currency, Facilitating Crowd Sales
- Selective Transparency and Privacy
- Resistance to Single Point of Failure

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Blockchain : Consortium

- Predefined or selected group of validators handle the consensus process (e.g. “consortium” of financial institutions)
- Types
  - Business-focus to build and operate a blockchain to solve a specific business problem (For example Fintech companies)
  - Technology-focus to build a reusable blockchain (For example Hyperledger)

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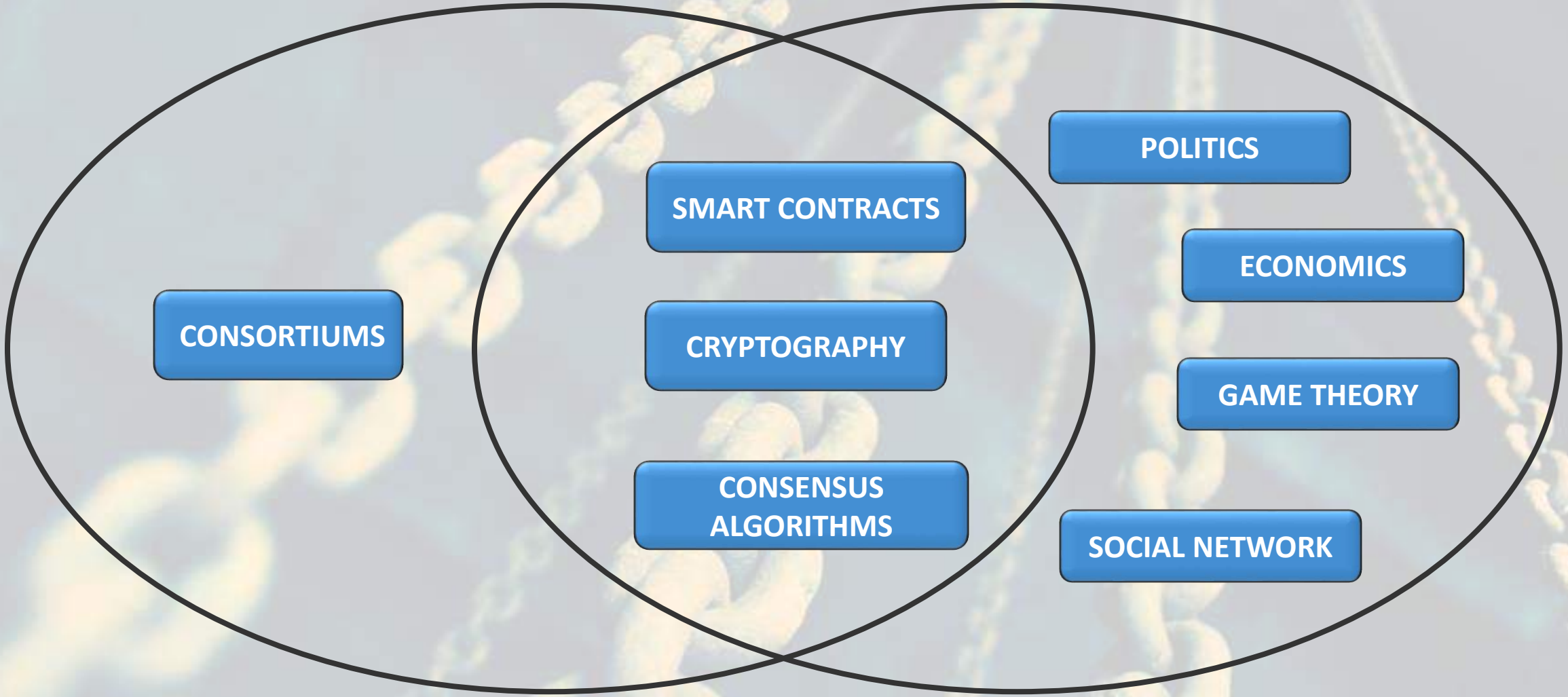
Permissioned vs Permissionless Blockchain



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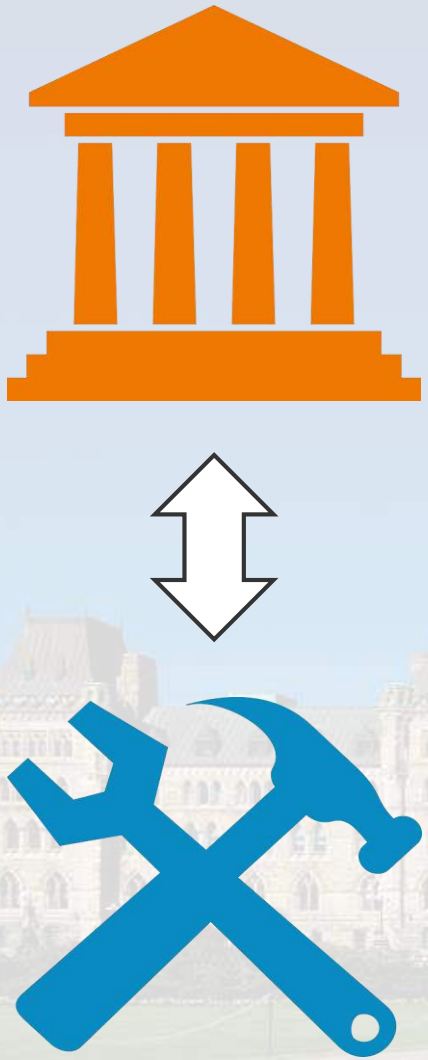
Use Cases: Government to Vendor



- **Contract compliance**, budgeting, and payments.
- **Invoice fraud prevention** & regulatory compliance.
  - Automate legal and statutory requirements through smart contracts.
- Improved **vendor performance** management through agreed-upon delivery of obligations and **recording of contract** service-level agreements.
- Creation of a **vendor "reputation" score** through blockchain transaction analysis.

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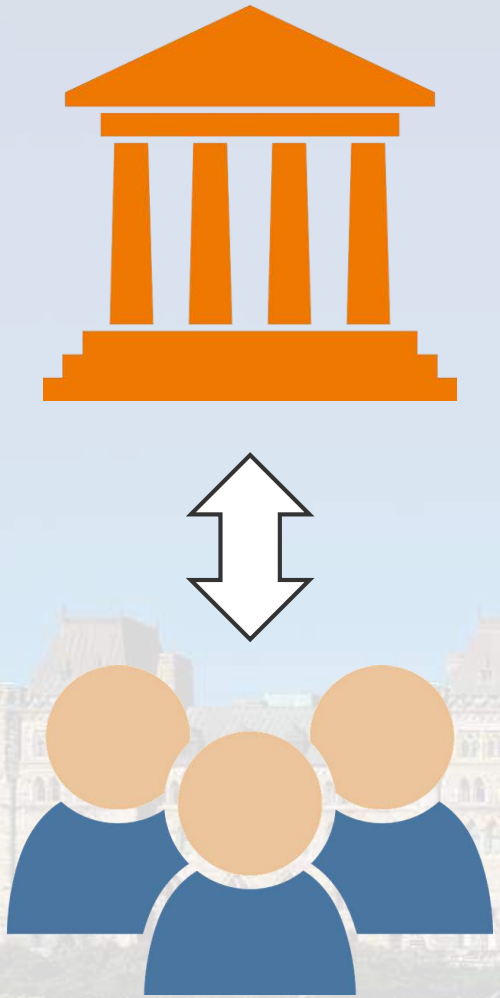
Use Cases: Government to Citizen



- **Asset Registry** and Asset Exchange
  - Track **property ownership** transactions in a secure, immutable fashion over time.
  - Reduce **property ownership fraud**.
  - Eliminate **manual, paper-based processes**.
  - Reduce errors.
- **Licenses, taxes**, & other citizen services.
- **Identity management**.
- Citizen / community **voting services**.
- Delivery of citizen-verified information with no single point of failure.

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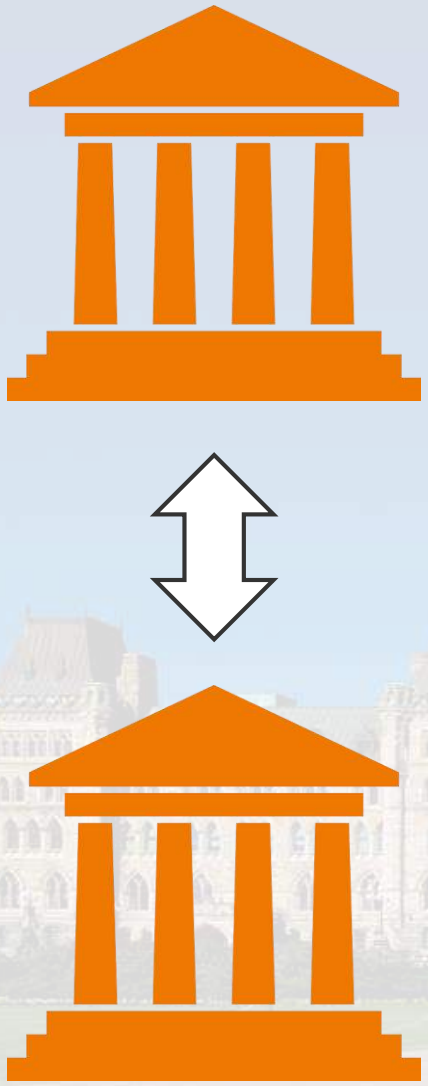
Use Cases: Government to Government



- Intra-agency information sharing & process automation through smart contracts.
- Contract management.
- Education credential verification.
- Coordinated service delivery.
  - e.g. emergency services
- Import / export regulatory compliance and monitoring.
- Identity management and verification.
- Supply chain / product provenance.

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Use Cases: Government

Reduce Risk

Reduce Cost

Reduce Time

Streamline Information Sharing
Provide More Complete Data

"Open Government"
Personalized Citizen Services

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Finance : Use Cases

Digital Identity Ecosystem

- Canada – SecureKey Concierge
- Government Regulated Secure Identity
- Digital Id Standard set by DIACC
- 3 Aspects
  Identity Verification, Authentication, Authorization
- Maintains privacy
- DIACC Applied Research Grant to host pilot
- All Canadian Banks Partnered to run pilot

Trade & Supply Chain Finance

- Information shared by different legal entities
- Goods shipped abroad needs approvals from Customs, Port Authorities and transport firms
- Blockchain record approvals and send notifications of goods received then transfers funds
- Information encrypted and only visible to authorized parties
- Records Immutable end to end Audit trail
- Reduce settlement times

Visibility in Cross-Border Transactions

- NOSTRO-VOSTRO Transactions
- Keeping track of payables/receivables and unsettled transactions
- Today
  Inefficient, Manual Fragmented Data, hard to track real-time account status
- Blockchain
  Improve Transparency, Efficiency, real-time liquidity position, secure permissioned access

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Aerospace & Defense : Industry Trends

Commercial aircraft orders declined over last 4 years

- In order to be competitive, the aerospace industry needs to be more profitable
- Strong dollar hampers sales to foreign buyers
- Some suppliers have experienced operational problems or program delays
- Up to 8 year backlog

Cyber Risk in Manufacturing

- Lack of skilled talent in the cybersecurity function represents a significant challenge for manufacturers ($500M-$5B in revenue)
- Top ten cyber threats facing their organizations are directly attributable to internal employees

Greater investment in defense spending

- North Korea and Issues with Russia prompted the current administration to strengthen country's military capability
- More developing nations expanding defense spending

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Aerospace & Defense : Use Cases

Manufacturing & Maintenance

Currently data not stored in one single location. Register components with serial codes, and used in maintenance to determine of parts are to be fixed or replaces

Supply Chain

Shared Database with suppliers to track quality and compliance.

15% of components are counterfeit

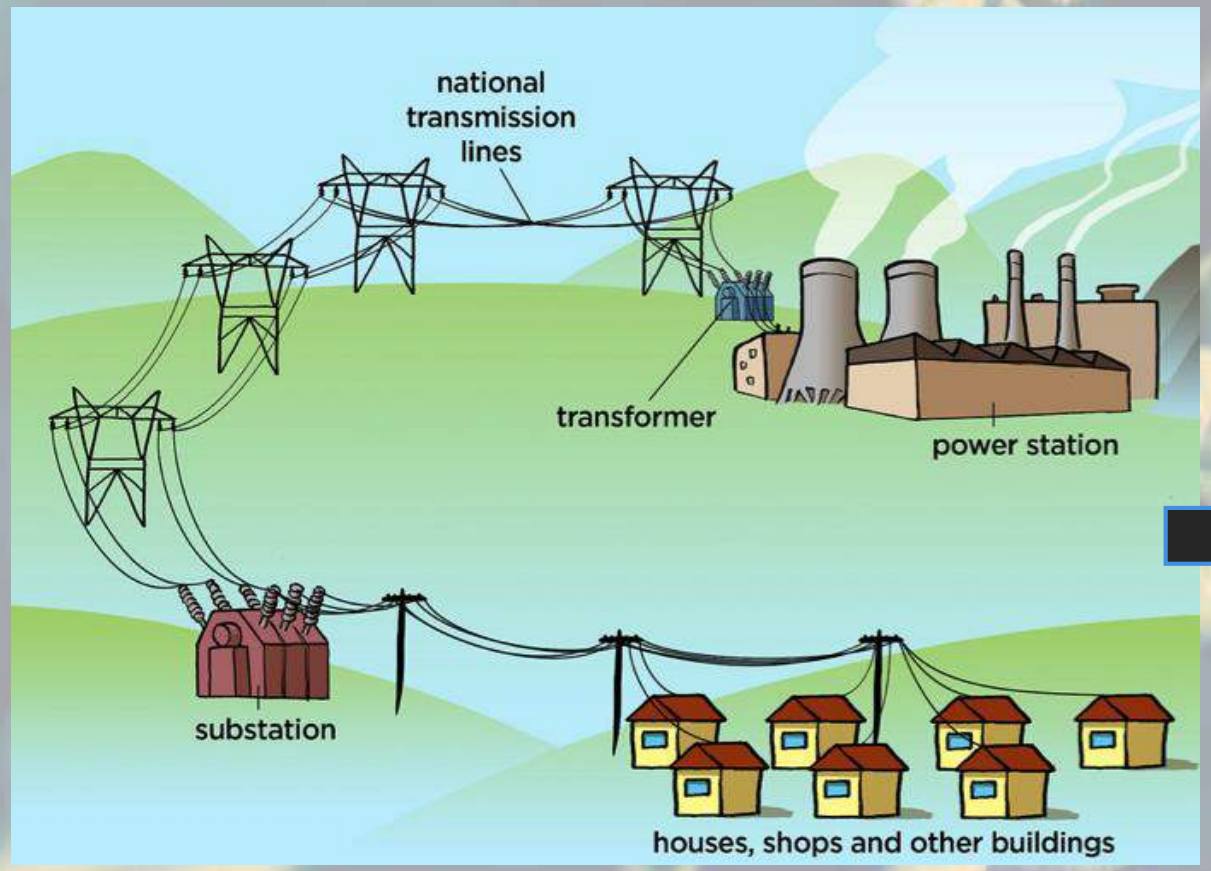
Engineer Certification

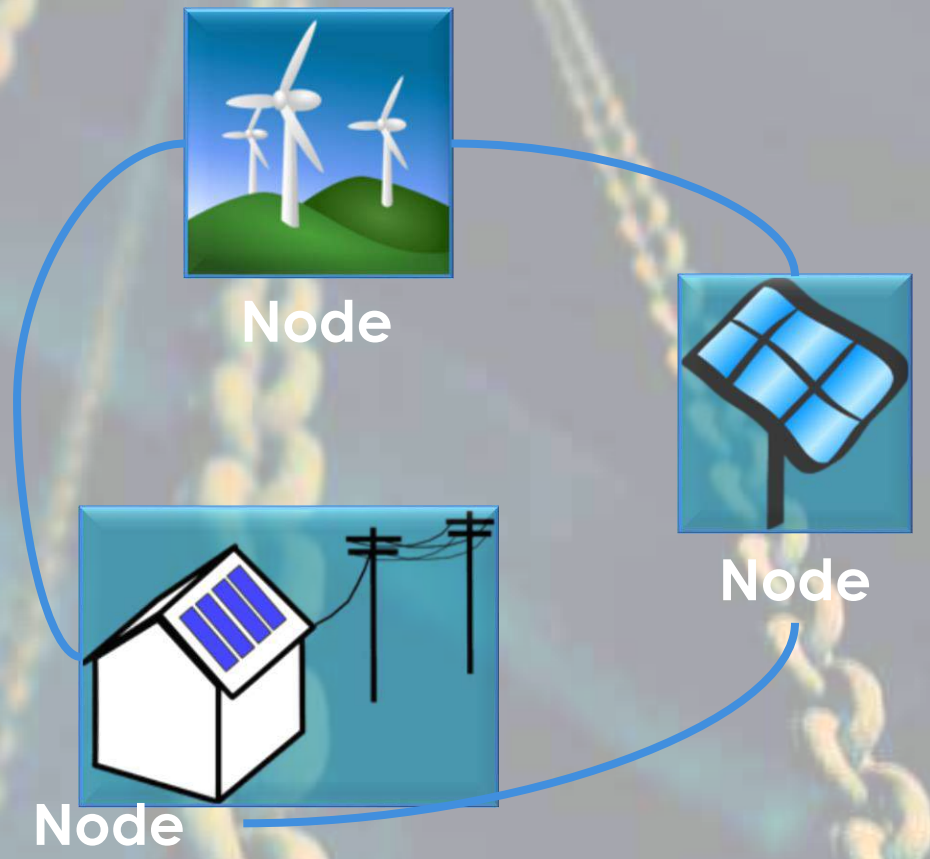
Secure management of recording engineer certification on blockchain by aviation authorities. Make sure engineers are qualified to fix equipment

Cyber Security

Department of defense requires security that extends to entire ecosystem

Use Cases: Energy Distribution

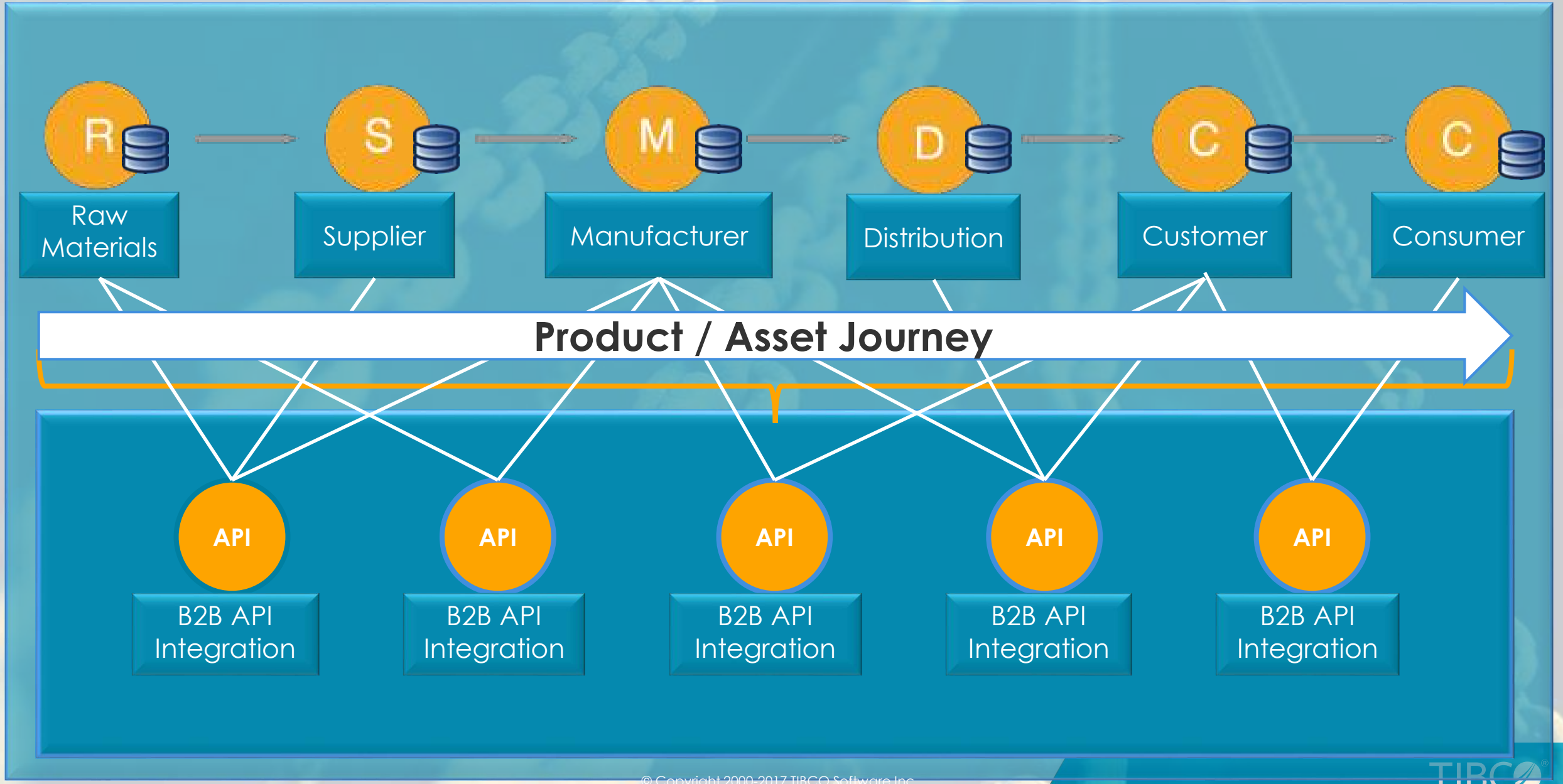




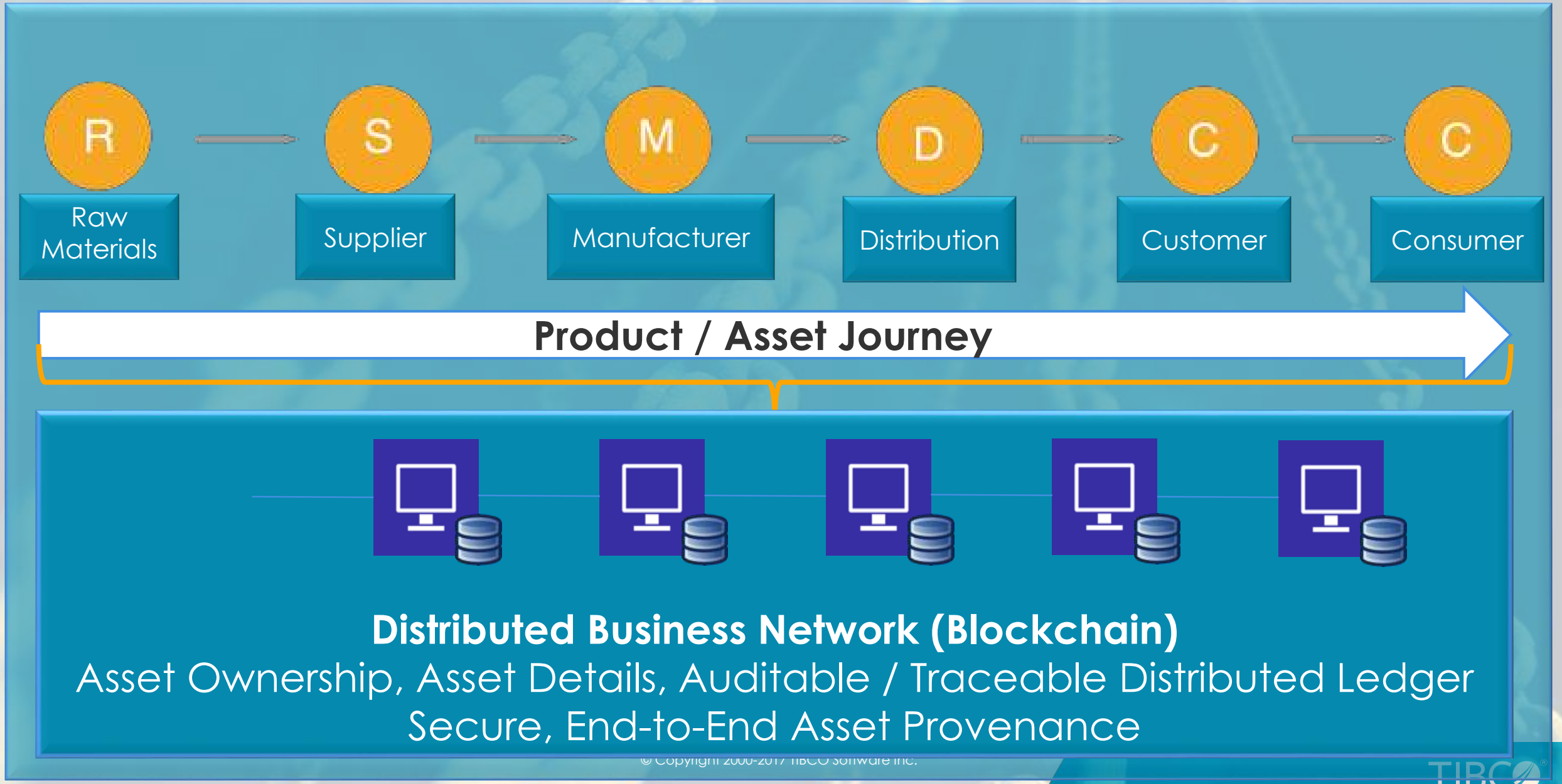
Power created by a central source, and transmitted to end consumers, often over long distances.

Power generated locally, and distributed in a peer-to-peer fashion via smart contracts.
(see Brooklyn microgrid as an example)

Use Cases: Supply Chain



Use Cases: Supply Chain



Healthcare : Use Cases

Claims Processing

Business network of payer, providers, and financial institutions, fraud prevention.

Electronic Health Record
Electronic Medical Record
Personal Health Record

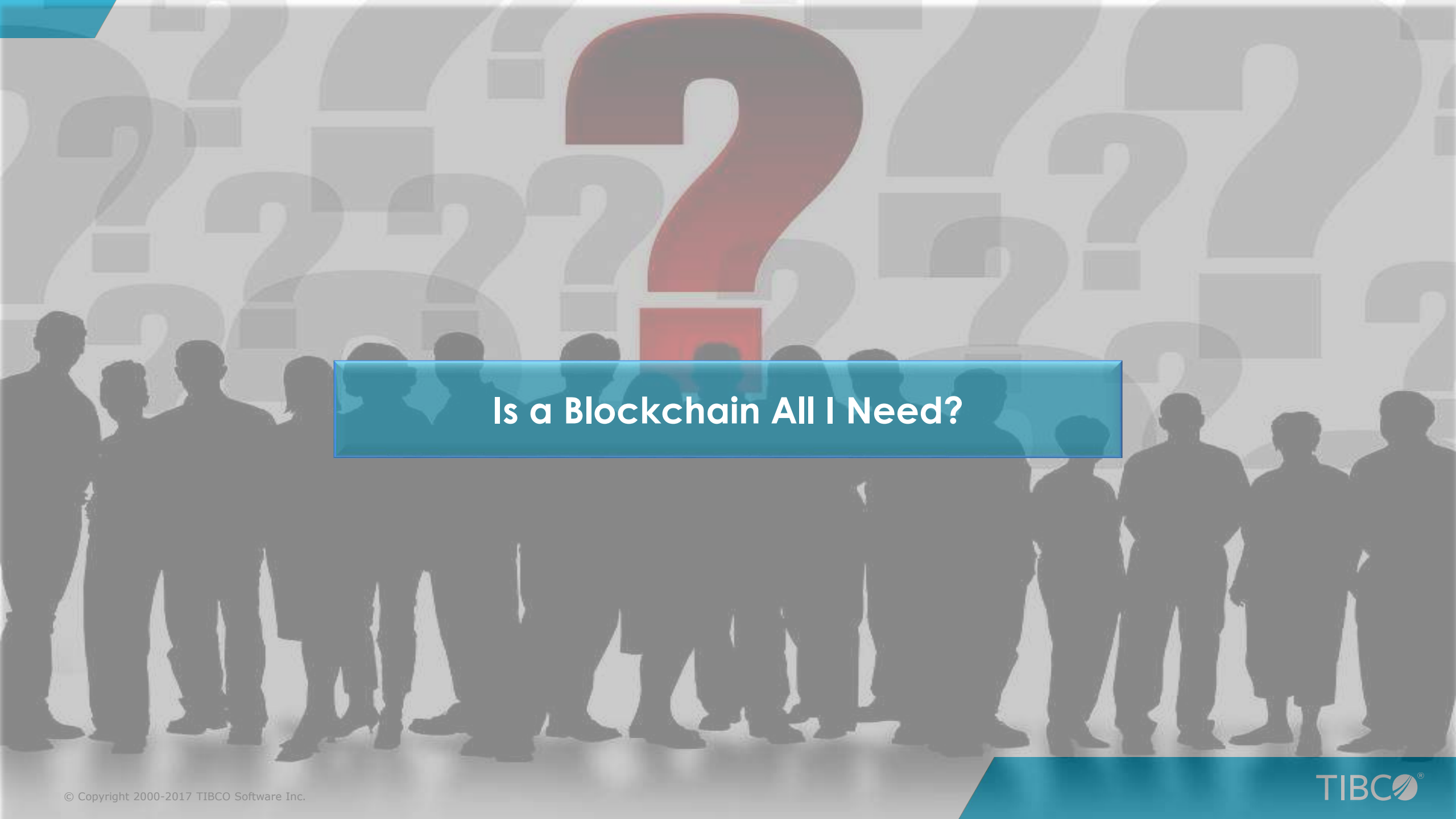
Secure, distributed patient health records. 25% of all identity theft is healthcare related, $5.6bn p.a. (HBR)

Provider Registry / Directory

Distributed, verified network of provider information.

Prescription Drug Provenance

Capturing the complete drug supply chain, from raw materials to consumer distribution. $75bn p.a. Problem



Blockchain : Challenges & Considerations

In general, in addition to the items discussed, we also have considerations such as:

- Governance & Stewardship
- Data Privacy
- Legal & Regulatory Risks
- Deployment, Management, & Logging
- New Technology, "Picking a Winner"

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Blockchain : Challenges & Considerations

Smart contracts show a lot of promise, but there are also concerns such as the following:

- Programming Errors
- Required Collaboration
- Supporting Infrastructure Needs
- Legal Implications
- Lack of Standards

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Blockchain : Challenges & Considerations

For the appropriate use case, blockchain can provide "part" of the solution. However, during implementation, there are still questions to answer:

- How Do I Get Data In/Out of the Blockchain?
- How Do I Extend Smart Contract Logic To My Enterprise?
- How Do I Respond To Events from my Ledger?
- How Do I Analyze Data Contained Within the Ledger?
- Can I Provide Controlled, Managed Access to Blockchain Capabilities?

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Blockchain : Enterprise Environment

Off-Chain Execution

Off-Chain Storage

API Management | Analytics

Microservices | Event Handlers

Data Distribution Transport

Blockchain Proxy Layer | Smart Contracts ChainCode, Solidity, …

HFC SDK | REST HTTP | JSON RPC | Web3 | Blockchain APIs

On-Chain Execution & Storage

Distributed Ledger Blockchain Security

Blockchain : Enterprise Environment

Off-Chain Execution TIBCO (Various)

Off-Chain Storage TIBCO GraphDB ActiveSpaces

API Management
TIBCO Mashery/TCI

Analytics
TIBCO Spotfire, Live Datamart, Transaction Insight

Microservices
TIBCO Hybrid Integration, AMX BPM, Foresight

Event Handlers
TIBCO BusinessEvents, StreamBase

Data Distribution Transport
TIBCO FTL / eFTL

Blockchain Proxy Layer
TIBCO Hybrid Integration

Smart Contracts
ChainCode, Solidity, …
TIBCO BusinessEvents

HFC SDK | REST HTTP | JSON RPC | Web3 | Blockchain APIs

On-Chain Execution & Storage

Distributed Ledger
Blockchain
Security

Blockchain : Recommendations

- **Not every problem requires a blockchain!**
  - Peer to peer networking, distributed data stores, and cryptography have been around for some time.
- **Need to look at a number of factors. For example:**
  - Number of network participants.
  - Required trust and integrity levels.
  - Amount of data to be stored.
  - Performance requirements and transaction processing times.
  - Ability to automate business interactions across a network.
- **A blockchain is only part of the equation.**

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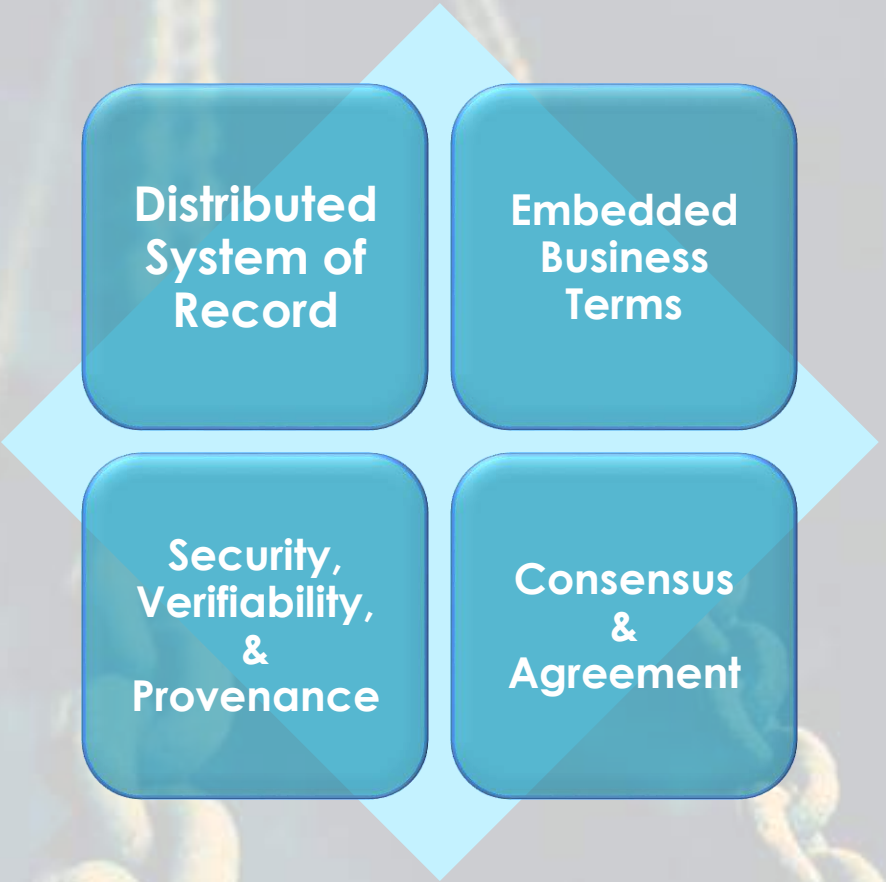
Blockchain : Recommendations

- **Gain awareness through experimentation.**
  - **Cloud based services make it easier to get started.**
- **Answer the factors (previous slides), and identify use cases / value appropriate for your business.**
- **Determine how the key characteristics of a blockchain can be beneficial to the business network.**



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https://community.tibco.com/

https://www.tibco.com/solutions/blockchain

Looking for someone to speak at your net Blockchain Event, email Erin Moeller at emoeller@tibco.com

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