Blockchain Technology

Overview for Mining Industry

Presented by: Brian Beveridge, CMC, Partner

Date: April 2019

Topics

- What blockchain is and how it works at a very high level
- How this technology can be used in Mining
- How to explore and get started adopting this technology


Bitcoin mining difficulty factor hits 500,000,000!
COIN IDOL.COM
BLOCKCHAIN
NEWS OUTLET

What is Blockchain?

Media Topic of the Day

Financial News

Blockchain has come to Bay Street, but will Bay Street get on board?

Corporate Canada's adoption of the technology that is expected to have a huge impact on the financial world has been mixed

Financial News

Blockchain is going to have a huge impact on the future of banking

Media Topic of the Day

Financial News

IBM and the Toronto-based [SecureKey Technologies] are using blockchain for a “digital identity and attribute sharing network” that aims to make it easier for consumers to verify their identities for certain services.

SecureKey has attracted a number of big players: Bank of Montreal, Bank of Nova Scotia, Canadian Imperial Bank of Commerce, Desjardins Group, Royal Bank of Canada and Toronto-Dominion Bank were part of a $27-million investment in the company announced in 2016.

TD Bank president and chief executive Bharat Masrani has also recently sung the praises of blockchain.

Source: Financial Post

Media Topic of the Day

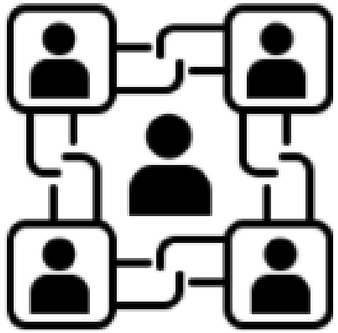
Financial News

While Masrani said TD had not yet deployed blockchain in any of its businesses, Bay Street may also have no choice but to get with the times, and fast. Campbell Harvey, a professor of finance at Duke University, told a conference at the University of Toronto's Rotman School of Management in March that more than half of the class of 2018 would have training in blockchain.

"You need to take this disruption very seriously, even though there's a lot of hype," Harvey said.

Source: Financial Post

Blockchain Significance



- **60% believe blockchain will prove to be the most significant technology development to affect business since the Internet**

Source: The Future of Retail Financial Services - by Cognizant, Marketforce and Pegasystems

My Personal Opinion

- **Blockchain will fundamentally revolutionize the architecture of the internet**
- **As a result, it will fundamentally revolutionize business architectures**

Blockchain Market Overview

- **24+ countries currently investing in DLT (distributed ledger technology)**
- **80% of banks predicted to initiate DLT projects by 2017**
- **Over $1.4 billion USD in investment over the past three years**
- **90+ central banks engaged in DLT discussions worldwide**
- **90+ corporations have joined blockchain consortia**
- **2500+ patents filed over the last three years**

Source: Cognizant 2016

What is blockchain?

“ A record keeping system (ledger) – of Any Asset to record the transactions of importance, that is electronic and distributed” – Hence the moniker – DLT – Distributed Ledger Technology.

Some examples include:

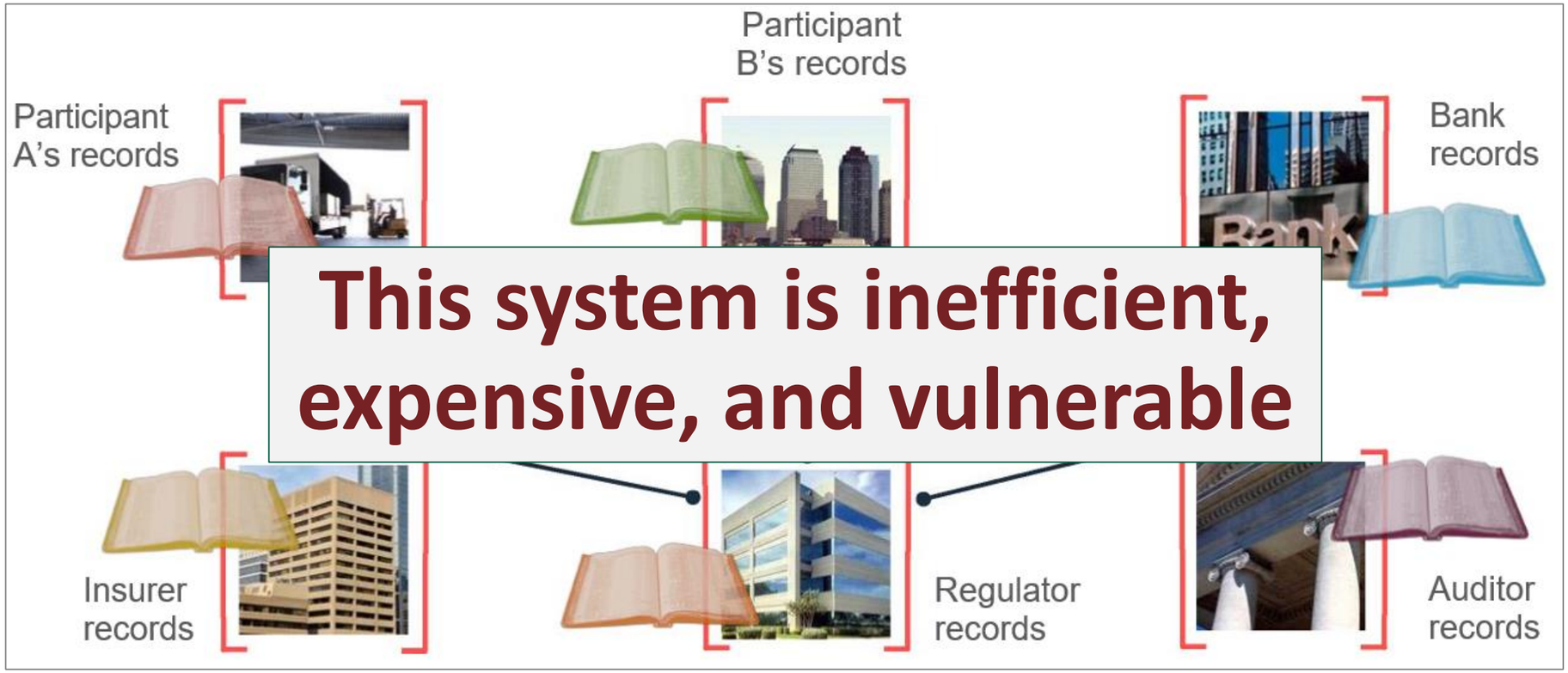
- Update to a medical record
- Transfer of ownership
- Certificates, bond, loyalty points etc..

Ledgers are Key

Ledger is **the** system of record for a business.

- Business will have multiple ledgers for multiple business networks in which they participate.
- **Transaction**—an asset transfer onto or off the ledger
  - John gives a car to Anthony (simple)
- **Contract**—conditions applicable for transaction to occur
  - If Anthony pays John money, then car passes from John to Anthony (simple)
  - If car won't start, funds do not pass to John (as decided by third party arbitrator) (more complex)

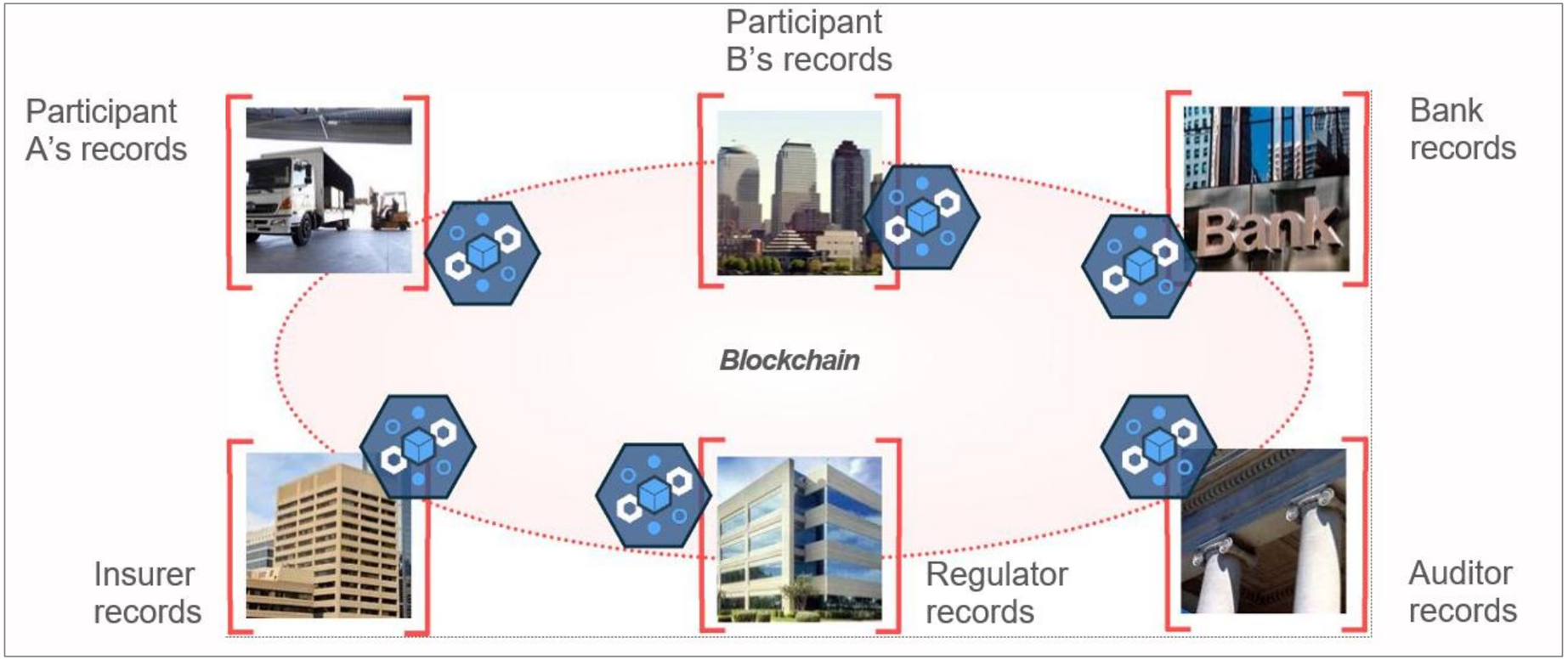
The Problem



This system is inefficient, expensive, and vulnerable

Source: IBM

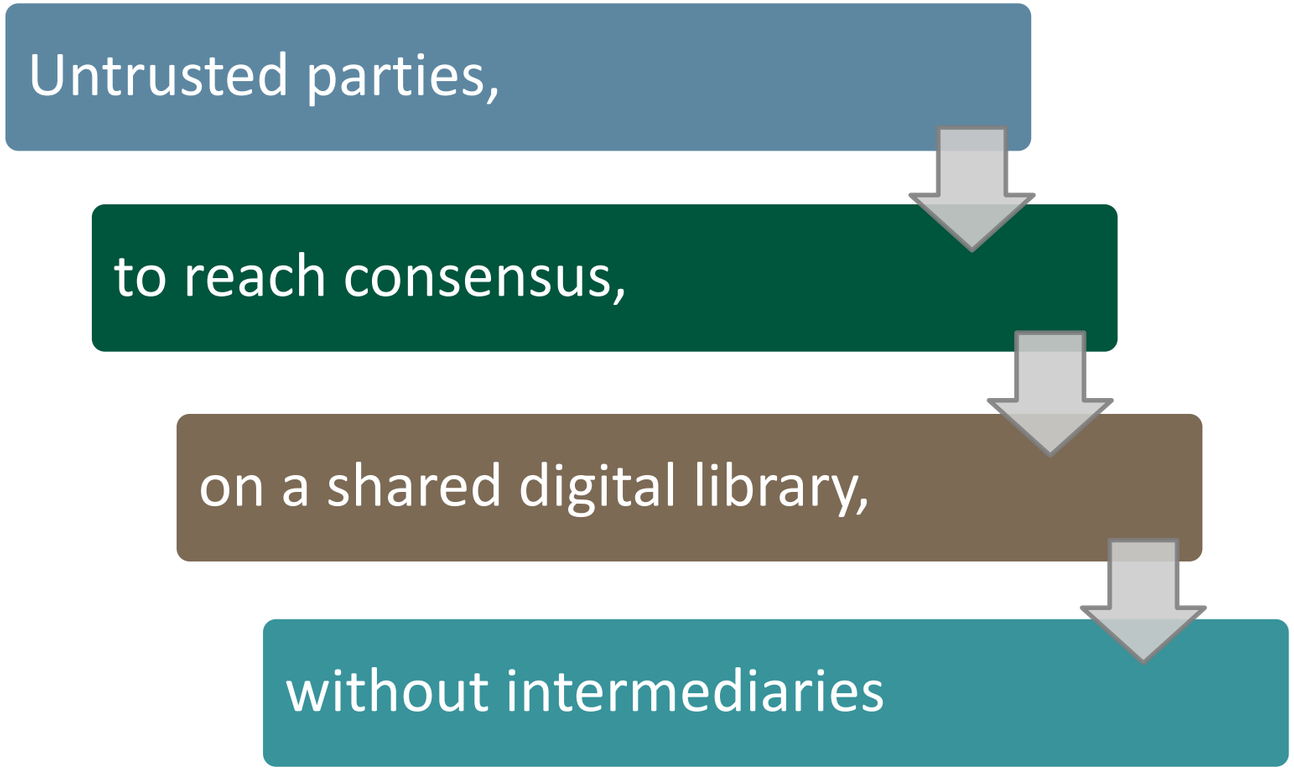
The Solution—Blockchain



Source: IBM

What is Blockchain?

In business terms, blockchain allows:



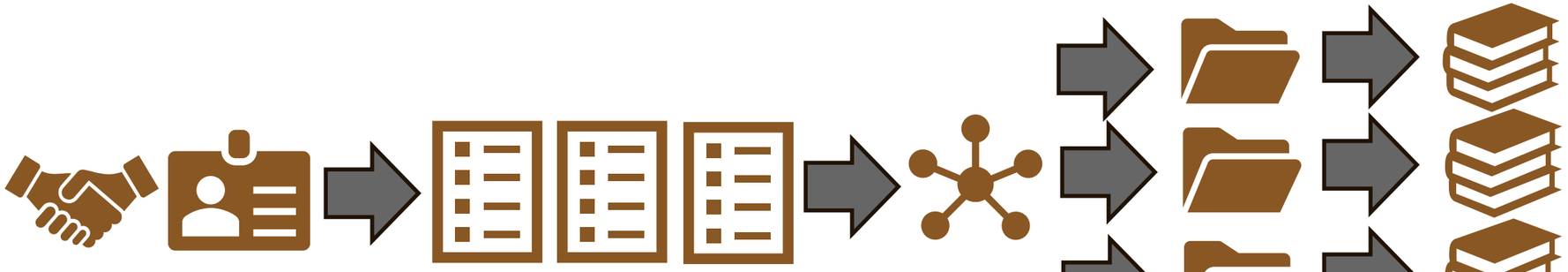
That's it … but it's a **lot!**

As each transaction occurs, it is put into a block.

Transactions are blocked together.

Each block is encrypted and connected to the one before and after it.

Each block is added to the next in an irreversible chain.



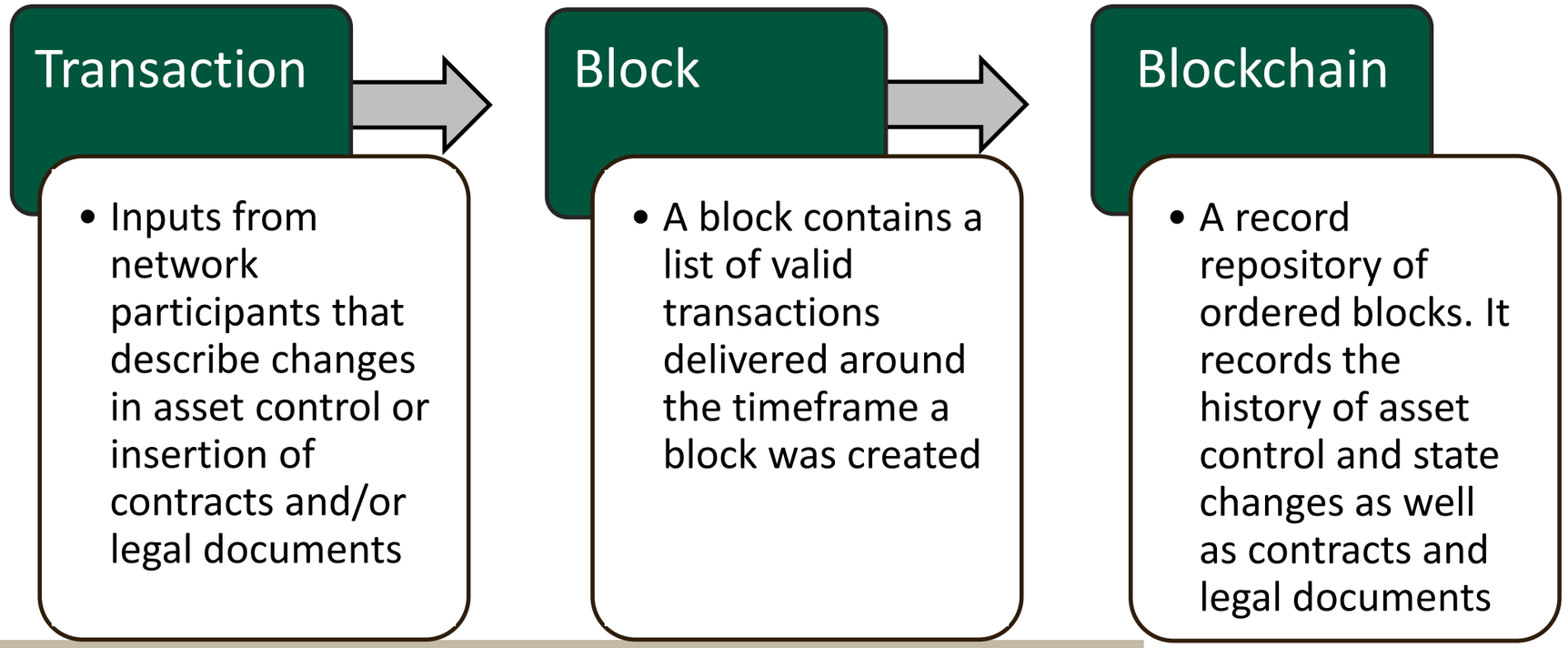
Incoming Transactions

Blockchain: A Distributed Ledger (DLT)

Benefits: Increased transparency, better scalability, security, and innovation

Blockchain = Secure and Trusted Record Keeping

- **By design, no one party can modify, delete, or even append any record to the ledger without consensus, ensuring the immutability of transactions, contract, and other legal documents**



Public vs. Private Blockchains

Public Permissionless Ledgers

- Also called un-permissioned ledgers
- Allow anyone to contribute data to the ledger with all participants possessing an identical copy of the ledger
- Better suited for peer to peer transactions like bitcoin

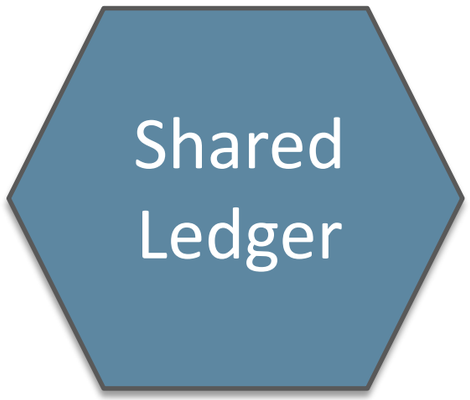
Private Permissioned Ledgers

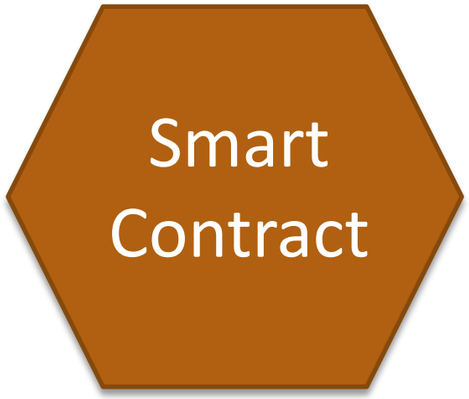
- Sometimes called private blockchains
- Allow for distributed identical copies of a ledger, but only to a **limited amount of trusted participants** only
- Better suited for applications requiring **simplicity, speed**, and **greater transparency**

Source: LinkedIn Learning

Requirements of Blockchain for Business

Append-only distributed system of record, shared across business network

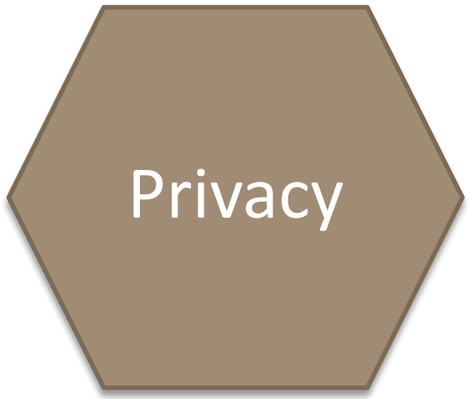




Business terms embedded in transaction database and executed with transactions

Ensure appropriate visibility

Transactions are secure, authenticated, and viable



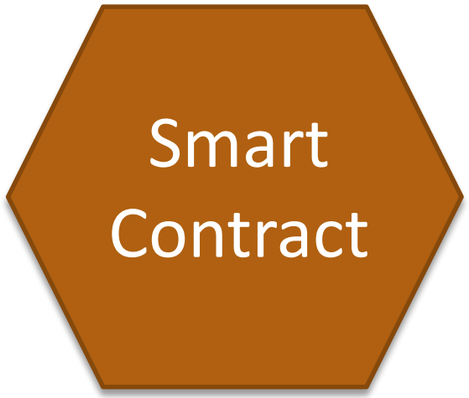
Transactions are endorsed by relevant participants

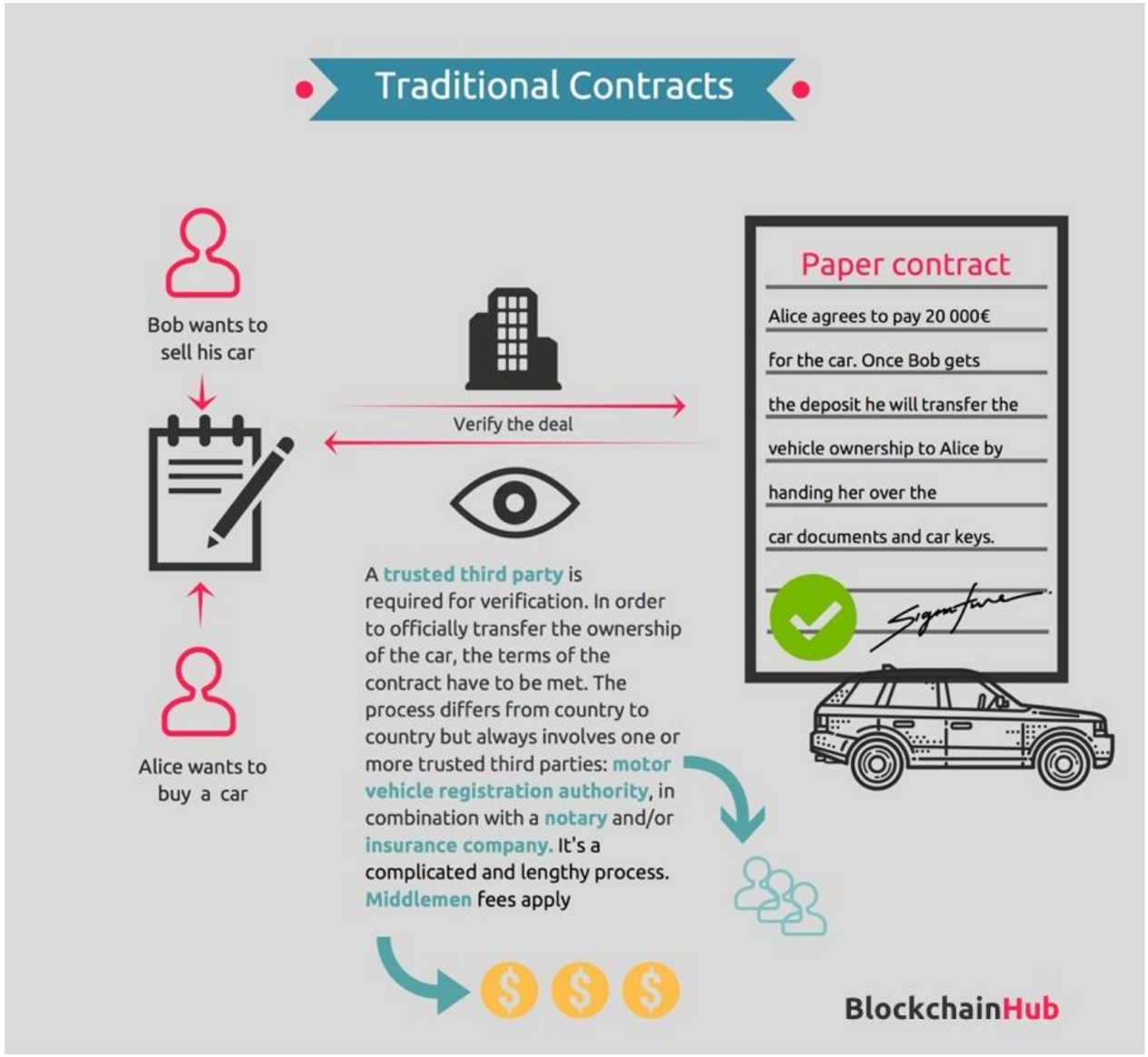
Source: IBM

Smart Contract

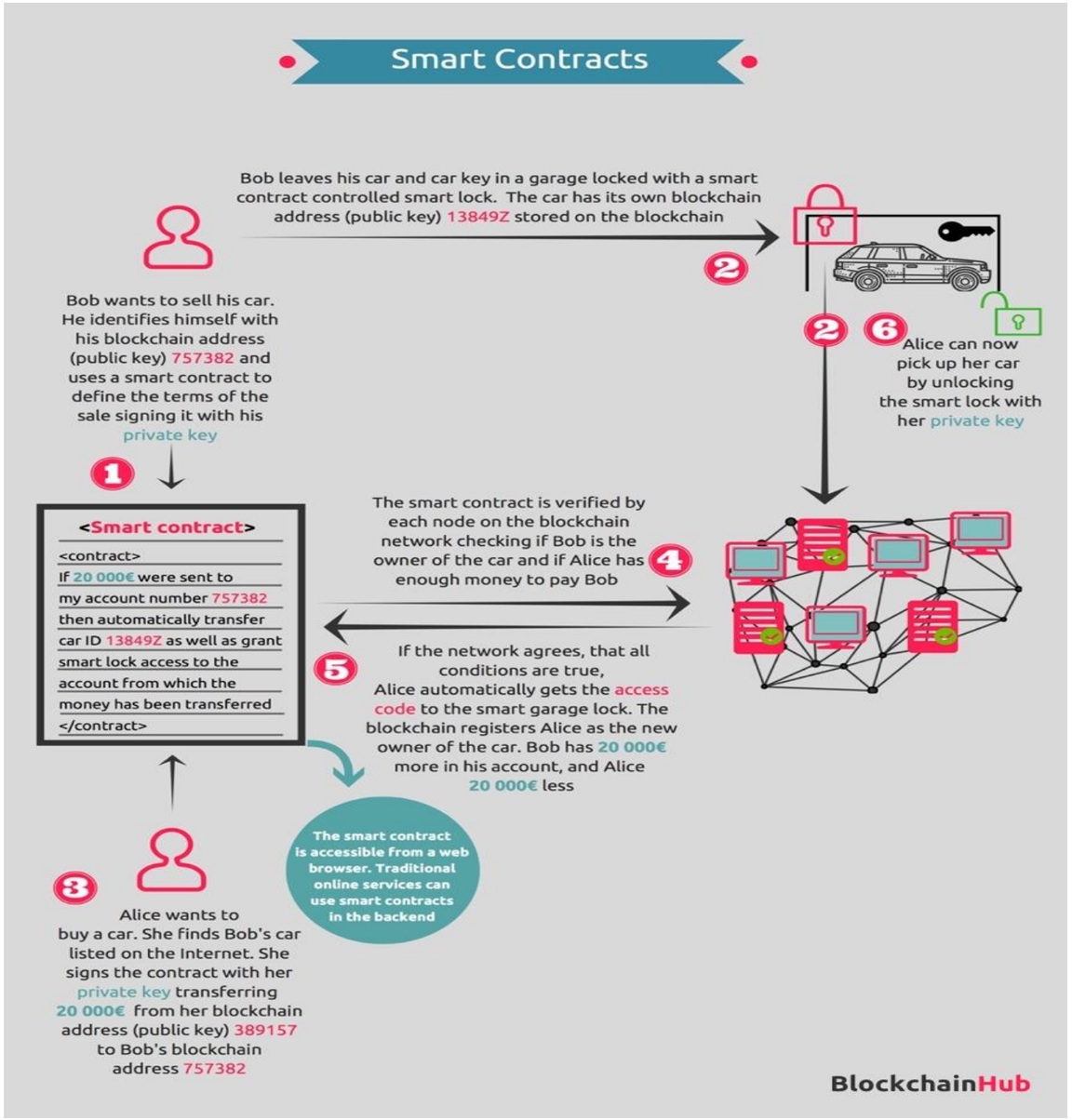
Business rules implied by the contract ... embedded in the blockchain and executed with the transaction

- **Verifiable, signed**
- **Encoded in programming language**





Smart Contract



Smart Contract

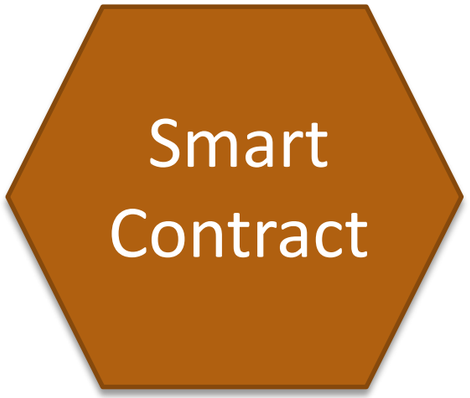
Smart Contract


```
contract MetaCoin {
  mapping (address => uint) balances;

  function MetaCoin() {
    balances[tx.origin] = 10000;
  }

  function sendCoin(address receiver, uint amount) returns(bool sufficient) {
    if (balances[msg.sender] < amount) return false;
    balances[msg.sender] -= amount;
    balances[receiver] += amount;
    return true;
  }

  function getBalance(address addr) returns(uint) {
    return balances[addr];
  }
}
```



Benefits of Blockchain

Saves
time

Transaction time from days to near instantaneous

Removes
cost

Overheads and cost intermediaries

Reduces
risk

Tampering, fraud & cyber crime

Increases
trust

Through shared processes and recordkeeping

Source: IBM

Use Cases

How can Blockchain be used in the Mining Industry?

Est.

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— F

LAST BEST

A farm-to-gla

CALGARY, A stilling have teamed up with technology pr

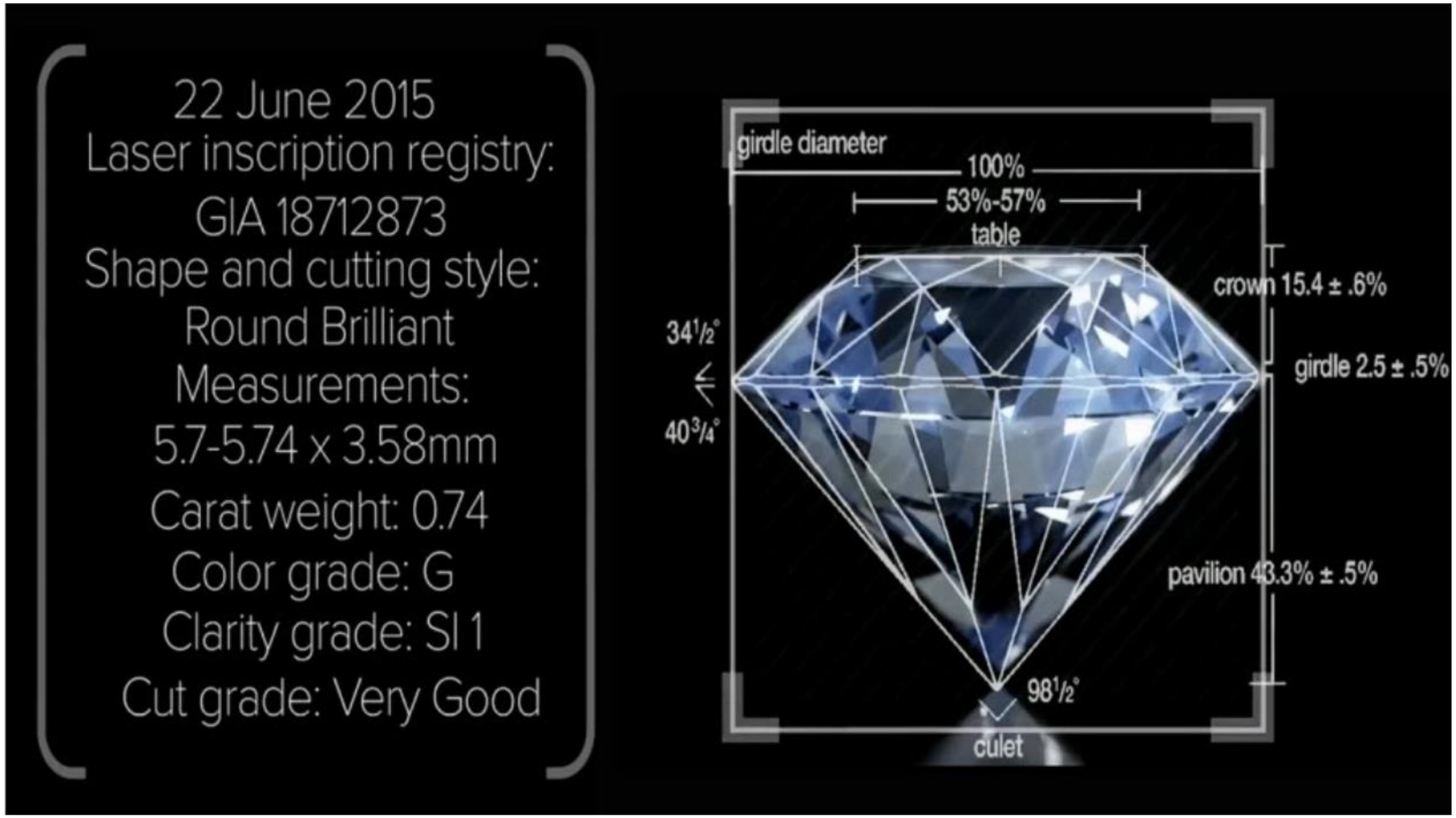
"Bock Chain" block chain technology to trace the bee

Block chain te ver where their food comes from, how it's

> "It's very r Hamill, Owner of Red Shed Malt

For Bock Cha lgary Canada for malting, then to a third Distilling in Calgary for brewing and

Everledger


22 June 2015
Laser inscription registry:
GIA 18712873
Shape and cutting style:
Round Brilliant
Measurements:
5.7-5.74 x 3.58mm
Carat weight: 0.74
Color grade: G
Clarity grade: SI 1
Cut grade: Very Good
girdle diameter
100%
53%-57%
table
crown 15.4 ± .6%
girdle 2.5 ± .5%
pavilion 43.3% ± .5%
34½°
40¾°
98½°
culet

Labelling diamonds

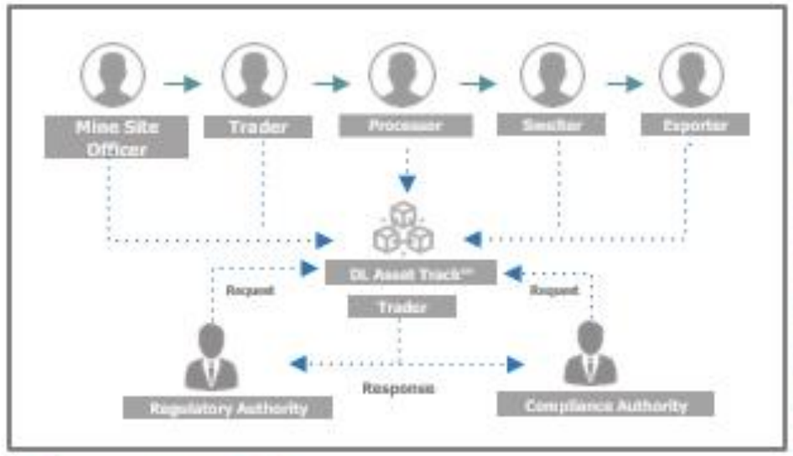
- The diamond business has been one of the first to embrace blockchain technology wholeheartedly.
- If you think about the journey of a diamond, from when it's mined, sorted and sold, to when it is mounted and displayed at a trusted retailer, say Tiffany's or Harrods, there is so much opportunity to exchange a valid diamond for something of different provenance, like a blood or conflict diamond. Using the blockchain, each step of the production process can be verified, guaranteeing the legitimacy of a diamond.


World’s Largest Mining Company to Use
Blockchain for Supply Chain

BHP Bitillon

- “We are looking at lots of different use cases.”
- Far from using blockchain as a form of currency, BHP’s solution envisions how its existing processes could be replicated on a blockchain as a way to prove benefits of the technology.
- The use case proves blockchain solutions can achieve decentralized file storage, multi-party data acquisition and immutability, all aspects that he believes will enhance the supply chain.

CASE STUDY – ETHICAL MINING (MINTRAX)



Mineral Traceability

- 6.5% penalty if no sourcing proof is provided
- NGO watchdogs & CSR
- Cost, inefficiency & complexity
- Brand Risk: Human rights & child labour
- Multi-stage compliance requirements & approvals
- Solutions applicable to any agriculture or natural resource

** Case study available on request/NDA*

Tracking conflict minerals

- Recent disclosures by **Tesla** and **Hewlett-Packard** to the United States' Securities & Exchange Commission (SEC) in 2015 indicate that they found difficulties in tracking conflict materials which could be linked to obtaining minerals from select African nations. This is driving a **new wave of rules and legislation** making it mandatory for manufacturer's to not only **disclose the source, but importantly reinforce the concept of ethical sourcing**.
- This makes the concept of **'chain of custody'** fundamental to transparency across the value chain.
- Simply put, it is the knowledge of every set of hands the minerals have passed through, between the moment it is extracted, to when it lands in the hands of the final owner.
- Complete knowledge of the chain of custody is the only way that Tesla or Hewlett-Packard can ensure they are compliant with SEC guidelines.

Other Potential Use Cases

- **Automation of ore acquisition and transfer**
- Mining companies often acquire ore from third parties to blend with their own ore. Blockchain can allow the automation of ore acquisition and transfer between ore suppliers and the main company, and between major ore producers and traders.
- **Automatic registration of mineral rights and IP**
- When a mining company makes a discovery or invention, it is important to prove the precedence over several others claiming the patent. Similarly, miners need to officially register mining rights – the first one to arrive gets the prize. It is possible to have a blockchain enabled automatic registering process that replaces the rush to the government mineral rights department for registering a finding.
- **Visibility of ore inventory at ports**
- Ports receive ore from several different sources and owners. Blockchain can be used to declare and provide visibility for all the reception of ore. As soon as the train is discharged in the car dumpers, or trucks are unloaded, the total amount of ore received is credited to the sender, the ore location and inventory in the yard is shown in real time, and outbound operations are registered for every ship's loading operations. The ore owners will always have accountability over their port operations.

Other Potential Use Cases

- **Uber-like automatic cargo hiring process**
- Ports need to hire ships for ore transportation for which they need to stablish a contract with the ship owner. Each port has a list of ships that are allowed to serve it, based on ship type, size/tonnage, ship draft, specialization for ore transportation, and conservation state. Blockchain can bring more flexibility to the freight hiring process and create an Uber-like cargo automatic hiring process. Specialized systems could hire the ship automatically and register the contract in a distributed ledger system automatically. This can reduce freight costs significantly and save significant time in the process to reduce contract lead time from days to minutes.

Blockchain

Myths

Blockchain Myths

- **Blockchain is Bitcoin**
  - Bitcoin is just on cryptocurrency application of blockchain
- **Blockchain is better than traditional databases**
  - Blockchain's advantages come with significant technical trade-offs that mean traditional databases often still perform better
- **Blockchain is immutable or tamper-proof**
  - Blockchain could be tampered with if >50% of the network computing power is controlled

Blockchain Myths

- **Blockchain is 100% secure**
  - Overall blockchain system security depends on the adjacent applications – which can be attacked or breached
- **Blockchain is a “truth machine”**
  - Blockchain cannot assess whether an external input is accurate or “truthful” – this applies to all off-chain assets and data digitally represented on blockchain

And the point is?

Blockchain solves many problems and creates new opportunities.

Where do you think blockchain could fit into your client's organization (if at all)?

How can your organization get started with blockchain?

Source: Clear Voice

Executive Discovery

Blockchain Discovery Session
(1-2 hour workshop or Discovery Days)

- **Discuss your industry and your business model**
- **How Blockchain could impact your organization and/or your industry**
- **Is blockchain a fit for your organization**
- **Brainstorm potential use cases**
- **Determine next steps**

Is blockchain a fit?

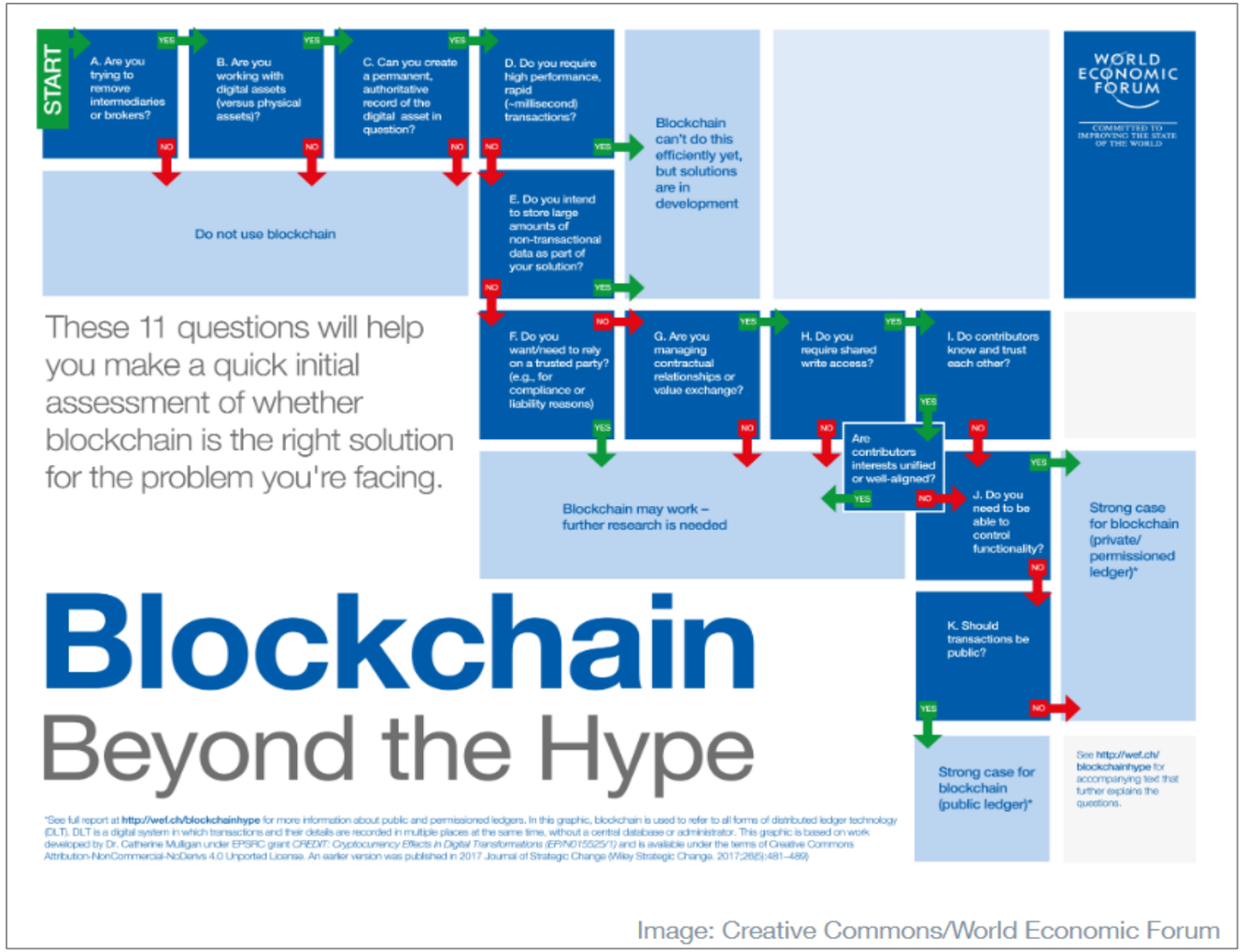


Image: Creative Commons/World Economic Forum

Experiment

Proof of Concept

1

A proof of concept is a theoretical demonstration to confirm that certain concepts or processes are feasible for real-world application. It purpose is to validate functional assumptions, to validate technical feasibility, to identify potential blocking points, to determine the customization efforts or to detect potential performance issues.

2

Prototype

A prototype is an early version, with a limited number of characteristics, built to validate a concept or process, The purpose of a prototype is to trial the proof-of-concept and to provide subsequent specifications for a real, working system rather than a theoretical one.

3

Pilot

A pilot is the first production version of a concept or process. The purpose of a pilot is to test if a concept or process are working as expected in a real, working system.

First Project(s)

- **All phases of launching a blockchain project:**
  - Planning (scope, architecture, etc.)
  - Designing
  - Building
  - Testing
  - Deploying
- **Work with an experienced partner who can deliver all phases and develop skills within your own team**

Blockchain at Scale

- **Time to take off the training wheels:**
  - Expanding your business network
  - Scaling for production volumes
  - Integration with enterprise applications (payments, ERP, portals, etc.)
  - Enabling your team to sustain

Summary—Blockchain

Blockchain:

- **Allows untrusted parties to reach consensus on a common digital history without intermediaries—a big deal**
- **Provides more security measures through transaction verification, inability to delete transactions, and the difficulty of hacking thousands of computers at once**
- **Can be applied to any ledger types (financial transactions, records management, voting, supply chain, etc.)**

Thank You

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