The Digital Pink Slip:

A Blockchain Use Case for Automobile Registration

Indiana State University

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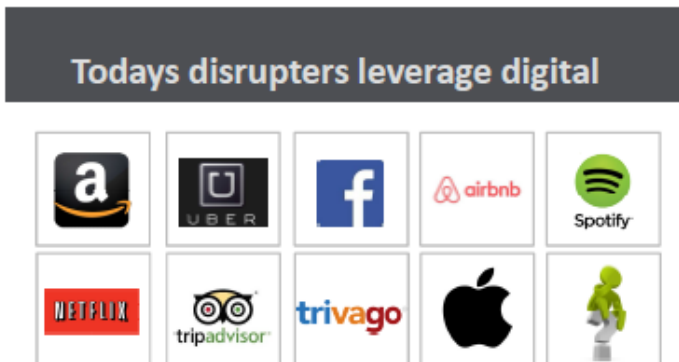
SAP

It all began.....June 29, 2007

Audit of the Future

"It's important for today's auditors to be at the forefront of disruptions, such as blockchain, and to identify ways to innovate to advance audit quality and to align auditing capabilities with the changes occurring in the marketplace."

Frank Casal, vice chair of audit KPMG

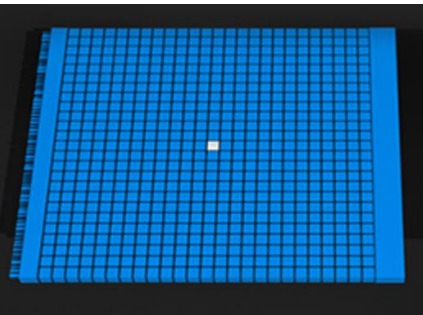**Todays disrupters leverage digital**

Agenda

- **What is Blockchain?**

- **How Does it work?**

- **Use Case**

- **Proof of Concept**

- **Conclusion**

- **What's Next....**
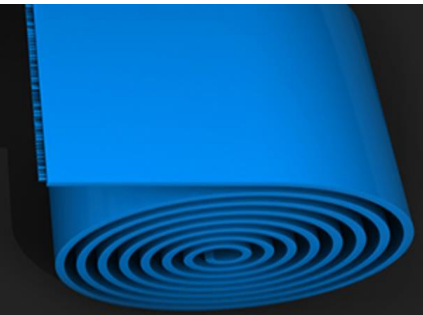
What is a Record? Block?? Blockchain???

Records
- ❑ Can be any information
- ❑ All the information about the asset

Blocks
- ❑ Collection of records
- ❑ Blocks are a snapshot of each of state
- ❑ Track an asset whose state changes

Blockchain is the ledger
- ❑ Continuously updated record of who holds what
- ❑ Representation of the continuous "change of state"

What is Blockchain?

Self-sustaining, peer-to-peer database for managing and recording transactions with no central bank or clearinghouse involvement

"Blockchain" is named after how transactions are stored—blocks of data, encrypted by altering (or hashing) part of the previous block
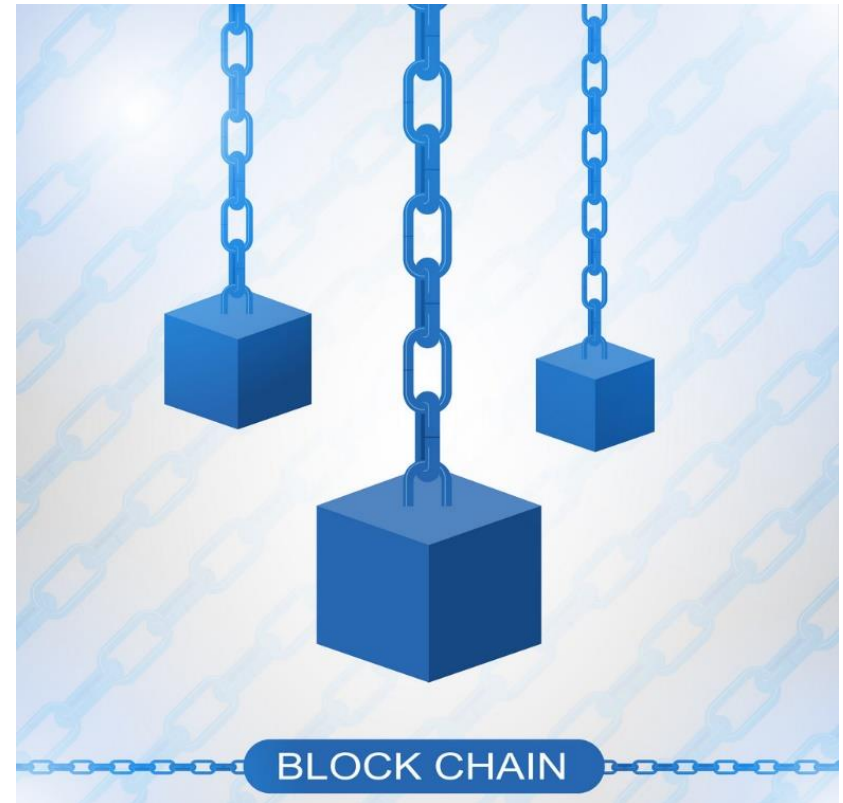
Blockchain is the representation of the continuous "change of state"

# How Does it Work? No Central Authority

Historically, we have had to rely on third party institutions (e.g. government, financial institutions, large corporations) to manage the integrity, trust, and transaction itself. In a way, we have shifted that protocol to the underlying technology of Blockchain.

Bill Briggs, managing director, US and Global Chief Technology Officer, Deliotte Consulting LLP

How Does It Work?

- System is presumed immune to tampering, fraud, or political control

- Handled through algorithms and consensus among multiple computers

- Designed to protect against domination of the network by any single computer

- Every transaction is processed just once, in an electronic ledger
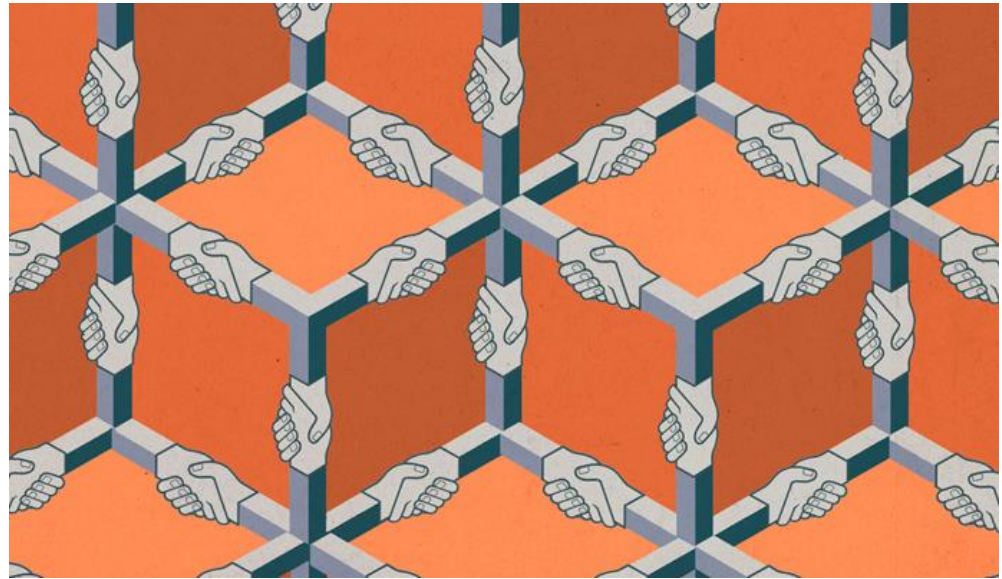
A Strategist's Guide to Blockchain
strategy+business

What is Blockchain used for?

Asset, Participant, Transaction

Blockchain is a technology used for managing the <u>exchange</u> of assets.

Asset
- An asset can be anything of value.
- Include physical or non-physical asset.
- e.g.) currency, real estate, inventory, EMR

Participant
- Organization or people who take part in the digital business network
- who exchange these assets

Transaction
- Submitted by a participant to affect the assets
- Exchange itself during which there is a change of state
  (a new block is created)

Wherever there is "change of state", there is new block

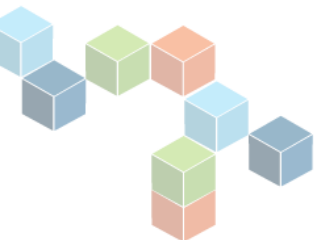The problem with traditional transactions.....

TRUST

❑ The seller doesn't trust the buyer

❑ The buyer doesn't trust the seller

❑ Buyer and seller must rely on the third party

Can we have a system where trust exists on the transaction and not the central authority?

BLOCK CHAIN

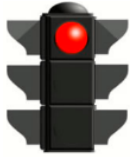# How can to build Trust

What obstacles inhibit Trust?

- Tampering
- Lack of Transparency
- Confirmation
- Double spending problem

Immutability for "Trust"

Problem: Tampering

Solution: Immutability

plaintext → hash function → message digest
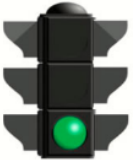
Hash is mathematical algorithm
- ✓ that allows one way encryption
- ✓ "easy" to compute & "difficult" to reverse.

Immutability →Crypto-technology

Crypto-technology

How much money would you have if you doubled one cent every day for one month?

$10,737,418.24

2^{30} = 1,073,741,824

How does that translate to 256 bit electronic signature?

2^{256} = 115,792,089,237,316,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000
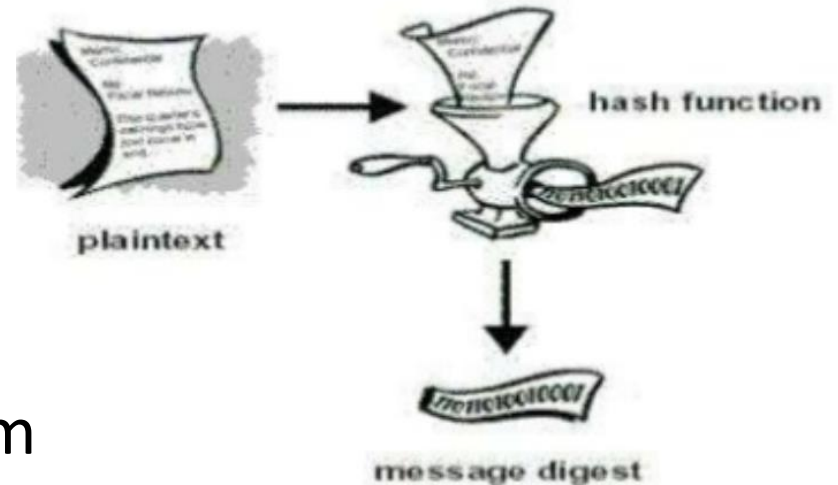
Public and Private Keys

Private Key: Sign (Message,sk) = Signature

Public Key: Verify (Message, 256 bit Signature, pk) = T/F

```
0000000000000001000000000000000
0000000000000000000000000000000
0000000000001000000000000000000
0000000000000000000000000000000
0000001010000000000000000000000
0000000000000000001000000000000
0000000000000000000000000000000
0000000000000000000000001000000
```

Public Key (pk): 01000111…..
Private Key(sk): 10010011…..

Provenance for "Trust"
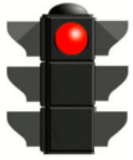
Problem: Transparency
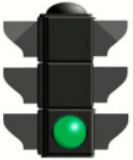
Solution: Distributed Ledger
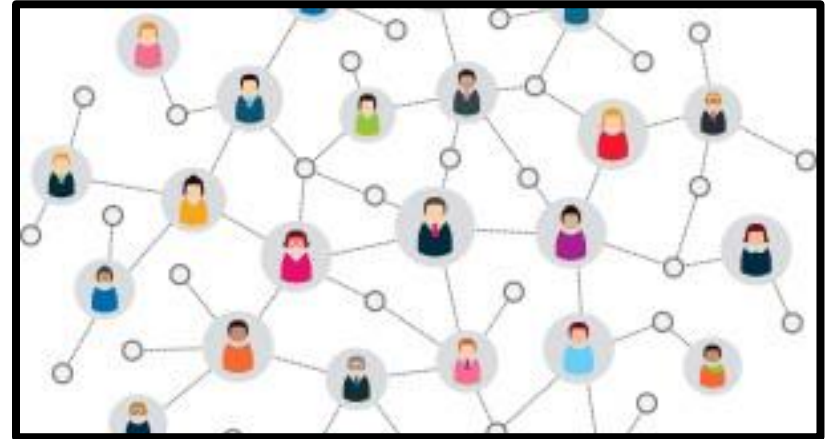
The chain is the ledger.
- ✓ Clear picture of the history of the chain itself
- ✓ Gives you confidence and helps create trust
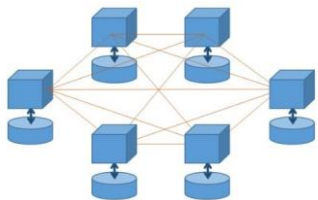
Provenance → Distributed Ledger

What are Distributed Ledgers
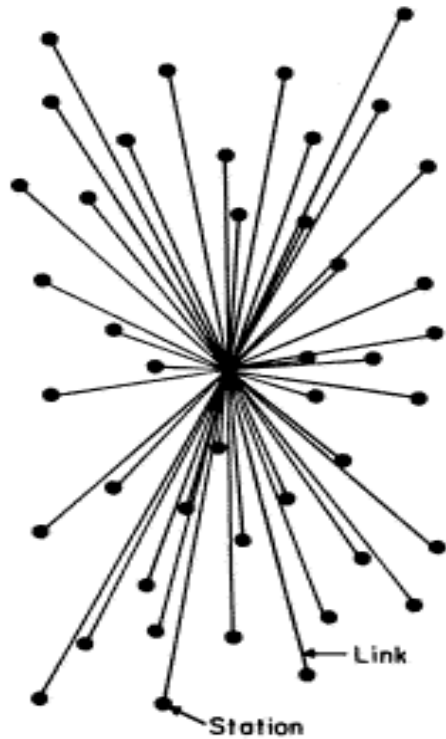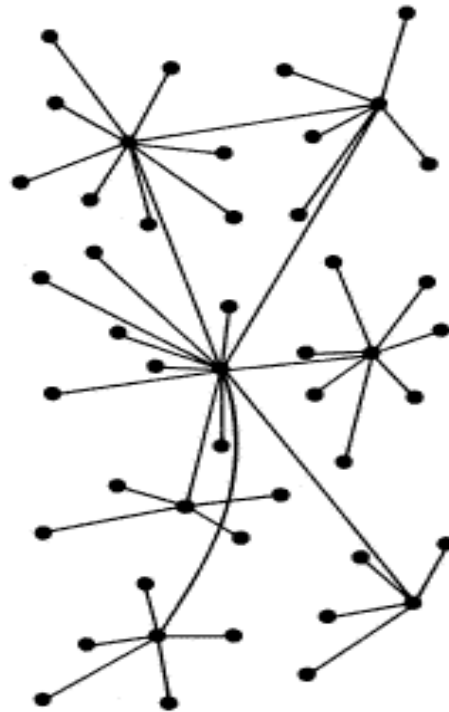
Centralized *Decentralized* *Distributed*
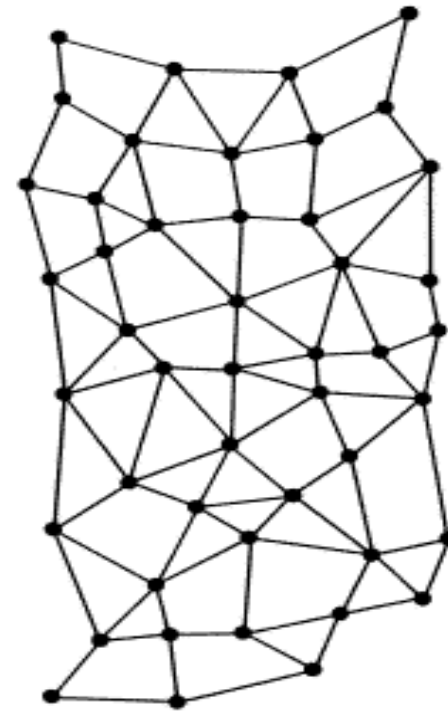
Finality for "Trust"

Problem: Double Spending
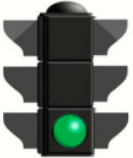
Solution: Finality (new block)

DOUBLE SPENDING PROBLEM
Buyer   ID: 537704   Seller A
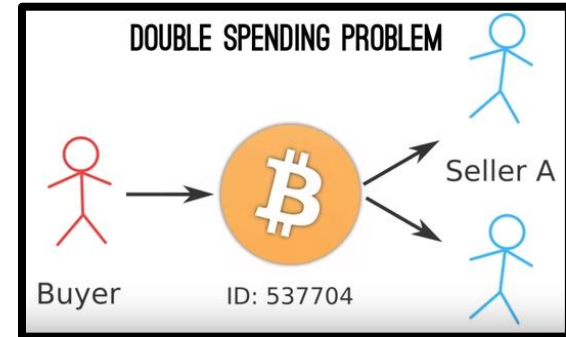
Block is only added after validation.
- ✓ Crypto has network of miners (validators)
- ✓ Algorithm to auto-validate the authenticity of prior blocks

VERIFIED   Finality → Verification e.g.) Proof of Work

Consensus for "Trust"
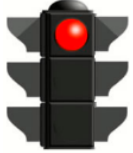
Problem: No Central Authority
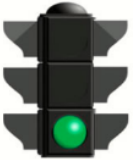
Solution: Verification/Acceptance
e.g.) mining

We build consensus by:

✓ Validation of each transaction.

✓ Participants in the chain can raise red flags

Consensus → No Central Authority

Build Trust in a "Trustless" System

Immutability →Crypto-technology
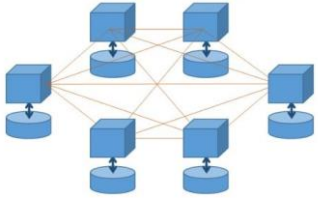
Provenance → Distributed Ledger

Finality → Verification e.g.) Proof of Work

Consensus → No Central Authority
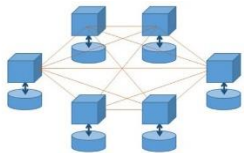
Adding Value through Blockchain

✓Recordation—track ownership of the physical asset

- e.g.) Stocks, bonds, money, artwork, votes, and digital identity

✓Value Exchange—transfer of ownership

- e.g.) Everyone on systems knows when an asset is sold

✓Smart Contracts—imbedded ledger is immutable

- e.g.) Buying a car in minutes not days

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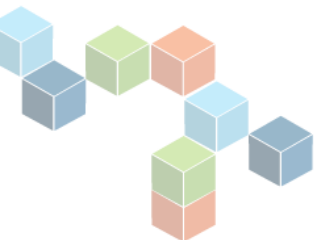
Build Trust in a "Trustless" System

TRUST

We can trust the transaction

But…..

Can we add conditions and/or constraints to our transaction??

Smart Contracts

Contracts

A contract is:

- A *promise* or a set of promises for the *breach* of which the law gives a *remedy* or the *performance* of which the law in some way recognizes a *duty*.

Parties of a Contract:

- At least 2 parties

- Offeror
  - Makes an offer
  - To do or not do something

- Offeree
  - Person to whom offer is made
  - If accepted, then contract

Contracts

Elements of a Contract:

✓Agreement

- Offer and acceptance; mutual assent

✓Consideration

- Money, property, services

✓Contractual Capacity

✓Lawful Object

Smart Contracts (1996) "a set of promises, specified in digital form, including protocols within which the parties perform on those promises"

"Smart Contracts" were formally proposed in 1996!
~Nick Szabo, Smart Contracts: Building Blocks for Digital Markets, EXTROPY, 1996.

Traditional Contracts

Paper Contract

Cory agrees to pay $20K for the car. Once Claire gets the deposit, she will transfer the vehicle ownership to Cory by handling him over the car documents and the car.

Signature

SELLER

BUYER

Third Party Verification
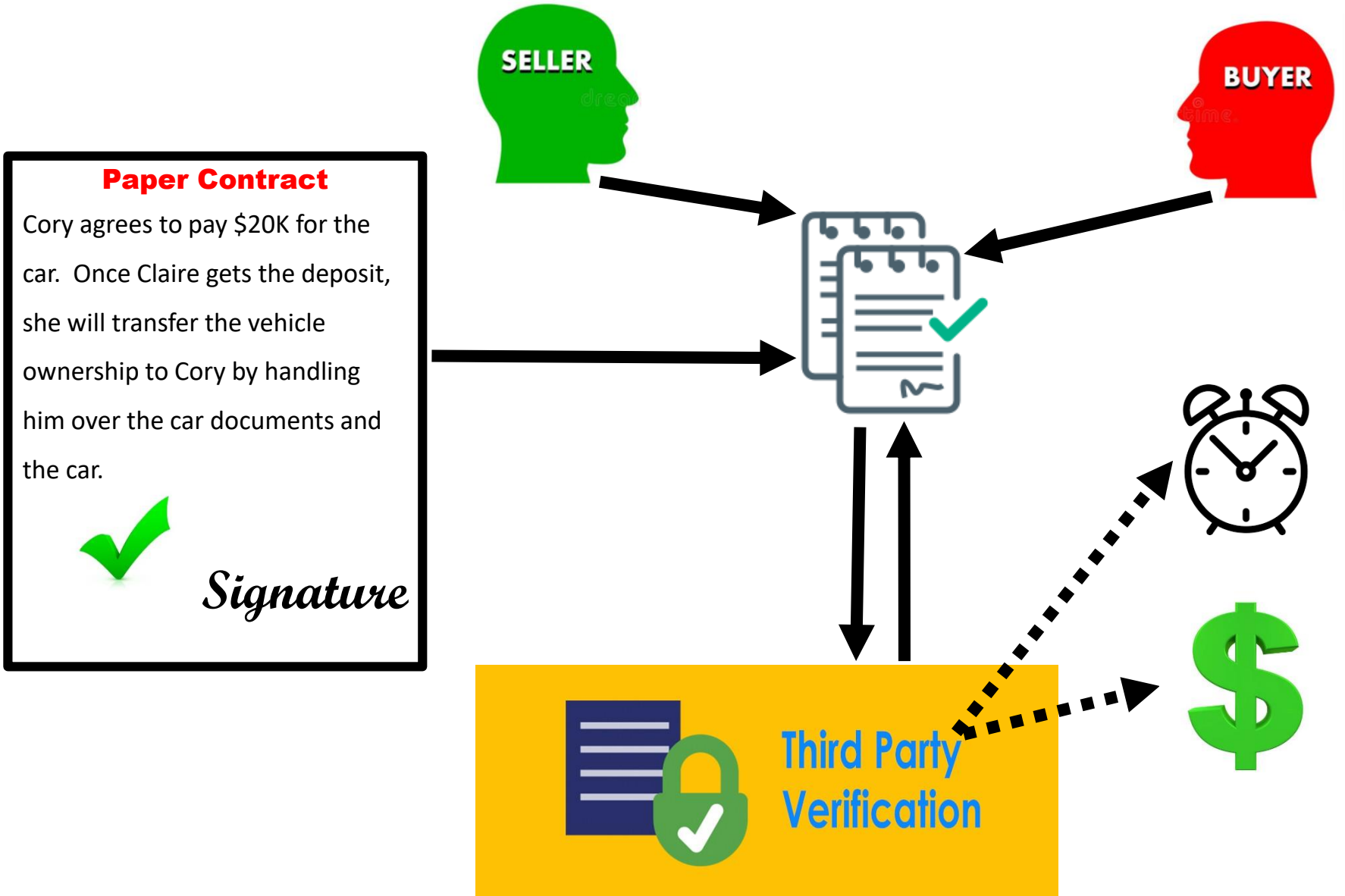
Smart Contracts

Problem: Adding Conditions/Constraints

Solution: Smart Contracts

Smart contract as a script (rules)

✓Executed before the new block will be created.

✓Any failure = lack of finality and new block will not be created.

Add Conditions to transactions → Smart Contracts

Smart Contracts

Bill leaves the boat and a key on the lot with a smart contract controlled lock. That boat has a (pk) =123456

2

1 Bill wants to sell a boat. He identifies himself with his public (pk)= 730484) and uses a smart contract to define the terms of the sale with his private key.

2

6

Phyllis can unlock smart contract with (pk) and pick up boat

Smart Contract

If $20K is sent to account (pk 730484) then automatically transfer boat ID 4920x8 and smart access to the account that transferred the funds.

Digital Signature
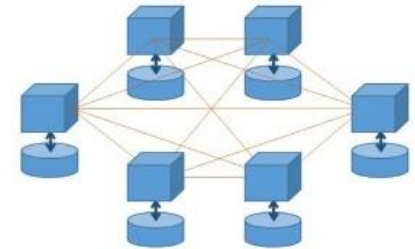
The smart contract is verified by each node on the network if Bill is the owner of the boat and if Phyllis have enough money to pay.

4

5 Network agrees, all conditions are true. Phyllis automatically gets access to the smart garage lock. Money exchanges and a new block is created.

3 Phyllis wants to buy the boat. She finds the boat on the internet. She signs the contract with her private key transferring $20K from her blockchain address (sk) to Bill's blockchain address 730484

Smart Contracts

Option contract written as code into a blockchain.

Contract is part of the public blockchain.

Parties involved in the contract are anonymous.

Contract executes itself when the conditions are met.

Regulators use blockchain to keep an eye on contracts.

https://codebrahma.com
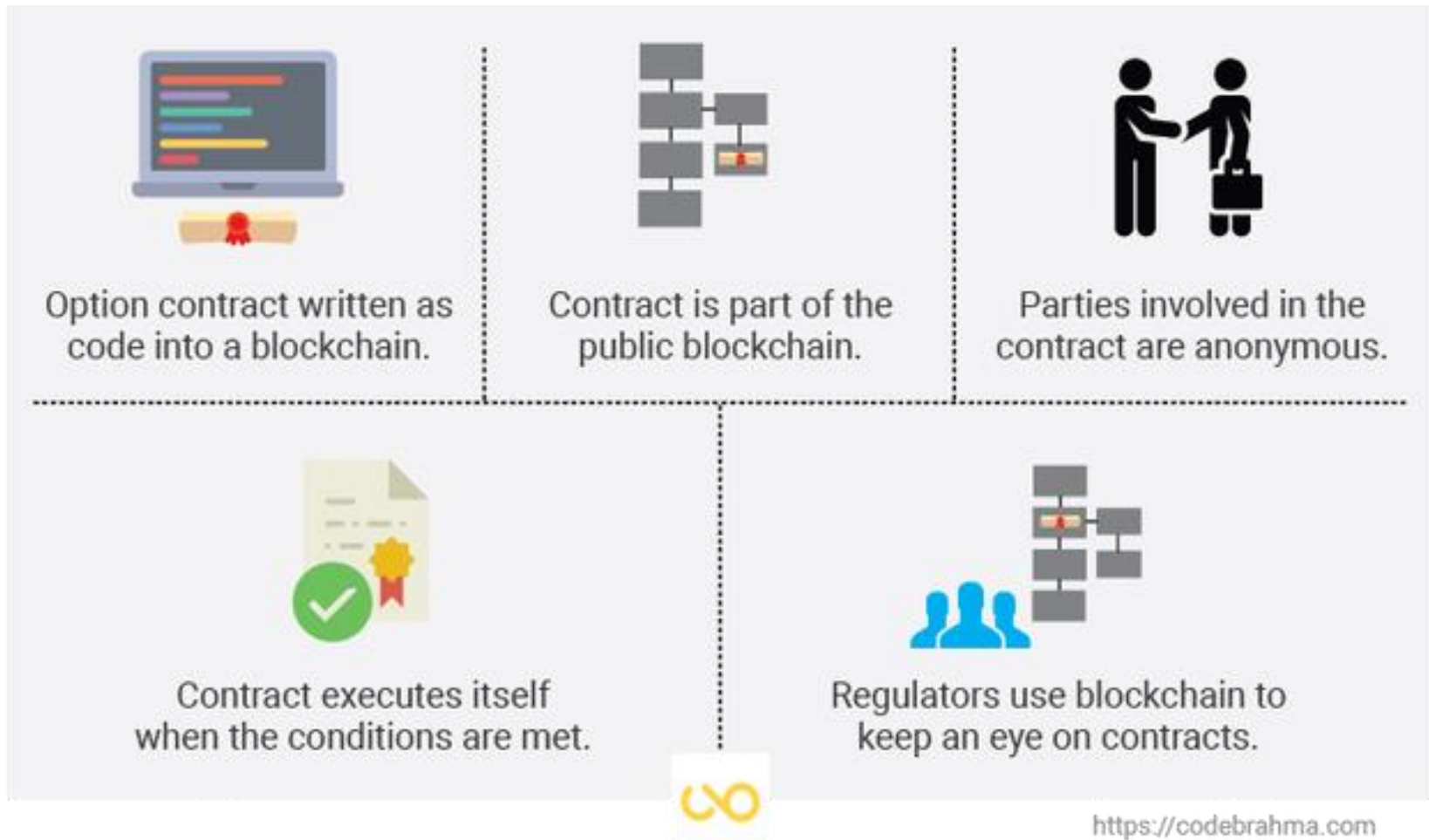
No court cases in US providing direct guidance on the enforceability of smart contracts.

McKinney, S. A., Landy, R., & Wilka, R. (2018). Smart Contracts, Blockchain, and the Next Frontier of Transactional Law. *Wash. JL Tech. & Arts*, *13*, 313.

Smart Contracts as "Digital Constraints"

Smart Contracts are:

- ❑ Not "Smart" or a "Contract"
- ❑ Self-governing contracts
- ❑ Simplify and automate lengthy and inefficient business processes.
- ❑ Terms and conditions are recorded in the contract's code.
- ❑ Shared network automatically executes the contract and monitors compliance.
- ❑ Outcomes are validated instantly without a third party.
- ❑ Self-executing

Examples of Smart Contracts:

- ❑ Only used in North America
- ❑ Cannot ship to California
- ❑ Validate age
  - ❑ e.g.) selling tobacco/liquor to minor
- ❑ Only physicians can validate EMR (HIPPA)
- ❑ Cannot sell prior to Jan 1, 2020 at 12:00pm
- ❑ If sold, then must pay royalty
- ❑ Interstate Commerce (Sherman Act)

Electronic Signatures in Global and National Commerce Act (E-Sign Act) of 2000 gives the legal effect to electronic signatures e.g.) DocuSign

Blockchain: Adding Trust to the Change of State

THE RECORD
All the information about an asset

THE BLOCK
A bundle of records

THE CHAIN
All the blocks linked together

Blocks

A block of data is simply a snapshot of the state of an asset.

Blockchain

A mechanism that registers the "change of state" adding trust to the transaction.

Trust is added through:

1.) Immutability. The "Hash" is a one way encryption to verify the transaction is authentic.

2.) Provenance. The distributed ledger is a historical record of who holds what.

3.) Finality. A block is only added after validation.

4.) Consensus. Participants in the blockchain network have the ability to raise red flags.

Smart Contracts

A smart contract is a computer script with a predefined set of rules. This script runs on the blockchain and sets the conditions required to complete a contract. It auto-executes if and when all the conditions are met before the new block will be created. Otherwise the transaction will fail.

"Like a cryptographic box that contains value & only unlocks if certain conditions are met."

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What are the possibilities?
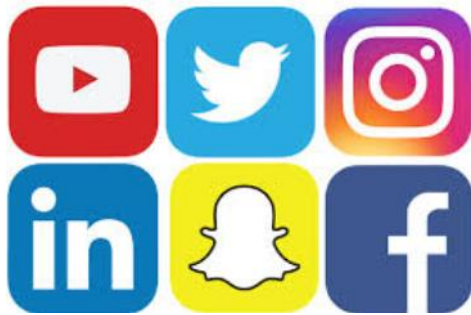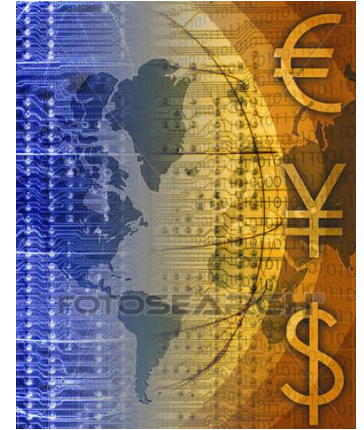
Gartner research predicts there will be over 26 billion connected devices by 2020

Banking Applications

Blockchain technology is moving into the financial mainstream with IBM and seven European banks

- IBM is building a blockchain for seven of Europe's biggest banks in the area of trade finance.
- Deutsche Bank, HSBC, KBC, Natixis, Rabobank, Societe Generale and Unicredit are the banks that are part of the consortium.

Harvard Business Review

The Blockchain Will Do to the Financial System What the Internet Did to Media

by Joichi Ito, Neha Narula, and Robleh Ali

Non-Financial Blockchain Uses

Blockchain-as-a-Service (BaaS)
Company: Ethereum Blockchain as a Service by Microsoft Azure, Rubix by Deloitte, IBM Blockchain on Bluemix

Authorship and ownership
Company: Bitproof, Blockai, Stampery, Verisart, Monegraph, OriginalMy, Crypto-Copyright, Proof of Existence, Ascribe, Po.et

Compliance and security
Company: Chainalysis, Third Key Solutions, Tradle, Vogogo, Elliptic, Coinalytics, Sig3, BlockSee, CryptoCorp, Blockverify

Energy
Company: Energy Blockchain Labs, Grid Singularity, TransActive Grid by LO3 Energy

Traceability of food products and supply chain audit
Company: Provenance

Reputation verification and ranking
Company: The World Table (Open Reputation), ThanksCoin

Job market
Company: Verbatm, Appii, Satoshi Talent, Coinality

Decentralized social network
Company: Datt, DECENT, Diaspora*, AKASHA, Synereo

Real estate recording
Company: UBITQUITY, Silvertown

E-voting
Company: Follow My Vote, Estonia's e-Residency platform

Gaming and gambling
Company: Etheria, First Blood, Etheramid, FreeMyVunk, CoinPalace, Etheroll, Rollin, Ethereum Jackpot

Content management/distribution
Company: Brave, Bittunes, PeerTracks, JAAK, Paperchain

Birth and death certificates
Company: Khanections, LLC

Digital identity, identification and authentication
Company: Keychain, 2WAY.IO, ShoCard, Guardtime, BlockVerify, HYPR, Onename, Civic, UniquID Wallet, Identifi, Evernym, BanQu, AID:Tech, SolidX

Government and organizational governance
Company: BITNATION, Advocate, Borderless, Otonomos, BoardRoom, Colony

Licensing
Company: license.rocks

Land registry
Company: The Dubai Land Department (DLD)

Open organization/business-related collaboration
Company: Colony

Internet of Things (IoT)
Company: Databroker DAO, Chronicled, Filament, Chimera, Filament, Stock.it

Ride-share
Company: Arcade City, La 'Zooz

Supply chain management
Company: Skuchain, Factom

Esports
Company: FirstBlood

Operating system
Company: BloqEnterprise by Bloq, BOLOS by Ledger, EOS by block.one, DeOS by Razormind, GemOS by Gem, Vault OS by ThoughtMachine

Enterprise-grade solutions and development platforms (infrastructure)
Company: XNotes Alliance, Tymlez, Symbiont, Sofocle, Pragmatic Coders, OTCXN, Openchain, Nuco, Monax, Libra Enterprise, Interbit, Credits, Colu, Ciphrex, ChromaWay, ChainThat, Chain Reactor, Chain, Bloq, BlockCypher, Blockchain Foundry, BigchainDB, Avalanchain, Applied Blockchain, AlphaPoint Distributed Ledger Platform

Network infrastructure
Company: Ethereum, ChromaWay

Mining
Company: Waves

Data integrity and security
Company: PeerNova, Guardtime

Media
Company: Publiq

Diamonds
Company: Everledger

Data management
Company: Factom

Non-Financial Blockchain Technology (Use Cases)

Blockchain Technology on the rise

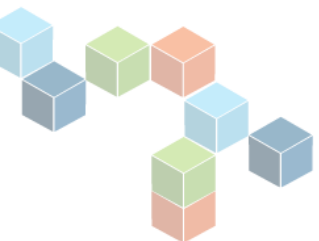Capital market spending on blockchain technology in $ billions

Source: Aite Group

How to do you build Blockchain?

- Need to depend on Blockchain database
- What are the BlockChain databases that are out there?
  - Microsoft--Azure Blockchain Workbench
  - Oracle Autonomous Blockchain Cloud Service
  - Intel's Sawtooth
  - SAP HANA Blockchain
  - IBM Hyperledger Fabric
  - Apache Hyperledger (open source)

Apache Software Foundation founder to lead blockchain Hyperledger Project

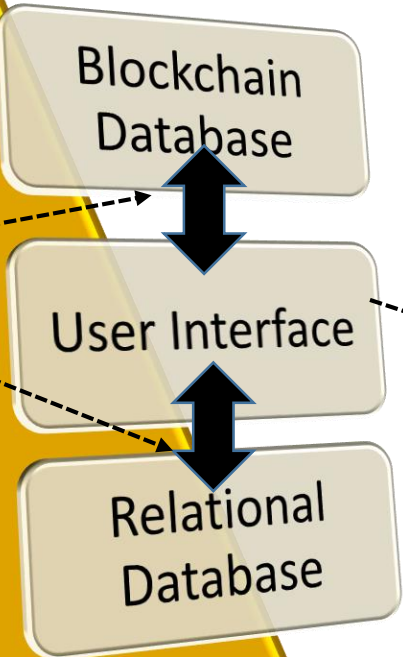Well-known open-source developer and leader Brian Behlendorf is now the executive director of Hyperledger, a project for advancing enterprise open-source blockchain technology

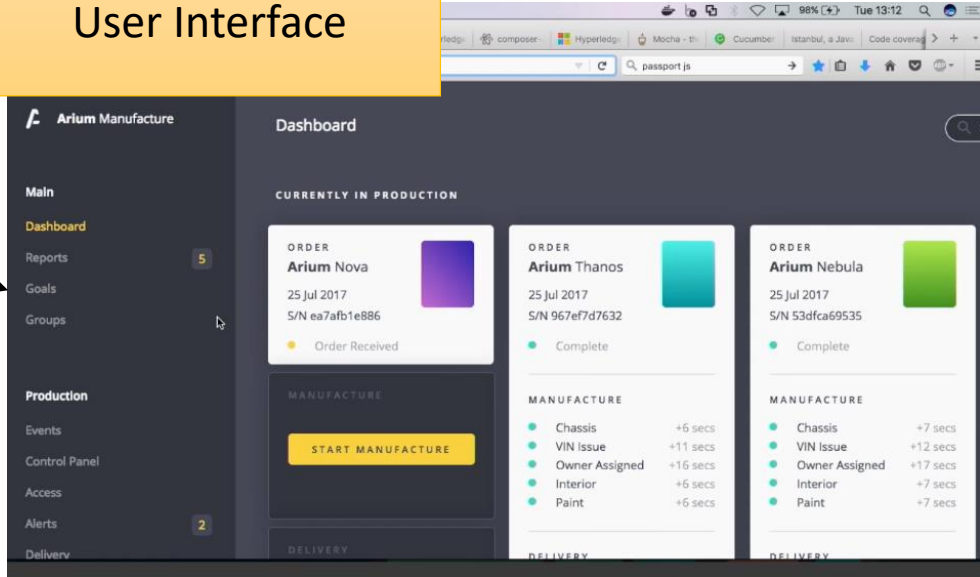By Steven J. Vaughan-Nichols for Linux and Open Source | May 19, 2016 -- 20:00 GMT (13:00 PDT) | Topic: E-Commerce

Application Architecture

(API) Application Programming Interface

User Interface

Blockchain Database

User Interface

Relational Database

Data Exchange Built on Blockchain

Software (Data provider)

Encrypted data transmission

1. Registration of data attributes and ID information
2. Setting of access rights
3. Automation of processes

Blockchain

Blockchain API

App generating API

Corporate system

Data registration
Authentication, permission, traceability

Data exchange

Blockchain
Access control, trace management, data directory

Data access
Authentication, permission, traceability

Wide area network

Software (Data user)

Encrypted data transmission

1. Registration of data attributes and ID information
2. Setting of access rights
3. Automation of processes

Blockchain

Blockchain API

App using API

User

Reference: Fujitsu.com

The Digital Pink Slip:

A Blockchain Use Case for Automobile Registration

The Digital Pink Slip:
A Blockchain Use Case for Automobile Registration

- Assets = cars

- Transactions = buying and selling of cars

- Participants =

Block 101

Previous Hash: fec04740-d898-43ac-b45v-69b8304c917a
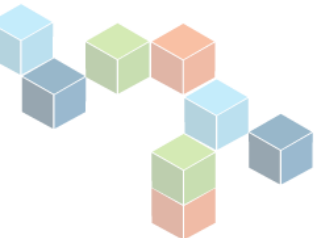
Hash: 01ea7ld5-52ec-4c34-b853-1b315aa4052a

Time stamp: September 1, 2018 11:49am UTC

VIN	1L81SJX26SA003608
Year	2018
Make	Tesla
Model	Model X
Color	Blue
Titleholder	Cory Campbell
Insurance Coverage	[...]
Registration	[...]
Status	Complete
Smart Contract	[...]

Manufacturer
Car Dealer
Buyers
Service/Mechanics
Financial Institutions
Insurance
Law Enforcement
Dept. of Motor Vehichles
Sellers

Use Case: Block 101

Block 101

Previous Hash: fec04740-d898-43ac-b45v-69b8304c917a

Hash: 01ea7ld5-52ec-4c34-b853-1b315aa4052a

Time stamp: September 1, 2018 11:49am UTC

VIN	1L81SJX26SA003608
Year	2018
Make	Tesla
Model	Model X
Color	Blue
Titleholder	Dijo's Autohaus
Insurance Coverage	[...]
Registration	[...]
Status	Complete
Smart Contract	[...]

100
The chain originates with the OEM manufacturer

101

Blockchain Transaction:

Dijo's Autohaus buys a car from the OEM Manufacturer.

✓ A new block (101) is created

✓ Title changes from Telsa (OEM) to Dijo

Use Case: Block 102

Block 102

Previous Hash: 01ea7ld5-52ec-4c34-b853-1b315aa4052a

Hash: jKla781d-4358-cjao5848a3-89jlxlejb8s0ak

Time stamp: September 2, 2018 7:32 pm UTC

VIN	1L81SJX26SA003608
Year	2018
Make	Tesla
Model	Model X
Color	Blue
Titleholder	Cory Campbell
Insurance Coverage	[...]
Registration	[...]
Status	Complete
Smart Contract	[...]

Blockchain Transaction:

Dijo's Autohaus sells the car to Cory Campbell.

✓ A new block (102) is created

✓ Title changes from Dijo's Autohaus to Cory

100   **101**   **102**

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Use Case: Block 103

Block 103

Previous Hash: jKla781d-4358-cjao5848a3-89jlxlejb8s0ak

Hash: a8akdidb-a8d9-a98ldkac99-jas8jalwpqzod

Time stamp: September 4, 2018 9:15am UTC

VIN	1L81SJX26SA003608
Year	2018
Make	Tesla
Model	Model X
Color	Blue
Titleholder	Kim Herb
Insurance Coverage	[...]
Registration	[...]
Status	Complete
Smart Contract	[...]

Blockchain Transaction:

Cory sells the car to Kim.

✓ A new block (103) is created

✓ Title changes from Cory to Kim

100   101   102   103

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Use Case: Can we sell to two people?

Double spending is trying to sell the same assets twice, to two different people.
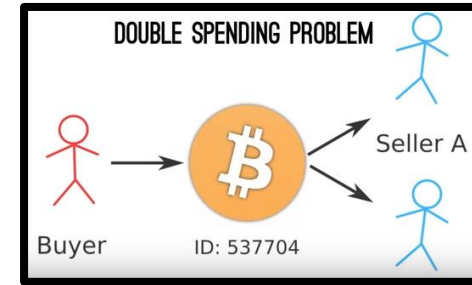
DOUBLE SPENDING PROBLEM
Buyer   ID: 537704   Seller A

~~Block~~

Previous Hash: a8akdidb-a8d9-a98ldkac99-jas8jalwpqzod

Hash:

Time stamp: September 1, 2018 11:49am UTC

|	
VIN	1L81SJX26SA003608
Year	2018
Make	Tesla
Model	Model X
Color	Blue
Titleholder	Cory Campbell
Insurance Coverage	[...]
Registration	[...]
Status	Complete
Smart Contract	[...]

Blockchain Transaction:

Cory sells the car to Claire

Cory owns Block 102—not the latest block in the chain

✓ Transaction **FAIL** Why?

Algorithm designed to ensure prior block is the longest

✓ No new Block Created

100   101   102   103
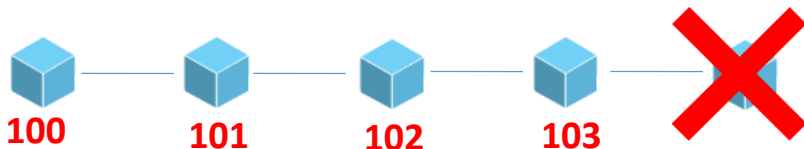
Use Case: What if a Block is altered?

Cory alters Block 103 by changing the Title holder to back to himself.

FRAUD ALERT

Block

Previous Hash: a8akdidb-a8d9-a98ldkac99-jas8jalwpqzod

Hash:

Time stamp: September 1, 2018 11:49am UTC

VIN	1L81SJX26SA003608
Year	2018
Make	Tesla
Model	Model X
Color	Blue
Titleholder	Cory Campbell ~~Kim Herb~~
Insurance Coverage	[...]
Registration	[...]
Status	Complete
Smart Contract	[...]

Blockchain Transaction:
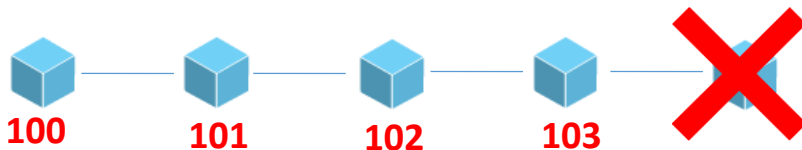
- ✓ Title changes from Kim Herb back to Cory Campbell.

- ✓ Cory tries to sell the car to Steve Lamb.

- ✓ Transaction FAIL Why?

**Change in Record changes the HASH.
Hash no longer links to the previous hash**

- ✓ No new Block Created

Cannot change a block--Immutability

100   101   102   103   ✗

Use Case: Addition of Smart Contracts

Smart Contracts

A smart contract is a computer script with a predefined set of rules. This script runs on the blockchain and sets the conditions required to complete a contract. It auto-executes if and when all the conditions are met before the new block will be created. Otherwise the transaction will fail.

"Like a cryptographic box that contains value & only unlocks if certain conditions are met."
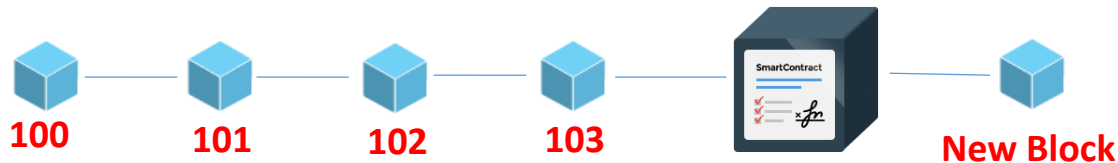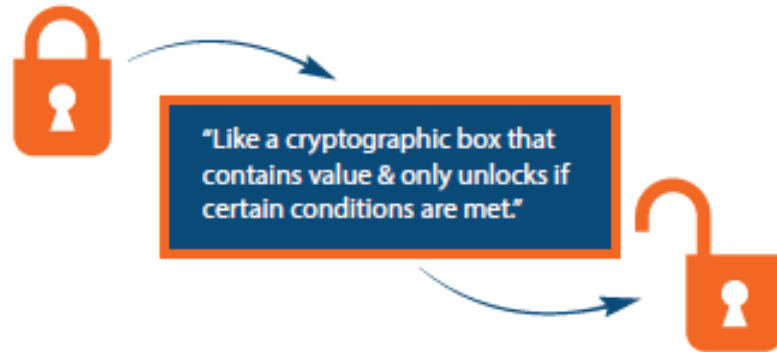
A smart contract is added by ___ to require registration with the Department of Motor Vehicles before any sale is complete.

100 **101** **102** **103** SmartContract **New Block**

Use Case: Addition of Smart Contracts

Blockchain Transaction:

Kim sells the car to Chloe, but the transaction fails.

✓Transaction **FAIL**   Why?

Kim did not register with the DMV

This Block Fail....Block 104 is NOT created

Block 104 ~~(crossed out)~~

Previous Hash: jKla781d-4358-cjao5848a3-89jlxlejb8s0ak

Hash: a8akdidb-a8d9-a98ldkac99-jas8jalwpqzod

Time stamp: September 4, 2018 9:15am CST

VIN	1L81SJX26SA003608
Year	2018
Make	Tesla
Model	Model X
Color	Blue
Titleholder	Cory Campbell
Insurance Coverage	[...]
Registration	[...]
Status	Complete
Smart Contract	[DMV Registration]

100   101   102   103   104

Use Case: Addition of Smart Contracts

Blockchain Transaction:

Kim sells the car to Chloe, but the transaction fails.

- ✓ Kim registers with DMV
- ✓ Smart contract executes
- ✓ Block 104 created
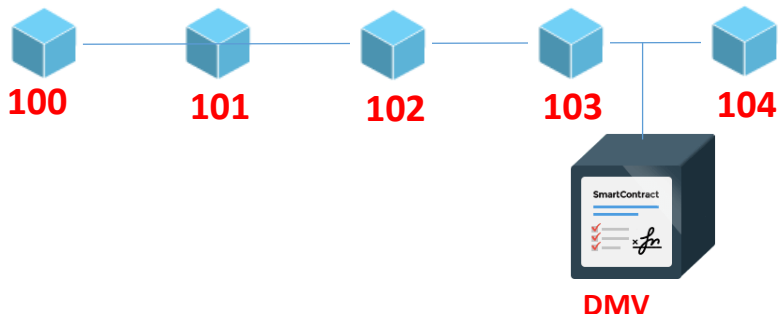
Block 104

Previous Hash: a8akidb-a8d9-a98ldkac99-jas8jalwpqzod

Hash: a89d02k-kald9-bjao89e0d-z938akdho3jd

Time stamp: September 5, 2018 3:47pm CST

VIN	1L81SJX26SA003608
Year	2018
Make	Tesla
Model	Model X
Color	Blue
Titleholder	Chloe
Insurance Coverage	[...]
Registration	[YES]
Status	Complete
Smart Contract	[DMV Registration]

**100** **101** **102** **103** **104**

DMV

PASS

Use Case: Addition of Smart Contracts

Smart Contracts

A smart contract is a computer script with a predefined set of rules. This script runs on the blockchain and sets the conditions required to complete a contract. It auto-executes if and when all the conditions are met before the new block will be created. Otherwise the transaction will fail.

"Like a cryptographic box that contains value & only unlocks if certain conditions are met."
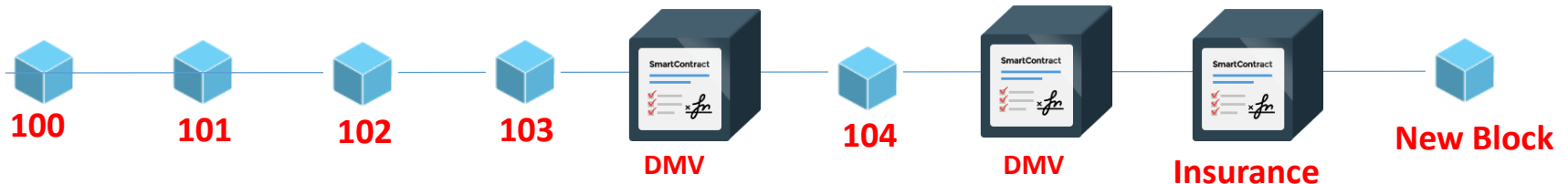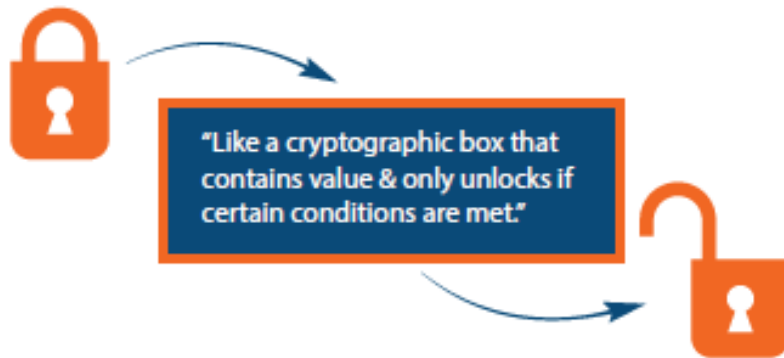
A smart contract is added by ___ to require insurance with ____ before any sale is complete.

100   101   102   103

SmartContract

DMV   104

SmartContract

DMV

SmartContract

Insurance   New Block

Use Case: Addition of Smart Contracts

Block 105

Previous Hash: 89d02k-kald9-bjao89e0d-z938akdho3jd

Hash: 9adkaigh-d8ad-mazpd8dd3-1k90ziah89a4
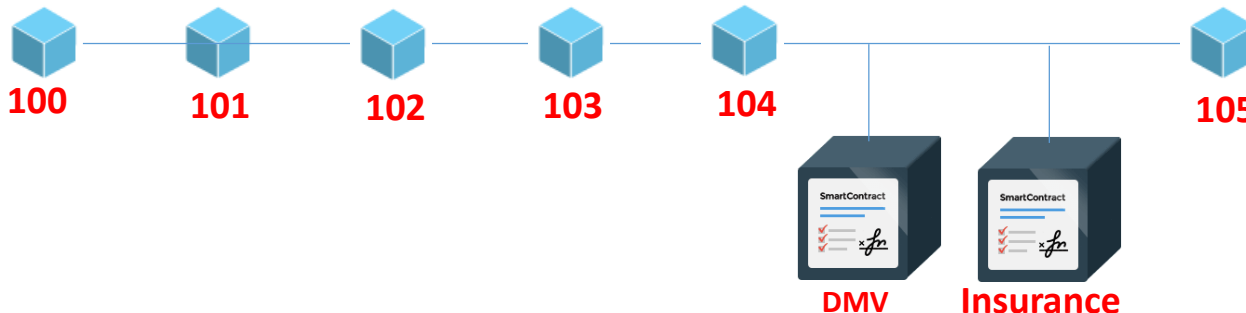
Time stamp: September 6, 2018 1:23pm CST

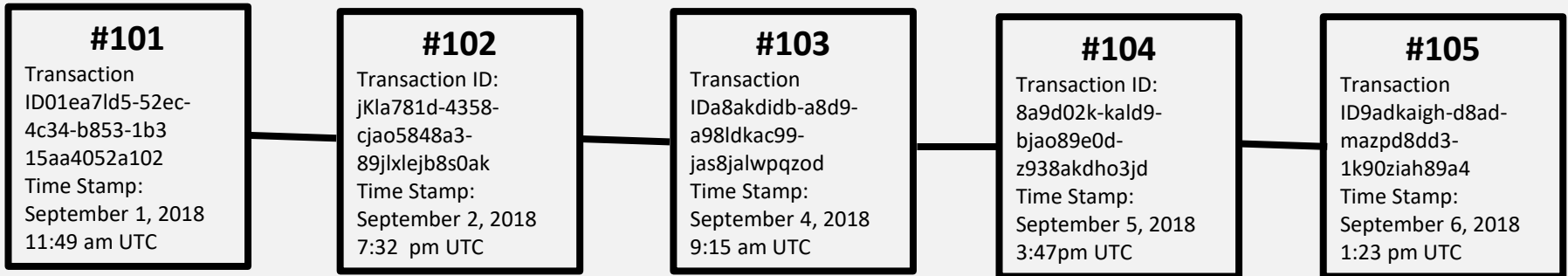|	
VIN	1L81SJX26SA003608
Year	2018
Make	Tesla
Model	Model X
Color	Blue
Titleholder	Chloe
Insurance Coverage	[...]
Registration	[YES]
Status	Complete
Smart Contract	[Insurance] [DMV]

Blockchain Transaction:

Regulatory body requires proof of insurance must be on file with the DMV.

- ✓ Chloe submits her proof of insurance to the DMV

- ✓ Smart contract executes

- ✓ Block 105 created

- ✓ Chloe retains Title

PASS

100   101   102   103   104   105

DMV   Insurance

Review: What happened?

#101
Transaction ID01ea7ld5-52ec-4c34-b853-1b3 15aa4052a102
Time Stamp: September 1, 2018 11:49 am UTC

#102
Transaction ID: jKla781d-4358-cjao5848a3-89jlxlejb8s0ak
Time Stamp: September 2, 2018 7:32 pm UTC

#103
Transaction IDa8akdidb-a8d9-a98ldkac99-jas8jalwpqzod
Time Stamp: September 4, 2018 9:15 am UTC

#104
Transaction ID: 8a9d02k-kald9-bjao89e0d-z938akdho3jd
Time Stamp: September 5, 2018 3:47pm UTC

#105
Transaction ID9adkaigh-d8ad-mazpd8dd3-1k90ziah89a4
Time Stamp: September 6, 2018 1:23 pm UTC

Recent Transactions:

Block	Time Stamp	Transaction ID	Transaction Submitter
101	September 1, 2018 11:49am UTC	01ea7ld5-52ec-4c34-b853-1b315aa4052a	Dijo's Autohaus
102	September 2, 2018 7:32 pm UTC	jKla781d-4358-cjao5848a3-89jlxlejb8s0ak	Cory Campbell
103	September 4, 2018 9:15am UTC	a8akdidb-a8d9-a98ldkac99-jas8jalwpqzod	Kim Herb
104	September 5, 2018 3:47pm UTC	8a9d02k-kald9-bjao89e0d-z938akdho3jd	Chloe Eleanor
105	September 6, 2018 1:23pm UTC	9adkaigh-d8ad-mazpd8dd3-1k90ziah89a4	Chloe Eleanor

"Trusting" the Transactions

Immutability → Altering block (e.g. changing titleholder) changed the hash
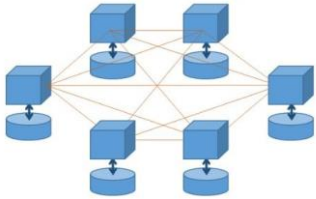
Provenance → participants can see where block originated as well as ownership

Finality → Single, trusted source of ownership and transaction history

Consensus → All the blocks in a chain must agree on the transactions validity

What's Next?

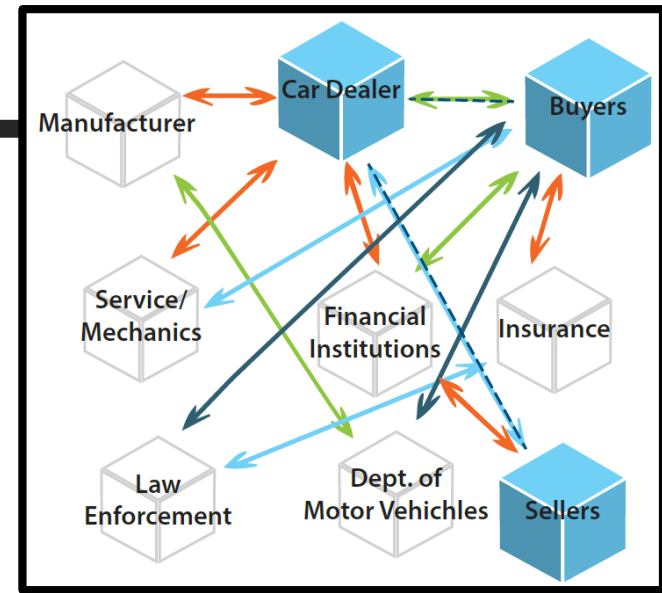## Regulation
- [ ] Emissions
- [ ] Insurance
- [ ] Registration

Innovation
- [ ] Certified mechanics
- [ ] Certified parts

Safety
- [ ] Valid licenses
- [ ] Proof of Insurance
- [ ] Registration

Disruptive Innovation
- [ ] Future for CarFax and Kelley Blue Book?

What's Next?

ENTERPRISE BLOCKCHAIN SURVEY

SAP has conducted a survey among its SAP Blockchain Community members. Our members are customers and partners, each sharing an interest and need to learn more about blockchain and its adoption as a technology to improve our lives. The highlights of the survey are shared in the infographic below, based on more than 200 responses, primarily from senior business leaders, supply chain managers, innovation & strategy officers and business analysts.

SAP www.sap.com/blockchain

1 EARLY ADOPTION

92%
OPPORTUNITY

92% of survey respondents view blockchain as an opportunity
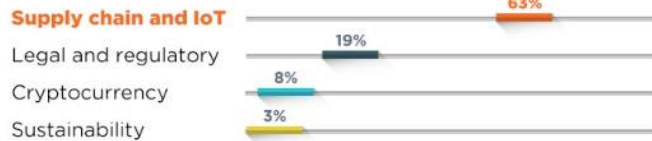
3%
LIVE

Only 3% of survey respondents are using blockchain in a production today

84%
ACTIVE

84% of survey respondents are currently engaged in blockchain related activities

2 LEADING USE CASES

MOST PROMISING BLOCKCHAIN USE CASES

Supply chain and IoT — 63%
Legal and regulatory — 19%
Cryptocurrency — 8%
Sustainability — 3%

MOST IMPORTANT BLOCKCHAIN ATTRIBUTES

42%
Transparancy in the value chain

39%
Trustworthy shared data

13%
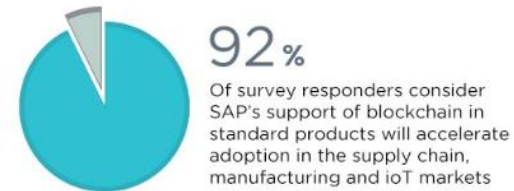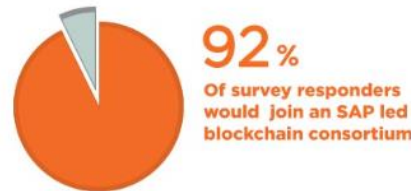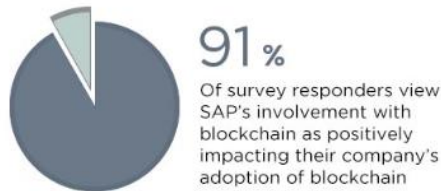Industry standardization

3 FUTURE IMPACT

96%
76%
83%

76% of survey respondents view that operational supply chain will be replaced by Smart Contracts in 5 - 10 years

83% of survey respondents assume that blockchain will become the system of trust

96% of survey respondents think that blockchain will improve the compliance of companies

4 SAP IMPORTANCE IN DRIVING BLOCKCHAIN

91%
Of survey responders view SAP's involvement with blockchain as positively impacting their company's adoption of blockchain

92%
Of survey responders would join an SAP led blockchain consortium

92%
Of survey responders consider SAP's support of blockchain in standard products will accelerate adoption in the supply chain, manufacturing and ioT markets

BLOCK CHAIN

Implications for the Accounting Profession

➢ **"A world where all transactions for a company occur on the blockchain would enable auditors to verify large amounts of routine data automatically, allowing them to focus instead on more complex transactions and controls"**

Kimberly Ellison-Taylor, chairman of the AICPA ~ December 5, 2017

➢ **"The accounting profession is built on confirmation and verification, and that's what blockchain is all about."**

Barry Melancon, AICPA president and CEO ~ October 23, 2017

➢ **"Blockchain is one of the technologies that are 'shaping' the accounting industry."**

Erik Asgeirsson, president and CEO of CPA.com ~ October 23, 2017

What Do Accountants Need to Know?

Potential uses for blockchain in accounting and audit:

- Immutable records
- Traceable audit trails
- Automated audit processes
- Authentication of transactions
- Tracking ownership of assets
- Development of "smart contracts"
- Registry and inventory system for any asset, ranging from raw materials to intellectual property

accountingTODAY

TARGET: CPAS

What Does it Mean for Accountants?

Impact on audit practices:

- blockchain in accounting & audit greatly reduces potential for errors when reconciling complex & disparate information from multiple sources
- accounting records <u>not alterable</u> once committed even by the owners of the accounting system
- every transaction is recorded & verified—the integrity of financial records is guaranteed
- potential to greatly reduce or even eliminate the need for auditing resources
- Increased need to audit controls and transaction anomalies
- potentially disrupting accounting profession as a whole
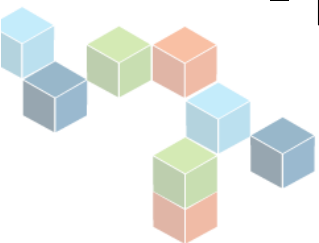
Conclusion:

❑ A "Block" is a snapshot of the "change of state" to the asset

❑ Blockchain has the potential to shift the nature of Accounting

❑ Blockchain has the potential to vastly automate the accounting process in compliance with regulatory requirements

❑ Blockchain will have a useful impact in every business

❑ The Accounting profession has a unique opportunity to define the blockchain agenda

❑ The future of Blockchains lies in smart contracts and supply chain

❑ Embrace the hype and before it's forced upon you!

Lead with technology, rather than follow it.

The Digital Pink Slip:

A Blockchain Use Case for Automobile Registration

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