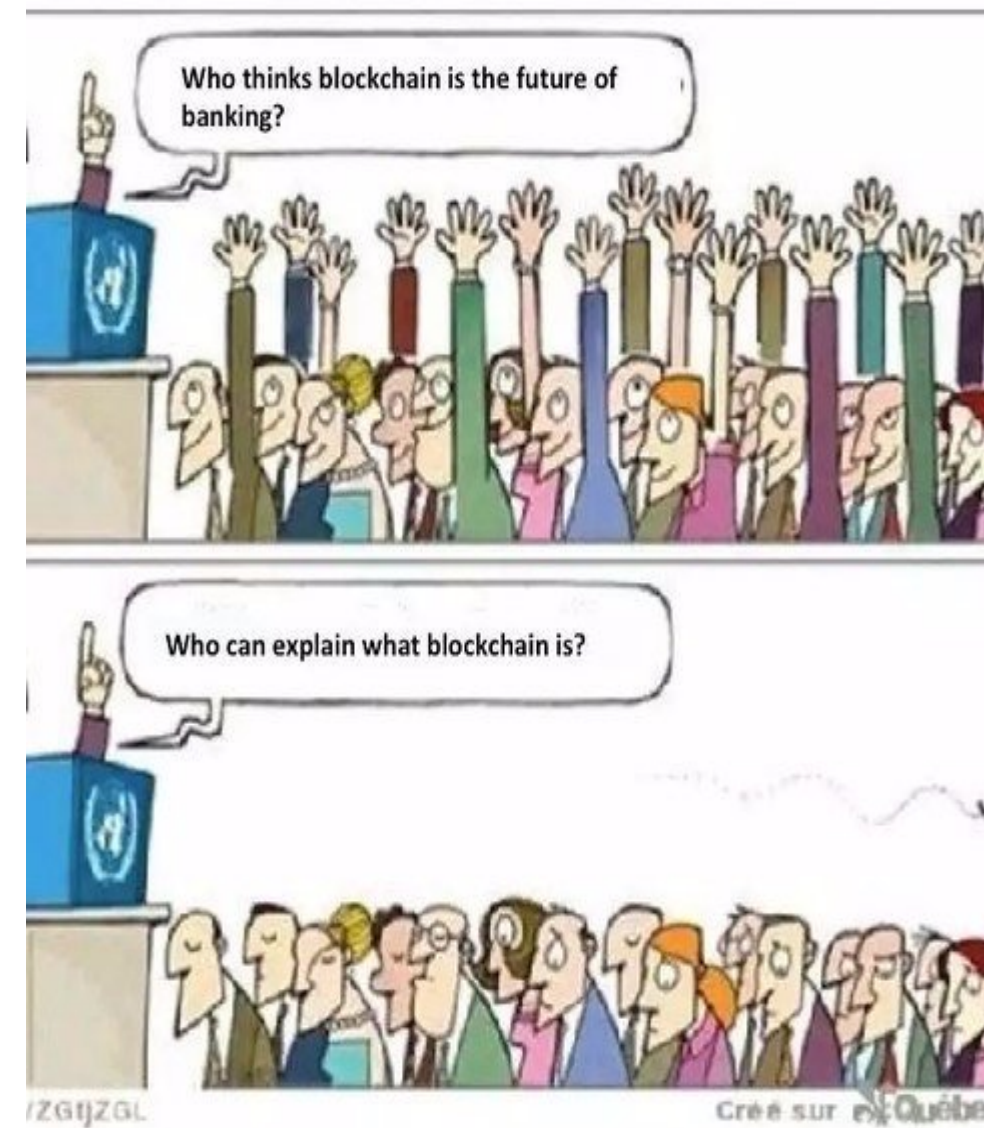


Accounting in the World of Blockchain, Cryptocurrency, and Smart Contracts

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Learning Objectives

1. Understand the basics of blockchain, cryptocurrency, and smart contracts.
2. Understand the accounting issues related to blockchain, cryptocurrency, and smart contracts



Cryptocurrency- History

- 1983 – ecash
- 1995- Digicash
- 1998- b-money
- 2009- bitcoin

What is Cryptocurrency?











- Investopedia - a digital or virtual currency that uses cryptography for security.
- Bank rate- a type of decentralized digital currency.
- Merriam-Webster- any form of currency that only exists digitally, that usually has no central issuing or regulating authority but instead uses a decentralized system to record transactions and manage the issuance of new units, and that relies on cryptography to prevent counterfeiting and fraudulent transactions

Formal Definition of Cryptocurrency

Six Conditions (Lanskey, 2018)

1. Does not require a central authority.
2. Maintains an overview of cryptocurrency units and their ownership.
3. The system defines whether new cryptocurrency units can be created.
4. Ownership of cryptocurrency units can be proved exclusively cryptographically.
5. The system allows transactions to be performed in which ownership of the cryptographic units is changed.
6. If two different instructions for changing the ownership of the same cryptographic units are simultaneously entered, the system performs at most one of them.

Current Cryptocurrencies

#	Name	Symbol	Market Cap	Price	Circulating Supply	Volume (24h)	% 1h	% 24h	% 7d	
1	 Bitcoin	BTC	\$168,011,374,189	\$9,325.05	18,017,200	\$35,646,462,762	-0.84%	-0.80%	13.10%	***
2	 Ethereum	ETH	\$19,831,433,456	\$183.07	108,328,769	\$11,802,882,627	-0.88%	0.90%	4.28%	***
3	 XRP	XRP	\$12,827,421,107	\$0.296601	43,248,091,671 *	\$2,307,759,367	-0.62%	0.44%	1.51%	***
4	 Bitcoin Cash	BCH	\$4,820,647,514	\$266.61	18,081,588	\$3,342,805,736	-1.03%	4.26%	15.93%	***
5	 Tether	USDT	\$4,106,590,283	\$0.999646	4,108,044,456 *	\$44,817,785,338	-0.39%	-0.49%	-0.45%	***
6	 Litecoin	LTC	\$3,712,484,854	\$58.41	63,558,967	\$4,354,744,393	-1.28%	1.50%	6.67%	***
7	 EOS	EOS	\$3,152,051,646	\$3.36	937,764,791 *	\$3,930,013,129	-0.40%	6.01%	14.73%	***
8	 Binance Coin	BNB	\$3,080,949,219	\$19.81	155,536,713 *	\$359,465,170	-0.92%	4.28%	8.82%	***
9	 Bitcoin SV	BSV	\$2,495,244,014	\$138.10	18,068,415	\$901,977,540	-1.04%	-1.10%	34.69%	***
10	 TRON	TRX	\$1,352,076,690	\$0.020276	66,682,072,191	\$2,124,564,313	-1.56%	18.65%	30.38%	***

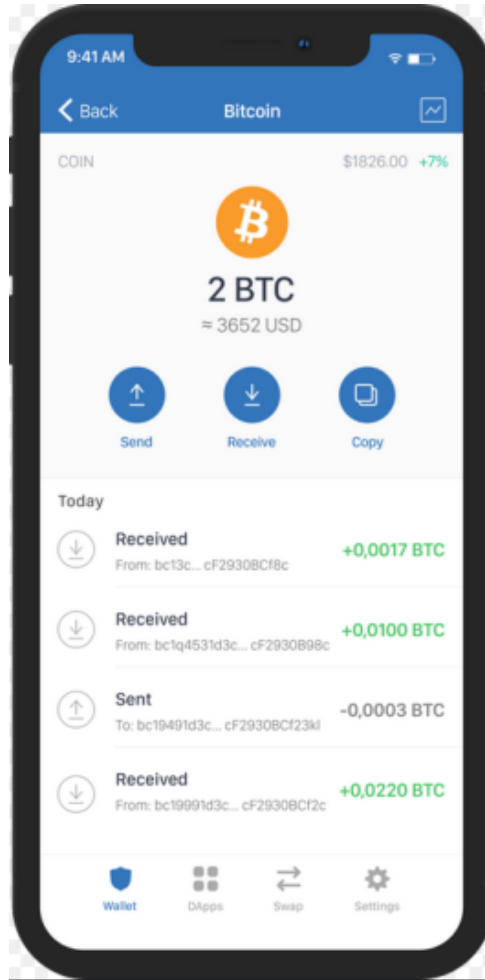
2353 cryptocurrencies as of 10/28/2019

2009 cryptocurrencies with a known market cap as of 10/28/2019

Transacting With Cryptocurrency



Desktop, Online,
Hardware, Paper



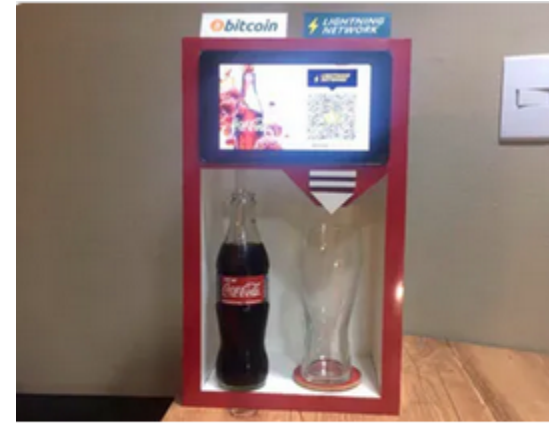
What's Coming?



M5Stick Libra Watch & Wallet



Arduino-Based Bitcoin Candy Vending Machine



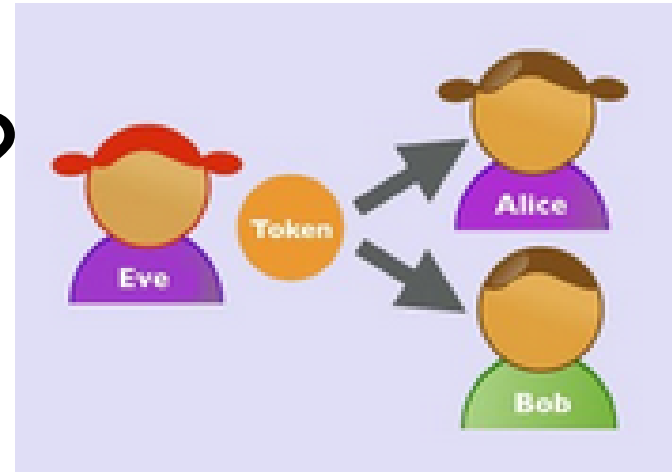
Coke Vending Machine with Bitcoin and Lightning Network



Bitcoin Powered Electrical Outlet

Why Cryptocurrency?

Double Spend



Trust

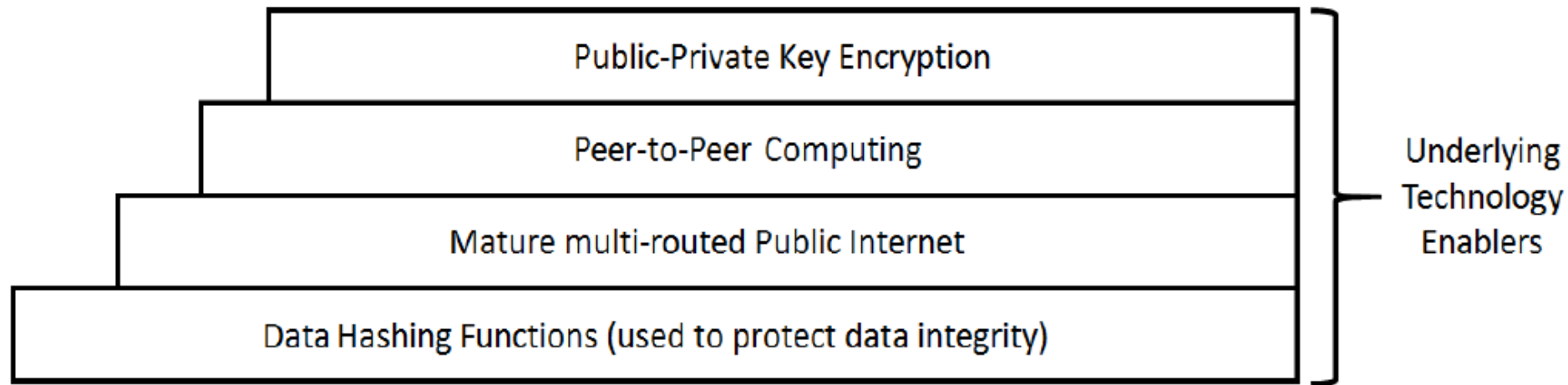


Pay Exact Amount



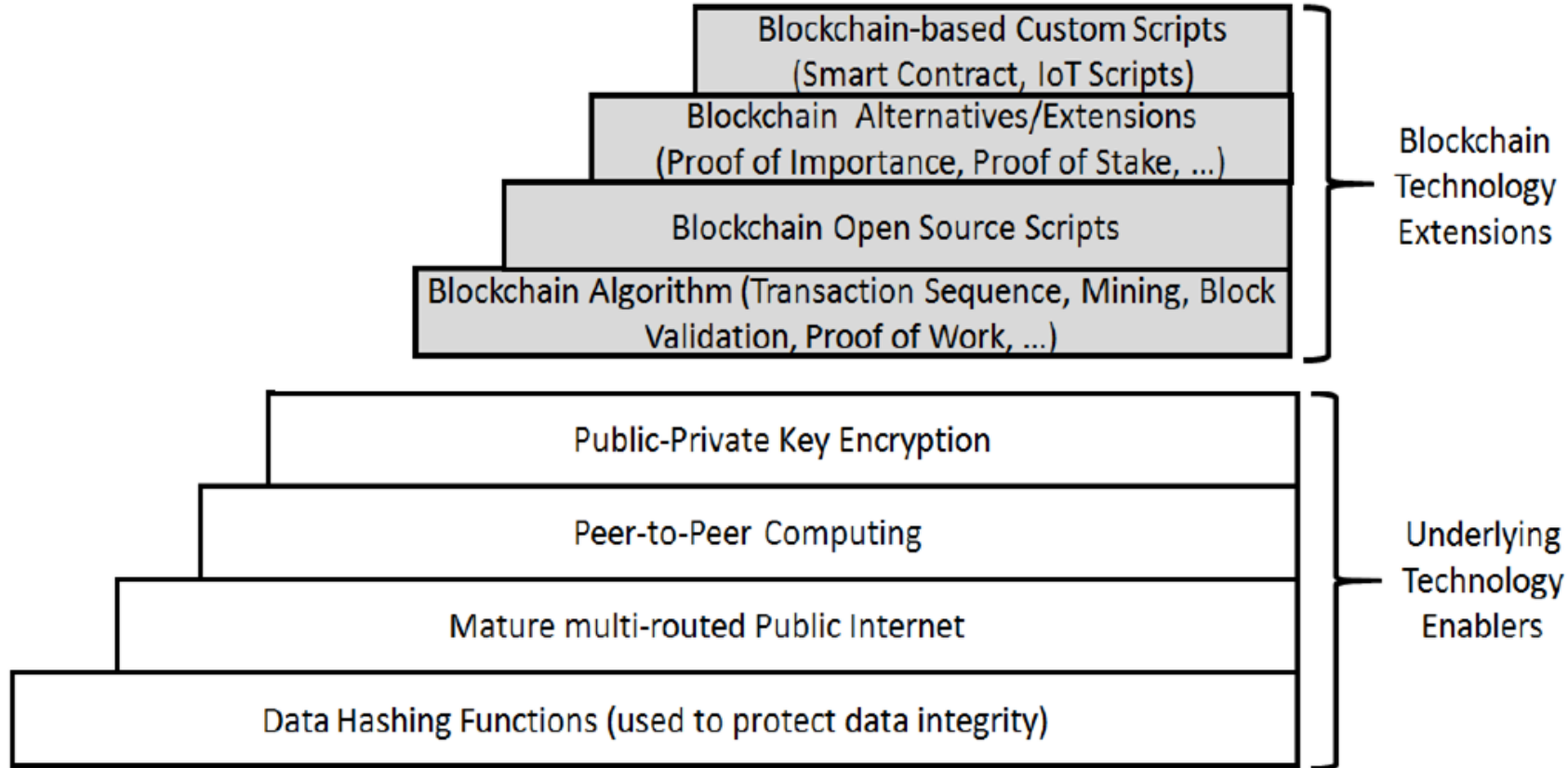
What is Blockchain?

Foundational Technologies



Source: Schmidt and Grabski. 2018. Blockchain capability decisions for implementing blockchain using hyperledger.

Blockchain Extensions



Source: Schmidt and Grabski. 2018. Blockchain capability decisions for implementing blockchain using hyperledger.

What is Blockchain?

- A blockchain is a transparent database that does not permit modification of previously approved transactions.
- Possible infrastructure of choice for managing exchanges of value just as the Internet provided the infrastructure for managing exchanges of information (Tapscott and Tapscott, 2016).
- New transactions, once approved, are packaged into blocks. The block is then appended to the ordered chain of preexisting blocks. In this way, we form a chain of blocks. (hence BLOCK + CHAIN).
- *Formally: The blockchain is a **decentralized, distributed ledger** that utilizes **cryptography** and **consensus algorithm** to ensure the immutability of data.*

Key Elements of Blockchain

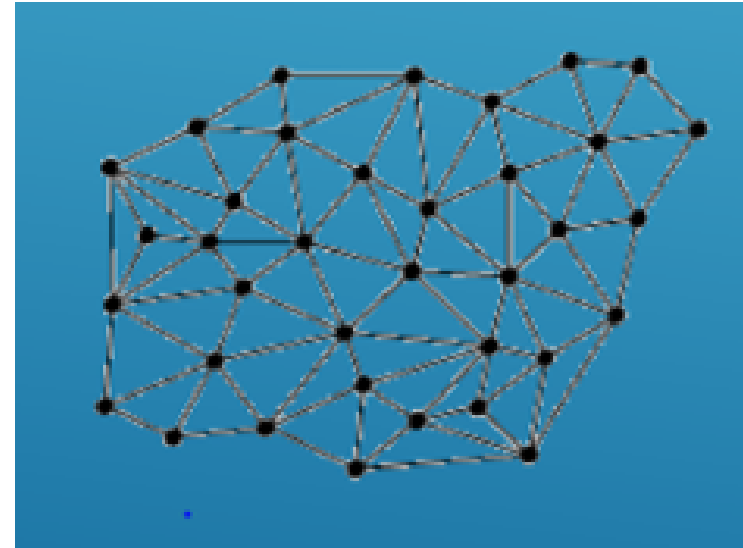
1. Decentralized Network

- Full Nodes
- Lightweight Node

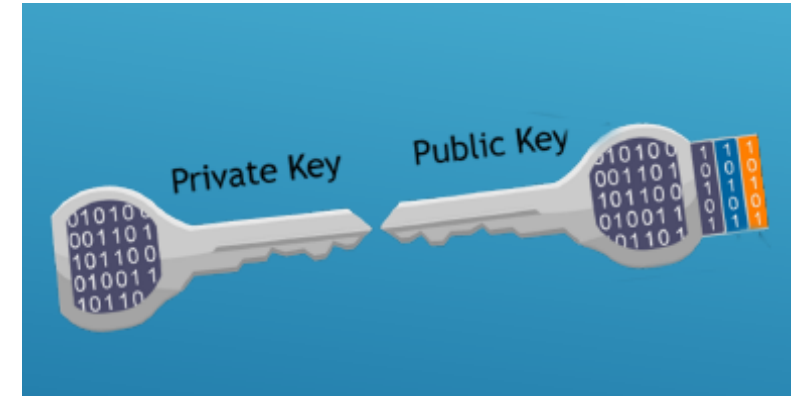


Key Elements of Blockchain

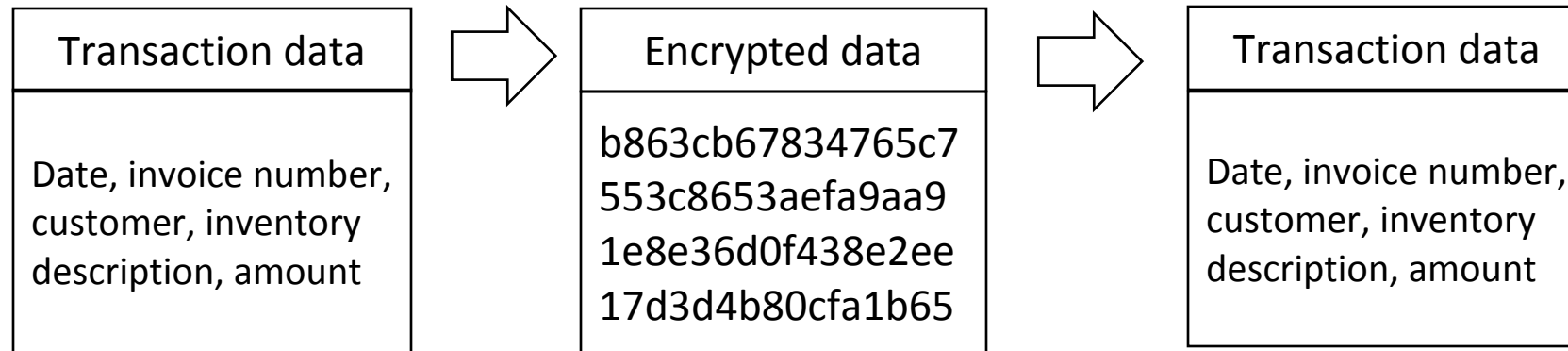
2. Distributed Ledger



Key Elements of Blockchain



3. Cryptography and Encryption



Key Elements of Blockchain

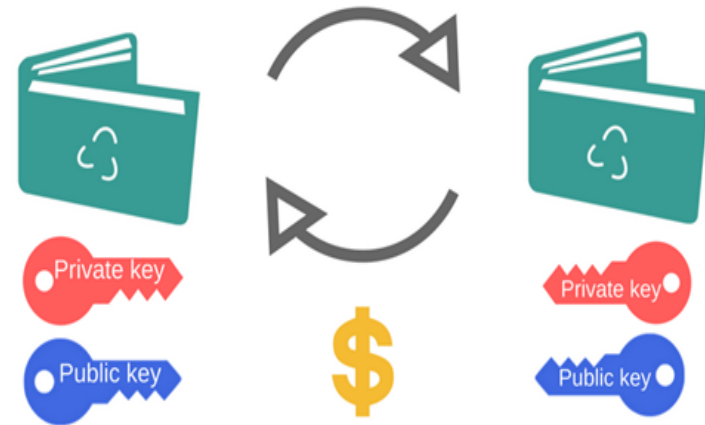
- Mining/Consensus Algorithm
 - Proof-of-Work
 - Proof of-Stake
 - Proof-of-Elapsed Time



How Does It Work? –Bitcoin Blockchain Example

1. New transactions are broadcast to all nodes

- Bitcoin Wallet
- Private Key
- Public Key



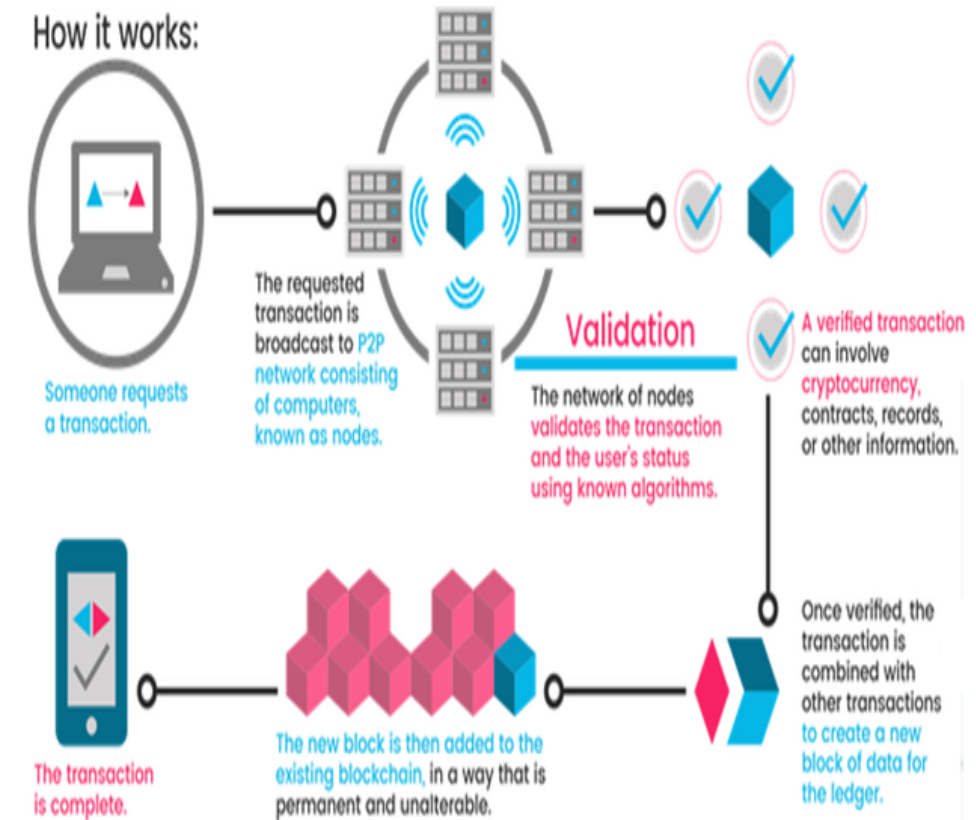
How Does IT Work? –Bitcoin Example Cont.

2. Each node collects new transactions into a block

- Verify the transactions
- Create a pool of transactions (transaction pool, memory pool etc.)
- Candidate block

Block header

- Version number
- The parent hash
- Add Merkle root
- Time stamp
- Nonce initialized to zero
- Fill in the target with the required PoW (difficulty target)



How Does IT Work? –Bitcoin Example Cont.

3.Each node works on solving an algorithm (mining process)

- The goal is to find a value for the nonce that result in a block header hash that is less than the target
- Block header hash < target

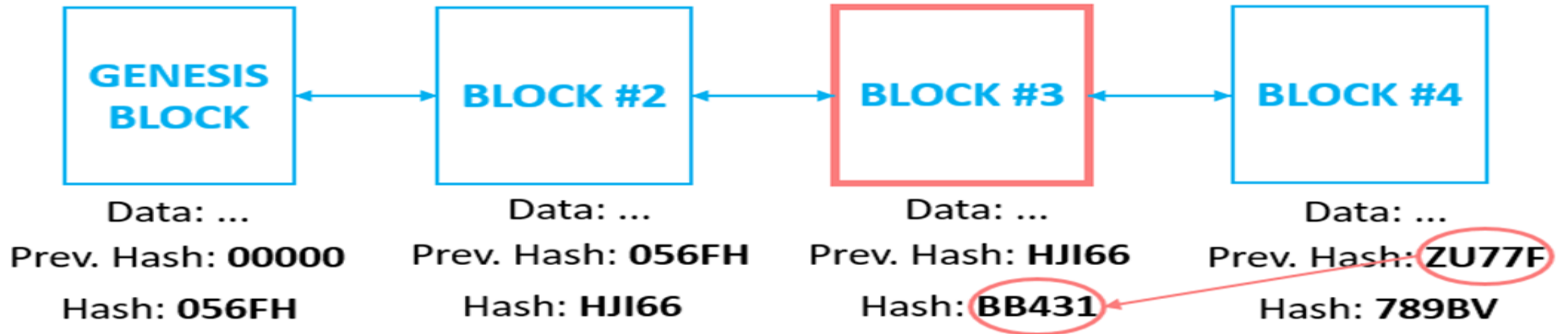
How Does IT Work? –Bitcoin Example Cont.

4. When a node finds a proof-of-work, it broadcasts the block to all nodes.

5. Nodes validate the block and accept the block

- The block data structure is synthetically valid
- The block header hash is less than the target
- The block time stamp is less than 2 hours in the future (allows for time error)
- Block size is within acceptable limits
- 1st transaction is a coin base transaction
- All transactions in the block are valid

Immutability of Blockchain



Types of Blockchain

- Public
- Private
- Hybrid
- Permissionless Blockchains
- Fully Permissioned Blockchains

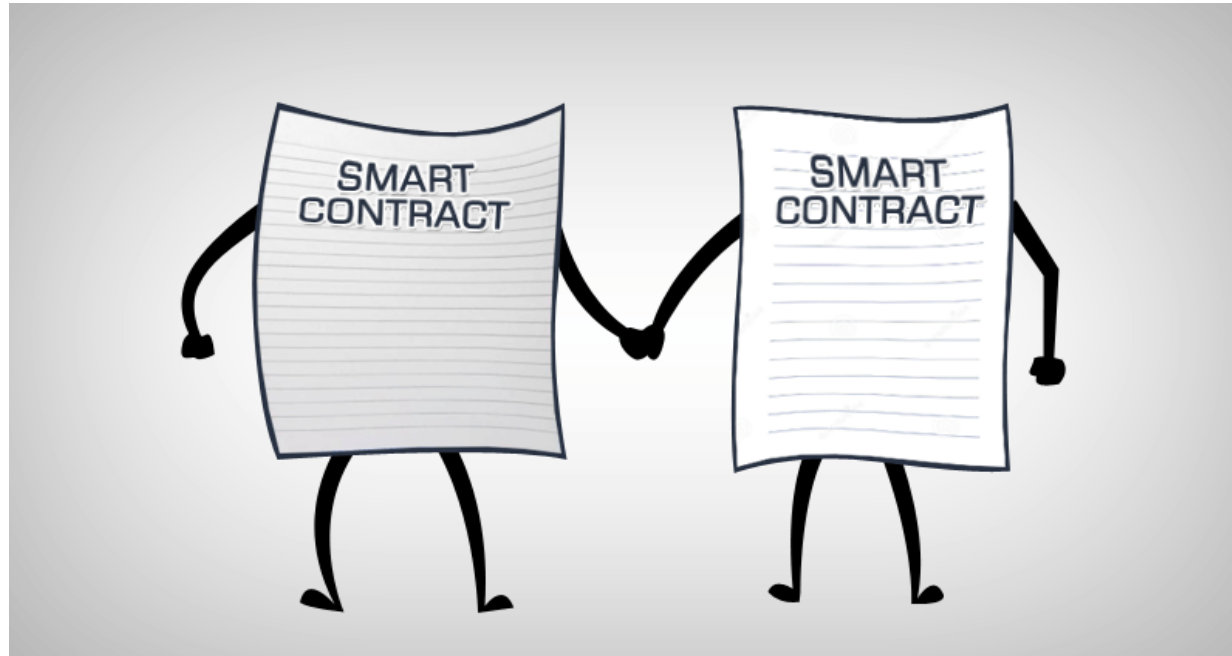
Strengths and Weaknesses

Strengths	Weaknesses
Visibility	Lack of privacy
Aggregation	Lack of standardization
Validation	Garbage in, garbage out
Automation	Black box effect
Resiliency	Inefficiency

Key Success Factors for Blockchain

- Widespread understanding
- Maturity of blockchain technology, interoperability, and standardization
- Regulatory and legal frameworks
- Increasing the number of participants
- Adoption issues – Implementation costs, integration with preexisting systems, etc.
- Scaling issues – the ability to efficiently process transactions

Is Blockchain used only for Cryptocurrency?



What is a Smart Contract?

- Computer protocol
- Self-executing
- Digital
- No third-party intervention

Smart Contract Use Cases

1. Supply chain and product tracking
2. Insurance policies and payments
3. Stock trading
4. Intellectual property rights
5. Music industry
6. Digital artworks
7. The diamond business
8. Healthcare industry
9. Transportation



Source: Ionixxtech.com and BlockstreetHQ

What are Some Design Considerations?

- What are some feasible use cases?
- How do we connect existing databases with blockchain?
- What type of a blockchain best fits the scenario?
- What consensus mechanism will provide scalability?
- Should we include transaction data in the blockchain?

Are There Alternatives to Blockchain?

- Supply Chain Management system
- Electronic Data Interchange (EDI)
- Vendor Managed Inventory (VMI)

Why Should We Care?

- Use of cryptocurrency
- Clients are investing in blockchain
- Proactive vs reactive

- Auditing
- Financial Accounting
- Management Accounting
- Forensic Accounting

Current Government Blockchain Projects (Jun, 2018)

Nation	Project	Status
Australia	Australian senators launch parliamentary friends of blockchain group.	Announced in August 9, 2017
	The Australian Securities Exchange (ASX) announced that they will use blockchain technology to clear and settle trades by replacing the outdated Clearing House Electronic Subregister System, also known as CHES.	Announced in December, 2017. The proposed transition is expected to take place in March 2018.
China	Social security funds management system	Announced in 2016
	Mortgage valuations on blockchain	Announced in 2016
	Blockchain-based asset custody system (PSBC)	Successfully executed more than 100 real business transactions on the blockchain since the system went live in October 2016
	Blockchain city project (By Wanxiang Group)	The project was announced by Wanxiang Group in 2016 and backed by Chinese government

Nation	Project	Status
Dubai	Government documents management system to be enacted by 2020	Ongoing
	Global blockchain council (GBC) was established in 2016 with 32 members, including government entities, international companies, leading UAE banks, free zones, and international blockchain technology firms	Ongoing
	Digital passport based on blockchain	Announced in June 2017
	Real-time information system about shipments to Dubai	Announced in 2017

Current Government Blockchain Projects Cont.

Nation	Project	Status
Estonia	eID (electronic ID management system)	The government is currently upgrading the existing system with blockchain technology.
	E-health (medical information management system)	The government is currently upgrading the existing system with blockchain technology.
	e-Residency (a first-of-a-kind a transnational digital identity)	Since 2015, more than 27,000 people from 143 countries have applied and 4272 companies have been established as of December 2017
France	French government has adopted new rules that will enable banks and fintech firms to establish blockchain platforms for unlisted securities trading.	Announced in December, 2017

Nation	Project	Status
Ghana	Land title registry project by NGO "Bitland"	Ongoing
Georgia	Land title registry project	Ongoing
Honduras	Land title registry project	Announced in 2015 and known as failure now
Kazakhstan	Announced that they will make the most favorable business climate for cryptocurrency and Financial technology(Fintech)	Announced in July 17, 2017
Russia	Blockchain based documents management system announced by Moscow government	Announced in 2016
	Russia's ministry of health is launching a blockchain pilot	Announced in Aug 10, 2017
Singapore	Cross-border interbank payments	A proof-of-concept project has been initiated in 2016.
Sweden	Trials of a blockchain smart contracts technology for land registry	Tested in early 2017

Current Government Blockchain Projects Cont.

Nation	Project	Status
Switzerland	The city of Zug (the capital of the canton of Zug) started accepting bitcoin as payment for city fees. The large number of companies engaged in cryptocurrency are located in Crypto Valley in Zug	Since July 2016 (Crypto Valley was named by Ethereum co-founder Mihai Alisie)
	Zug offers blockchain-based digital identity to their residents	Announced in 2017
The United Arab Emirates and Saudi Arabia	The central banks of the United Arab Emirates and Saudi Arabia announced that they would launch a pilot initiative that two institutions test a new cryptocurrency for cross-border payments.	Announced in December, 2017
Ukraine	E-vox (Ethereum blockchain-based election platform)	Announced in 2016
	Blockchain-based auction system	Announced in 2016

Nation	Project	Status
United Kingdom (UK)	The UK government's Department of Work and Pensions tested an experiment in which a blockchain system is used to distribute welfare payments.	Announced in July 2016 and successfully finished trial system
	Blockchain as a service for each government department	Available since August 2016
	Blockchain-based digital currency	UK's Financial Conduct Authority (FCA) permitted blockchain startup, Tramonex, to issue digital money
	Blockchain-based payment system between banks	Announced in 2017

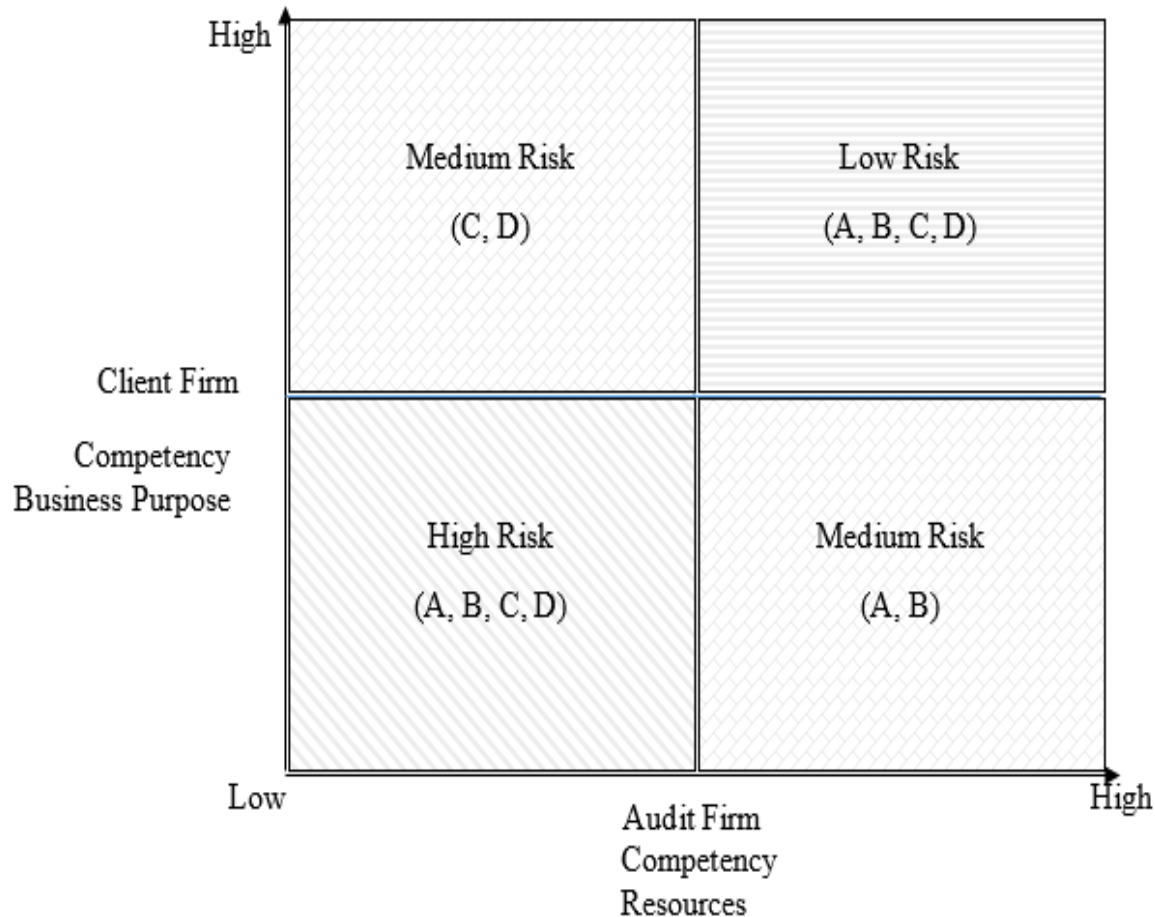
Current Government Blockchain Projects Cont.

Nation	Project	Status
United States (US)	Pilot project for secure exchange of personal health data online	A two-year agreement for the tests was announced in 2016
	Approving plan to issue stock via Bitcoin's blockchain (Securities and Exchange Commission)	Announced in 2015
	Arizona bill to make blockchain smart contracts "legal"	Officially became state law in March 29, 2017
	Governor of Delaware has officially signed a bill making it explicitly legal for those entities to use blockchain for stock trading and record-keeping.	Announced in July 2017
	Illinois launches blockchain pilot to digitize birth certificates	Announced in Aug 31, 2017

Current Issues in Auditing Cryptocurrencies

- Client acceptance and continuance
- Verifying
 - Existence
 - Rights and Obligations
 - Completeness – orphan transactions
 - Valuation and accuracy
 - Authorization
 - Cutoff
 - Occurrence
 - Disclosure

Client Acceptance and Retention Decision



Source: Vincent and Wilkins, 2019

Audit Firm

- A. Audit firm's requisite competence in cryptocurrency to recognize risks and design appropriate auditing procedures is (high/low)
- B. Audit firm's access to resources such as the appropriate mix of personnel and technology is (high/low)

Client Firm

- C. The client's requisite competence in cryptocurrency to recognize and mitigate associated risks is (high/low)
- D. The alignment of the client's cryptocurrency transactions with business purpose and the strategy is (high/low)

Current Issues- Based on the COSO Integrated Framework

- Control Environment
 - Given the blurring boundaries whose integrity and ethical values should be evaluated here?
 - If the firm is a participant in a smart contract, but not the initiator, should we evaluate the integrity of the initiating firm? If not, why?
 - To what extent should the board of directors be involved? Should the board collaborate with other participating firms' board of directors?
 - If smart contracts eliminate the need for human involvement, how do we assess accountability, responsibilities and authorization levels?

Current Issues- Based on the COSO Integrated Framework Cont.

- Risk Assessment
 - What is the extent of the risk analysis given that smart contracts can be written to include external environmental changes?
 - How do we identify fraud scenarios that would be embedded into smart contracts and manipulation of smart contract trigger events?
 - What impact will blockchain have on the existing system of internal controls?

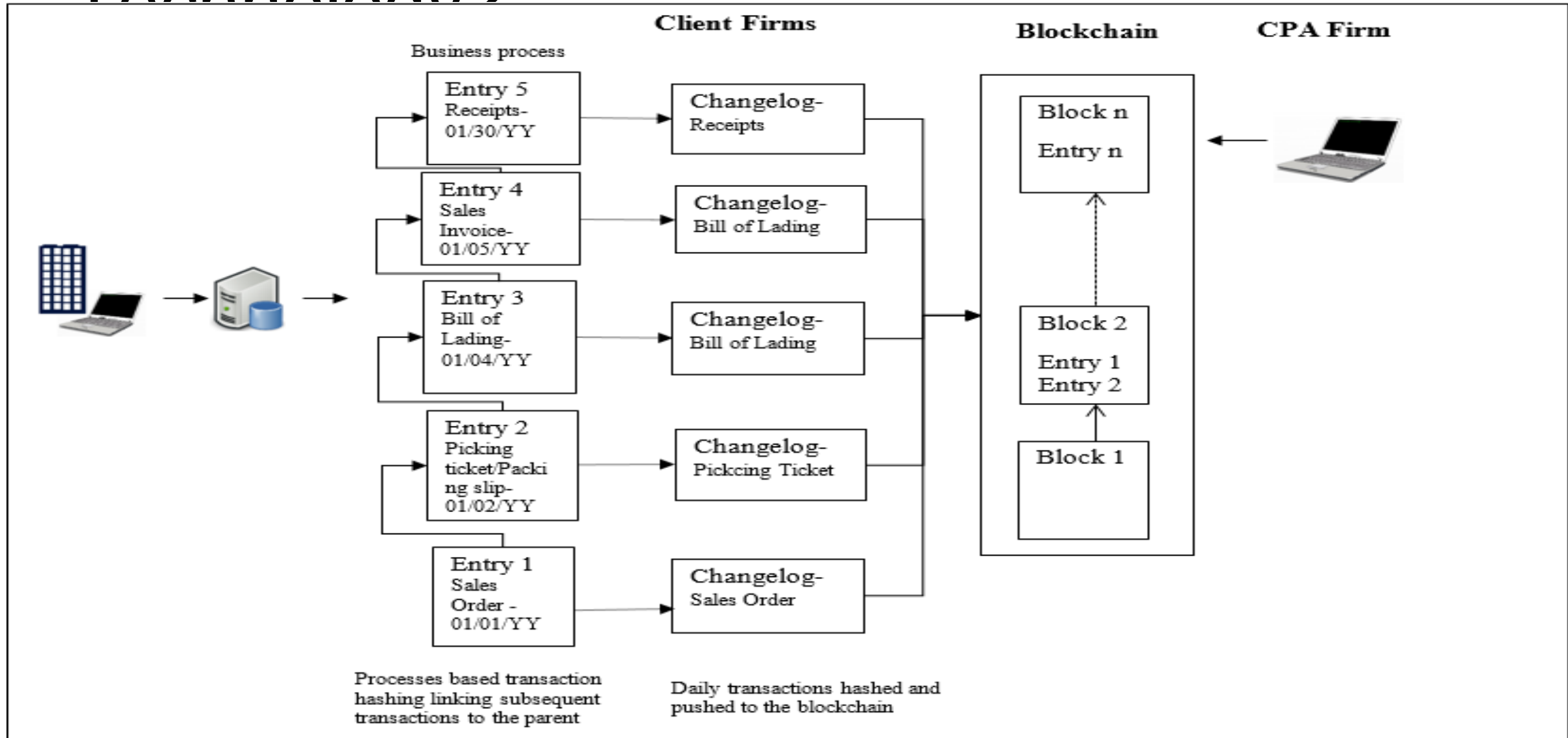
Current Issues- Based on the COSO Integrated Framework Cont.

- Control Activities
 - How to embed controls into the smart contract?
 - Who should be responsible for determining the adequacy of built in controls?
 - What criteria should determine the best set of controls applicable to a given smart contract? Is there generalizability?
 - What impact will smart contracts and blockchain have on the existing general controls over technology?

Current Issues- Based on the COSO Integrated Framework Cont.

- Information and Communication
 - Since smart contracts may depend on inputs from external sources, how do we determine the integrity and quality of such data?
- Monitoring
- Who should be responsible for monitoring if the firm is not the initiator of smart contracts?
 - How do we monitor whether smart controls built into smart contract are present and functioning?

Can CPA Firms Leverage the Technology?



HOW DO YOU THINK THE RISE OF CRYPTOCURRENCY AND BLOCKCHAIN TECHNOLOGY WILL AFFECT ACCOUNTING AND FINANCE DEPARTMENTS?



Source: Robert Half Finance and Accounting Survey 2018

Other: 1%

Multiple responses permitted.

Role of the Accountants in the Blockchain World

- Blockchain Risk Assessment
- Blockchain Development
- Blockchain Audit
- Blockchain Management



New Skillset for Accountants ?



- Business process
- Communication
- Accounting

- Design Concepts
- Programming language



Additional Resources

- CPA perspectives on blockchain - <http://www.cpacanada.ca/en/business-and-accounting-resources/other-general-business-topics/information-management-and-technology/publications/cpa-perspectives-on-blockchain>
- Blockchain technology and its potential impact on the audit and assurance profession- <https://www.cpacanada.ca/en/business-and-accounting-resources/audit-and-assurance/canadian-auditing-standards-cas/publications/impact-of-blockchain-on-audit>
- Blockgeeks - <https://blockgeeks.com/articles/>
- Blockchain is here. What's your next move? - <https://www.pwc.com/gx/en/issues/blockchain/blockchain-in-business.html>
- AICPA - <https://www.aicpa.org/interestareas/informationtechnology/resources/blockchain.html>
- Deloitte - https://www2.deloitte.com/us/en/pages/consulting/topics/blockchain.html?icid=internalsearch_promo_blockchain-topic
- EY- https://www.ey.com/en_gl/blockchain

WHERE SHOULD
WE FOCUS
THIS YEAR?



"BLOCKCHAIN"



IT WILL
CHANGE
EVERYTHING.



EVERYBODY
IS TALKING
ABOUT IT.



THE POTENTIAL
APPLICATIONS
ARE ENDLESS.



WE DON'T
WANT TO BE
LEFT BEHIND.



WHAT
EXACTLY IS
BLOCKCHAIN?



ALSO,
"ARTIFICIAL
INTELLIGENCE"



TOM
FISH
BURNE

