Blockchain Technology

2022-2023 Student Board Research Project

FORT HAYS STATE UNIVERSITY

High Plains Farm Credit

What is Blockchain?

- A more secure, transparent, and reliable way of conducting third party transactional business
- “Blockchain technology stores data in blocks and links them together to form a chain. The blocks have a specific capacity and, when filled, are closed and linked to the previous block. Any newly added information after the last block is compiled into a newly formed block and added to the chain once filled.” (Advantages and Disadvantages of Blockchain Technology, Forbes, 2022)
- The number of cryptocurrencies available doubled from 2021 to 2022, and over 12,000+ cryptocurrencies available

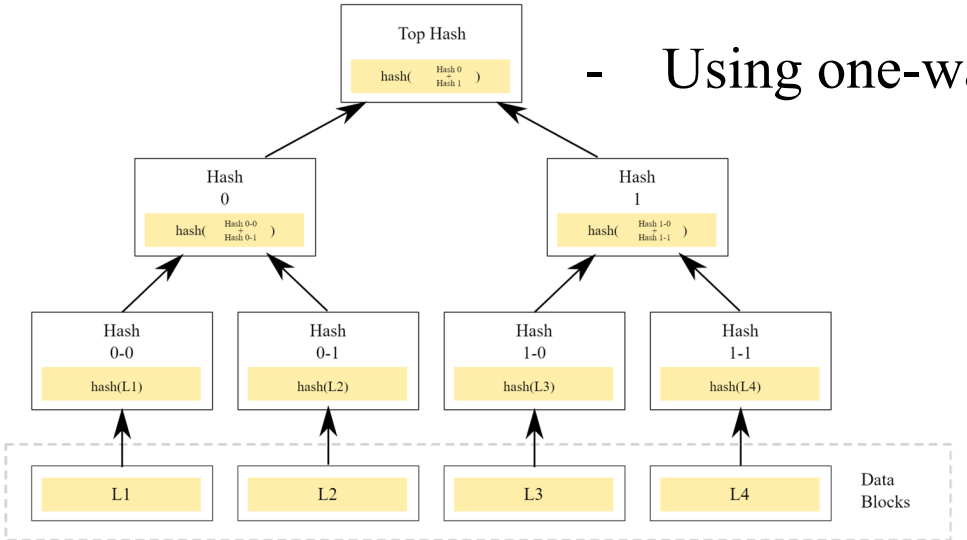
HISTORY

First introduced in 2008

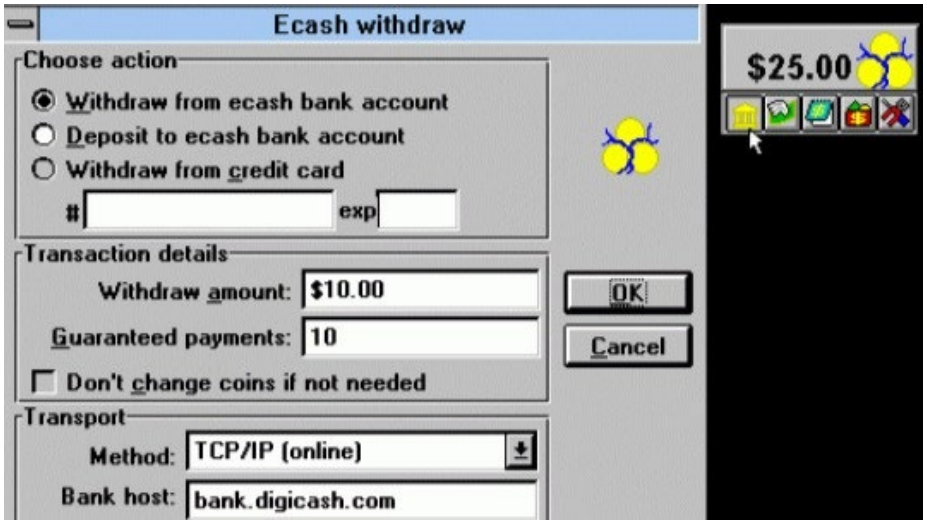
Distributed ledger behind bitcoin transactions

Took off quickly after

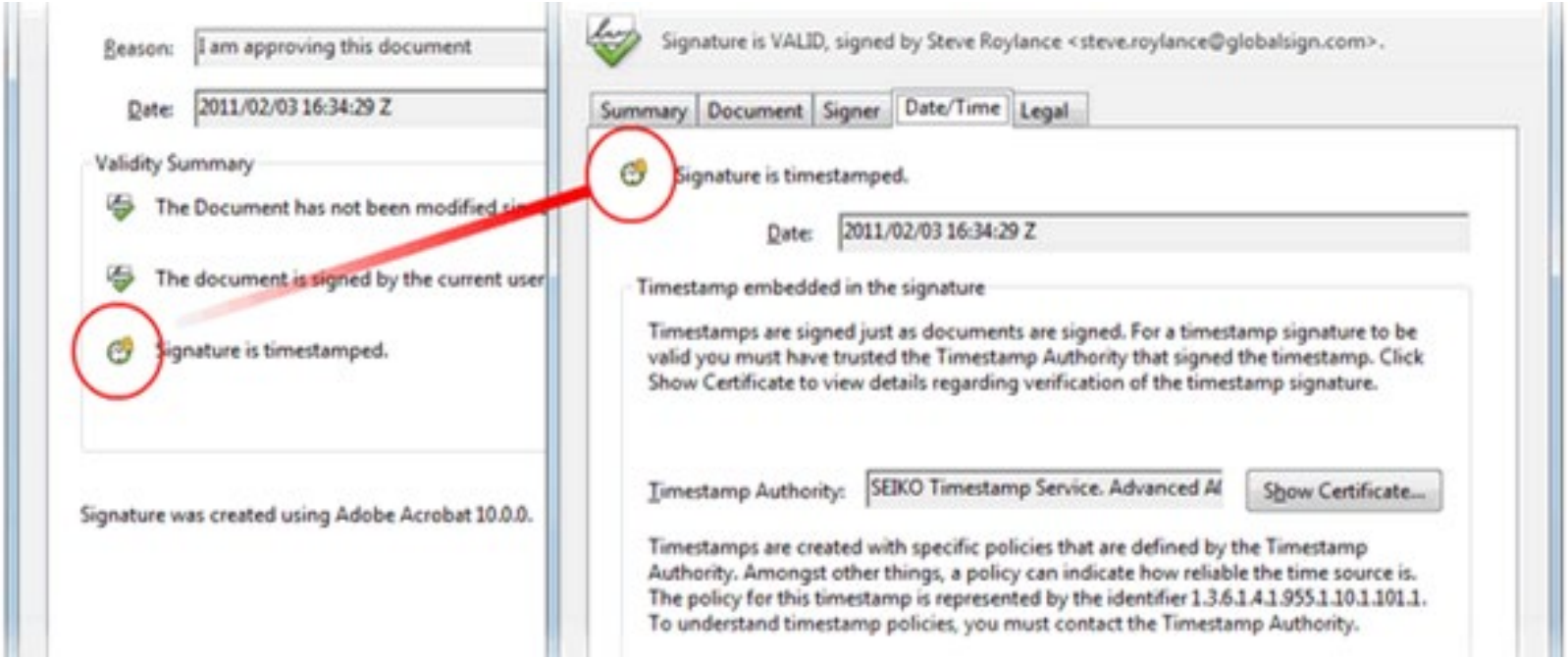
- 1979 - Merkle Tree - Ralph Merkle
  - Ph.D. thesis Stanford University - public key distribution and digital signatures called "tree authentication"
    - Provides a data structure for verifying individual records
      - Using one-way hash functions as blocks



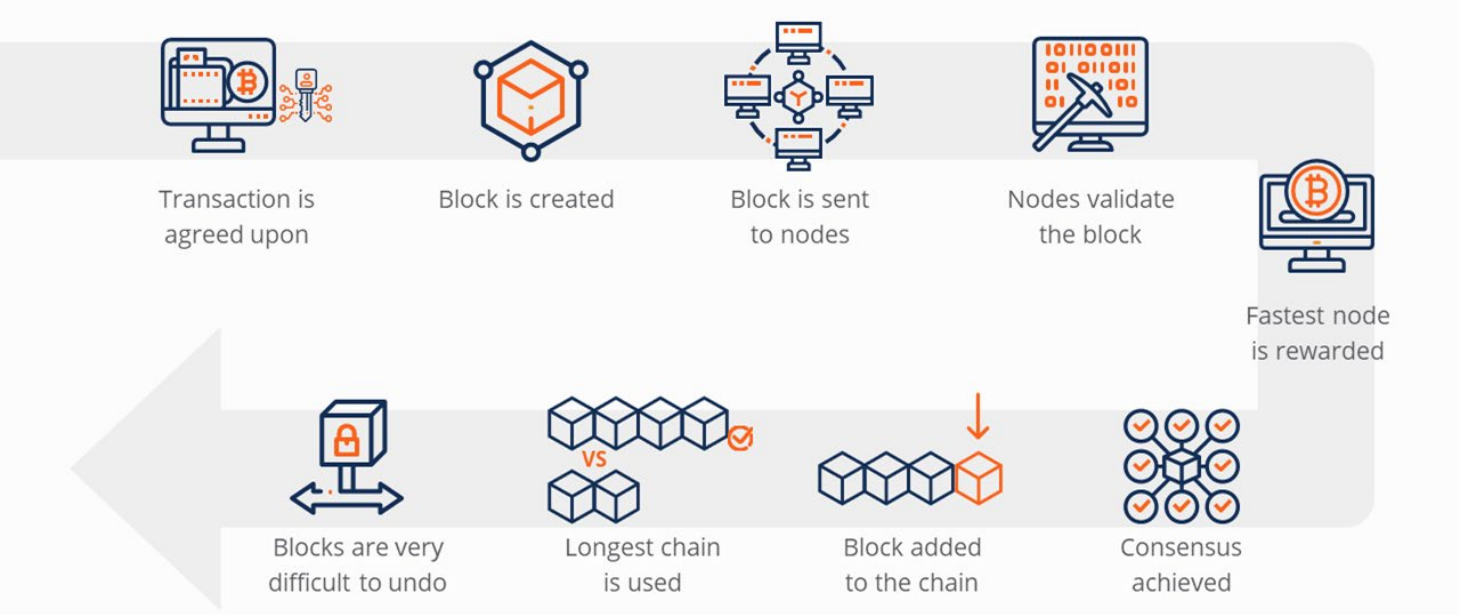
- 1989 - DigiCash - David Chaum
  - Ph.D. dissertation University of California - described vault system for establishing, maintaining, trusting computer systems by mutually suspicious groups
    - Embodied many of the elements that make up blockchain



- 1991 - Timestamping Digital Documents - Haber and Stornetta
  - Article which proposed solution for preventing users from backdating or forward-dating electronic documents



- 2008 - Bitcoin - Satoshi Nakamoto
  - Paper on the best-known cryptocurrency and how relates to block
  - Support secure, peer-to-peer transactions without need for trusted third parties such as banks or governments



Four Types of Blockchains

1. Payment currencies	Bitcoin, Dogecoin
2. Utility tokens	NFTs, Ether, Storj, Genesis DAO
3. Stablecoins	Tether's USDT, (Terra USD, Luna)
4. Central bank digital currencies (CBDC)	Sand Dollar by the Central Bank of the Bahamas Niara in Nigeria Digital Rupe launched by the Reserve bank of India Digital Ruble by the Bank of Russia

Advantages & Disadvantages

- Increases trust and security
- Ability to trace information
- Control who has permission to view data
- Reduces paperwork and errors
- Reduces transaction costs
- Cuts out the middleman
- Less time from sender to recipient

- Extremely difficult to remove or change data
- Slower than traditional due to more operations occurring
- Higher cost

Arguments for Opposition

- Uncertainty
- Security concern
  - Cyberattacks
  - Exploit coding flaws
- One key
  - If lost, can never re-access the account
- Information is permanent
  - Consequences depending on usage?

Blockchain Technology Across Different Industries

- A variety of different industries have already incorporated blockchain technology into their operations, others are skeptical and continue to proceed with caution
- Major industries that could potentially be impacted:
  - Healthcare
  - Supply Chain Management
  - Cybersecurity
  - **Finance & Banking**

Healthcare

- Blockchain technology can allow healthcare professionals to authenticate and verify medical records and patient information across a decentralized network
    - This greatly reduces the threat of counterfeit prescriptions and medical data that could be tampered
- Increased prescription safety
    - The blockchain can help prevent counterfeit drugs from ever entering the market due to its' unalterable data storage system
- Blockchain technology also provides a standardized method of sharing data
    - Increased efficiency, coordination, and transparency
    - All parties have access to the same data, helping prevent miscommunication

Supply Chain Management

- Blockchain technology allows for the usage of smart contracts
  - Smart contracts are self-executing contracts with the terms of the buyer and seller directly written into the coding
    - Smart contracts automatically execute once the terms have been met, eliminating the need for manual intervention
- Blockchain technology enables the tracking of products from production to consumption and reduces the risk of fraud and counterfeiting
  - Increased traceability, sustainability, and efficiency
- Standardization, scalability, and processing speed may prove to be challenging for implementation

Cybersecurity

- Distributed ledger creates difficulties for hackers
  - No central authority controlling the data, so attacks can’t be targeted at a main data hub
- Cryptography provides an additional layer of security
  - Ensures that data is encrypted and authenticated
- Smart contracts provide an upperhand over cybercriminals
  - Smart contracts can be automated to enforce all transactions to follow specific requirements
    - If specific requirements are not met, the transaction will either fail to verify or cause an alert

Finance & Banking

Blockchain technology has the potential to greatly impact the finance and banking industries in both positive and negative ways:

- Positive:
  - It offers increased security and transparency, as transactions are recorded on a decentralized ledger that is extremely difficult to alter
    - Reduces the risk of fraud and increases trust in the financial system
  - Potential to streamline many financial processes, making them faster and more efficient
- Negative:
  - There is still a lot of uncertainty surrounding regulation and adoption
    - Some industry players may be hesitant to change
  - Concerns about the scalability of blockchain technology
    - Unsure about blockchain's ability to handle the high volume of transactions that occur in the financial world

Current & Potential Uses that could have an Impact on Agriculture

Uses in agriculture:

- Farm inventory management
  - Help monitor storage climate and time spent in inventory
- Supply chain efficiency
  - Ledger System
- Farm management software - (likely to happen soon)
- IoT security - weather data and land data
- Fair pricing - more secure and available
- Microloans to small farmers
  - Connect farmers with lenders around the globe for lower interest rates
  - Farmers are no longer restricted to a local banking market.

Roles in Agriculture

- Gathering information
  - Provide assurance of nature of seed, record results of harvest, track where products go after leaving the farm
- Tracking pathways
  - On average 74.72% consumers desire knowledge
  - Quality, chemicals used, harvest, nutrition, origin, producer, circulation and production standards
- Data collection and processing (food production efficiency leads to food security)

How Blockchain could Help Farmers and Ranchers

- Reduces human error
  - Lower the 43% of wasted food produced
- Better access to financial grants and loans
  - Gives transaction history and a reliable farmer’s identity
- Reduced transactions and fair pricing
  - Suppliers can make direct mobile payment transactions

How Blockchain could Hurt Farmers and Ranchers

- Could limit small farmers while enabling larger farmers
    - This is because of the cost of having the capability to access the information
    - Smaller farmers may not be willing to dedicate away from work.
- The largest “hurt” is really just the difficulty of implementing blockchain technology
    - Blockchain would not be easily transitioned to

Effect on High Plains Farm Credit Business in the Future

- Blockchain could strengthen the overall security of HPFC by integrating a decentralized ledger that tracks customer records and payments.
- With the integration of a decentralized ledger, it can increase transparency with customers which can increase trust between HPFC and its customers.
- Could slightly reduce risk exposure by mitigating potential acts of fraud by customers of HPFC.
- Could increase the speeds of financial processes that are seen at HPFC, allowing for quicker
- Could potentially increase the amount of compliance and the costs associated with it, due to uncertainty regarding the regulation of blockchain.

References & Additional Resources

What is blockchain?

- https://www.youtube.com/watch?v=266rwsSzBo4
- https://corporatefinanceinstitute.com/resources/cryptocurrency/types-of-cryptocurrency/
- https://www.federalreserve.gov/central-bank-digital-currency.htm

Blockchain & Cybersecurity

- https://www.infosys.com/insights/cyber-security/cybersecurity-blockchain.html

How Blockchain Affects Agriculture

- https://www.frontiersin.org/articles/10.3389/fbloc.2020.00007/full

Benefits of Blockchain

- https://www.ibm.com/in-en/topics/benefits-of-blockchain

Positives & Negatives of Blockchain

- https://academy.binance.com/en/articles/positives-and-negatives-of-blockchain