

BLOCKCHAIN FOR HEALTHCARE AND RESEARCH PRIMER

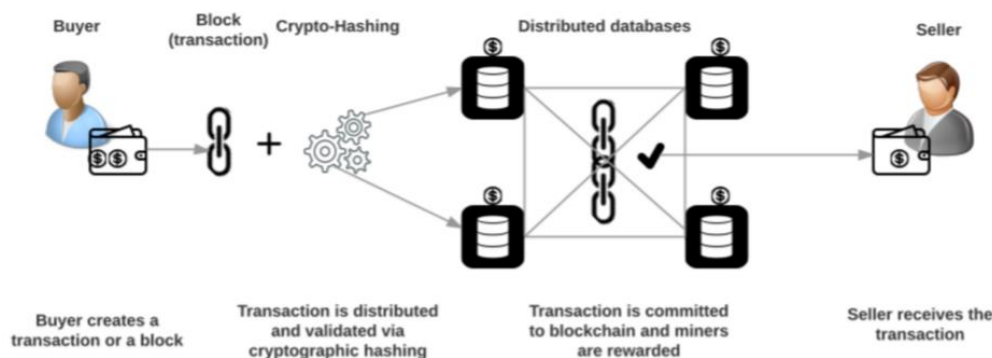
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WHAT IS A BLOCKCHAIN?

1. *Blockchain technology is a distributed ledger of data transactions, exchanges, or events.*
2. *Blockchain/distributed ledger technology (DLT) allows a distributed network to automatically maintain a single, virtually immutable record based on an agreed upon governance protocol for consensus.*
3. *Blockchain/DLT can be public, permissioned, or private. Incentives and consensus proofs will vary. There are different types of distributed ledgers; blockchain is most common and gets used as a general term*
4. *Benefits: secure, encrypted, inexpensive, interoperable with legacy systems, redundant/resilient
Challenges: novel, requires standardized data, complex with complex data, scalability/resources*
5. *Blockchain is not Bitcoin. Bitcoin is the most popular cryptocurrency, which is one type of application.*

Blockchain - Process



Example of a financial application of blockchain (By B140970324 - Wikimedia Commons)

More info: hyperledger.org/
(Hyperledger is the blockchain arm of the Linux foundation.)

WHEN IS A BLOCKCHAIN USEFUL?

1. **Blockchain** is useful when there is a need for trust between parties without an intermediary.
2. **Finance** – Payments, digital identity, clearing and settlement, smart assets
3. **Supply Chain** – Tracking, quality, life-cycle, provenance, authenticity
4. **Healthcare** – Provider identity, payments, supply chain (i.e. pharma, devices) clinical trials, EHR
5. **Science** – Data access and audit, supply chain (i.e. reagents), publishing, regulatory audit, grant proposal review, intellectual property/contribution tracking, data sharing, reproducibility

WHO IS USING BLOCKCHAIN?

1. **Technology Companies** – IBM, Oracle, AWS, Facebook, Google and more. Tons of startups.
2. **Financial Companies** – BNY Mellon, Deutsche Bank, Credit Suisse and more. Lots of startups.
3. **Retail and Manufacturing Companies** – Alibaba, Walmart, Amazon, and more. Many startups.
4. **Healthcare Companies** – Change Healthcare, Aetna, Optum, Humana and more. Some startups.
5. **Science Companies** – Springer Nature, Digital Science, Frontiers and more. A handful of startups.

HOW CAN BLOCKCHAIN BE USED IN HEALTH SCIENCE RESEARCH?

1. **Better Science** - Improved reproducibility through transparency and immutable audit trail for research data
2. **Better Science** – Improved material quality and provenance via supply chain tracking
3. **Cheaper Research** – Increased return on investment for research dollars spent; reduced data management costs through blockchain/smart contracts, amplified with machine learning/AI
4. **Faster Medical Miracles** – Moving more quickly from bench to bedside and improved outcomes with accelerated research and higher quality data; improved tracking of individual contribution; increased meta-analysis
5. **Faster Medical Miracles** – Assisting with administrative applications for blockchain (e.g. IRB process, proposal review) to speed up the time to go bench to bedside

WHERE CAN I LEARN MORE ABOUT BLOCKCHAIN AND HEALTHCARE?

1. **Health & Human Services Office of the National Coordinator - 2016 White Paper Contest**
<http://www.cccinnovationcenter.com/challenges/block-chain-challenge/view-winners/>
2. **Blockchain in Healthcare Global – IEEE/International Standards & Trade Organization**
<http://www.blockchaininhealthcare.global/>
3. **Hashed Health – Leader in blockchain in healthcare; outstanding resource section**
<https://hashedhealth.com/>
4. **Blockchain in Healthcare Today – First peer-reviewed journal on blockchain in healthcare**
<https://blockchainhealthcareday.com/index.php/journal>
5. **HIMSS Blockchain Task Force – Industry-wide health informatics application**
<https://www.himss.org/library/blockchain-healthcare-toolkit>

ADDITIONAL INFORMATION ON BLOCKCHAIN FOR HEALTH & RESEARCH

1. **Science Distributed – PDF of this document and more**
<https://sciencedistributed.com/>
2. **Free, weekly newsletter – Distributed Ledger Tech Applications in Health Report**
Email info@sciencedistributed.com with “DLTA-H” in the subject line
3. **IEEE Standards Association – Standards for Blockchain in Health and Life Sciences**
https://standards.ieee.org/project/2418_6.html
4. **Frontiers in Blockchain – Peer-reviewed scientific journal**
<https://www.frontiersin.org/research-topics/9698/blockchain-for-distributed-research>
5. **HIMSS Text Book – Blockchain in Healthcare: Empower Patients and Improve Care**
<https://www.crcpress.com/Blockchain-in-Healthcare-Innovations-that-Empower-Patients-Connect-Professionals/Dhillon-Bass-Hooper-Metcalf-Cahana/p/book/9780367031084>