Blockchain Technology and Global Access to Healthcare Records

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Objectives

- Identify what is the Block Chain medium versus the electronic medical record

- Discuss application of information sharing among systems

- Discuss pros and cons to creating systems

- Determine shortcomings of current electronic health records and block chain technology solutions

Biggest Challenges Facing Patient Care

Storage of patient files

This Photo by Unknown Author

Shareability of Patient Records Between Providers

Development a secure computer system to hold shared records

Data entry and acquisition for further studies

Electronic Medical Records and Blockchain Transition

Federal government created the largest EHR.

Ralph Merkle, computer scientist, described an approach to public key distribution and digital signatures called "tree authentication" in his 1979 Ph.D.

David Chaum described a vault system for establishing, maintaining and trusting computer systems by mutually suspicious groups in his 1982 Ph.D

Resources became available through the American Recovery and Reinvestment Act (ARRA) – pushing EHRs to 95% within hospital settings.

Satoshi Nakamoto published a white paper introducing the concepts behind bitcoin and blockchain.

Bitcoin making 100 million Utilization options in information storage

| 1970s | 1922 | 1982 | 2004 | 2009 | 2016 | 2022 |

Hardware became cheaper and more powerful (more technologically advanced)

EHR was incorporated into the Health Information Technology for Economic and Clinical Health Act (HITECH)

Blockchain goes mainstream

What is an Electronic Health Record?

- EHR is a digital version of the patient's health record

- Includes:

    - Highly sensitive private information

    - Diagnosis

    - Treatment

    - Appointments

    - Billing

    - Labs

Electronic Health Records

- Advantages:

  - Reduced inefficiency

  - Reduced disorganization

  - Reduced data redundancy

  - Reduced duplicate records

Time and Technology: EHR

1. **Outdated data.**

2. **It takes time and costs money.**

   - Selecting and setting up an EHR system and digitizing all paper records can take years.

   - After the EHR system is fully set up and operational, it will take time to train your staff in its use.

   - There are also the costs of switching to a completely new medical record system as updates are released, which is not cheap, even at competitive prices.

   - But it's worth remembering that the more players enter the EHR system market, the competition becomes more pervasive, and prices decrease.

3. **Inconsistency and inefficiency.**

   Maintaining an EHR system requires frequent updates.

4. **Management of technical issues.**

   Need a team of information technology specialists on hand to address technical issues immediately to minimize interruptions in patient care.
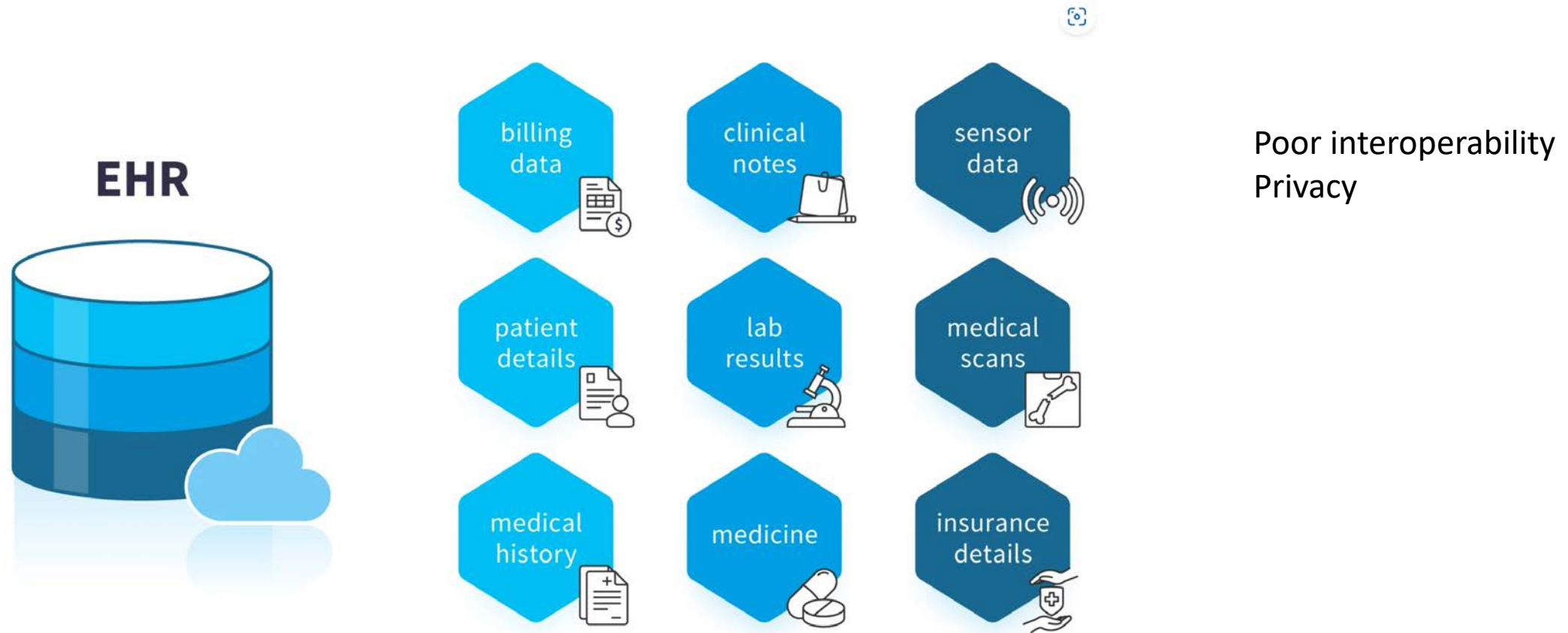
Problems Converting

Houston-based MD Anderson Cancer Center reported

a 76.9 percent drop in adjusted income for the 10

months ended June 30, a downfall it largely attributes

to its Epic EHR implementation project in 2016

MD Anderson took a $266 million hit on revenue of $4 billion last fiscal year. The prior year, the hospital reported a $157 million operating gain on operating revenue of $4.1 billion.

EHR Integration Challenges

Poor interoperability
Privacy

What is EHR: Benefits and Disadvantages – NIX United (nix-united.com)

Interoperability

- The degree to which computer software and/or systems share, interdigitate and or make use of data between programs and devices made by different companies

- Does not include standards for wider healthcare and computing research communities or non-specialists

- Looks at

  - Heterogeneities in hardware and software

  - Heterogeneities in structure, purpose, and deployment

Privacy

Data privacy and security are increasingly being hacked or

stolen

Data breaches

Theft is at 47.5% and loss of 27.4%

Largest Data Breaches by Number of Stolen Records
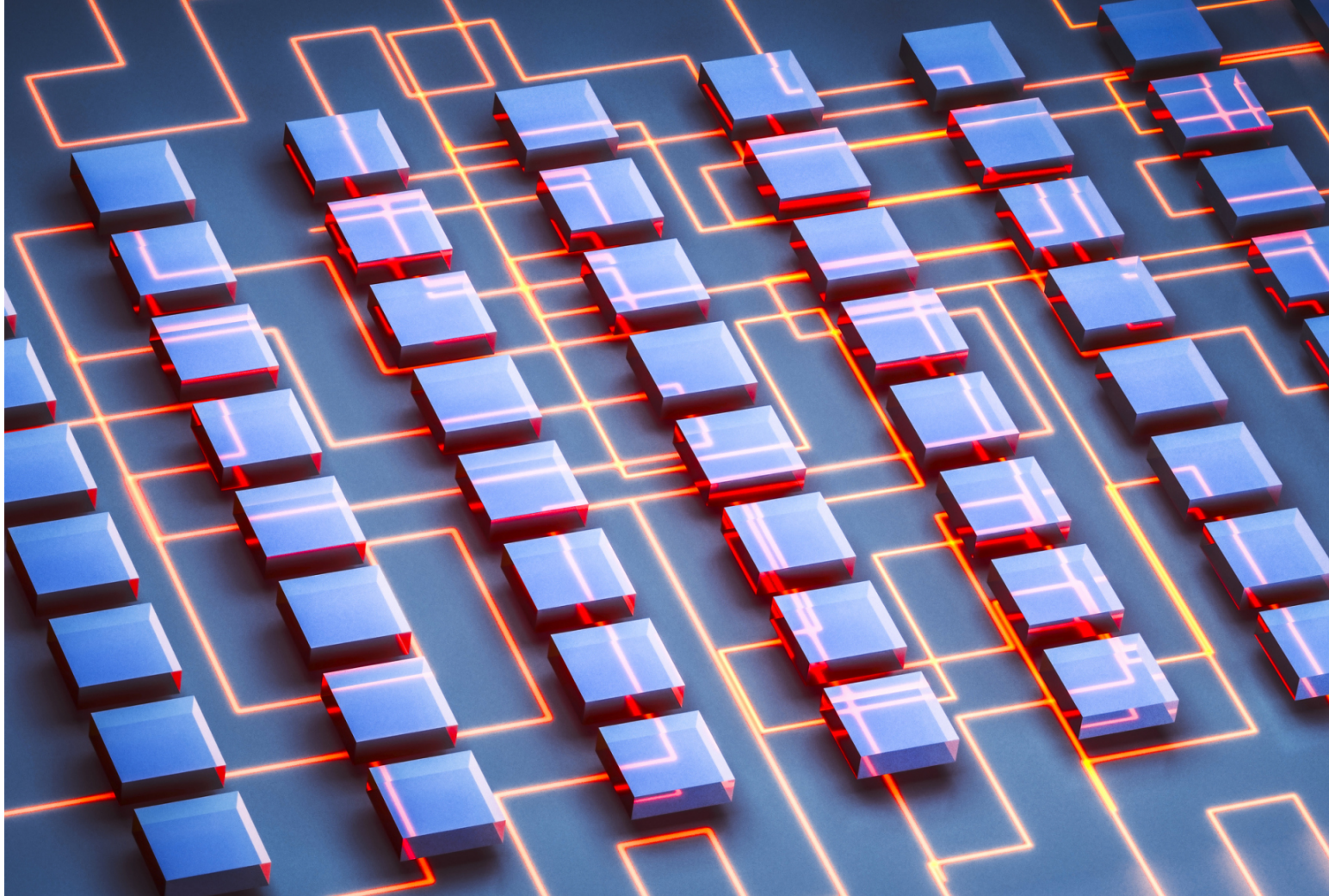
What did they steal?

Community Health Systems
- Number of Stolen Records: 6.1 million
- Date Discovered: June 2014

Anthem Blue Cross
- Number of Stolen Records: 78.8 million
- Date Discovered: January 29, 2015

Premera Blue Cross
- Number of Stolen Records: 11+ million
- Date Discovered: January 29, 2015

What is Blockchain?
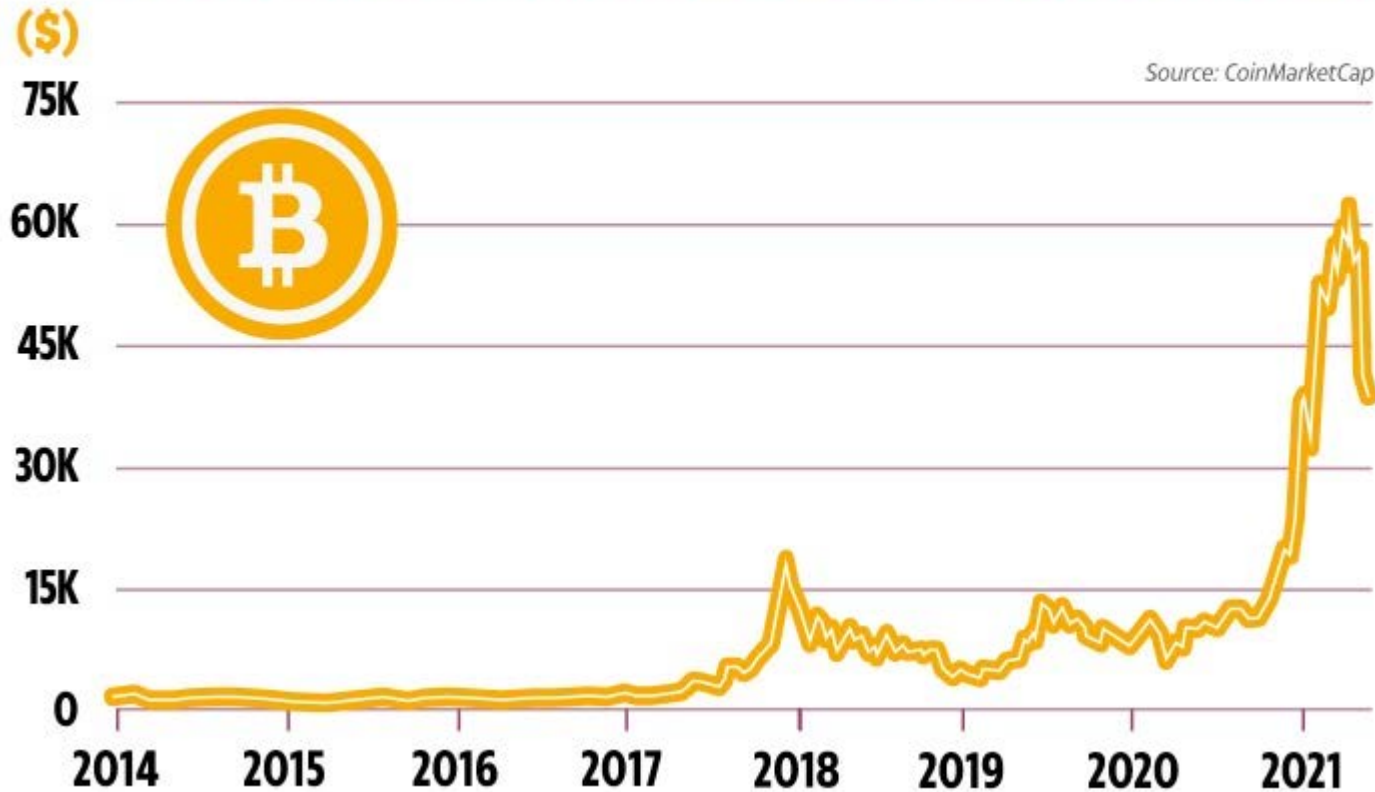

(Illustration: Jonathan Kitchen/Getty Images)

Is a database storage using encrypted blocks of data organized in chains for access as a disturbed ledger protocol

All parties (nodes) participating in contributing to, or accessing data in the blockchain decide what chains can be accessed by different groups

Blockchain Utilization
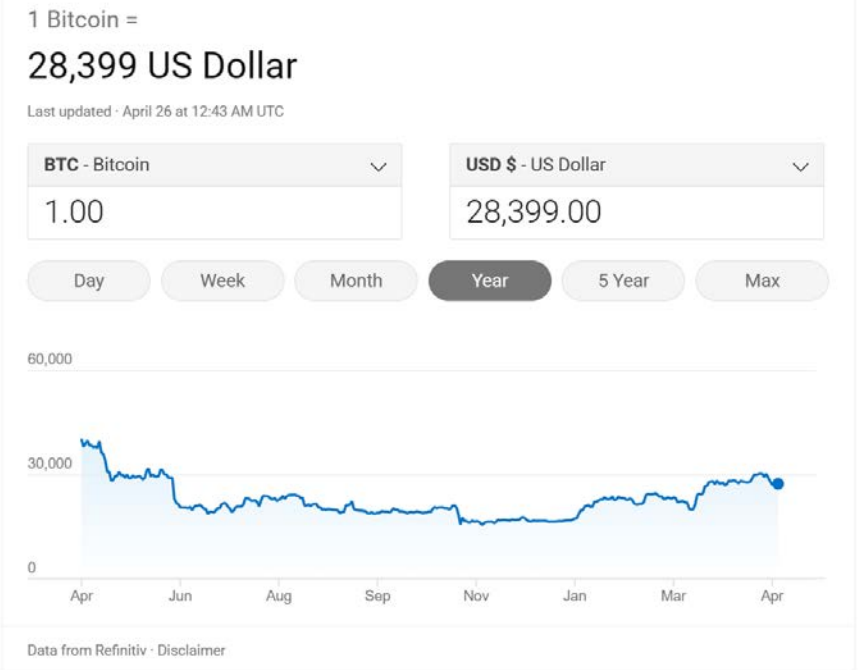
NFT

A non-fungible token (NFT) is a unique digital asset that represents ownership of real-world items like art, video clips, music, and more.

•NFTs use the same blockchain technology that powers cryptocurrencies, but they're not a currency.
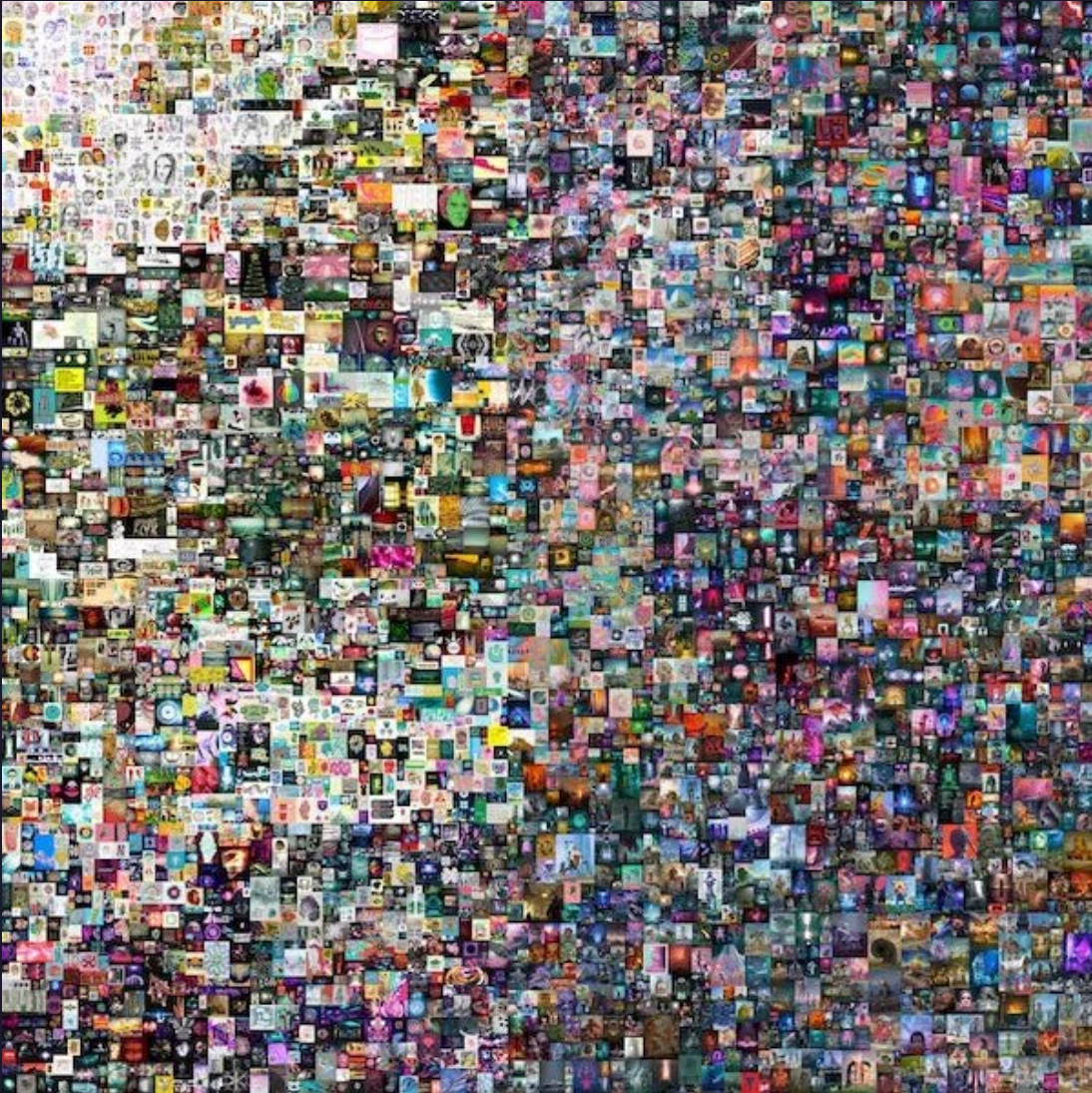
Innovations in Blockchain Utilization

NFT artwork is Quantum – the first NFT ever created, back in 2014. Quantum is the oldest entry by quite some way and was put together when Anil Dash and Kevin McCoy built the first blockchain-backed system for selling NFTs.

Blockchain Artwork

Beeple, aka [Mike Winkelmann](#) sold his work in March 2021.
It went an impressive $69.3million, which is the highest price paid for an NFT so far.
The piece is a true labor of love – a collage Winkelmann created by collating one artwork a day for 5,000 days, since 2007.

Innovations Blockchain Utilization

A non-fungible token (NFT) of a video clip of LeBron James dunking recently sold for more than $200,000 on NBA Top Shot, a website that allows users to buy and sell NBA video clips.

Blockchain Regulations

- A public ledger for recording transactions without needing a third-party to validate each one.

- The blockchain is distributed across a peer-to-peer (P2P) network.

- It is made up of data blocks that are linked together to form a continuous chain of immutable records.

- Each computer in the network maintains a copy of the ledger to avoid a single point of failure.

- Blocks are added in sequential order and are permanent and tamperproof.

Figure 1. Centralised versus a distributed, peer-to-peer network

Central Server Network

Peer-to-Peer Network
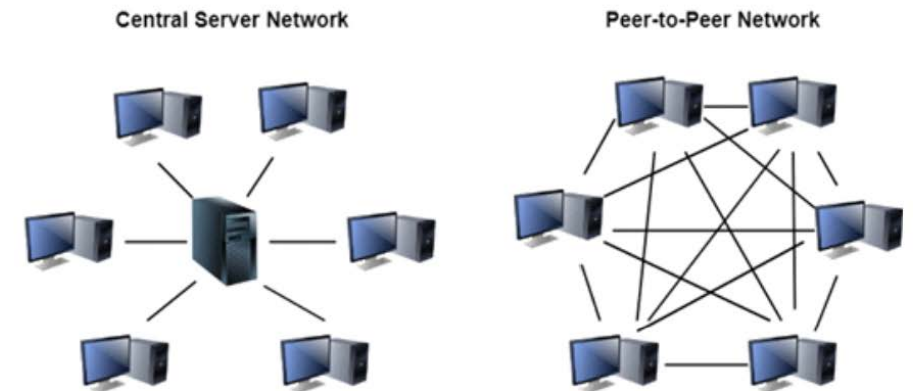
Source: Source: HIMSS Blockchain Networks Overview (HIMSS, 2019)

Opportunities and Challenges of Blockchain Technologies in Health Care (oecd.org)

Blockchain and Healthcare Data Security

AKIRI
BURSTIQ
MEDICALCHAIN
GUARDTIME

Blockchain Medical Records

AVANEER HEALTH
PROCREDEX
CORAL HEALTH
PATIENTORY

Blockchain and Medical Supply Chain Management

CHRONICLED
EMBLEEMA
BLOCKPHARMA
FARMATRUST
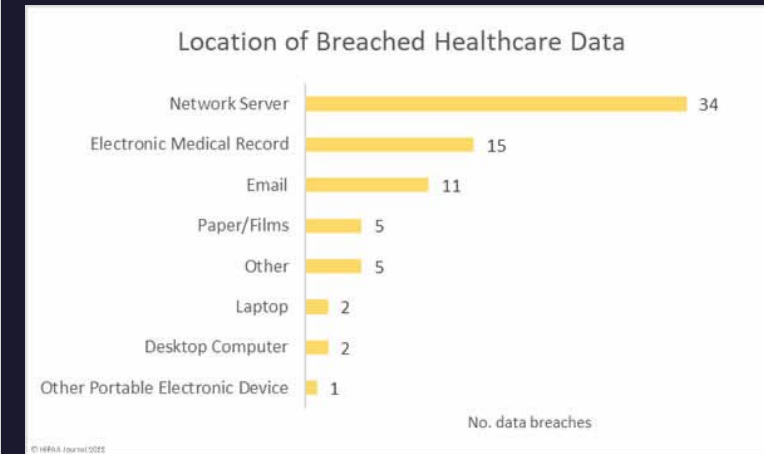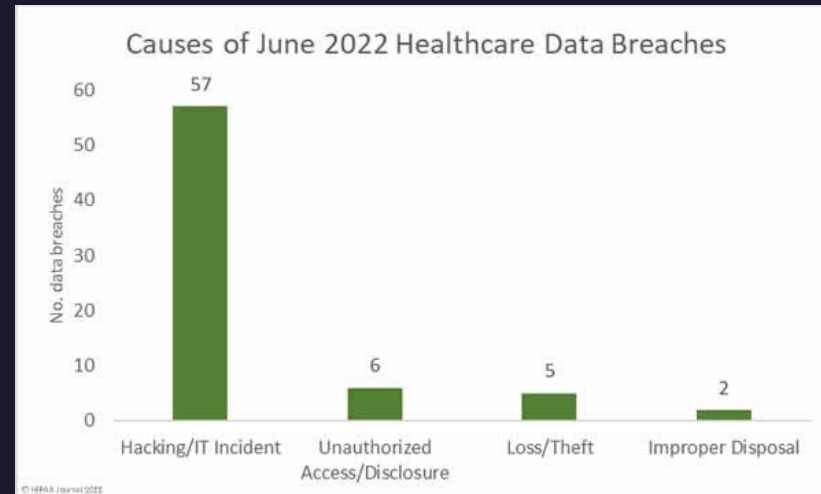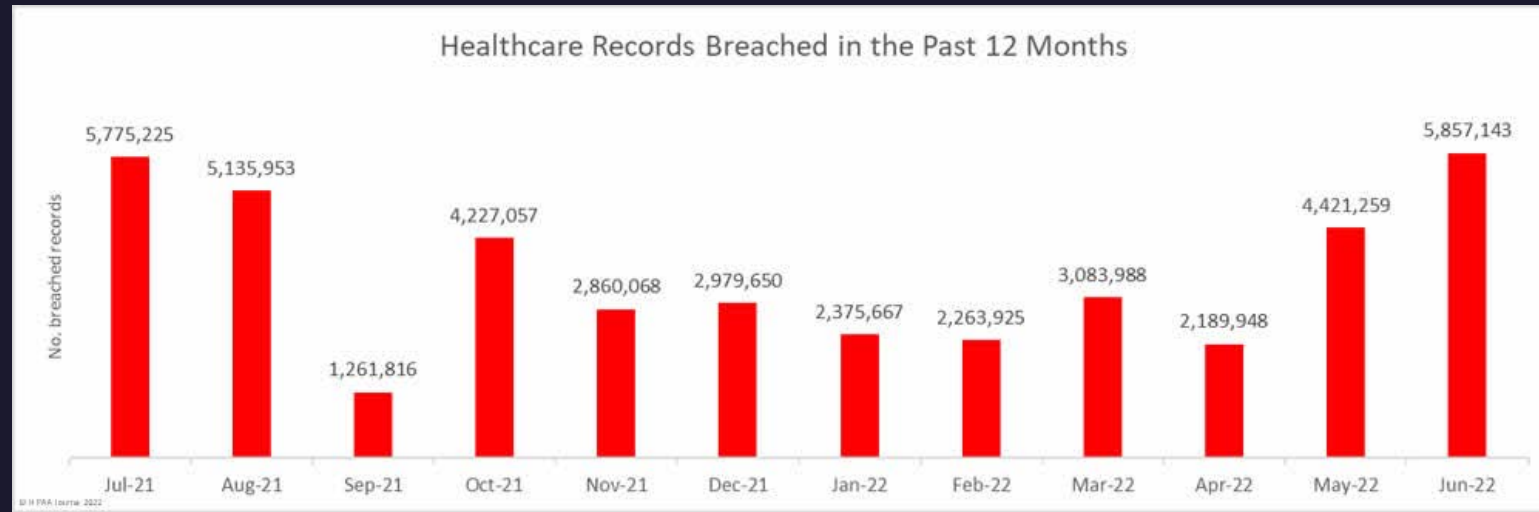SOLULAB
TIERION

Breakthroughs in Genomics

ENCRYPGEN
NEBULA GENOMICS
SHARECARE

Blockchain Companies Healthcare

Why We Need Blockchain?

- There were <u>692 large healthcare data breaches</u> reported between July 2021 and June 2022. The perpetrators stole credit card and banking information, as well as health and genomic testing records.

- Waste from factors like failure of care delivery and failure of care coordination is responsible for <u>up to 16 percent of national healthcare spending</u> in the U.S.

- <u>Utilization of blockchain Genome sequencing could cost</u> between $100 million and $1 billion in 2001, but expenses fell to below $1,000 in 2021

Healthcare Records Breached in the Past 12 Months

Causes of June 2022 Healthcare Data Breaches

Location of Breached Healthcare Data

June 2022 Healthcare Data Breach Report (hipaajournal.com)

Uses for Blockchain in Healthcare

Patient Data

Store information of an individual patient

Procedural outcomes

Analyses the effects of a particular procedure

Result Validation

The authenticity is sealed until the material is encrypted, digitally signed and saved.

Safety and transparency

Smooth exchange of clinical trials, treatments, medical solutions (rare disorders)

Uses for Blockchain in Healthcare

Health record keeping

Its applications include sharing healthcare data, keeping electronic healthcare records, managing insurance, and performing administrative tasks

Clinical Trial

Blockchain Technology is used to address problems of false results and data disintegration that do not match the purposes and objectives of the research.
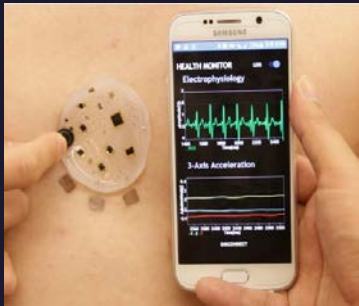
Identification of false content

Allows the general public to monitor what occurs in a clinical trial closely.

Reduces needless overhead expenses

Many problems that plague the healthcare system can be resolved, including interoperability, report completion, theft and even catastrophe data failure.

Uses for Blockchain in Healthcare

Patient Monitoring

Blockchain healthcare network to build a stable digital identity for healthcare institutions and provider

Create Research Initiatives

Transfer the manual mode of processing for membership claims and disputes

Maintain Financial Statements

Title

Improves Safety

Title

Uses for Blockchain in Healthcare

Title

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Minimizes data transformation time and cost

Display Information

Display information about the origins of the medication to ensure high quality and that the approved medicine's manufacturer supplies it.

Advantages

- Decentralization
- Data transparency
- Privacy
- Security

Challenges of Blockchain Usage

BLOCKCHAIN INEFFICIENCY

- Complex computation operations

- Consensus mechanisms and digital signatures

- Bitcoin cybercurrency blockchain transaction processing mechanism is 3.3 – 7 transactions per second with the smallest transactions being 200-250 bytes

- 10 minutes wait for confirmation

- This is slow compared to banks that can do 10,000s of transactions per second

CONGESTION

- If a large number of patients or providers are added to the block chain

- Huge computational burden

INJUSTICE AND INEQUITY IN ACCESS AND HIGH ENERGY DEMANDS

- The high demand for energy arises due to an algorithm called Proof of Work. Designed as a proven mechanism to secure public blockchains to spend large amounts of electricity in exchange

- Access to modern energy sources is essential for sustainable development and human well-being. Research shoes lack of access will persist until 2050 under different socioeconomic pathways and decarbonization scenarios.

Disadvantages of Blockchain

Address inequality of healthcare resources

Huge carbon footprint of computational needs

Potential distrust of healthcare provides and patients

How to address inequality in healthcare - Wiederhold and Associates, Inc. (wiederholdassoc.com)

Further Research

Informatics

Data sciences

Ethical obligations

To establish EHR based on blockchain technology

Resources

- https://www.techtarget.com/whatis/feature/A-timeline-and-history-of-blockchain-technology#:~:text=But%20that%27s%20not%20the%20only%20application%20for%20this,...%206%20The%20future%20of%20blockchain%20technology%20

- A timeline and history of blockchain technology (techtarget.com)

- What Is an NFT? How Non-Fungible Tokens Work (businessinsider.com)

- June 2022 Healthcare Data Breach Report (hipaajournal.com)

- Opportunities and Challenges of Blockchain Technologies in Health Care (oecd.org)