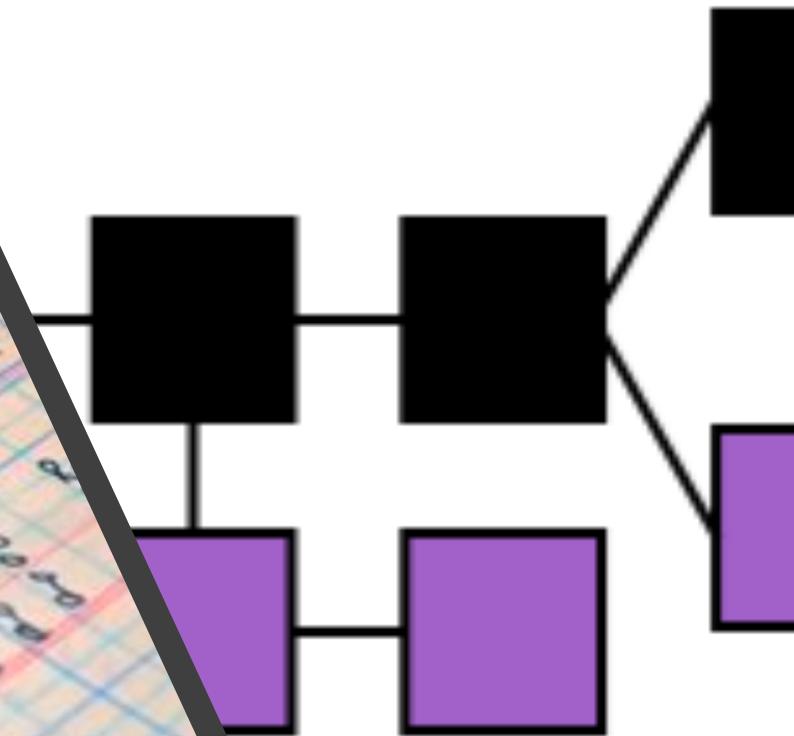


# Block Chain

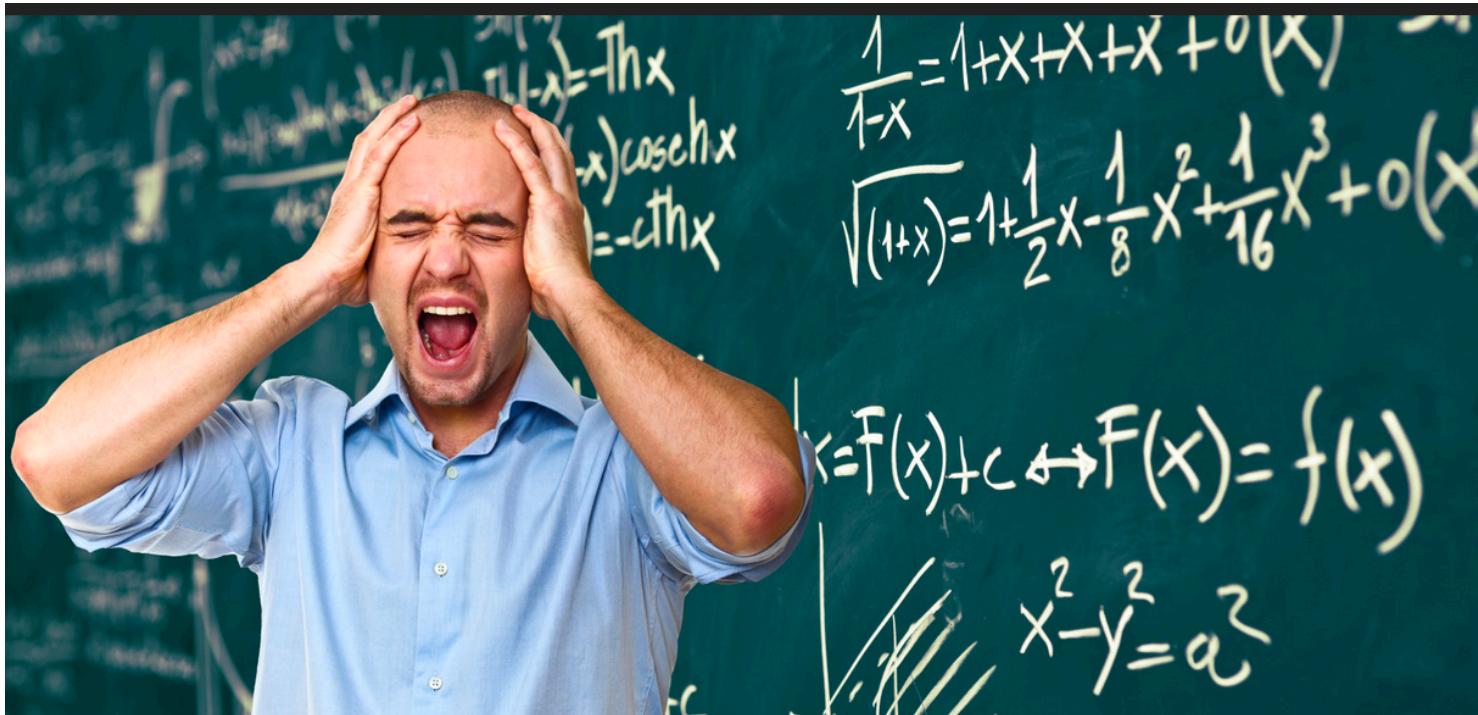
## A Secure Ledger For High Volume Transactions

Steve Pittard



# Block Chain

What Usually Happens When I Mention Bit Coin Or Block Chain



# Block Chain

What I Hope Your Eventual Reaction Will Be



## Essential Concepts:

**Bit Coin / Crypto Currency –**  
A Cryptographically Secured  
Digital Currency.



**Ledger – A Record Of Transactions.**  
Block Chain Is A Digital Ledger Used  
By Bit Coin / Crypto Currencies



# Bit Coin

Bit Coin Is **Not** Block Chain – Bit Coin **Uses** Block Chain

- People Generally Like Things That Can Make You Rich
- Bit Coin Is Useful For Teaching People About Block Chain
- Warning: Owning Bit Coin Leads To Obsessive Behavior

Mid-Market Rates: 2019-09-23 at 16:00 UTC

1	=	9863.64
Bitcoin (XBT)	v	US Dollar (USD)

24 Sep 2014 00:00 UTC - 23 Sep 2019 19:44 UTC XBT/USD close:9814.85262 low:170.87549  
high:19447.68573



# Blockchain

If You Learn Nothing Else From This....

- *Bit Coin Is a (Crypto) Currency That Relies Upon....*
- *Block Chain, Which Is A “Write Once, Read Only” Ledger System*
- *Block Chain Is A Shared Ledger (No Single Owner)*
- *A Block Is Just A Digital Transaction*

You may now zone out.... Well, I hope not.

## Timeline

- 1990 – “Linked Time Stamps” introduced by Haber and Stornetta (like a Digital Notary Public)
- 1996 – “Smart Contracts” introduced Nick Szabo
- 2009 – “Block Chain” introduced by Satoshi Nakamoto

# Time Line

· Weird Plot Twist !



# Timeline

- Turns Out That Satoshi Nakamoto....

Could be an anonymous person or group of people  
Maybe one or more of the following ?



Dorian Nakamoto



Nick Szabo



Craig Wright

# Time Line

If You Invented Block Chain You Would Be Smirking Too.



## Existing Money Transfer & Exchange Scenarios



Entity A Uses Their Bank to Send Money To Entity B's Bank

Both Banks Take A Fee For the Exchange

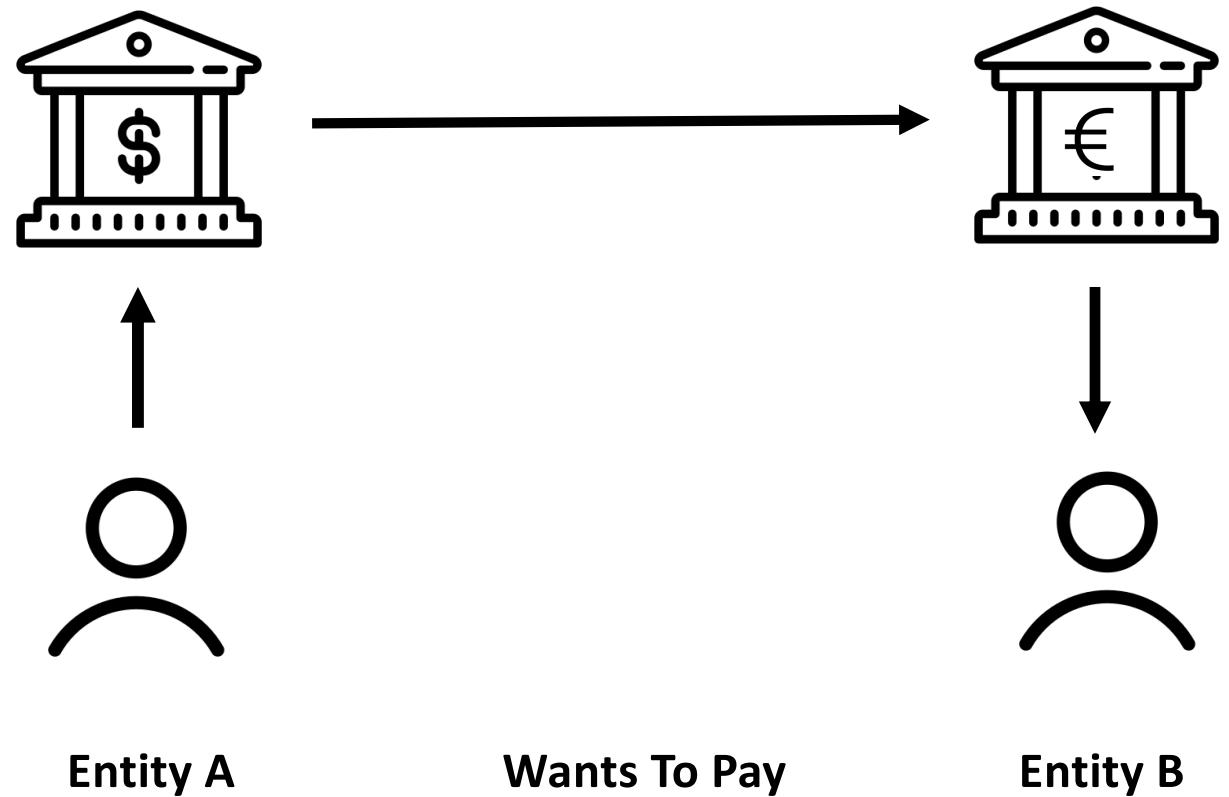
Both Banks Have Their Own Private Ledgers

The Transaction Might Not Happen Due to Regulations

Banks Can Be Hacked

The Transaction Might Be Reported To Respective Government(s)

## Interstate Or International Banking Regulations



## In This Case, Both Entities Use The Same Third Party Service

Pay Pal Takes A Fee And  
Can Raise It

Pay Pal Maintains A  
Private Ledger

Ledger Could Be Hacked

The Transaction Might Be  
Reported To the Government

Pay Pal, (like a bank), Knows  
A lot About You



**HEY, I FOUND  
YOUR NOSE.  
IT WAS IN MY  
BUSINESS AGAIN.**

# Block Chain Transactions

- No Need To Pay Intermediaries
- User Retains Control Of Identity
- No Central Authority
- Transactions Are Publicly Verifiable
- Governments and Wall Street Do Not Like This

# But, Is This Secure ?



Use of Hashes / Unique IDs

Proof Of Work

Distributed Ledger – Peer To Peer

## A Block Contains Transaction Info



**Data:** Transfer 100 BTC From Person A To Person B

**Hash:** A Unique Numeric Identifier

a37938270ba6fafb4c27273cc93bfa598f361000

If the Block Content changes then so does the Hash.

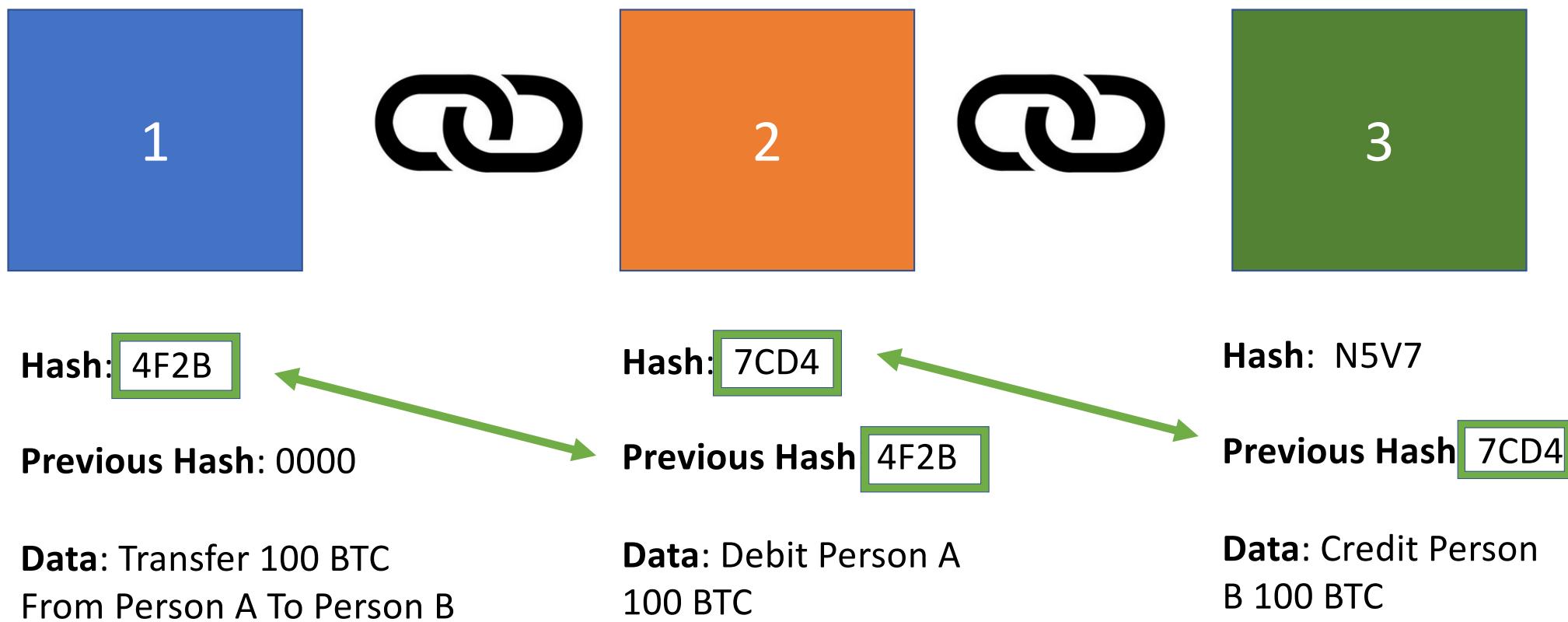
**Hash Of The Previous Block:**

A Unique Numeric Identifier of the Previous Block In The Chain



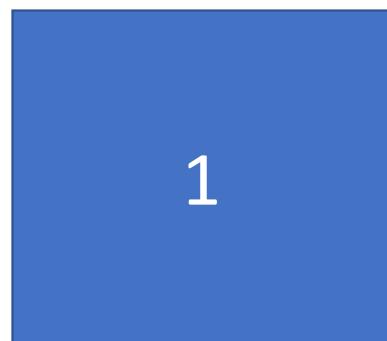
## A Chain Of Three Blocks

The “Genesis” Block

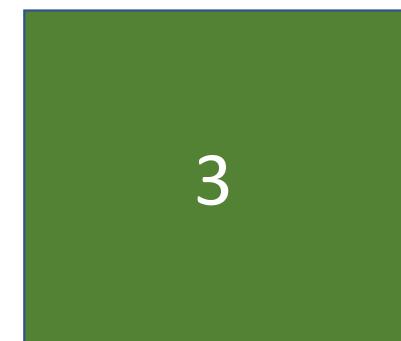


## A Hacker Changes Block #2 To “Debit Person A 10 BTC” Block 3 Is Now Invalid

The “Genesis” Block



Was Hash: 7CD4



Hash: 4F2B

Previous Hash: 0000

Data: Transfer 100 BTC  
From Person A To Person B

Hash: 8CF4

Previous Hash: 4F2B

Data: Debit Person A  
10 BTC

Hash: N5V7

Previous Hash: 7CD4

Data: Credit Person B  
100 BTC

1

3



4F2B

8CF4

N5V7

0000

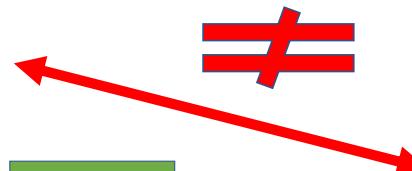
4F2B

7CD4

Transfer 100 BTC  
From Person A To Person B

Debit Person A  
10 BTC

Credit Person B  
100 BTC



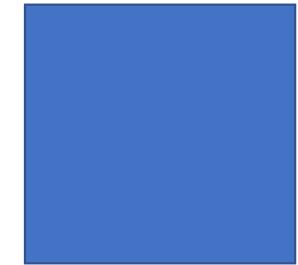
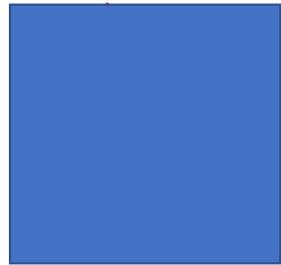
.

## Use of Hash IDs Helps Prevent Fraud, But....

- Large Compute Clusters Can Recompute Hashes To Cover Up Hacks
- In Effect - Rewriting Ledger Entries
- If There Is Only One Ledger Copy, Then This Works, But
- Block Chain Is Distributed (No Single Owner)

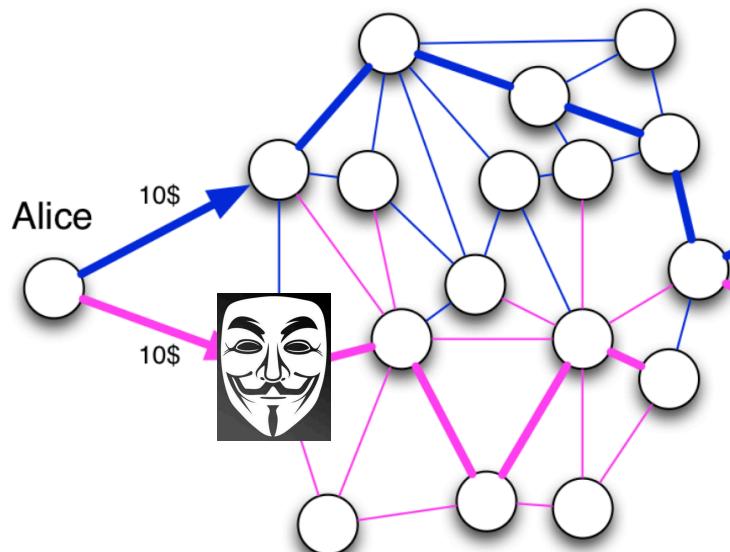
## “Proof Of Work” - PoW

- A method to deliberately delay the creation of new blocks – For Bit Coin it's about 10 minutes / block
- Tampering With One Block Requires PoW Recalculation for all impacted Blocks
- Very Slow To Do With a Large De-Centralized Ledger



10 Minutes

10 Minutes



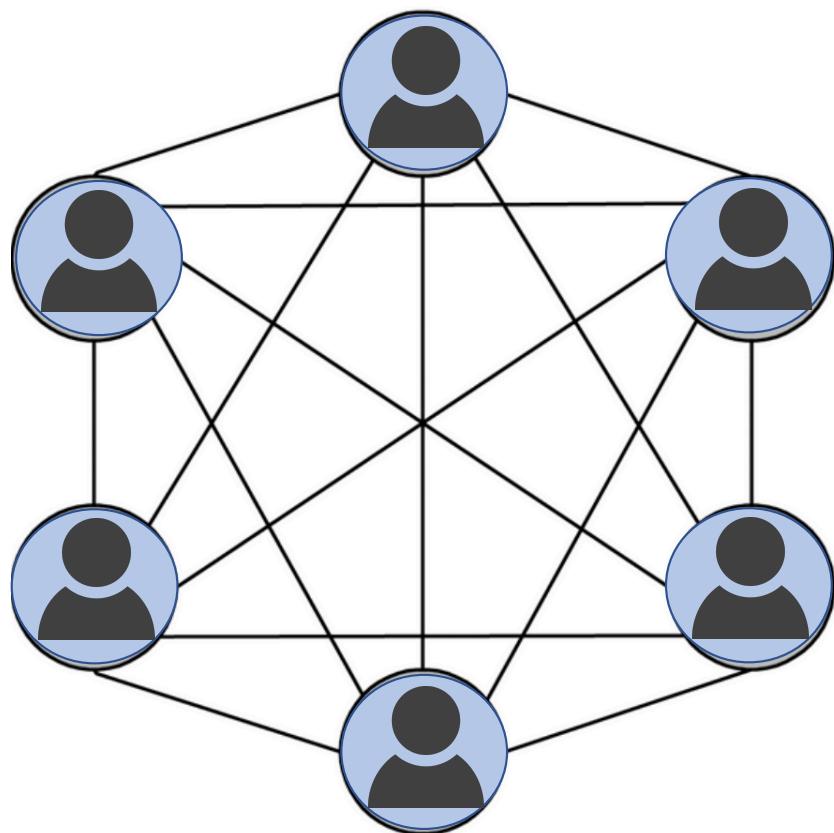
Recompute Hash  
For 16 nodes at  
10 minutes Each,  
Serially: 160  
minutes.

# Block Chain

## Distributed Ledger – Peer to Peer Network

- Block Chains Use A Peer To Peer Network  
Remember Napster ?
- No One Entity Owns The Ledger Or Network
- Any One Can Join The Network
- Must Be A Consensus On The Ledger State

1  $\bowtie$  2  $\bowtie$  3

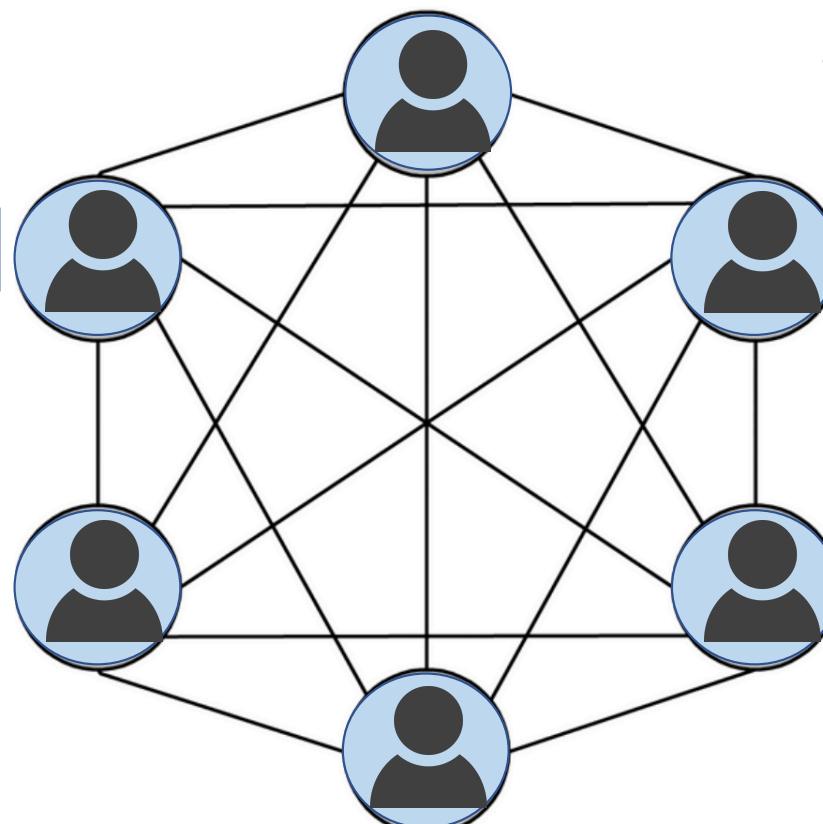


1  $\bowtie$  2  $\bowtie$  3

A New Block Is Added  
PoW Begins



There Must Be Consensus



# Yes, This Is Secure



Use of Hashes / Unique IDs

Proof Of Work

Distributed Ledger / Peer To Peer

# Block Chain

“***Smart Contracts***” help you exchange money, property, shares, or anything of value in a transparent, conflict-free way while avoiding the services of a middleman.”



<https://blockgeeks.com/guides/smart-contracts/>

# Block Chain

“***Smart Contracts***” - Embeds code that enables conditional transactions. Very useful for decision-based purchases or evidence of satisfaction of pre-specified conditions.



<https://blockgeeks.com/guides/smart-contracts/>

## ***Block Chain*** Can Be Used For Documenting:

- Global Shipments Of Food, Medicine, Supplies
- Transportation of Organs In Emergent Donor Situations
- Medical Compliance and Attendance
- Course Completion And Academic Transcripts
- Copyrights (e.g. musical works, manuscripts)

## *Activities That Might Benefit From Block Chain:*

- Transcript And Credential Management
- Time-Based Diagnostic Testing (e.g. food testing)
- Compliance (Research study, Clinical Studies)
- Move Data Back To Patient