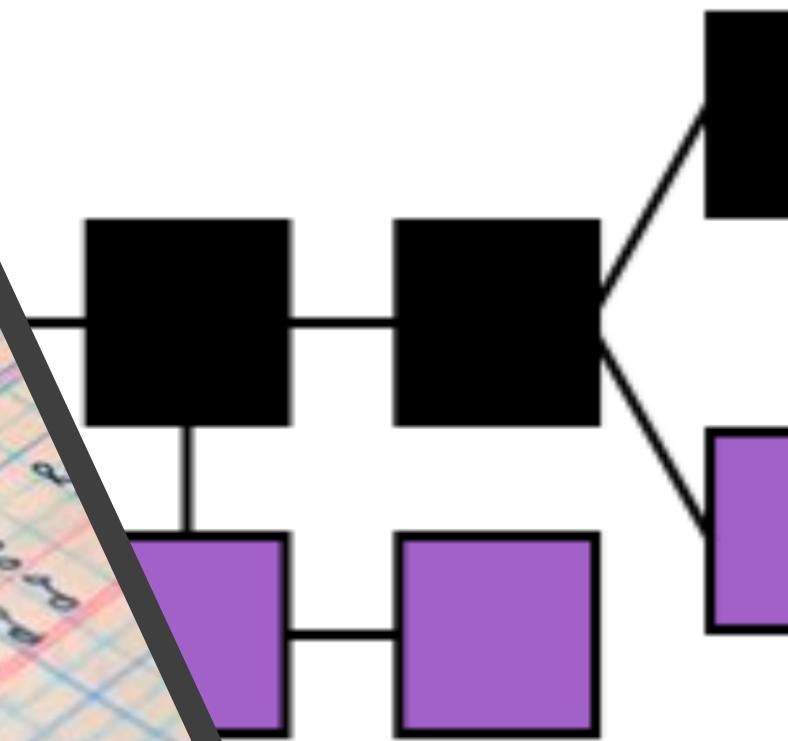


Block Chain



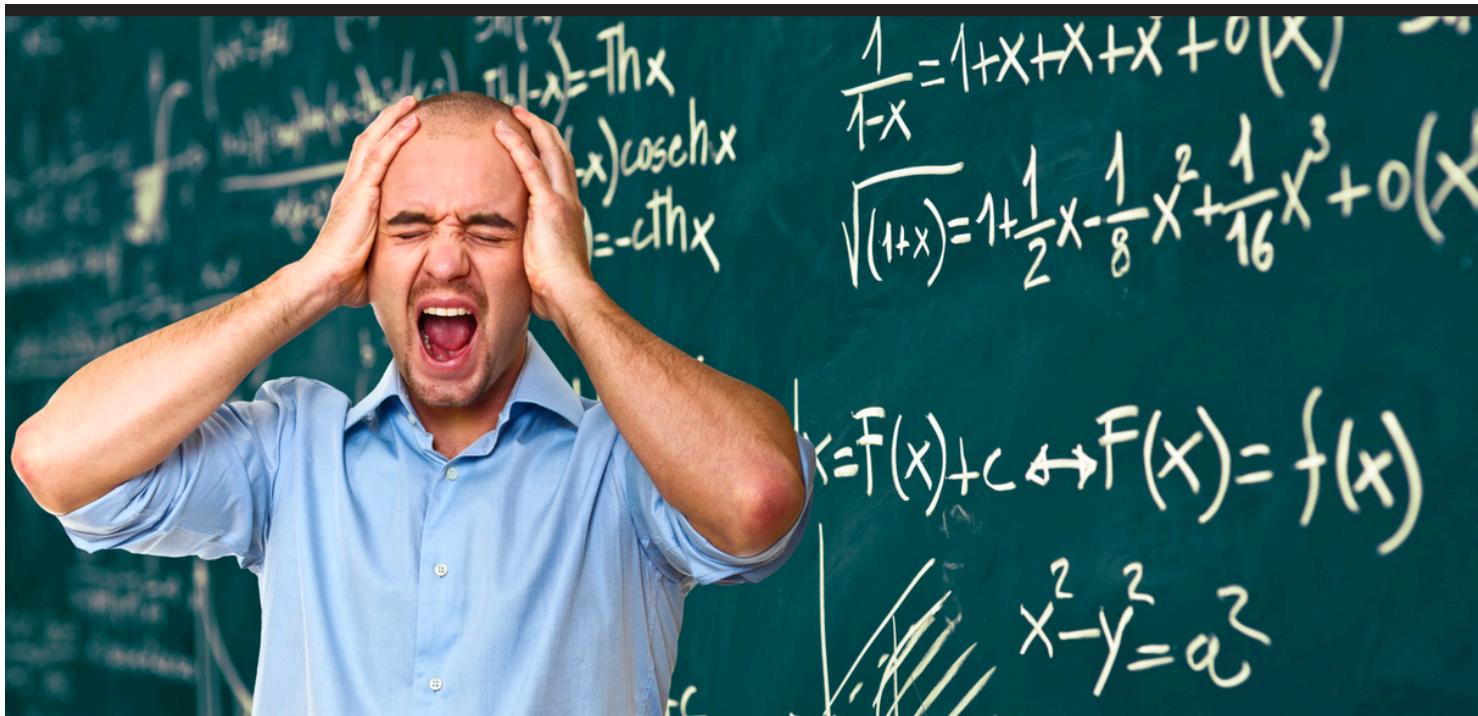
# Block Chain

## How I Hope People Will React



# Block Chain

## Versus The Usual Reaction



# Bit Coin

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.

## ***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)

# Bit Coin

Most People Hear About Block Chain Because ***Bit Coin Uses Block Chain*** – And That's About All They Know

- 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

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



<https://www.xe.com/currencycharts/?from=XBT&to=USD&view=1Y>

Nurse: Sir, you've been in a coma for 9 seconds

Me: Oh boy I can't wait to see how much my bitcoin is worth



## 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

# “Old School” 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

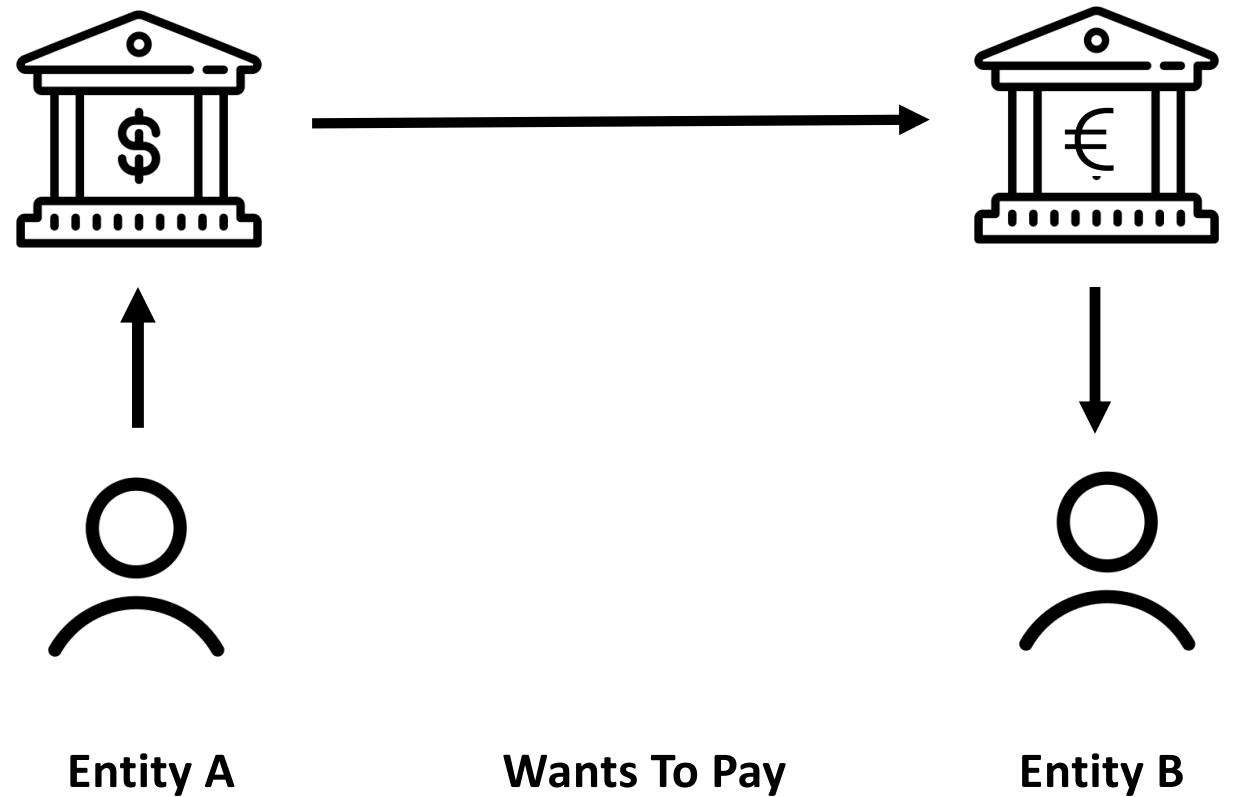
Both Banks Have Their Own Private Ledgers

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.**

# Bit Coin

- No Need To Pay Intermediaries
- User Retains Control Of Information And Actions
- No Central Authority
- Anonymous (if desired)
- Transactions Are Publicly Verifiable

## An Actual Hardware Bit Coin “Wallet” Device



# Block Chain



- Transactions are stored in blocks that form a public ledger referred to as a **Block Chain**
- Each **block** contains a “**hash**” (unique id) as well as the **hash** of the previous block all the way up to first block of the chain.
- Transactions are verified by Peer to Peer network participants “miners”

# But, Is This Secure ?



Use of Hashes

“Proof Of Work”

“Distributed Ledger”

## A Block Contains Transaction Info

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

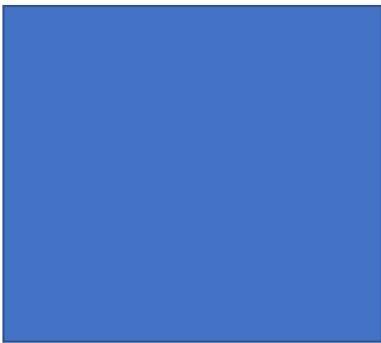
**Hash:** A Unique Numeric Identifier

a37938270ba6fafb4c27273cc93bfa598f361000

The Hash is a function of the Block's Content. So if the Block Content changes then so does the Hash.

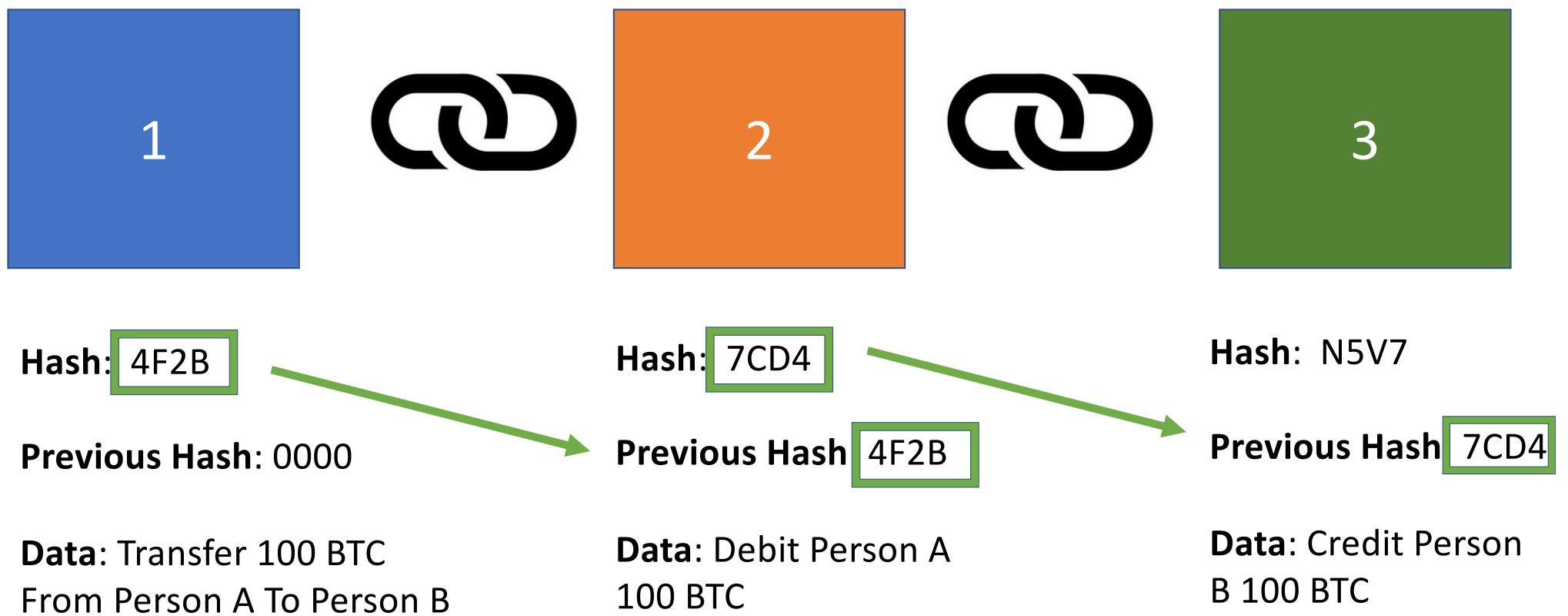
**Hash Of The Previous Block:**

A Unique Numeric Identifier of the Previous Block In The Chain



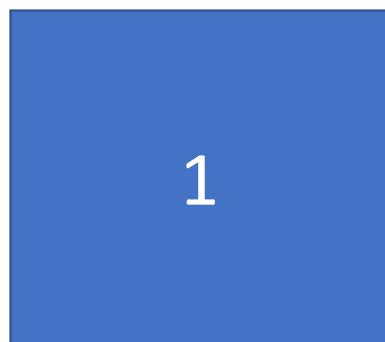
## A Chain Of Three Blocks

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

7CD4

8CF4



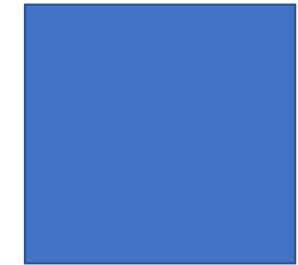
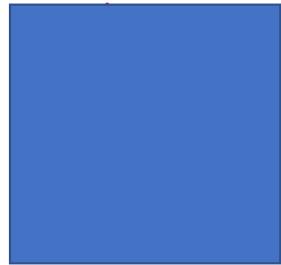
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## Use of Hash IDs Helps Prevent Fraud, But....

- Large Compute Clusters Can Recompute Hashes To Cover Up Hacks
- In Effect, Rewrite Ledger Entries
- If There Is Only One Ledger Copy, Then Evidence Is Erased

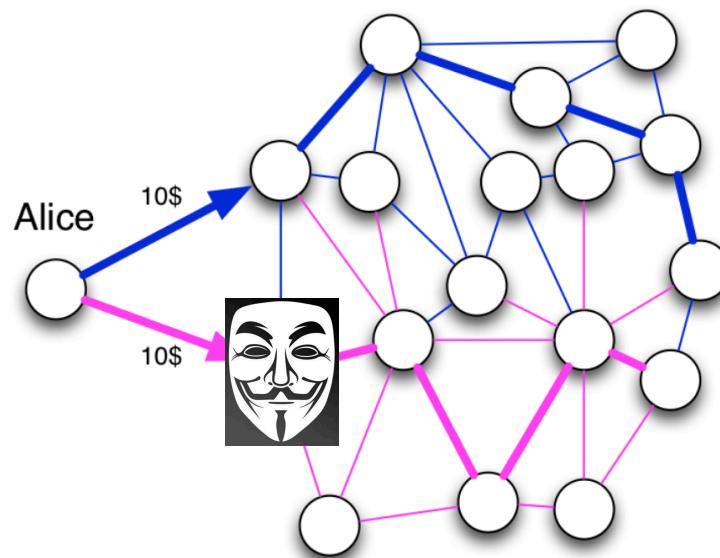
## “Proof Of Work” - PoW

- A method to intentionally delay the creation of new blocks – For BitCoin 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

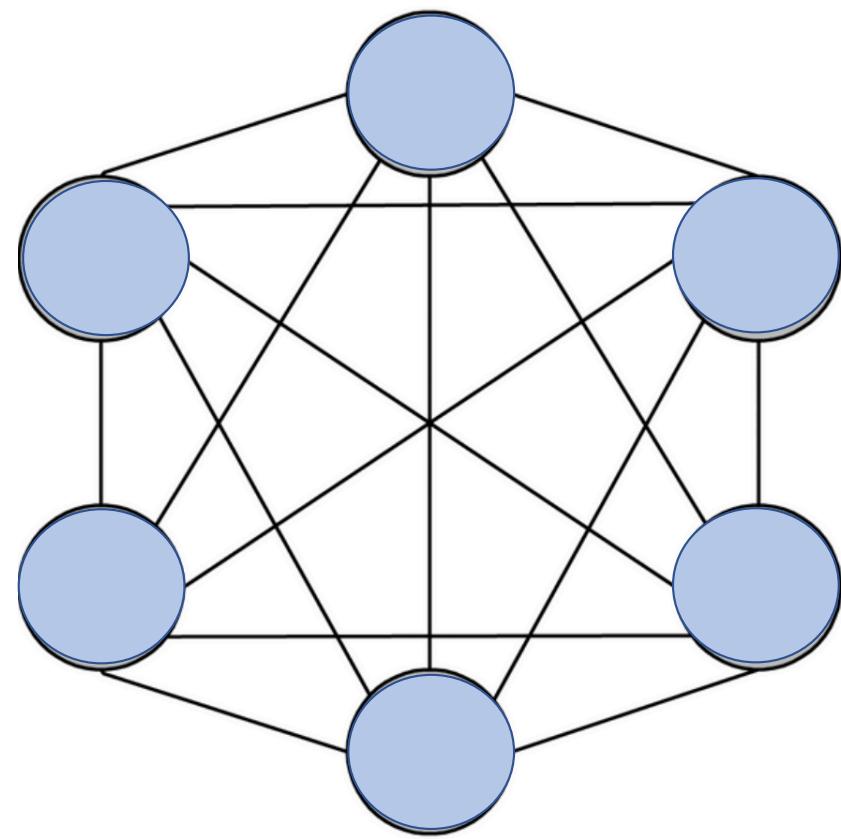


Recompute Hash  
For 16 nodes at  
10 minutes Each,  
Serially: 160  
minutes.

## “Distributed Ledger – Peer to Peer Network

- Block Chains Use A Peer To Peer Network
- No One Entity “Owns” The Ledger Or Network
- Any One Can Join The Network
- Every One Gets A Copy of The Ledger
- Must Be A Consensus On The Ledger State

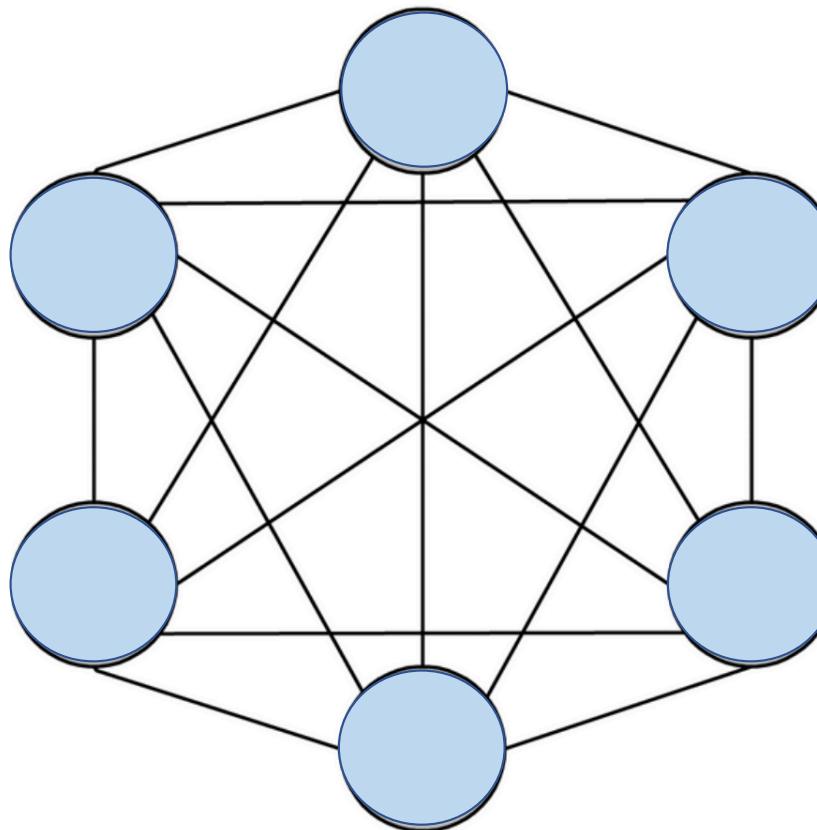
1  $\bowtie$  2  $\bowtie$  3



A New Block Is Added  
PoW Begins



There Must Be Consensus



# 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/>

# Brainstorm Ideas

Longitudinal Patient Records

Patient X Got Drug Y At Time Z

Identification  
People Who