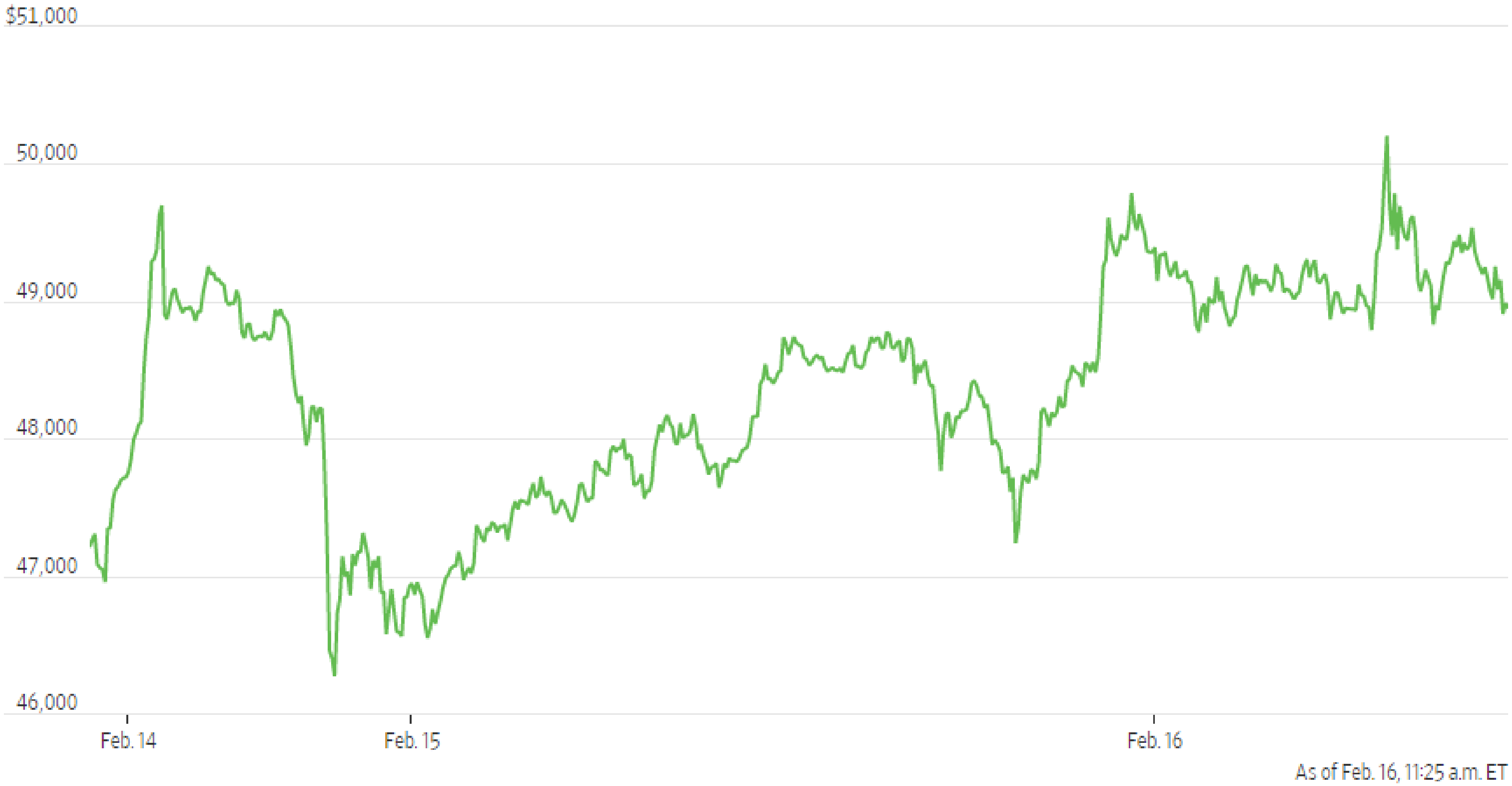
Bitcoin
&
Blockchain and Crypto Currency

February 22, 2021



Bitcoin topped $50,000 for the first time Tuesday, doubling in value in less than two months.

Wall Street Journal 2/16/2021

What is it?
How does it work?
What is its future?
What about other Crypto Currencies?

Bitcoin is the 1st computer technology to solve the social issue of TRUST, without a 3rd party

- **Satoshi Nakamoto’s** white paper* in 2008:
  - **Solved double spend problem – a coin cannot be copied**
  - **Blockchain and Proof Of Work consensus protocol**
- Supports a currency based on cryptographic proofs instead of trusted banks

Double Spend

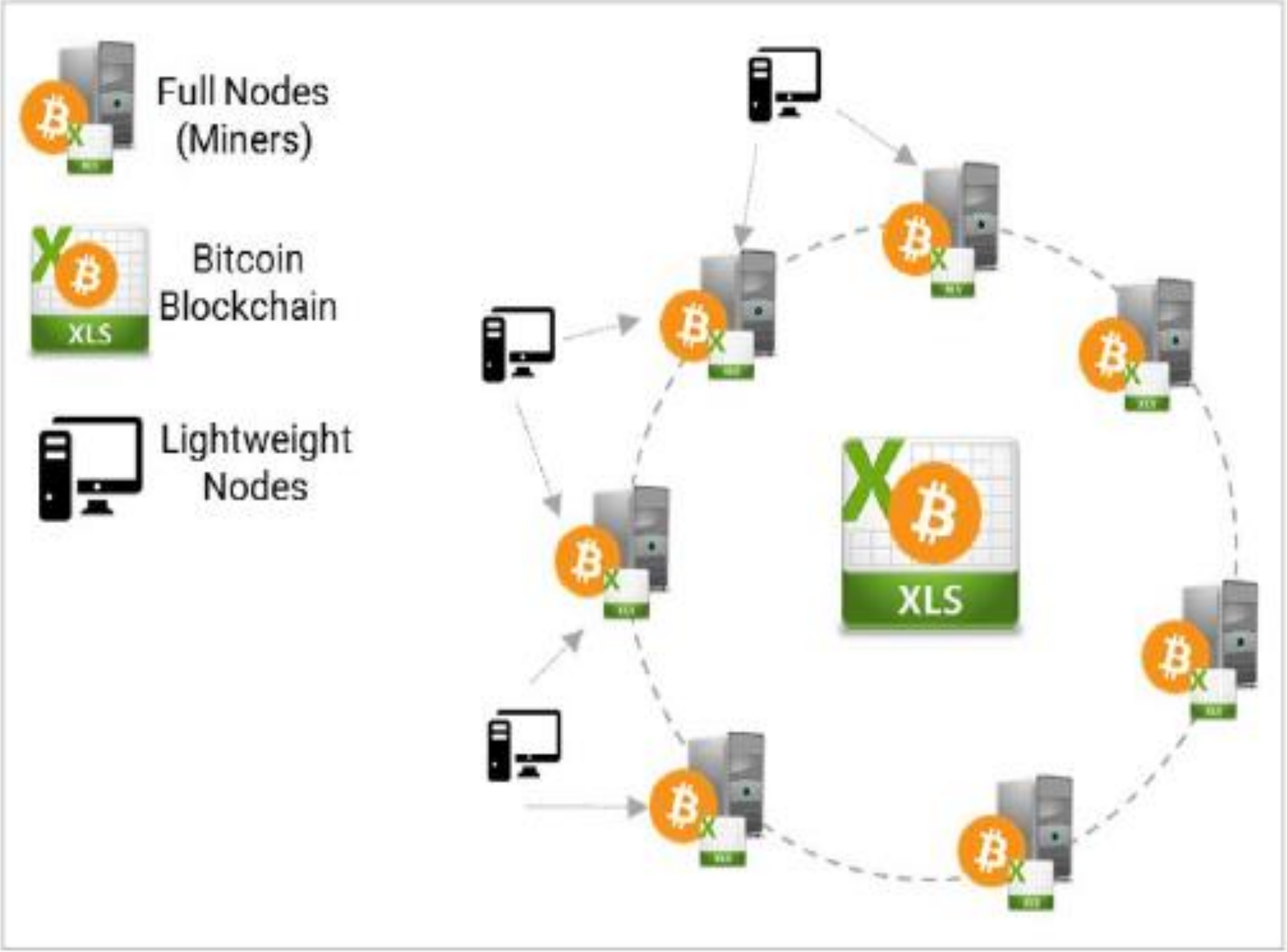
- Paper dollar – Counterfeit $'s
- Banking System
  - Spend through checks or other transactions
  - Bank reconciliation can take days
  - Other transactions may be initiated before transactions clear
  - Bad checks
- Bitcoin
  - Each transaction is verified against the current ledger before it is approved. No possibility to execute a transaction where the funds (bitcoins) are not available

Blockchain

- **Protocol** that runs over the internet (like tcp/ip or http)
- **Blockchain is a shared database** that is **distributed** over a peer-to-peer network.
- **Open-Source -** “tribe” of programmers keep it running.
- **Chain** - Each Block in the chain is tied to the previous block so that no block can be removed or altered without changing every block that follows it.
- **Block –** Each Block contains “ledger” transactions moving bitcoins from one “wallet” to another. Since blocks are never able to be deleted and every block is always visible, the account in every wallet can be calculated accurately at any point in time.

Blockchain

- A distributed, peer to peer network
- Each block is tied to it’s preceding block
- Every block is always visible



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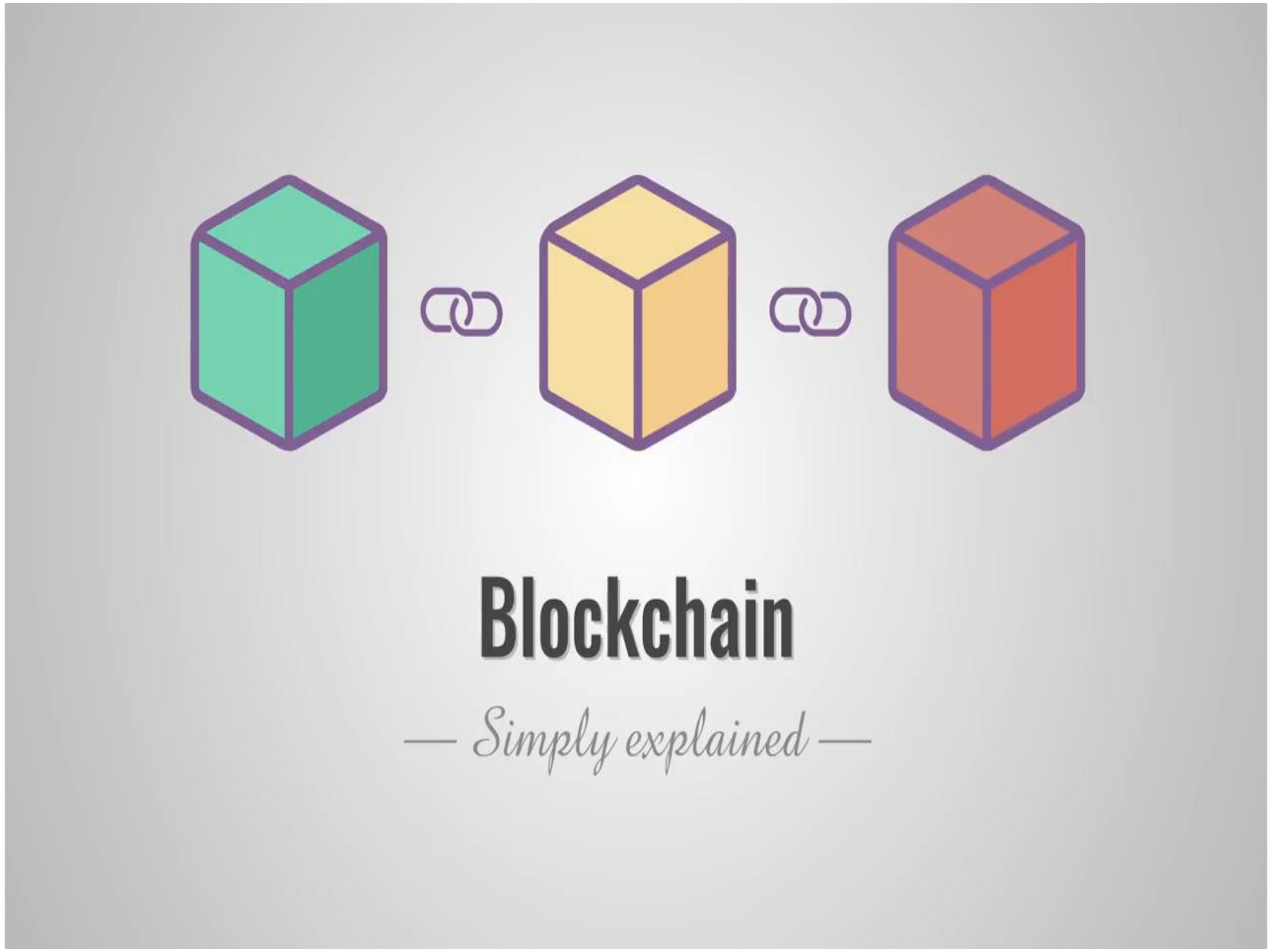
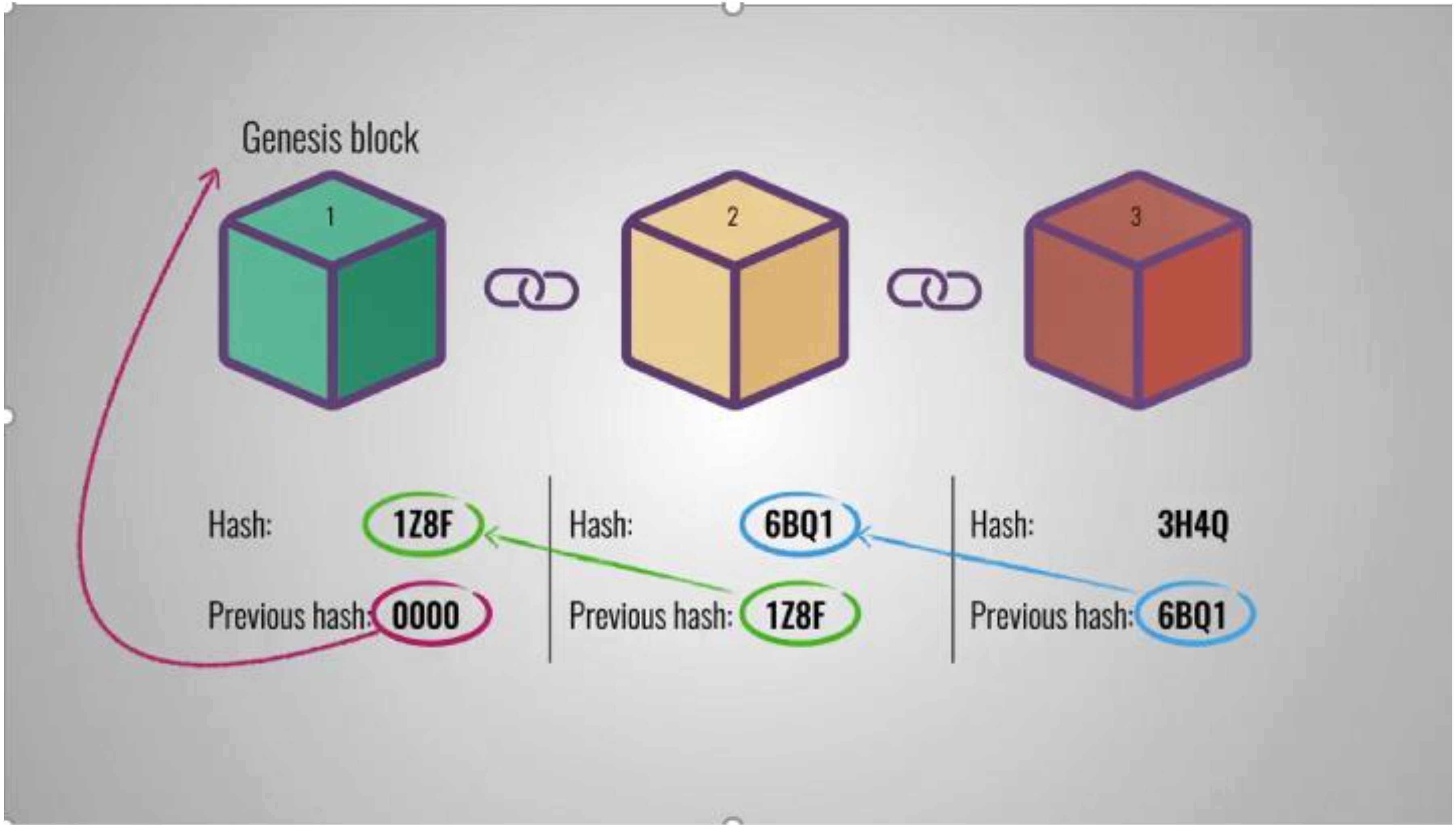
Proof of Work

- Insures that the Blockchain records can not be modified after they are agreed upon.
    - To change a block you have to solve a very difficult math problem and store the solution in the block.
    - Miners do this when they create a new block
        - Bitcoin transactions happen in real-time and get lumped into a new block
        - Thousands of miners race to solve the math problem for the new block
        - The first one to solve the problem wins the right to place the new block in the chain – it takes an average 10 minutes for a solution to be found (it is totally luck to find it)
        - The winning miner is rewarded with a fixed number of Bitcoins and the sum of all the fees (in bitcoin) of all the transactions in the block
    - Anyone wanting to change a block after it is already installed, would have to find the answer to put in the block – 10 minutes X thousands = time to calculate the answer once
    - This prevents any block in the chain from being tampered with without the whole chain knowing that it is happening (effectively impossible to modify)

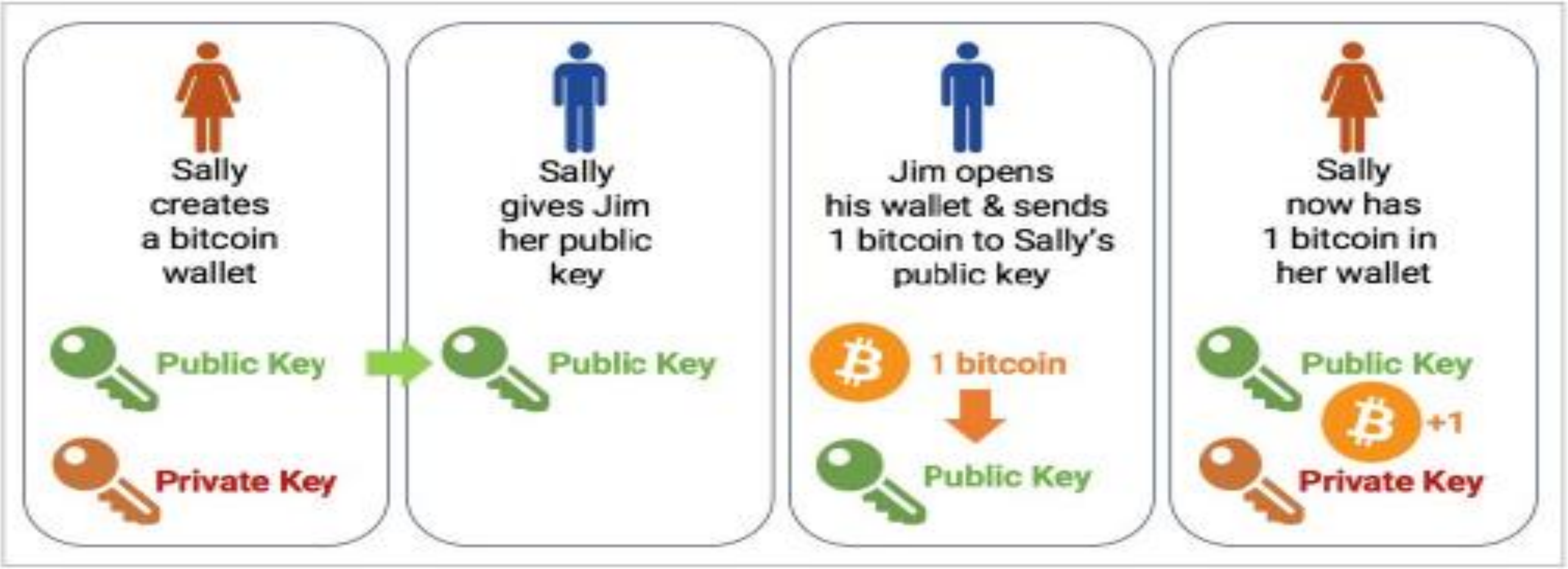
Video: Blockchain Security with Hashing Explained




Genesis block
1
2
3
Hash: 1Z8F
Previous hash: 0000
Hash: 6BQ1
Previous hash: 1Z8F
Hash: 3H4Q
Previous hash: 6BQ1

How Does Bitcoin Work?

- Bitcoin ledger is kept in transaction records like an excel spreadsheet.
- Transactions are lumped into blocks and a new block is added to the blockchain about every 10 minutes.
- When the block is added to the chain, all of the transactions in the block are completed, can never be changed, can not be reversed.
- The block is added to the chain when a Bitcoin miner solves a very hard math problem. The miner is also responsible for "validating" that all the transactions in the block are valid – that is, there are enough bitcoins in the accounts to cover the transactions and there are no other outstanding transactions that would use the same bitcoins.
- Anyone can create a "wallet" which means they are given a Private Key. From the private key, they create a public key which is then then their address. Their wallet contains the portion of block chain related to their transactions. Transactions go from one Bitcoin Wallet to another.



Sally creates a bitcoin wallet

Sally gives Jim her public key

Jim opens his wallet & sends 1 bitcoin to Sally's public key

Sally now has 1 bitcoin in her wallet

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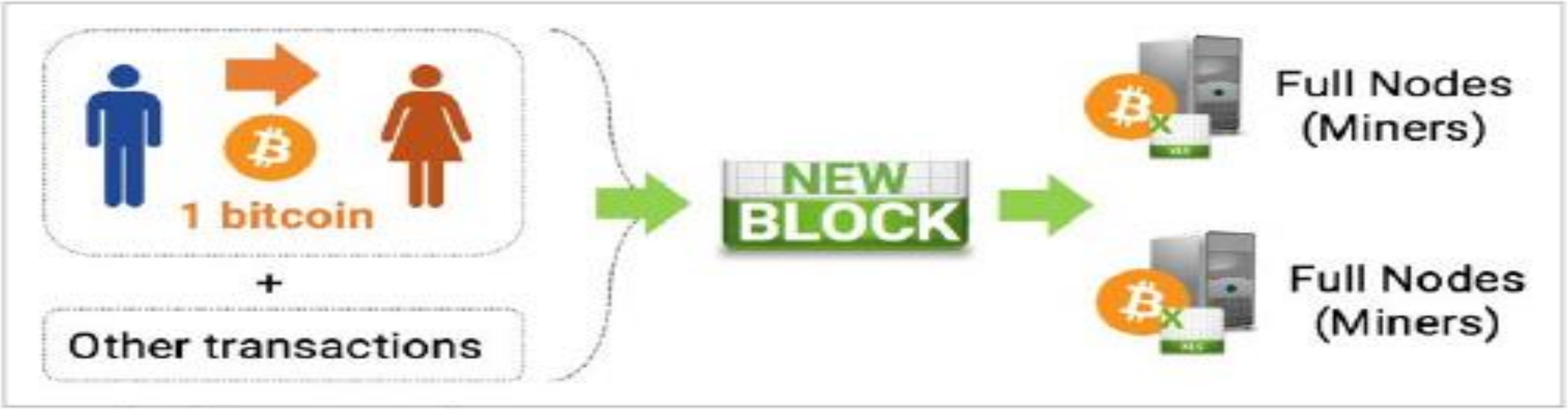

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How can I “own” a bitcoin

- Do it yourself
  - Get a Bitcoin Wallet from
    https://bitcoin.org/en/bitcoin-for-individuals
  - Buy bitcoin currency from a broker and put it in your Wallet
  - Use the currency with others who have wallets
  - The Wallet private key is yours, if you lose it, all value in the wallet is lost and no one can recover it.
- Get an account with a third party broker
  - Use the broker’s tools to buy, sell, transfer values
  - Your value is in an account with the third party, if the third party account is hacked, all value in it goes to a crook.
- Third Party manages your Wallet – Coinbase.com and others

Bitcoin / Blockchain Disadvantages

- **10 Minutes average to complete a transaction**
- **Proof of Work** mining calculations are energy intensive
  - Electricity used would power a small country
- **Changes** to the infrastructure require widespread adoption
  - Block maximum size limits the number of transactions per minute – much too slow for consumer activities.
  - Hard Fork or Soft Fork changes must be agreed by the open source "tribe"
- **User wallet** can be accessed only by a private key which is nearly impossible to decipher. If the user loses the key, all the bitcoins in that wallet are lost.
- **There is a limited number** of Bitcoin that will ever be created. That number will be reached in 2041.

Bitcoin Mining Costs
Hardware, Electricity, Cooling, Admin.

Consumes more power than Ireland or Nigeria

Special PC’s running multiple graphics processors.

Large companies design their own processors and make them in the most advanced Semi Conductor plants

Consume about 7.46 GW, equivalent to around 63.32 terawatt-hours of energy consumption.

Bitcoin – what is it good for?

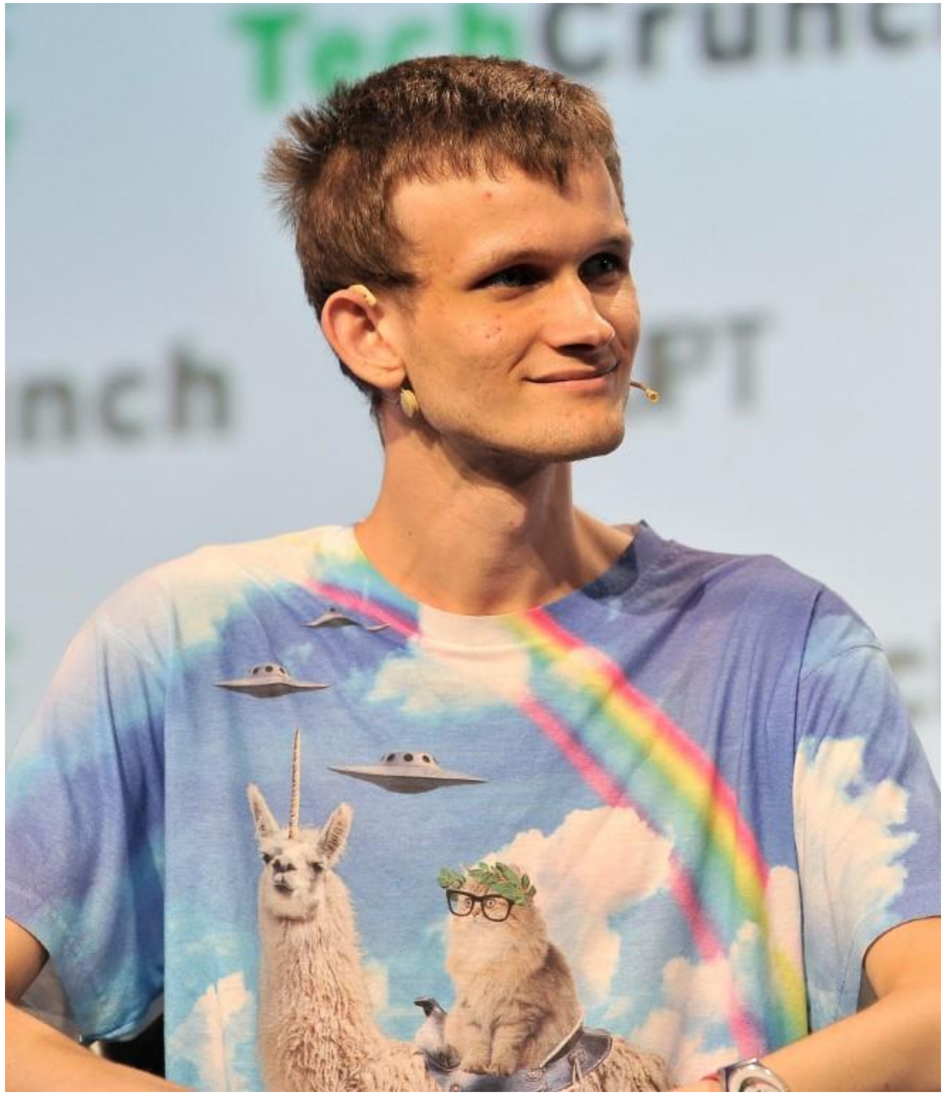
- **Not for retail purchases!**
  - high transaction fees ($1-$40)
  - slow transaction speed (10 min.+)
- **Speculation**
  - Volatile market value may provide useful portfolio balance
- **Store of Value, Digital Gold**
  - Very easy to obtain and store
  - May be useful inflation hedge in countries with high inflation – Argentina, Venezuela, Turkey
- **Global Currency**,
  - Transfer funds across borders
- **Dark web transactions** (use rapidly declining)

Bitcoin Future

- Mainstream Adoption gives it credibility
    - Musk / Tesla
    - PayPal
    - Melon Bank
- Volatility makes it interesting for investors
    - Portfolio risk balance
    - “Bet the farm” investors
- Programming model makes the “certainty” a little less certain
    - Hard Forks – Bitcoin Cash in 2017
- Government actions a total unknown
    - Restrictions for law enforcement and taxing regulations
    - Climate change actions

A Brief History of Ethereum and Ether (ETH)

- Invented by Vitalik Buterin when he was 19
  - Russian born Canadian
  - Co-editor of Bitcoin Magazine
  - Univ. of Waterloo drop-out
- 2013 Issued White Paper
- 2015 Launched Ethereum global distributed blockchain protocol
- Includes complete programming language
- Runs smart contracts
- Runs decentralized apps (DApps)
- Committed to “Proof of Stake” process



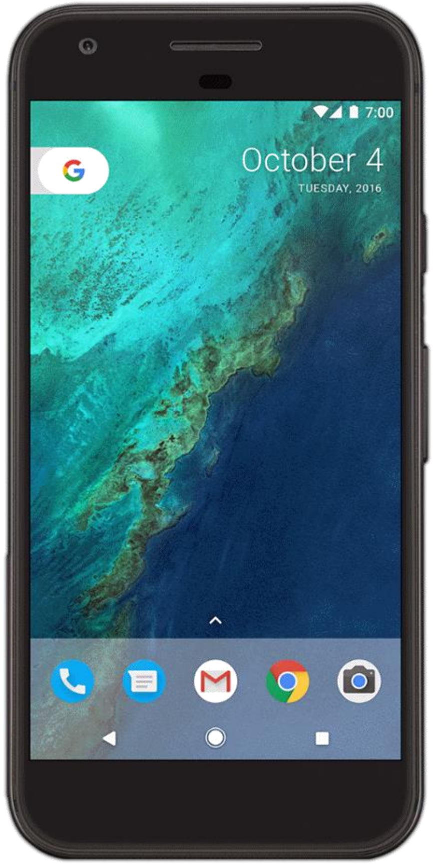
Compare and Contrast

Bitcoin (currency)

- The ‘Gold Standard’ of blockchains
- Asset: bitcoin (BTC)
- 10 Minute block time
- Simple and robust
- Proof-of-Work
- Primary purpose is payments, competes with fiat currencies, gold

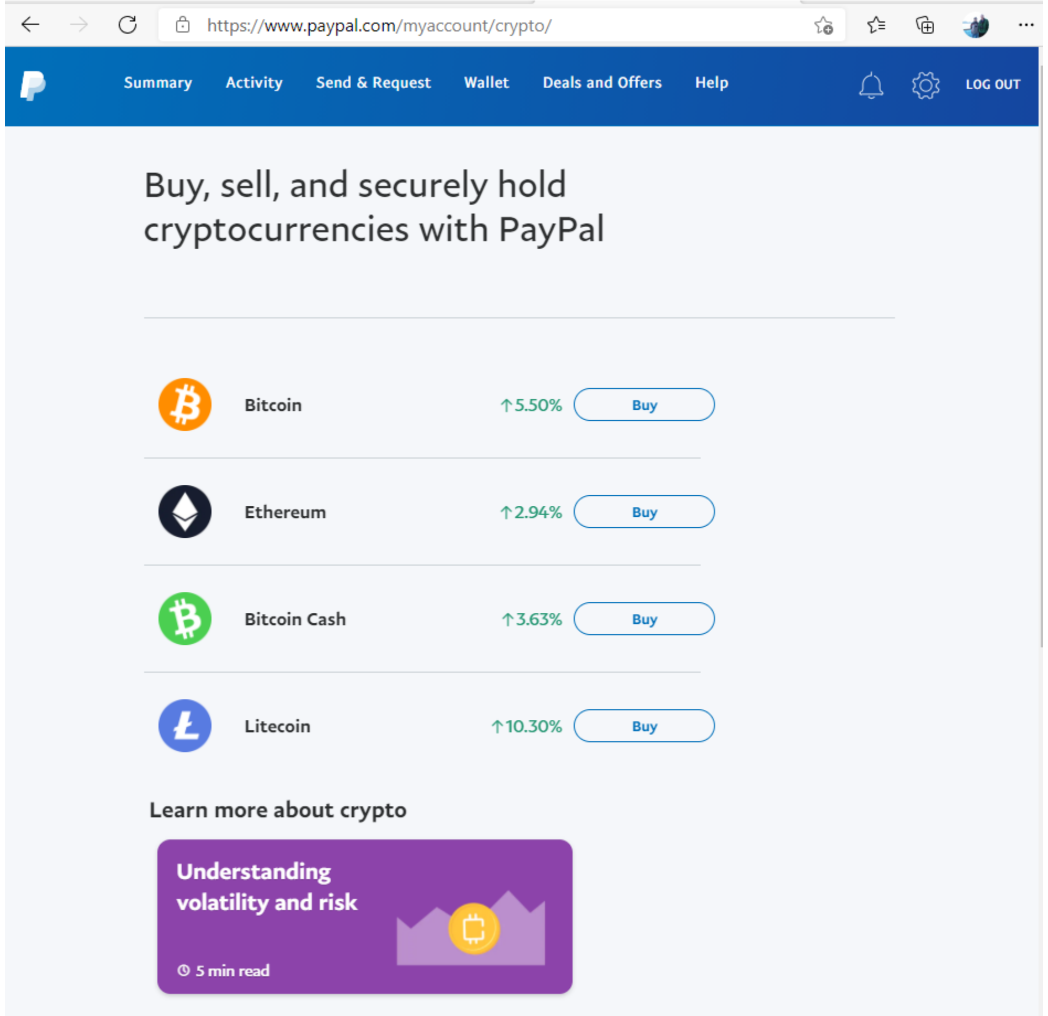
Ethereum (general)

- Smart Contract Blockchain Platform
- Asset: ether (ETH)
- 14 Second block time
- Complex and feature-rich
- Moving to Proof-of-Stake
- Primary purpose is to fund computation on Earned Value Management and align incentives
- DeFi (Distributed Finance)



How do you buy and sell Crypto Currency?

- Getting started – Bitcoin
    - Get your own Wallet, purchase your first Bitcoin and you are on your own
- Use and exchange
    - iTero
    - Coinbase
    - PayPal



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Bitcoin Cash	↑3.63%	Buy
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Understanding volatility and risk

5 min read