

Blockchain in Low Earth Orbit

Off Earth Atlas

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Who am I?

I'm an astronomer by training.

I've been working in cryptocurrency for the last 10 years.

VP of Engineering at Bloq, Inc (where we focus on Blockchain infrastructure).

A New Currency in a New Location

Humanity has been in space for less than 100 years.

Bitcoin (the oldest cryptocurrency) is less than 15 years old.

Outline

- ▶ Quick review of Cryptocurrency.
- ▶ Wallets in Space.
- ▶ Connections between things in Space.

Blockchains

- ▶ Bitcoin
- ▶ Cryptocurrency
- ▶ Decentralized Ledger
- ▶ Just a fancy database?



- ▶ Bitcoin: A Peer-to-Peer Electronic Cash System (Satoshi Nakamoto, October 2008).

Ethereum and Beyond



Programmable Money.

Digitally Native Currency

- ▶ Most money will never touch the physical world.
 - ▶ Only 9% of people (in US) primarily use cash or check according to <https://www.forbes.com/advisor/credit-cards/credit-card-statistics/>
- ▶ Most of us still think of money as the physical object.

Blockchain Basics

- ▶ Why?
- ▶ How?

Blockchain Basics: Why?

Can we agree on a shared state of the world without explicit trust?

- ▶ This lets us transfer value (money).
- ▶ More interesting things as well.

Blockchain Basics: Ledgers

- ▶ Most of our terminology comes from money (the first application of this).
- ▶ Decentralized Ledger.
- ▶ A database with Eventual Consistency
 - ▶ No single source of truth.

Consensus Mechanisms

- ▶ Instead of forcing good behavior incentivize it.
- ▶ Cheaper to be a good player than a bad player.
- ▶ Rewards for being 'good'.

Proof of Work vs. Proof of Stake

Blockchain: Wallets

- ▶ Public key: 0xd4c...d9066
- ▶ Sometimes a human readable name: jcv.eth
- ▶ Private key lets you do actions on chain since it proves you 'own' the public key.

Spacechain

<https://spacechain.com/>



Feb 2, 2018

Launched a full-node program on the Qtum blockchain that can process existing blockchain data



Oct 25, 2018

Embedded with SpaceChain OS and can perform blockchain related functions like smart contracts on the Qtum blockchain



Dec 5, 2019

Launched a testbed for Bitcoin multisignature authentication service to the International Space Station



Jun 3, 2021

Launched into space the first commercial Ethereum blockchain integrated satellite payload to the International Space Station



Jun 30, 2021

Launched a blockchain-enabled payload incorporated with space nodes created for customers



Jan 13, 2022

Launched a space node to support on-orbit Velas transactions and minting of an ERC-721 standard NFT



Nov 26, 2022

Launched our 2nd Velas blockchain payload integrated to the International Space Station

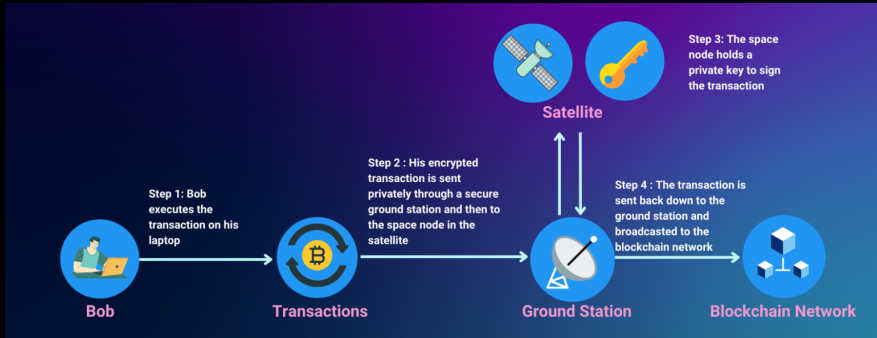
Nodes in space?

- ▶ Limited resources mean limited options for nodes.
- ▶ TB of fast storage needed for some chains.
- ▶ Power and heat requirements.
 - ▶ Space (even LEO) gives you a nearly limitless place to dump heat and no way to use it.
 - ▶ Terrestrial locations have limited heat sinks but they are easy to use.

Cheap Hardware



Keys in space



(multisig) Wallets on satellites.

Multisig

- ▶ Security through isolation.
- ▶ Security through time-delay.

But is there more?

Satellite to Satellite communication?

- ▶ Normally satellites communicate with the ground and most coordination happens there.
- ▶ This was one of our bottlenecks in astronomy satellites like Fermi and Swift.
- ▶ Eventually consistent db, p2p comms, conflict resolution all provide options to get around this.
- ▶ Needs new (but cheap hardware).

Economies and Infrastructure

We have the potential for doing both digitally native economic activities and decentralized infrastructure related activities on satellites or the ISS.