Token Lecture Series

January 15, 2019
Organized By

Blockchain NYC
http://blockchainNYC.io

Chainhaus
http://chainhaus.com
Token Lecture Series
Meetup Page: http://blockchainNYC.io

Upcoming Events

Jan 21 - 26 - Zero to Hero Python Bootcamp
Feb 28 - HyperLedger Fabric for Architects & Developers
Feb 4 - Artificial Intelligence Masterclass
Feb 11 - Data Science for Medical Professionals
Feb 12 - Full Day JVM Data
Feb 25 - Blockchain Masterclass
Feb 18 - Building Crypto App w/ Django + Python
Feb 26 - Global Blockchain Healthcare


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<td>Dan Raykhman</td>
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What are enterprise tokens?

Professor Jamiel Sheikh
Chainhaus
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Bio

- CEO of Chainhaus (dev shop, education, STO advisory, products and studio)
- 20 years of enterprise and startup fintech experience
- Professor at Columbia, NYU and CUNY teach graduate level data science, blockchain, AI & performance management
- Writing O'Reilly book on Corda
- Organizer of Blockchain NYC
- Coder since 11 yo: Java, Kotlin, Python, Scala, C, C+, Solidity, NodeJS, Swift, Objective-C
- Education:
  - Second Master’s in AI from Georgia Tech
  - MBA Columbia University
- LinkedIn: [http://linkedin.com/in/jamie](http://linkedin.com/in/jamie)
What is an enterprise?

- Organization
- 3 Ps
  - Privacy matters
  - People matter ... (and are not anonymous)
  - Profits matter
What is a token? Philosophical

- Arbitrary label
- For arbitrary value
- A coin is a token
- A token is not a coin
What is a token? Economist / Trader

- Digital asset
- Varying valuation models
- Friction
- Fractional
What is a token? Technologist

- Rules (“smart contract”)
- Asset
Token Valuation

- Bitcoin - Unfettered standard deviation %ch
- Stablecoin - Fettered standard deviation %ch
- Everything in between
- Omid Malekan & Dan Raykhman
Public / Private Chains

- Blockchain diffusion
- Todd McDonald
- Naeim Yaganeh
Private Market Valuation

- Public reference
- Beta, multiples, ratios
- Compcos, etc.
What is an enterprise token?

- Internal economy
- Awarded / Traded
- External liquidity
- Public market reference
- Public market redeemability
Enterprise token: Basic architecture
Underlying assets

- Cash
- Stablecoins
- Enterprise’s STO (Samson Williams, Eilon Shalev, Maureen Murat, Joshua Jahani)
- Enterprise’s debt (Michael Mazier)
- Real estate (Alan Donenfeld)
- Public equity (Mike Naylor)
- R&D IP (Sean Manion)
- Other cryptos
- Why?
  - Transparency
  - Cash in enterprise is not transparent
- Custodian (Grace Shroeder)
Challenges

- Cross chain
- Atomic transactions
- External redemption
Use Case: Performance Management
Use Case: Performance Management

- AI + IoT to track behavior
- Extreme fractionalization of $1
- Streaming “compensation”
- Enterprise wallets
Thank You

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Tokenized Security Offerings and Crowdfunding

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Bio

Principal, Axes And Eggs - A Think Tank & Digital Advisory

Adjunct Professor, University of New Hampshire School of Law - Blockchain, Cryptocurrency & Law

Instructor, London School of Business & Finance - Blockchain, Fintech & Cash Management Systems

Deputy Chief of Staff, Fannie Mae - Ops & Tech Executive Office, 2008 - 2016

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Things You’re Getting Wrong about STOs:

1. Security Tokens exist
2. You're not crowdfunding
3. Lockup periods can be avoided
4. You can trade STOs today
5. Crowdfunding rules for securities don’t already exist
6. You’ll make more money selling your security as a “token”
DACS: Digital Assets, Commodities, Securities
Thank You

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Tokenizing Real Estate

Alan Donenfeld
CityVest
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Bio

Alan Donenfeld has 40 years of experience as a financial services entrepreneur. He founded several investment and financing companies as well as investing in and advising on over $3 billion of deals.

Founder and CEO of CityVest, an online investment marketplace for real estate private equity funds. Alan oversees all investment, technology and administration of the company.

Founder and General Partner of Paragon Capital, a private investment fund focused on making structured debt and equity investments.

Founder and President of Bristol Investment Group, an SEC registered / FINRA broker-dealer.

In the 1980’s, for 10 years he worked in private equity for Bear Stearns and Lehman Brothers.

MBA from the Fuqua School of Business at Duke University and a BA from Tufts University.
The Opportunity: Massive Markets Meet

Real Estate

$1.5 Trillion
Global Real Estate
Transactions Annually

Tokenization

Digital Assets

$200 Billion
Global Cryptoasset
Market in 2018
The Problem With Real Estate

- Difficult to trade
- Requires significant capital
- Barriers to access
- Historically opaque market
- Illiquid
- Difficult for individuals to analyze
- Difficult for individuals to access
- Highly localized expertise
The Solution: Tokenization

- Tokenized Real Estate is a Backed by Assets
- Tokenized Securities are Liquid & Tradeable
- Transparency, Security & Fraud Protection
Combining Crypto, DLT and Real Estate

- Tradability
- Programmable Securities
- Asset Backed Liquidity
- Access
- Transparency
- Efficiency
- Reduced Costs

Digital Securities and Tokenization

- CRYPTO
- REAL ESTATE
- TECHNOLOGY
  - Blockchain, Data, DLT

The Solution: Tokenization
# Benefits of Tokenization and Digital Securities

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<tr>
<td><strong>COMPLIANCE</strong></td>
<td>Built-in programmable regulatory compliance at the token and protocol levels</td>
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<tr>
<td><strong>LIQUIDITY</strong></td>
<td>Access to global markets 24/7/365</td>
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<td><strong>EFFICIENCY</strong></td>
<td>Eliminate friction and middlemen, immediate trades/pricing and lower costs</td>
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<td><strong>FRACTIONAL OWNERSHIP</strong></td>
<td>Lower barriers to entry creates more investors and more liquidity</td>
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<td><strong>PROGRAMMABLE SECURITIES</strong></td>
<td>Self-executing governance and investor/issuer rights such as dividends, buybacks and cap table management</td>
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<tr>
<td><strong>TRANSPARENT &amp; IMMUTABLE</strong></td>
<td>Providing more direct and certain ownership to investors</td>
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1. Type of Interest is Being Tokenized

• Direct ownership in the equity or debt of an asset
• A fund holding one or more real estate assets
• REITS aka T-REITS
2. Legal Domicile

• Physical location of the asset is crucial to the valuation and long-term viability of the asset.
• Property rights are strong in the US, and will vary by jurisdiction.
• SwissRealCoin (CH), Evareium (UAE), IHT (China), MonacoEstate, etc.

3. Corporate Structure and Governance

• How is the equity structured? Corporation, partnership, other.
• Who are the officers?
• How to handle: voting rights, liquidation of assets and distributions?
Strategic, Legal and Technical Considerations

4. Capital Raise through Issuance Platform or Issuer Direct
   • Investor onboarding and management, KYC/AML, aftermarket support

5. Exchanges and Secondary Trading
   • Which exchanges will be online, registered and capable of transacting with the token by the time minimum lock-up periods expire?
   • How do they integrate with each other?

6. Token Custody
   • Various institutional custody solutions are in early stages of commercial use. Which are the most trusted and reasonably priced?
   • How will token holders conveniently maintain access?
   • What happens if private keys are lost?
Strategic, Legal and Technical Considerations

7. Securities Regulation

• For U.S. sales, tokens will need to be registered as securities through the SEC with placement under Reg D, Reg S or Reg A+ offerings.
• International offerings must comply with local securities regulation. (FINMA, MAS, FSA)

8. Tax Implications

• Issuers must be aware of any tax and reporting requirements they may incur.
10. Timing and Budget

• Issuers will need to ensure they are sufficiently capitalized to weather unexpected complications.
• The process can take anywhere from 3-9 months, with roadshow and investor relations consuming a major proportion.
• To what extent can broker dealers assist with this part and how will they be compensated?
**Common Ethereum Token Types**

**ERC-20**
- The prevailing standard, most commonly used for ICOs.
- Only allows for one issuance event.

**ERC-721**
- Non-fungible Standard
- Enables verifiably unique digital assets (for ex. Cryptokitties and other collectibles)

**ERC-1440**
- Security Token Standard
- Provides a suite of standard interfaces for issuing / redeeming tokens, managing ownership and transfer restrictions.

**ERC-1410**
- Adds security specific metadata that renders token partially fungible
- Allows programming different parameters for direct ownership of individual assets such as Real Estate
Tokenized Real Estate Deals So Far

1. Tokenized REIT: Aspen St. Regis Hotel
   • Sponsor/owner was Elevated Returns
   • Offered through Templum Markets
   • The St. Regis Aspen Resort is a trophy property and a luxury tourist destination
   • A token sale in the Fall of 2018 brought in $18 million for at a $100 million valuation of the equity.
   • The cap rate is reported to be 5.8 percent
   • This was security token offering using Reg D 506c (general solicitation)
   • Tokens represent 18.9% indirect ownership of the corporation that owns the asset
   • Tokens constitute common shares in REIT with voting rights (tokenized common equity)
   • It is believed that a group of Chinese investors contributed most of the capital in the deal, rather than crypto investors buying the tokenized equity.
2. Tokenized REIT: Student Housing Apartment in South Carolina

- Sponsor / Owner: Convexity Properties
- Offering through Harbor
- $20M of tokenized equity capital: T-REIT
- 49% equity ownership
- 955 shares – represented by 955 tokens
- Available at minimum investment of $21,000 each token
- The 14-floor, 500,000 square-foot facility includes 260 apartment units with over 800 beds, 4,000 square feet of street-level retail, 6,000 square feet of leased commercial space, 150,000 square feet of parking and common space
- BitGo is the custodian of the asset
3. Direct Ownership Interest: NYC Condo Development

- Issuance by Propellr and Fluidity's AirSwap
- $36.5 million appraisal, minimum investment is $25,000
- 12 Unit Condo in Manhattan
- Reg D 506c offering
- Investors will have the option of receiving either analog or digital securities
- Investors will be entitled to a preferred return and profit participation
- AirSwap technology will be utilized allowing for a compliant secondary market trading
Digital Securities – Growing Pains

**Investor Onboarding**
- KYC
- AML
- Accreditation
- Regulatory compliance in multiple jurisdictions

**Token Issuance**
- Smart Contracts
- Issue tokens to wallets
- Collect funds and enable issuer withdrawal
- Custodian and Escrow Services

**Ownership Lifecycle**
- Manage token ownership rights
- Distribute returns such as dividends or buybacks
- Manage governance such as voting

**Compliance and Liquidity**
- Comply with secondary marketplace trading rules
- Integrate with Exchanges
- Ensure compliance with securities regulations
- Record and trace ownership
Smart Contract and Token Technology

Technology to enable the issuance of digital securities.

Securitize
Polymath
Securrency
Civic
KoreConX
Prime Trust
Exchanges and token marketplaces are in place to provide liquidity.

Liquidity will be a key differentiator for tokenized / digital securities.
The Future of Tokenization

**LIQUIDITY** and ACCESS
Marketplaces and Secondary Trading Exchanges

**EFFICIENCY AND REDUCED COSTS**
Investor Onboarding and Token Issuance Technologies

**COMPLIANCE AND PROGRAMMABLE SECURITIES**
Security Regulations, Governance and Transparency
Thank You

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Tokens & Securities: Regulatory Challenges Beyond the Howey Test

Maureen Murat
Crowdie Advisors
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5 Things SEC Wants You to Know About ICOs

ICOs can be securities offerings.

They may need to be registered.

Tokens sold in ICOs can be called many things.

ICOs may pose substantial risks.

Ask questions before investing.

@CrowdieAdvisors
The definition of “commodity” in the Commodity Exchange Act (CEA) is broad:
— Physical commodity, such as an agricultural product (e.g., wheat, cotton) or natural resource (e.g., gold, oil).
— Currency or interest rate.

In 2015, Bitcoin and other similar virtual currencies were determined commodities by the CFTC. CFTC determined that because as defined, commodity includes: among other things, "all services, rights, and interests in which contracts for future delivery are presently or in the future dealt in," the CFTC’s jurisdiction is implicated when a virtual currency is used in a derivatives contract, or if there is fraud or manipulation involving a virtual currency traded in interstate commerce.

Internal Revenue Services - IRS
In 2013, FinCEN issued an interpretive guidance to clarify which regulations pursuant to the Bank Secrecy Act ("BSA") are applicable to persons/companies creating, obtaining, distributing, exchanging, accepting, or transmitting virtual currencies.

In it, virtual currency defined as a medium of exchange that operates like a currency in some environments, but does not have all the attributes of real currency.
Tokenizing the Equity of Private Companies

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Bio

Michael Naylor, Managing Director at Edgewater Markets, has over 30 years of experience in financial services sales and marketing, introducing innovative products and developing new markets. Mike helped launch the first electronic inter-bank fiat matching system at Dow Jones Telerate and lived and worked in Asia and Europe opening new markets as Chief Marketing Officer for Standard & Poor’s. Mike holds a BA in Economics from Rutgers University and an MBA in Finance and Int’l Business from NYU Stern School of Business, with studies at The Hong Kong University of Science and Technology.
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Security Tokens – General Overview

- Tokenization was popularized by initial coin offerings (ICOs).
- Security Tokens involve issuing digital tokens on a distributed ledger that represent fractional ownership of an underlying financial asset.
- Traditional “securities” are financial instruments, such as stocks (equity) and bonds (debt), which can be tokenized.
- Other assets, not considered “securities” traditionally, including real assets, such as real estate and art, and commodities, such as gold and foreign exchange, can also be tokenized.
Private Placements

- Securities such as equity or debt sold directly to private investors, rather than as part of a public offering, are considered “private placements”.
- Many private companies raise equity capital prior to going public thru private placement of shares.
- Private placements are subject to regulations that limit the number and type of investors that can buy shares.
- When raising money, a private security issuer typically specifies the terms of the securities in a Private Placement Memorandum (providing details regarding the company’s business, use of proceeds, the price and timing of the transaction and shareholder rights among other information).
- In the past, privately owned securities have been illiquid as they have not had easily accessible secondary markets.
“Tokenizing” Assets

- Tokenization of assets, whether traditional financial securities, real assets, commodities or private placements, has the promise of enabling any asset to be traded like a traditional security on digital exchanges.

- Some of the advantages of tokenization include:
  - Lower cost issuance as compared to traditional capital markets
  - Automated compliance thru programmable “smart contracts”
  - Improved transparency and accuracy of ownership records
  - Efficient investor management, including streamlined payment of dividends, buy-backs, communications, etc.
  - Increased accessibility thru fractional ownership, global reach and 24/7/365 availability
Regulations

- Regulatory frameworks in the US such as Regulation D, Regulation S, Regulation A+, and Regulation Crowdfunding apply to the issuance and sale of securities.

- The regulations regarding selling securities are designed to protect investors with limitations on:
  - who can sell securities, for example US broker-dealer or FCA regulated brokers in the UK
  - who can invest in securities offerings, for example US accredited investor or EU sophisticated investor rules
  - who can run a marketplace, for example USA ATS license or EU MTF license

- Many STO’s are set up as private placements which are not open for the general public, to avoid the heavy regulation associated with publicly listed securities.

- Reg D 506(c), which is limited to accredited investors, requires a 12-month lock-up when investors are not allowed to sell or transfer their shares, but afterwards the shares can be freely traded.
Tokenized Private Company Equity

- Tokenized equity is simply issuing traditional private placement equity in the form of a digital security token.
- Tokenizing a private company's equity provides advantages over traditional fund raising including:
  - Lower cost of issuance
  - Automated compliance via smart contract
  - Efficient shareholder management and transparency via blockchain
  - Liquidity via listing on security token exchange
  - Interoperability via blockchain standards (for example, ERC-20)
  - Borderless 24/7/365 access
Anatomy of an Equity STO

- Reg D 506(c) Private Placement, offering equity in a private company.
- Available to accredited investors only.
- Delaware (US) company registration.
- Offering an opportunity to purchase a Simple Agreement for Future Equity (SAFE), which secures the right to acquire shares (equity) in a private company at a later date.
- The SAFE is considered a prepaid forward contract for tax purposes.
- After the offering is complete the SAFE terminates and the investor holds uncertificated shares in the company in the form of tokens or book-shares.
Why SAFE

- Share price and company valuation agreed up front.
- *Issuers can close with an investor as soon as both parties are ready to sign and the investor is ready to wire money, instead of trying to coordinate a single close with all investors simultaneously.*
- Both founders and investors have more certainty and transparency into what each side is giving and getting
- Issuer receives funds sooner, has more time to establish shareholder management processes and issue the tokens properly.
- Investor lock-up begins when they execute the SAFE and provide investment funds.
Plan for Tokenizing

- Provide investors with option of receiving either analog or digital interests in the securities.
- Arrange for issuance of the token on Ethereum blockchain (ERC 20).
- Develop smart contract.
- Establish compliance, reporting and shareholder management functions.
- Identify security exchange(s) and market maker(s) for trading post lock-up period.
- Establish policies for maintaining the number of investors post-lockup period (non-accredited and total number of investors).
Timing of Equity Issuance

- After the offering is complete/terminated, within 90 days shares are issued, either in token form or uncertificated book-shares.
- “Certificate of Designation” filed with Corporate Register in Delaware, which contains the terms of the shares.
- Arrange for the transfer of the digital assets.
- After the lock-up shares are freely tradable on a “designated exchange” (determined by company management).
Thank You

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EDGEWATER COIN
How to move tokens across chains

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Bio

As a computer scientist specializing in distributed database systems, Naiem is dedicated to solving the most complex and fundamental problems in the blockchain and cryptocurrency sector. Naiem obtained his PhD in Computer Science from University of Queensland in Australia, and has been developing massively scalable distributed systems as an engineer and machine-learning expert throughout the last decade, most notably at Microsoft, Amazon, and Bloomberg. Taking these skills and experiences, he built Ferrum Network, a entirely new kind of decentralized interoperability network, from the ground up. Naiem is no stranger to entrepreneurship. He sold his first software package before high school, and he founded and ran a computer game company from 2001-2005, selling thousands of units.
The decentralized trust

- The #1 innovation of bitcoin was to decentralize trust.
- For the first time in history human has access to a technology that eliminates need to trust
- What are the notable business models of trust?
  - Governments
  - Banking system
  - Crediting system
  - Education certificates, bachelor, master, PhD, etc.
  - Corporations
- First / easiest application of decentralized trust:
  - Tokens that can represent some sort of value
ERC-20 vs chuck e cheese tokens

- Issuing tokens representing values is not new
- Preventing counterfeit has never been easy
- Legal hurdles, need of trust, lack of market for tokens prevented emergence of a token economy

ERC-20 as a standard to facilitate token economy

- Trust is provided by Ethereum blockchain.
- Very hard to counterfeit
- Standard interface means tokens can be easily traded using popular tools
- Global reach and lack of central agency meant regulators cannot just shut down the economy
Token standards

Standardization provides means for systems to be implemented once yet interact with all tokens

- ERC-20, ERC-223, ERC-721, And ERC-777
- Each standard defines an API (Application Programming Interface)
- API allows standard interaction with the token program:
  - Create or burn tokens
  - Move ownership
  - Get balance
  - etc.
Example: ERC-20

```
//  -------------------------------
2 //  ERC Token Standard #20 Interface
4 //  -------------------------------
5 contract ERC20Interface {
6     function totalSupply() public view returns (uint);
7     function balanceOf(address tokenOwner) public view returns (uint balance);
8     function allowance(address tokenOwner, address spender) public view returns (uint remaining);
9     function transfer(address to, uint tokens) public returns (bool success);
10    ...
11 }
```
The great wall between networks

- Token standards are limited to one network
  - E.g. Ethereum Network
- Different networks cannot interact
- A token in the Ethereum network cannot be moved to the Bitcoin network

Could there be standard for networks such as standards for tokens?

- In theory, yes. In reality much harder
- Most important networks already exist and cannot be easily changed
- Communities of networks don’t have a lot of motivation to join a standard
- It might / will happen in future
- Unlike token standards, existing interconnectivity standards are not loved
Flashback - Why so many networks?

- Bitcoin was a great means of transaction, but was limited otherwise
- Ethereum envisioned a universal unstoppable computer that can run any program
- Other networks (e.g. Zcash) wanted to make transactions impossible to track

Major problem of all networks

- They all failed at scaling
- Bitcoin transactions became expensive and slow with more people using Bitcoin
- Many others tried to solve the scaling problem, hence TPS (Transactions Per Second)
What is Proof of Work?

- Blockchains are open so everyone can create their own version of reality and present it to others.
  - The reality here means which transaction happened before another.
  - The famous double spend problem
- To ensure there is only one version of reality the proof of work was invented
  - Transactions get confirmed by people who solve pointless math problems
  - The math problem is designed such that there is no shortcut to solve it other than hard work. Being smart, rich, or famous doesn't help either
  - But it is very easy to verify the solution. For example, finding a needle in haystack. Once you found it it is easy to verify you did. Just show us the needle
  - As the time goes on more and more problems are solved and results accumulate
  - For a bad actor to create an alternative version of reality, they should work infinitely hard, so it doesn't make sense.
What is Proof of Stake?

- Proof of work is very expensive
- A lot of electricity is used to solve those math problems
- Bad for environment
- Doesn’t scale

Alternative, Proof of Stake

- It’s like American democracy.
- If you are in the system and hold the currency, your vote counts
- If you hold a lot of currency, your vote counts more than others
- Reasonable compromise to PoW as long as stake is fairly distributed
- But less secure
Proofs of ...?

- Delegated proof of stake
- Proof of time and space
- Proof of useful work
- Proof of reputation
- Proof of capacity
- Proof of elapsed time

Many networks with different protocols
Moving tokens across networks

Necessary for adoption

- If we move Bitcoin to a fast and cheap network, we can use it as currency
- If we move XRP to a network with smart contracts we can use it in a decentralized application
- If we have access to other tokens in the network we use for payment, we can pay using those currencies
- If we move tokens across networks, we can exchange values freely
Middle man - the traditional way

- A middle man holds tokens from both sides
- User interacts with the middle man
- Middle provides the service user wants for an exchange of fee
- Middle man must be trusted
- Middle man can go bankrupt, steal the value, get hacked, be subject to regulation
- This is how the world has worked so far

Examples:

- Coinbase
- VISA
- Hedge funds
Removing the middle man - no trust necessary

- In a decentralized trustless world there is no room for middle men
- Users can interact peer to peer
- An auditable, unchangeable program can be the middle man
- Middle man can become decentralized itself. No single entity ever has custody
- There could be a middle man but no trust needed due to mathematical magic
Off chain transactions - Lightning network

- A cryptographically secure method to move transactions off-chain
- This means people can do transactions peer-to-peer or middle man without blockchain
- No need to trust anyone.
- Protocol ensures that in worst case scenario no-one’s assets can be stolen
- Blockchain as the back-off mechanism
  + No blockchain needed for transactions, hence very scalable
  + Trustless
  - Transactions not happening on blockchain
  - Long term locks required on assets
  - Complicated and not applicable to all networks
Atomic Swap

- Swap two assets without third-party risk
- + No trust
- - Slow and expensive

Image from hackernoon.com
Proxy Tokens

- Token in one network represents tokens in another
- Money vs Travel Check
- Hard to make it trustless
- + Can be very fast
- + Proxy tokens can be created in bulk, hence minimizing the exposure to original assets
- - Very hard to do trustless
- - Most current solutions are centralized or semi-centralized
Decentralized Proxy Tokens

- In development
- Check [https://ferrum.network](https://ferrum.network)
- We can make the proxy tokens work without a need to trust a third party
- + Can be very fast and cheap
- + No need for smart contract, hence can cover almost all networks
- - No production solution available yet
World with isolated networks - before picture

- Hundreds of currencies do not interact
- Users need to use countless apps and tools
- Users need to be very sophisticated to navigate through all the tech
- Massive centralized exchanges (Coinbase, Binance, etc.) rule the crypto world
- Applications are limited by networks they can use
- Users need to choose which cryptocurrency they want to work with.
World with connected networks - After picture

- Hundreds of currencies can interact
- No need for centralized exchanges
- Assets can be changed freely without third parties
- Applications can use multiple networks
- Businesses can accept their favorite cryptocurrencies and be paid in any
- Adoption of cryptocurrencies for day-to-day use cases becomes more likely.
Thank You

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Linkedin: https://www.linkedin.com/in/naiem-yeganeh-12874712/
Peer-to-peer bond trading and tokenizing debt

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Bondirectly
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Michael F. Mazier, Founder & Chief Architect, Bondirectly

- Blockchain/ICO/STO advisor for Lampix, Opiria, dxDigital and others
- Co-Founder, LendingCalc analytics platform
- Chief quantitative strategist & portfolio manager of $5bn in assets at Van Eck Global
- Bond analyst/IT at Morgan Stanley, Merrill Lynch, Citibank
- Electrical engineer/artificial intelligence researcher at General Electric Aerospace
- MBA Columbia, MSEE Villanova, BSEE Syracuse
What is Bondirectly?

For institutional investors who pay huge markups trading odd-lot bonds, we’re building a cryptographic peer-to-peer trading network so they can pay near zero markups while preserving privacy.
Problem

Small bond investors and large investors with odd lots pay more than 10X in brokerage costs compared with stock investors.

Discovery process

Legacy Business model

Re-engineer

Blockchain (strictly digital)
- verify
- tokenize

Off-chain/Interface
- Browsers
- wallets
- cybersecurity

Off-chain/real world activities
- regulation
- settlement
- custody
- “last mile”
Solution

secure peer-to-peer trading network using cryptography/encryption for investors to trade at mid-market prices while preserving privacy
Market Size

Preliminary Data: Global bond market size is $100 trillion

Source: JPMorgan as cited in zerohedge.com

Source: Bank for International Settlements and World Federation of Exchanges as cited by Financial Pipeline (www.finpipe.com)
Total Addressable Market

US retail bond investors pay a conservatively estimated $33 billion per year in markup fees (corporate and municipal bonds only). Institutional odd-lots are additional

<table>
<thead>
<tr>
<th>Bond Type</th>
<th>2017 Trading volume ($Billion)</th>
<th>% held by retail</th>
<th>retail markup</th>
<th>Total fees ($Billion)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Municipal</td>
<td>2,700</td>
<td>45%</td>
<td>1.60%</td>
<td>19</td>
</tr>
<tr>
<td>USTreasury</td>
<td>126,300</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agency MBS</td>
<td>52,275</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>non-Agency MBS</td>
<td>625</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ABS</td>
<td>350</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corporates</td>
<td>7,675</td>
<td>20%</td>
<td>0.90%</td>
<td>13.9</td>
</tr>
<tr>
<td>Federal Agency Secs</td>
<td>1,025</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emerging Markets</td>
<td>4,901</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>196,851</td>
<td></td>
<td></td>
<td>33.2</td>
</tr>
</tbody>
</table>

Why Now?

- Markup disclosure rule effective May 14, 2018
- MiFID II in Europe increases transparency, data
- Voluntary Fiduciary Rule “best interest” adoption
- Electronic trading is gaining ground among institutional investors, but not for small trades. 80% of trading volume is still over phone/chat
- Blockchain-related solutions are cautiously gaining mindshare in the regulated investment world
## Competitive Landscape

<table>
<thead>
<tr>
<th></th>
<th>embonds.com</th>
<th>tmc</th>
<th>Tradeweb</th>
<th>MarketAxess (MKTX)</th>
<th>trumid</th>
<th>FIC Network</th>
<th>bondirectly</th>
</tr>
</thead>
<tbody>
<tr>
<td>notes</td>
<td>emerging markets focus, $8.3m funding</td>
<td>privately held focus on munis</td>
<td>Thomson Reuters subsidiary; $430bn daily volume globally</td>
<td>$7.5bn market cap</td>
<td>funded $84mn by Soros, Thiel et al; focus on high yield</td>
<td>tokenizing bonds on blockchain (ICO raise targeting $16m)</td>
<td>startup w/ patent pending</td>
</tr>
<tr>
<td>annual revenue</td>
<td></td>
<td>est. $10-25m</td>
<td>not disclosed</td>
<td>$397 mil</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>peer-to-peer</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>no (some all-to-all)</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>encryption to preserve privacy</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>software-as-a-service</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>yes</td>
</tr>
</tbody>
</table>
Trade at 3rd party mid-price (based on ETF in-kind process)

Step 1. Place orders for execution at 11AM, 4PM
- Buy 1000 ven 12.75 '22
- Sell 600 ven 12.75 '22

Step 2. Orders matching before 11AM, 4PM
- Rules-based matching engine (operates on encrypted data)

Step 3. at 11AM, 4PM all trades done at uniform mid-price from third-party
- 3rd Party Pricing
- Clearing Broker (counter-party on all trades)

Send trade confirms to all buyers’, sellers’ backoffice
Product

Uniform Price Double Auction (based on Vickrey Auction)

Step 1.
Place bids or asks for auction at periodic times of day

Step 2.
compute uniform price at end of each period

Step 3.
matched trades done at uniform mid-price after each auction period subject to rules

Clearing Broker (counter-party on all trades)

send trade confirms to all buyers’, sellers’ backoffice
Business Model

Software-as-a-service model

Broker-dealer partners are counter-party for risk-less trade

User trades at mid-price + lowest transaction costs available from clearing broker-dealer

Initially test/focus on one market (Credit Risk Transfer Bonds)
Thank You

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Security Tokens: Reinventing 50 years of financial services.

Grace F. Schroeder
OKTO
www.okto.io
grace@okto.io
Bio

Grace founded OKTO in 2010 and raised $3.5M in Angel financing including a sizable investment from Britt Banks, Chair of the World Economic Forum for Sustainable Mining.

Prior to OKTO, Grace was the Senior Director of Channel and Field Marketing at Qwest Communications where she negotiated the first North American carrier agreement to integrate Microsoft’s fledgling Hosted Messaging & Collaboration (now LYNC) platform with Voice over IP delivered by Qwest.

From 2000-2002, Grace launched two managed hosting startups in Chicago IL that featured an EMC data-centric architecture that later informed the design of the OKTO platform. From 1998-2000, Grace founded GO Trading in Los Angeles, CA which she grew from 1 to 5 branches and $3M in annualized revenue.

From 1995-1998, as Vice President of Variable Annuities, she helped design and launch the Transamerica/Dreyfus Triple Advantage Variable Annuity which she grew from launch to $400M in the first 12 months, and then launched the successful Charles Schwab Variable Annuity. Prior to Transamerica, Grace managed a retail client base for Shearson Lehman Hutton, and was responsible for the Northern California territory for John Nuveen & Company where she helped launched the first closed-end bond fund, raising $1.2B in 1987.

Grace has a BA in Psychology from San Francisco State University and has attended executive education programs at the Center for Creative Leadership in La Jolla, CA., Harvard University and Northwestern/Kellogg.
THE RAPID MIGRATION TO DIGITAL SECURITIES REQUIRES REINVENTING 50 YEARS OF FINANCIAL SERVICES SYSTEMS IN FIVE

Stocks/Bonds/Real Estate

Security Tokens

Nasdaq  NYSE  OTC  tZERO  SHARESPOST  RIALTO  POLYMATH  FundAmerica  seedinvest  NORTHCAPITAL  token  Computershare
LAUNCHING A SECURITY TOKEN REQUIRES THE TIGHTLY COUPLED EFFORTS OF ISSUERS, LAWYERS, BROKER/DEALERS, MARKETING AND MONEY SERVICES
BLOCKCHAINS AND TOKEN PROTOCOLS REDEFINE TRADITIONAL ROLES AND SYSTEMS REQUIREMENTS

DISTINCT TECHNICAL METHODS TO OPERATE

Blockchains
Smart Contracts
Features
Modules
Whitelists
Wallets
Balances
Transfers
Reporting
EVERYONE IS NAVIGATING NEW TECHNOLOGY IN THE FACE OF PERSISTENT CHANGE
THE UNIVERSE OF SECURITY TOKEN PROTOCOLS AND WHITELISTS INFRASTRUCTURE IS EVOLVING IN AN EFFORT TO AUTOMATE SEC COMPLIANCE

SECURITY TOKEN PROTOCOLS
Security tokens are smart contracts represented by code that is deployed on a blockchain to manage the features of a security.

A growing number of service providers offer security token templates, automated token deployment, and whitelists that simplify the process of launching a security token.

WHITE LISTS
Whitelists govern the universe of investor wallets who are allowed to invest and trade security tokens. Each security token “consults” a whitelist before allowing a transfer of tokens to a given wallet address. The whitelist contains wallet addresses that are associated with investors who have passed relevant accreditation and/or KYC/AML screening requirements.
WHILE SMART CONTRACTS CAN TECHNICALLY HANDLE THE DETAILS OF COMPLIANCE, THE SEC STILL FAVORS THE INVOLVEMENT OF REGULATED INTERMEDIARIES

Factories addresses

These are the current contract addresses of the factories on Ropsten:

- SecurityTokenFactory => 0x90A72de8A74d04bdC11c66429bcDeDa9C7870e70
- RestrictSenderTokenModuleFactory => 0x83d07312CE1d15832791574b8200856731e9bF80
- KYCTokenModuleFactory => 0xA1F2CDe2DFeef1C7Fe4E51664A7fDE47fCE6747
- InvesteorsLimitTokenModuleFactory => 0xBaF429c680E211e38681123f01f8eFE979a04
- SupplyLimitTokenModuleFactory => 0x1C7a97e8DD083dd6b41BC271F7c73568696d05E9
- ForcedTransferTokenModuleFactory => 0xF0C52bf4A70682F8445E2927837769959e3
- OfferingTokenModuleFactory => 0xA96bd1C23cF320BF4547e0333923437C2716d
- WhitelistFactory => 0xEB69F4783EfEF5640e076447F6Fd723CFeb97f
- StandardWhitelistFactory => 0x72597371C54642843e665946CE361600F5014
- MultiSigWalletFactory => 0x6f6db6f85012c57a2789860ad27eee8be7821d8e

Free OKTO Protocol (GitHub)

Libraries:

- AddressArrayLib => 0x3C904f91aB8c45195f33D0b5336c8C20Ba6cBe242
- Bytes32ArrayLib => 0x447368a37e030480875E0f825e027991AbC73f4E
BUDGETARY ESTIMATES FOR A SECURITIES TOKEN

REG A REGISTRATION: $125K-$350K
TOKEN DEVELOPMENT: $10K - $50K
TRANSFER AGENT: $10K SETUP + $5K/MONTH
OFFERING AUTOMATION: $50K SETUP + 3% OPTIONS + FEES
BROKER/DEALER: 1%-8% DEPENDING UPON SERVICES
MARKETING: VARIABLE
Thank You

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Fiat Stablecoins: The Oldest New Idea in the World

Omid Malekan
Citi Ventures & Conversance
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Bio


Blockchain Innovation Expert @ Citi Ventures

Explainer-in-Chief @ Conversance

www.explainer-in-chief.com
Fiat Stablecoins

“First killer application on blockchain”

“Worst blockchain idea ever”

“Stablewha??......worst banking idea ever”
Definition

Fiat Stablecoin: A fully collateralized, transferrable and programmable digital token that could be redeemed for fiat money.
The New

- tether
- TrueUSD
- GEMINI dollar
- PAXOS STANDARD
- Stably
- USD Coin
“..it is not obvious that the model will scale, or that governments will let it.”

- Barry Eichengreen, Professor of economics at Berkeley

“Fiat stablecoins are too centralized, too censorable, and promote evil fiat money that this tech was invented to replace in the first place”

- Generic hardcore crypto guy
The Old
Definition

Traditional Payments: A fully collateralized, transferrable and programmable *thingie* that could be redeemed for fiat money.
The Current

Wires <> SWIFT <> ACH <> ABA <> FedWire
How We Pay

Fact: Most payments are not done in physical cash, but with cash proxies held at institutions.

Fact: In 2017, global payments industry revenues hit $2T (McKinsey)
Fiat Stablecoin

The least controversial idea in all crypto, applying new technology to a very old idea.
But Why?

- First Truly Global Payment System
- Speed
- Cost
- Accessibility
- Simplicity
Old Payment System vs. New
## Speed

<table>
<thead>
<tr>
<th>Type of Payment</th>
<th>Settlement Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper Check</td>
<td>5 days</td>
</tr>
<tr>
<td>ACH</td>
<td>2 days</td>
</tr>
<tr>
<td>Wire</td>
<td>1 day</td>
</tr>
<tr>
<td>Fiat Stablecoin</td>
<td>Minutes - Seconds</td>
</tr>
<tr>
<td>E-pay (PayPal, Venmo, etc)</td>
<td>Instant</td>
</tr>
</tbody>
</table>
## Cost

<table>
<thead>
<tr>
<th>Method</th>
<th>Fee ($1 million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PayPal (merchant)</td>
<td>$29,000</td>
</tr>
<tr>
<td>Transferwise</td>
<td>$600</td>
</tr>
<tr>
<td>Fiat Stablecoin</td>
<td>A few cents</td>
</tr>
</tbody>
</table>
# In the Crosshairs

<table>
<thead>
<tr>
<th>Company</th>
<th>Market Cap</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visa</td>
<td>$300b</td>
</tr>
<tr>
<td>PayPal</td>
<td>$100b</td>
</tr>
<tr>
<td>Adyen</td>
<td>$23b</td>
</tr>
<tr>
<td>Transferwise</td>
<td>$2b</td>
</tr>
</tbody>
</table>
The Beneficiaries

- Gas Stations
- Retailers
- Low Margin / High Frequency Commerce
- Micropayments
- Small Business
- You!
- The Crypto Industry
The Endgame

Thanks to Fiat Stablecoins, we are now on the fast track to a world where payments are free.

All payments.

From anyone anywhere to anyone else anywhere else.
How is that possible?

“Long distance is still the most profitable business in America, next to importing illegal cocaine.”

- CEO of Qwest Communications, 1997
  (while introducing 7 cents per minute)

“They say it couldn’t be done” 1977 TV ad for 70 cents per minute
Conclusion

A payment is nothing more than data, and data wants to be free, both physically and financially. Fiat stablecoins, and the decentralized, global and public blockchain rails they employ, will help realize that dream.
P.S.

Bitcoin: A Peer-to-Peer Electronic Cash System

Satoshi Nakamoto
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www.bitcoin.org
Thank You

Omid Malekan

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Preliminary SWOT analysis for STOs

Eilon Shalev
elphi, Inc.
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Bio

12.5 years in multiple commanding-officer positions in the Israeli Air Forces

PM @ heastart.co.il | The Leading Israeli Crowdfunding Platform

MBA @ MIT Sloan

Founder @ elphi, Inc.
What is a security?

Investment Contract

The HOWEY test

1. An investment of money or assets
2. In a common enterprise
3. With an expectation of profits
4. Predominantly from the efforts of others

ICOs - securities?

How do we record a $15mm ICO in the company books: 

\[ A = L + E \]

\[ $15mm \text{ (Cash)} = ? + ? \]
What is Money?

A Social Agreement of

1. Medium of exchange
2. Store of value
3. Unit of account

Cryptocurrencies - are they really currencies?
Medium of Exchange

Anything that is used to determine value during the exchange of goods and services
Store of Value

Something that keeps its value if it stored rather than used
Unit of Account

Something that can be used to value goods and services, record debts, and make calculations

How many BTC / Satoshis for?
STO

Financial securities that mimic traditional shares

Security Tokens give investors some rights to the company

Traditional process of an IPO

So, why do we need STOs?
Strengths

1. The value of the company is commensurate with the value of the token

Weaknesses

1. Register just like an IPO - expensive (4-7% + $4mm)
2. Report like a public company - less flexible
3. A white paper is not enough - blockchain companies are not ready yet
4. Business logic behind STOs is unclear

Opportunities

1. Easy to raise money? - Investor FOMO
2. Establish brand in a blue ocean

Threats

1. Comply with SEC regulations - risk
2. Affected by how the market perceives STOs
Thank You

Feel free to reach out for any inquiry

eilon@elphi.io
Digital Assets & Security Tokens: Three blockchain revolutions... for the price of one?

Todd McDonald
R3
R3.com & corda.net
todd@r3.com
Bio: Todd McDonald

In my previous life, I was an FX Trader
(~15 years at Standard Chartered Bank)

In 2014/15, I helped co-found R3. I have held a lot of roles in that time:
Head of Product, Head of Partners, Head of Digital Assets...

R3 is an enterprise blockchain company that has built the open source blockchain called Corda, which has an ecosystem of over 300 firms, across financial institutions, insurance companies, technology giants, systems integrators, ISVs and fintechs, to name a few.
Revolution 3: a new, more peer-to-peer capital market?

BITCOIN AND BLOCKCHAIN: TWO REVOLUTIONS FOR THE PRICE OF ONE?
Bitcoin: A Peer-to-Peer Electronic Cash System

Satoshi Nakamoto
satoshi@gmx.com
www.bitcoin.org

Abstract. A purely peer-to-peer version of electronic cash would allow online payments to be sent directly from one party to another without going through a financial institution. Digital signatures provide part of the solution, but the main benefits are lost if a trusted third party is still required to prevent double-spending. We propose a solution to the double-spending problem using a peer-to-peer network. The network timestamps transactions by hashing them into an ongoing chain of hash-based proof-of-work, forming a record that cannot be changed without redoing
The ‘a ha’ moment... the creation of censorship resistant digital cash
But…the original blockchain design just doesn’t work for business

- It solves a different problem!
- Views lack of identity as a feature, not a bug
- No privacy: all data is shared with all participants
- Settlement is probabilistic, not definitive
- Existing smart contracts are buggy, difficult, prone to bad outcomes, and don’t scale...

Turns out, being your own bank is kind of a drag!
Revolution 2

$215,000,000,000

The estimated IT spend by investment banks in 2017... and it is probably on the low side!

Driven from hidden costs, intractable complexity and countless points of reconciliation.
What if...we could build an industry-level system of record?
What if...we could build an industry-level system of record?
Back to Revolution 3
Lessons from the token gold rush

The ICO boom was a massive experiment with other people’s money...

but also a new example of peer to peer capital markets

those seeking capital directly connecting with those looking to allocate capital
Tokens for the enterprise?
Why digital assets and tokens?

- New tools for capital formation
- Settlement (atomic DvP)
- Improved liquidity and access
- Banking while the bank is shut...
We need to remember where blockchains are best

- Need for many participants to reach consensus on a set of shared facts
- Need for many participants to share control over the evolution of shared facts
- Need for atomic value transfer
- Need to create digitally scarce assets (securities, money, identity...
Thank You!

todd@r3.com

@mcdtv
Using blockchain to automate VC terms in an STO Contract - a Cornell Tech Case Study

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Cornell and NYU Teacher

Investment Banker that Does STOs

FINRA

JAHANI & Associates

BBMA
Increase trust in the ICO and STO market by addressing SEC rules, digital marketing practices, and investment banking objectives
The talent behind the project

Cyrus Ghazanfar
CS

Pooja Kale
CS

Jim Campbell
MBA

Kibum Byun
LLM
What is an ICO or STO?
A company creates a cryptocurrency ("coin" or "token") and sells a portion to the public in order to raise money.
The company retains a significant portion of the tokens to be given to founders, employees, advisors, and more. **Investors have no transparency into how these tokens are actually distributed.**
Example: Airswap

$37 million raised
VestVault allows companies to create their own smart contracts that autonomously controls the token distribution in a secure and transparent way.
How It Works

1. Distribution from Whitepaper
   - Public: 60%
   - Company: 25%
   - Founders: 8%
   - Advisors: 5%
   - Partners: 2%

2. Input Parameters
3. Smart Contract Generated
4. Upload Smart Contract
5. Distribution Locked in Blockchain
6. Tokens Vest Automatically
```solidity
contract FixedSupplyToken is ERC20Interface, Owned {
    using SafeMath for uint;

    string public symbol;
    string public name;
    uint8 public decimals;
    uint _totalSupply;

    mapping(address => uint) balances;
    mapping(Address => mapping(Address => uint)) allowed;

    // beneficiary address: 0xdad87fafa1b7c4700f2bd7f44238821c26f7392148
    // release time: 1542391189

    constructor() public {
        symbol = "FIXED";
        name = "Example Fixed Supply Token";
        decimals = 18;
        _totalSupply = 1000000; // 10**uint(decimals);
        balances[owner] = _totalSupply;
        emit Transfer(address(0), owner, _totalSupply);
    }

    // Constructor

    // Validation that tokens are properly locked
}
```
1. Attract More Investors
2. Increased Regulatory Safety
3. Protection from Internal Theft
Fully integrated END-TO-END System
For enforcing ICOs distribution model
In a decentralized and trustless way
Thank You

Please contact me at:

jahani@jahaniassociates.com
Problems with all “Stable Coins”

Dan Raykhman
Fungible Network
http://fungible.network
dan@fungible.network
Bio

- Fintech veteran
- Built multiple trading platforms
- Ran HFT system
- Designed financial products (ETFs)
- Worked with many Wall St. firms like BlackRock, BNY Mellon, Guggenheim Partners, FTSE, Direxion, etc.
- Speaker, mentor, inventor
"Holly Grail" of Crypto

- Price stability
- Crypto characteristics (decentralization, immutability)
- Cryptocurrency designation (not Security Token)
- Independence from traditional regulation
- Easy convertibility, on/off ramping
"Holly Grail" of Crypto

- How will the price stability be maintained?
- Will this coin be a security?
- Can this coin be shielded from the government's regulation and control?
- How will the convertibility, on/off ramp work?
- What gives investors confidence in the value of stable coin?
Fiat vs Crypto Use Cases

Functions of a Currency
- Store of value
- Medium of exchange
- Unit of account

Cryptocurrency Promise
- Fiat Currency substitute
- Cross border transfers
- Micro payments
Three types of “Stable Coins”

Haseeb Qureshi: Stablecoins: designing a price-stable cryptocurrency
Fiat currency backed Coins

- Traditional Custody
- KYC, AML requirements
- Possibility of coin freezing and call back
- Dependence of US banking system
- Creation and redemption friction
- Delegated stability
Cryptocurrency backed Coin

- As “stable” as underlying coin
- Over collateralization
- Limited use case
- C/R friction

Dai (MakerDAO)
Non-collaterized “stable coin”

- Target arbitrary price level
- Pegs need to be defended
- Use of outside resources to maintain the peg
- Unproven and unreliable (prone to “run on banks” scenarios)
Problem with “price-stable” cryptocurrency

- Price stability is artificial, needs external mechanism to support it
- There are no “price-stable” assets in the history of finance!
- Value stable assets. Stable Value = Stable Price
Stability as a commodity

- Demand for stability increases when volatility and uncertainty goes up
- Demand for stability goes down when riskier assets performing well
Conclusion

Asset-backed coins have many reasons to exist

- FIAT Currency substitute
- Access to liquidity
- Access to leverage
- Access to assets in a new format

Programmable, price-stable coin probably not

- Need for outside stability
- Reliance on market confidence
Thank You

Dan Raykhman

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Mobile +1.646.330.1244

@DaRaykhman
Tokenizing Science

Sean T Manion, PhD
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Bio

Science Distributed – CEO, Co-Founder
Blockchain in Healthcare Global IEEE/ISTO – Co-Founder, Treasurer
Science will be Blockchained by 2025
Sean Manion - Published on January 16, 2017 (LinkedIn Pulse)
https://www.linkedin.com/pulse/science-blockchained-2025-sean-manion
What is Science?

- **Science** is the systematic study of the natural world.
- **Research** is the application of the scientific process: Observe, Hypothesize, Test, Conclude.
- **Development** is the application of basic scientific findings in specific areas like engineering (physical) and medicine (health).
- **Research & Development (R&D)** is a $2.5 Trillion annual industry worldwide.
- **$150 Billion Health Science Research annually in the US.**
Distributed Science Value Proposition

- Better Science (for Scientists)
  - Problem: Reproducibility Issues; **20% of U.S. health science research can’t be replicated/reproduced**
  - Solution: Improved reproducibility through transparency and immutable audit trail for research data; better quality data from standardization; improved materials; increased meta-analysis capabilities

- Cheaper Research (for Funders)
  - Problem: Expensive; decreasing ROI; **$30 billion in U.S. health science on non-replicable research**
  - Solution: Increased return on investment for research dollars spent; reduced data management costs through blockchain/smart contracts, amplified with machine learning/AI; cheaper administration

- Faster Miracles (for Everyone)
  - Problem: 17 years from bench to bedside; **2-5 years on administrative processes (my estimate)**
  - Solution: Faster time from idea to treatment; improved outcomes with accelerated research and higher quality data; improved tracking of individual contribution allowing for expanded permissioned access of data to more researchers; faster administrative processes (e.g. IRB, grant review)


Reasons for the problems with Science

- Scaled beyond optimal function in traditional model
- Siloed across multiple systems
- Trust breakdown; limited sharing
- Misaligned incentives; publishing
- Quality decline with expansion of peer-reviewed journals
- Decreasing return on investment
- **HUGE** upside in application of blockchain and tokenization
Early Efforts to Tokenize Science

- Small number of projects
- Only a handful focused primarily on science
- Recent ICO/STO presale received only 1.62 ETH total in 2 months
- Too broad; one-size doesn’t fit all
- No differentiation between scientific disciplines & phases
- Insufficient approach to non-monetary incentive systems
- Ex: 64 million hours of volunteer peer-review each year can not be monetized w/o integrity issues
Questions to consider across the steps in science:

1. **Form Hypotheses**
   - Where can things be improved in each area?
   - Can blockchain/DLT facilitate and/or incentivize?
   - What is the cost/benefit of implementation?
   - If it can be achieved w/o blockchain/DLT, why isn’t it?

2. **Plan research**
   - What hypotheses have already been tested?
   - By whom?
   - When?
   - What happened?
   - What was the approach?
   - What was the result?
   - Current status?

3. **Get Funding**
   - What methods are available?
   - What variations have been developed?
   - Are skilled collaborators available?
   - Where?
   - Are other resources (i.e. space, equipment) available?

4. **Regulatory Approval**
   - Where are funds?
   - Does my plan match programmatic need?
   - Have I applied here before?
   - Why am I filling in all this information again?
   - How is the money being tracked?

5. **Collect Data**
   - Can parts of this process be automated?
   - Will that be faster and more reliable for researchers and regulator?
   - Can multiple IRBs be aligned?
   - Can parts of IRB review be crowdsourced?
   - Can audits be easier?

6. **Analyze & Interpret**
   - What are the data standards?
   - Will it be mergeable with other studies?
   - What are the quality assurance steps?
   - Is PHI secure?
   - Is there existing data that can be used?
   - How accessible is the data?
   - What is the ROI for the data?
   - Are analyses tied to original hypotheses?
   - Are analyses outlined in protocol?
   - Justification of new analyses?
   - Record of attempted analyses?
   - Statistical power?
   - Lit basis of interpretation?
   - Quality of refs?
   - Replicable?
   - Retractions?

7. **Publish & Present**
   - What are the pre-publication presentations?
   - What is the quality or confidence level?
   - How is feedback captured?
   - Gray lit?
   - What are the comments?
   - Are there objective criteria?
   - Crowd-source peer review?
### Distributed Science Publishing Opportunities?

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<tr>
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<tbody>
<tr>
<td>What are the incentives for publication?</td>
<td>How many reviewers?</td>
<td>How are comments captured?</td>
<td>How accessible are abstracts and full manuscripts?</td>
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<tr>
<td>How is contribution and IP tracked?</td>
<td>How big is the pool?</td>
<td>Are responses and edits available?</td>
<td>Reference tracking for appropriateness?</td>
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<tr>
<td>Transparency on fees?</td>
<td>What is the balance for bias?</td>
<td>Can unreported changes inform what should or shouldn’t be done in follow up research?</td>
<td>Retractions tracked and alerts to authors referencing?</td>
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<tr>
<td>Funding agencies?</td>
<td>Incentives for review?</td>
<td>Can this be done in condensed time?</td>
<td>Funding tracked by dollar through publication?</td>
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<tr>
<td><strong>Incentives for reviewers?</strong></td>
<td>Weighting for review?</td>
<td><strong>Confidence score gradient?</strong></td>
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Roadmap to Tokenizing Health Science

1. **Administrative use cases** - Learn to use the tech; challenges and opportunities identified; value demonstrated with little risk

2. **Regulatory use cases** – Bring efficiency to the IRB review process will speed research; easier regulatory audit process; regulators comfortable with the tech

3. **Working groups** – Established by scientific disciplines and sub-disciplines; semantic standards of the data; include funding agencies, professional societies, and researchers along with those familiar with the tech

4. **Pilot studies** - Multi-site and cross institutions; sandboxed demonstrations in complex research environments; in parallel w/ current standard data processing for side by side comparison of effectiveness

5. **Economic models** – Map current monetary/non-monetary incentive systems; identify ideal system of exchange; model and refine tokenization strategy
Farm to Table, Bench to Bedside: Health Research as Data Supply Chain
From “Advancing Health Research with Blockchain,” by Sean Manion in Blockchain in Healthcare: Innovations that Empower Patients, Connect Professionals and Improve Care (1st Edition); CRC Press, HIMSS Book Series

**Food Supply Chain**
- Linear progression
- Timeline: < 30 days*
- Key variables: type, quantity, quality, variables (e.g. temp)

**Health Research Data Supply Chain**
- Parallel progression
- Timeline: 2-5yrs (x multiple repeats)
- Key Variables: design, methodology, patient demographics, research contribution, statistical approach, outcomes
Challenges for Blockchain in Science

• **Administrators are risk averse**
  - Regulators are wary of the unknown
  - Acquisition standards matter
  - No incentive for innovation

• **Researchers are complex**
  - Science is a complex system
  - Layered incentives; $$ only one
  - Want input on protocols

• **Developers assume simple, clean data**
  - Research data is messy, non-standardized
  - Research partially centralized/distributed
  - Central and single node intermediaries

**Average scientist/administrator perception on blockchain for research currently**
Review: Tokenizing Science

- **When**: Science will be blockchained by 2025 with a functional tokenization model by 2027 *(and Samson Williams will owe Sean Manion a steak)*

- **Why**: Better Science, Cheaper Research, and Faster Miracles

- **How**:
  - Grass roots pilots leading to multi-site studies
  - Funding agencies piloting and moving forward requirements
  - Research administration innovating for value (Lives, $$)
  - Independent standards development
  - Refined token models capturing monetary & non-monetary economics

- **Who**: Researchers, technologists, administrators, investors, patients/caregivers, policy makers, economists, businesses, non-profits, federal agencies, and me...
Thank You

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