NYC Bitcoin Exchange

The First NYDFS Regulated Bitcoin Exchange

Problem

Bitcoin is innovative but exchanges have had problems

- **A brief history of Bitcoin**
  - Bitcoin: open source technology invented in 2009
  - Widely hailed as technological breakthrough
  - Like the early Internet, bumpy patches and security problems
  - Most prominent: Mt. Gox meltdown and funds loss
  - Also potential issues around KYC, AML, compliance

- **Where we are today**
  - Pressing need for a stable, regulated Bitcoin exchange
  - NYDFS is leading the way with a regulatory framework
  - Regulated exchange should have provisions for auditing of customer balances, KYC/AML compliance, strong security

Solution

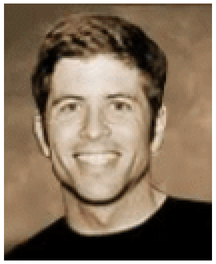
A safe, regulated Bitcoin exchange under NYDFS

- **Compliance Goals**
  - Compliance: Provide full audit trails of every dollar and BTC that passes through the system, along with identities of large buyers
  - Liquidity: Ensure liquidity for the Bitcoin ecosystem, and have large enough reserve ratios to prevent Gox-like situation
  - Trust: Create trust in Bitcoin ecosystem, allow institutional investors to establish positions in digital currencies
  - Reputation: Build in partnership with established/reputable investors and venture capital firms

- **Technological Goals**
  - Easy to use front-end comparable to large consumer websites
  - Top-to-bottom emphasis on information security

Executive Team

Have built and scaled $1B+ in tech/finance companies



- Matt Pauker (CEO)
  - Founder, Voltage Security (>$40m rev)
  - Author of 15+ cryptography patents; commercialized IBE
  - BS Computer Science, Stanford

- Andrew Farkas (Board of Directors)
  - CEO of Island Capital
  - BA Economics, Harvard

- Balaji S. Srinivasan (Chairman)
  - Newest General Partner at Andreessen Horowitz (1, 2)
  - Founder/CTO, Counsyl (~5% US births, ~$1B+ val)
  - BS/MS/PhD EE, MS ChemE Stanford

- Terence Spies (CTO)
  - CTO of Voltage Security
  - Designed SSL server/client for Microsoft Internet Explorer
  - Chairs ANSI X9F1 bank cryptography committee

Technology

What technological considerations are involved?

Technical Challenges

Building a Bitcoin exchange is computer science

- **Security**
  - Exchange will be under constant attack by hackers around the globe; both Denial of Service and active threats (e.g., APTs)
  - Bitcoin relies on advanced cryptography; getting it wrong can result in loss of funds (see Mt. Gox)
- **Ecosystem integration**
  - Exchange is one of several core Bitcoin infrastructure services
  - Must provide tight API integration with wallets, merchant processors, miners
- **Compliance**
  - Technology must be designed to support (often conflicting) compliance goals
  - Leverage best practices from PCI, FFIEC, NIST

Technical Challenges

Our number one concern technologically is security

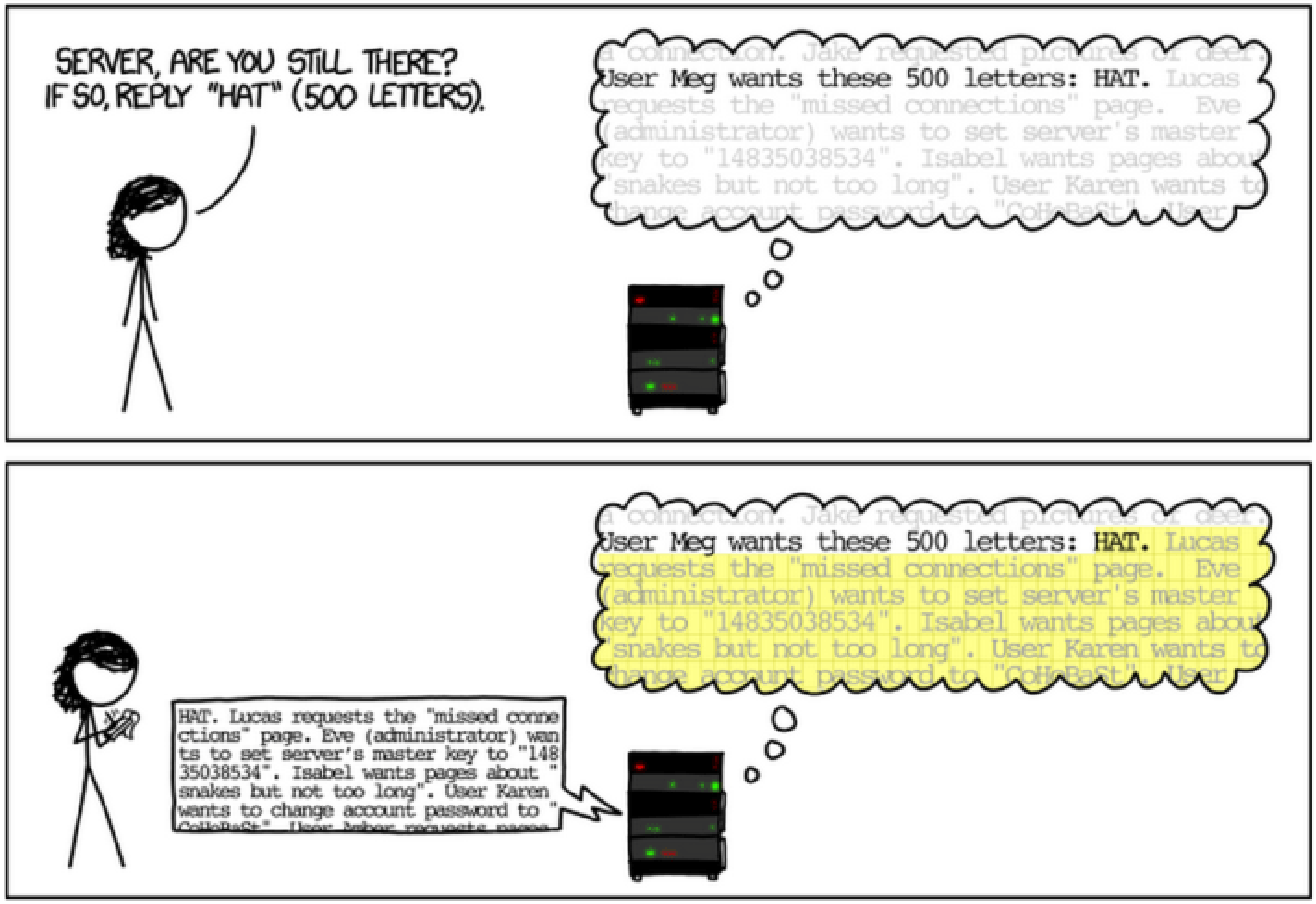
- **Threats**
  - Distributed denial of service (DDoS)
  - 0-day exploits in open source software
  - Spear-phishing
  - Advanced persistent threats (e.g. China)
  - Source code compromise
  - Social engineering attacks
  - Physical compromise of vaulting facility or datacenter

- **Mitigation**
  - FireEye/Mandiant (malware), Cloudflare (DDoS), Sift Science (fraud), Voltage (encryption), Skipfish/Ratproxy (headless)
  - Open bids for zero days in any software utilized
  - Constant penetration testing, automatic/manual (Detectify)
  - Static and dynamic checking of codebase (Coverity)

Technical Challenges

Security expertise must be baked into every layer

Example: Heartbleed: Security issues are subtle


SERVER, ARE YOU STILL THERE? IF SO, REPLY "HAT" (500 LETTERS).
a connection. Jake requested pictures of deer. User Meg wants these 500 letters: HAT. Lucas requests the "missed connections" page. Eve (administrator) wants to set server's master key to "14835038534". Isabel wants pages about "snakes but not too long". User Karen wants to change account password to "CoHoBaSt". User
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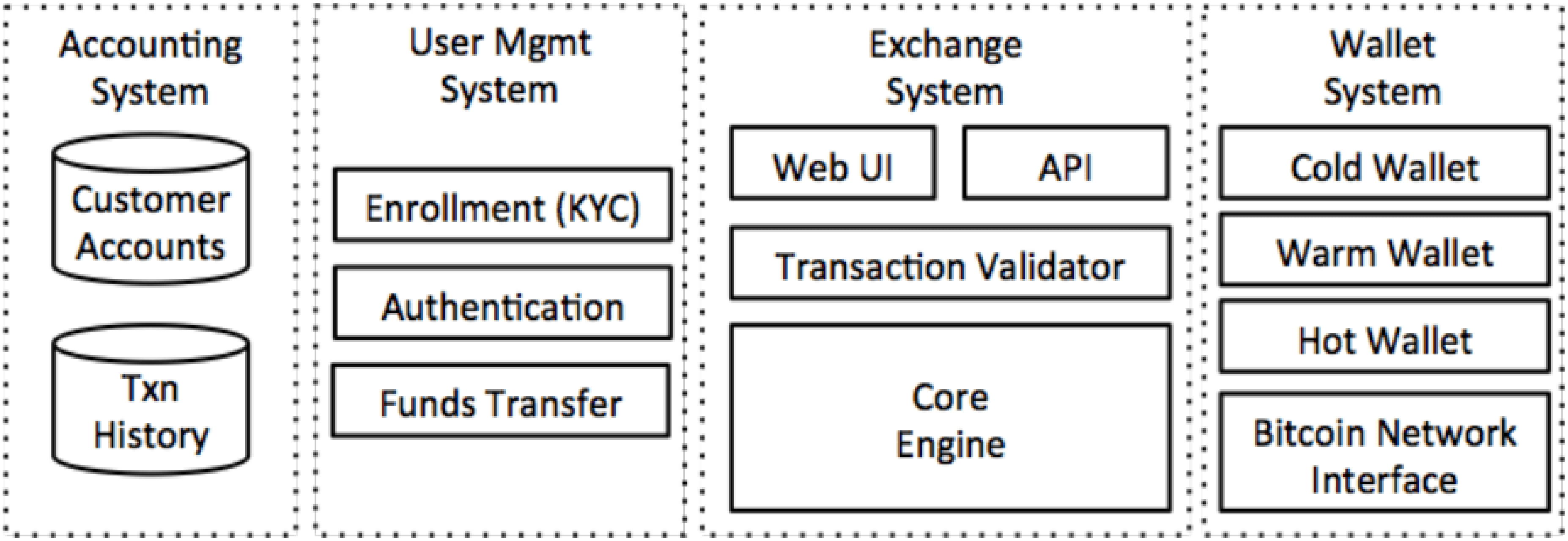
Technical Architecture

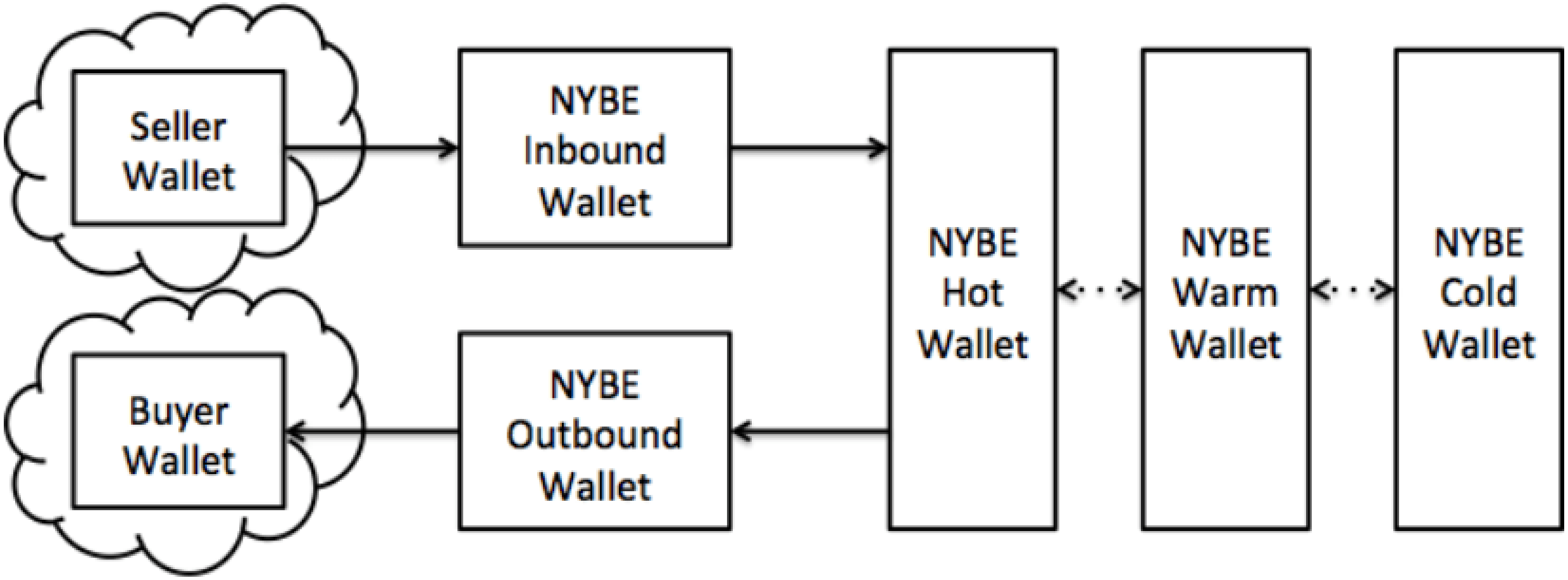
Increase security via subsystem isolation, cold storage



- **Services-Oriented Architecture improves security**
  - Discrete, well-defined subsystems reduce risk of spillover attacks
- **Full auditability for all functions**
  - User activity, funds, trades
- **Will work closely with NYSDFS on functionality & user interface**
  - Ensure regulatory compliance, proper disclosures, transparency

Technical Architecture

Limit amount of “hot” Bitcoin; most in cold wallet



- **Typical transaction flow:**
  - Seller sends BTC into NYBE Inbound Wallet, then stored in Hot Wallet
  - After trade, BTC is moved to Outbound Wallet, then Buyer Wallet
  - Seller & Buyer Wallets reside at 3rd party (Coinbase, Xapo, etc.)
- **Occasionally: money moved out of Hot Wallet**
  - Maintain minimum required amount of BTC online

Technical Architecture

Security principles for wallets, passwords, pentesting

- **Bitcoin wallets**
  - Not a consumer wallet provider: only hold customer funds for trading
  - Three-tiered wallet hierarchy
    - Hot: online, available immediately (~25%)
    - Warm: offline, available within 24 hours (~25%)
    - Cold: offline & geo-dispersed, available within 72 hours (~50%)

- **Industry-standard best practices**
  - Least-privilege architecture
  - Two-factor user authentication
  - n-of-m key sharing
  - Bank-level network & data security design (256-bit encryption, anti-DDoS)

- **Continuous evaluation**
  - Regular internal security audits
  - External “red teams” to identify potential vulnerabilities

Technical Architecture

We build the exchange for extensibility beyond BTC

- **Exchange built to handle more digital currencies over time**
  - Compliance is key in all of this; start with BTC, generalize as we build confidence
  - Technology: simply requires additional wallet subsystems on top of existing architecture

- **Items we may trade over time**
  - Altcoins: Bitcoin “clones” (Litecoin, Namecoin) which primarily change some parameters
  - Appcoins: new proof-of-work systems with new functionality (Namecoin, Ethereum, Mastercoin)
  - Side-chains: support for side-chains & proof-of-burn
  - Smart property: can use the blockchain to exchange software licenses, stock certificates, digital keys to houses, etc.
  - And more: Colored Coins video gives sense of what Bitcoin can enable

Exchange Economics

Two possible models for an exchange

- **Model I: Pure facilitation of trades**
  - In this model, we bucket all buy/sell orders into (say) .1 BTC buckets
  - We then match buyers and sellers in the same bucket
  - Buyers and sellers exchange directly with each other and the exchange takes a commission

- **Model II: Serve as counterparty**
  - In this model, we are the buyer and seller of BTC traded on the exchange
  - We maintain BTC and USD reserves that are sufficient to handle large spikes in buy or sell orders
  - The exchange monetizes through the size of the bid/ask spread
  - Benefit: greater liquidity for exchange customers. Cost: larger reserve ratios.

Next Steps

We’d like to work with NYDFS on this.

Next Steps

What's the next step from NYDFS's perspective?

- **Areas we are seeking input**
  - What is the optimal corporate structure for this vehicle in NYDFS's view?
  - What existing legislation/regulatory framework is NYDFS thinking about using as a basis for this?
  - How does NYDFS think about annual Bitlicense/exchange fees and the like, if any?
  - What type of ongoing supervision does NYDFS envision?
  - These are the sorts of questions we'd like to figure out collaboratively; please tell us how we can help.