Smart Contracts, Blockchain and Data Standards

April 4, 2016 | New York City

Sponsoring organizations

Baruch College Zicklin School of Business

CFA Institute

XBRL US

- Campell Pryde, President and CEO, XBRL US
- John Turner, CEO, XBRL International

The Blockchain Bitcoin & Beyond

Christian Lundkvist, ConsenSys

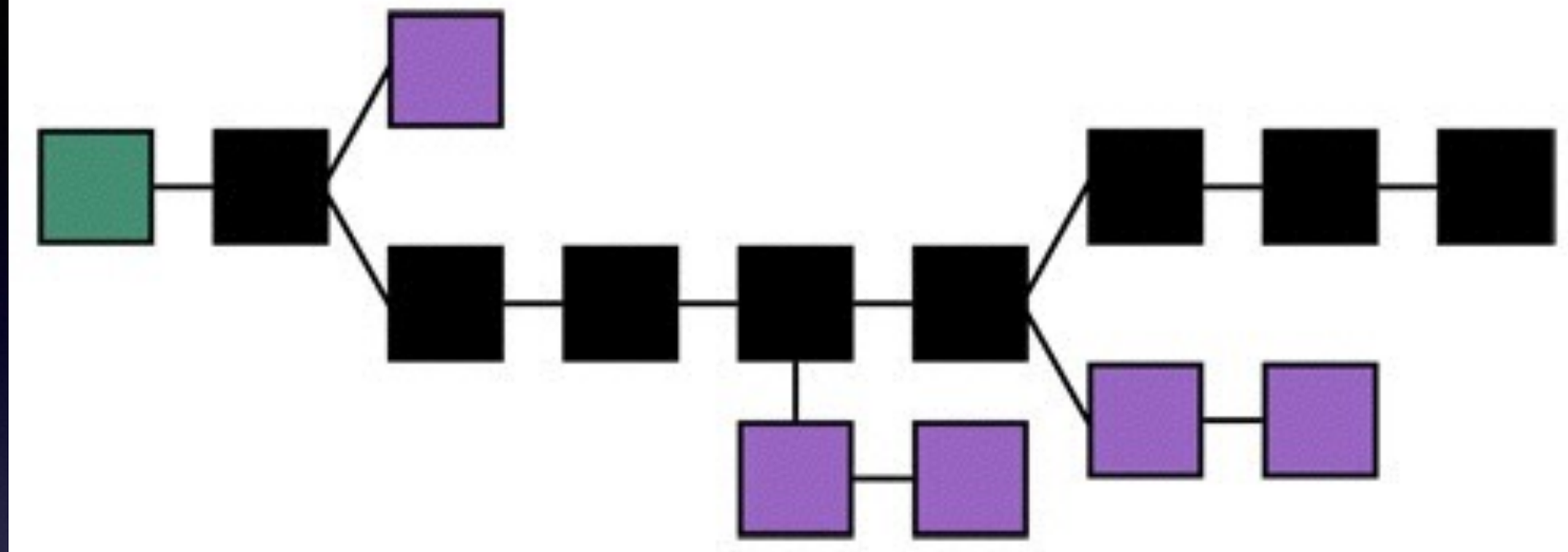
Outline

- What is Bitcoin?
- What is a Blockchain?
- Generalized blockchains
- Smart contracts

What is Bitcoin?

Not that!

(Those are metal coins with the letter "B" on them)



Bitcoin is a specific application of **Blockchain technology**

What is a Blockchain?

A blockchain is a **database** with specific properties:

- **Decentralized:** Redundant copies shared among many P2P-networked participants

- **Strong Authentication:** Updates to the database require cryptographic access control (private keys)

- **Tamper-resistance:** Can get strong assurance that the database has not been tampered with (mining)

The above makes the database resistant to a minority of participants actively trying to forge and/or corrupt data.

The Bitcoin database

In the case of Bitcoin the blockchain database contains

- Accounts (look like this: 18bdsW2XFibQKk1yFmk718TeZPAbo3aUeN)
- Balances of the accounts (denominated in BTC)

Updating the database means reducing the number of BTC in an account and increasing it in another account ("Sending bitcoins"). Each account has a corresponding private key needed to send.

What is Bitcoin?

- P2P network
- Blockchain of accounts & balances (~30GB)
- Used to store and transmit value tokens ("bitcoins")
- Similar to internal bank database of account balances, but shared and replicated

Use Cases

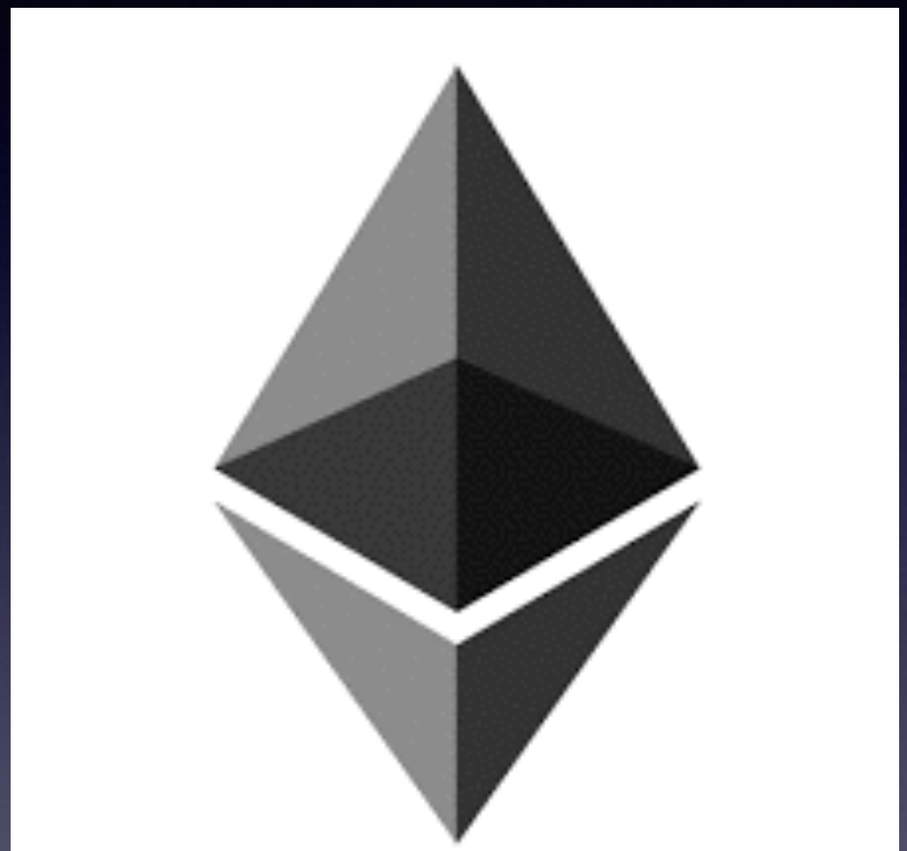
Narrow protocol, still useful for certain applications

- Currency in low-trust online environments (SR, Overstock)
- Middleware in remittances (Abra, rebit.ph)

Generalized blockchains (Ethereum)

Newer blockchain designs like Ethereum generalizes the Bitcoin blockchain. The Ethereum blockchain includes:

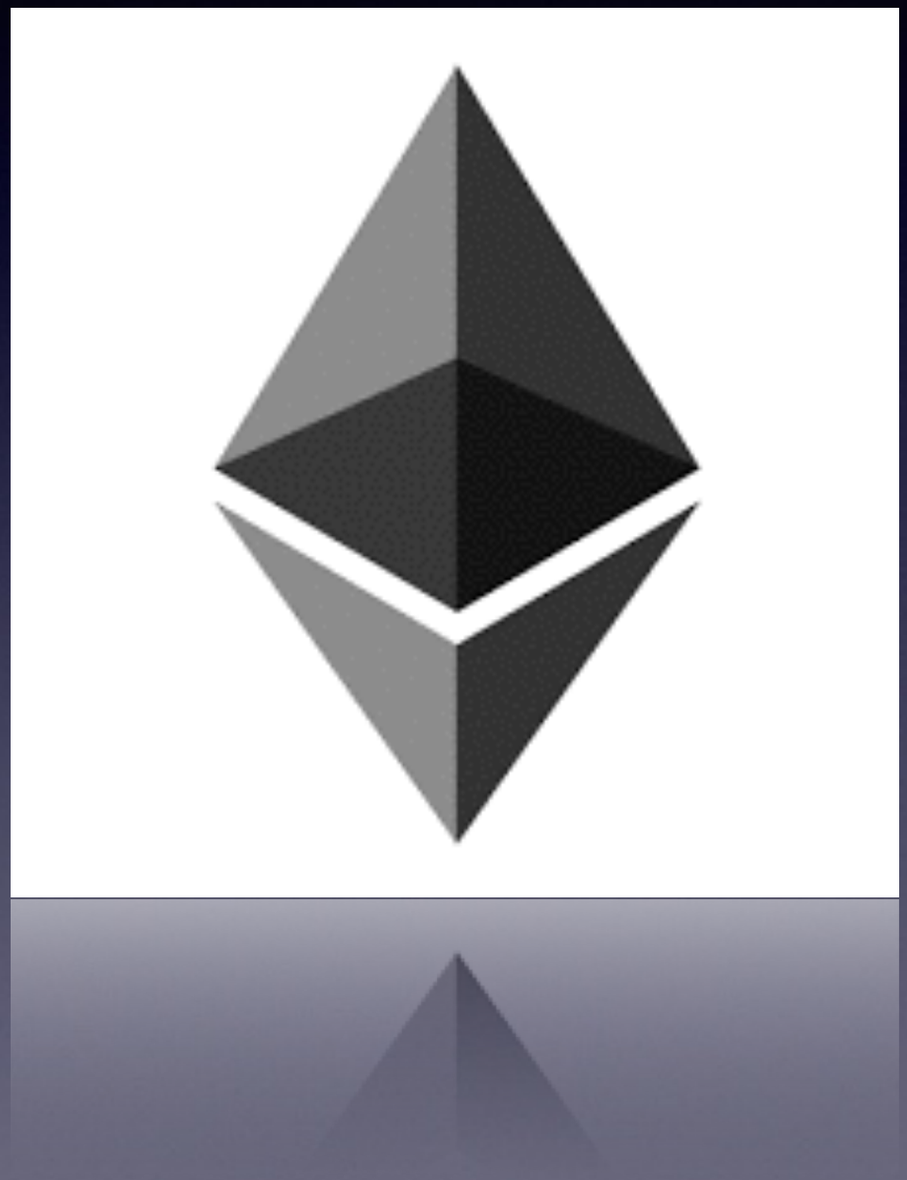
- Accounts & balances (Ether)
- Arbitrary user-created programs (smart contracts) with function interface
- Programs have associated data and funds and programs can call functions of other programs



Generalized blockchains (Ethereum)

Updating the Ethereum database can be done in three different ways:

- Sending Ether tokens from one account to another (like bitcoin)
- Uploading a program to the blockchain
- Calling a function of a program on the blockchain



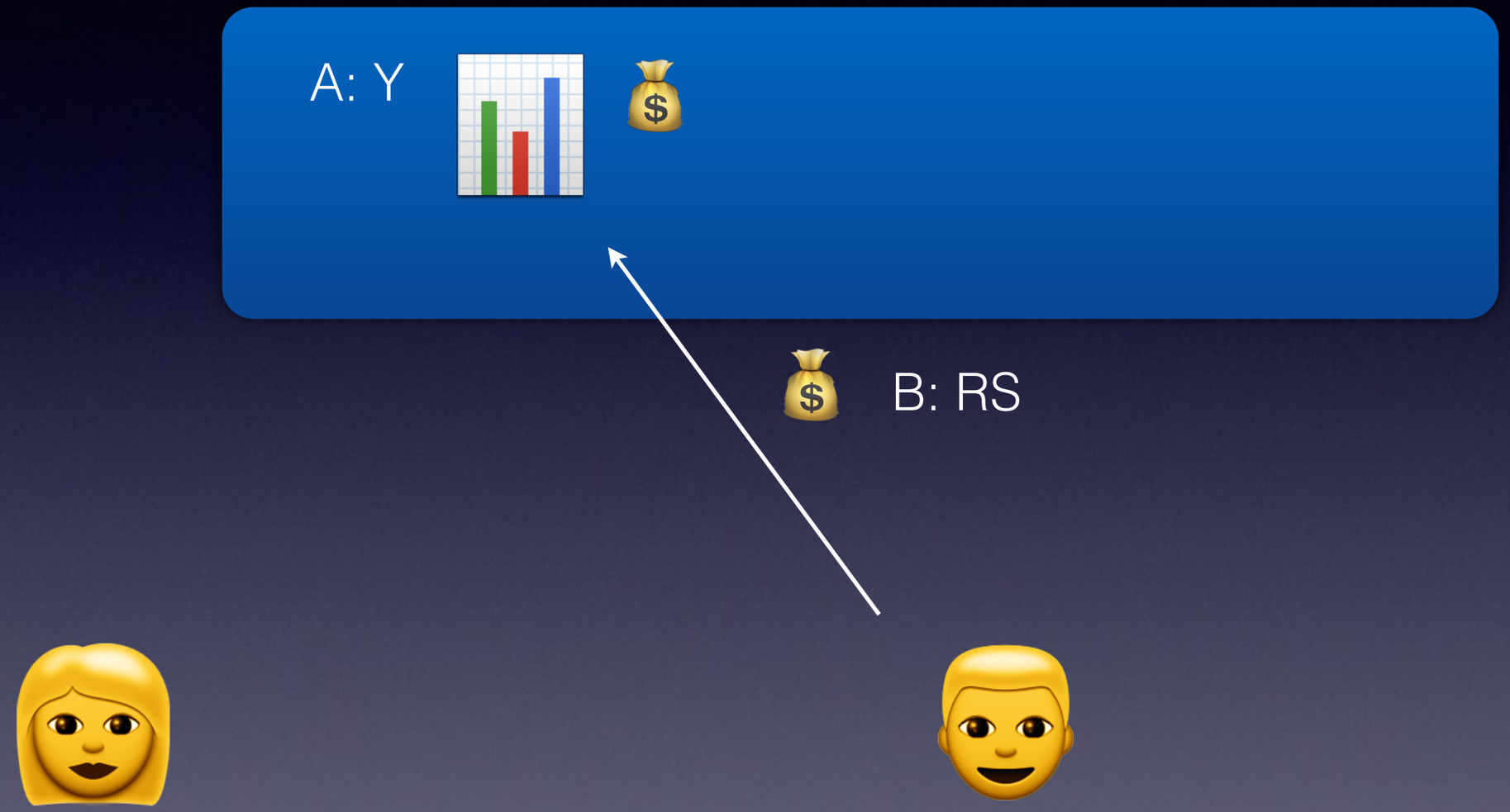
Example: Simple Bet

- Alice and Bob wants to bet on who wins a baseball game
- The bet can be facilitated through a smart contract
- A third party like ESPN can maintain a smart contract containing sports scores that can be queried by other smart contracts

Example: Simple Bet

Alice uploads a smart contract to the blockchain along with her bet (Yankees)

Example: Simple Bet

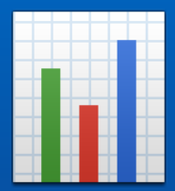


Bob makes his bet (Red Sox) to the contract

Example: Simple Bet

A: Y

B: RS



The contract lays dormant with custody of the funds

Example: Simple Bet

A: Y

B: RS

Win: RS

On game day the Red Sox wins.The winning team is published on the blockchain by ESPN

Example: Simple Bet

Bob calls the contract to claim his winnings

Example: Simple Bet

The contract calls the getWinner() function of the ESPN contract which returns Red Sox

Example: Simple Bet

The contract verifies that Bob is the winner and sends the winnings

Applications of smart contracts

- Auto-settling financial derivatives
- Triple-entry accounting systems
- Efficient inter-bank settlement
- Self-enforcing legal contracts
- Secure transfer of property titles
- With logic on blockchain - less need for server backend

In general: Smart contracts with front ends allows for **Decentralized Applications (dApps)**

About ConsenSys

- Blockchain Production Studio
- Building dApps and basic infrastructure/platforms
- Identifying areas and industries where blockchain tech can improve/disrupt
- Developing on Ethereum right now since most developer-friendly

Thank you! 😀

QUESTIONS?

Epilogue: Mining

- Updates to the database come in **blocks**
- Each block is hashed to a small number
- Can check hashes to verify integrity

Smart Contracts for Compliance

Mike Goldin

XBRL: The Blockchain Before The Blockchain!

- XBRL aims to resolve many problems that blockchains aim to resolve.
- Open, uniform standards.
- Some automation of standards conformance checking.
- Some automation of compliance checking.
- Blockchains can go further by automating penalties for bad compliance on the basis of structured data.

Accountability + enforcement, by example

- Lets look at a very simple smart contract.
- This is Solidity, a programming language for the Ethereum blockchain.

```
contract QuarterlyReport {

  bool frozen;
  uint penaltyEscrow;

  address accountableSignatory;
  address accepter;
  address penaltyCollector;

  uint40 reportHash;
  bool accepted;

  function QuarterlyReport(address _accountableSignatory, address _accepter,
                           address _penaltyCollector, uint _penaltyEscrow) {

    accountableSignatory = _accountableSignatory;
    accepter = _accepter;
    penaltyCollector = _penaltyCollector;
    penaltyEscrow = _penaltyEscrow;

    frozen = false;
    accepted = false;
  }

  function submitPenaltyEscrow() {
    if(this.balance == penaltyEscrow || msg.value != penaltyEscrow) {
      msg.sender.send(msg.value);
      return;
    }
  }

  function submitReportHash(uint40 _reportHash) {
    if(this.balance != penaltyEscrow || msg.sender != accountableSignatory
       || frozen == true) {
      return;
    }

    reportHash = _reportHash;
  }

  function freezeSubmissions() {
    if(msg.sender != accepter) {
      return;
    }

    frozen = true;
  }

  function acceptReport() {
    if(msg.sender != accepter || frozen != true) {
      return;
    }

    accountableSignatory.send(penaltyEscrow);
    accepted = true;
  }

  function rejectReport() {
    if(msg.sender != accepter || frozen != true) {
      return;
    }

    penaltyCollector.send(penaltyEscrow);
  }

}
```

```
contract QuarterlyReport {

  bool frozen;
  uint penaltyEscrow;

  address accountableSignatory;
  address accepter;
  address penaltyCollector;

  uint40 reportHash;
  bool accepted;
```

```
function QuarterlyReport(address _accountableSignatory, address _accepter,
                         address _penaltyCollector, uint _penaltyEscrow) {

  accountableSignatory = _accountableSignatory;
  accepter = _accepter;
  penaltyCollector = _penaltyCollector;
  penaltyEscrow = _penaltyEscrow;

  frozen = false;
  accepted = false;
}
```

```
function submitPenaltyEscrow() {
  if(this.balance == penaltyEscrow || msg.value != penaltyEscrow) {
    msg.sender.send(msg.value);
    return;
  }
}

function submitReportHash(uint40 _reportHash) {
  if(this.balance != penaltyEscrow || msg.sender != accountableSignatory
     || frozen == true) {
    return;
  }

  reportHash = _reportHash;
}
```

```
function submitPenaltyEscrow() {
  if(this.balance == penaltyEscrow || msg.value != penaltyEscrow) {
    msg.sender.send(msg.value);
    return;
  }
}
```

```
function submitReportHash(uint40 _reportHash) {
  if(this.balance != penaltyEscrow || msg.sender != accountableSignatory
     || frozen == true) {
    return;
  }

  reportHash = _reportHash;
}
```

```
function submitPenaltyEscrow() {
  if(this.balance == penaltyEscrow || msg.value != penaltyEscrow) {
    msg.sender.send(msg.value);
    return;
  }
}
```

```
function submitReportHash(uint40 _reportHash) {
  if(this.balance != penaltyEscrow || msg.sender != accountableSignatory
     || frozen == true) {
    return;
  }

  reportHash = _reportHash;
}
```

```
function freezeSubmissions() {
  if(msg.sender != accepter) {
    return;
  }

  frozen = true;
}

function acceptReport() {
  if(msg.sender != accepter || frozen != true) {
    return;
  }

  accountableSignatory.send(penaltyEscrow);
  accepted = true;
}

function rejectReport() {
  if(msg.sender != accepter || frozen != true) {
    return;
  }

  penaltyCollector.send(penaltyEscrow);
}
```

```
function freezeSubmissions() {
  if(msg.sender != accepter) {
    return;
  }

  frozen = true;
}
```

```
function acceptReport() {
  if(msg.sender != accepter || frozen != true) {
    return;
  }

  accountableSignatory.send(penaltyEscrow);
  accepted = true;
}
```

```
function rejectReport() {
  if(msg.sender != accepter || frozen != true) {
    return;
  }

  penaltyCollector.send(penaltyEscrow);
}
```

```
function freezeSubmissions() {
  if(msg.sender != accepter) {
    return;
  }

  frozen = true;
}
```

```
function acceptReport() {
  if(msg.sender != accepter || frozen != true) {
    return;
  }

  accountableSignatory.send(penaltyEscrow);
  accepted = true;
}

function rejectReport() {
  if(msg.sender != accepter || frozen != true) {
    return;
  }

  penaltyCollector.send(penaltyEscrow);
}
```

```
function freezeSubmissions() {
  if(msg.sender != accepter) {
    return;
  }

  frozen = true;
}

function acceptReport() {
  if(msg.sender != accepter || frozen != true) {
    return;
  }

  accountableSignatory.send(penaltyEscrow);
  accepted = true;
}
```

```
function rejectReport() {
  if(msg.sender != accepter || frozen != true) {
    return;
  }

  penaltyCollector.send(penaltyEscrow);
}
```

XBRL + blockchains

- The XBRL you know and love
- Plus the ability for regulators to collect penalties programmatically on the basis of XBRL data
- Markets on SEC penalty tokens? ☺

Smart Contracts, Blockchain and Data Standards

APRIL 4, 2016 | NEW YORK CITY

Sponsoring organizations

Baruch COLLEGE ZICKLIN SCHOOL OF BUSINESS

CFA Institute

XBRL US

The Landscape for Blockchain Technology

- Campbell Pryde, President and CEO, XBRL US
- Philip Moyer, Senior VP and Managing Director, Technology, Safeguard Scientifics
- Joseph Lubin, Founder, Consensys

BLOCKCHAIN TECHNOLOGY LANDSCAPE > APRIL 2016

xBRL US

OTHER

R3 CEV *Bank Consortium*

APPLICATIONS *(Products & Services)*

BITCOIN NETWORK BASED

PAYMENT PROCESSOR
- BITPAY
- CIRCLE

EXCHANGE
- COINJAR
- BITSTAMP
- KRAKEN
- COINBASE
- MORE

TRADING PLATFORM
- **HEDGY** — **Product:** *Bitcoin Trading Platform*
- **LedgerX** — **Product:** *Bitcoin Options Trading Platform*
- **TeraExchange** — **Product:** *Bitcoin Swap Trading Platform*

ISSUANCE PLATFORM
- **LINQ (NASDAQ)** — **Product:** *Private Issuance Platform*
- **tØ** — **Product:** *Debt & Equity Trading Platform*

NON-BITCOIN NETWORK BASED

BLOCKCHAIN TOOL PROVIDERS

- **CHAIN** — **Tools:** *Bitcoin API's & Tools*
- **SYMBIONT** — **Tools:** *Smart Contract API's & Tools*
- **BLOCKSTREAM** — **Tools:** *Sidestream*
- **MONETAGO** — **Tools:** *Bitcoin API's & Tools*
- **CONSENSYS** — **Tools:** *API's and Tools for Ethereum, bitcoin and private permissioned ledgers*
- **BLOCKAPPS** — **Tools:** *API's and Tools that are compatible with Ethereum*
- **ERIS INDUSTRIES** — **Tools:** *Smart Contract apps on Eris software network using Tendermint and Ethereum compatible*
- **DAH (Digital Asset Holdings)** — **Tools:** *API's & Tools for Financial Services*
- **ITBIT** — **Tools:** *API's & Tools for Financial Services using Bankchain*

INFRASTRUCTURE ADD-ON

- **COUNTER PARTY** — **Infrastructure:** *Smart Contracts*
- **ROOTSTOCK** — **Infrastructure:** *Smart Contracts*

INFRASTRUCTURE *(Blockchain Networks)*

NON PERMISSIONED PUBLIC LEDGER

- **BITCOIN BLOCKCHAIN** — **Currency:** *Bitcoin* **Settlement Process:** *Proof of Work* **Ledger Owner:** *All Users*
- **ETHEREUM** — **Currency:** *Ether* **Settlement Process:** *Proof of Work* **Ledger Owner:** *All Users*

PERMISSIONED PUBLIC LEDGER

- **TENDERMINT** — **Settlement Process:** *Consensus (Proof of Stake)*
- **HYPER LEDGER** — **Settlement Process:** *Proof of Work* **Ledger Owner:** *All Users*
- **RIPPLE** — **Currency:** *XFR* **Settlement Process:** *Consensus* **Ledger Owner:** *Trusted Parties*

PERMISSIONED PRIVATE LEDGER

- **BANKCHAIN** — **Settlement Process:** *Consensus* **Ledger Owner:** *ItBit*

Smart Contracts, Blockchain and Data Standards

April 4, 2016 | New York City

Sponsoring organizations

Baruch College Zicklin School of Business

CFA Institute

XBRL US

Blockchain Funding Climate

Philip Moyer,

Managing Director Safeguard Scientifics

Financial Technology Markets

FinTech Funding 2013: $4B 2014: $12.2B 2015: $20B

Global

- London Financings have been growing at twice the rate of Silicon Valley
- KPMG 100 Top FinTech Companies:
  - 40 US companies,
  - 20 from EMEA,
  - 18 from the UK
  - 22 from ASPAC.

Sector	Unicorns	Semi-Unicorns	Total
Lending	11	11	22
Payments	11	6	17
Investing	1	5	6
Real estate	2	3	5
Insurance	3	1	4
Accounting	2	0	2
Credit Reports	2	0	2
Security	1	1	2
Bitcoin	1	2	3
Other	2	5	7

Data Sourced: FT Capital

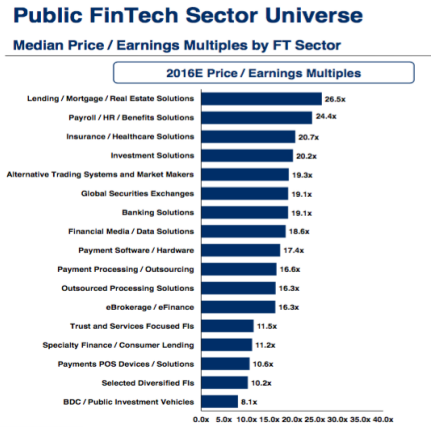
Corporate Venture Larger & Smarter

February - 50 Fin Tech Deals (Source FT Capital)

- 18 - Payments
- 12- Securities & Cap Mkts
- 9 – Banking
- 6 – Finance Mgmt
- 3 – Insurance
- 2 – Finance BPO

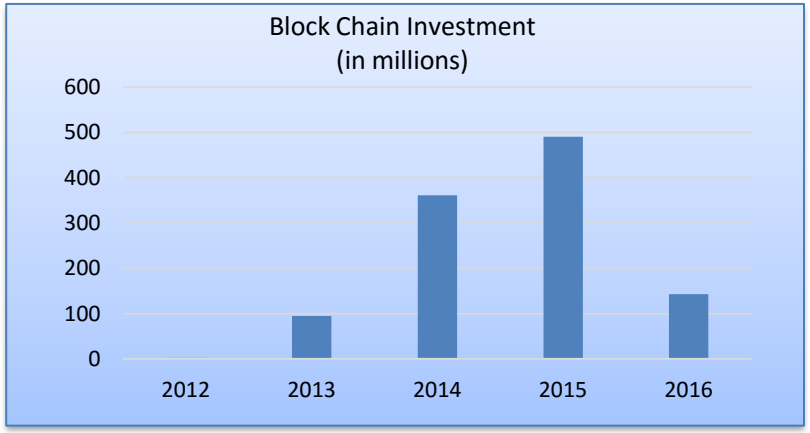
Valuations

Infrastructure: 10x, Tools 7-10x Applications: 3-7x



Blockchain Funding Market

Over $1B in Blockchain Deals



Institutional Investors

- 177 Unique Investors
- Top 10 Most Active Blockchain Investors

Investor	Deals	Investor	Deals
Digital Currency Group	14	AME Cloud Ventures	4
Blockchain Capital	8	Khosla Ventures	4
Plug and Play Ventures	7	RRE Ventures	3
Pantera Capital	5	Coinsilium	3
500 Startups	4	SV Angel	3

Global # of Deals

Bay Area, CA	22	Cambridge, MA	2
New York, NY	12	Ireland	2
London, UK	7	Hong Kong	2
Southern CA	7	France	2
Canadian	5	Phillipines	2
Austin, TX	4	Australia	2
Singapore	4	Israel	1
Spain	3	Japan	1
Sweden	3	South Korea	1

Data Sourced From : VentureSource, Crunchbase

Corporate Investors

Citi, Visa, Mastercard, American Express, NY Life, StateStreet, JP Morgan, Wells Fargo, Goldman Sachs,BBVA, Barclays, Comm Bank of Australia, Credit Suisse, Royal Bank of Scotland, UBS, Banco Santander, Danske Bank, Sumitomo Mitsui Banking Corporation, Westpac, JP Morgan,

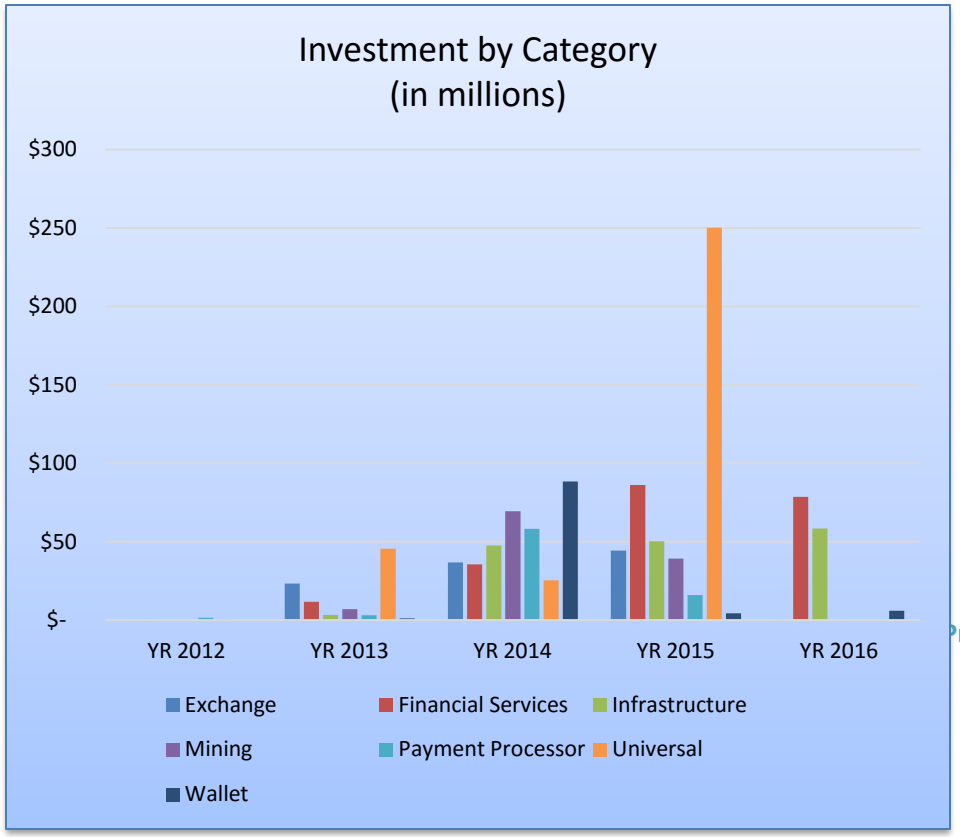
London Stock Exchange, Nasdaq, NYSE,

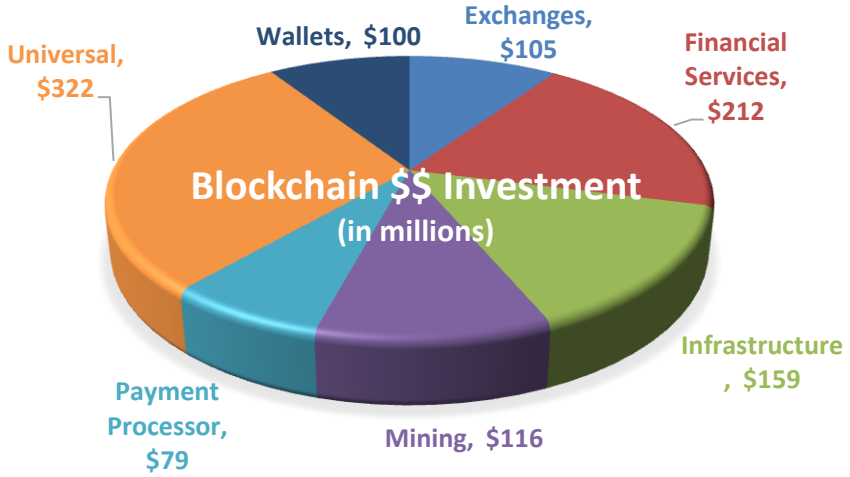
Deloitte, Microsoft, IBM, Intel, Cisco….

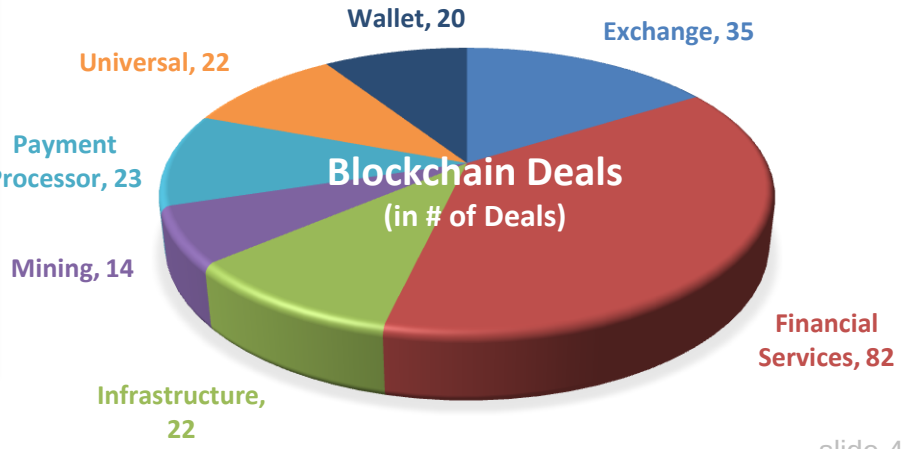
•

Blockchain Funding

We are in the infrastructure build-out phase…







Data Sourced From : VentureSource, Crunchbase

Examples of Large Blockchain Deals

NAME	CATEGORY	DESCRIPTION	TOTAL RAISE	ROUND
21 Inc (21e6)	Infrastructure/Ledgers	Bit Coin Computer	$121	First
Coinbaase	Exchange	Wallet, Peer to Peer Payment	$106	Third
Blockstream	Tools	SideStream	$76	Series A
Circle	Payment Processor	Peer to Peer Payment	$76	Third
BitFury	Tools	Mining	$60	Third
Digital Asset Holdings	Tools	APIs & Tools for Financial Services	$60	N/A
Chain	Tools	Bitcoing API's & Tools - PAAS	$44	Second
Ripple Labs	Infrastructure/Ledgers	Financial services	$41	First
Xapo	Wallet	Bitcoin Wallet	$40	First
BitPay	Payment Processor	Merchant - Bitcoin Payment Processor	$33	First
Blockchain	Infrastructure/Ledgers	Wallet	$31	First
KnCMiner	Tools	Mining	$29	Second
itBit	Trading Platform	Exchange	$28	First
Vogogo	Payment Processor	Payment Processor	$21	Second
Etherium	Infrastructure/Ledgers	Open Source PAAs	$18	Seed
BitStamp	Exchange	Currency Exchange	$10	First

Data Sourced From : VentureSource, Crunchbase

Smart Contracts, Blockchain and Data Standards

April 4, 2016 | New York City

Sponsoring organizations

Baruch College Zicklin School of Business

CFA Institute

xBRL US

James Allen, CFA, Head of Capital Markets Policy for CFA Institute

Blockchain Presentations

- Nasdaq Linq for Private Securities Issuance
- ItBit Bankchain for Gold & Corporate Actions
- Ethereum Total Return Swap (eTRS)

NASDAQ LINQ

Smart Contracts, Blockchain and Data Standards

APRIL 4, 2016 | NEW YORK CITY

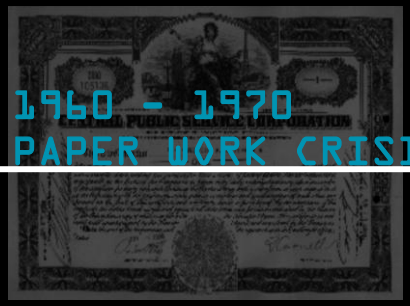
Nasdaq

THE INFLUENCE OF TECHNOLOGY AND RISK

ON CAPITAL MARKETS STRUCTURES

- Brief History
- Current State
- Blockchain in the mix
- Linq

EVOLUTION OF CAPITAL MARKETS



1960 - 1970
PAPER WORK CRISIS

1968
Centralized Securities Depository created to facilitate immobilization

1969
Rockwell Study
Decentralized network of individual transfer agent depositories (TAD)

1969
Arthur Little Study, nationwide clearance and settlement system

1970
BASIC advocates for Central Securities Depository System

1970
CCS -> DTC American Stock Exchange joins CCS

1970 - 2000
EFFICIENCIES THROUGH CENTRALIZATION

1975
Securities Act Amendment, national system for the prompt and accurate clearance and settlement

1980-1990
DTC mergers and acquisitions

1999
DTCC, the Commission issued an order approving DTC's integration with NSCC

2008 - FUTURE
ENTER THE BLOCKCHAIN

2008
Satoshi Nakamoto published the seminal bitcoin paper

2015
First Transaction on Nasdaq Linq
Announcement of Proxy Voting Increased Traction in

FUTURE
Markets Everywhere

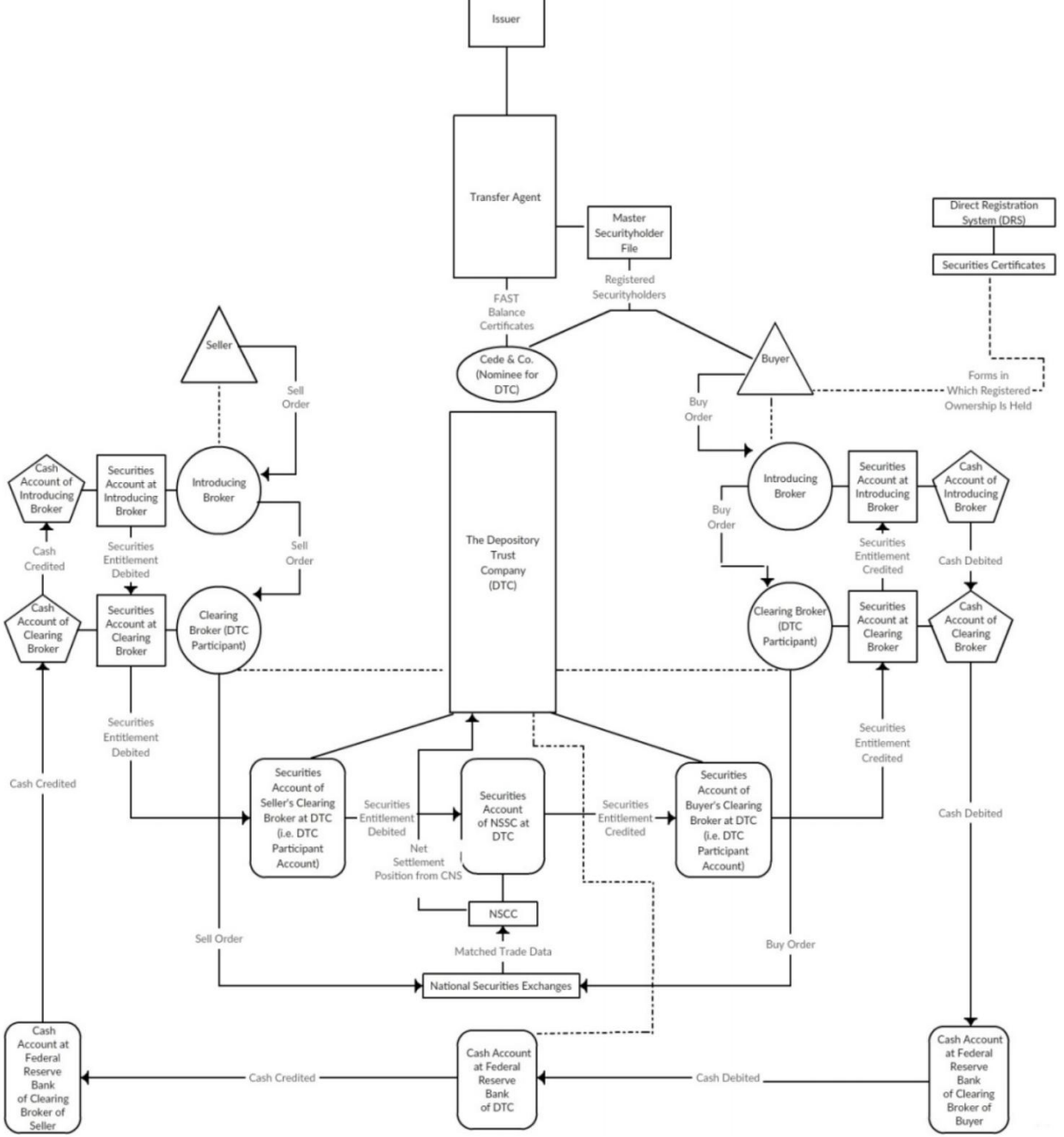
THE WORLD TODAY

CENTRALIZED CORE

MULTIPLE INTERMEDIARIES

SILOES OF INFORMATION

PAIN-POINT - RECONCILIATION



WHY IS BLOCKCHAIN RELEVANT FOR CAPITAL MARKETS?

A DIGITAL ASSET = A DIGITAL BEARER TOKEN

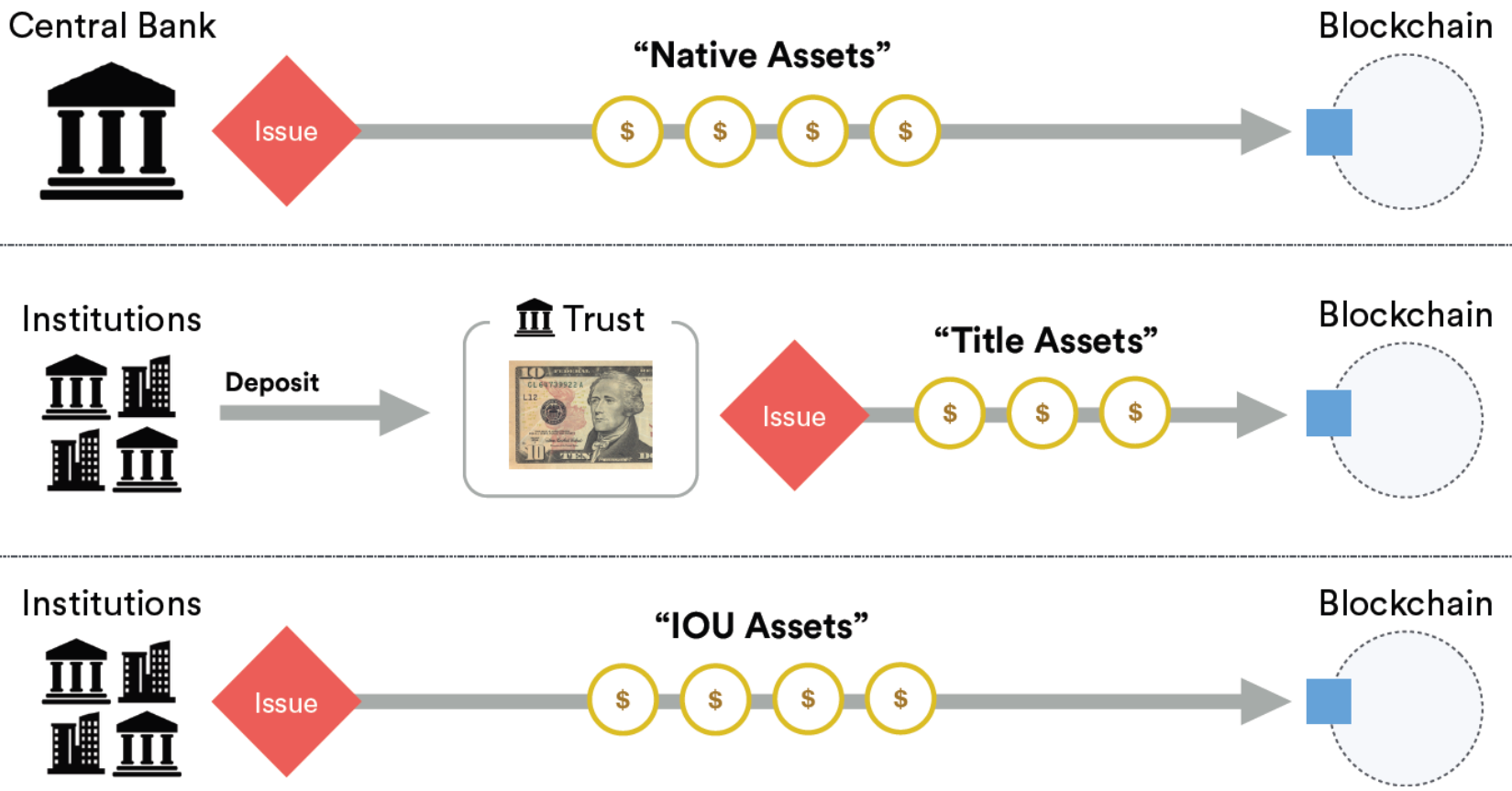
Physical Bearer Tokens

Digital Bearer Tokens

Bitcoin	Exists
Currencies	
Securities	Emerging
Commercial IOUs	
Brand/Loyalty Points	
Etc..	

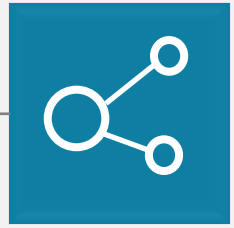
Source: chain.com

WHERE DIGITAL ASSETS GET THEIR VALUE



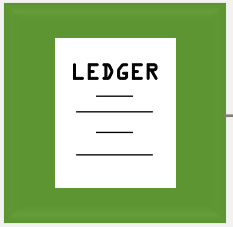
Source: chain.com

HOW IS BLOCKCHAIN DIFFERENT?



Assets are **issued onto a network** that spans organizations

Entities control asset movement by **directly interacting** with the network's shared ledger

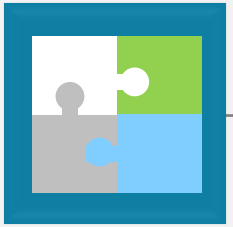


All transactions are enabled and secured by **cryptography**

Programmable
"smart contracts" enable complex transactions

Instant, **direct** value transfer; 24/7

Flexible, digital rails enable user-friendly apps and **interoperability**



Transaction finality: eliminates clearing, reconciliation, errors; a single source of truth provides perfect auditability

Source: chain.com

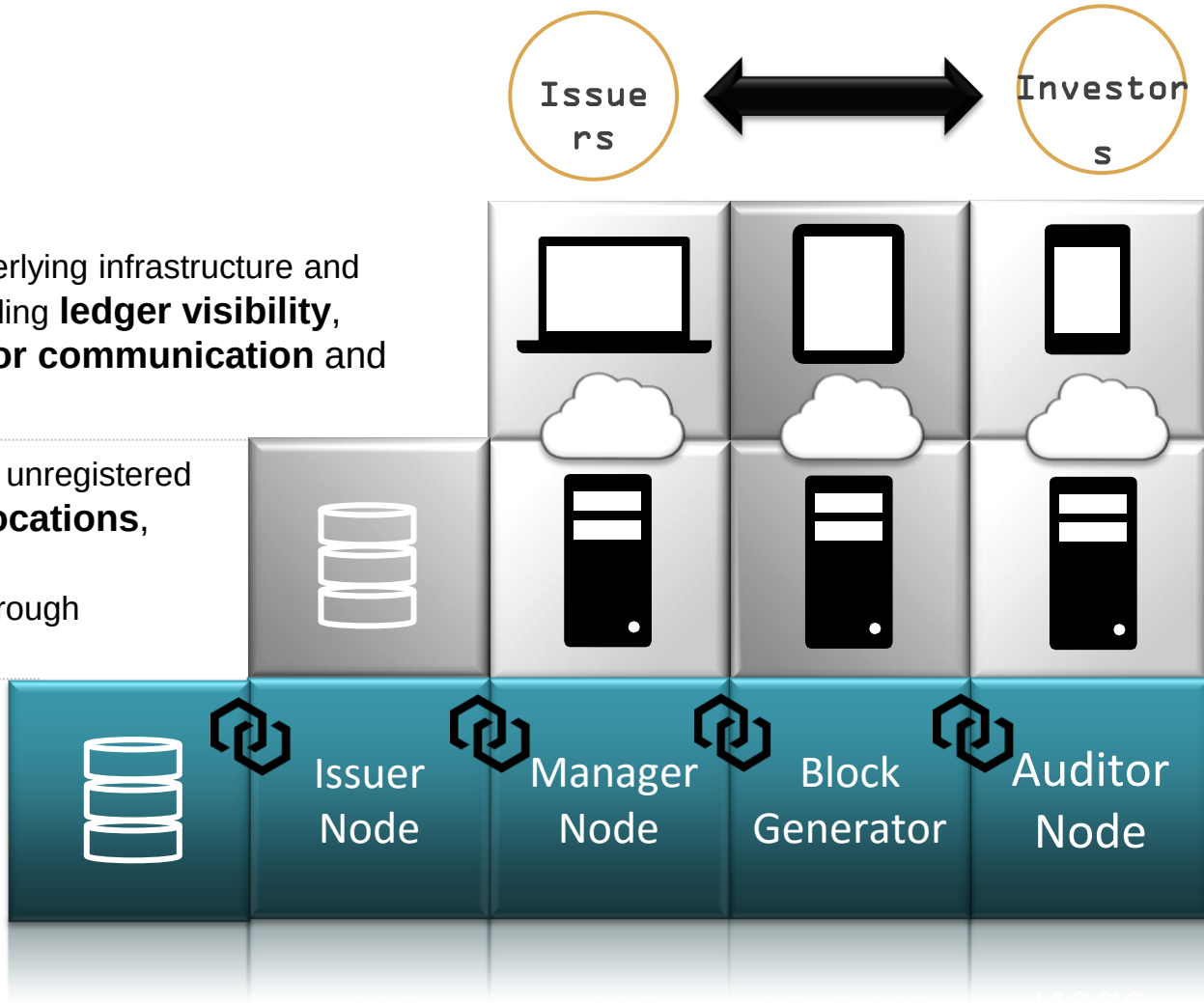
LINQ ARCHITECTURE

TECHNICAL INNOVATION IN PRIVATE SECURITIES

User Features leverage the underlying infrastructure and provide value-added services including **ledger visibility**, **contract management**, **investor communication** and **order management**.

Linq API enables management of unregistered securities including **issuance**, **allocations**, **corporate actions**, **auctions**, **transactions** and **settlement** through integration with paying agent.

Blockchain Enabled Ledger provides **data provenance**, **immutability**, **protection from double-spend** and **distribution** of record keeping.



NATIVE ASSET ISSUANCE

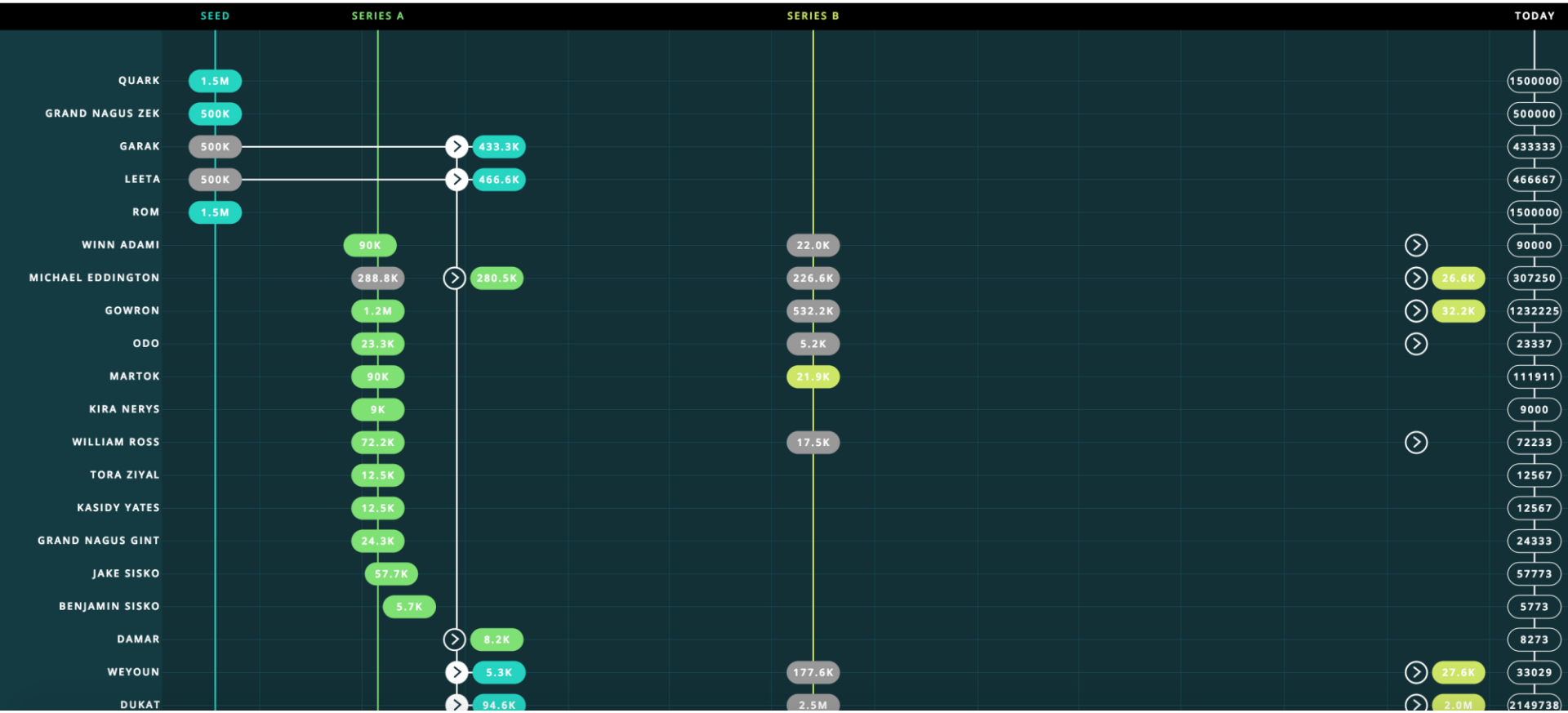
FOR EACH CLASS OF SHARES

Key Financing Events

ROUND	ISSUED	ALLOCATED	UN-ALLOCATED	SHARE PRICE
SEED	9,716,729	4,719,465	4,997,264	$0.0001
SERIES A	3,611,984	2,013,267	1,598,717	$1.5555
SERIES B	5,889,714	3,827,840	2,061,874	$11.75

FULL REGISTRAR RECORD KEEPING

EQUITY TIMELINE



AUCTION-BASED ORDER MATCHING

ALL POSITIONS VALIDATED FROM THE REGISTRAR

Chain 2016 Q1 Series B

MATCHED BUY TOTAL $18,068,597.75 | CLEARING PRICE $11.75

EXECUTE AUCTION

TOTAL SHARES TO BUY	TOTAL SHARES TO SELL	TOTAL SHARES MATCHED	TOTAL SHARES UNMATCHED	IMBALANCE SIDE	IMBALANCE SHARES
1,750,000	1,537,753	1,537,753	212,247	*Buy*	212,247

Buyers

3 BUYING 1,750,000 SHARES

ORDER	DATE	PARTICIPANT	ORDER SIZE	PRICE	MATCH SIZE	SPECIAL
336	2016-3-4	GRAMMAR BIO-MEDICAL GROUP	900,000	$15.00	900000	
338	2016-3-4	CALTEGRIS FUTURES INC	300,000	$14.00	300000	
337	2016-3-4	BLACKGEM INC	550,000	$13.00	337753	

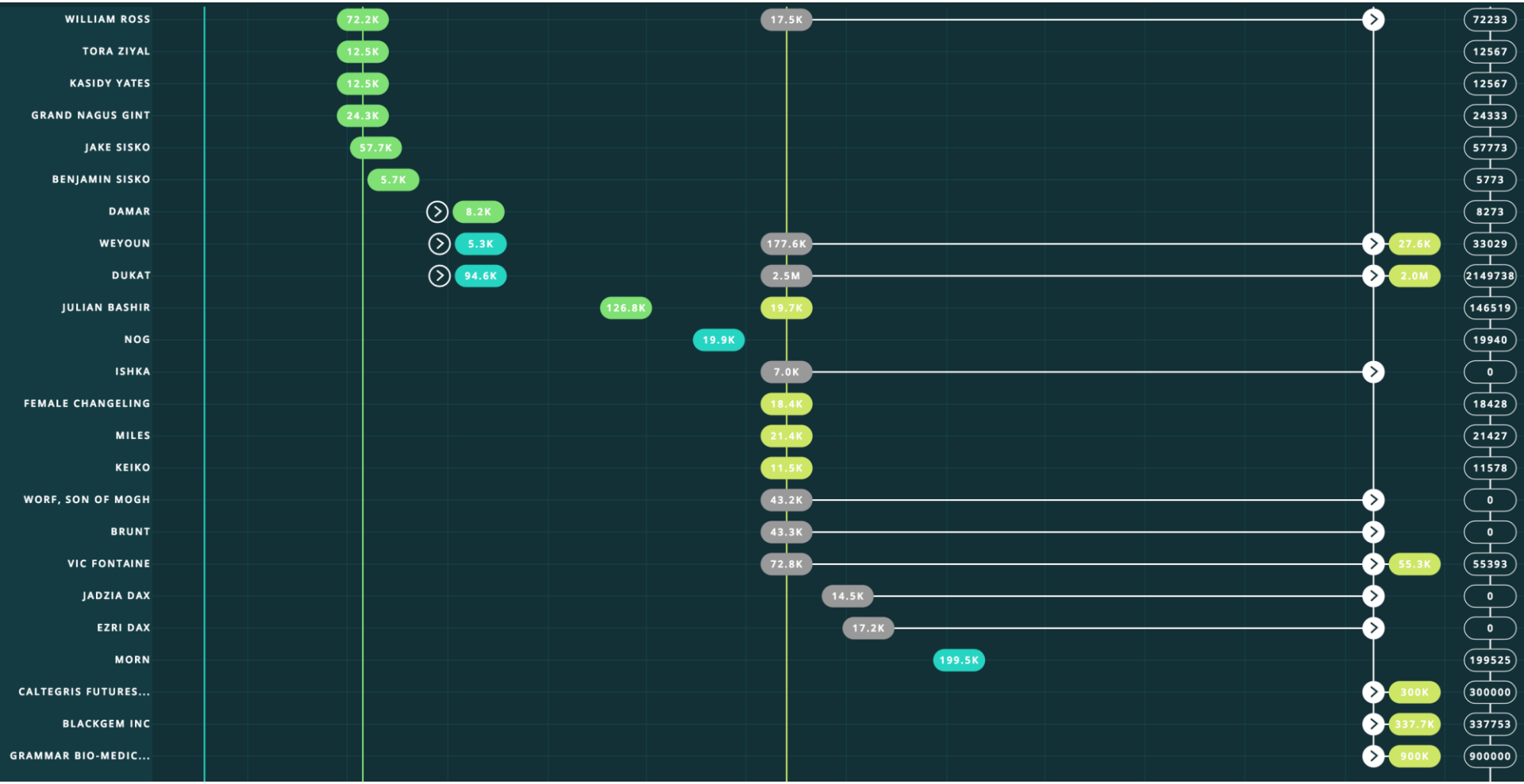
Sellers

13 SELLING 1,537,753 SHARES

ORDER	DATE	PARTICIPANT	ORDER SIZE	PRICE	MATCH SIZE	SPECIAL
328	2016-3-4	VIC FONTAINE	17,504	$9.00	17504	
329	2016-3-4	WINN ADAMI	22,011	$9.00	22011	
330	2016-3-4	WILLIAM ROSS	17,560	$9.00	17560	
331	2016-3-4	ODO	5,220	$9.00	5220	
332	2016-3-4	BRUNT	43,332	$9.00	43332	
339	2016-3-4	EZRI DAX	17,263	$9.00	17263	
333	2016-3-4	ISHKA	7,031	$10.00	7031	
334	2016-3-4	WORF, SON OF MOGH	43,255	$10.00	43255	
335	2016-3-4	JADZIA DAX	14,577	$10.00	14577	
324	2016-3-4	DUKAT	500,000	$10.50	500000	
325	2016-3-4	WEYOUN	150,000	$10.50	150000	

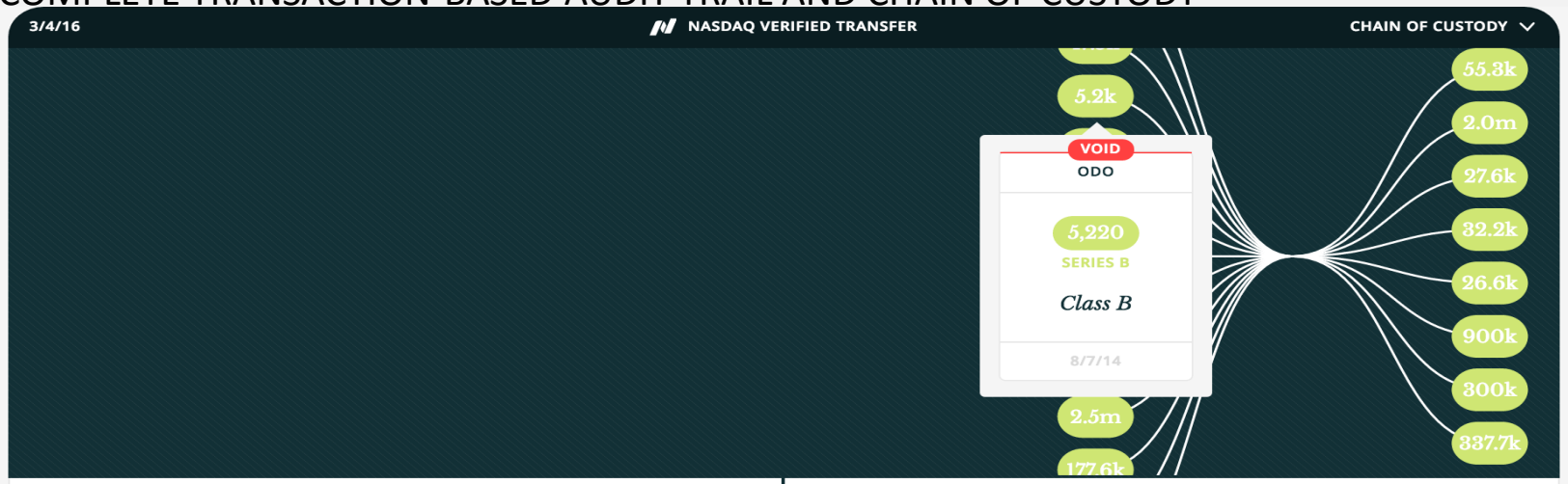
TRANSACTION EXECUTION

A SINGLE BLOCKCHAIN TRANSACTION REPRESENTS A MANY-TO-MANY TRANSFER



TRANSACTION EXECUTION

COMPLETE TRANSACTION-BASED AUDIT TRAIL AND CHAIN OF CUSTODY



VIC FONTAINE	72,897	SERIES B SHARES	>	VIC FONTAINE	55,393	SERIES B SHARES
WINN ADAMI	22,011	SERIES B SHARES		DUKAT	2,055,109	SERIES B SHARES
WILLIAM ROSS	17,560	SERIES B SHARES		WEYOUN	27,658	SERIES B SHARES
ODO	5,220	SERIES B SHARES		GOWRON	32,225	SERIES B SHARES
BRUNT	43,332	SERIES B SHARES		MICHAEL EDDINGTON	26,656	SERIES B SHARES
EZRI DAX	17,263	SERIES B SHARES		GRAMMAR BIO-MEDICAL GROUP	900,000	SERIES B SHARES
ISHKA	7,031	SERIES B SHARES		CALTEGRIS FUTURES INC	300,000	SERIES B SHARES
WORF, SON OF MOGH	43,255	SERIES B SHARES		BLACKGEM INC	337,753	SERIES B SHARES

INVESTOR VISIBILITY

Leeta

Investor

466.6k *Shares*

1 *Certificates*

LEETA	VOID LEETA
466,667	500,000
SEED	SEED
Common Class	*Common Class*
10/31/13	2/20/13

CLASS	SHARES	PRICE	AMT. INVESTED
CO COMMON CLASS	466,667	$0.000001	$0.47
TOTAL	466,667		$0.47

BLOCKCHAIN BACKED RECORDS

EACH RECORD OF OWNERSHIP BACKED BY BLOCKCHAIN TRANSACTION

Certificate #2085

466,667 shares of Common Class issued on October 31st, 2013 to Leeta .

NASDAQ VERIFIED CERTIFICATE | TRANSACTION ID 29D042CF06142AD711AF3C0532E66863C9493055AC8C4CE290D813E1D1AB5252

THIS CERTIFIES THAT

Leeta

IS THE OWNER OF

466,667

Fully paid and non-assessable shares of the Common Class stock of Leeta

PRICE PER SHARE:

$0.0001

INVESTMENT AMOUNT:

$46.67

Chain

THESE SECURITIES HAVE NOT BEEN REGISTERED UNDER THE SECURITIES ACT OF 1933, AS AMENDED. THEY MAY NOT BE SOLD, OFFERED FOR SALE, PLEDGED OR HYPOTHECATED IN THE ABSENCE OF A REGISTRATION STATEMENT IN EFFECT WITH RESPECT TO THE SECURITIES UNDER SUCH ACT OR AN OPINION OF COUNSEL SATISFACTORY TO THE COMPANY THAT SUCH REGISTRATION IS NOT REQUIRED OR UNLESS SOLD PURSUANT TO RULE 144 OF SUCH ACT.

THE SECURITIES REPRESENTED BY THIS CERTIFICATE ARE SUBJECT TO A LOCK-UP PERIOD AFTER THE EFFECTIVE DATE OF THE ISSUER'S REGISTRATION STATEMENT FILED UNDER THE SECURITIES ACT OF 1933, AS AMENDED, AS SET FORTH IN AN AGREEMENT BETWEEN THE COMPANY AND THE ORIGINAL HOLDER OF THESE SECURITIES, A COPY OF WHICH MAY BE OBTAINED AT THE ISSUER'S PRINCIPAL OFFICE. SUCH LOCK-UP PERIOD IS BINDING ON TRANSFEREES OF THESE SHARES.

THE SHARES EVIDENCED HEREBY ARE SUBJECT TO A VOTING AGREEMENT (A COPY OF WHICH MAY BE OBTAINED UPON WRITTEN REQUEST FROM THE ISSUER), AND BY ACCEPTING ANY INTEREST IN SUCH SHARES THE PERSON ACCEPTING SUCH INTEREST SHALL BE DEEMED TO AGREE TO AND SHALL BECOME BOUND BY ALL THE PROVISIONS OF SAID VOTING AGREEMENT.

THE COMPANY IS AUTHORIZED TO ISSUE MORE THAN ONE CLASS OR SERIES OF STOCK. A COPY OF THE PREFERENCES, POWERS, QUALIFICATIONS AND RIGHT

IN-SYSTEM CONTRACT FLOWS

REDUCE ANY POTENTIAL FOR DOUBLE ENTRY OF INFORMATION

Pending Certificate

1 shares of Common Class issued on March 4th, 2016 to Leeta .

All contracts are signed. AUTHORIZE PAYMENT

LEGEND

FIRST REFUSAL & CO-SALE | INVESTOR RIGHTS | PURCHASE AGREEMENT | VOTING AGREEMENT

THIS CERTIFIES THAT

Leeta

IS THE OWNER OF

1

Fully paid and non-assessable shares of the Common Class stock of Quark Inc.

PRICE PER SHARE:

$0.01

Chain

SECOND AMENDED AND RESTATED FIRST REFUSAL AND CO-SALE AGREEMENT

This **SECOND AMENDED AND RESTATED FIRST REFUSAL AND CO-SALE AGREEMENT** (the "Agreement") is entered into as of the 31st day of August, 2015 by and among CHAIN, INC., a Delaware corporation (the "Company"), the holders of Common Stock of the Company (the "Common Stock") listed on Exhibit A attached hereto (the "Common Holders") and the holders of Series A Preferred Stock, Series B Preferred Stock, Series C Preferred Stock and Series C-1 Preferred Stock of the Company (collectively, the "Preferred Stock") listed on Exhibit B attached hereto (the "Investors").

WITNESSETH:

WHEREAS, the Company and certain of the Investors (the "Series C Investors") are parties to that certain Series C and Series C-1 Preferred Stock Purchase Agreement of even date herewith (the "Series C Agreement"), pursuant to which the Series C Investors are purchasing shares of the Company's Series C Preferred Stock and Series C-1 Preferred Stock;

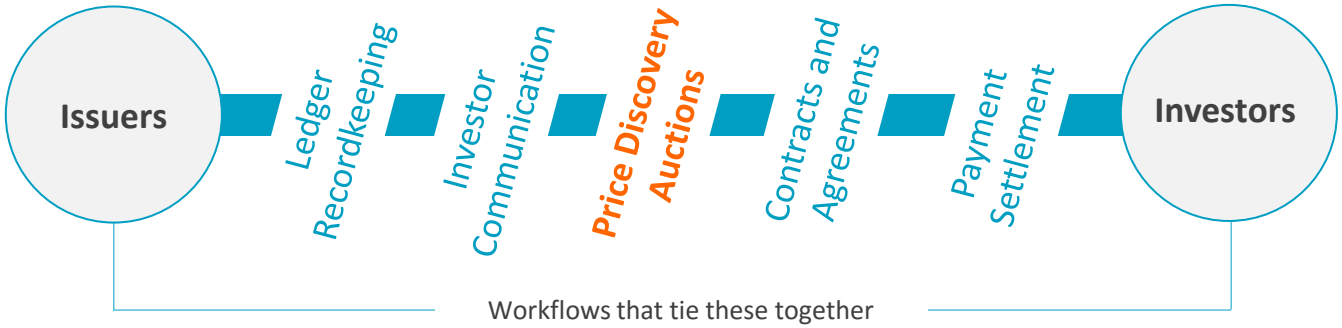
WHEREAS, each Common Holder is the beneficial owner of the number of shares of Common Stock set forth opposite his name on Exhibit A attached hereto;

WHEREAS, the Company, the Common Holders and certain of the Investors (the "Existing Investors") are parties to that certain Amended and Restated First Refusal and Co-Sale Agreement, dated as of August 7, 2014 (the "Prior Agreement"); and

NASDAQ LINQ AS A PLATFORM ACROSS ASSETS

Given the platform capabilities, Linq can become the foundation to support a wide variety of asset types and market structures.

PLATFORM CAPABILITIES



Bankchain

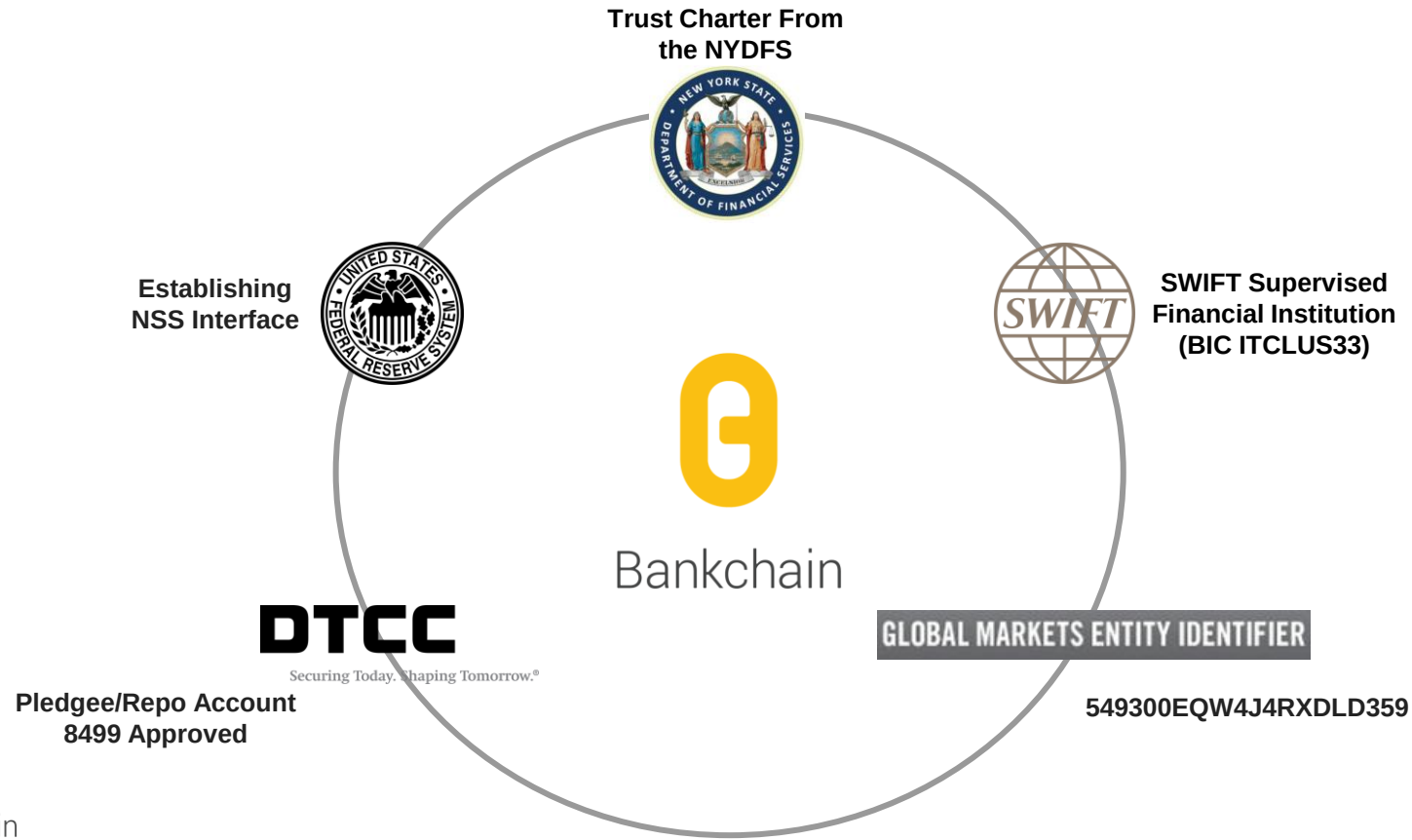
T+0 Delivery-versus-Payment Settlement for Gold and Listed Securities

What is Bankchain?

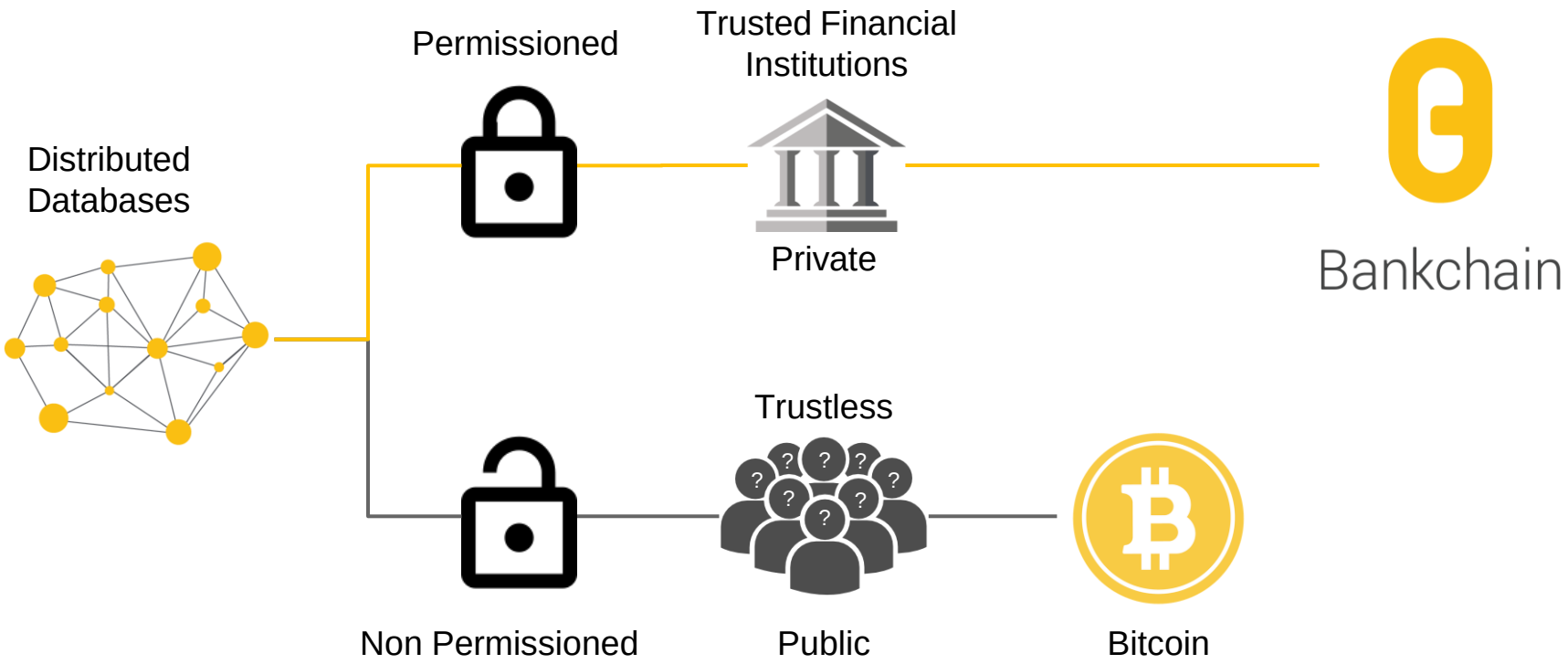
Bankchain is a permissioned, distributed ledger, engineered specifically for financial institutions as the next generation post-trade platform.

- Verified, shared books and records amongst financial institutions
- Fault tolerant: multi-node, decentralized system
- Provides perfect asset provenance
- Removes need for multiple reconciliations

Bankchain's Regulated Infrastructure Connectivity



Ledger Landscape



Architecture

Bankchain's Native Tokens

Overview:

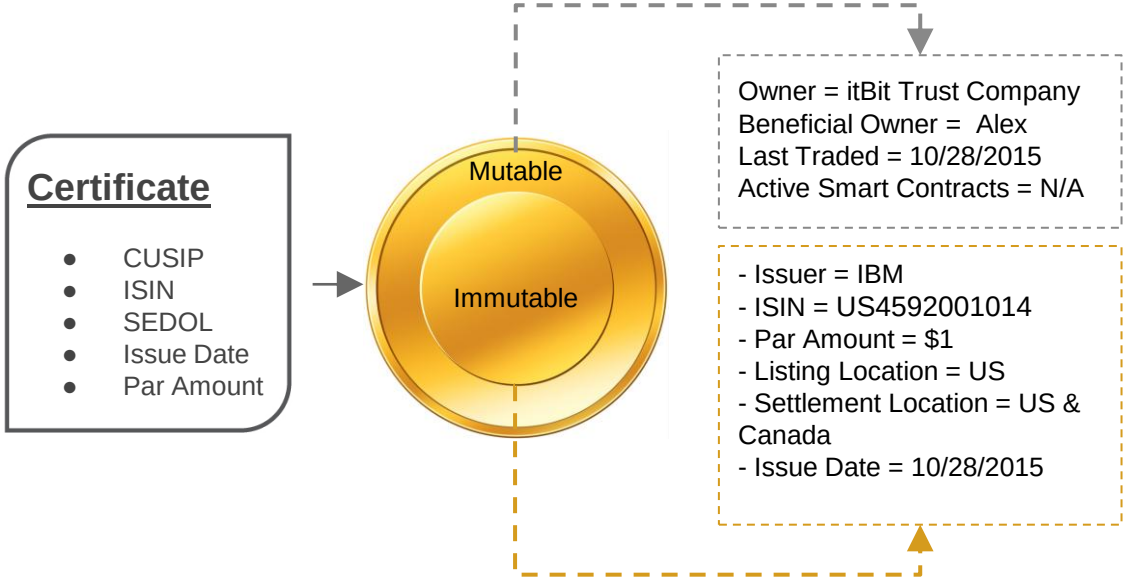
Tokens are digital representations of assets which convey a perfected interest in the underlying security.*

Primary Types:

- Asset Tokens
- Cash Notional Tokens

Characteristics:

- Enhanced Database Entries
- Valueless
- Unlimited



* Legal Opinion via Cleary Gottlieb

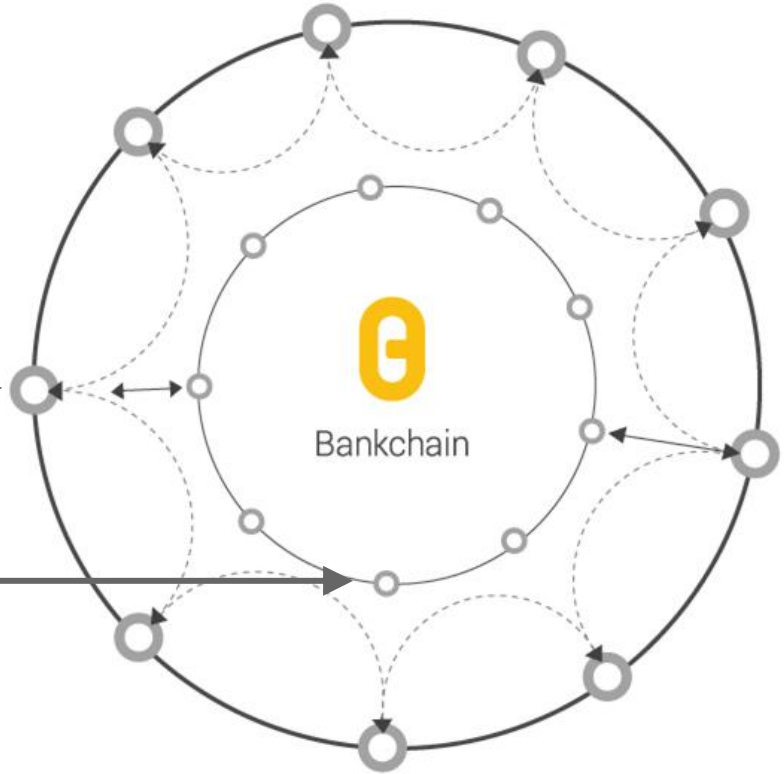
Messaging and Consensus

Messaging Layer

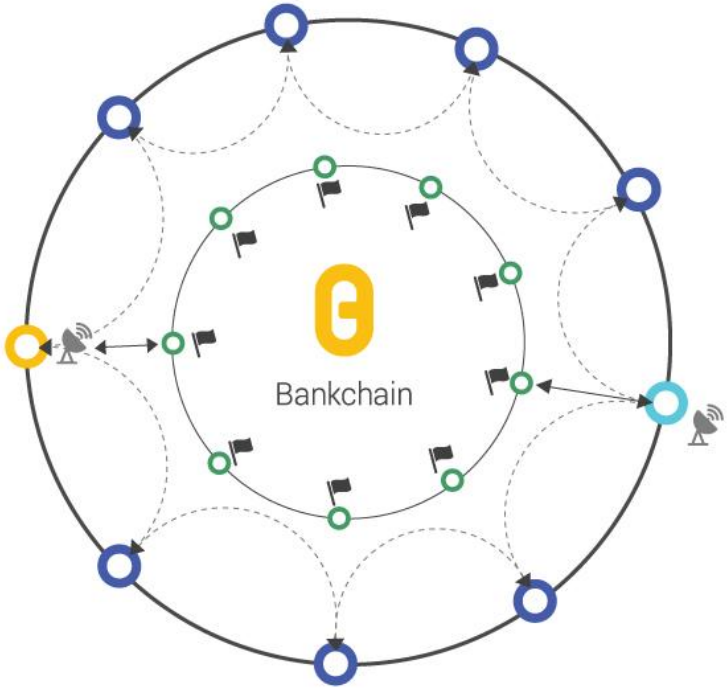
Clearing / Matching Trades
Fund Verification
Messaging
Netting

Consensus Layer

Performs consensus and adds blocks to the chains in 30 second intervals. Maintains ownership states across the ledger.



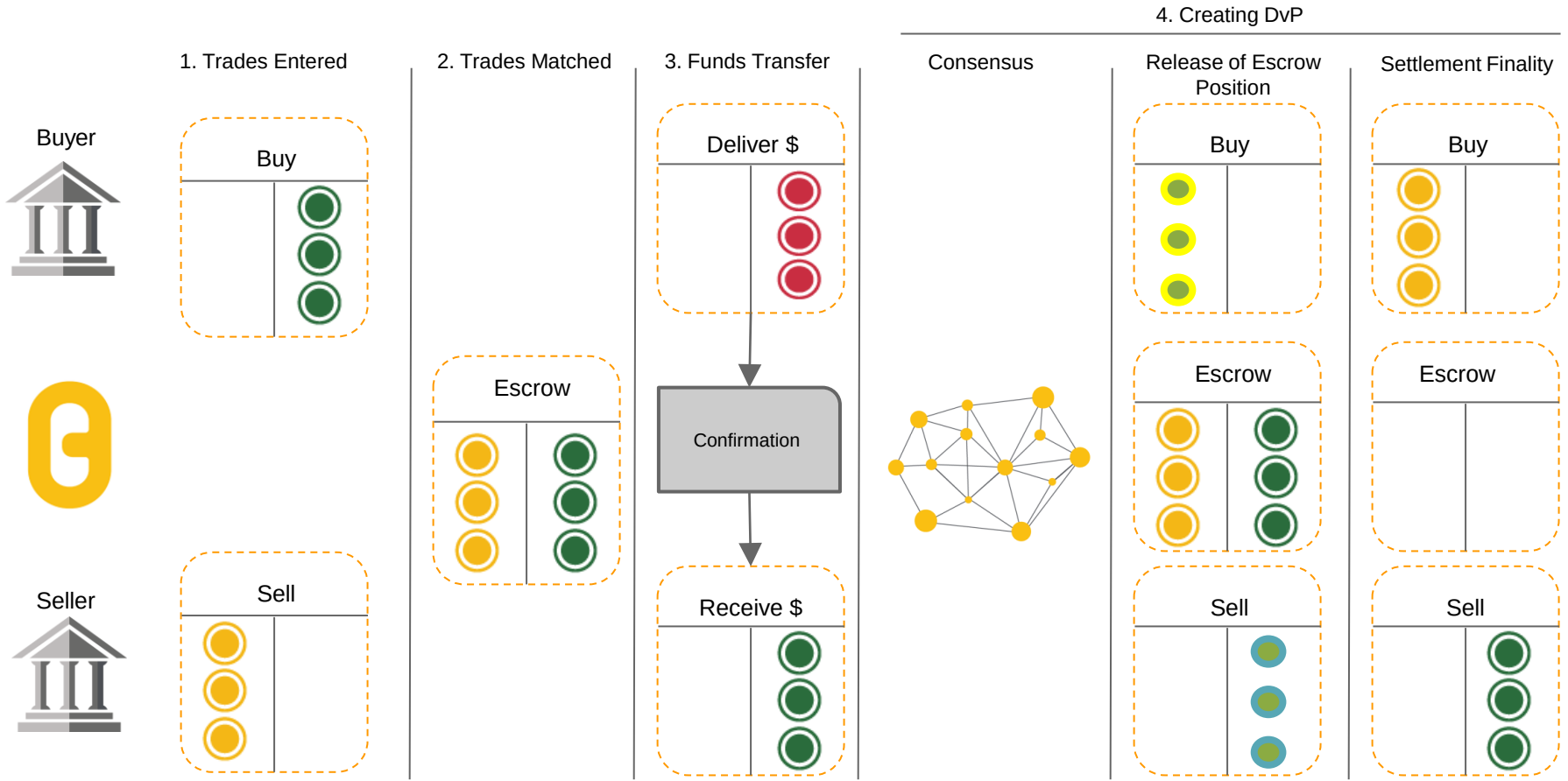
Trade Validation (for OTC Transactions)



Node / Bankchain Activities

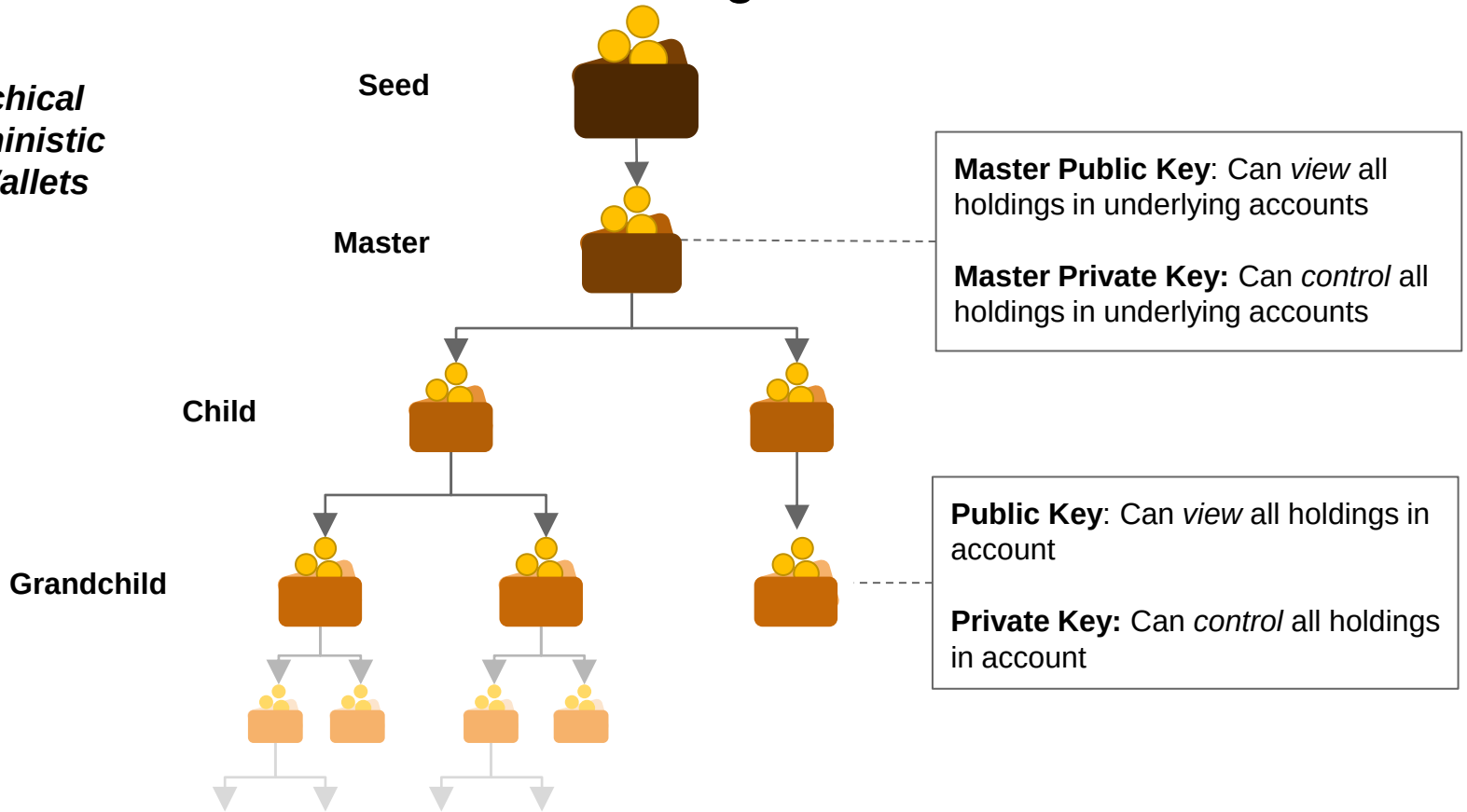
- Transmits MT541/RvP (Buyer) - Encrypted Matching Instruction
- Transmits MT543/DvP (Seller) - Encrypted Matching Instruction
- No Matching Instructions
- Hash and Key Match
- Performs Key Field Matching and Balance Check
- Confirms Match (or Fail) via MT548 (Trade Status)
- Submit Confirmed Hash for Consensus
- Bankchain Nodes Perform Consensus
- Transactions Posted to Bankchain

Settlement and Funding Flows



Next Generation Sub-Accounting

Hierarchical Deterministic (HD) Wallets



The Bankchain Advantage

- **Risk Mitigation and Next Generation Analytics**
  - Increased transparency
  - Regulatory adaptability
  - Stability via the distributed ledger system
  - Trusted network of permissioned participants
  - Full inventory control
  - Real-time credit tracking
  - Perfect asset provenance

- **Increased Speed & Improved Economics**
  - Integration and synchronization with participant platforms
  - Near instantaneous clearing and settlement
  - True Delivery vs Payment (DvP)
  - High level of automation through smart contracts
  - Promptly announced and synchronized corporate actions -- ***revive initiatives to have issues use XBRL to tag corporate actions in prospectuses? More on this later…***

Precious Metals

Current Market Landscape

- Wide recognition that infrastructure needs to be improved
- Concern about transparency / liquidity / cost: LBMA RFPs
- Potential for the fracturing of the market: WGC and other initiatives
- Our **proprietary RWA study**: for every $100 worth of an unallocated gold balance, a participant is charged approx. $1.20 for capital usage
- London's clearing and settlement service to global participants constricted by London business hours
- Buildout of competitive Asian infrastructure
- Departure of trading houses (Most recently Mitsui)

Challenges to Today's Infrastructure

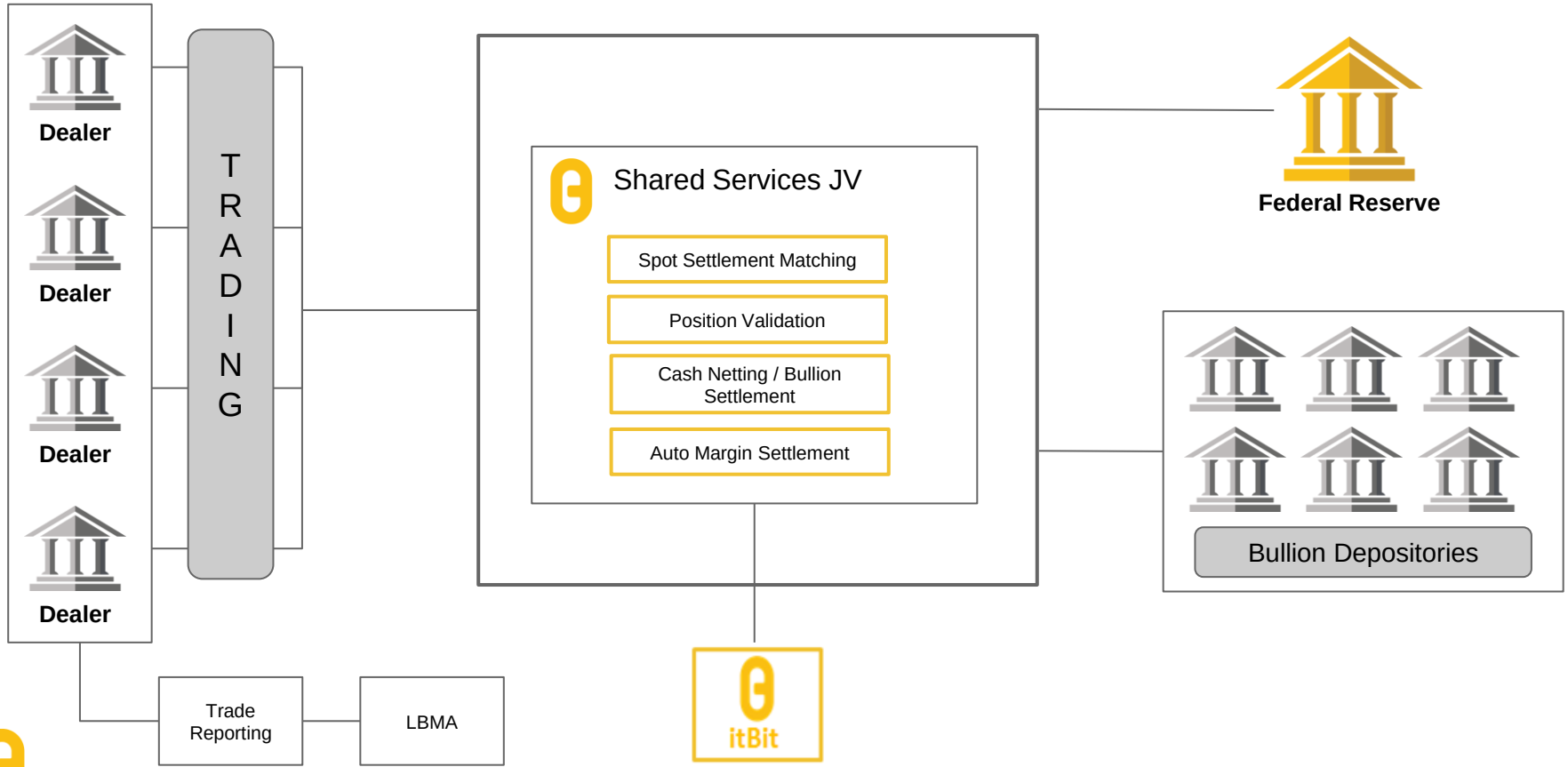
The cornerstone of London trading is unallocated gold which has a bifurcated settlement process with inherent risk:

- Large intraday credit exposure amongst clearers, between clearers and clients, and between market participants
- Inefficient balance sheet utilization
- Unallocated positions possibly irrecoverable in insolvency
- Settlement concentration risk: *what if a clearer fails?*
- Insufficient transparency
- Deutsche, Barclays exits

Features & Benefits of Precious Metals on Bankchain

FEATURES	BENEFITS
Automated DvP for the first time in the gold market	Risk reduction
Faster settlement times	Capital savings; better capital utilization
Automated clearing and settlement solutions for allocated and unallocated gold	Error reduction; Lower operational cost
Dematerialized Gold	Efficient use in collateral and financing

Envisaged Strategic Solution



Allocated, Unallocated…or the best of *both?*

Our joint solution marries the best qualities of allocated and unallocated for the wholesale market

Allocated qualities

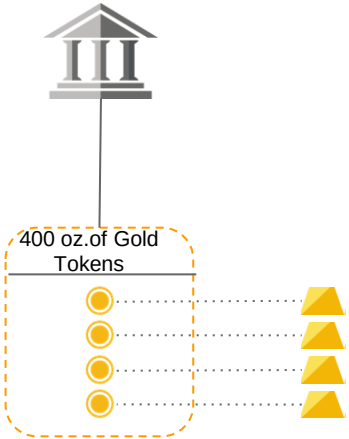
- Perfected ownership
- Use for collateral
- Use for liens
- Credit exposure to clearer eliminated
- Risk weighted asset (RWA) cost eliminated

Unallocated qualities

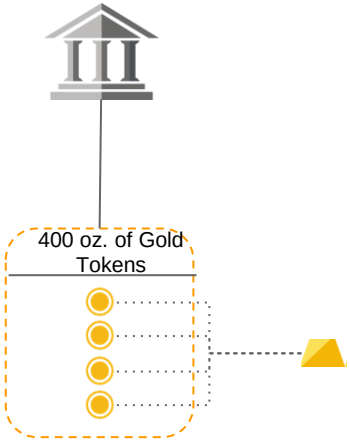
- Convenience of settling without a bar list
- Settle amounts different than bar sizes
- Speed and simplicity of settlement
- Reduced vaulting fees

Leveraging these best qualities will strengthen London as a clearing and settlement hub

Fractionalization



Intra-settlement cycle participants can own fractional positions in numerous gold bars



At the end of settlement cycle, the bars are reconstituted to consolidate positions back into whole bars

Reduction in Capital Charges

Bankchain will reduce/ eliminate credit risk capital charges associated with unallocated gold, increasing profit by ~1.2% of unallocated gold assets

Unallocated

Asset	Liability
$100 unallocated loan to dealer (RWA = 100%)	$100 unallocated deposit from customer
	Equity
	~$13 capital for unallocated gold

Bankchain

Asset	Liability
$100 allocated (RWA = 0%) 	$100 allocated deposit from customer
	Equity
	~$0 capital for allocated gold

Reduction in capital charge improves profitability of gold

If a market participant extends $100mn in intraday credit to counterparties for unallocated gold processing, Bankchain could save $1.2M in capital charges

Future-Proofing of London Clearing

itBit proposes an evolution of traditional settlement by keeping key benefits, eliminating risky weaknesses, and adding potent attributes.

- Bankchain enables the market to trade with the ease of unallocated while settling with the safety of allocated.
- Our solution reflects the increasing preference for allocated storage in recent years, which addresses increasingly important credit and balance sheet concerns
- Allocated storage is approaching unallocated rates, minimizing friction between allocated and unallocated.

A Game Changer for the Front Office

Expand profitability through new relationships and products.

- Lower credit names that otherwise meet account opening standards can be serviced with Delivery vs. Payment (DvP) and same day settlement (T+0)
- Residual arbitrage positions from these trades provide “an ax to grind” with other clients - increasing trade velocity and profitability
- Revenue growth in other business units (Advisory, etc.) from these new relationships
- Solve for customer risk by innovating solutions using Bankchain tools

Next Generation Operational Efficiencies

- Risk reduction from DvP
- Errors swiftly identified at market level
- Significantly lower transaction costs
- Front and back office integration
- Real-time status of the settlement cycle
- Dynamic inventory and credit exposure management
- Simplified process of using gold as collateral, which will be useful as collateral needs arise

Opt-In T+0 Listed Securities

Listed Securities DVP on Bankchain

Overview:
Bankchain can provide near instant clearing and settlement for all listed securities by integrating the current financial infrastructure with next-generation distributed ledger technology.

Advantages:

- Near instantaneous settlement finality
- Increased liquidity
- Full automation
- Big data analytics

The Architecture of T+0

Achieving Same-Day Settlement

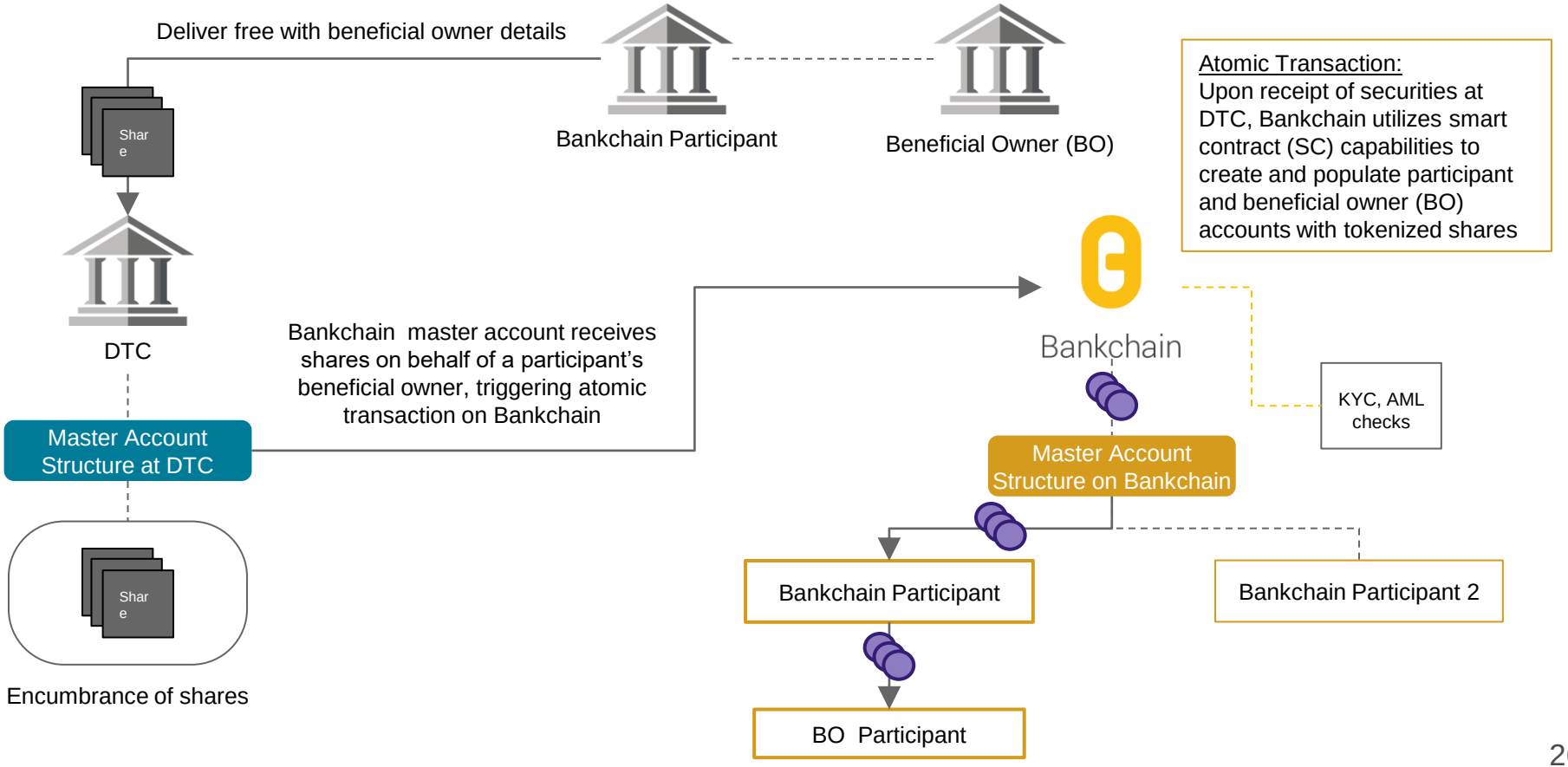
Bankchain offers participants T+0 via the use of “Master Account Structure”. This new entity will be created within the DTC and designed to hold and manage listed securities. These securities will then be tokenized and traded on Bankchain.

In choosing to make use of the “Master Account Structure”, participants would be opting into T+0. With this comes the advantages of:

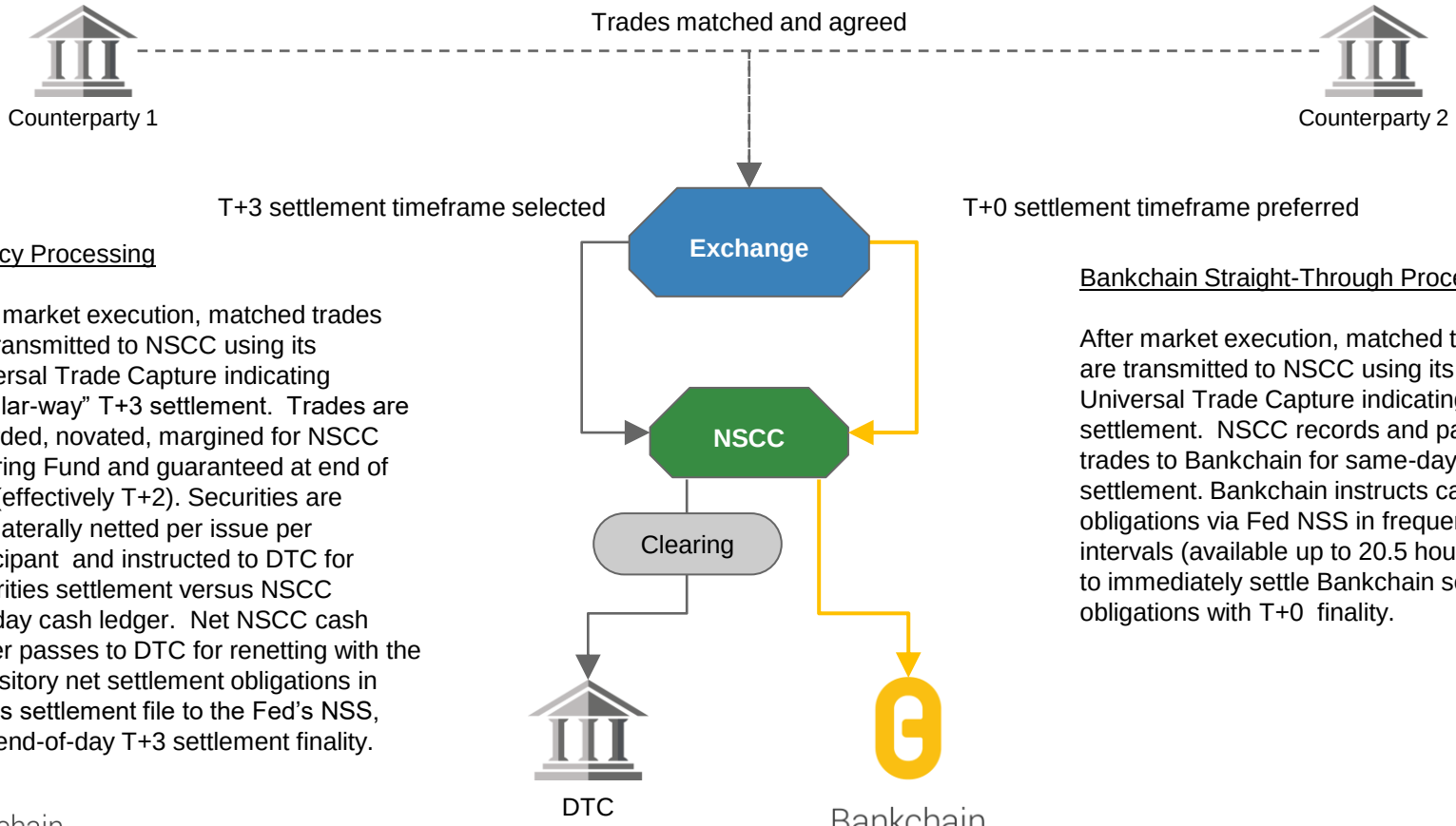
- Same day settlement/DvP
- Automated allocation and corporate actions
- True beneficial owner level information

Participants would agree to meet the requirements of facilitating T+0 settlement.

Tokenization of Listed Securities



Bankchain as a Settlement Location



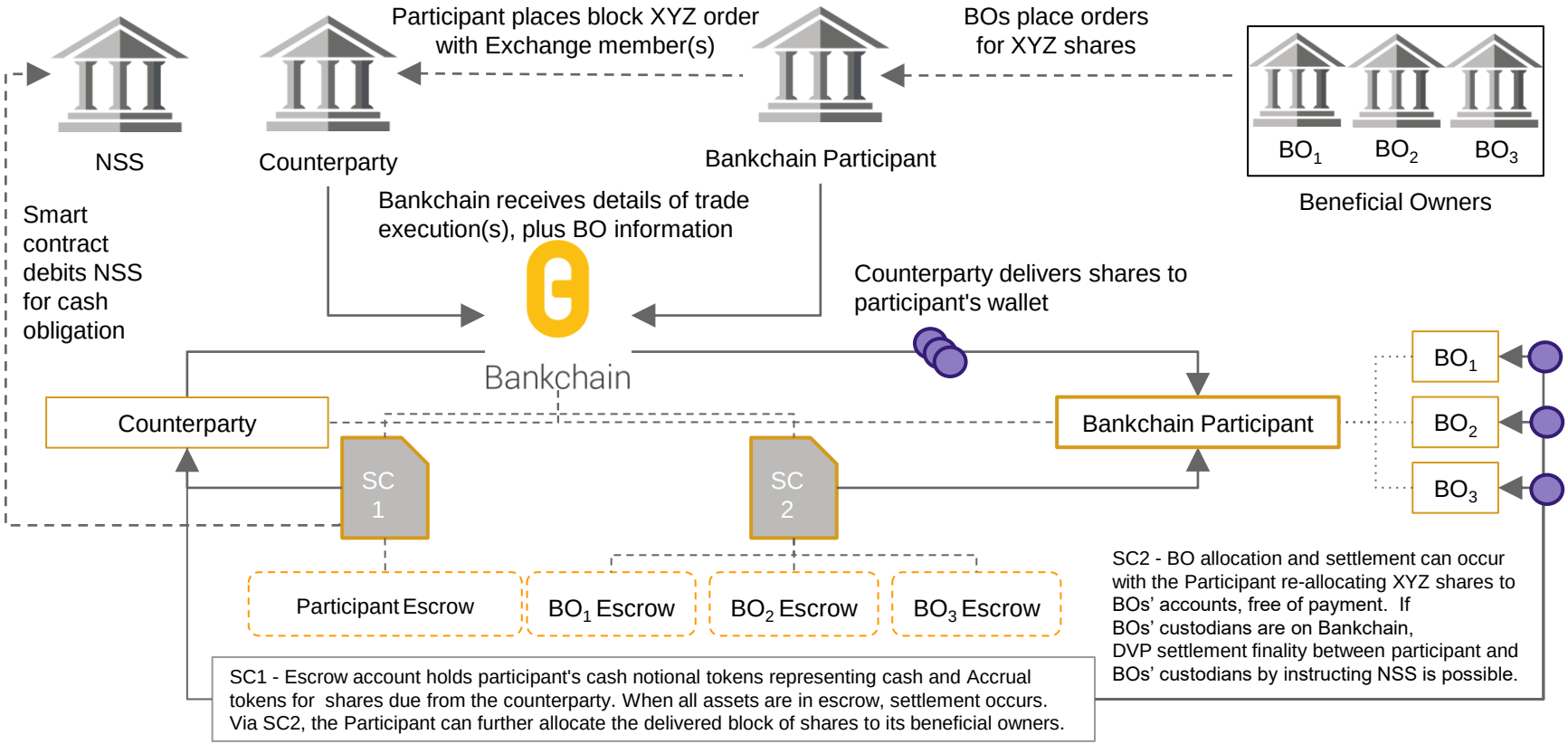
Legacy Processing

After market execution, matched trades are transmitted to NSCC using its Universal Trade Capture indicating "regular-way" T+3 settlement. Trades are recorded, novated, margined for NSCC Clearing Fund and guaranteed at end of T+1 (effectively T+2). Securities are multilaterally netted per issue per participant and instructed to DTC for securities settlement versus NSCC intraday cash ledger. Net NSCC cash ledger passes to DTC for renetting with the depository net settlement obligations in DTC's settlement file to the Fed's NSS, with end-of-day T+3 settlement finality.

Bankchain Straight-Through Processing

After market execution, matched trades are transmitted to NSCC using its Universal Trade Capture indicating T+0 settlement. NSCC records and passes trades to Bankchain for same-day DVP settlement. Bankchain instructs cash obligations via Fed NSS in frequent intervals (available up to 20.5 hours a day) to immediately settle Bankchain securities obligations with T+0 finality.

How the Trade is Made on Bankchain



Why Use XBRL for Corporate Actions?

The Problem

"Losses on corporate actions worldwide were between $400 and $900 million U.S. dollars each year"

2006 study by the U.K. independent research firm Oxera

- **Manual process**
- **Re-keying of data**
- **Time consuming**
- **Inefficient**
- **Significant financial impact**

The XBRL Solution

DTCC, SWIFT and XBRL US are building a corporate actions XBRL taxonomy aligned with ISO 20022 repository elements

- **Automates the process**
- **Eliminates re-keying**
- **Faster process**
- **More efficient process**
- **Reduces losses**

Corporate Actions API via XBRL-Tagged ISO 20022?

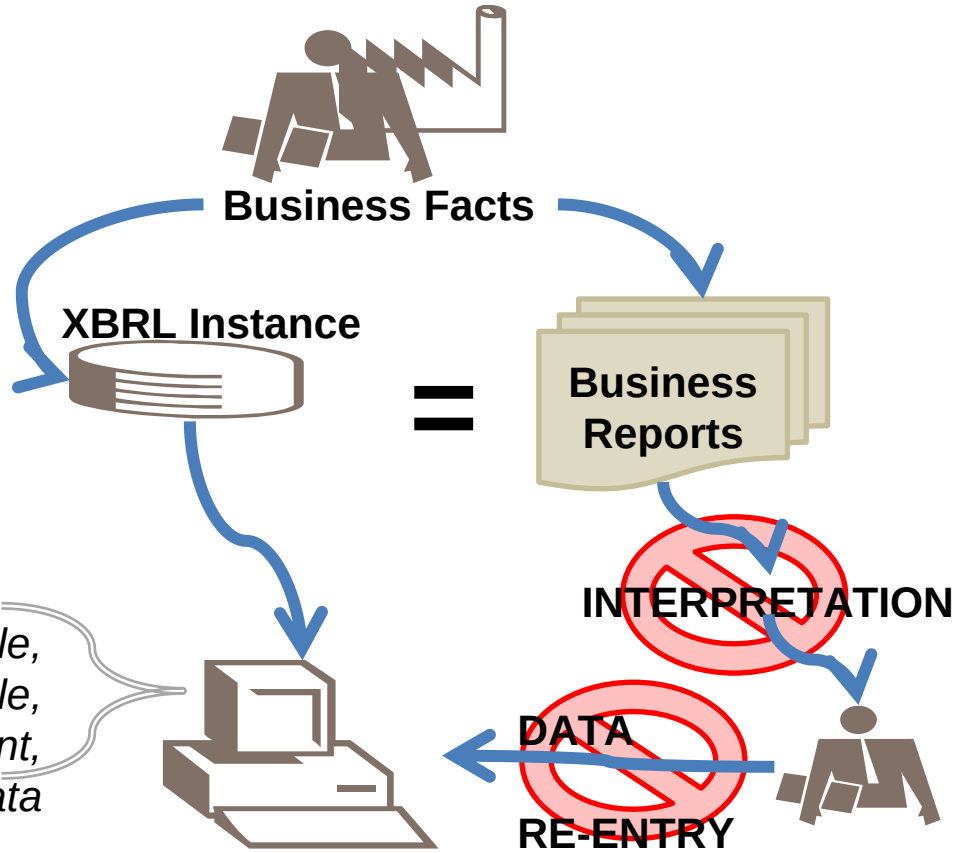
BUSINESS STANDARDS

XBRL Standard

XBRL TAXONOMY
(data dictionary, metadata)

Examples:
IFRS, US GAAP, JP GAAP
UK HMRS, US FDIC,
US Corporate Actions

Features: machine readable, structured, comparable, analyzable, consistent, verifiable, usable data



Bankchain

Bankchain will automate, accelerate and enhance post-trade processes across the financial services industry, saving institutions time and money.

Visit bankchain.com or contact us at bankchain@itbit.com to learn more.

Smart Contracts, Blockchain and Data Standards

April 4, 2016 | New York City

Sponsoring organizations

Baruch College Zicklin School of Business

CFA Institute

XBRL US

ConsenSys Blockchain Highlight Use Case: Ethereum Total Return Swap

James Slazas

- ConsenSys Head of Capital Markets
- James.Slazas@ConsenSys.net

Agenda

- Ethereum
- Ethereum eTRS/Collateral Management
  - Blockchain Core Components
  - Step by Step Demo

General Purpose Computer

There are **5 interacting technological elements that are common between the Bitcoin and Ethereum Protocols.**

1. Blockchain Data Structure = entire history of transactions
2. Cryptographic Tokens = bitcoin and ether
3. Peer 2 Peer Networks = every node is both a client and server
4. Consensus Forming Algorithm = 10 min and 15 seconds
5. A Turing Complete Virtual Machine
    a. A virtual machine enables programmable money in both Bitcoin and Ethereum plus decentralized applications on Ethereum.

Ethereum = Smart Contracts

When we speak about smart contracts on the blockchain, we are talking about the Ethereum blockchain.

Bitcoin	transfers value
Ethereum	transfers value and enables non-specialist programmers to build decentralized applications (Smart Contracts) easily
	programming digital money only to be spent on food

Ethereum's History

Jan 2009	Bitcoin blockchain released
Nov 2013	Vitalik Buterin releases the Ethereum blockchain White Paper
Jul 2014	Ethereum crowdsale raises $18M worth of BTC for development
Jul 2015	**Ethereum 1.0 launched, Genesis block created**
Jan 2016	40+ banking consortium used Ethereum to transfer digital assets

7 Months After Launch…

Price:

~$12.50 (up from $0.30 at genesis sale)

Monetary base:

~ $1,000,000,000

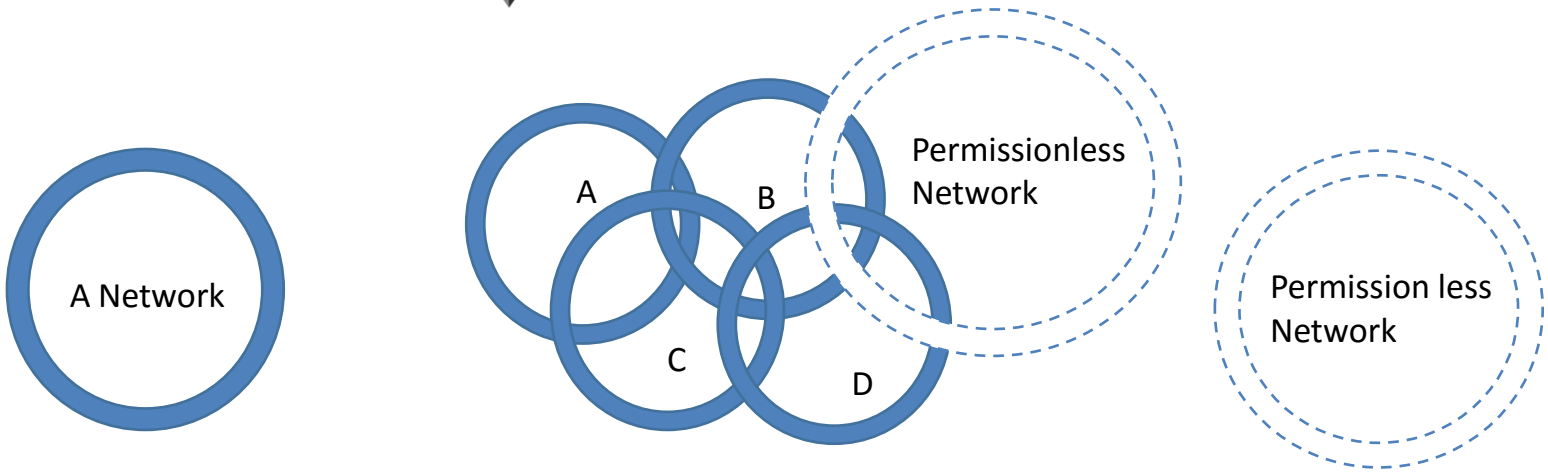
2nd largest crypto currency

Types of Blockchains

PRIVATE

PUBLIC

ethereum



Permissioned chain

Consortium chain

Permissionless chain

Technology Stack

// Application	BALANCE	DApps, Balanc3 Triple Entry Accounting, eTRS, eSign Smart Document and Mgt. Sys, Business Logic
// Core components	uport	**Wallet, Identity, Persona, Reputation, Registries, Token Issuance, Glue-BTC Relay, Token Issuance and Management Systems, EtherEx Token Exchange System (Native and Subtoken), Stable Token Systems**
// Interface		Tooling, Integrated Development Environments & Testbeds
// Infrastructure	BlockApps	Virtualized Network Node & API
// Blockchain	ethereum	**2 of 6 Ethereum Clients: Java and Haskell, Private Blockchains (ETH BaaS)**

Use Case: Core Components

- **uPort-Digital Identity**
  - Attributes-information controlled by individual
- **uPort-Reputation and Persona**
  - Attestations-information others have said of the individual
- **Oracles for Pricing and Reputation**
- **Balanc3-Triple Entry Accounting**
- **eSign-Smart Documentation Management**
- **Digital Assets**
- **Smart Contracts**
  - Business processes

LOGIN

Click to browse or

Drag uPort-wallet-id file here.

uPort Password:

1 Access uPort Wallet

This password decrypts your uPort wallet file.

LOGIN

Brought to you by:

Microsoft Azure

ETH BaaS
Ethereum Blockchain as a Service

CONSENSYS

WELCOME NIGEL

uPort Public Address

0x58415ffcb3a993cc3c702af21b3cb356237caccb

1 Public Address

AML/KYC Verified

2 Attribute: AML/KYC

4 Attestation: Reputation

Normalized Oracle Reputation

94/SD

3 Attribute: Regulatory Swap Dealer

INPUT CONTRACT TERMS »

CONTRACT TERMS

Please enter TRS

1 Pseudonymous CP

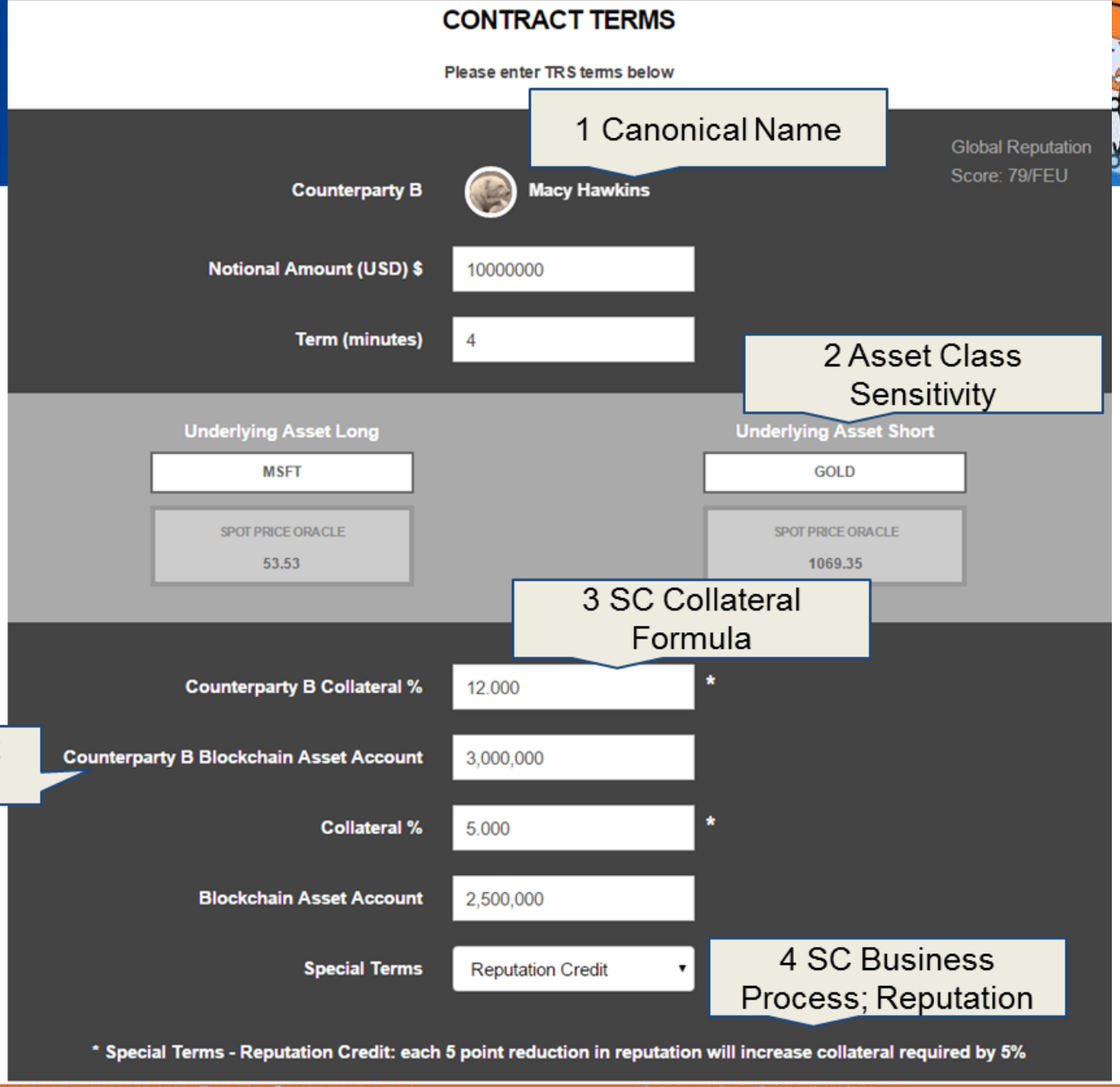
2 Identity and Reputation

Counterparty B	0x7fbe93bc104ac4bcae5d643fd3747e1866f1ece4	Global Reputation Score: 79/FEU
	ID COUNTERPARTY	
Notional Amount (USD) $	e.g. 10,000,000	
Term (minutes)		

Underlying Asset Long	Underlying Asset Short
MAKE SELECTION...	MAKE SELECTION...
SPOT PRICE ORACLE	SPOT PRICE ORACLE

Counterparty B Collateral %		*
Counterparty B Blockchain Asset Account	3,000,000	
Collateral %		*
Blockchain Asset Account	2,500,000	
Special Terms	Reputation Credit	

* Special Terms - Reputation Credit: each 5 point reduction in reputation will increase collateral required by 5%



5 Blockchain Asset Account

SMART CONTRACT

The counterparties agree to the following:

Nigel Woolworth			Macy Hawkins		
NOTIONAL AMOUNT	$10,000,000		NOTIONAL AMOUNT	$10,000,000	
POSITION	MSFT / Gold		POSITION	Gold / MSFT	
REQUIRED COLLATERAL AMOUNT	$500,000	NOT FUNDED	REQUIRED COLLATERAL AMOUNT	$1,200,000	NOT FUNDED
BLOCKCHAIN ASSET ACCOUNT	$2,500,000		BLOCKCHAIN ASSET ACCOUNT	$3,000,000	

1 Unfunded Collateral

SPOT PRICE

MSFT : 53.52

Gold : 1069.43

SWAP TERM

4 minutes

NEXT STEPS:

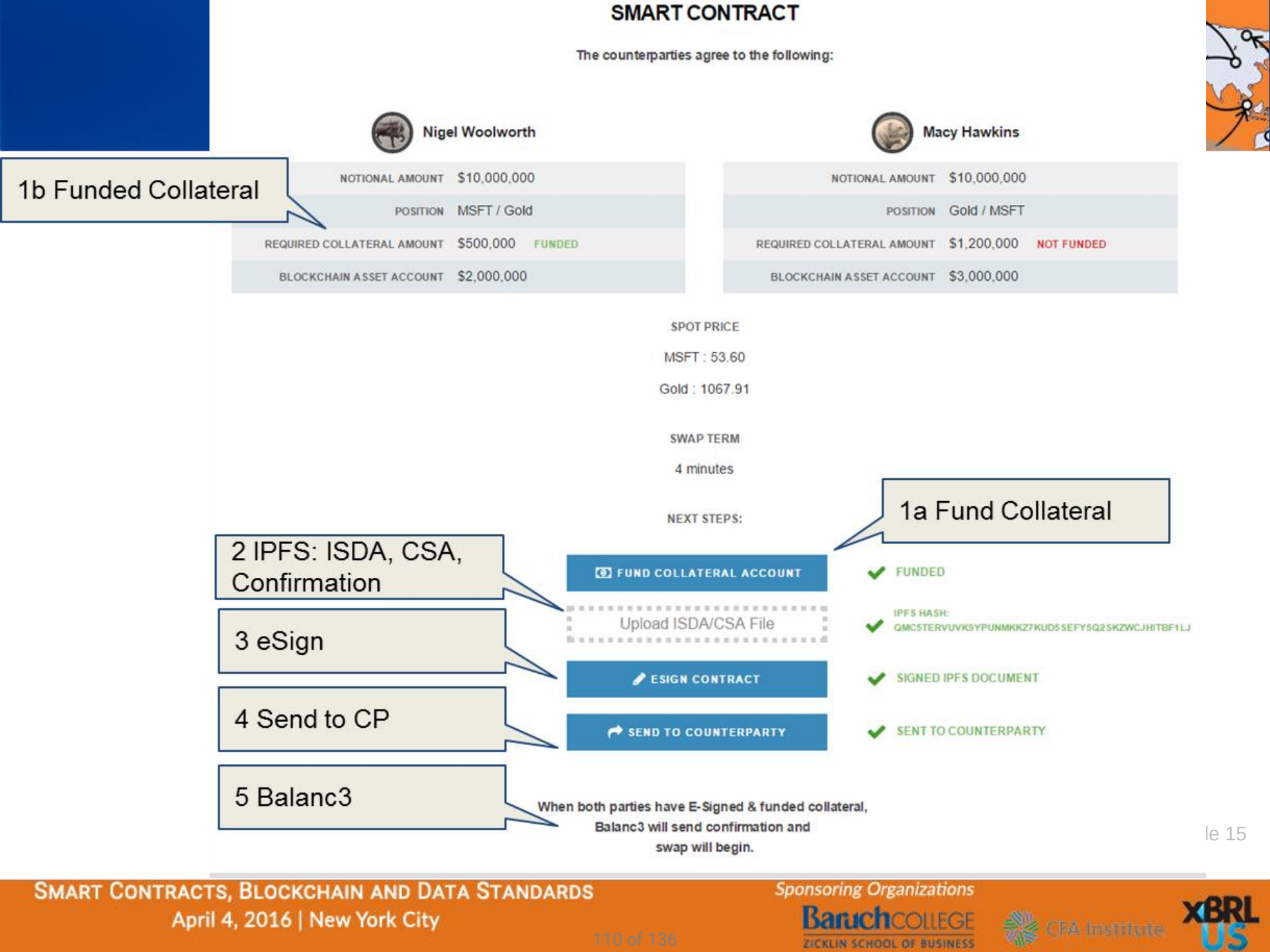
FUND COLLATERAL ACCOUNT

Upload ISDA/CSA File

ESIGN CONTRACT

SEND TO COUNTERPARTY

When both parties have E-Signed & funded collateral,
Balanc3 will send confirmation and
swap will begin.


SMART CONTRACT
The counterparties agree to the following:
Nigel Woolworth
NOTIONAL AMOUNT $10,000,000
POSITION MSFT / Gold
REQUIRED COLLATERAL AMOUNT $500,000 FUNDED
BLOCKCHAIN ASSET ACCOUNT $2,000,000
Macy Hawkins
NOTIONAL AMOUNT $10,000,000
POSITION Gold / MSFT
REQUIRED COLLATERAL AMOUNT $1,200,000 NOT FUNDED
BLOCKCHAIN ASSET ACCOUNT $3,000,000
1b Funded Collateral
SPOT PRICE
MSFT : 53.60
Gold : 1067.91
SWAP TERM
4 minutes
NEXT STEPS:
1a Fund Collateral
2 IPFS: ISDA, CSA, Confirmation
3 eSign
4 Send to CP
5 Balanc3
FUND COLLATERAL ACCOUNT
FUNDED
Upload ISDA/CSA File
IPFS HASH:
QMC5TERVUVK9YPUNMKKZ7KUD5SEFY5Q2SKZWCJHITBF1LJ
ESIGN CONTRACT
SIGNED IPFS DOCUMENT
SEND TO COUNTERPARTY
SENT TO COUNTERPARTY
When both parties have E-Signed & funded collateral, Balanc3 will send confirmation and swap will begin.

MSFT PRICE		GOLD PRICE	% CHANGE	RETURN DIFFERENCE
$ 52.82	-1.271 %	$ 1093.31	2.306 %	-3.577 %

1 Oracle for Prices

NOTIONAL AMMOUNT	RETURN DIFFERENCE	CURRENT SWAP VALUE
$ 10,000,000	-3.577 %	$ -357,700.00

Nigel Woolworth

NOTIONAL AMMOUNT	$10,000,000
POSITION	MSFT / Gold
REQUIRED COLLATERAL AMMOUNT	$857,700
BLOCKCHAIN ASSET ACCOUNT	$1,642,300

Normalized Oracle Reputation **94/SD**

Macy Hawkins

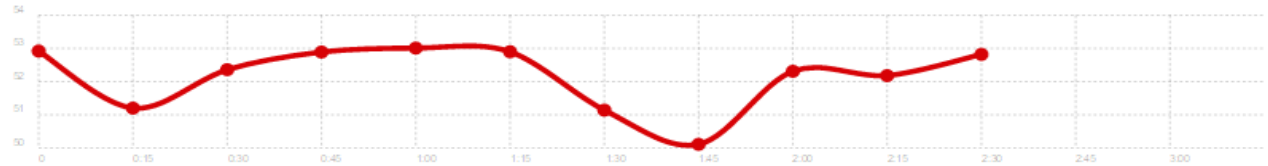
NOTIONAL AMMOUNT	$10,000,000
POSITION	Gold / MSFT
REQUIRED COLLATERAL AMMOUNT	$1,557,700
BLOCKCHAIN ASSET ACCOUNT	$1,442,300

Normalized Oracle Reputation **79/FEU**

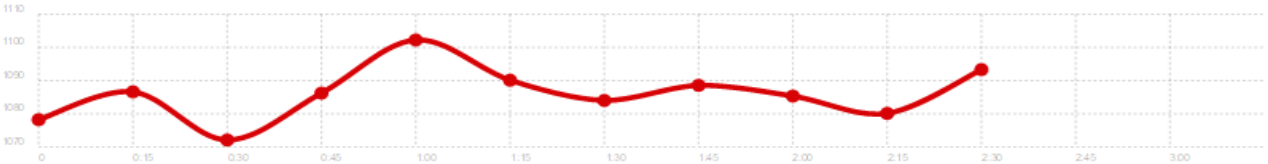
3 Triple Entry Accounting

2 Collateral Rebalancing

MSFT



Gold



Nigel Woolworth

NOTIONAL AMMOUNT	$10,000,000
POSITION	MSFT / Gold
REQUIRED COLLATERAL AMMOUNT	$792,300
BLOCKCHAIN ASSET ACCOUNT	$1,707,700

Normalized Oracle Reputation
94/SD

Macy Hawkins

NOTIONAL AMMOUNT	$10,000,000
POSITION	Gold / MSFT
REQUIRED COLLATERAL AMMOUNT	$1,992,300
BLOCKCHAIN ASSET ACCOUNT	$1,007,700

2 Collateral Rebalancing

2 Reputation Downgraded from 79

Normalized Oracle Reputation
74/FEU

1 Oracle for Reputation

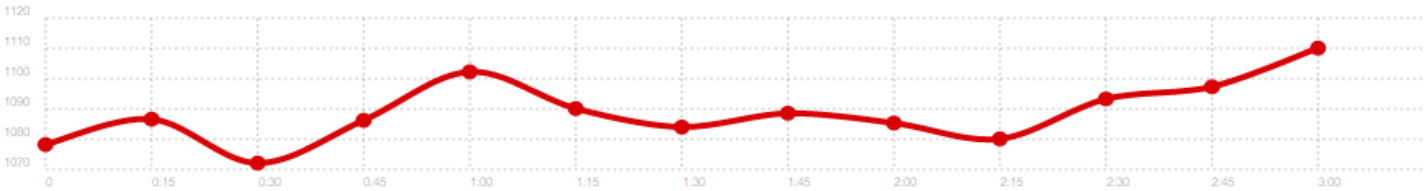
REPUTATION DOWNGRADED

COLLATERAL REBALANCING EVENT

FUNDS TAKEN FROM BLOCKCHAIN ASSET ACCOUNT

MSFT

Gold



SWAP SETTLEMENT

FINAL OUTCOME

Nigel Woolworth

NOTIONAL $10,000,000

Reputation Score

94/SD

MSFT / Gold

+ $94,400.00

Macy Hawkins

NOTIONAL $10,000,000

Reputation Score

74/FEU

Gold / MSFT

- $94,400.00

FINAL RETURN DIFFERENCE

0.944 %

COLLATERAL ACCOUNTS RELEASED

1 Triple Entry Accounting

BALANCE

Use Case Benefits

- Next Generation IT Security
- Cost Reduction of AML/KYC
- Counterparty and Internal Risk Reduction
- Trade and Settlement T+0
- Efficient Capital Deployment
- Automated Collateral Re-balancing
- Regulatory Adherence
- Transparency and Immutability

James Slazas
james.slazas@consensys.net

Smart Contracts, Blockchain and Data Standards

April 4, 2016 | New York City

Sponsoring organizations

Baruch College Zicklin School of Business

CFA Institute

xBRL US

James Allen, CFA, Head of Capital Markets Policy for CFA Institute

Blockchain Industry Panel Discussion

- Steve Wager, EVP, Operations and Development, ItBit
- James Slazas, CFO, Consensys
- Alex Zinder, Senior Director, Corporate Solutions Technology, Nasdaq

Smart Contracts

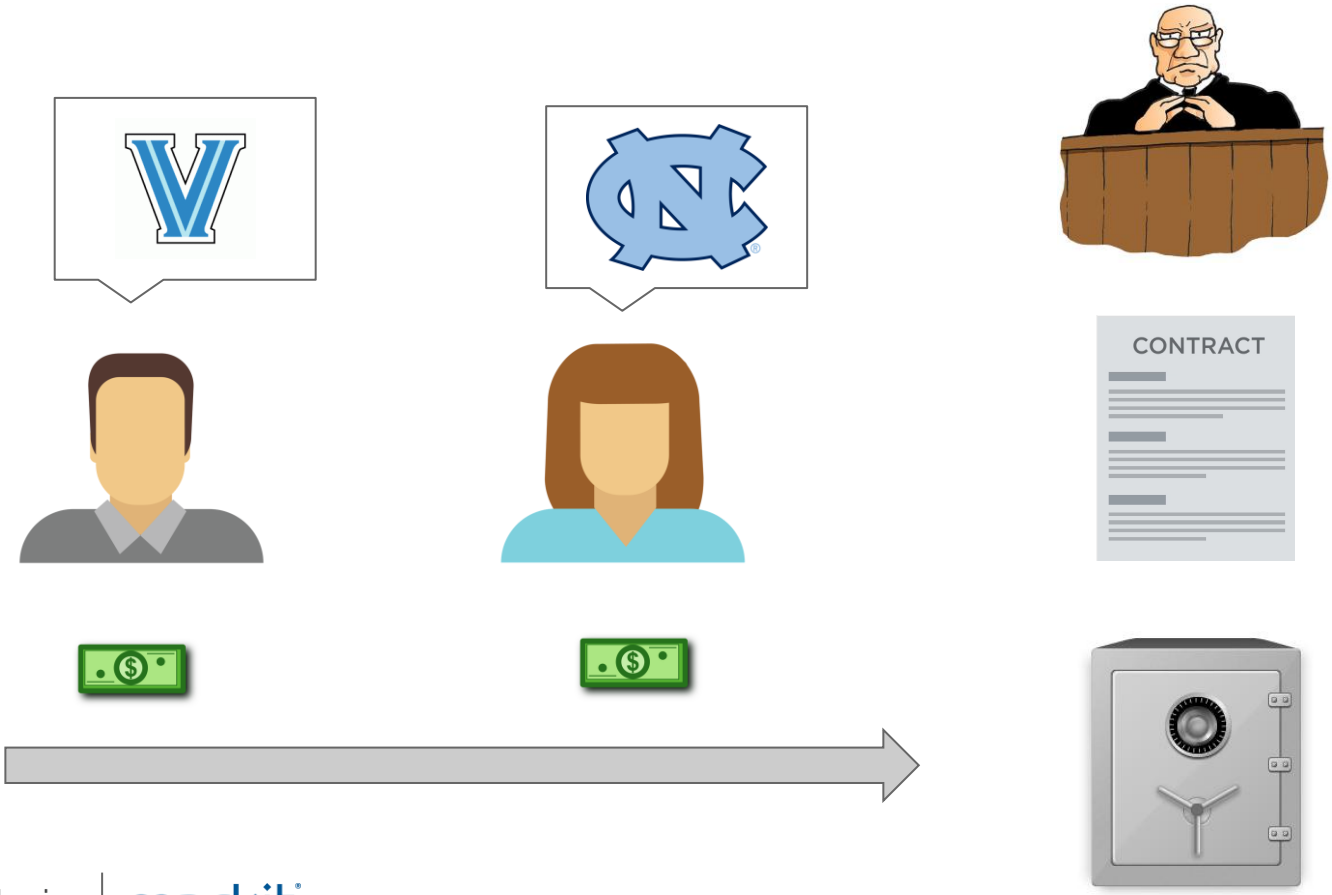
Smart Contract Fundamentals

Smart Contracts

A smart contract is a programmatically enforceable arrangement in which the contractual clauses are written in code rather than legal-ese

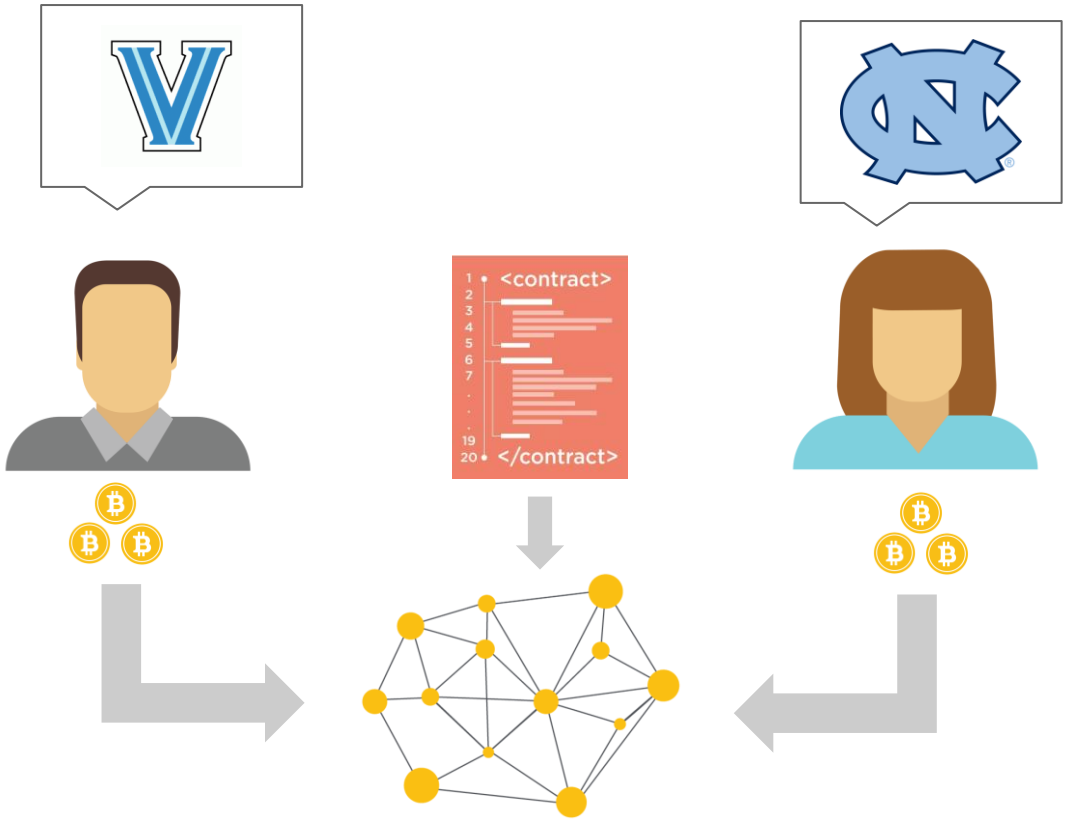
- Predetermined logic
- Typically replicated across a distributed ledger
- Removes the need for trust
- Automated / self executing

Example



Bankchain | markit

Example

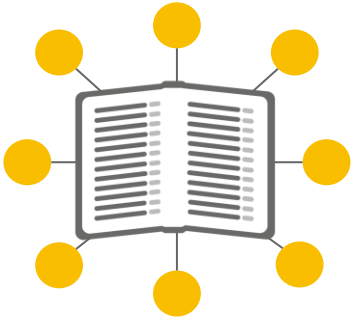


Bankchain | markit

Why Smart Contracts

Safety

- Removes the need to trust your counterparty or escrow agent
- Ability to verify contract code



Replicability

- Code execution is absolute
- Contracts are no longer up for interpretation amongst parties

Agility

- Removes reconciliation latency
- Can execute contractual clauses in real time

Bankchain | markit

Smart Contracts vs Automation

- Guarantees the terms of an agreement
- Maintains full control of the asset
- Primarily used today to enter into agreements with untrusted counterparties

- The use of programs / scripts to reduce the need of human input
- Does not provide a guarantee of a transaction

How Smart Contracts Work

Example Smart Contract on a Blockchain

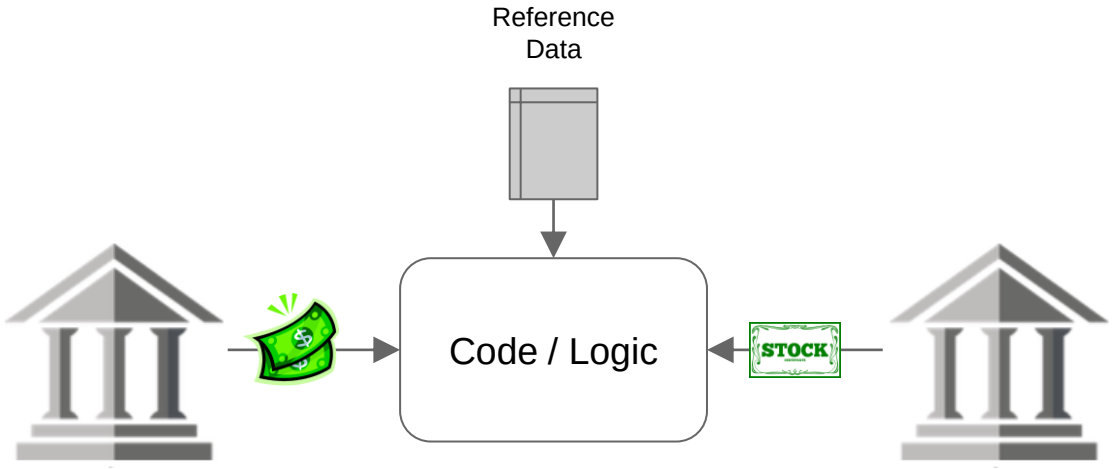
Applications in Financial Services

Oil Options Contract

- Margining
- Automatic Exercise
- Executed on a decentralised basis

Repo

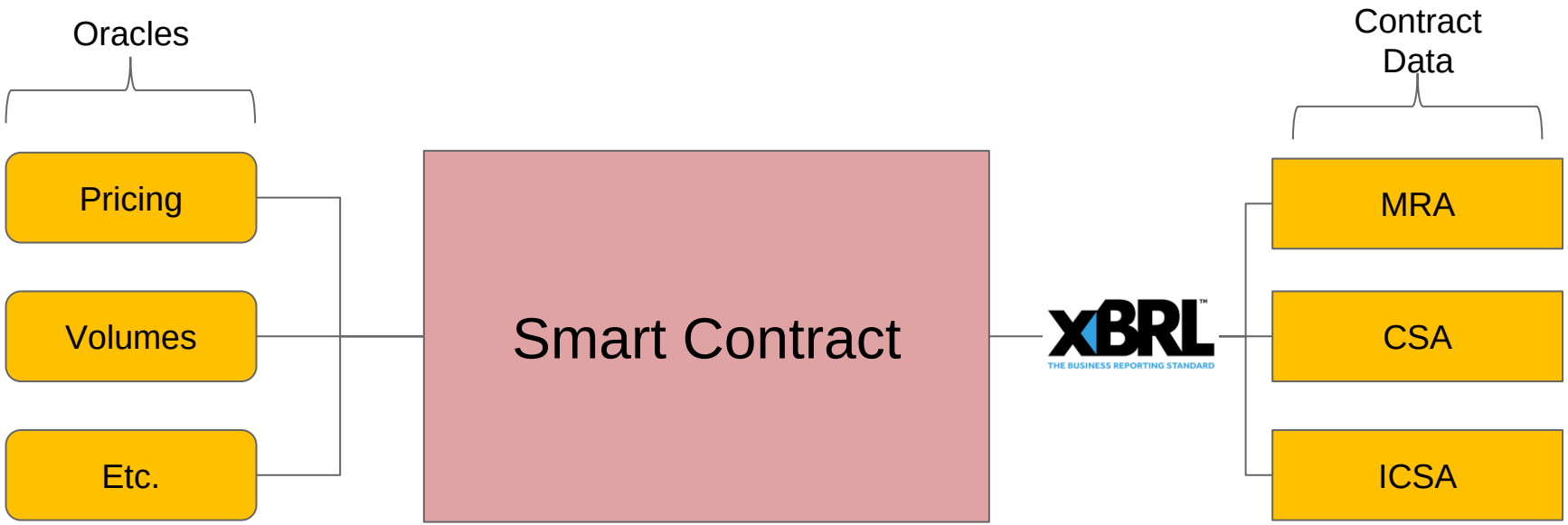
- Enforces pre arranged collateral schedule
- Ensures compliance
- Provides DvP
- Automates contract logistics



Data Standards

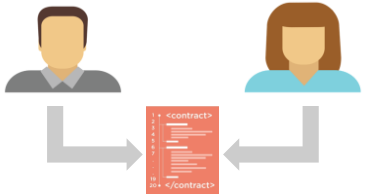
Reference Data / Oracles

Most smart contracts rely upon oracles for external data in order to execute upon their programming



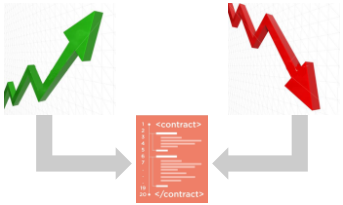
Bankchain | markit

Defining Contract Components



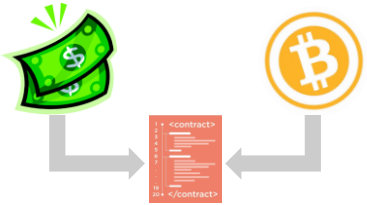
Peer Transactions

Transactions that are initiated by one or more parties to a contract



Market Transactions

Transactions that are unanticipated and change contract characteristics



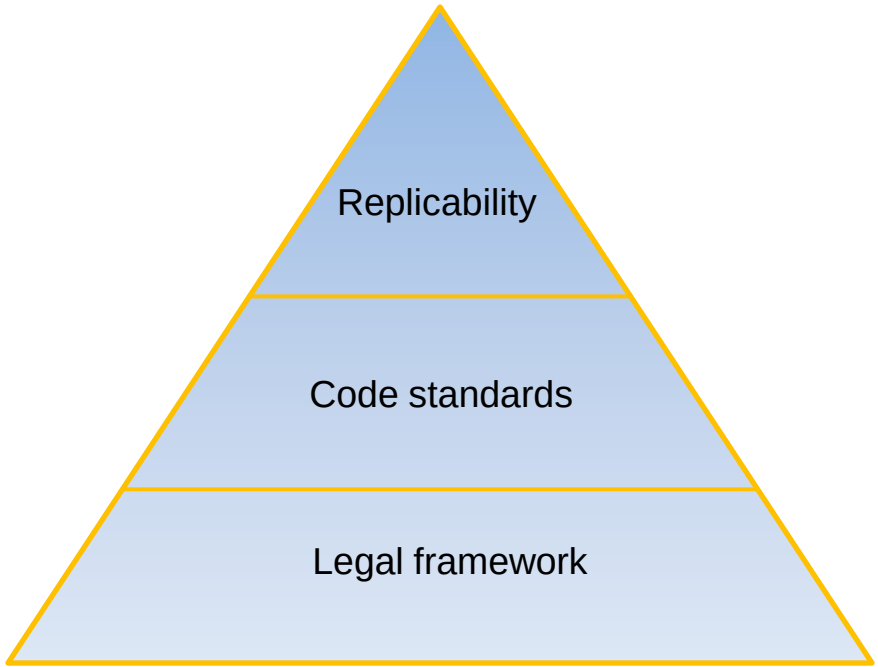
Asset Transactions

Transactions that are future-dated and anticipated but discretionary

Risks / Outstanding Issues

Smart Contract Code Hierarchy

Replicability depends on code standards, and code standards depend on a legal framework.



Risks and Outstanding Issues

- Smart Contracts: a runaway train?
  - Gate checks
  - Optionality
  - Reversibility
- Who sees what?
  - Information secrecy
  - Data privacy
  - Counterparty validation
- Who controls the assets?
  - Managing collateral
  - Managing credit
  - Fungibility of assets

Future of Smart Contracting

Future of Smart Contracting

Digital Assets

Digital Currencies

Internet of Things

Questions