# Artificial Intelligence in Finance

*at*

# Hong Kong University of Science and Technology

www.slido.com
#UST

# Codename

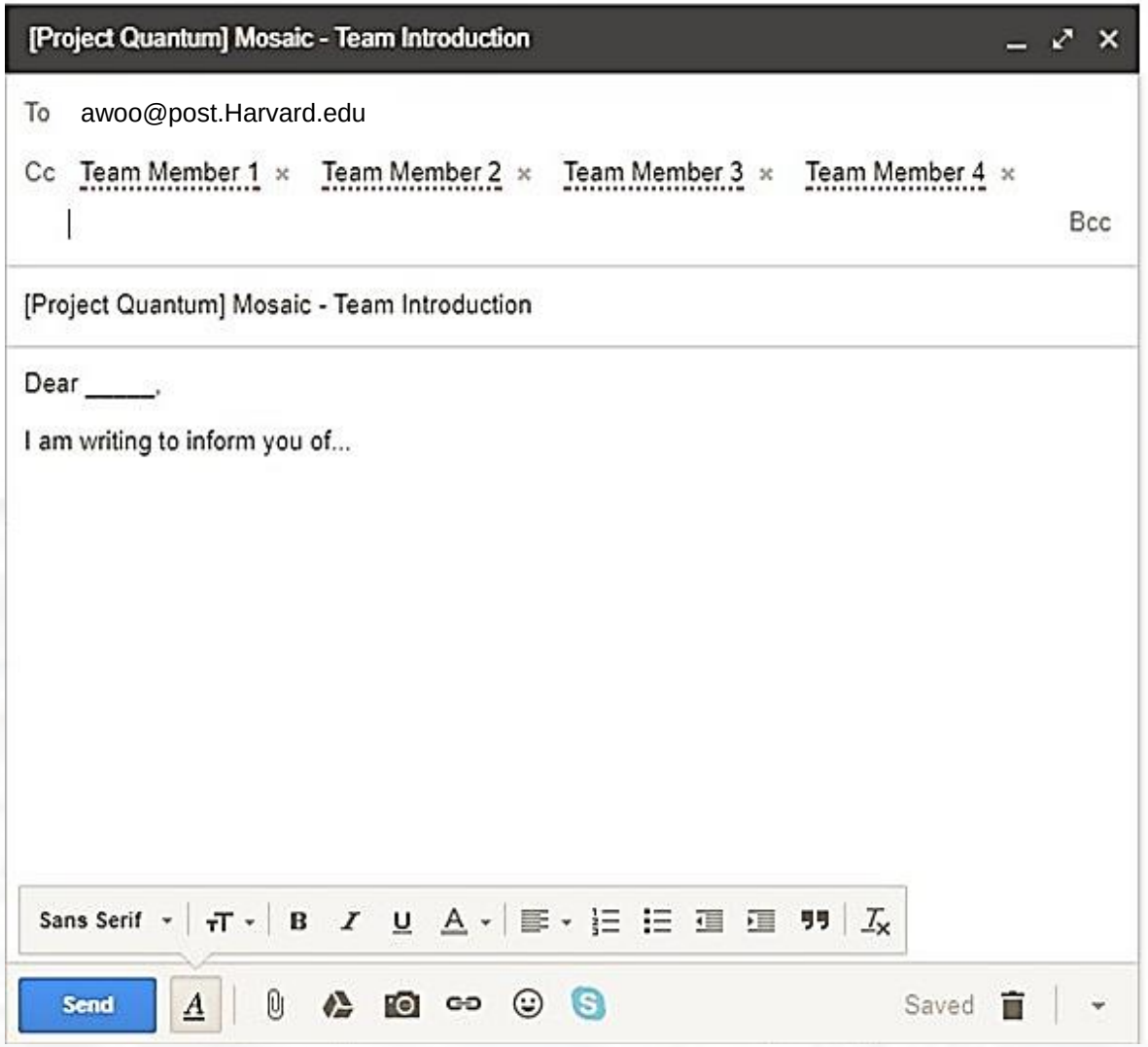
Project **Quantum**

Project **Redbook**

Project **Dragon**

Project **Oasis**

Project **Fire**



## All ECM (IPO, Follow-On, Equity-Linked) - Asia (excluding Japan)

| Pos. | Institution | Amt US$ m | No. | % |
|---|---|---|---|---|
| 1 | Goldman Sachs | 1,473 | 4 | 9.6 |
| 2 | CITIC Securities | 1,389 | 8 | 9.0 |
| 3 | China International Capital Corp Ltd | 1,340 | 6 | 8.7 |
| 4 | Morgan Stanley | 1,105 | 8 | 7.2 |
| 5 | UBS | 822 | 6 | 5.3 |
| 6 | Bank of China | 773 | 4 | 5.0 |
| 7 | Guotai Junan Securities Co Ltd | 732 | 5 | 4.8 |
| 8 | Citi | 650 | 7 | 4.2 |
| 9 | Ping An Securities Co Ltd | 641 | 1 | 4.2 |
| 10 | Bank of America Merrill Lynch | 535 | 4 | 3.5 |
| | **Total** | **15,370** | **124** | **100** |

Source: Dealogic

## All ECM (IPO, Follow-On, Equity-Linked) - Asia (exc. Japan, exc. A-shares)

| Pos. | Institution | Amt US$ m | N |
|---|---|---|---|
| 1 | CITIC Securities | 851 | |
| 2 | Goldman Sachs | 722 | |
| 3 | Bank of China | 641 | |
| 3 | China International Capital Corp Ltd | 641 | |
| 3 | Guotai Junan Securities Co Ltd | 641 | |
| 3 | Ping An Securities Co Ltd | 641 | |
| 7 | Citi | 216 | |
| 7 | Morgan Stanley | 216 | |
| 9 | Bank of America Merrill Lynch | 201 | |
| 10 | BNP Paribas | 135 | |
| | Subtotal | 5,040 | |
| | | | |

Source: Dealogic

## Equity-Linked - Asia (excluding Japan)

| Pos. | Institution | Amt US$ m | No. | % |
|---|---|---|---|---|
| 1 | Morgan Stanley | 889 | 6 | 9.3 |
| 2 | Goldman Sachs | 750 | 2 | 7.9 |
| 3 | UBS | 741 | 5 | 7.8 |
| 4 | China International Capital Corp Ltd | 699 | 5 | 7.3 |
| 5 | CITIC Securities | 539 | 5 | 5.7 |
| 6 | Citi | 433 | 5 | 4.5 |
| 7 | China Securities Co Ltd | 399 | 5 | 4.2 |
| 8 | Bank of America Merrill Lynch | 334 | 2 | 3.5 |
| 8 | China Renaissance Holdings Ltd | 334 | 2 | 3.5 |
| 10 | HSBC | 296 | 1 | 3.1 |
| | **Total** | **9,538** | **110** | **100** |

Source: Dealogic

## Stock (IPO,Follow-On) - Asia (excluding Japan)

| Pos. | Institution | Amt US$ m | N |
|---|---|---|---|
| 1 | CITIC Securities | 404 | |
| 2 | Shenwan Hongyuan Securities Co Ltd | 198 | |
| 3 | Zhongtai Securities Co Ltd | 180 | |
| 4 | Krung Thai Bank pcl | 150 | |
| 5 | China Securities Co Ltd | 149 | |
| 6 | China International Capital Corp Ltd | 99 | |
| 7 | Guoyuan Securities Co Ltd | 95 | |
| 8 | Morgan Stanley | 95 | |
| 9 | Citi | 93 | |
| 10 | Changjiang Financing Services Co Ltd | 87 | |
| | **Total** | **2,724** | |

Source: Dealogic

## IPO - Asia (excluding Japan)

| Pos. | Institution | Amt US$ m | No. | % |
|---|---|---|---|---|
| 1 | CITIC Securities | 505 | 4 | 16.2 |
| 2 | Shenwan Hongyuan Securities Co Ltd | 198 | 2 | 6.4 |
| 3 | Zhongtai Securities Co Ltd | 180 | 1 | 5.8 |
| 4 | Krung Thai Bank pcl | 150 | 2 | 4.8 |

## New Listings* - Asia (excluding Japan)

| Pos. | Institution | Amt US$ m | N |
|---|---|---|---|
| 1 | Morgan Stanley | 1,105 | |
| 2 | Goldman Sachs | 832 | |
| 3 | Citi | 575 | |
| 4 | Bank of America Merrill Lynch | 535 | |

# Note on Banking

| Investment Bank | Universal Bank |
| --- | --- |
| An Investment Bank is a financial institution that deals with **raising capital**, trading in securities and managing corporate mergers and acquisitions. Investment banks profit from companies and governments by raising money through issuing and selling securities in the capital markets and insuring bonds (selling CDS), as well as providing advice on transactions such as mergers and acquisitions. | A Universal Bank participates in many kinds of banking activities and is **both a commercial bank and an investment bank** as well as providing other financial services such as insurance. These are also called **full-service financial firms**, although there can also be full-service investment banks which provide wealth and asset management, trading, underwriting, researching as well as financial advisory. |

# Note on Banking (Cont'd)

| Banking History | Regulations |
| --- | --- |
| • The concept is most relevant in the United Kingdom and the United States, where historically there was a distinction drawn between pure investment banks and commercial banks. In the US, this was a result of the **Glass-Steagall Act of 1933**.<br>• In both countries, however, the regulatory barrier to the combination of investment banks and commercial banks has largely been removed, and a number of universal banks have emerged in both jurisdictions. However, at least until the global financial crisis of 2008, there remained a number of large, pure investment banks. | • Glass-Steagall Act of 1933: Prohibited commercial banks from engaging in corporate securities offering<br>• Securities Exchange Act of 1934: Established the Securities & Exchange Commission (SEC)<br>• Gramm-Leach-Bliley Act of 1999: Repealed Glass-Steagall Act of 1933 |

**Dr. Jeffrey Hui (凌羽一博士)**

Managing Director, InnoSightsFounder and Principal, Dr. Phoenix Global Education GroupProducer-in-Chief (Education) Founding Chairperson, Phoenix Intellectuals Foundation

EdD (Bristol), MSt (Cand) (Cambridge), EMBA (CUHK), MA (HKU), BBA (Hons) (CUHK), Beta Gamma Sigma (Life), SHKIM (Life), ProM, FIMS, DTM, CNLPT, CNLPMP

- Dr Jeffrey Hui, a seasoned educationalist and strategist, is currently serving as Managing Director of InnoSights, Founder and Principal of Dr. Phoenix Global Education Group, Producer-in-Chief (Education) and Host of Metro Broadcast Corporation, Honourary Advisor and Former Chairperson of Hong Kong Institute of Marketing as well as Founding Chairperson of Phoenix Intellectuals Foundation.
- As a well-rounded marketing and management professional, Jeffrey served at various top-notch business, media and educational organizations, including Procter & Gamble (P&G), Cathy Pacific Airways (CX), Television Broadcasts Limited (TVB), Radio Television Hong Kong (RTHK) and King's Glory Education (KGE). Being a scholar-of-practice, Jeffrey has keen interest in the research of management theories and practices. Since 2002, he has been conducting extensive face-to-face interviews of over 1,000 reputed CEOs, scholars, business and community leaders from a wide range of fields in Hong Kong and The Greater China.
- As a veteran educator, Jeffrey has been the faculty at a number of tertiary institutions, including The Chinese University of Hong Kong, The Polytechnic University of Hong Kong, The Chinese University of Hong Kong (Shenzhen) and The Hang Seng University of Hong Kong. Delivering an outstanding level of teaching and training, Jeffrey was elected as "The Best Lecturer of the Year" (ranked 1st among 104 university lecturers) in 2009 and achieved full score of 6.00/6.00 for his teaching evaluation in 2018.
- As a passionate education expert, Jeffrey has also been serving in multiple education advisory roles for various universities and governmental bodies, including Academic Advisor, The Chinese University of Hong Kong (CUHK) and Hong Kong Shue Yan University (HKSYU); External Examiner, The Polytechnic University of Hong Kong (PolyU); Appointed Specialist (Education, Business and Management), The Hong Kong Council for Accreditation of Academic & Vocational Qualifications (HKCAAVQ), Hong Kong SAR Government; Adjunct Professor in Marketing, Guangdong Food and Drug Vocational College, etc.

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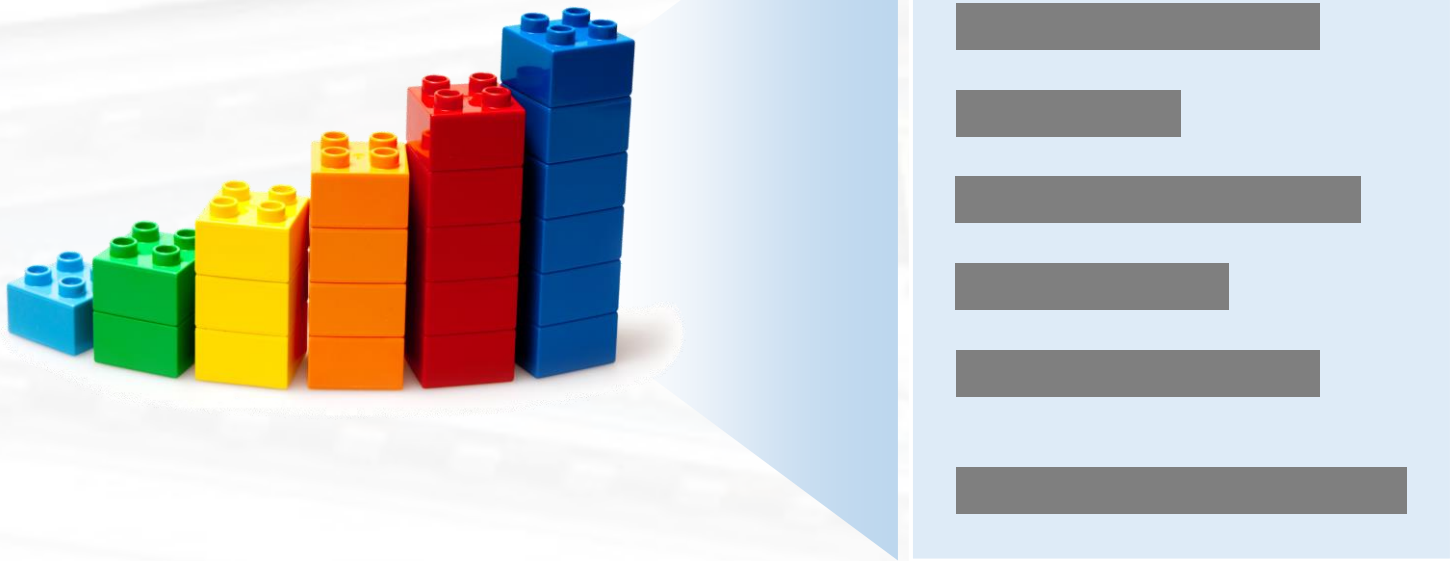
- As an experienced education strategist, Jeffrey has been helping hundreds of students in college applications. Numerous students, mentees and coachees of Jeffrey have successfully obtained offers for bachelor, masters and doctoral studies in a vast mix of world-class universities, including: University of Cambridge, University of Oxford, Harvard University, Yale University, Stanford University, Massachusetts Institute of Technology, Columbia University, University of California at Berkeley, University of Los Angeles, London School of Economics and Political Science, Imperial College London, University College London, etc.
- Jeffrey's coaching does not only confine to college applications, but also extended to career developments. Hundreds of Jeffrey students, mentees and coachees have been hired by Fortune 500 and other renowned corporations, e.g. McKinsey & Co., BCG, Bain, Google, Tencent, UBER, Goldman Sachs, UBS, HSBC, Standard Chartered, Citibank, Value Partners, PwC, Deloitte, Ernst and Young, KPMG, P&G, L'Oreal, Unilever, Nestlé, Estee Lauder, Coca Cola, Johnson & Johnson, Pfizer, AstraZeneca, Cathay Pacific, Swire Properties, etc Jeffrey has also authored and co-authored several top-selling books on branding, marketing, strategies and management, including:《贏銷策略──打造品牌必讀50例》，《商識滿天下──香港商管翹楚30訪》，《讓品牌「飛」!──策略社交媒體、網絡營銷實戰秘笈》*，《品牌超連結──十大Marketers成功實學》* and 《贏銷0與1》* (*NO. 1 Finance and Business Category Bestseller at Eslite誠品書店).
- In appreciation to his in contributions and achievements in education and social services, Jeffrey was granted "The 3rd Global Chinese Outstanding Youth Award", "The 6th Young Leaders Award" as well as "The 4th Youth DreamMakers Award".

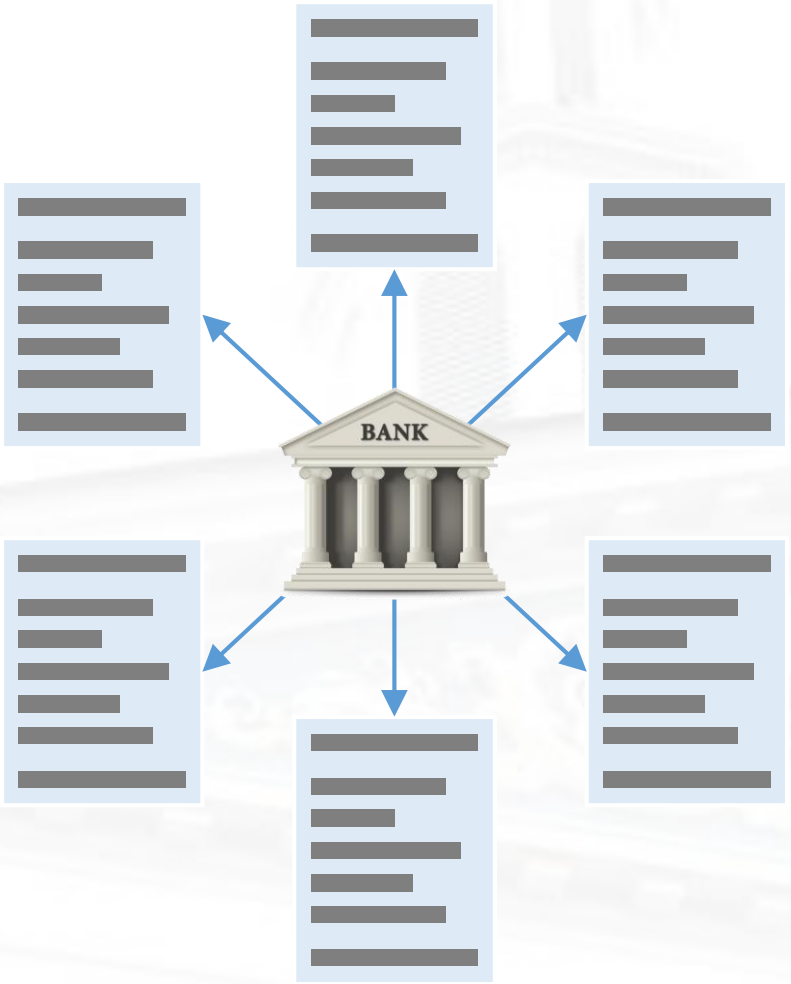
# Blockchain

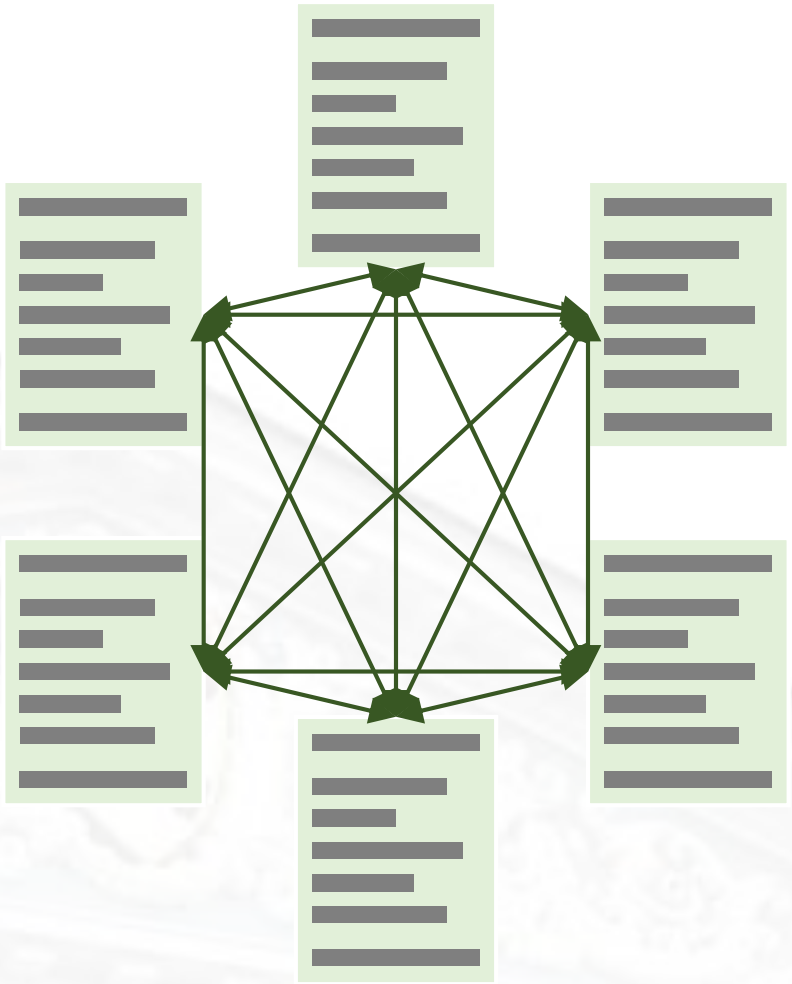
As the underlying technology of Bitcoin, Blockchain (also known as **Distributed Ledger Technology** or “DLT”) is a self-sustaining, peer-to-peer ledger technology, using **peer-to-peer network**, **distributed consensus**, and **cryptography**, negating the need for a central authority for trust.



Credit: https://ninesilos.wordpress.com/tag/blocks/
Source: Harvard Business School “Blockchain Note” by HBS Prof. David Yoffie and Researcher Anthony Woo

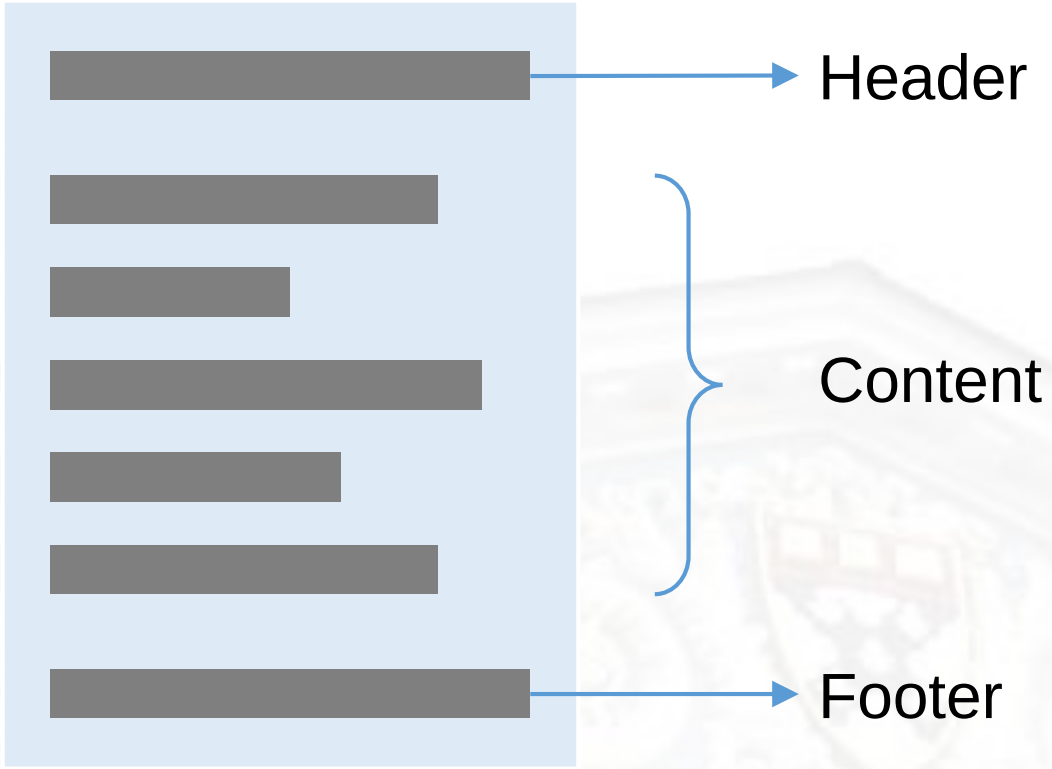
# P2P Networking & Distributed Consensus



Credit: https://moodle.glyndwr.ac.uk/course/view.php?id=20&section=12

# Block

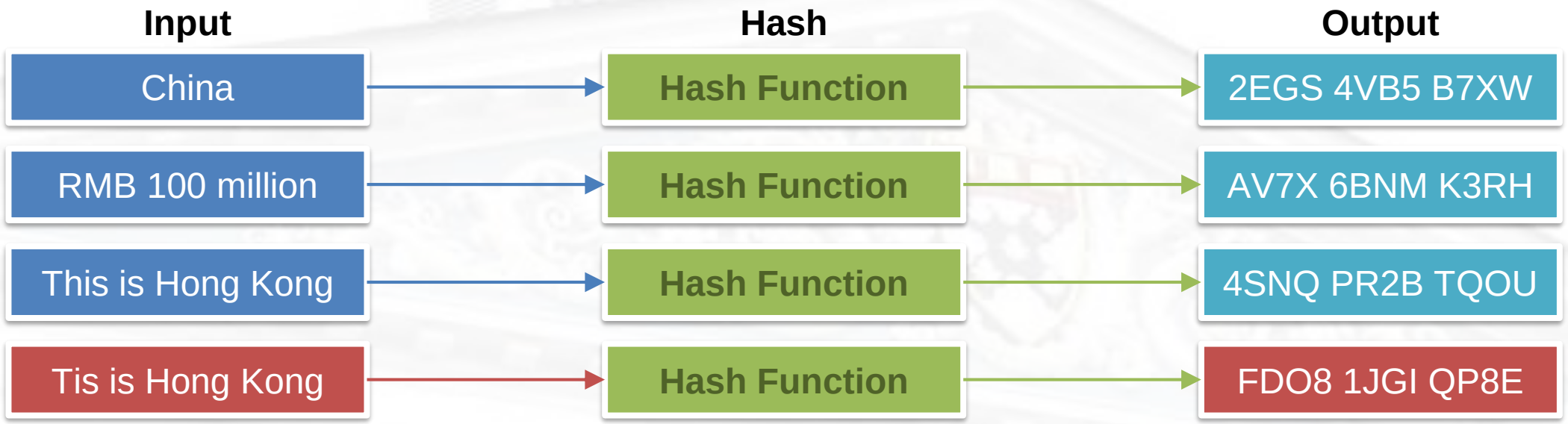


# Hash Function

**Hash Function**
Any function that can be used to map data of arbitrary size to a fixed size

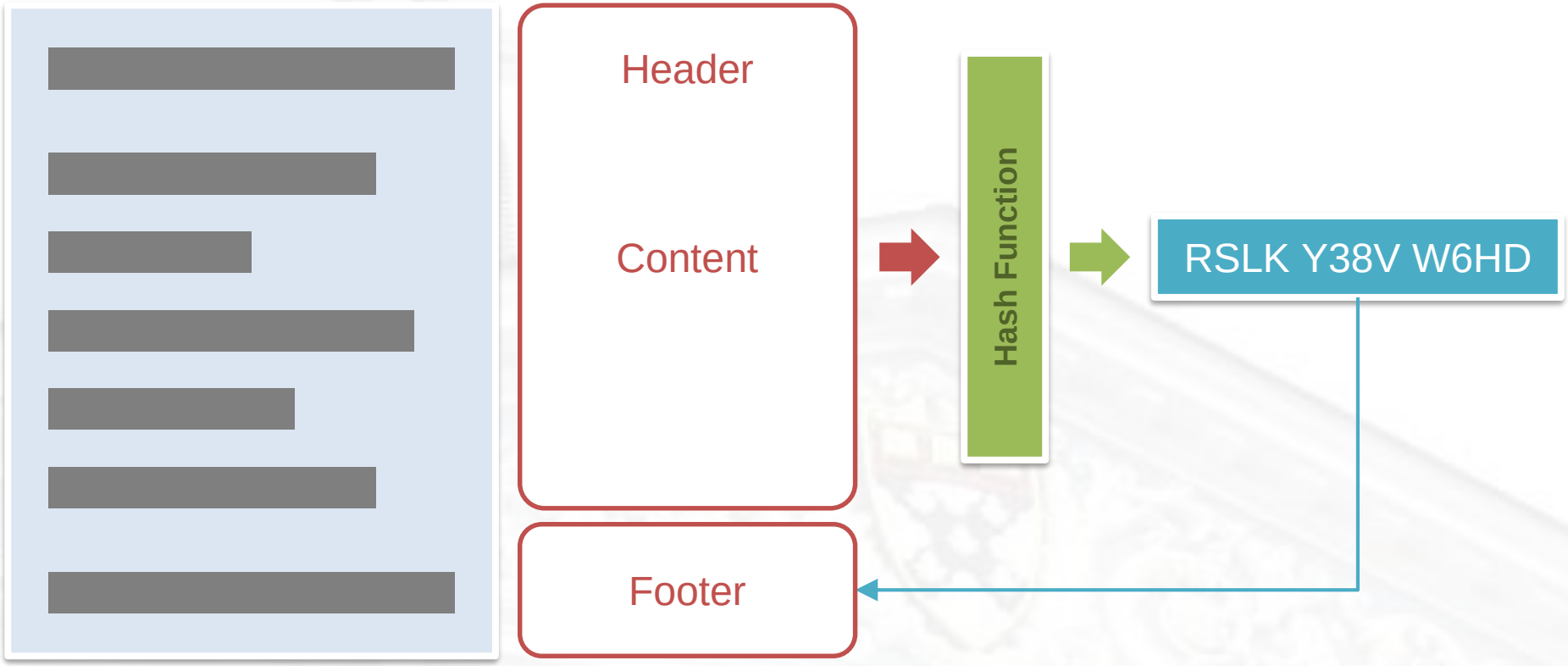
**Properties**
- Extremely easy to calculate a hash for any given data
- Extremely computationally difficult to calculate an alphanumeric text that has a given hash
- Extremely unlikely that two slightly different messages will have the same hash

**Bitcoin Hash**
Secure Hash Algorithm
Member of the SHA-2 cryptographic hash functions used in Bitcoin by NSA[1]

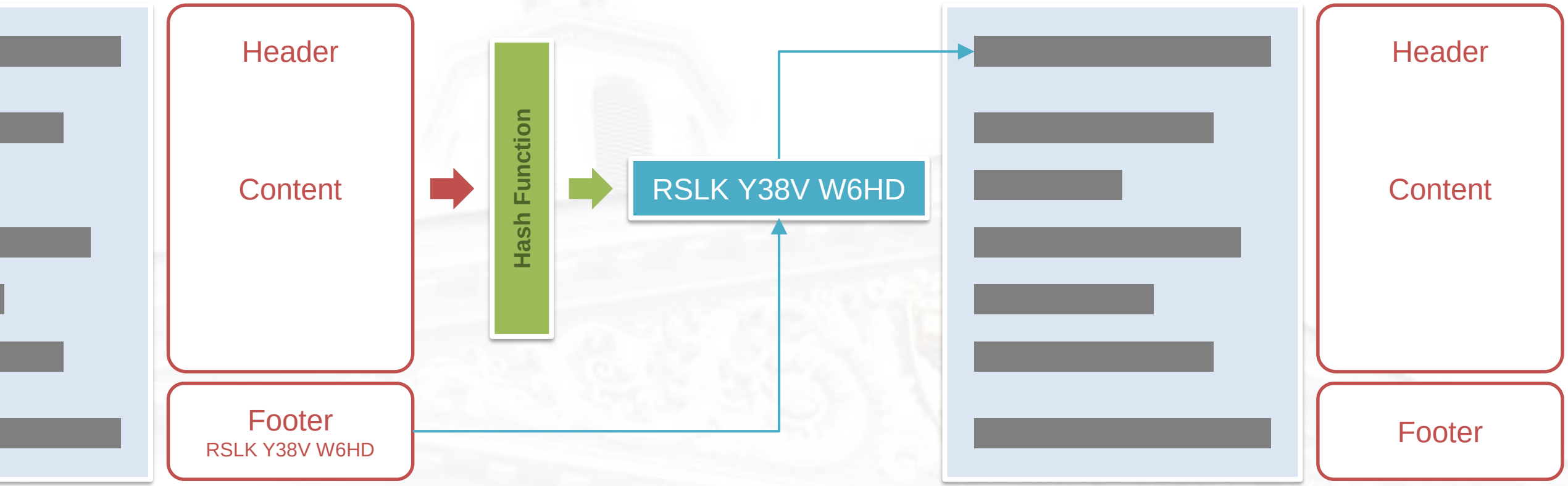



Sources:
https://en.wikipedia.org/wiki/Hash_function
https://simple.wikipedia.org/wiki/Cryptographic_hash_function
Note: 1. National Security Agency

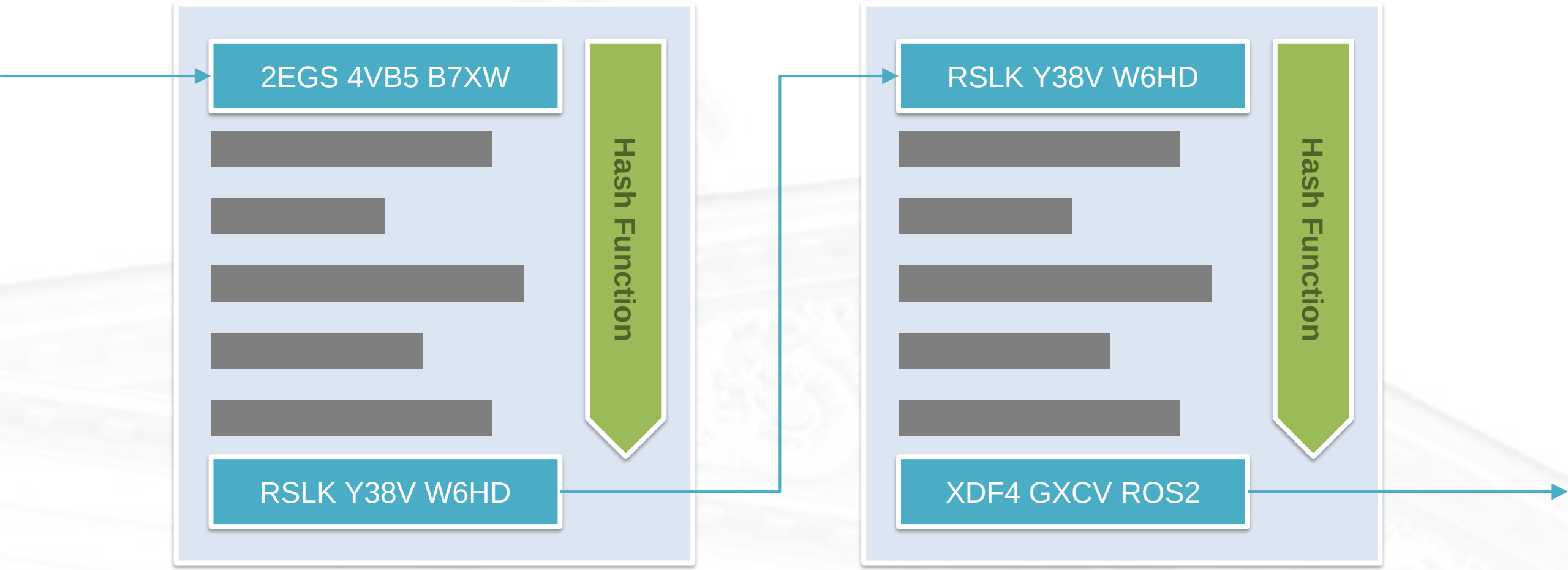
# Block + Hash Function



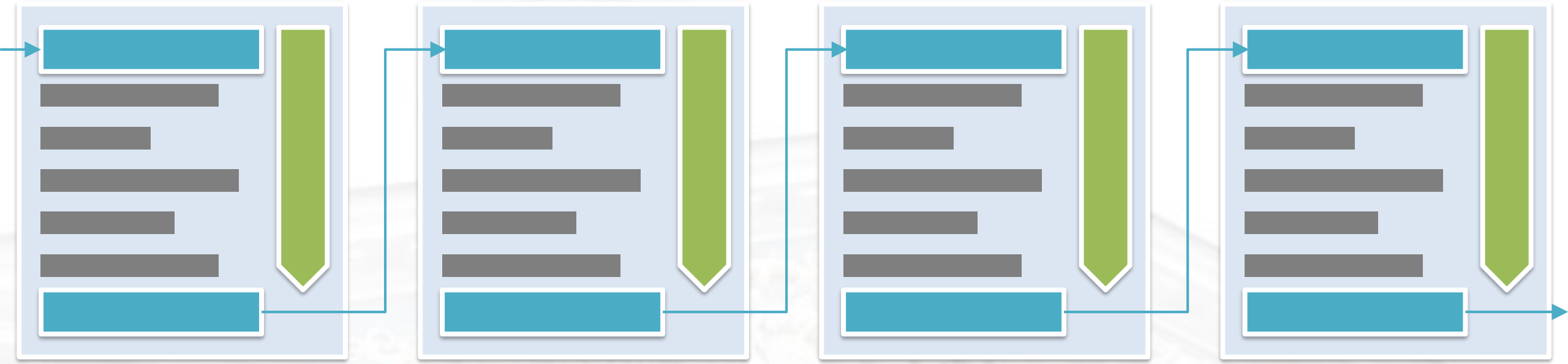
# Block + Hash Function



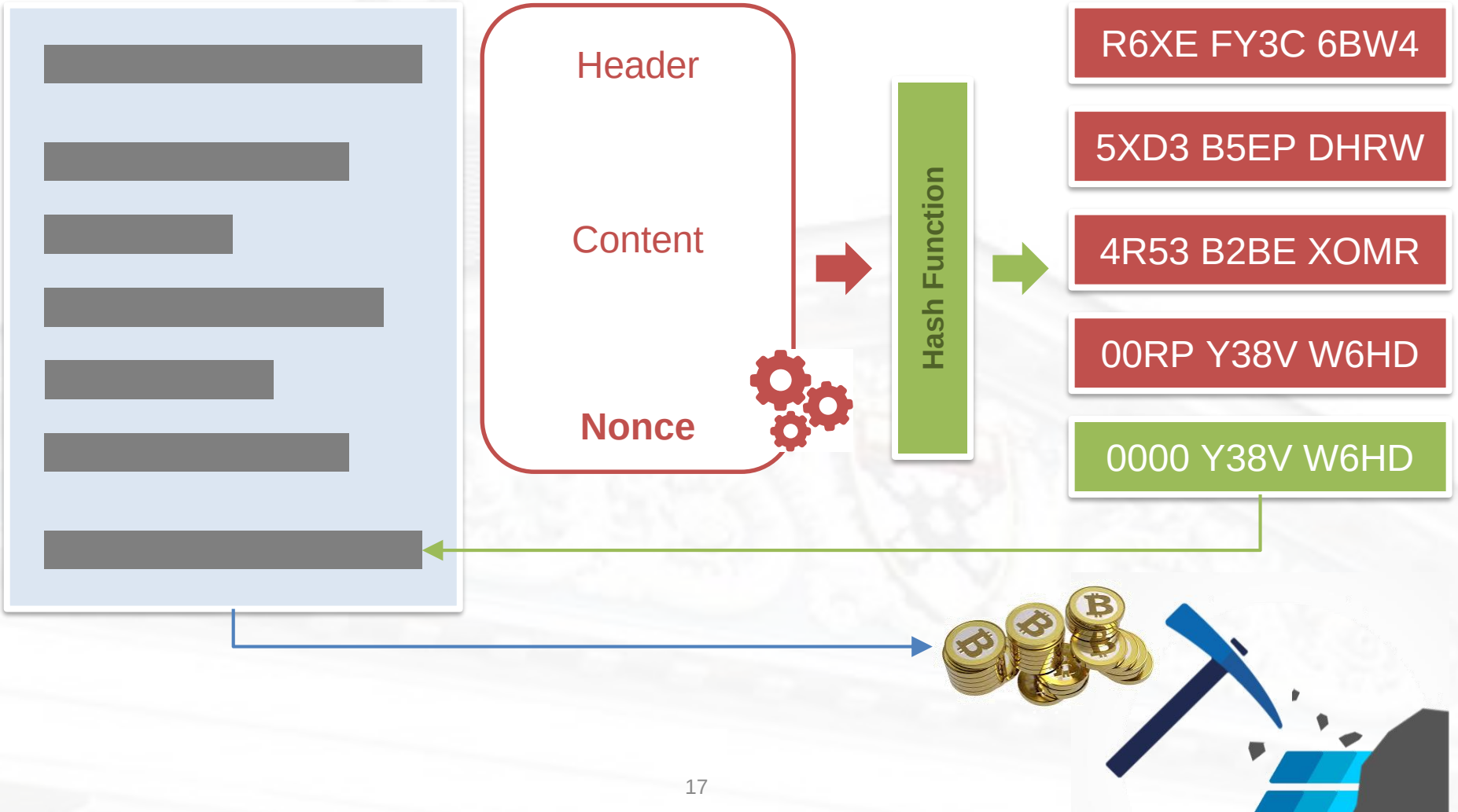
# Block + Block


2EGS 4VB5 B7XW
Hash Function
RSLK Y38V W6HD
RSLK Y38V W6HD
Hash Function
XDF4 GXCV ROS2

# Block + Block + Block…

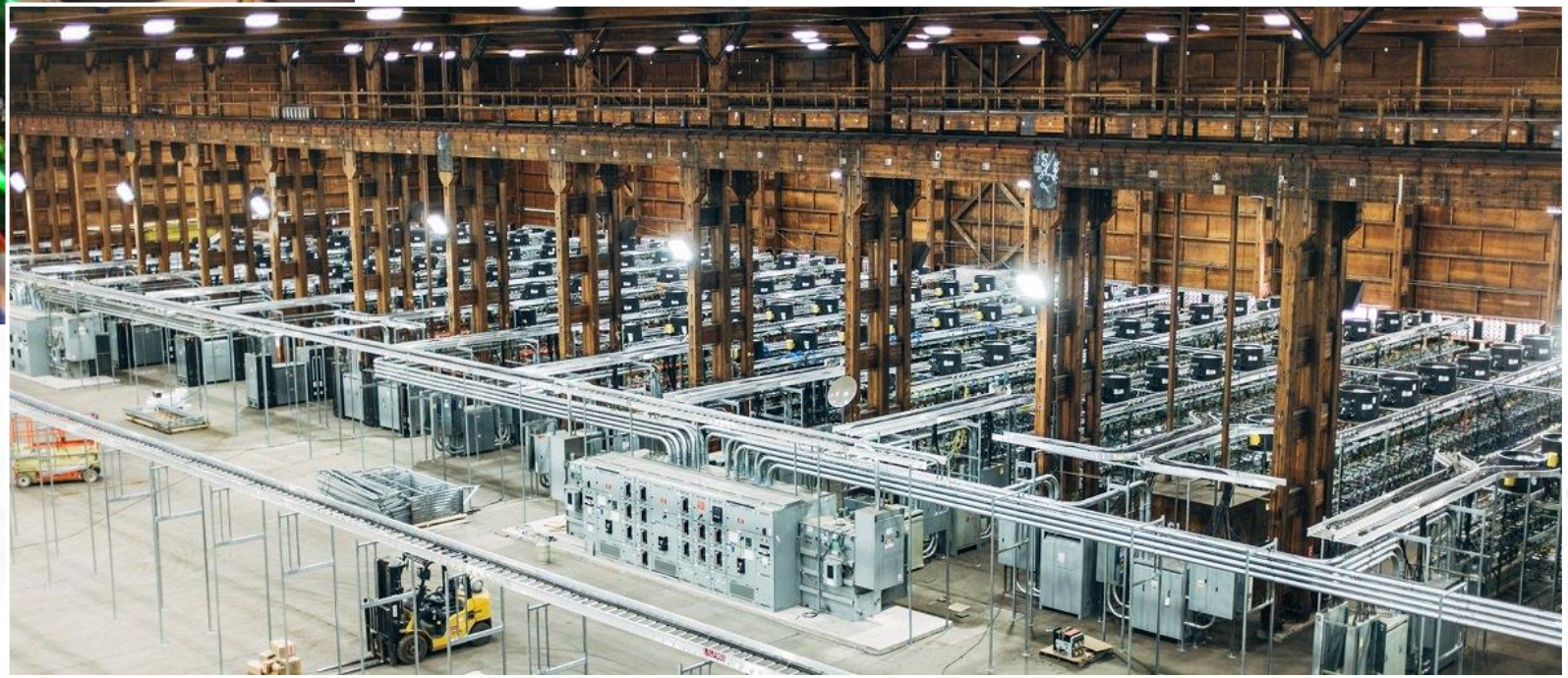


# Bitcoin Mining



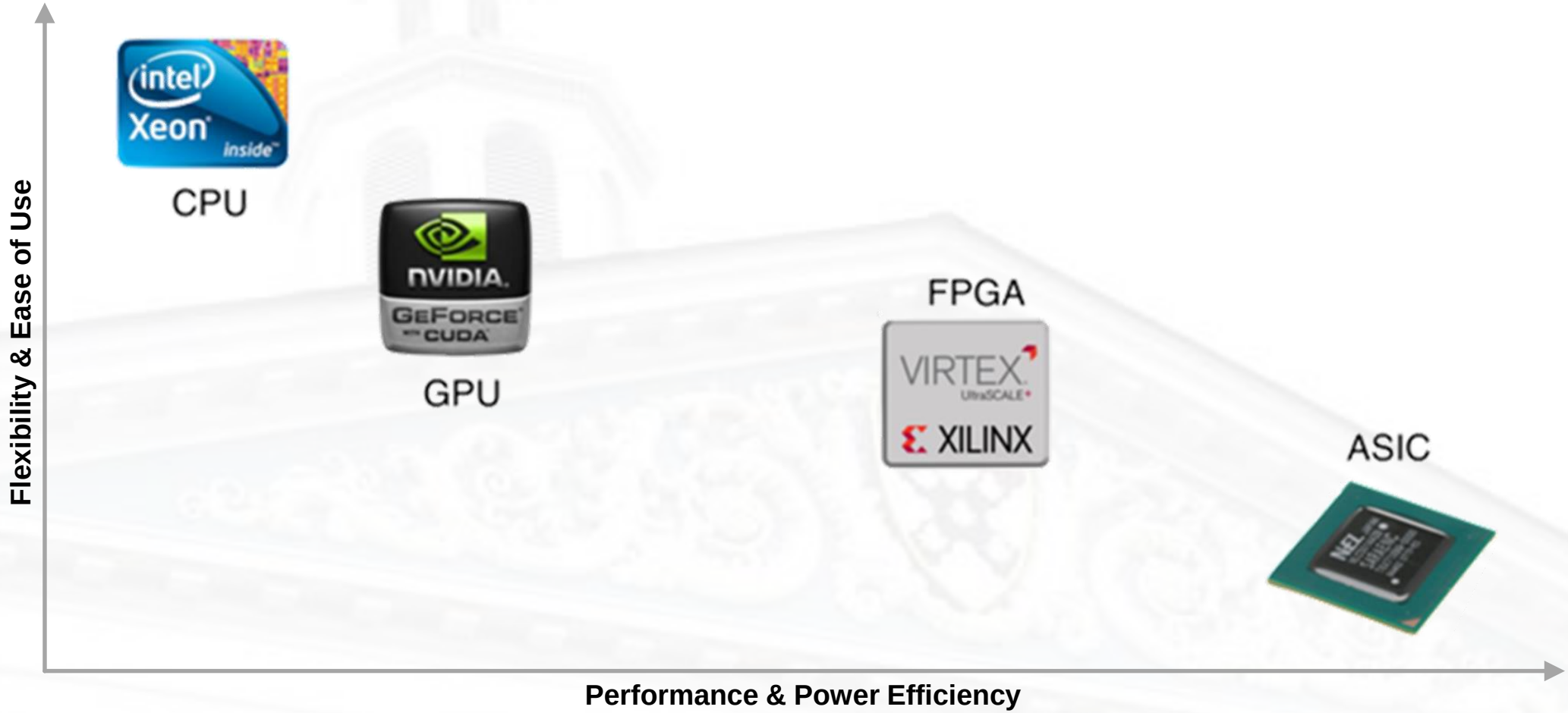

Anthony Woo
Harvard Business School
Asia-Pacific Research Center

# Bitcoin Mining

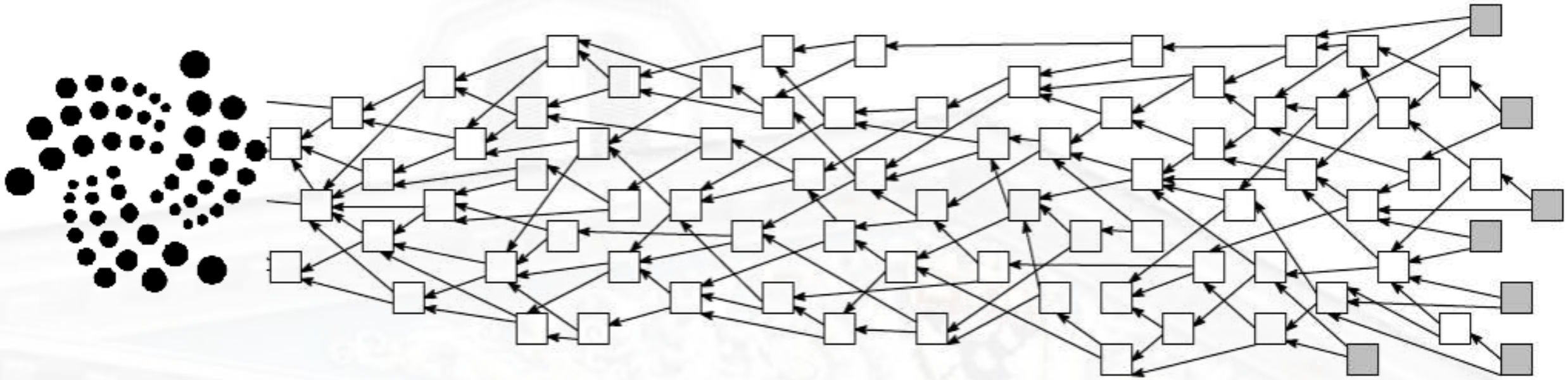
Sources:
https://99bitcoins.com/20-insane-bitcoin-mining-rigs/
https://pool.bitcoin.com/index_en.html
https://www.cryptocompare.com/mining/sapphire/radeon-r9-290x-tri-x-ethereum-mining/

# Bitcoin Mining




Source: https://ngcodec.com/markets-cloud-transcoding/

# IOTA: Tangle



Source: https://iota.org/

# Asset Management Framework

**Large Cap**
Large cap companies are generally valued at US$5 billion of above. These companies are known to be less volatile and focused more on stable dividend payouts.

**Mid Cap**
These middle sized companies are focusing on becoming large cap companies. Investors look to capture their growth returns.

**Small Cap**
Small cap are "up and coming" companies that are focused on substantial growth. They are also the most volatile because they have the biggest incidence of business failures.

| | Value | Core | Growth |
|---|---|---|---|
| Large | **Large Cap Value** | **Large Cap Core** | **Large Cap Growth** |
| Mid | **Mid Cap Value** | **Mid Cap Core** | **Mid Cap Growth** |
| Small | **Small Cap Value** | **Small Cap Core** | **Small Cap Growth** |

**Value**
Value investments take a look at companies that are trading at below average/bargain prices. Investors buy at this point to buy low and sell high.

**Core**
Core investments have a balance of value and growth investments in one portfolio (also known as "Blended").

**Growth**
Growth investments look at trends in the market. If a specific company is expected to grow substantially, investors will buy into it.

Source: http://dropwealth.com/2017/03/7-types-stock-use/
Past performance is not indicative of future returns.

# Correlation with Bitcoin

**Large Cap**
Large cap companies are generally valued at US$5 billion of above. These companies are known to be less volatile and focused more on stable dividend payouts.

**Mid Cap**
These middle sized companies are focusing on becoming large cap companies. Investors look to capture their growth returns.

**Small Cap**
Small cap are "up and coming" companies that are focused on substantial growth. They are also the most volatile because they have the biggest incidence of business failures.

| | Value | Core | Growth |
|---|---|---|---|
| Large | 0.68<br>**0.58** | 0.66<br>**0.60** | 0.68<br>**0.61** |
| Mid | 0.63<br>**0.55** | 0.66<br>**0.59** | 0.66<br>**0.60** |
| Small | 0.67<br>**0.60** | 0.69<br>**0.60** | 0.68<br>**0.60** |

As of October 2017
As of January 2018

**Value**
Value investments take a look at companies that are trading at below average/bargain prices. Investors buy at this point to buy low and sell high.

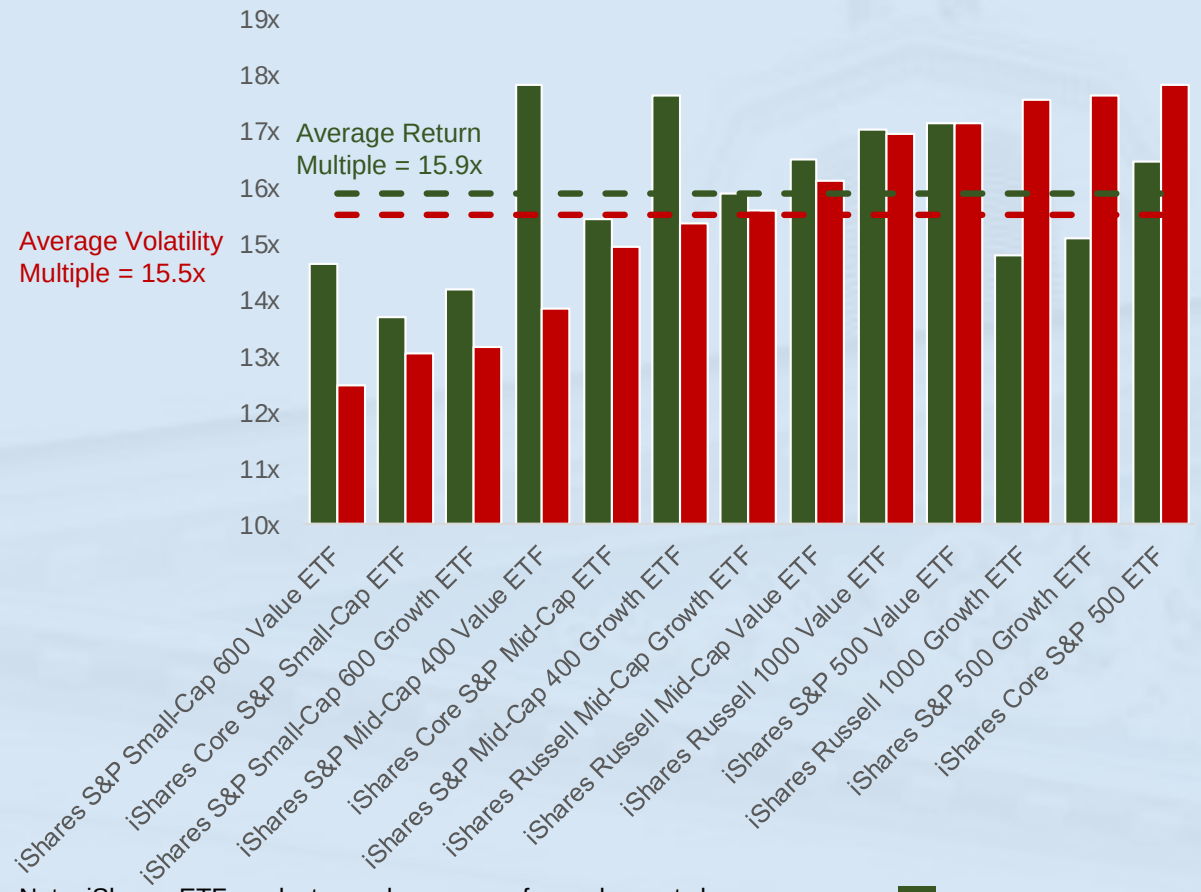
**Core**
Core investments have a balance of value and growth investments in one portfolio (also known as "Blended").

**Growth**
Growth investments look at trends in the market. If a specific company is expected to grow substantially, investors will buy into it.

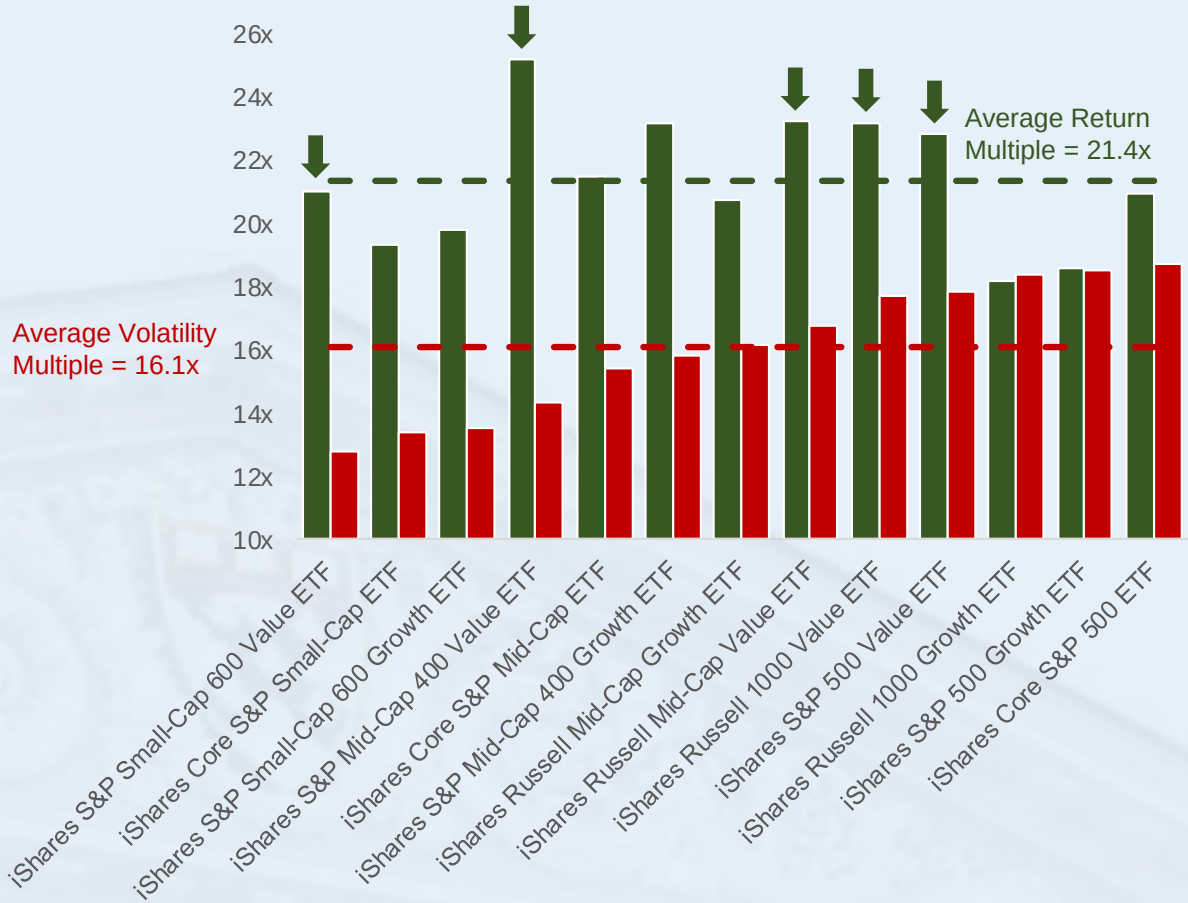
Note: iShares ETF products used as a proxy for each asset class
Source: https://www.ishares.com/us/products/etf-product-list
Past performance is not indicative of future returns.

# Risk vs. Return Analysis: Multiples Approach

**United States**
As of October 2017




**United States**
As of January 2018

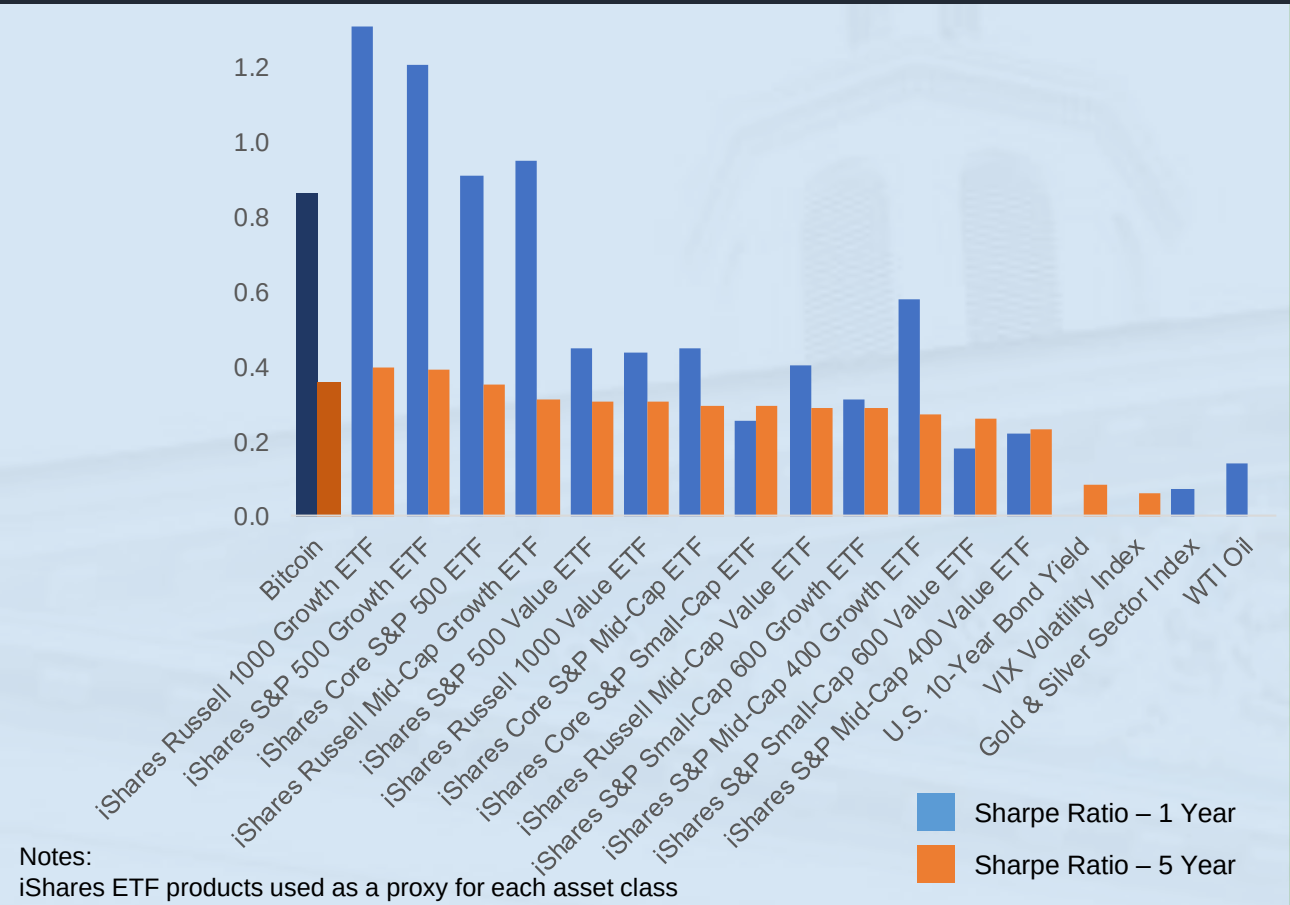



Note: iShares ETF products used as a proxy for each asset class
Source: https://www.ishares.com/us/products/etf-product-list
Past performance is not indicative of future returns.

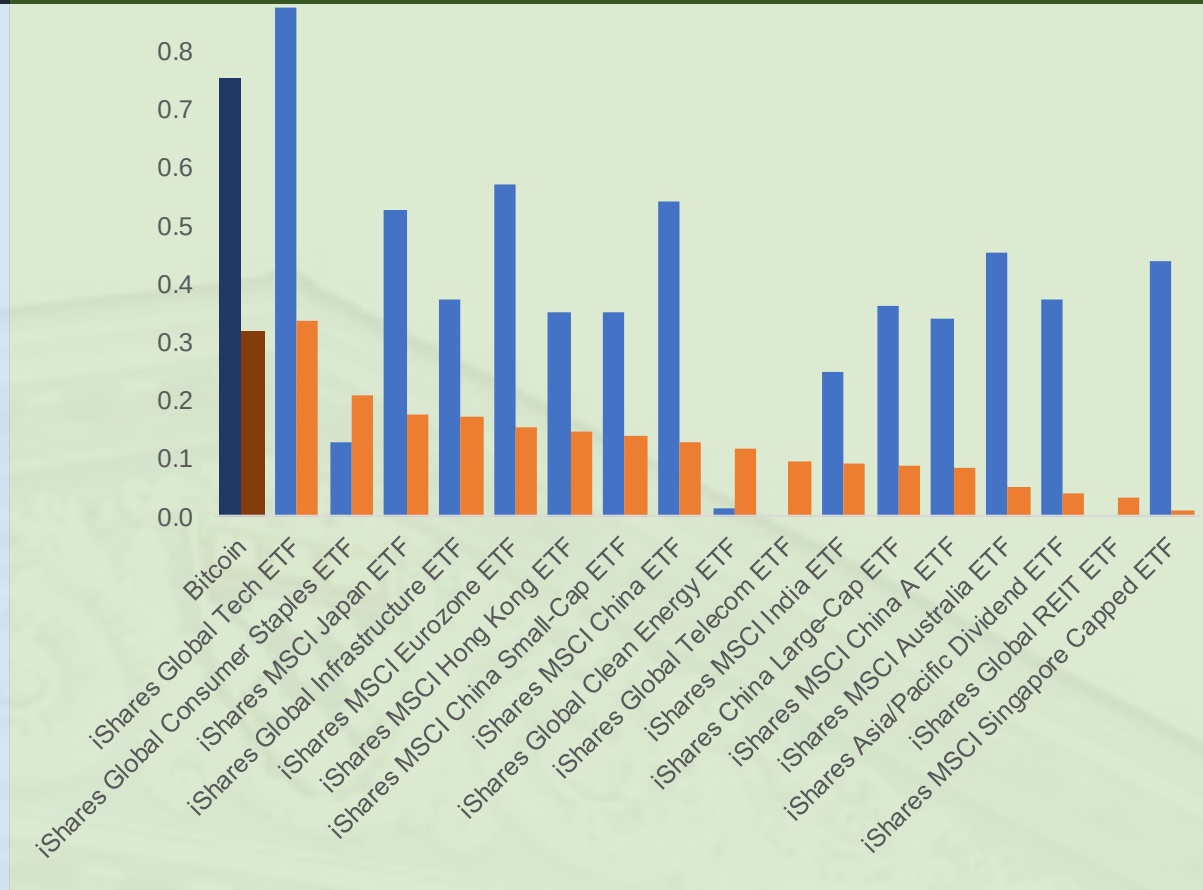
Return Multiple – 5 Year
Volatility Multiple – 5 Year

# Risk vs. Return Analysis: Sharpe Ratio

## United States



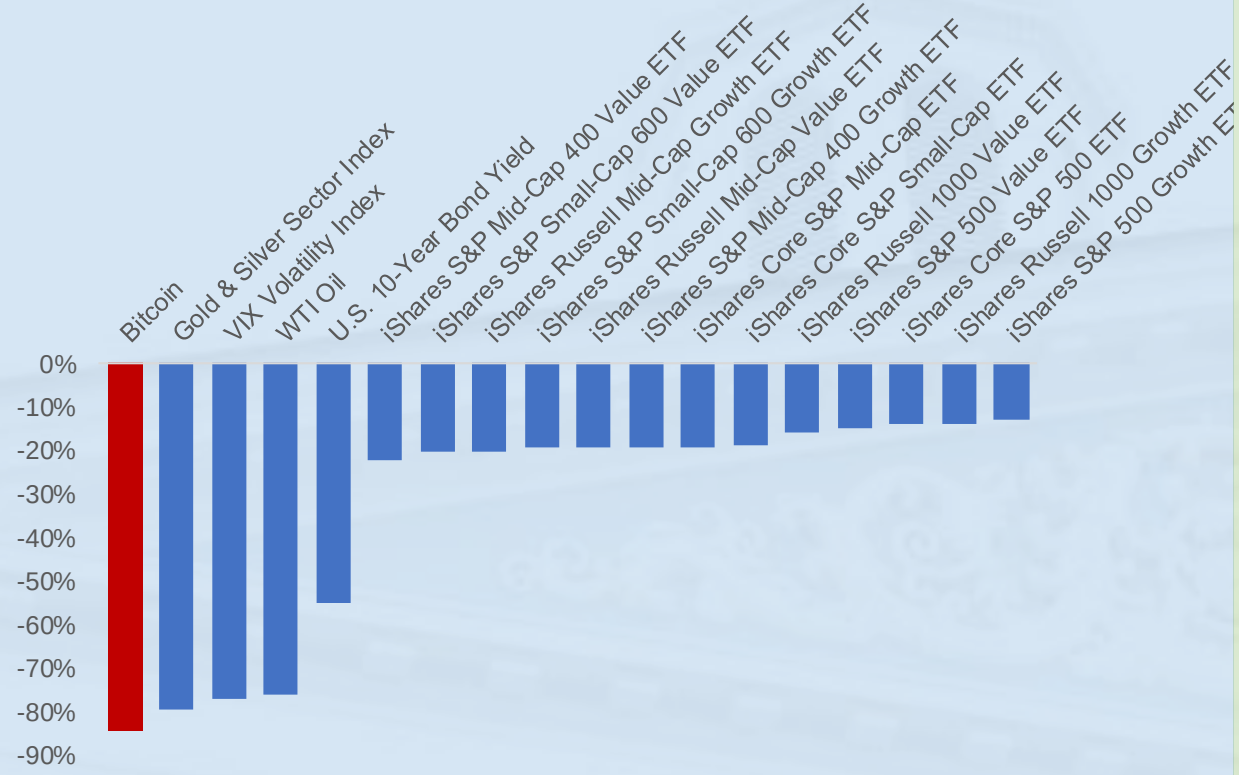

## Global



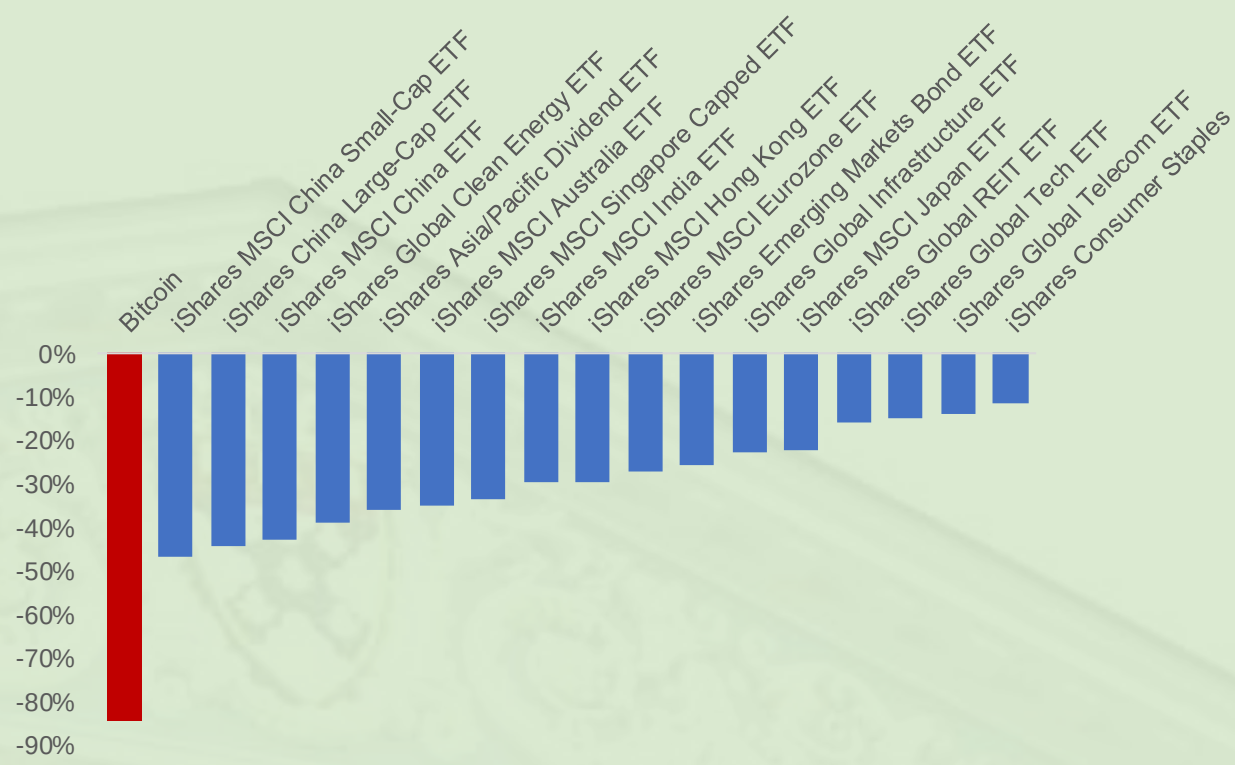

Notes:
iShares ETF products used as a proxy for each asset class
Risk free rate based on the U.S. Generic Government 10-Year Yield (USGG10YR:IND) from Bloomberg
Source: https://www.ishares.com/us/products/etf-product-list
Past performance is not indicative of future returns.

# Risk Analysis: Maximum Drawdown

## United States



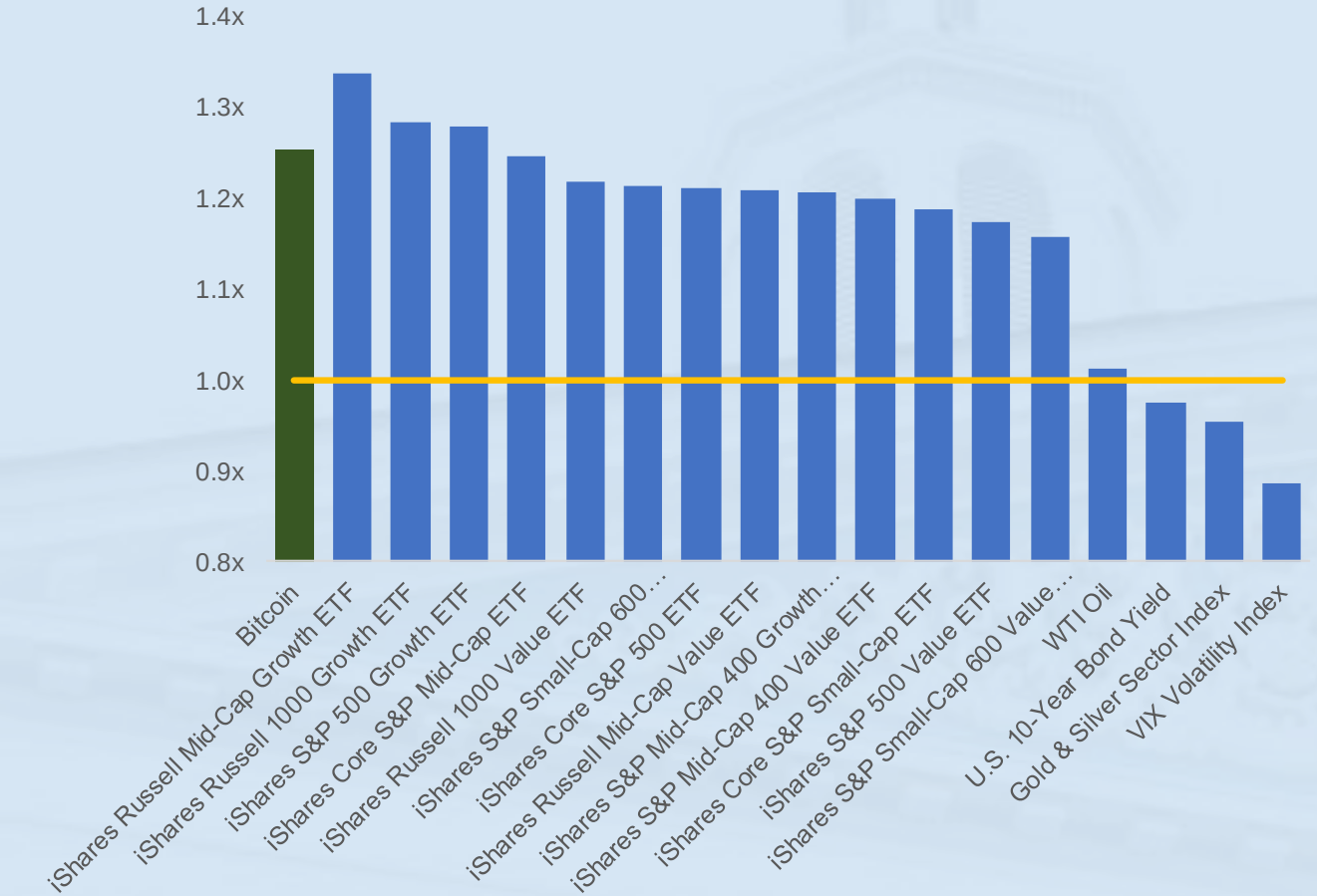

## Global



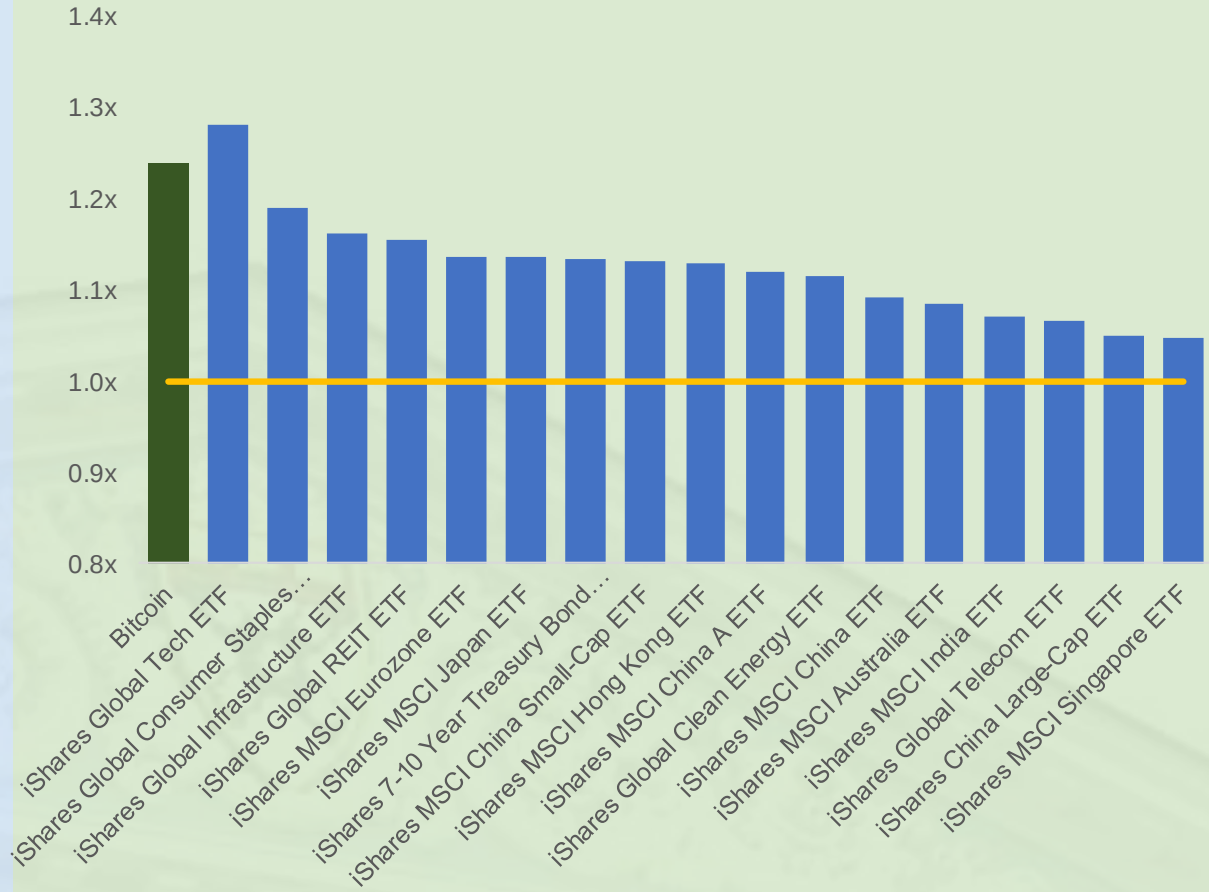

Note: iShares ETF products used as a proxy for each asset class
Source: https://www.ishares.com/us/products/etf-product-list
Past performance is not indicative of future returns.

# Return Analysis: Up vs. Down

## United States




## Global




Note: iShares ETF products used as a proxy for each asset class
Source: https://www.ishares.com/us/products/etf-product-list
Past performance is not indicative of future returns.

# Exogenous Risks


ICO

| Hacking | ICO Regulation | Exchange Regulation |
|---|---|---|
| • Collapse of Mt. Gox (largest cryptocurrency exchange in 2013, handling over 70% of all bitcoin volume)<br>• Hacking of Bitfinex[1] (the world's largest bitcoin exchange with 12% volume) | • Global crackdown on ICOs<br>• General consensus: Tokens = Securities<br>• Future ICOs may require appropriate regulatory agency, a prospectus, and limited to accredited investors | • Removal of gateways between fiat currencies and cryptocurrencies<br>• Chinese bitcoin market is pricing in that all major cryptocurrency exchanges in China will be closed |

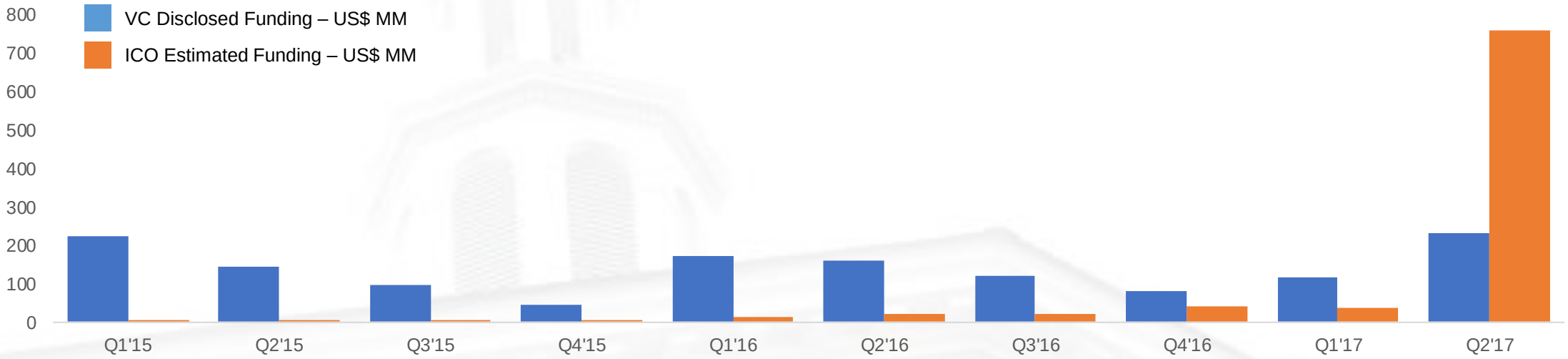
Credits:
https://thenounproject.com/term/mountain/70698/
https://thenounproject.com/term/exchange/136901/
Source: https://medium.com/@Truth_Investor/bitcoin-three-ways-the-bubble-will-pop-40678ce11698
Note: 1. Bitfinex is a crypto-currency exchange trading and currency-storage platform based out of Hong Kong and owned and operated by iFinex Inc.

# Initial Coin Offerings (ICOs)

- An entity offers investors some units of a **new cryptocurrency** or crypto-token in exchange against cryptocurrencies such as Bitcoin or Ethereum
- An **unregulated means of crowdfunding** via use of cryptocurrency, which can be a source of capital for startup companies
- A percentage of the newly issued cryptocurrency is sold to investors in exchange for legal tender or other cryptocurrencies


Sources:
https://blockgeeks.com/guides/what-is-an-initial-coin-offering/
https://medium.com/@Truth_Investor/bitcoin-three-ways-the-bubble-will-pop-40678ce11698
Credit;
http://www.kabukencafe.com/list-of-companies/large-stock-certificate/Microsoft.htm

# Geopolitical Variations for ICOs




| Switzerland | Singapore | United States | United Kingdom | China | Russia |
|---|---|---|---|---|---|
| Switzerland's Crypto Valley Association warns investors about danger of ICOs | Singapore MAS clarifies certain tokens are subject to security laws | U.S. SEC rules DAO tokens were securities and recommends Howey test and legal counsel to new ICOs | U.K. FCA warns consumers about ICOS, and makes clear that FCO does not regulate most ICOs | China bans ICOs (which could be temporary while licensing is drafted) | Russia Central Bank warns about the dangers of ICOs |

Sources:
https://medium.com/@Truth_Investor/bitcoin-three-ways-the-bubble-will-pop-40678ce11698
https://www.coindesk.com/state-ico-regulation-new-report-outlines-legal-status-6-nations/
https://www.cbinsights.com/research/blockchain-startup-deals-ico-trend/

HARVARD | BUSINESS | SCHOOL

N9-718-433
OCTOBER 17, 2017

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ANTHONY K. WOO

# Note on Blockchain and Bitcoin, 2017

Blockchain was a self-sustaining, peer-to-peer ledger technology with an integrated set of computer codes for managing and recording transactions without the involvement of any central authority.[1] The technology represented an innovation in information storage and distribution that eliminated the need for a trusted party to facilitate digital relationships.[2] Although originally devised for the digital currency bitcoin, blockchain technology promised to make data storage and management processes more democratic, secure, transparent, and efficient.[3]

A limitation of traditional databases was that they only be edited by one user at a time. And while one user was making changes to the database, other users were effectively locked out. By comparison, blockchain allowed every participant to hold an identical copy of the ledger that was distributed across the entire network, which made information management and sharing more efficient. The concept of a single, shared ledger was akin to Google Docs, which granted access to the same document to every party, and allowed everyone to work on the same version of a document, at the same time.[4]

Blockchain was a technology that could be applied across a wide range of sectors such as finance, education, healthcare, and supply chain. From 2013 to 2017, the sector had attracted USD 1.53 billion of investments from banks, business and governmental organizations.[5] In 2017, blockchain was mostly being used for cryptocurrencies and data storage.

## Background of Blockchain

Each block in a blockchain was analogous to an individual page in a book.[6] Instead of ordering the pages according to page number, the "pages" in a blockchain were linked with a set of computer protocols. The header of a page in a blockchain would refer to the footer of a previous page, thus forming a "chain" of blocks allowing every participant in the network to trace this "book of blockchain" all the way back to its first "page," or the "genesis" block. Each block was connected using an algorithm that was dynamically linked to the content of the page. Because of this algorithm,[a] every time the content of a page was altered, the link between that page and a subsequent one would change. Therein lay the technology's "immutability" attribute, because a perpetrator who wanted to alter the information on a blockchain would have to carry out the computationally intensive and extremely difficult task of rebuilding the links connecting all the blocks.

Enabled by the blockchain technology, "smart contracts" were computer protocols with embedded computer codes that would automatically execute a particular set of actions. One could think of smart contracts as "little programs that execute 'if this happens then do that', run and verified by many computers to ensure trustworthiness. If blockchains give us distributed trustworthy *storage*, then smart contracts give us distributed trustworthy *calculations*."[7] For example, the state of Delaware announced in May 2016 initiatives to utilize smart contracts to streamline back-office procedures to store state archival records on a distributed ledger.[8] In addition, Barclays was investigating how blockchain-based smart contracts could be connected to real-world legal contracts, and had created templates that could translate lines of text into code executable on a distributed ledger.[9]

The blockchain technology was still in its early stages of development, and its progress varied from country to country. In the United Kingdom, the Financial Conduct Authority (FCA) launched a regulatory sandbox in May 2016,[10] enabling businesses to put disruptive technologies (including blockchain) to the test in a live environment "without immediately incurring all of the normal regulatory consequences."[11] In China, the Jiangsu Huaxin Blockchain Research Institute (JBI) went public in September 2016 as the first state-owned enterprise to focus solely on the blockchain technology.[12] In the United States, the Securities and Exchange Commission (SEC) issued its first blockchain-related regulation on July 25, 2017, subjecting Initial Coin Offerings[b] (ICOs) to the agency's regulation.[13] A recent IBM survey of policy makers found that nine in ten government organizations worldwide had voiced their intention to invest in blockchain technology by 2018.[14]

## Advantages of Blockchain

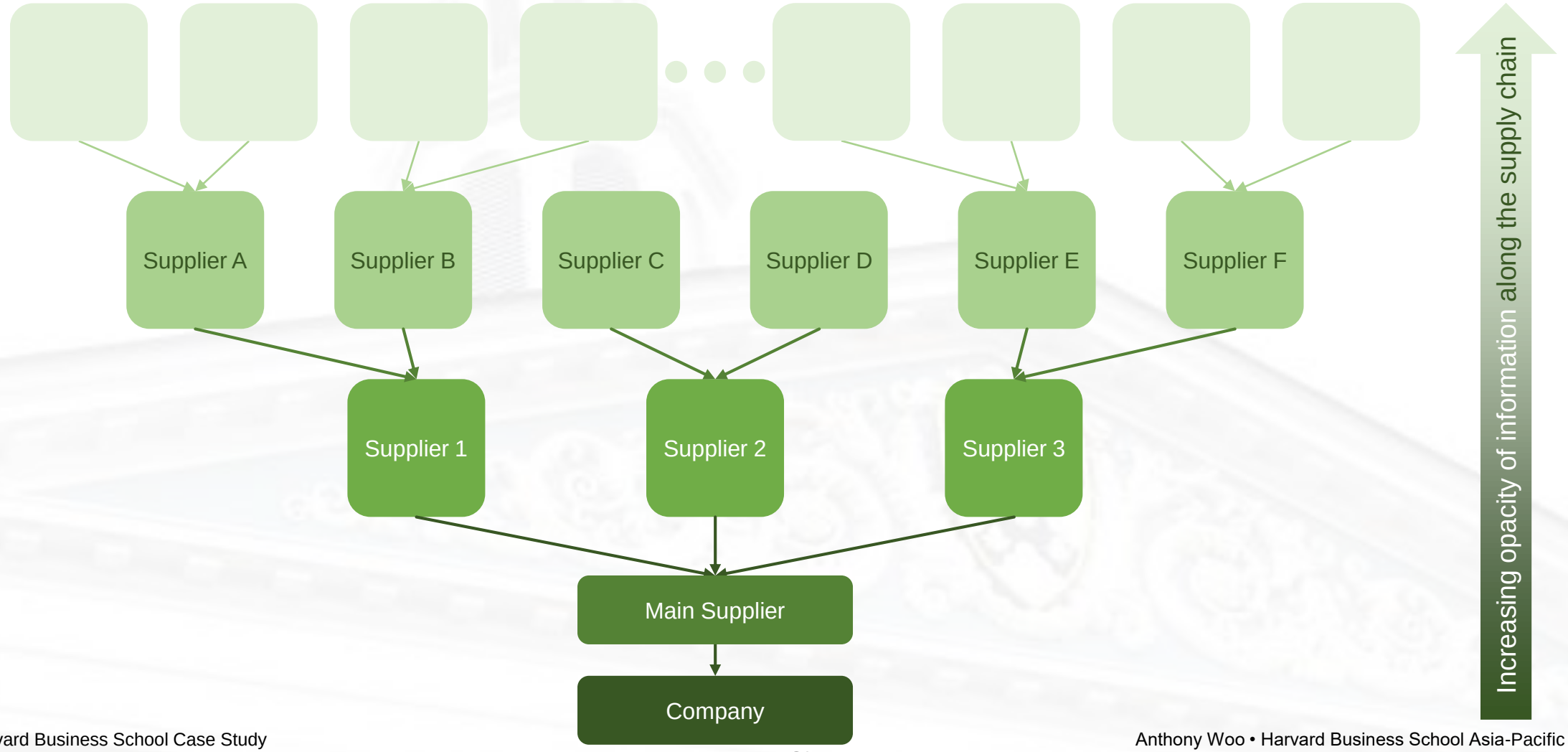
In addition to its immutability, another defining feature of blockchain was distributed consensus. Distributed consensus meant that each participant independently verified transaction data before an official record was made on the blockchain, which made the system as a whole robust and reliable. (See **Exhibit 1** for details.) For instance, to settle a transfer payment made between two banks, changes had to be made at separate ledgers at each bank. Blockchain allowed banks to have one common ledger from which to source reliable information.

With distributed consensus, all participants in a blockchain network were connected to a single, unified database. Coordination among multiple stakeholders was no longer necessary, thereby enabling more rapid transactions at lower costs. For instance, under the current SWIFT transaction network,[c] it usually took three days (i.e. T+3) for a stock or corporate bond to settle in the United States, with banks managing their own internal databases and transaction records. Using blockchain, financial institutions would no longer have to clear and settle transactions manually. On April 21, 2017, BBVA, the second largest bank in Spain, completed the first-ever institutional international money transfer using blockchain.[15]

[a] The algorithm was known as a "hash function," a mathematical process that took input data of any size, performed an operation on it, and returned output data of a fixed size.

[b] Also called an Initial Public Coin Offering (IPCO), an Initial Coin Offering (ICO) was an unregulated means by which funds were raised for a new cryptocurrency venture.

# Blockchain: Supply Chain Finance Use Case




Source: Harvard Business School Case Study

# Blockchain: Education Use Case

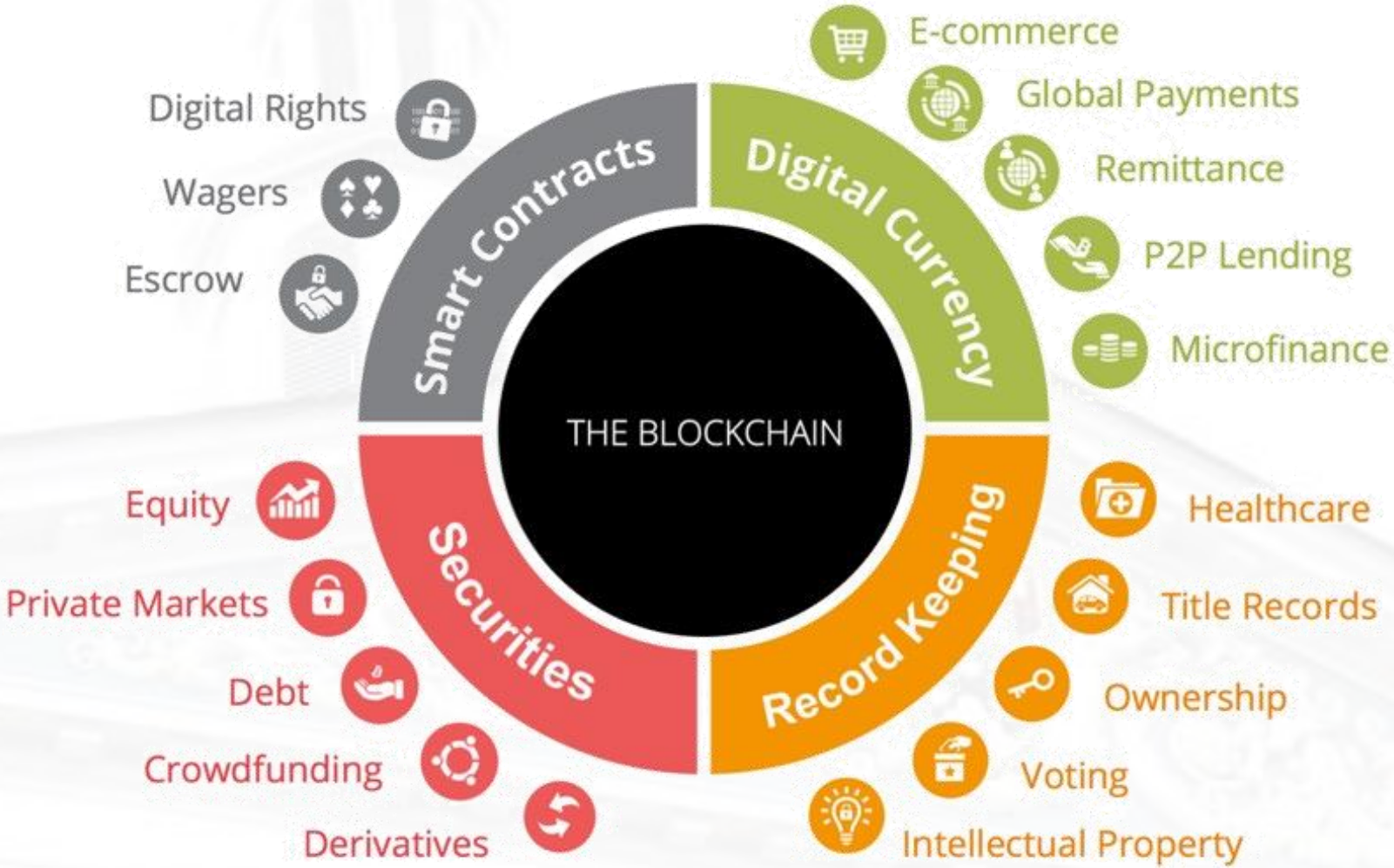

**MIT Digital Certificates Project**
An incubation project by the Media Lab Learning Initiative and Learning Machine that builds an ecosystem for creating, sharing, and verifying blockchain-based educational certificates. Digital certificates are registered on the Bitcoin blockchain, cryptographically signed, and tamper proof. All code is open-source and open to feedback, contributions, and general discussion.

**Sample Deployments**

- The Media Lab issued digital certificates (nicknamed “coins”) to Media Lab alumni who attended the Lab’s 30th anniversary in October 2015.
- Learning Machine issued digital certificates to all of its employees.
- MIT's Global Entrepreneurship Bootcamp issued digital certificates to the students that attended their workshop in Seoul, South Korea in March 2016.
- The Laboratorio para la Ciudad issued digital certificates to participants of a week-long workshop in Mexico City in September 2016.

Source: Massachusetts Institute of Technology

# Use Cases




Source: https://www.aciworldwide.com/insights/expert-view/2017/march/blockchain-for-retailers-producing-real-business-benefits


Blockchain
(Use Cases)
Source: GrowthPraxis
Proof of ownership and a marketplace for sales and purchase of digital assets
Company: MyPowers
Enables authenticity of a review through trustworthy endorsements for employee peer review
Company: TRST.im
Decentralized prediction platform for the share markets, politics etc
Company: Augur
Decentralized patient records management
Company – BitHealth (Healthcare IT)
Proof of ownership for digital content
Arts, pictures and images
Companies: Blockai, Bitproof, ascribe, Artplus
Other companies: Chainy.Link, Stampery
Digitizing assets: Improves anti-counterfeit measures
Consumer electronics, Automotive
Companies: The Real McCoy, ChainLink
Other companies: Everpass, BlockVerify
Degree Verification
Company: Degree Of Trust
Provides digital identity that protects consumer privacy
Internet, car locks: Onename
Customer identification: Trustatom
Elections Voting: Follow My Vote
Enables authenticity of a review
Helps users engage, share reputation and collect feedback
Company: The World Table
Through trustworthy endorsements
Company: Asimov
Decentralized internet and computing resources to every home and business
Company: ePlug
Digitizing company incorporations, transfer of equity/ownership and governance
Company: Otonomos
Escrow/Custodian service
Gaming industry
Companies: PlayCoin, Bitnplay
Gaming industry and loan servicing
Company: New System Technologies
E-commerce
Company: Fundrs.org
A smart contract IT portal executing order fulfilment in ecommerce/manufacturing
Company: UbiMS
Provides digital identity that protects consumer privacy
Companies: Sho Card, Uniquid
Decentralized IoT
Home automation: Chimera-inc.io
Industries: Filament
Decentralized storage using a network of computers on blockchain
Company: Storj
Digitization of documents/contracts and proof of ownership for transfers
Company: Colu (Colored Coins)
Digital security trading: ownership and transfer
Companies: Symbiont, Mirror, Spritzle, Secure Assets, BitShares, Coins-e, equityBits, DXMarkets, MUNA
Points based value transfer for ride sharing
Company – La'Zooz
Proof of ownership for digital content storage and delivery
Companies: Blocktech (Alexandria), Bisantyum, Blockparti, The Rudimental, BlockCDN
Proof of ownership of modules in app development
Company: Assembly

# Blockchain Coding

```
import java.lang.reflect.Array;
import java.util.Arrays;

public class Block {

   private int previousHash;
   private String[] transactions;

   private int blockHash;

   public Block(int previousHash, String[] transactions) {
      this.previousHash = previousHash;
      this.transactions = transactions;

      Object[] contents = {Arrays.hashCode(transactions), previousHash};
      this.blockHash = Arrays.hashCode(contents);

   }

   public int getPreviousHash() {
      return previousHash;
   }

   public String[] getTransaction() {
      return transactions;
   }

   public int getBlockHash() {
      return blockHash;
   }
}
```

```
import java.util.Arrays;

public class Main {

   public static void main(String[] args) {

      String[] genesisTransactions = {“A gives B 10", “B gives C 20"};
      Block genesisBlock = new Block(0, genesisTransactions);

      String[] block2Transactions = {“C gives B 5", “B gives A 5"};
      Block block2 = new Block(genesisBlock.getBlockHash(), block2Transactions);

      String[] block3Transactions = {“B gives E 30"};
      Block block3 = new Block(block2.getBlockHash(), block3Transactions);

      System.out.println("Hash of genesis block:");
      System.out.println(genesisBlock.getBlockHash());

      System.out.println("Hash of block 2:");
      System.out.println(block2.getBlockHash());

      System.out.println("Hash of block 3:");
      System.out.println(block3.getBlockHash());

   }

}
```

Source: https://github.com/ivan-liljeqvist/SimpleBlockchain/

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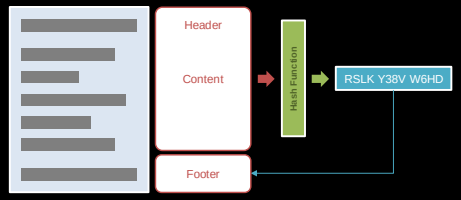


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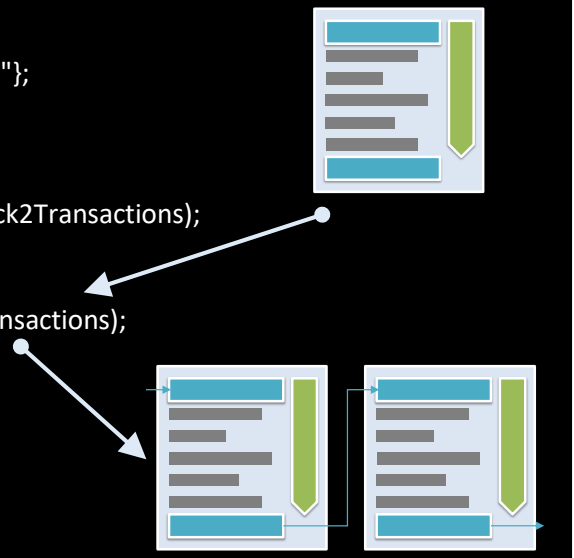

Source: https://github.com/ivan-liljeqvist/SimpleBlockchain/

# Smart Contracts

```
contract MyToken {
        /* This creates an array with all balances */
        mapping (address => uint256) public balanceOf;

        /* Initializes contract with initial supply tokens to the creator of the contract */
        function MyToken(
                uint256 initialSupply
                ) {
        balanceOf[msg.sender] = initialSupply;                  // Give the creator all initial tokens
        }

        /* Send coins */
        function transfer(address _to, uint256 _value) {
                require(balanceOf[msg.sender] >= _value);       // Check if the sender has enough

                require(balanceOf[_to] + _value >= balanceOf[_to]);  // Check for overflows

                balanceOf[msg.sender] -= _value;                // Subtract from the sender

                balanceOf[_to] += _value;                       // Add the same to the recipient
                }
}
```

Source: https://www.ethereum.org/token