Bitcoin Payment Integration

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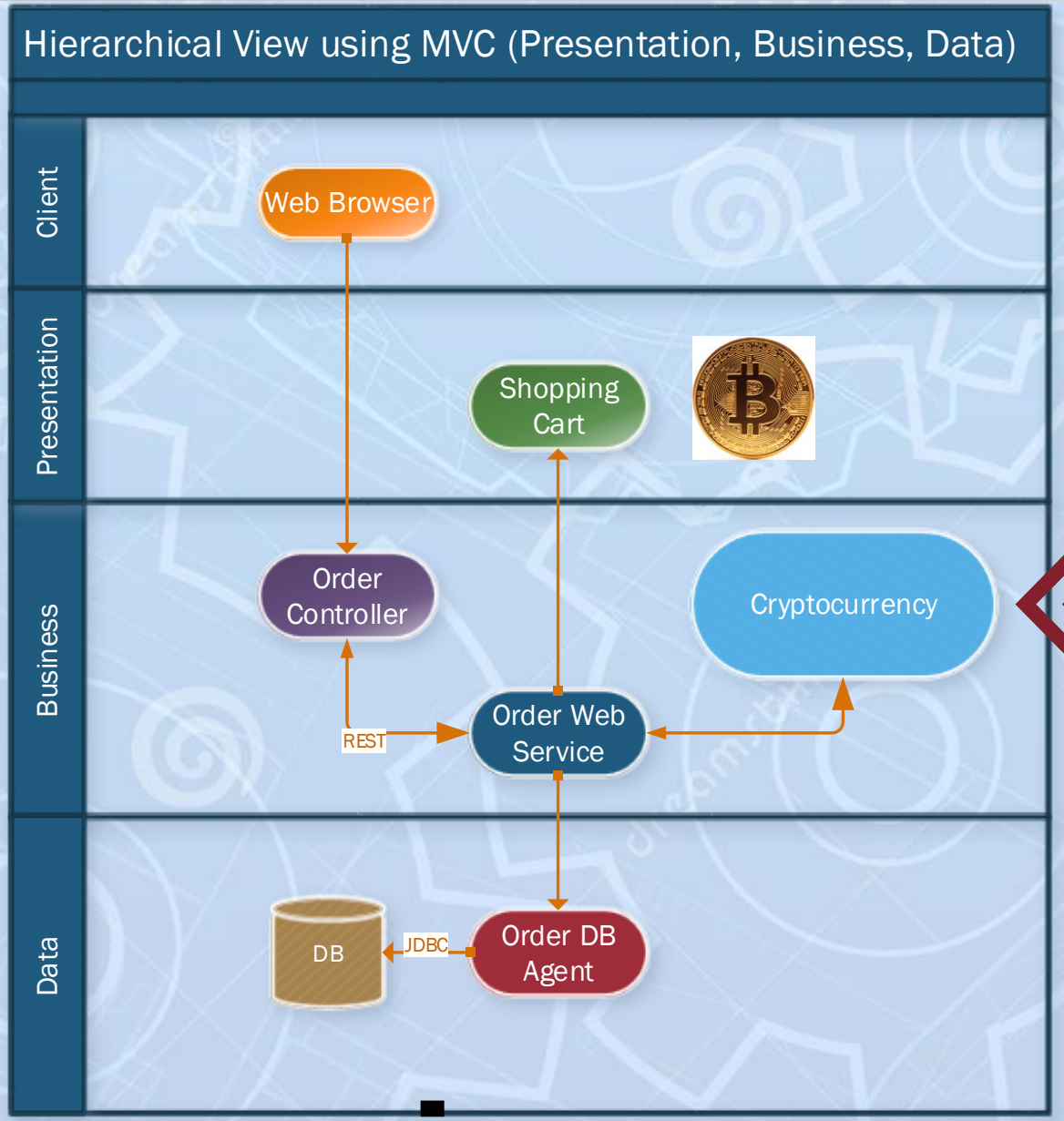
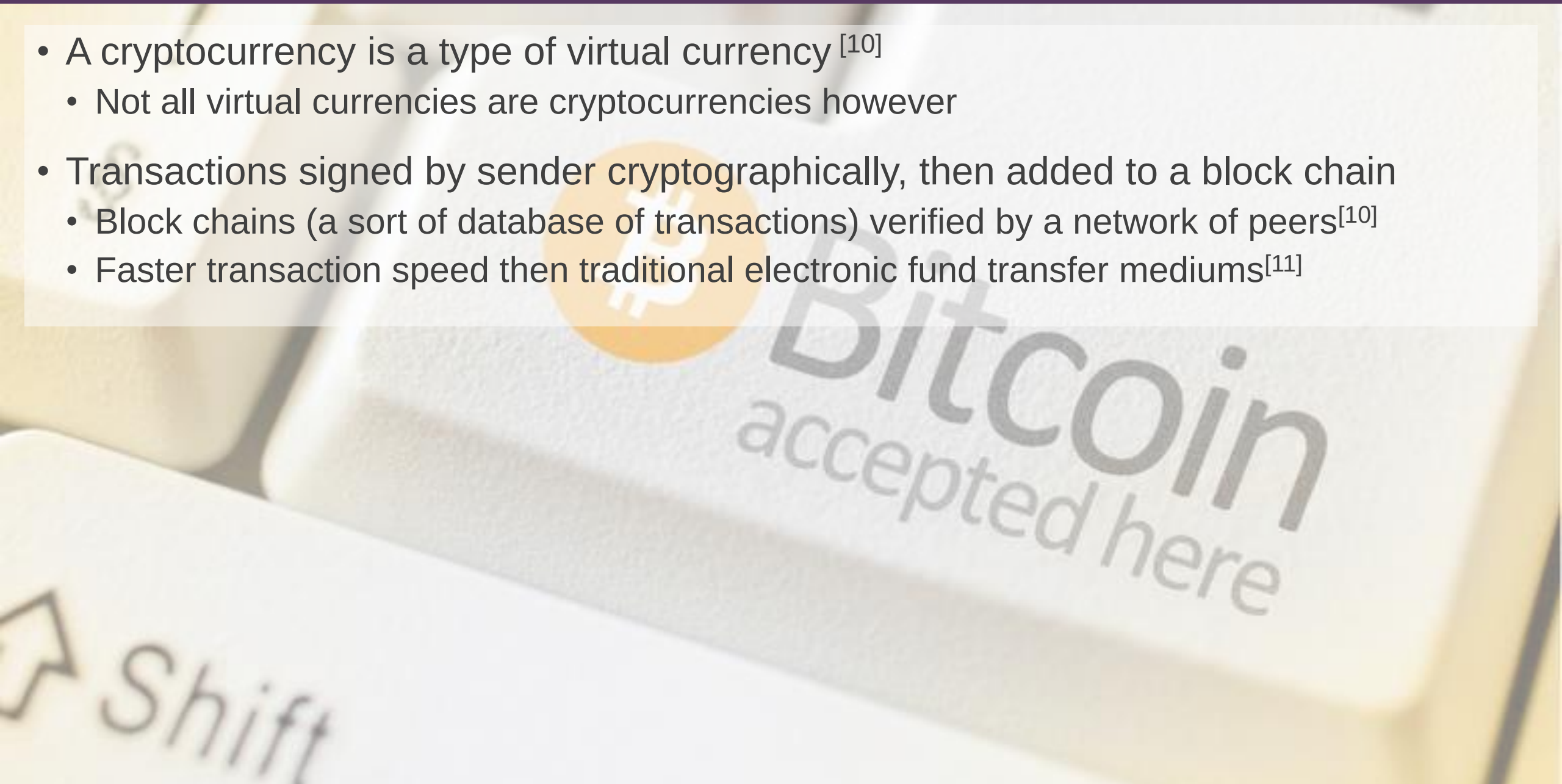


Cryptocurrencies

Definition

- A cryptocurrency is a type of virtual currency [10]
  - Not all virtual currencies are cryptocurrencies however
- Transactions signed by sender cryptographically, then added to a block chain
  - Block chains (a sort of database of transactions) verified by a network of peers[10]
  - Faster transaction speed then traditional electronic fund transfer mediums[11]



Transaction Verification Process

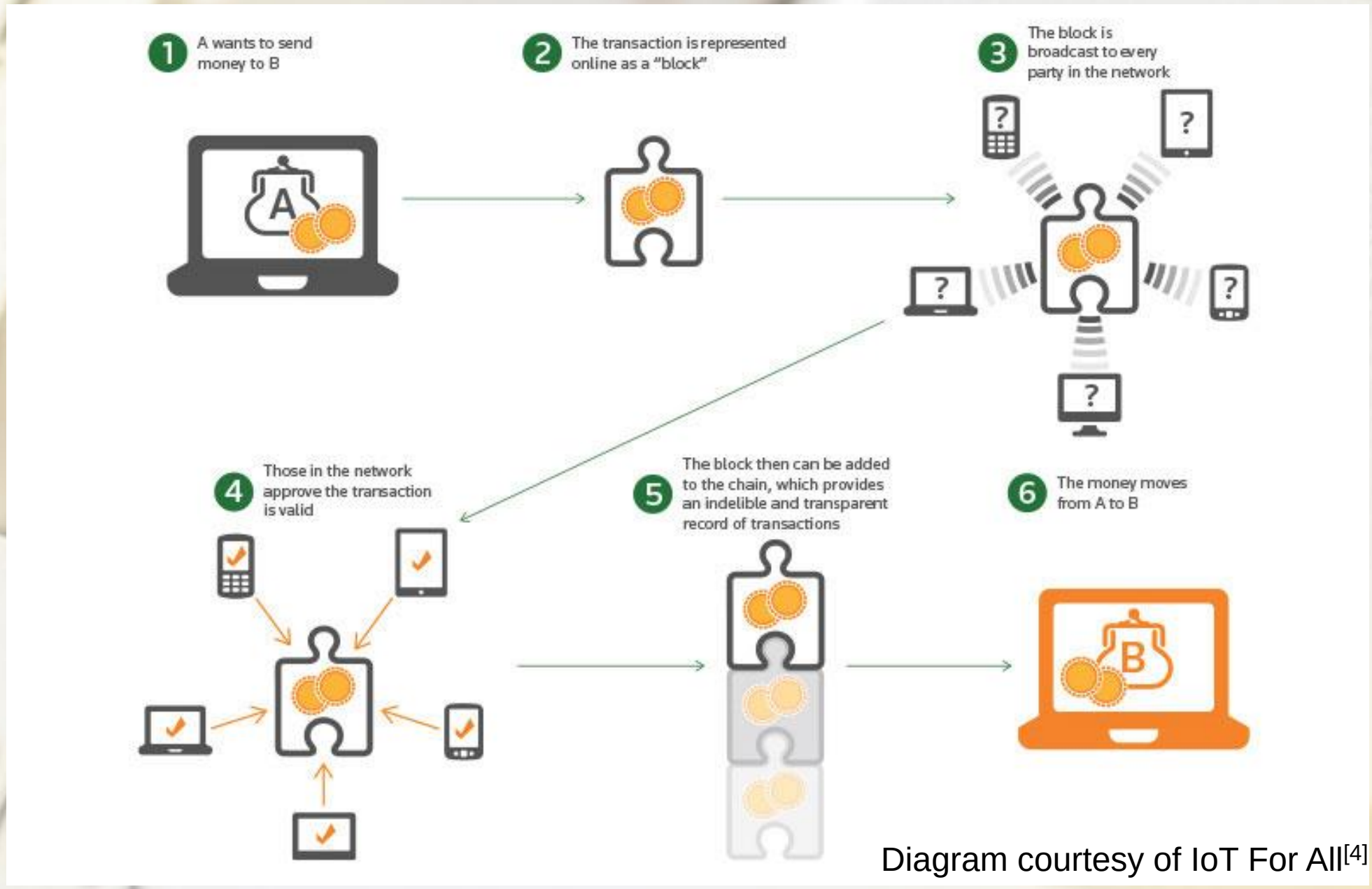


Diagram courtesy of IoT For All[4]

Top 5 Cryptocurrencies

- Current top 5 currencies are:
  - Bitcoin (XBT/BTC)[2][13]
    - Original Cryptocurrency
  - Ethereum (ETH)[8][14]
    - Cryptocurrency with support for “Smart Contracts”
  - Ripple (XRP)[12]
    - Centralized non-mineable cryptocurrency with participating financial institution
      - BMO, RBC, American Express, etc
    - Based on transferring liability of payment across a chain of trust
  - Bitcoin Cash (BCH) [8]
    - Based on Bitcoin
    - Adjustable blockchain verification difficulty for scalability[9]
  - Dash (DASH)[7]
    - Based on Bitcoin
    - Cryptocurrency focused on self funding to pay developers

Logos of the top 5 [2][8][3][12][7]

Currency Comparison Chart

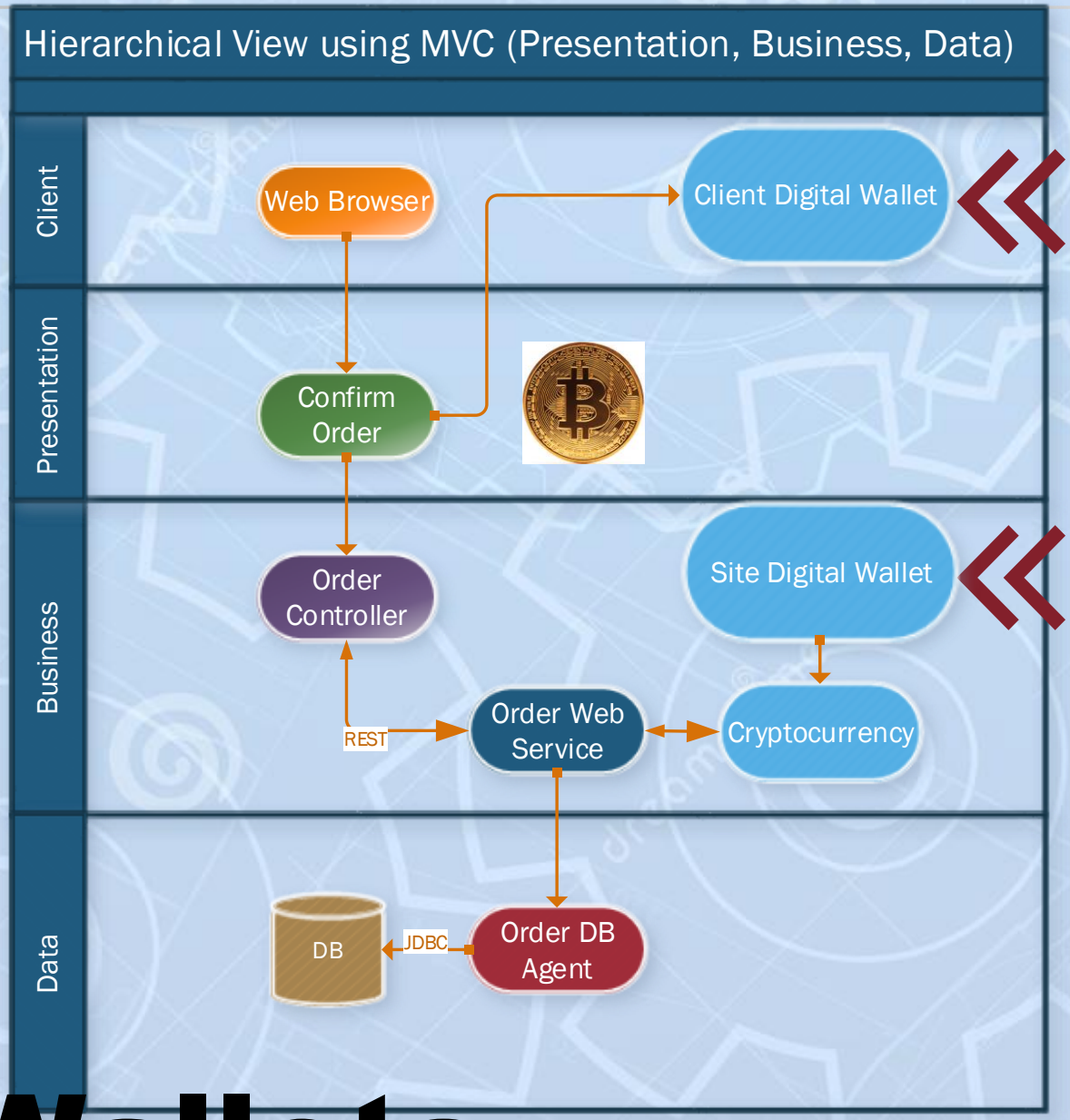
Cryptocurrency	Cryptocurrency based on	Average Block Size	Decentralized?	Average Verification Time	Max Coins
Bitcoin[2]	Original Currency	1 MB	Yes	10 minutes[18]	21 Million[10]
Ethereum[14]	Original Currency	22 KB	Yes	15 seconds[18]	Predicted 100 Million[16]
Bitcoin Cash[2]	Bitcoin	300 KB	Yes	10 minutes[18]	21 Million
Ripple[12]	Original Currency	Uses Transaction calls to update a Ledger	No	3.5 seconds[17]	100 Billion[15]
Dash[7]	Bitcoin	20 KB	Yes	2 minutes[18]	22 Million Theoretically

Legality

- Under Canadian Law[5][1]:
  - Not recognized as an official legal currency
  - Under Barter Laws cryptocurrency for goods or services is considered a taxable gain
  - Similarly “cashing out” or charging a fee for exchange of Bitcoin is considered taxable
- Recent crackdown on cryptocurrency use
  - China has declared exchange of cryptocurrency as illegal[10]
  - Crackdowns done on premise of fighting against criminal activity[6]
    - Tax evasion
    - Cryptocurrency as Pyramid schemes
    - Use as currency for exchange of illegal goods and services
  - Regulation by the US’ IRS via the NYC BitLicense[10]
    - Cryptocurrency treated as a property vs currency[1]

➢ Acquisitions of Cryptocurrency

- Exchanges
  - Online and currency transferred to digital wallets through QR codes
  - Exchange fee charged
- Bitcoin ATMs[11]
  - Allow users to exchange physical cash for bitcoins
  - HUGE fees applied
  - Reason for use
    - Convenience of not setting up many exchange accounts
    - Potential use in countries with less stable stock markets to safeguard against major downwards fluctuations
    - Similar to exchanges, currency given through QR codes
- Mining[1]
  - Not as viable for some cryptocurrencies



Digital Wallets

Digital Wallets

- A Bitcoin wallet is simply a collection of private keys.
- It is actually the requisite information proving ownership of a Bitcoin address, which in turn allows that user to spend bitcoins associated with that address.
  - Can be copied, distributed, received only.
- A wallet software is a piece of software that allows spending funds from the addresses in a wallet and to manage the wallet

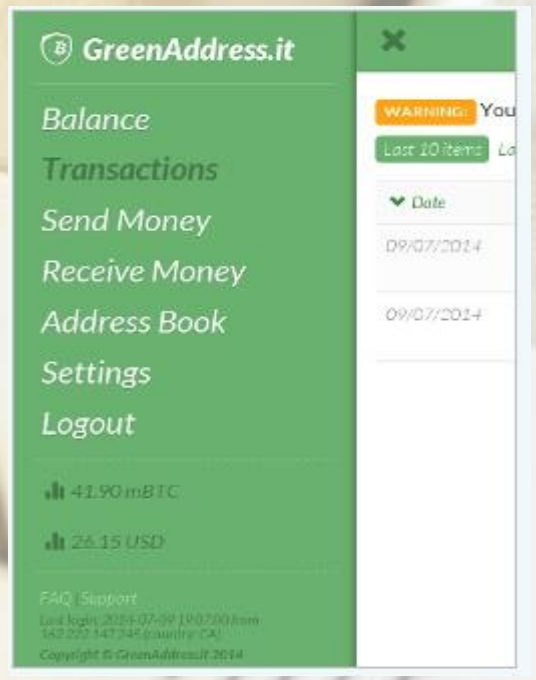
Types of Wallet [1][7]

- Offline/ cold wallets- USB, Paper, offline devices, hardware

Ledger Nano S, KeepKey, Trezor

- Web/Online/Hot wallet

Bitcoin Wallet, GreenAddress, Mycelium, Breadwallet

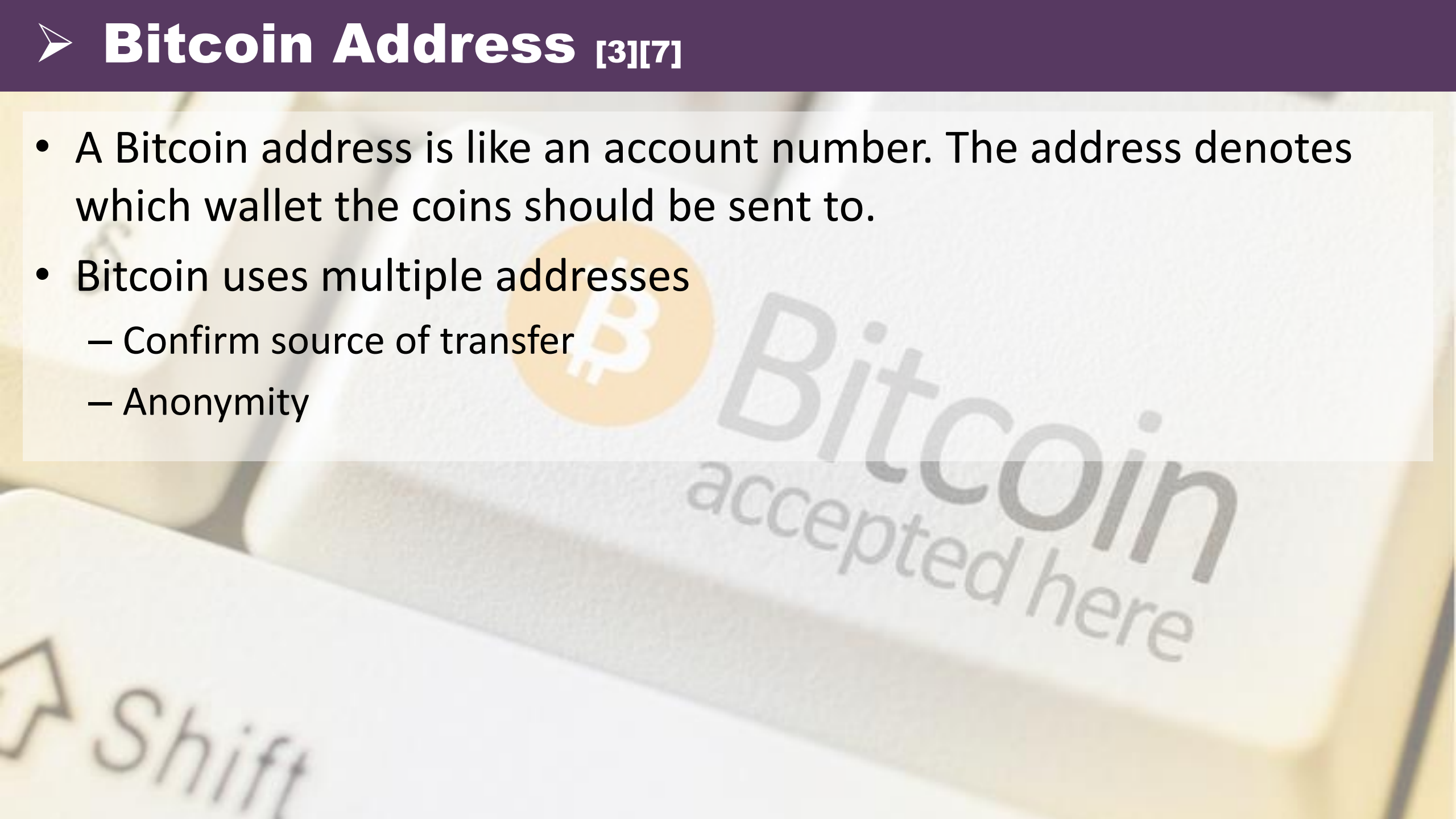


➢ Categories of Wallet [1][7][9]

- Lightweight wallet
- Full node/heavy wallet
- Deterministic wallet
- Brain Wallet

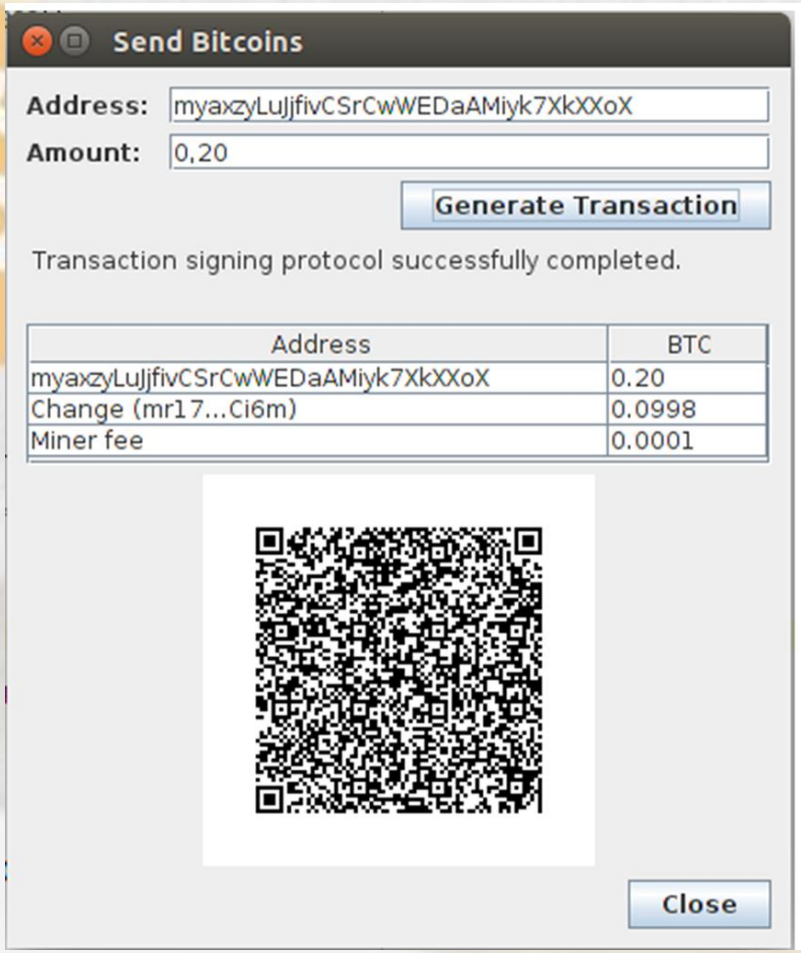
Bitcoin Address [3][7]

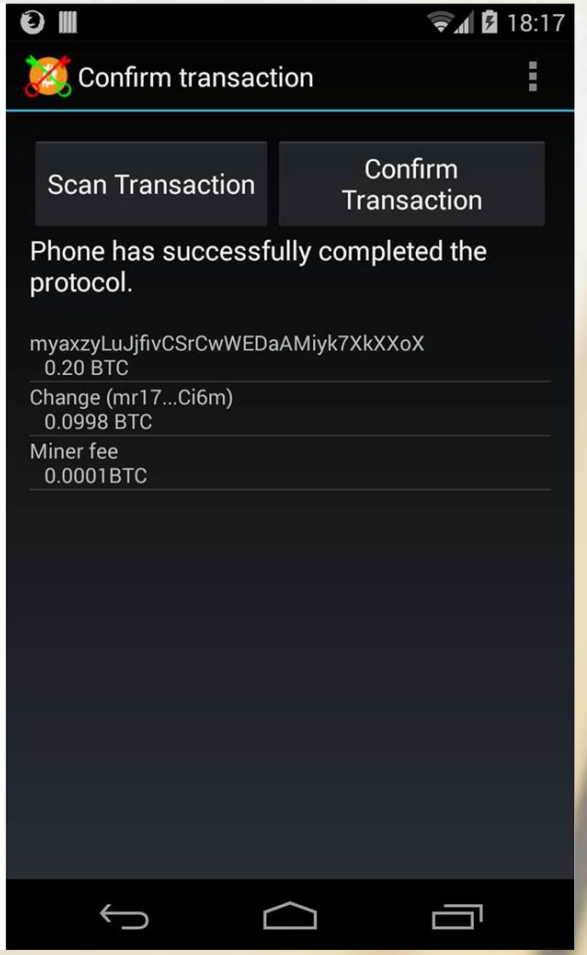
- A Bitcoin address is like an account number. The address denotes which wallet the coins should be sent to.
- Bitcoin uses multiple addresses
  - Confirm source of transfer
  - Anonymity

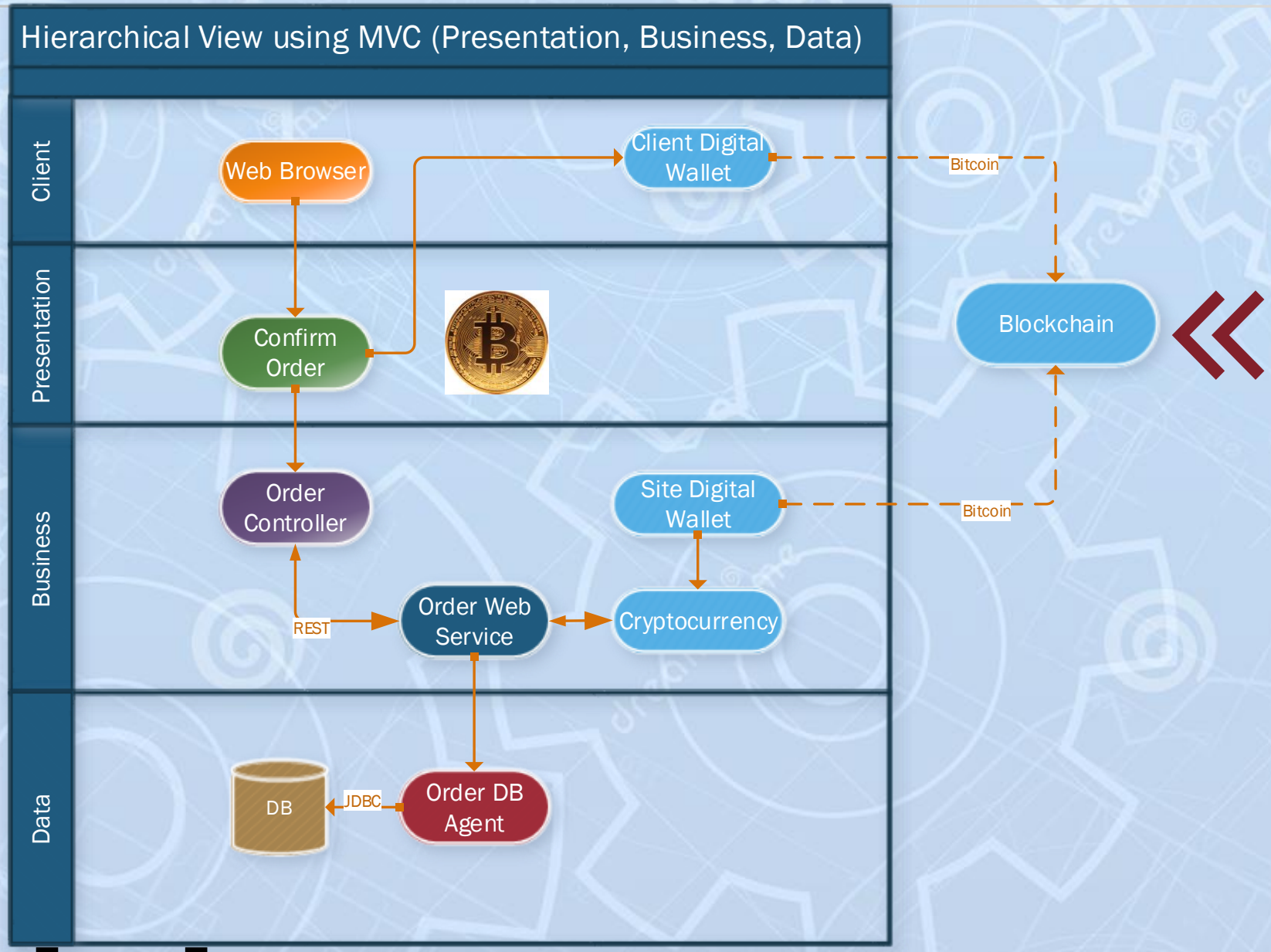


Security [5][6]

- Public and private key
- Biometrics
- Two factor authentication
- QR Codes







Blockchain

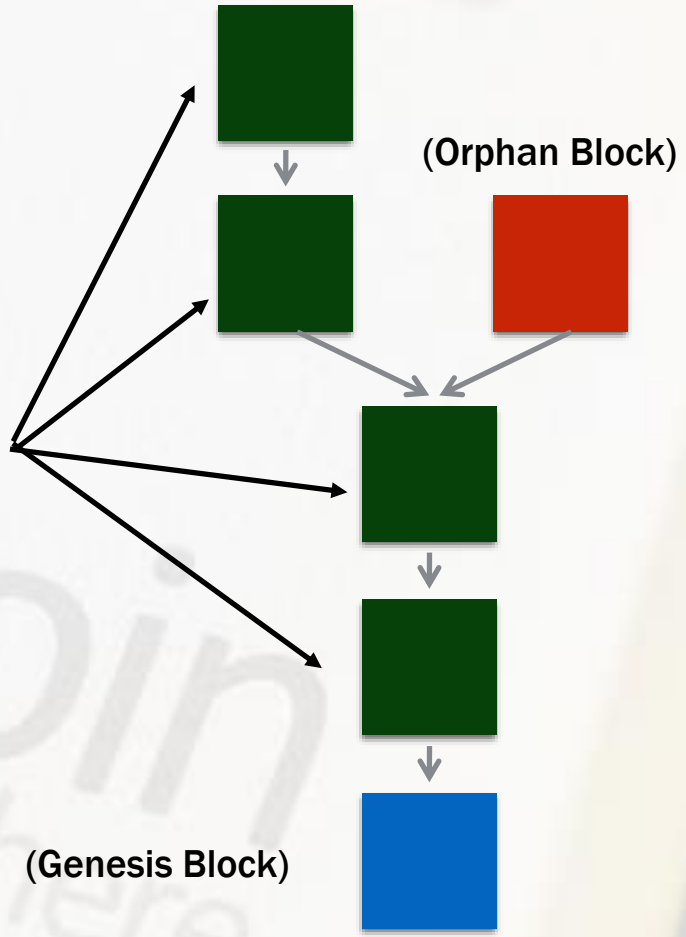
Ahmad Traboulsi

Blockchain

What is a blockchain?

"A distributed, public ledger that contains the history of every bitcoin transaction." (coinbase definition of the block chain)

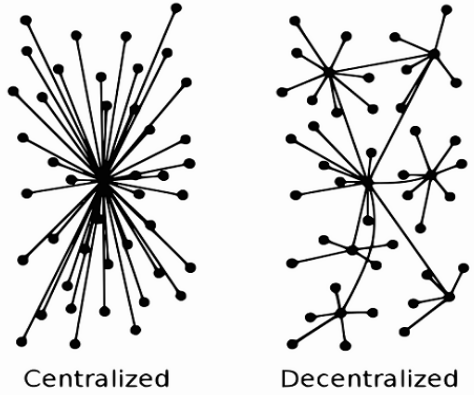
" A continuously growing list of records, called blocks, which are linked and secured using cryptography." (wikipedia definition)



The Blockchain

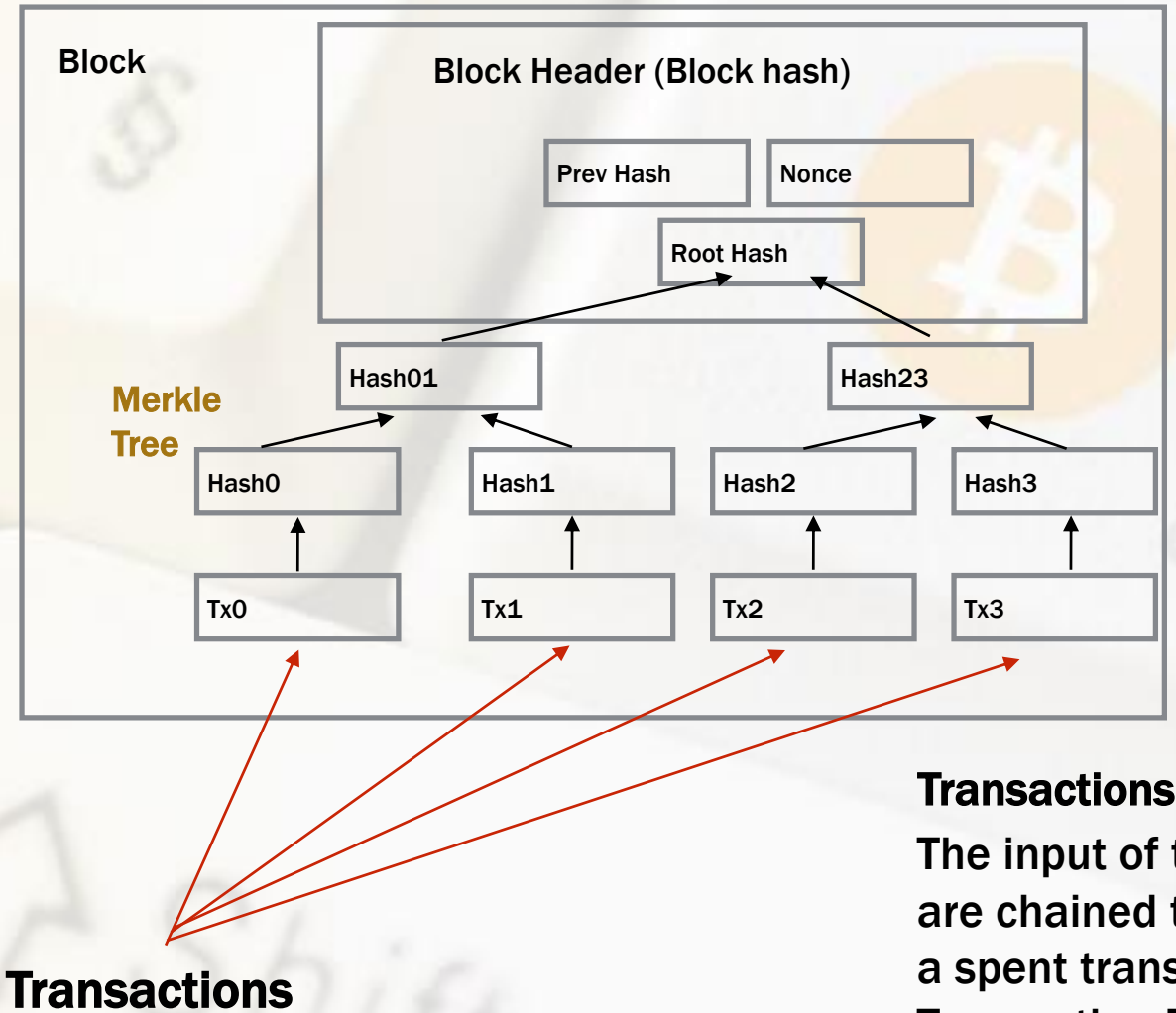
How did it begin?

It all began with a solution proposed by Satoshi Nakamoto to allow online payments to be sent directly from one party to another without going through a financial institution and without the requirement of a trusted third party that would prevent double spending.



Blockchain

What's in a block?



How are the blocks linked?

Each block contain the hash of the prev block in the chain, linking them together.

How are transactions stored?

A batch of transactions are stored in a merkle tree in a block.

How does it store balances?

Balances are not stored in the blockchain. The balance for a certain address is simply determined by summing up of all the UTXOs(unspent transaction outputs) for that address.

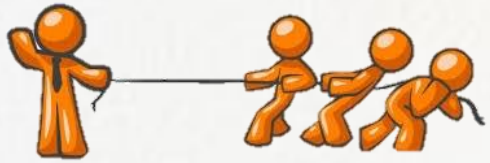
Transactions inputs vs outputs

The input of transactions are the output of other transactions. Transactions are chained together. All transaction outputs can be categorized to be either a spent transaction outputs or UTXOs. Bitcoin uses (Transaction-To-Transaction Payments).

Blockchain

Every 10 minutes a block is added to the block chain.But who gets to update the block chain?

Miners compete against each other to solve a mathematical problem.
(More processing powers a greater chance the miner wins)



Every 10 minutes one miner solves the puzzle and announce the addition of the block of transactions to the chain.

Other nodes/peers check if the puzzle was solved. If so they, also checks if the transactions in that block are valid.

If more than 50% of those nodes agree. That block of transactions is included.

A record/block who's authenticity is verified by the whole community rather than a centralized authority.

12.5 bitcoins are awarded to the miner that solves the puzzle required for the proof-of-work.

Blockchain

How does miners validates transactions?

The transaction validation is governed by a set of rules. Miners validate/verify the transaction according to a set of rules.

What is mining?

Mining is the action of creating a valid Bitcoin block which requires the demonstration of proof-of-work.

Consensus Algorithm: Proof of work

- Ensures each added block is legitimate
- Consist of solving a hard cryptographic puzzle (solving the puzzle consist of generating a block hash that complies with the difficulty target).

Difficulty is a measure of how difficult it is to find a hash below a given target.

Blockchain

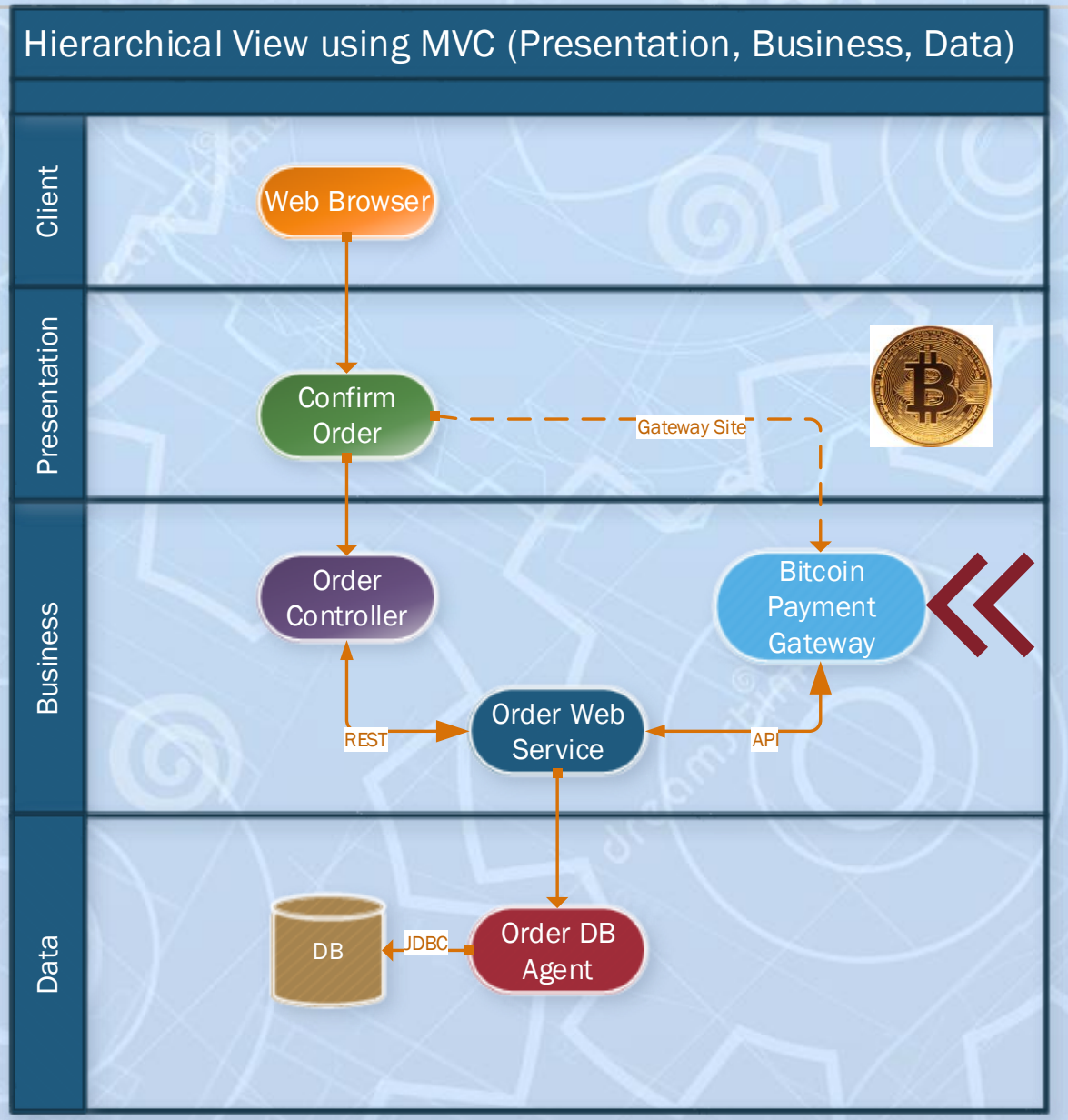
Hardware required and mining pools

Application-Specific integrated circuit (ASIC) machines are used to for efficient mining.

Mining pools uses the resources available by the members upon which these resources are used to solve the block. A share is given to the members upon the amount of work their miners did.

Pulling the plug on bitcoin

Due to the nature of the decentralized system pulling the plug on bitcoin is impossible.



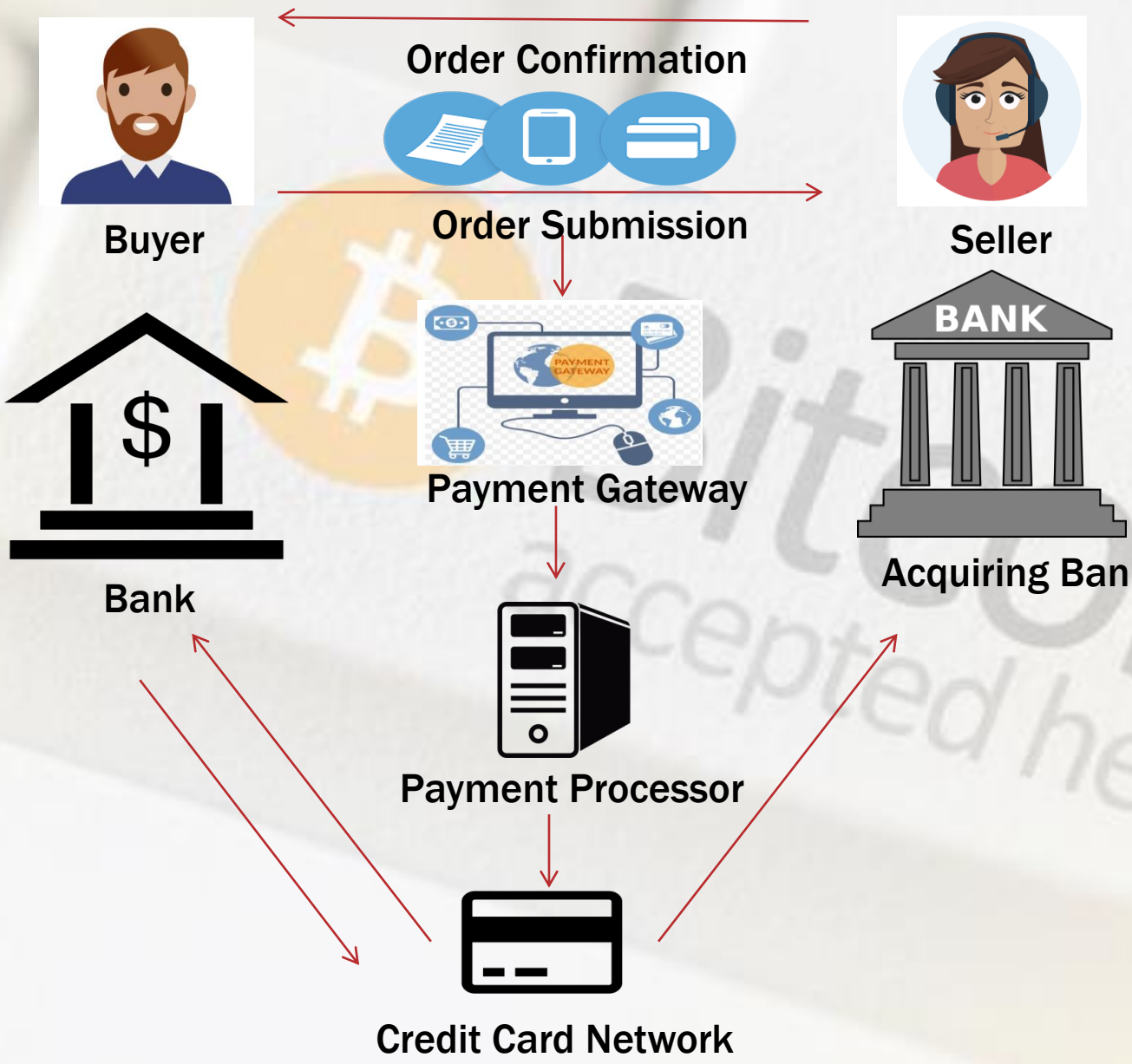
Payment Gateways

Saad Rabiei

Bitcoin Payment Gateways [1][2][3][4][8][14]

- **Bitcoin**
  - Is the digital cash you can transact through the internet. Unlike traditional payments, Bitcoins are sent from one person to another without going through banks or other middlemen. They are controlled only by you.
- **Payment Gateway**
  - Any software or service that facilitates the communication of transaction information
- **Payment Processor**
  - A company appointed by a merchant to handle transactions, offers solutions to merchants to accept bitcoins as payment
  - In some cases the payment processors provide gateways, as well
- **Bitcoin Settlement**
  - The process through which a merchant receives funds for a transaction with a customer
  - Chargeback proof, Once the transaction is verified
  - The transaction is controlled and confirmed by miners
- **Fee Structure**
  - The size of a transaction depends on the number of addresses that the transaction draws funds from and are sent to.
  - Mainly depends on size of the transaction (in Bytes)
  - Fees are collected by miners
  - Bitcoin wallets use dynamic fee structures
  - The fees for processing BTC payments are lower in comparison to those for credit cards

Credit Card Payment Gateways [17]

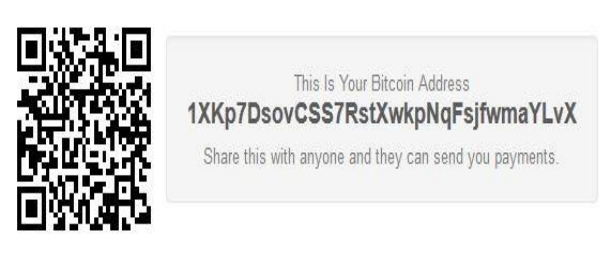


Bitcoin Payment Gateway [1]

Consumer fills Shopping Cart

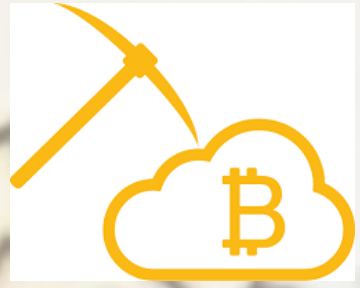
Merchant converts CDN to BTC

Consumer confirms order



Merchant provides a new BTC payment address, which has its own balance

Consumer submits payment



New transaction block

Cryptographic Hashes

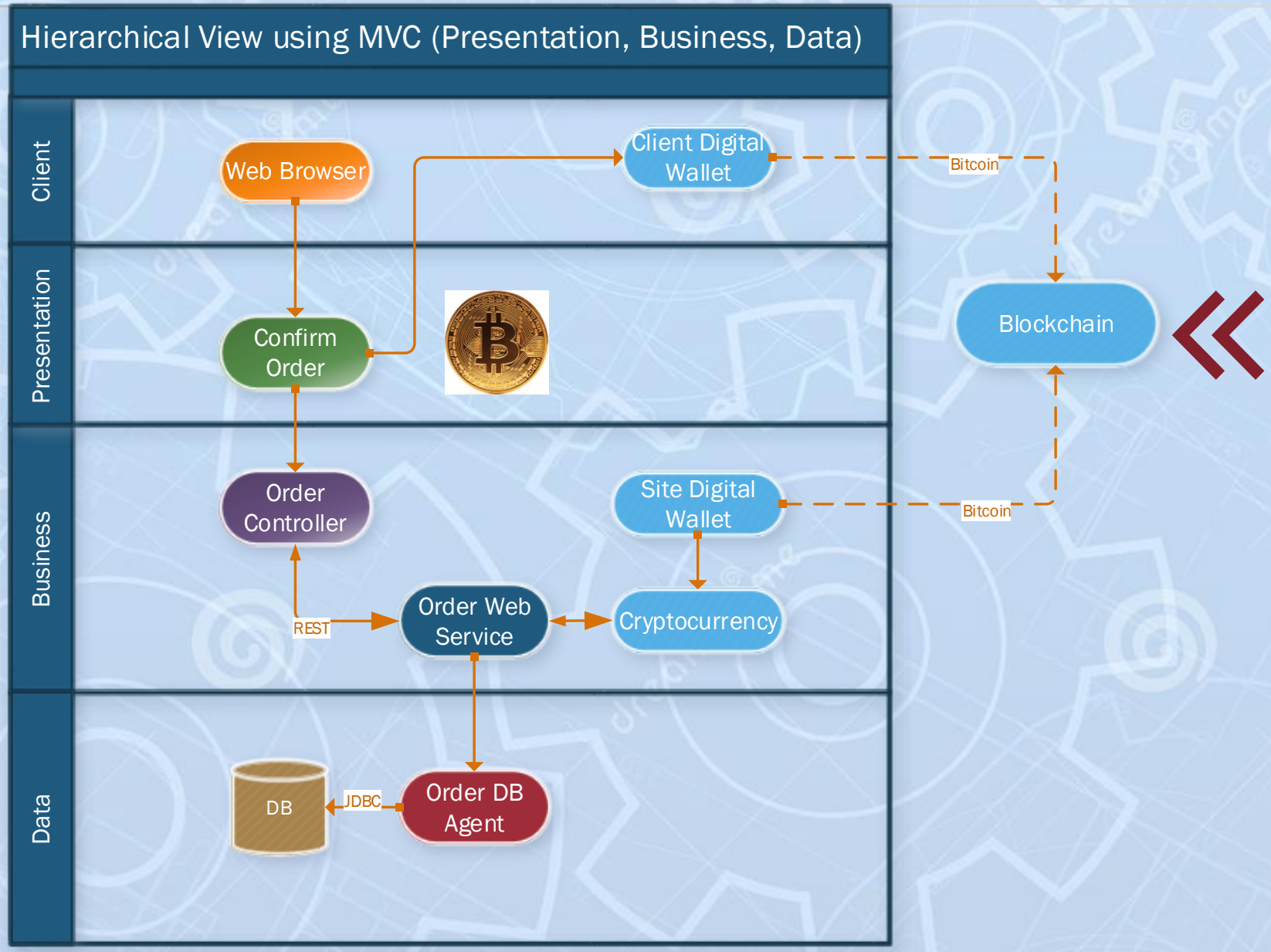
Transaction verified

Integration [1]

- **Commercial Shopping Cart** [2][9]
  - Integration with a payment gateway, for an ecommerce website, it is the easiest and fastest way to get started with Bitcoin
  - Most of the ecommerce platforms have existing integrations to facilitate accepting bitcoin
  - Bitcoin Payment buttons are usually provided and their APIs to create a button.
  - **Note:** Transaction Fees Customer, Country and Currency Support Payout Frequency
- **Roll-Your-Own (DIY)** [9]
  - Since there is no bank behind Bitcoin, it is possible for those with technical background to waive the payment processors fees and integrate payments into the system directly
- **Vendor APIs** [3][10]
  - Vendor APIs allow us to access most of the processors' services through programming interface. API integration lets us easy buy, send and sell bitcoin and other digital currencies.
  - If we want to program backend, we can use API by SOAP or REST web services.
  - Vendor API can be used for "roll your own" or to further customize the shopping cart.
  - For example, bitpay offers an API but it's limited, BlockChain.info has very powerful and cbix.ca offers a very good API for converting prices, without any JSON or webservice

Top Bitcoin Payment Gateways [2][5][6][7]

Payment gateway	Transaction fees	Key features	API	Technology Integrations	cons
BitPay [3]	-No transaction fees for 30 days. Capped at $1,000 daily and $10,000 annually. -1% for transactions going above the cap.	· Two-factor authentication for accounts. · Invoicing supported in 40+ languages . calculated pricing displayed on an invoice in 150 currencies. · Bank payouts in Euro, USD, GBP, and five other currencies. · Supports payment protocol (BIP 70 and BIP 73), which adds an additional level of security. · Hassle-free bitcoin refunds.	Standard-based REST interface	. Open source plugins available for the majority of popular e-commerce solutions. . Compatible with the POS systems and accounting software . Code libraries available for Ruby, Python, C#, Java, Perl, PHP, Go and Elixir . Mobile code libraries for Android SDK, iOS SDK, and Cordova SDK	. Direct bank deposits in some currencies are not supported in every country . Additional transaction fees for businesses in the high-risk industries.
CoinBase [11]	-No transaction fees for keeping the funds in BTC. -1% transaction fee for converting BTC to other account currencies	· Highly customizable checkout experience · Mobile-friendly design · Two-click payments for Coinbase wallet holders · Instant exchange available for payouts · Supports invoicing via email · Supports micro transactions in bitcoins	select among embedded widgets, plugins or built a custom integration with their APIs (i.e. shopping cart plugins)	. Code libraries are available for Ruby, Python, PHP, Node.js, Java . Mobile code libraries are available for Android and iOS SDK	
CoinGate [12][13]	1%	. POS support sales via iOS/Android app · Create bitcoin payment/donation buttons in websites · Receive payouts in EU/US to your bank account	. Multiple integrations and plugins available . API documentation available for Ruby and PHP	. Plugins and extensions available for popular ecommerce solutions	No documentation for Java, .NET, and Python based applications
BlockChain .info [10][15][16]	Depends on the size of transaction	. Empowers users in 140 countries . Tools and data for users to analyze the digital economy	Payments API V2 ,the quickest and easiest way to begin accepting automated bitcoin payments, Consists of just a simple HTTP GET request	. Blockchain Charts & Statistics API . Exchange Rates API . WebSocket API, Real-Time blockchain data . The Wallet API provides a simple interface for merchants to interact with their wallet programmatically.	Because of lacking ready-to-use plugins, the process is not straightforward



Strategic Analysis

Karim Sultan

Strategic Analysis: Market Maturity [4]

Strategic Analysis: SWOT [1] [2]

Strengths

- No Intermediaries (banks, 3rd parties)
- No Fees (XBT <-> XBT)
- Securely decentralized
- The Blockchain

Weaknesses

- Long validation time (10 – 60m)
- Low TPS (6-10)
- Doesn't Scale
- Not Turing Complete

Opportunities

- Defacto Cryptocurrency
- Escrow & Multi-party Transactions
- Micro-Billing / Micro-Transactions
- Basis for cashless society?

Threats

- New Altcoins (ETH, Zcash, etc…)
- Government Regulations
- Price Volatility
- Increasingly Difficult to Obtain XBT

Strategic Analysis: Porter 5-Forces [3]

Threat: New Entrants

- Complex market to enter
- Scarce and critical skillset
- High barriers to entry

Supplier Leverage

- Few suppliers (exchanges)
- High fees
- Deflationary currency

Competitive Rivalry

- Few established competitors
- Banks and Govs pushing regulations
- High customer loyalty

Buyer Leverage

- Extreme price volatility
- Low buyer power

Threat: Substitutions

- Established CC market
- Google and Apple Pay
- Bank products

Strategic Analysis: Future Trends [3] [7]

Volatility

- Price will gradually stabilize
- Units used will no longer be bitcoins, but likely satoshis (1 millionth XBT)

Scaling

- Scaling technologies like “sharding” and “lightning” will improve TPS
- Banks will become nodes and miners, offering XBT loans and mortgages

Regulation

- Canada will strictly regulate XBT access, usage, and taxation
- Global pacts will be setup to stop “off-shoring” and “XBT tax havens”

Payment Gateways

- Easy to use / low fee Payment Gateways will enter ecom site market
- Wider range of altcoins will be accepted

Other

- Smart contracts will become standard (i.e., employment contract; loans; etc…)
- Bhutan will make bitcoin their national currency (☺)

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