ΟΙΚΟΝΟΜΙΚΟ ΠΑΝΕΠΙΣΤΗΜΙΟ ΑΘΗΝΩΝ

ATHENS UNIVERSITY OF ECONOMICS AND BUSINESS

The future of Digital Money
From Bitcoin to Smart Contracts

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Athens University of Economics and Business

Spoiler Alert: Conclusions

- **Lesson 1: The money of the future will be DIGITAL**
  - Not digital counterparts; **natively digital (algorithmic)**
  - Kids born today will probably grow in a world where cash and plastic money will seem odd
  - Maybe even government money will seem odd.

- **Lesson 2: Digital Money will not be passive – it'll be ACTIVE**
  - Money will have code embedded on it (**programmable money**)
  - Code will allow money to determine appropriate action/behavior
  - Money will determine FOR ITSELF when/where to go (move, be invested, etc.)

- **Lesson 3: Programmable money will not be used by humans – it'll be used by MACHINES**
  - Intelligent machines will enter the economic landscape as quasi-independent economic agents
  - **M2M commerce** will prevail
  - Naturally, **social consequences will be vast**

Outline

Money Digitized

From fiat currencies to **Bitcoin**

Technology of native Internet money

From Bitcoin to **blockchains**

Machine-to-machine (M2M) money?

From homo economicus to **machina economica**

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Money as technology: Versions

Money 1.0: Hardware-based money

Gold (until early 20th century)

Currencies, backed by **gold** (until c. 1973)

Fiat currencies, backed by **governments** (now)

Money 2.0: Software-based money

Enter **Bitcoin** (2009)

Enter **Ethereum** (2014)

and many others (alt-coins, colored coins, meta-coins, sidechains, …)

The nature of money

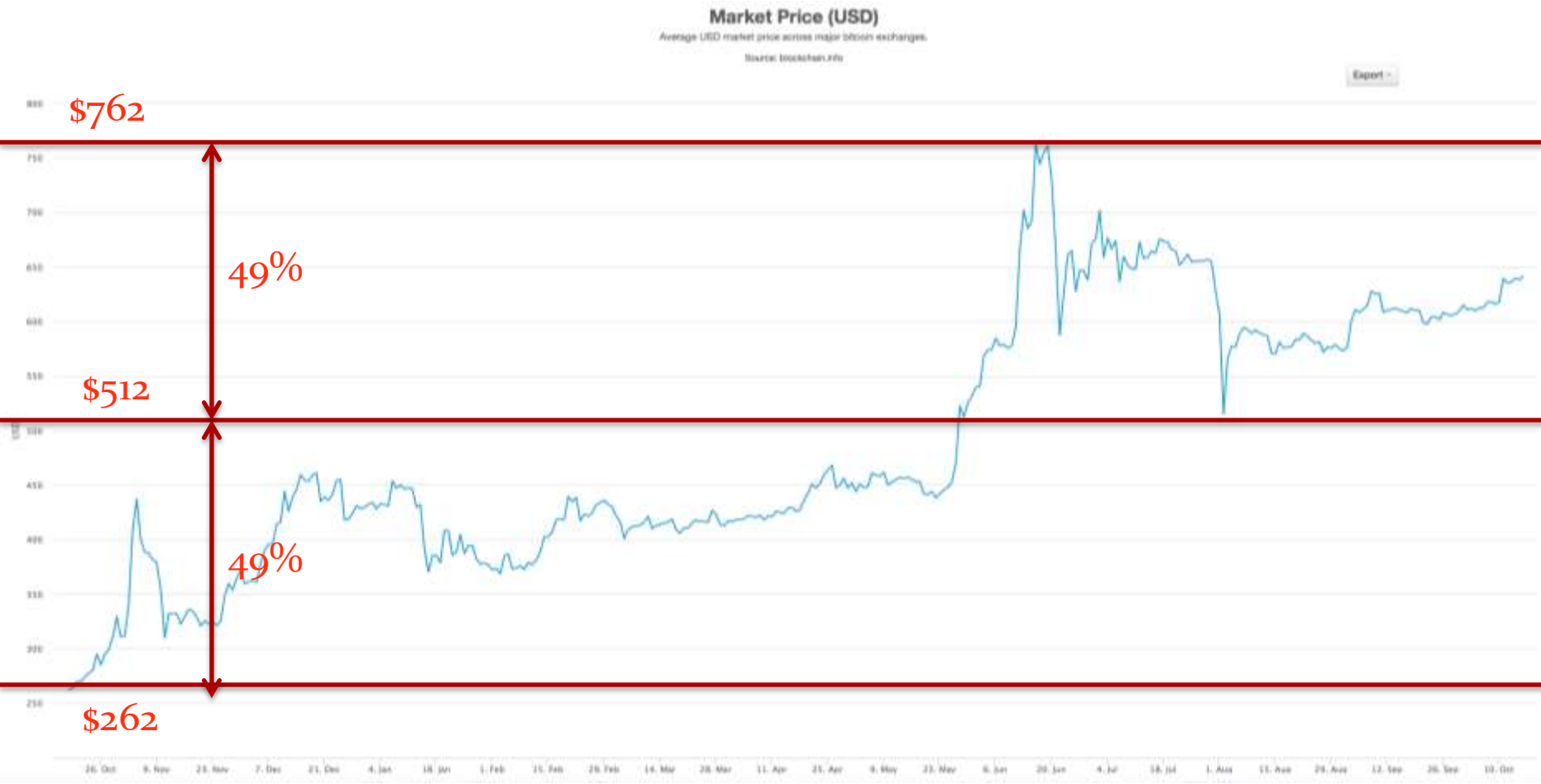
- Think for a while: what is **real** m
  - "*The mo*
    appears
- Money is a h

A first attempt at Money 2.0: Bitcoin

Bitcoin is a <u>private</u>, <u>decentralized</u>, <u>digital</u> <u>cryptocurrency</u>

- **Private**: Not issued by a sovereign
- **Decentralized**: No issuing party; units are issued algorithmically
- **Digital**: Fully electronic; with no underlying peg to assets
- **Cryptocurrency**: Anti-counterfeiting through cryptography

Bitcoin as currency



Bitcoin as a payment network

Still much smaller than competition, but growing fast

Year	VISA		MasterCard		Discover		Western Union		Bitcoin	
	(Vol.)	(Tx.)	(Vol.)	(Tx.)	(Vol.)	(Tx.)	(Vol.)	(Tx.)	(Vol.)	(Tx.)
1Q11	15,153.8	198.3	8,011.0	65.6	746.5	14.7	208.8	0.6	0.04	0.002
2Q11	16,604.4	213.2	8,934.1	72.5	787.0	15.7	226.4	0.62	1.6	0.006
3Q11	17,033.0	217.7	9,285.7	77.1	787.0	15.4	231.9	0.63	0.92	0.008
4Q11	17,450.5	223.6	9,505.5	84.4	761.3	15.1	226.4	0.65	2.1	0.006
1Q12	16,934.1	215.7	9,329.7	84.8	804.3	15.8	214.3	0.62	0.7	0.007
2Q12	17,252.7	218.7	9,780.2	93.8	861.1	17.5	220.9	0.64	1.04	0.021
3Q12	17,582.4	225.3	10,087.9	95.4	860.9	17.6	216.5	0.63	2.47	0.032
4Q12	18,648.4	236.8	10,835.2	101.3	840.1	16.8	219.8	0.64	2.45	0.033
1Q13	18,120.9	227.9	10,406.6	95.1	819.2	16.1	207.7	0.61	8.12	0.052
2Q13	19,109.9	245.6	11,087.9	104.1	856.1	17.0	225.3	0.66	26.2	0.053
3Q13	19,175.8	252.1	11,494.5	109.9	850.5	17.1	231.9	0.69	19.3	0.050
4Q13	20,197.8	259.9	12,142.9	114.0	883.8	17.2	236.3	0.71	108.65	0.061
1Q14	19,011.0	249.9	11,483.5	108.2	850.4	16.5	223.1	0.66	91.01	0.063
2Q14	20,274.7	269.6	12,351.6	116.6	892.2	17.6	239.6	0.70	52.35	0.063
3Q14	20,703.3	275.9	12,714.3	120.5	881.0	17.5	242.9	0.72	51.07	0.068
4Q14	20,879.1	285.4	12,879.1	127.1	912.0	17.7	233.0	0.72	60.1	0.084
1Q15	19,263.74	275.6	11,681.32	121.3	852.32	16.3	214.29	0.68	48.80	0.094

Table: Volume in million USD (Vol.) and millions of transactions (Tx).

Source: P. Tasca, Digital Currencies, ECUREX Research

Bitcoin's monetary features

Bitcoin has a number of interesting monetary features:

- **Fixed Supply**:
  - Money supply is regulated in the protocol
  - **Only 21 million bitcoins will ever exist**.
- **Transparent monetary policy**:
  - Available to everyone to examine and verify
  - The protocol is fully **open source**.
- **Consensus-based**:
  - Key features can't change unless a **majority of participants** in the system agree to change them.

So, is s/w money better than h/w money?

Property	Money 1.0	Money 2.0
Scarcity	✓ (trust in CB/gov)	✓ (fixed supply)

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Verifiability	✓ (third parties)	✓✓ (blockchain)

So, s/w money IS better than h/w money

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Acceptability	✓✓	✗ **(it'll take time)**

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Bitcoin is NOT just currency

Bitcoin is **a collection of technologies**:

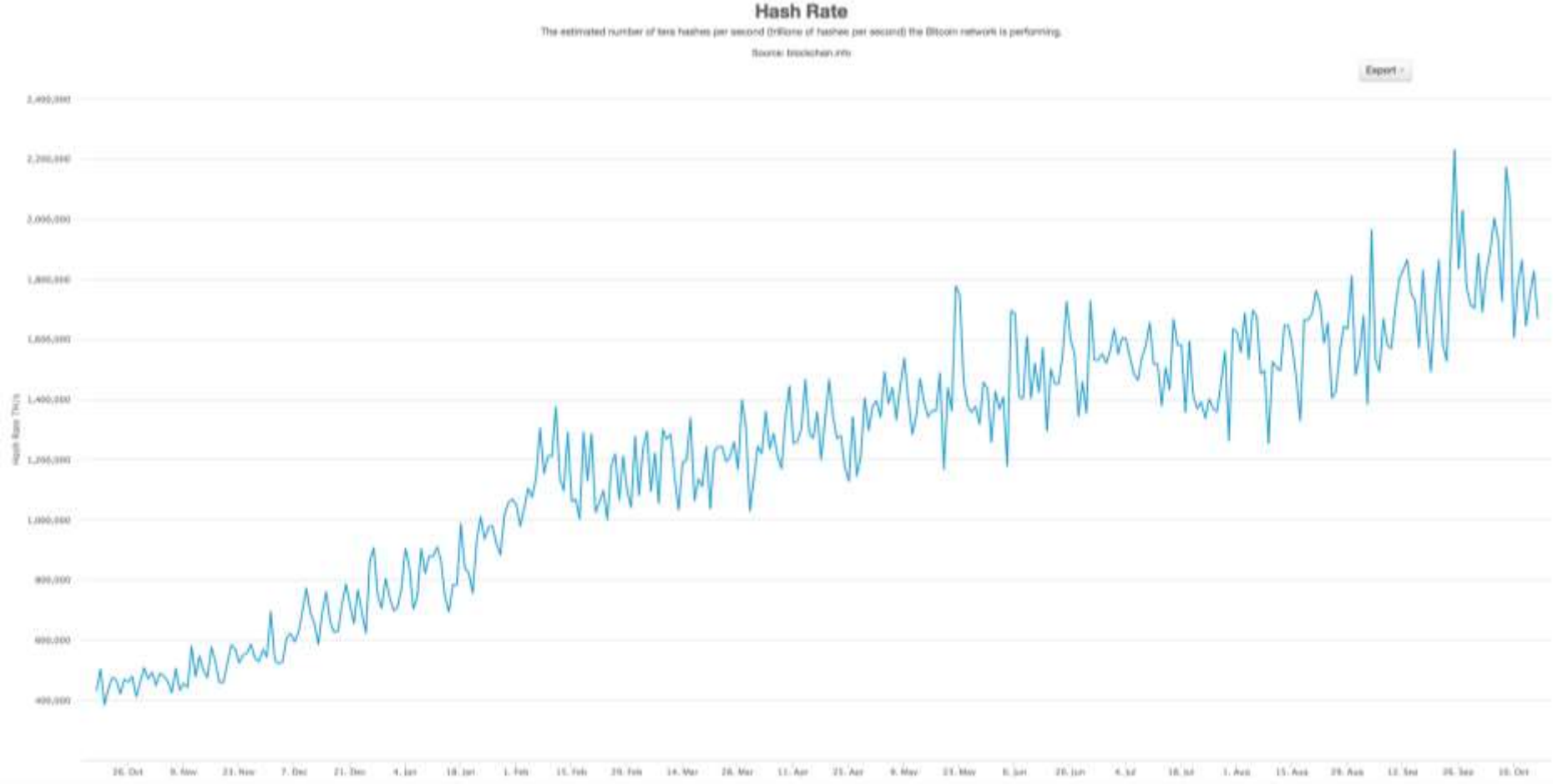
A de-centralized peer-to-peer network (the bitcoin **protocol**)

A de-centralized deterministic
currency issuance and transaction verification
mechanism (**proof-of-work** and **mining**)

A public transaction ledger (the blockchain)

The Blockchain

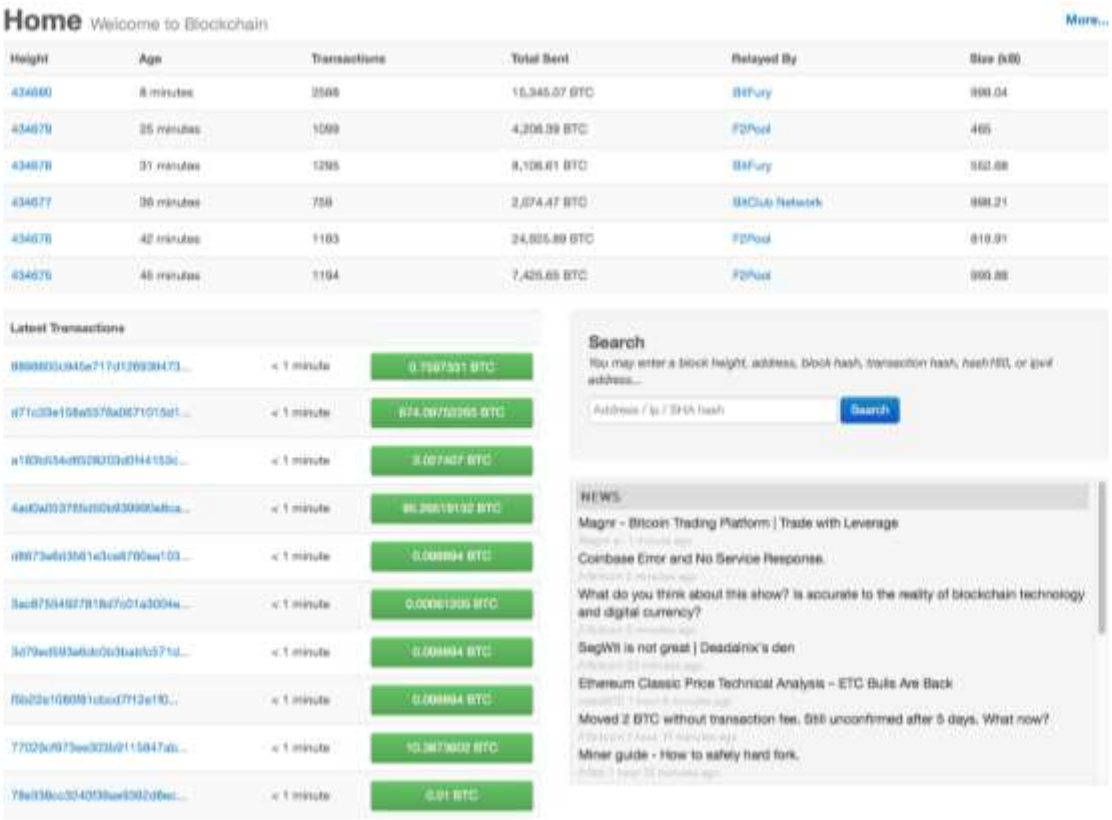
- A publically reviewable ledger, where **every transaction is written in and verified**
  - **Shared by thousands of computers** worldwide
  - Making it impossible for anyone to tamper with its contents



Let me say that again:

The blockchain is a

public record of <u>ALL</u> Bitcoin transactions in history!



Why is this important?

- Think of Bitcoin as **an Internet-wide trust system:**
  - Anyone can buy in or sell out of its ledger
  - Anywhere in the world
  - Without anyone's permission or intervention
  - At virtually no cost
  - **Without needing to know or trust one's counterparty!**

- Practically, this gives us, for the first time, **a way for one Internet user to transfer a unique piece of digital property to another Internet user, such that:**
  - the transfer is **guaranteed** to be safe and secure
  - **everyone knows** that the transfer has taken place
  - **nobody can challenge** the legitimacy of the transfer

The consequences and application implications of this breakthrough are hard to overstate

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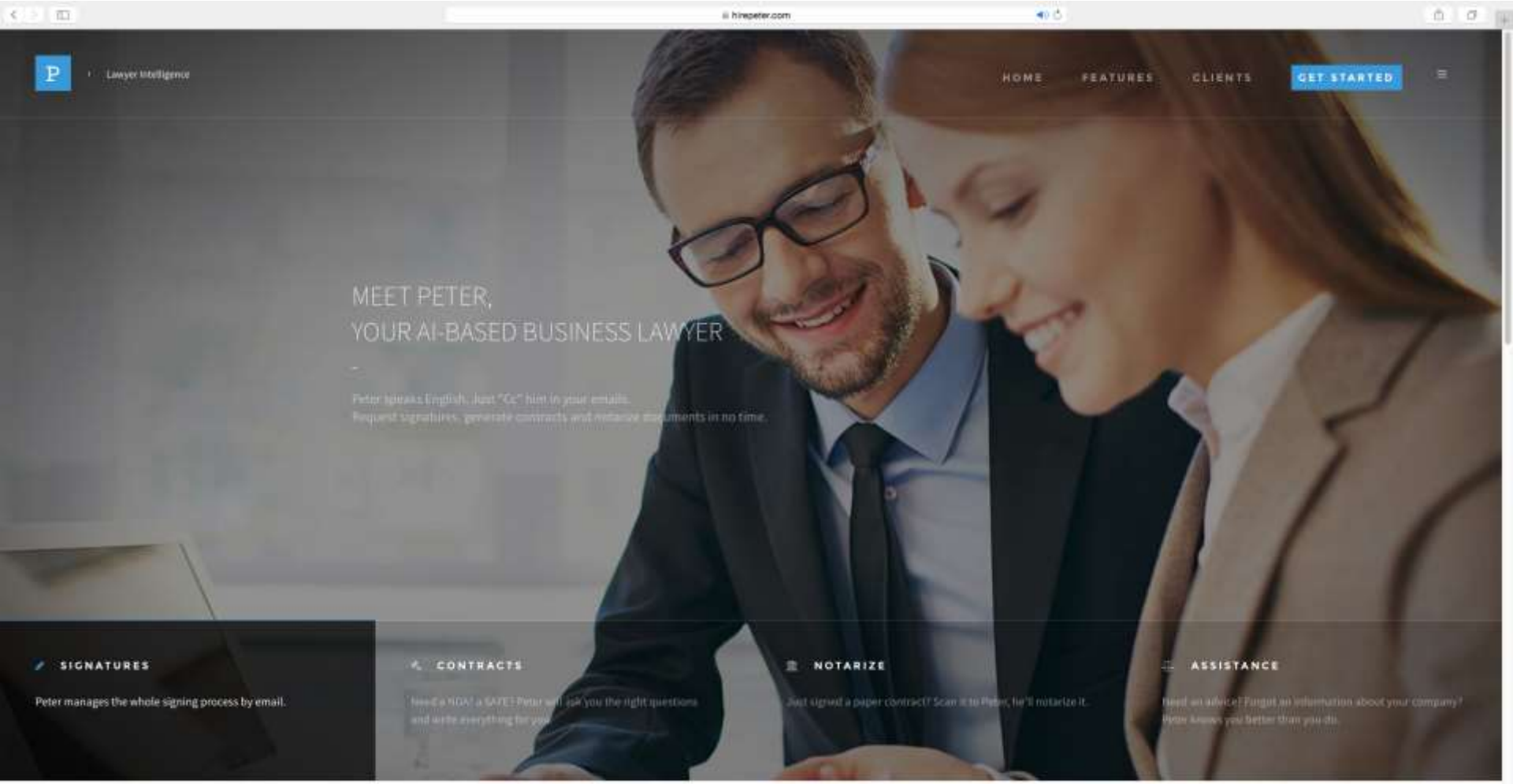
Bitcoin/Blockchain implications

- Bitcoin can be thought of as a **beta version** of real digital money: **Money-over-IP** or **Programmable Money**

- Blockchain will create a new Internet layer: a **trusted Internet**
  - Its implications will be the same as with Internet 1.0: **dis-intermediation & cyber-mediation**
  - **Whole industries will be disrupted – probably, even the society**

- For example, in the future we may see:
  1. Money that can be transacted in really small quantities (**nano-payments**), most likely conducted by machines
  2. Autonomous, AI-based, economic agents (imagine **self-driving cars bidding for your ride**)
  3. Cloud-based, human-less corporations (imagine a **blockchain-based lawyer/notary/bank**)

How far are we?



Naturally, global interest is high

Perhaps to a level of hyperbole

- Remember the dot-com bubble in the late 1990s?)

Which areas will be disrupted?

- Ultimately, all markets that rely on the following mechanisms:
  - **Intermediation**
  - **Clearing and settlement**
  - **Recording and information keeping**
  - Rating, recommendation, voting
  - **Databases**
  - Distributed storage, authentication, anonymization
  - Incentive schemes (rewarding / punishing)
  - **Transaction traceability**
  - **Refereeing, arbitration**
  - **Notarization**

Banking/finance is right in the epicenter!

Banking / Fintech disruption

Ex-Barclays CEO: Banks are about to have an 'Uber moment' – and it's going to be painful

Oscar Williams-Grut
Nov. 26, 2015, 5:30 AM 64,418 20

FACEBOOK LINKEDIN TWITTER EMAIL PRINT

Antony Jenkins, the former CEO of Barclays, has a nightmare vision for the future of big banks.

In a speech in London this week he said: "The incumbents risk becoming merely capital-providing utilities that operate in a highly regulated, less profitable environment, a situation unlikely to be tolerated by shareholders."

"A series of Uber-style disruptions in the industry **could shrink headcount at traditional big banks by as much as 50%, while profitability in some areas could collapse by over 60%**"

The Fintech 2.0 Paper: rebooting financial services

A report by Santander estimates that blockchain technology could reduce banks' infrastructure costs by up to $20 billion a year. Santander is said to have identified "**20 to 25 use cases for the technology**"

Banking / Fintech initiatives

Hands On With Visa Europe's Bitcoin Remittance App

Joon Ian Wong (@joonian) | Published on December 5, 2015 at 09:49 GMT

FEATURE

729 596 62 in 336

Visa Europe's innovation lab was demonstrating its proof-of-concept remittance app, which sends funds over the bitcoin blockchain, at the UnBound London conference on 30th November.

The lab built the prototype with startup Epiphyte as part of a 100-day development project. Visa Europe Collab's Jon Downing and Epiphyte's Edan Yago discussed the reasons for embarking on the project, and for using the bitcoin blockchain instead of a closed network, in this CoinDesk exclusive.

At the conference, held under the Victorian railway arches of London Bridge, Collab's Nigel Clarke, an innovation partner there, gave us a hands-on demo of the money-transfer prototype with an exclusive screen-by-screen walkthrough.

Remittance journey

The "remittance journey" starts on the send screen. This is a responsive web page that works on a desktop or mobile browser. The idea is for a user to link a Visa card to the remittance app. Once linked, the app will

Barclays is experimenting with bitcoin's blockchain

Oscar Williams-Grut

Jun. 23, 2015, 8:57 AM ▲ 1,059

FACEBOOK LINKEDIN TWITTER EMAIL PRINT

Barclays is working with a startup to explore how it could use the technology underpinning bitcoin

Goldman Sachs just put a bunch of money into a Bitcoin startup

Shane Ferro

Apr. 30, 2015, 2:40 PM 288

FACEBOOK LINKEDIN TWITTER EMAIL PRINT

Goldman Sachs is jumping on the Bitcoin bandwagon.

The New York Times reports that Goldman "struck a partnership with a major Chinese investment firm, IDG Capital Partners, to lead a $50 million investment into Circle Internet Financial, a start-up that aims to use the technology underlying Bitcoin to improve

And many others:

- UBS has set up a blockchain lab in Canary Wharf
- Nasdaq is tinkering with the blockchain
- …

Banking / Fintech initiatives

Banks involved include: Bank of America, Barclays, BBVA, BNP Paribas, BNY Mellon, Commonwealth Bank of Australia, CIBC, Citi, Commerzbank, Credit Suisse, Deutsche Bank, Goldman Sachs, HSBC, ING Bank, J.P. Morgan, Macquarie Bank, Mitsubishi UFJ Financial Group, Mizuho Financial Group, Morgan Stanley, National Australia Bank, Nordea, Royal Bank of Canada, Royal Bank of Scotland, SEB, Societe Generale, State Street, Toronto-Dominion Bank, UBS, UniCredit, and Wells Fargo.

Conclusion

- **Blockchains may be the biggest revolution since the invention of the Internet**
  - Blockchains will enable a **trusted Internet**
  - Bitcoin is but one application (like e-mail is for the Internet)

- For the first time in history, we have access to **open, distributed, trusted networks**, verifying and storing financial transactions without requiring any sort of trusted intermediary.

- For the first time in history, we can conceive the notion of **human-less corporations**, which exist only in the cloud.

- Taken together, these developments will unleash a new **Networked Economy**, with profound consequences to the fabric of how societies and economies operate.