Many thanks for the invitation to talk to you today.

Overview of what we will discuss

- Bitcoin and how it works
- Some new developments– stable coins, defi (decentralized finance)
- What lies beyond
Digital currencies
### How Common Are Crypto Currencies Around the World?

Share of respondents who said that they used or owned crypto currencies

<table>
<thead>
<tr>
<th>Country</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turkey</td>
<td>20%</td>
</tr>
<tr>
<td>Brazil</td>
<td>18%</td>
</tr>
<tr>
<td>Colombia</td>
<td>18%</td>
</tr>
<tr>
<td>Argentina</td>
<td>16%</td>
</tr>
<tr>
<td>South Africa</td>
<td>16%</td>
</tr>
<tr>
<td>Mexico</td>
<td>12%</td>
</tr>
<tr>
<td>Chile</td>
<td>11%</td>
</tr>
<tr>
<td>China</td>
<td>11%</td>
</tr>
<tr>
<td>Indonesia</td>
<td>11%</td>
</tr>
<tr>
<td>Spain</td>
<td>10%</td>
</tr>
<tr>
<td>Russia</td>
<td>9%</td>
</tr>
<tr>
<td>Denmark</td>
<td>8%</td>
</tr>
<tr>
<td>Australia</td>
<td>7%</td>
</tr>
<tr>
<td>UK</td>
<td>6%</td>
</tr>
<tr>
<td>U.S.</td>
<td>5%</td>
</tr>
<tr>
<td>France</td>
<td>4%</td>
</tr>
<tr>
<td>Germany</td>
<td>4%</td>
</tr>
<tr>
<td>Japan</td>
<td>3%</td>
</tr>
</tbody>
</table>
What is the Bitcoin blockchain?

A trustless, decentralized digital currency and payment system

- Envisioned in 2008, the “genesis” transaction took place in January 2009
  - There are now 18.674 million Bitcoins in existence

- The blockchain is a distributed ledger that keeps track of every transaction on “nodes”
  - A node is just a computer that has downloaded the bitcoin implementation and a copy of the entire bitcoin blockchain
How it works overview

“Miners” (actually specialized computer hardware and software) create new Bitcoins, validate transactions, and provide security for the blockchain

- Miners gather up pending transactions into a block and race to solve a computational problem (i.e. finding a long string of numbers)

- The first miner to do so is compensated with a fixed number of newly issued Bitcoins called the block reward
  - They also get any fees appended to the transactions

- The block is then appended to the blockchain
How it works:

1. Someone requests a transaction.
2. The requested transaction is broadcast to P2P network consisting of computers, known as nodes.
3. Validation - The network of nodes validates the transaction and the user’s status using known algorithms.
4. A verified transaction can involve cryptocurrency, contracts, records, or other information.
5. The new block is then added to the existing blockchain, in a way that is permanent and unalterable.
6. Once verified, the transaction is combined with other transactions to create a new block of data for the ledger.

Cryptocurrency

Cryptocurrency is a medium of exchange, created and stored electronically in the blockchain, using encryption techniques to control the creation of monetary units and to verify the transfer of funds. Bitcoin is the best known example.

- Has no intrinsic value in that it is not redeemable for another commodity, such as gold.
- Has no physical form and exists only in the network.
- Its supply is not determined by a central bank and the network is completely decentralized.

Source: https://blockgeeks.com/guides/what-is-cryptocurrency/
Some important points

● There will only ever be 21 million Bitcoins issued

● The block reward declines deterministically over time – it is currently 6.25 bitcoins

● Blocks are added on average every 10 minutes
  ▪ The difficulty of the computation problem is adjusted every 2 weeks to achieve this rate
Some more important points

- Blocks can contain anywhere from 0 to 2-ish MB of transactions
- Transactions waiting to be added are in the “mempool”
- Bitcoin is not scalable – approximately 3-ish transactions per second
  - Pay Pal more like 200, Visa more like 1500
- It is not actually decentralized – gigantic mining consortia now control much of the blockchain
An ecological nightmare

- A single bitcoin transaction consumes as much electricity as an average U.S. household consumes in 22.99 days!
  - Every miner is trying to solve the same problem so there is a tremendous waste of resources

- 70% of all digital currencies use a similar “proof of work” approach so the overall problem is much larger

But all this mining has been good for Iceland...
Bitcoin mining

Annualized Total Footprints

<table>
<thead>
<tr>
<th>Carbon Footprint</th>
<th>Electrical Energy</th>
<th>Electronic Waste</th>
</tr>
</thead>
<tbody>
<tr>
<td>36.95 Mt CO₂</td>
<td>77.78 TWh</td>
<td>10.32 kt</td>
</tr>
</tbody>
</table>

Comparable to the carbon footprint of New Zealand.

Comparable to the power consumption of Chile.

Comparable to the e-waste generation of Luxembourg.
Every node has an identical copy of the Bitcoin blockchain.
Mining

Making a hash of it

INPUT
Transaction A
Any length of data

OUTPUT #A
#DFCD 24D9 AEFE 93B9
Unique hash value of fixed length

Each transaction in the set that makes up a block is fed through a program that creates an encrypted code known as the hash value.

Hash values are further combined in a system known as a Merkle Tree.

The result of all this hashing goes into the block’s header, along with a hash of the previous block’s header and a timestamp.

The header then becomes part of a cryptographic puzzle solved by manipulating a number called the nonce.

Once a solution is found the new block is added to the blockchain.
02 RESEARCH

What is this?

Sex, Drugs & Bitcoin: How much illegal activity is financed through Bitcoin?

Sean Foley
A bitcoin payment
...for murder

(According to US FBI allegations)
Bitcoin price Nov. 8, 2021

1 Bitcoin equals

65,863.20 United States Dollar

Nov 8, 7:55 PM UTC - Disclaimer

Data provided by Morningstar for Currency and Coinbase for Cryptocurrency
Today’s price – it’s on sale!

1 Bitcoin equals

59,083.50 United States Dollar

Nov 18, 2:35 PM UTC • Disclaimer

1

Bitcoin

59083.50

United States Dollar

64,976.60 Wed, Nov 10
You should have bought it last year -
Bitcoin price Dec. 6, 2020

1 Bitcoin equals
19,147.30 United States Dollar

Dec 6, 9:14 PM UTC · Disclaimer

1
19147.30

Data provided by Morningstar for Currency and Coinbase for Cryptocurrency
Or even better –
Bitcoin price Nov. 15, 2016

$707.03 0.64%

BITCOIN PRICE INDEX CHART

Closing Price

Exchanges
- CoinDesk BPI
- Bitstamp
- Bitfinex
- Coinbase
- ItBit
- OKCoin

1h 12h 1d 1w 1m 3m 1y All

Nov 7, 2016 to Nov 14, 2016

www.coindesk.com
Enter Ethereum - 2015

Benefits of Decentralized networks

With no central point of failure and secured using cryptography, applications are well protected against hacking attacks and fraudulent activities.

Advantages:
- Immutability
- Corruption & tamper
- Secure

The Blockchain

Blockchain technology is like the internet in that it has a built-in robustness. By storing blocks of information that are identical across its network, the blockchain cannot:

The Ethereum makes the process of creating blockchain applications much easier and efficient than ever before. Instead of having to build an entirely original blockchain for each new application, Ethereum enables the development of potentially thousands of different applications all on one platform.
## Top digital currencies – Nov. 2021

<table>
<thead>
<tr>
<th>#</th>
<th>Name</th>
<th>Price</th>
<th>24h %</th>
<th>7d %</th>
<th>Market Cap</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><strong>Bitcoin BTC</strong></td>
<td><strong>$65,874.67</strong></td>
<td>-5.69%</td>
<td>-7.20%</td>
<td><strong>$1,243,213,347,244</strong></td>
</tr>
<tr>
<td>2</td>
<td><strong>Ethereum ETH</strong></td>
<td><strong>$4,755.23</strong></td>
<td>-3.19%</td>
<td>-8.94%</td>
<td><strong>$562,410,584,391</strong></td>
</tr>
<tr>
<td>3</td>
<td><strong>Binance Coin</strong></td>
<td><strong>$645.53</strong></td>
<td>-1.68%</td>
<td>-17.96%</td>
<td><strong>$107,695,489,532</strong></td>
</tr>
<tr>
<td>4</td>
<td><strong>Solana SOL</strong></td>
<td><strong>$246.62</strong></td>
<td>-0.43%</td>
<td>-20.77%</td>
<td><strong>$74,549,538,708</strong></td>
</tr>
<tr>
<td>5</td>
<td><strong>Tether USDT</strong></td>
<td><strong>$1.00</strong></td>
<td>-0.05%</td>
<td>-0.04%</td>
<td><strong>$72,567,069,825</strong></td>
</tr>
<tr>
<td>6</td>
<td><strong>Cardano ADA</strong></td>
<td><strong>$2.10</strong></td>
<td>-4.24%</td>
<td>-7.30%</td>
<td><strong>$69,716,350,685</strong></td>
</tr>
<tr>
<td>7</td>
<td><strong>XRP XRP</strong></td>
<td><strong>$1.25</strong></td>
<td>-2.45%</td>
<td>-14.47%</td>
<td><strong>$59,023,828,106</strong></td>
</tr>
</tbody>
</table>

*Stable coin*
There are lots of digital currencies!!!!

<table>
<thead>
<tr>
<th>#</th>
<th>Name</th>
<th>Price</th>
<th>24h %</th>
<th>7d %</th>
<th>Market Cap</th>
<th>Volume(24h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7136</td>
<td>Treat TREAT</td>
<td>$108.05</td>
<td>-6.56%</td>
<td>-80.09%</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>7137</td>
<td>Riverboat RIB</td>
<td>$1,973.72</td>
<td>-5.67%</td>
<td>-0.65%</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>7138</td>
<td>Kollector KLTR</td>
<td>$0.2936</td>
<td>-22.67%</td>
<td>-22.67%</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>7139</td>
<td>Premio PREMIO</td>
<td>$0.02782</td>
<td>-5.60%</td>
<td>-5.60%</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>7140</td>
<td>Baby Ryukyu Inu BRKI</td>
<td>$0</td>
<td>--</td>
<td>-0.00%</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>7141</td>
<td>Mobius Money MOBI</td>
<td>$0.1072</td>
<td>-0.26%</td>
<td>-0.26%</td>
<td>--</td>
<td>--</td>
</tr>
</tbody>
</table>
What do you do with these?

- In principle you can buy things but this use is very limited
  - You can pay your taxes in El Salvador with bitcoin
  - You can pay for ransomware to unlock your computer
- They can be a store of value – an alternative investment class?
- Can be used as tokens underlying “smart contracts” – the new world of “decentralized finance” or defi.
Transaction fees

Average transaction fees in USD per transaction.

USD

Blockchain.com
2021
April
July
October

Date
Ransomware

● One use of bitcoin that is booming....

● May 2018 – City of Atlanta computers held hostage for 6 days. Demand – 6 bitcoins, or about $51,000. Didn’t pay but it cost Atlanta >$18 million to restore services.


● October 2019 – City of Johannesburg held up for ransomware. Hackers wanted 4 bitcoins (30,000). The city refused to pay.
● A huge issue during the Covid crisis is ransomware attacks on school systems
  - In 2021 so far there have been 58 attacks on school districts
  - Hospitals even more vulnerable – over 600 hospitals and clinics affected in 2020

● WSJ cites average ransomware payments across all industries were $233,817 in 3q 2020, up from $41,198 in 2019

● Total cost in 2020 - $350 million. Average ransom over 300,000. Average remediation cost $1.85 million
And people are paying....

- Colonial Pipeline – April – paid $4.4 million in bitcoins
- Brenntag – May- chemical distribution – paid $4.4 million
- JBS Foods – May – meatpacker - $11 million
Helpful instructions

1. You should register Bitcoin wallet (click here for more information with pictures)

2. Purchasing Bitcoins - Although it's not yet easy to buy bitcoins, it's getting simpler every day.

   Here are our recommendations:
   - LocalBitcoins.com (WU) - Buy Bitcoins with Western Union
   - Coincafe.com - Recommended for fast, simple service. Payment Methods: Western Union, Bank of America, Cash by FedEx, Moneygram, Money Order. In NYC: Bitcoin ATM, In Person
   - LocalBitcoins.com - Service allows you to search for people in your community willing to sell bitcoins to you directly.
   - bitcointoel - THE BEST FOR EUROPE
   - coinre.com - Another fast way to buy bitcoins
   - bitquick.co - Buy Bitcoins Instantly for Cash
   - How To Buy Bitcoins - An international directory of bitcoin exchanges.
   - Cash Into Coins - Bitcoin for cash.
   - CoinJar - CoinJar allows direct bitcoin purchases on their site.
   - anxpro.com
   - bitlicious.com
   - ZipZap - ZipZap is a global cash payment network enabling consumers to pay for digital currency.

3. Send 1.79 BTC to Bitcoin address: 

4. Enter the Transaction ID and select amount:

   Note: Transaction ID - you can find in detailed info about transaction you made.
   (example: 44214efca5ef039386dddb929c40bf34f19a27c4207f5cf3e2aa08114c4d1f2)

5. Please check the payment information and click "PAY".
A new entrant - Stablecoins

- A type of cryptocurrency that is backed up by either fiat currency (i.e. the dollar) or another cryptocurrency (Ethereum)
Chart 1: Top Stablecoins by Market Capitalization (in billions)

- USDT (Tether)
- BUSD (Binance USD)
- TUSD (TrueUSD)
- USDC (USD Coin)
- DAI (Dai Stablecoin)
- Others, including USDP (Pax Dollar) and GUSD (Gemini Dollar)

Source: Coin Metrics, The Block
Updated: October 21, 2021
What do you do with these?

- Mostly used to facilitate trading, lending and borrowing of other digital currencies

- Could they be used for retail payments? Maybe
  - Diem – Facebook’s proposed cryptocurrency

- Problems
  - What backs up these currencies?
  - Could they trigger financial stability?
  - Are they used for money laundering, other illicit purposes?
# Aave – borrowing and lending

<table>
<thead>
<tr>
<th>Assets</th>
<th>Market size</th>
<th>Total borrowed</th>
<th>Deposit APY</th>
<th>Variable Borrow APY</th>
</tr>
</thead>
<tbody>
<tr>
<td>DAI</td>
<td>$1.99B</td>
<td>$1.56B</td>
<td>2.85%</td>
<td>4.00%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1.03% APR</td>
<td>1.32% APR</td>
</tr>
<tr>
<td>Gemini Dollar</td>
<td>$19.64M</td>
<td>$15.98M</td>
<td>8.27%</td>
<td>11.46%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1.30% APR</td>
<td>1.60% APR</td>
</tr>
<tr>
<td>sUSD</td>
<td>$78.02M</td>
<td>$57.95M</td>
<td>2.23%</td>
<td>3.78%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1.74% APR</td>
<td>2.34% APR</td>
</tr>
<tr>
<td>TrueUSD</td>
<td>$167.92M</td>
<td>$118.32M</td>
<td>2.42%</td>
<td>3.59%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.40% APR</td>
<td>0.59% APR</td>
</tr>
<tr>
<td>USD Coin</td>
<td>$3.39B</td>
<td>$3.01B</td>
<td>3.37%</td>
<td>4.03%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1.21% APR</td>
<td>1.39% APR</td>
</tr>
</tbody>
</table>
What backs up a tether?

Tether reserves

- Cash & Cash Equivalents & Other Short-Term Deposits & Commercial Paper (75.85%)
- Secured Loans (none to affiliated entities) (12.55%)
- Corporate Bonds, Funds & Precious Metals (9.96%)
- Other Investments (including digital tokens) (1.64%)
Is there a problem here??

• There are over $72 billion tethers outstanding
  ▪ It is owned by Bitfinex (a crypo-exchange) and operates out of the British Virgin Islands
  ▪ It has been fined by the NY Attorney General and the CFTC for misleading claims about what backs up tethers
  ▪ Not regulated by anyone

• Can this cause financial instability?
  ▪ Federal Reserve - This is just a prime money market – and it could lead to runs and fire sales if it had to liquidate
Promising uses of the blockchain

- Digital currencies
- Provenance tracking
- Clearing and Settlement
- Prediction markets
- Corporate document registry
- Supply chain management
- Decentralized decision-making
The internet of value?

- The bitcoin blockchain was the first step in the new virtual economy

- What lies beyond? Some argue that it will be the internet of value, with blockchains allowing the development of new payment systems, supply chains and the like.

- Also on the horizon – central bank digital currencies? Already a reality in the Bahamas – the Sand Dollar

Stay tuned
Want more information?

[Book Cover: American Kingpin]

[Book Cover: DeFi and the Future of Finance]