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What is a DApp?

Week 4
Lesson 2

Agenda

- Traditional vs Decentralised Apps
- Examples
- App Development
  - Planning
  - Testing
  - Recommended software to install locally
- Homework

Traditional Applications

- Centralised databases
  - Trusted
  - Hacks and server downtimes
- Not anonymous
- Easy to use
- Advanced tools

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Fundamental DApp Architecture

- Blockchain-based application
  - Front end plus smart contract allowing human interaction
  - API accessed by a program with a smart contract to perform the calculations/storage
  - Query routing doesn’t have to be decentralised - often is not
- Smart contract - program running on a blockchain
- API - Application Programming Interface
  - Weather
  - Movie
  - ‘GET’ examples to try out:
    - `curl https://jsonplaceholder.typicode.com/posts`
    - `curl https://jsonplaceholder.typicode.com/posts?userId=1`

Popular DApps

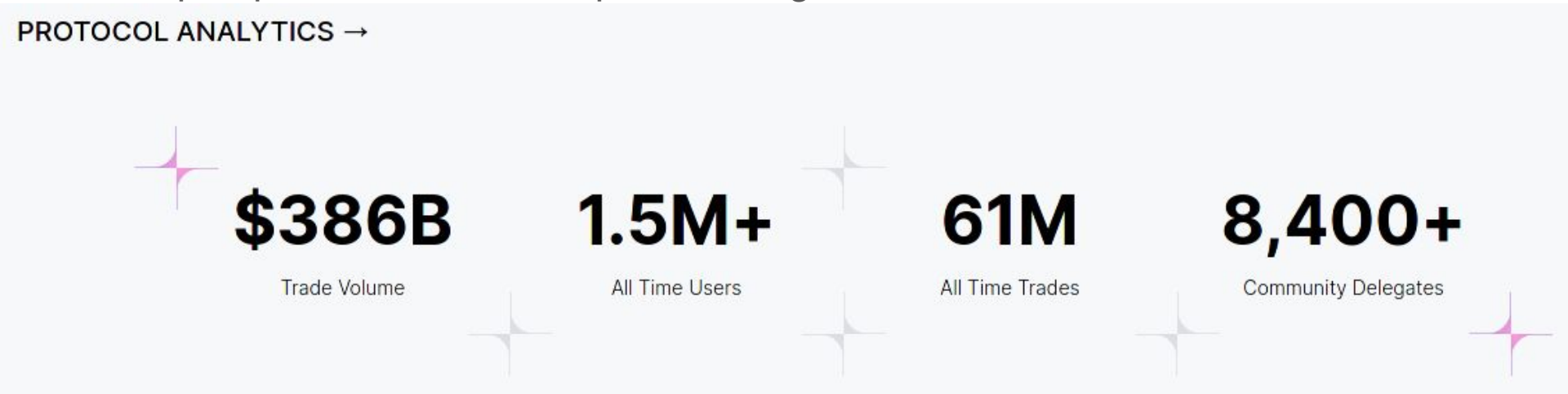
1	Uniswap V3	DeFi	ETH	$3.57B	203.67k -4.29%	$51.16B	
2	Uniswap	Exchanges	ETH	$10.19B	313.52k -9.25%	$46.74B	
3	Fei Protocol	DeFi	ETH	$236.42M	1.52k +35.15%	$25.04B	
4	SushiSwap	Exchanges	ETH	$4.38B	76.91k +39.12%	$14.58B	
5	Compound	DeFi	ETH	$7.51B	3.98k -27.78%	$12.34B	
6	Curve	DeFi	ETH	$8.94B	7.17k -8.31%	$11.69B	
7	dYdX	DeFi	ETH	$427.15M	15.65k +21.60%	$9.09B	

https://dappradar.com/rankings/protocol/ethereum

UniSwap V3 = Concentrated Liquidity, Active Liquidity, Range Orders, Non-Fungible Liquidity, Flexible Fees, Advanced Oracles, License https://uniswap.org/blog/uniswap-v3/

Finance - DeFi: UniSwap

- Decentralised crypto trading protocol
- Exchange and liquidity pool
- Governed by UNI token holders
- Open protocols for developers to integrate

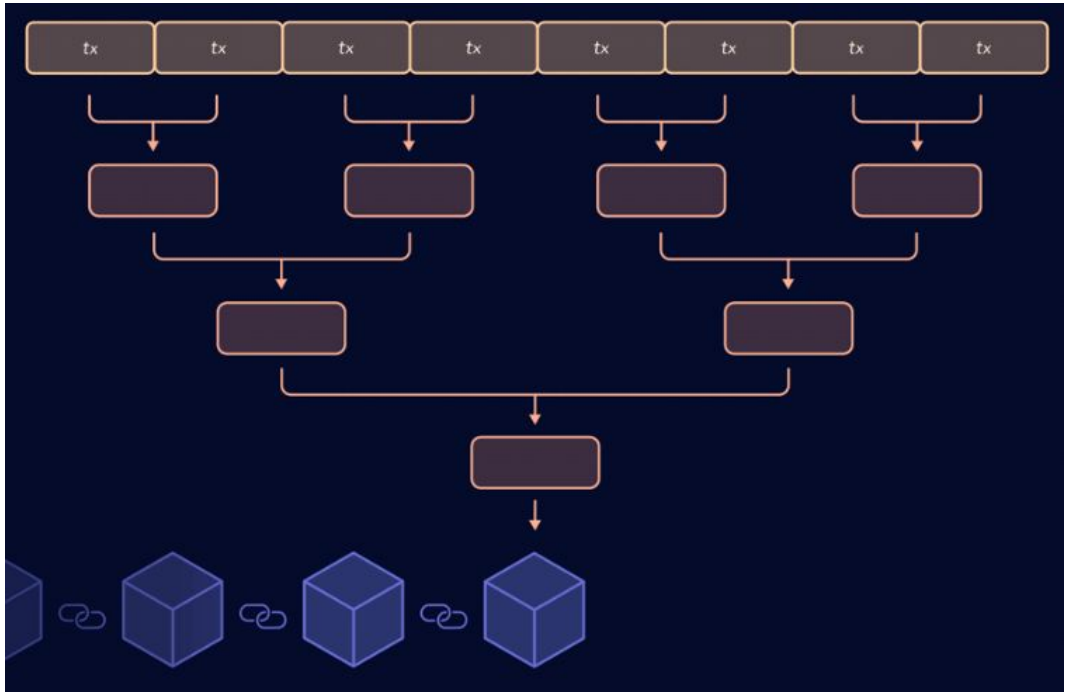


Finance - DeFi: AAVE

- Liquidity/staking pool
- Depositors provide liquidity to the market to earn a passive income
- Borrowers are able to borrow in an overcollateralised (perpetually) or undercollateralised (one-block liquidity) fashion

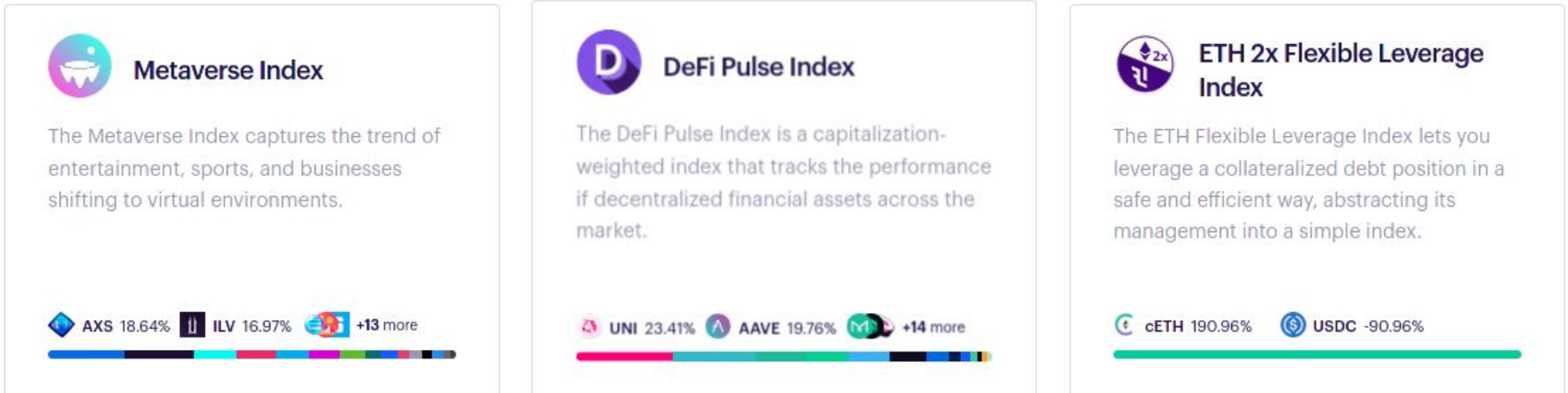
Finance - DeFi: IDEX

- Cryptocurrency exchange
- Promises solutions to failed trades, slippage and front-running
- V2 will operate with lower fees by using rollups on layer 2



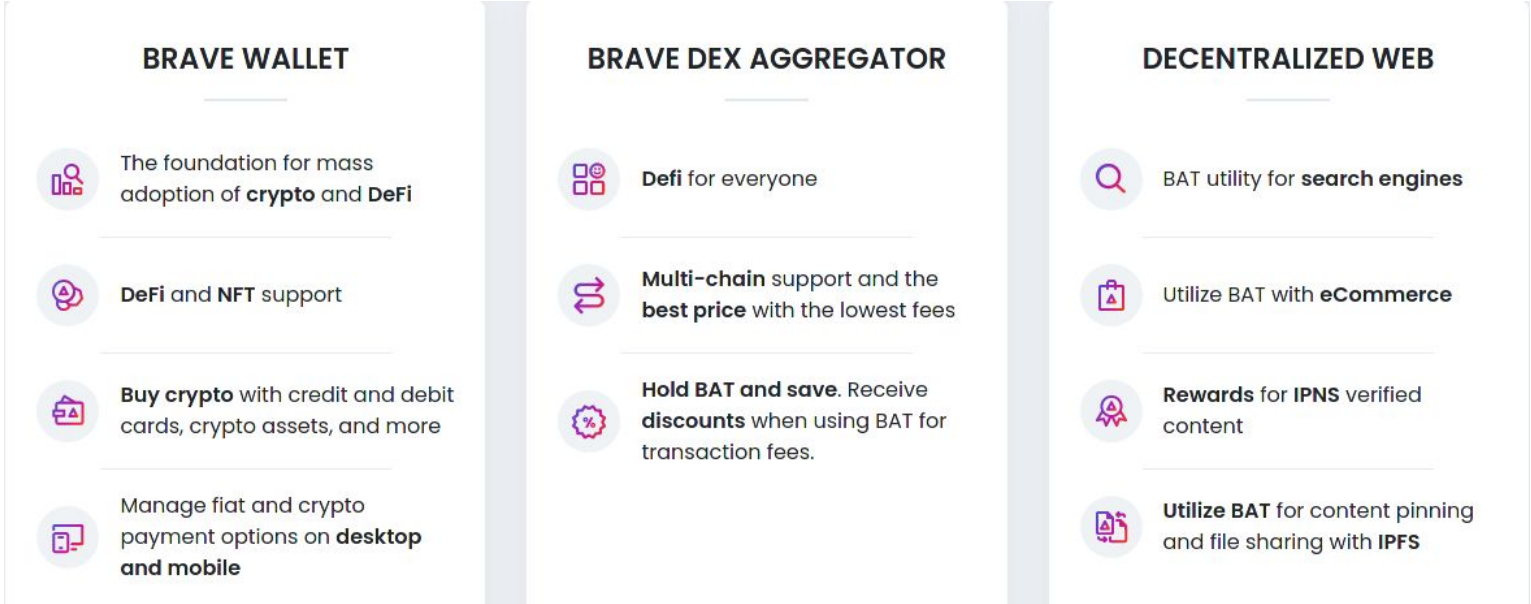
Finance - Asset management: TokenSets

- Ethereum and Polygon used for storing assets
- Yield farming
  - Generate yield by depositing assets into yield generating positions.
- Multi asset support
- Flexible trade execution



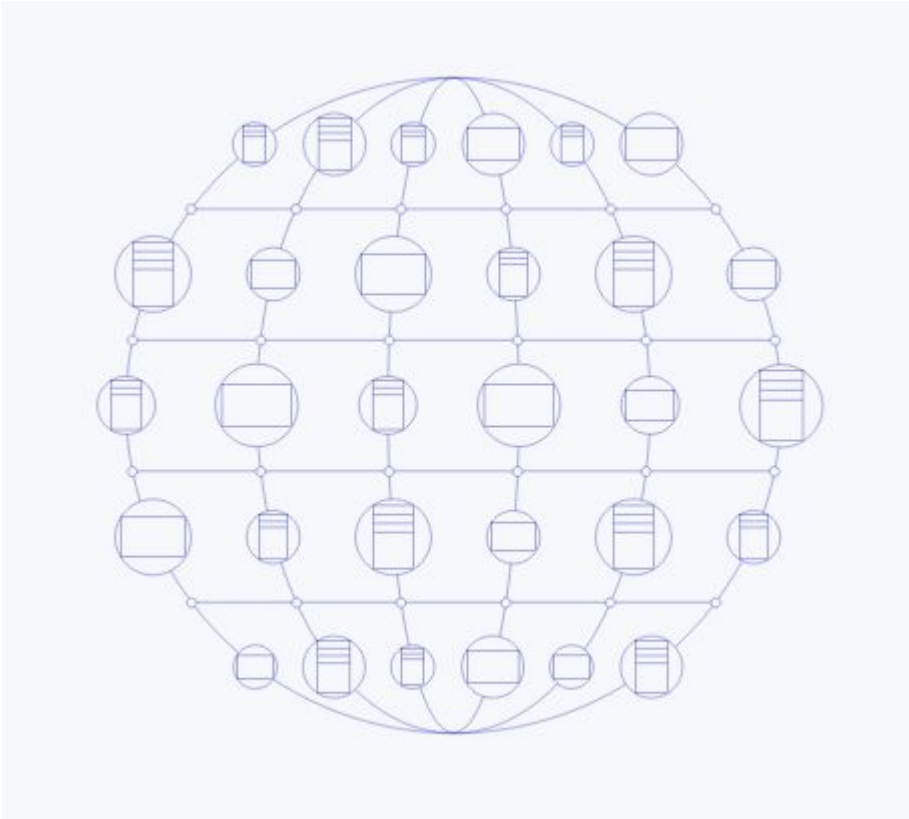
Finance - Reward schemes: BAT

- Basic Attention Token
- Reward ad views with a token
- Seamlessly integrated into Brave browser crypto wallet



IT / Software: Golem

- Share unused computing power
- Unrestricted, proxy-free network
- Programmable platform to allow development
- Rewards in GLM token
- Network settlement built on Ethereum Layer 2 for cheaper transactions



IT / Software: Unstoppable Domains

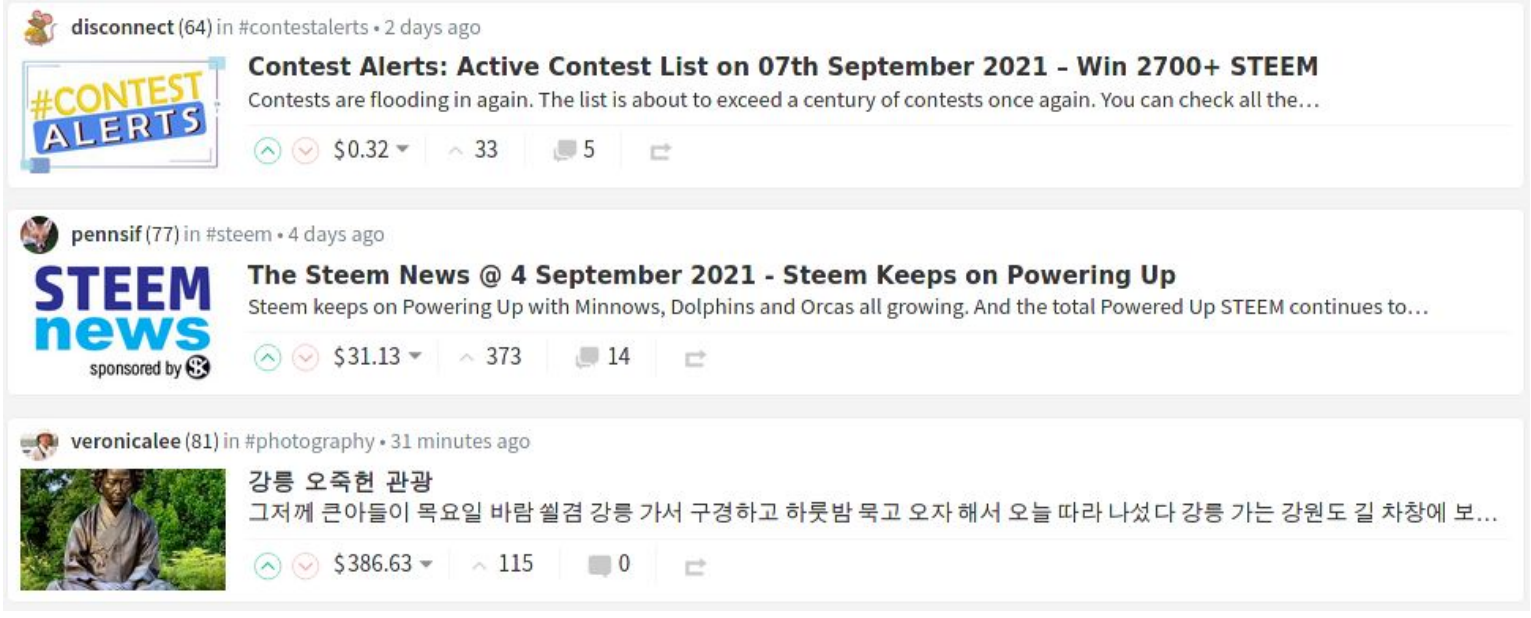
- Blockchain domains
- Buy-once, forever owned
- Multi-use:
  - Universal username across apps and websites
  - Website URL
  - Payment address for wallets
- Domains included:
  - .zil
  - .crypto
  - .coin
  - .wallet
  - .bitcoin
  - .x
  - .888
  - .nft
  - .dao
  - .blockchain*

Data Visualisation: The Graph

- Indexes protocols like Ethereum and IPFS to provide datasets for analysis and visualisation
-

Social media: Steemit

- Blogging site
- STEEM token earned by posting, commenting or upvoting
- STEEM can be staked to influence the platform



Social media: Minds

- ‘Anti-Facebook’ where you get paid for your time
- Get paid for creating content, driving traffic and referring friends
- Receive direct payments in USD, Bitcoin and Ether

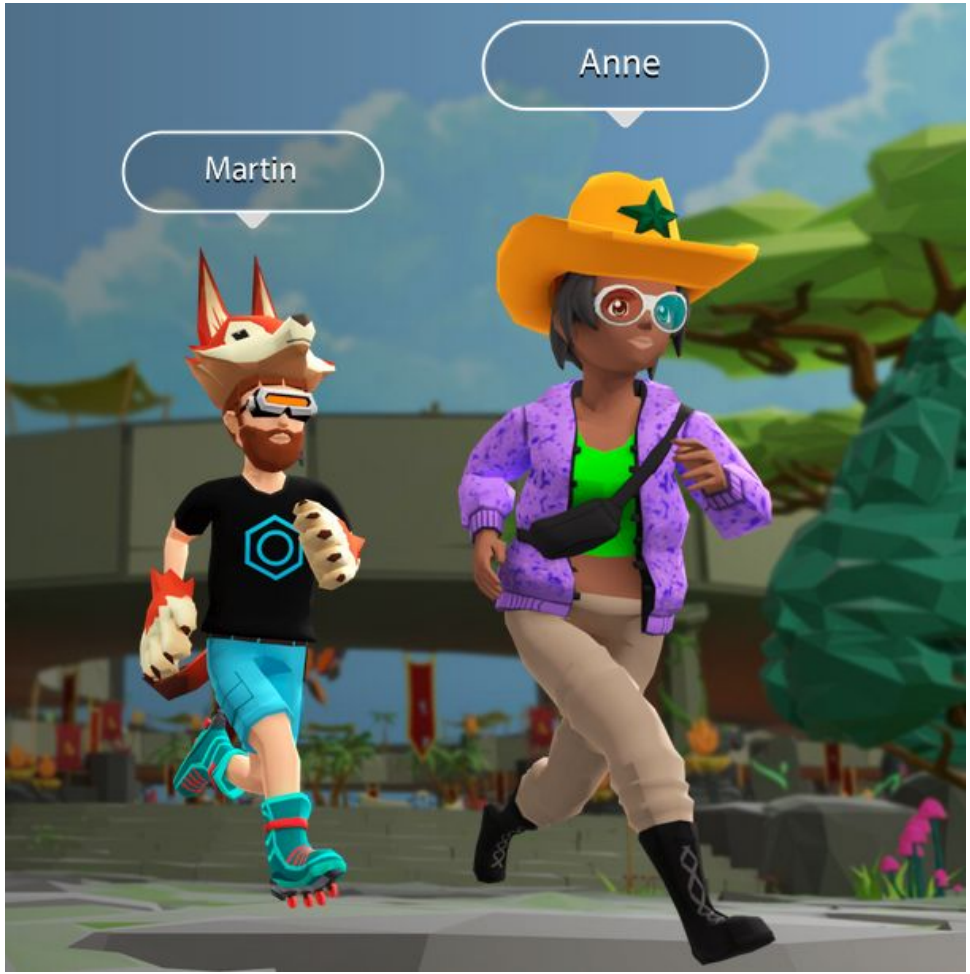
Take back control of your social media

Gaming: Dark Forest

- zkSNARK space warfare
- Initially released on Ethereum
- Pun on the Dark Forest (mempool)

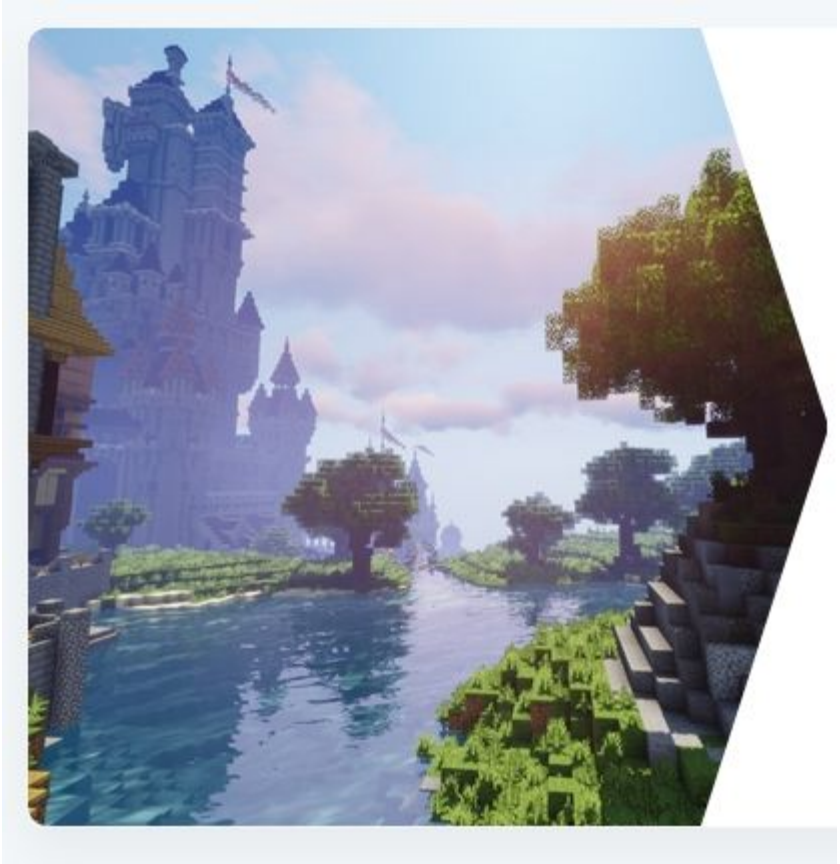
Gaming: Decentraland

- Virtual world
- Buy and sell virtual assets
- Host events



Gaming: EnjinCraft

- Minecraft blockchain plugin
- Allows linking assets on blockchain to players and vice-versa
  - Wallet balances
  - Tokens / items
- Open source
- Allows developers to develop on top of platform



Gaming: Rabona Soccer Manager

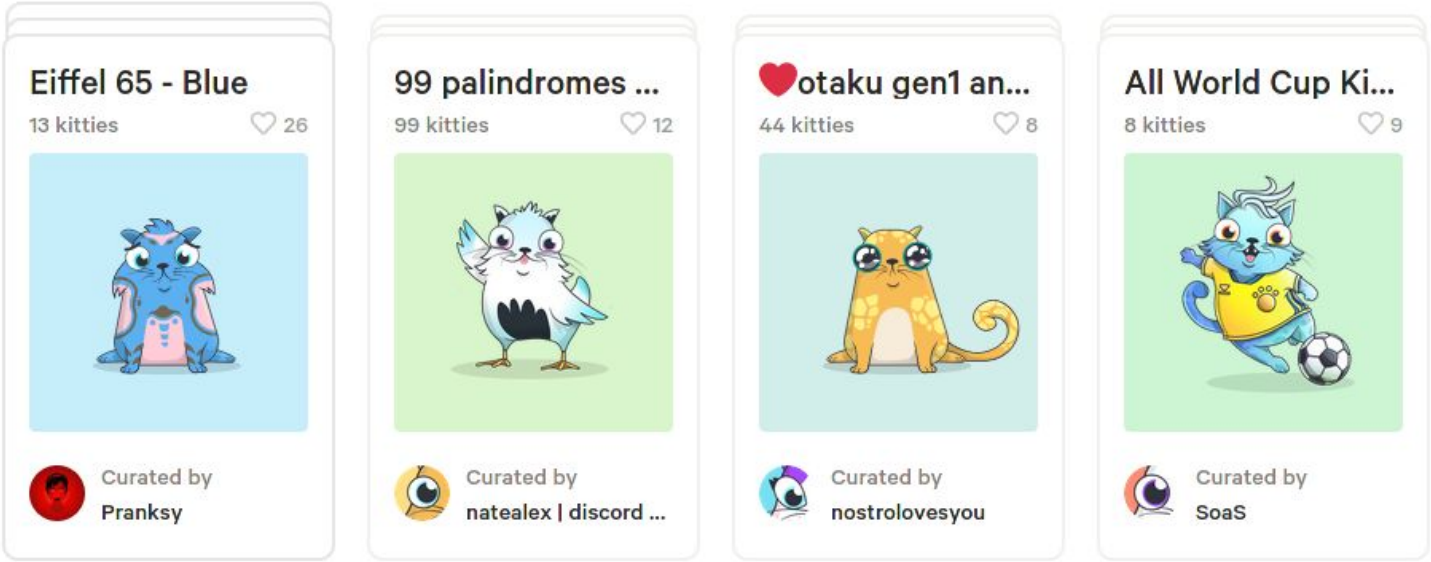
RABONA

SOCCER MANAGER

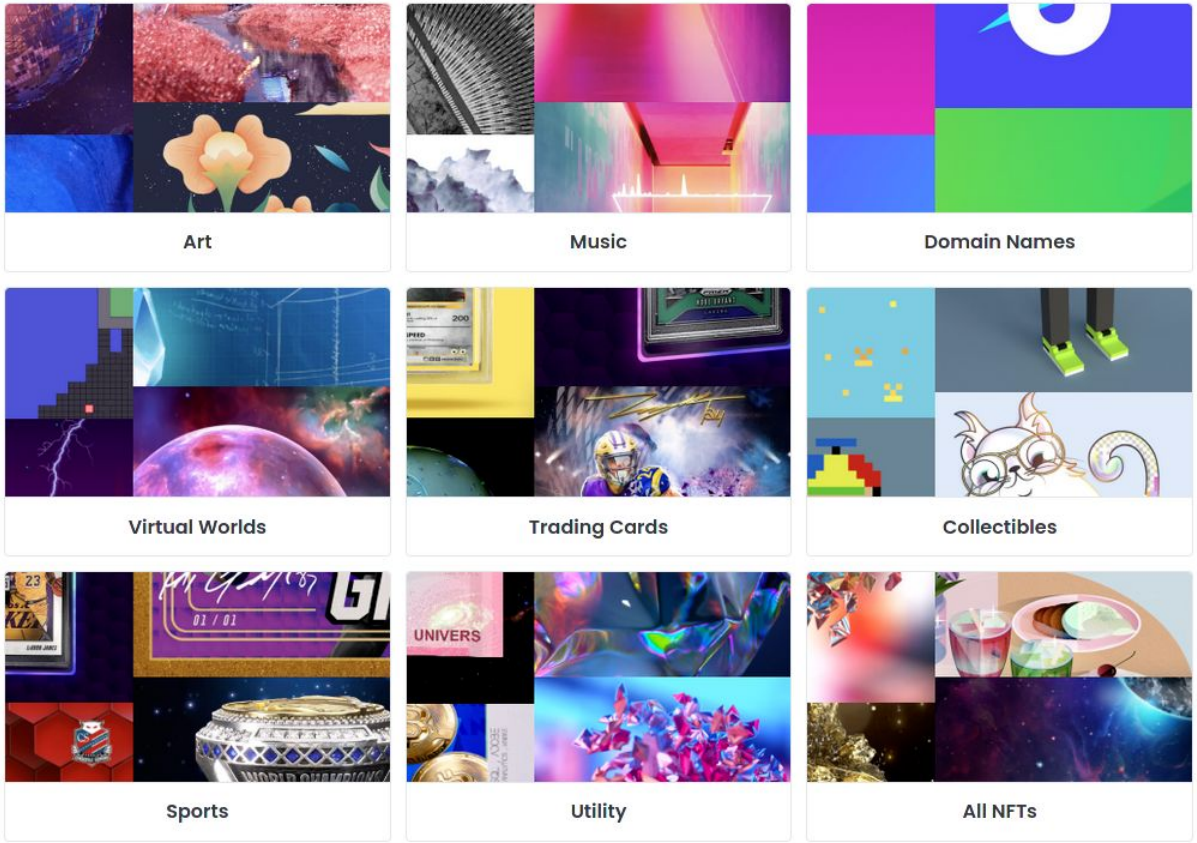
Manage your soccer club
Scout, train, and trade players
Build and expand your stadium
Become the champion

Gaming: CryptoKitties

- Collect cat NFT’s
- Allows breeding of cat items, mixing features
- One of the first/most famous examples of gaming on a blockchain

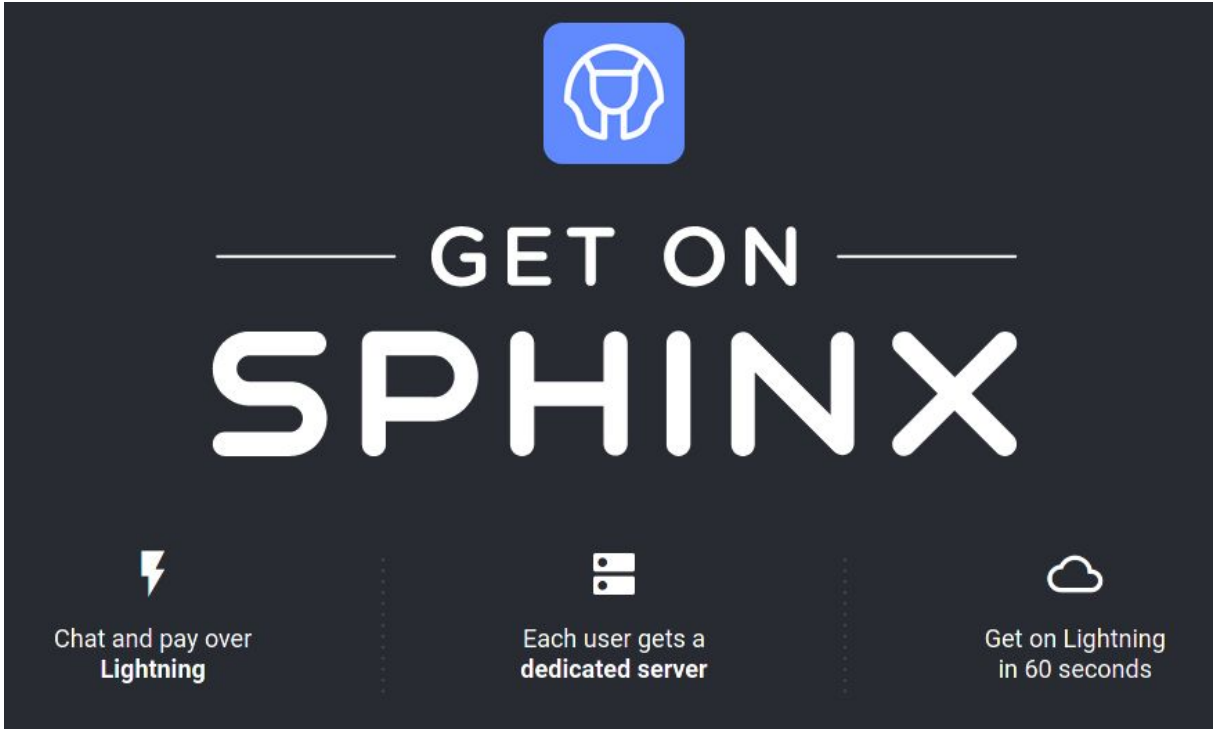


Collectibles: OpenSea



Entertainment: Sphinx

- Podcasting 2.0
- Stream sats to content creators
- Tip creators
- All on Lightning network



Insurance

- Etherisc
- B3i
- FidentiaX
- Lemonade
- Blue Cross
- Insurwave

Supply Chain

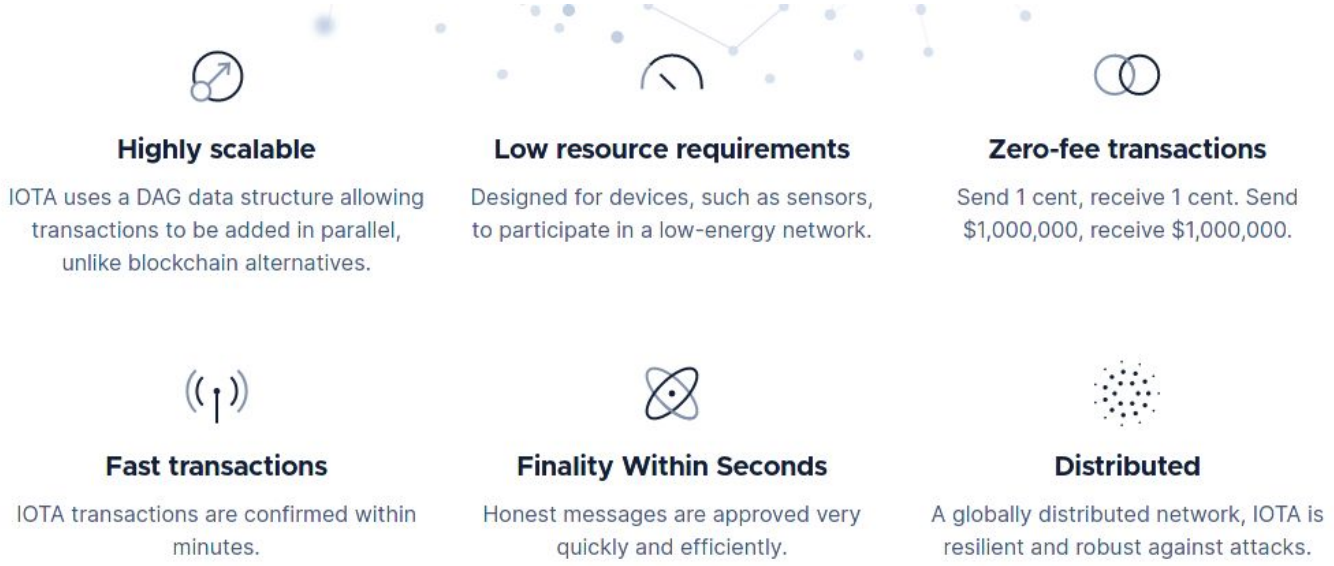
- Provenance
- Tomcar pay 2% of components in Bitcoin
- **Hyperledger** has multiple use cases… PlasticCoin
- Everledger for battery recycling
- Food supply…

Smart Cities: Blockchain4Cities

- Research / study to determine how blockchain can be used in smart cities
- Urban management via DApps and DAOs
- Focussing mainly on cybersecurity

Internet of Things: IOTA

- Designed for frictionless data and value transfer
- Built for the “Internet of Everything”
- Feeless system ‘paid for’ by validating 2 transactions for every 1 submitted

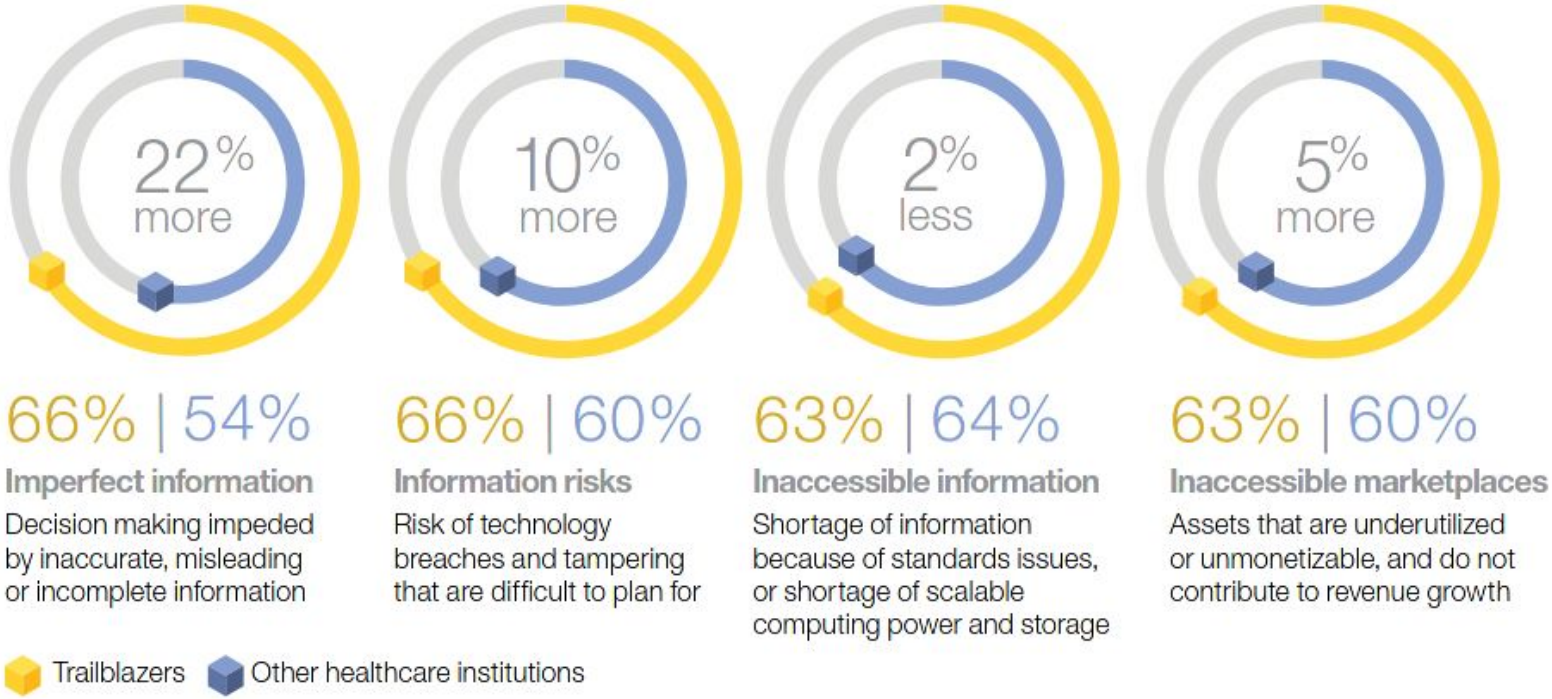


Healthcare

https://www.ibm.com/downloads/cas/BBRQK3WY

Figure 3

Top frictions that Trailblazers expect to reduce using blockchains



Healthcare

From Blockchain: the trust solution for the healthcare industry

A brief summary of the added value of blockchain in healthcare:

- Establishing a trust network: giving patients an overview of what data is being shared, while empowering them to decide who they share their health data with (smart contracts).
- Reduced transaction costs: the cost-effectiveness of data storage. In cloud computing, the use of blockchain can be an important tool for data transaction.
- Standardised data fields: a lot of data varies in format and is therefore not easily compatible between different systems. Blockchain standardises the format and stimulates interoperability.
- Real-time data management: using blockchain, data can be analysed in real time, which can have many uses – such as tracking medicines, personal subscriptions, etc

Healthcare: Data and privacy

From Blockchain and Healthcare - HIMSS

“ On-Chain:

- High Level Data: The ideal transaction typically takes the form of higher level data, metadata, transactional information, audit records, pointers and hash codes.

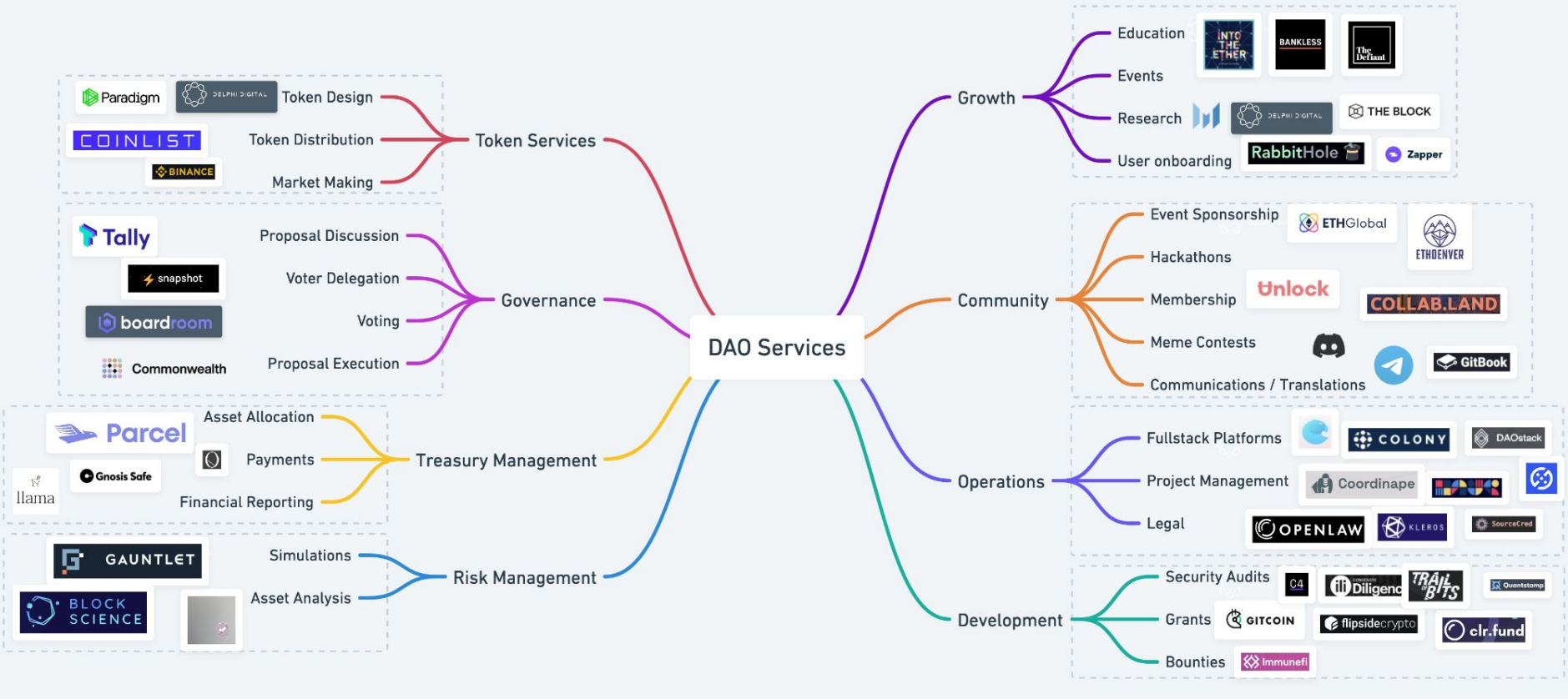
Off-Chain:

- Large Data Files: The architecture of the distributed ledger should keep large volumes of clinical information off-chain and in secure access-controlled enterprise systems where they exist today, and reference these data records as required from the blockchain with pointers and hash codes that can be used to verify their integrity.
- PHI and PII: This information should be stored in secure access-controlled enterprise systems. Referencing these data records as required from the blockchain would be an acceptable way to get the benefit of the technology while maintaining HIPAA and other privacy standards. “

When is a DApp a DAO?

- Decentralised Autonomous Organisation
  - Operates using smart contracts
  - Members usually vote using governance tokens
- **The DAO**
  - First ever DAO in April 2016
  - Raised 12.7 million Eth
  - Hacked - 3.6 million Eth moved into ‘Child DAO’ - stayed for 28 days
  - Caused hard fork in Ethereum (Ethereum Classic was born)
  - The DAO was delisted by major crypto exchanges September 2016
- A DAO is an automated DApp

DAOs



https://twitter.com/corbpage/status/1402626913974341636

Capabilities 1 of 2

- Deployable by anybody
  - No credentials required to publish app
- (Can be) accessible by anybody
  - Pseudonymity prevents blocking certain people / participants
  - Restrictions can be implemented if required
- Uncensorable
  - Public blockchains + decentralised storage mitigates any blocking by malicious actors
- Immutable
  - Data are stored on open blockchains that cannot be rewritten
- Cryptoeconomics
  - Cryptography, game theory and economics
  - Incentives to play by the rules
  - Staking / running a node

Capabilities 2 of 2

- Open-source
  - Audits performed by a wide range of people
  - No black-box functions
  - Code can be forked to create a different version
- Trustless
  - Designed to make participation fair for all parties
  - Strength in numbers --- Vires in Numeris
- Transparent
  - Full paper trail auditable by anyone

Restrictions

- Experimental
  - Frameworks in development
- Monetary
  - Deploy
  - Run operations (calculations, store/retrieve data)
- Vulnerable to exploits
  - Publicly accessible code opens up opportunities for hackers
  - Large sums of money lost
- User Experience
  - Accessibility issues. Often require basic knowledge (MetaMask or Brave Browser) and the ownership of crypto / tokens.
- Security
  - GDPR
- Scalability
- Regulatory

DApp Development: Planning

- Sketch UI from design spec
- Create flow charts / swim lanes https://miro.com/
  - Visualise data flows
  - Build up required functionality
  - Check logic before writing any code
  - Share program flow to managers and other non-developers

DApp Development: Test Driven Development

- One of many development philosophies
  - See:
    - Behaviour Driven Development
    - Acceptance Test Driven Development
- Fairly well documented in JavaScript and Solidity
- Tests should focus on smallest thing possible
- Breaks down development into bite-size chunks
  - Define a single function and create a test
  - Repeat for each additional function until the full functionality is tested
  - Knit together into application
- Can be tricky when developing with unfamiliar frameworks
  - Importance of simple tests

Homework Assignment: Recommended Software

- VSCode https://code.visualstudio.com/
- Node / NPM recommend use https://github.com/nvm-sh/nvm
- Ganache https://www.trufflesuite.com/ganache
- Postman https://www.postman.com/
- Browser (for contract development in Remix)

Homework Assignment: Outline

- **Create DApp to show details of and transfer NFTs**
- Front-end:
  - Allows transfer of NFT's (ERC721) in exchange for token (ERC20) between web3 accounts
  - Values shown on front-end update regularly (~ once per second)
  - Show market cap (list of NFT's must be tracked and stored somewhere)
  - Recommended written in NodeJS Express, however can use Flutter or ReactJS if preferred
- NFT:
  - Store depiction (image/text etc) of NFT on IPFS (or any other suitable NFT storage platform)
  - Link location to NFT when initially minted
  - NFT allows transfer of ownership
  - Each NFT has a value (# ERC20) (extra) value can be different
- Develop on local blockchain (extra) then deploy to a testnet
- (extra) Market cap of NFT market depends on
  - # of 721's
  - Liquidity available (increasing at an average rate)
- (extra) Data/state of NFT market should be stored on IPFS/other decentralised storage platform
- Keep code:
  - Readable and well commented
  - Modular
  - Rely on standard libraries where possible
  - Tested (next session)