Blockchains for Artificial Intelligence

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BIGCHAIN DB

IPDB | INTERPLANETARY DATABASE

The Unreasonable Effectiveness of Data

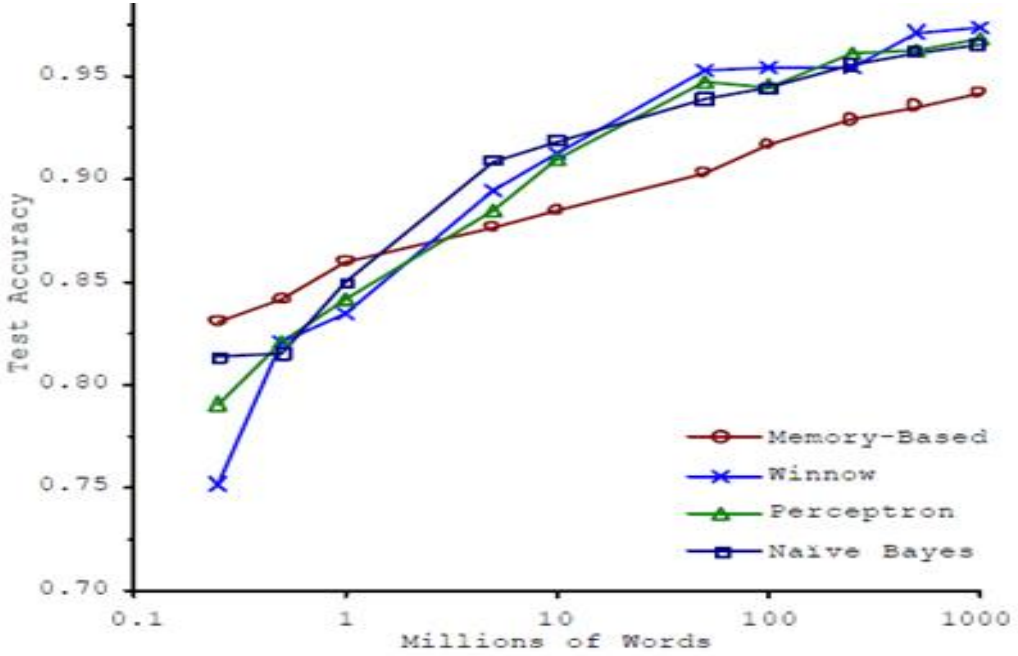

Figure 1. Learning Curves for Confusion Set Disambiguation

[Banko and Brill, 2001]

Mo' data

(and mo' compute)

↓

Mo' accuracy

↓

Mo' $

THE 3 ELEMENTS OF COMPUTING

STORAGE	PROCESSING	COMMUNICATIONS

THE 3 ELEMENTS OF COMPUTING

Key Blocks in AI Landscape

STORAGE	PROCESSING	COMMUNICATIONS
FILE SYSTEM HDFS, S3	BIZ LOGIC CPU, EC2	DATA TCP/IP, HTTP
DATABASE MongoDB, Cassandra	HIGH PERF. COMPUTE Nvidia GPU, Goog TPU, MapReduce, Spark	

But all is not well in the world of AI

- Data hoarding. Big guys have all the data.
- Weak data history. Garbage in, garbage out.
- Data is *expensive*.

And more..

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And more..

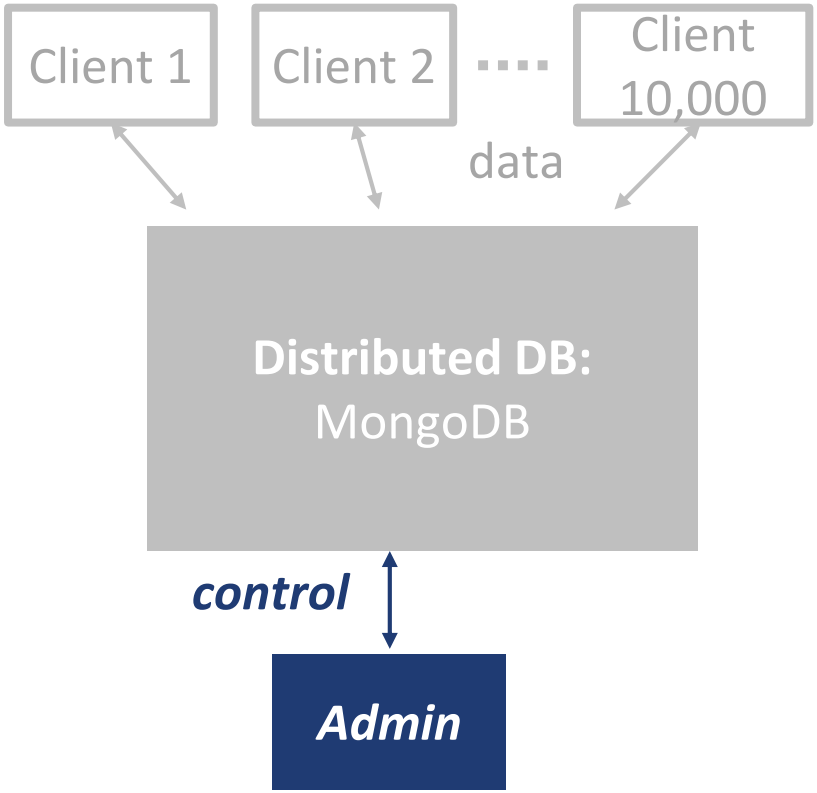
Can decentralization help?

Q: How to unlock blockchains for AI?

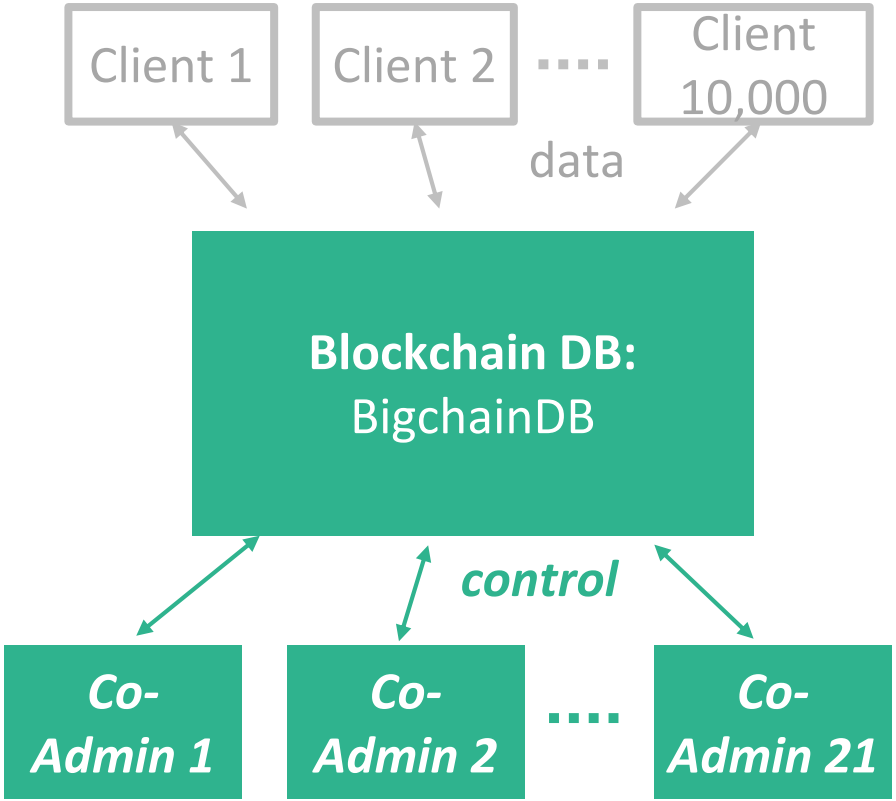
A: A shared database with planetary reach

+Query
+Open-source
+Scale
+Decentralized, Assets

1. Relational DB – Oracle
2. Website-ready DB – MySQL
3. “Big data” Distributed DB – MongoDB
4. “Blockchain” DB – BigchainDB + IPDB



A traditional database has
one administrator
(centralized)



A blockchain database has
many administrators
(decentralized)

THE 3 ELEMENTS OF COMPUTING, *DECENTRALIZED*

STORAGE	PROCESSING	COMMUNICATIONS
FILE SYSTEM IPFS/FileCoin, Swarm	BIZ LOGIC Ethereum, Hyperledger	DATA TCP/IP, HTTP
DATABASE BigchainDB/IPDB	HIGH PERF. COMPUTE TrueBit, Golem, iExec, VMs, client-side compute	VALUE ILP, Cosmos
E-GOLD / E-CASH Bitcoin, zcash, .*		State PolkaDot, Aeternity

THE 3 ELEMENTS OF COMPUTING, *DECENTRALIZED*

Key Blocks in AI Landscape

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GENESIS OF THINGS

Cognizant innogy 3D MAKERS ZONE. intel BDB

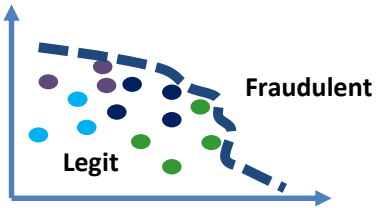
Online platform for industrial 3d printing.
E.g. spare aircraft parts

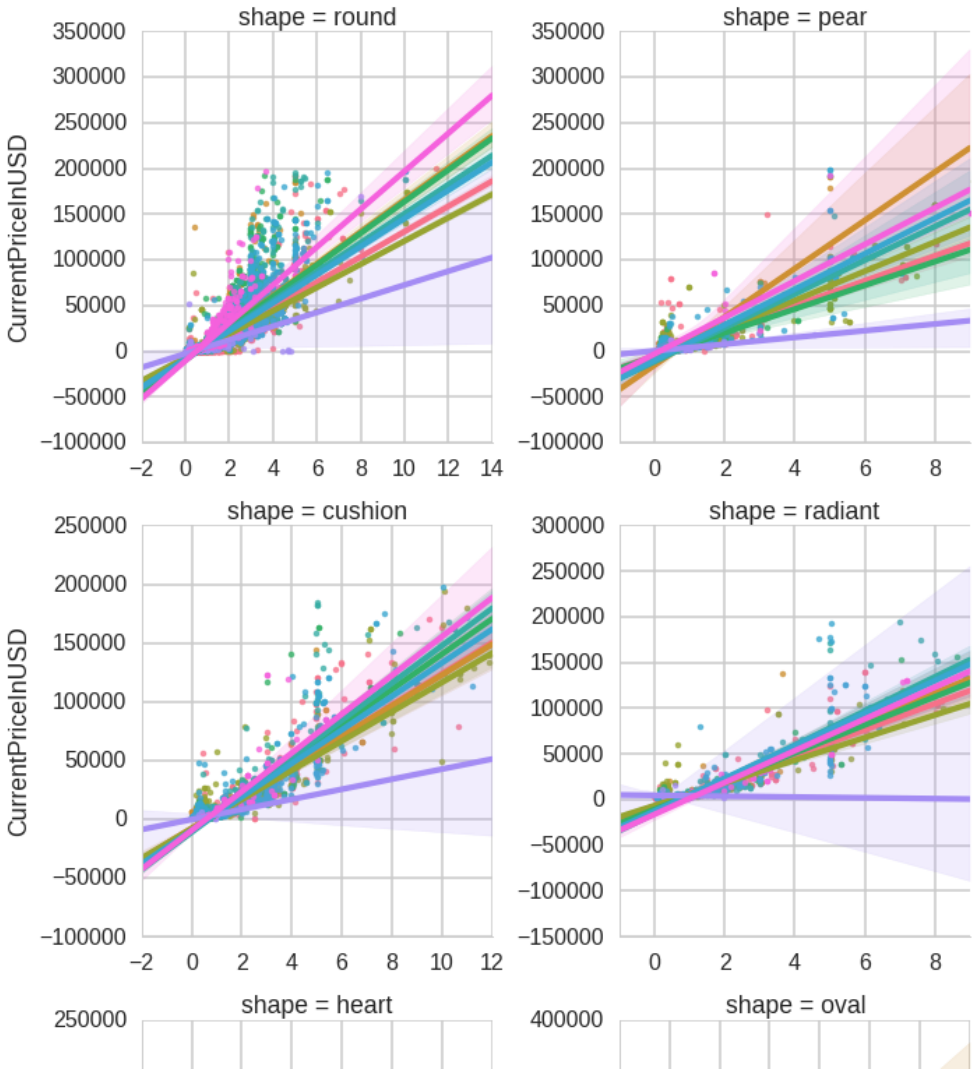
- Find and contract the best 3d printer
- Securely transfer production files
- Pool data in ecosystem → 1-class classifiers for fraud detection

Problem: **Data Hoarding**

Sol'n: **Data Pooling**

For More Accurate Models





Problem: Data Hoarding (2)

Sol'n: Data Pooling For More Accurate Models

Diamond price prediction for fraud detection: Warn if predicted price !≈ asking price

Certificate of Authenticity

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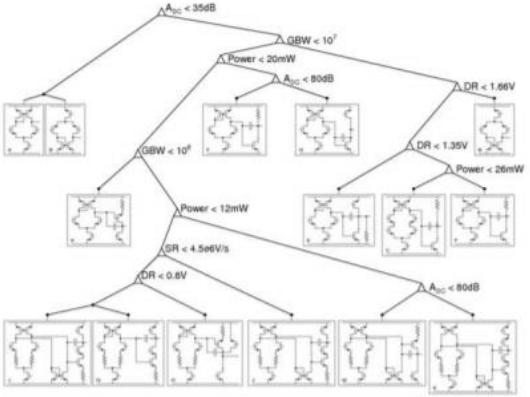

Circuit Decision Tree

Edition: 1/3
Created by: Trent McConaghy
Owner: trent

ARTWORK DETAILS

Artwork ID: 136UbLGSHNHqY9kJxQ3tDy83K7P69zDJeN
File Extension: .png
File Size: 87090 bytes

PROVENANCE/OWNERSHIP HISTORY

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Summary: Trent McConaghy*Circuit Decision Tree*1/3*2008*2016Nov06-19:10:42

Signature: C38D56C823CEC09E40B35B9D27D48B9C8EF9ADECC9592F469CE0144CF9ECA406B3ABF1D976ADB7813895379A66F9F7C327BB0EE090A52F6A8274F3F4AC9EE3D7DF0FA98964C834678A6F4[illegible]E687E7B4243F8F65FF57315CB7391A03874CD4BDFCB357[illegible]42AB5256B72A4C2D2593F3492372A66C82679263E39BA[illegible]EL

Problem: **High Friction to Monetize Algorithms**

Sol'n: **Claim & License Your Algorithm IP**

BDB

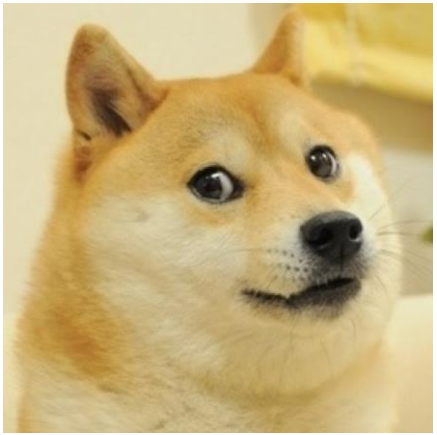
Problem: High Friction to Monetize Algorithms (2)

Solution: Hedge Fund In a Box (Numeraire)

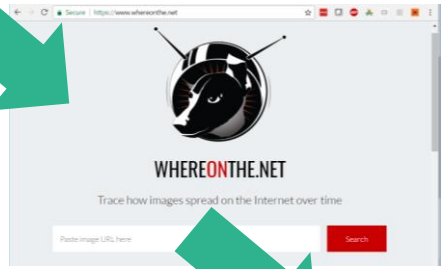
1. 12K+ data scientists submit algorithms
2. Market winnings are distributed wrt performance
3. Positive-sum via tokenization

Problem: blockchain-secured data spreads online

Sol'n: visibility into spread via web crawl + AI



WHEREONTHE.NET



Problem: Weak Data History (Garbage In Garbage Out)

Sol'n: Immutable Audit Trails of AI Data & Models

Provenance in model building:

- Sensor / input stream data
- Training X/y data
- Model building convergence

Time-stamp to IPDB
Store to IPFS

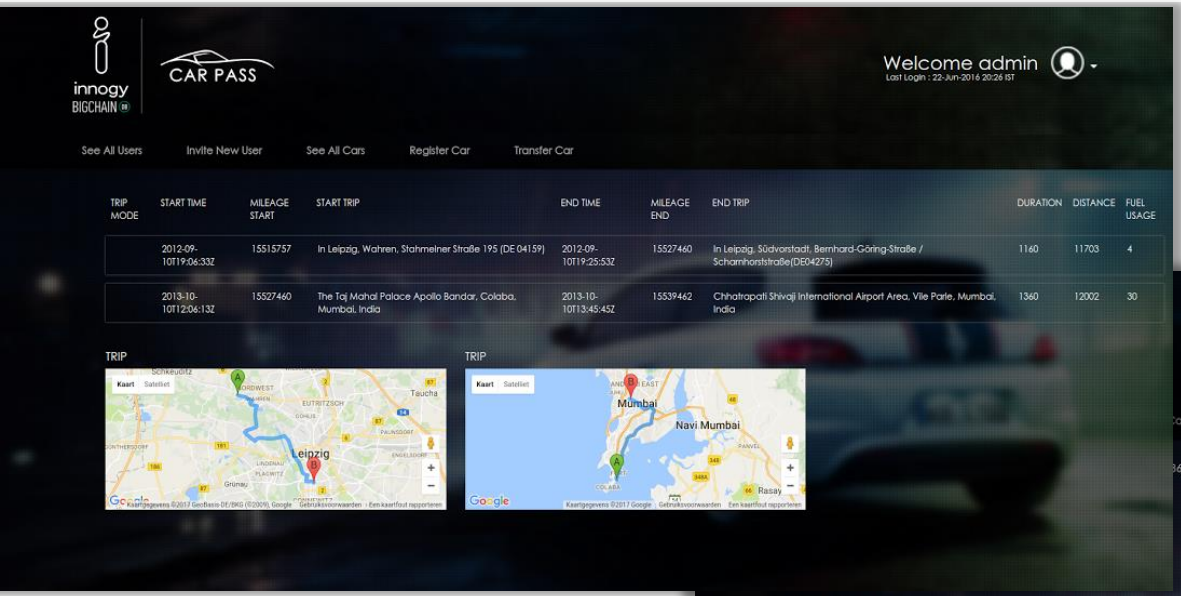
Provenance in model deployment:

- Testing X data
- Model simulation
- Testing yhat data

IPDB | INTERPLANETARY DATABASE

Problem: Weak Data History (2)

Sol'n: Audit Trails of Vehicle Life Cycle Data (CarPass)

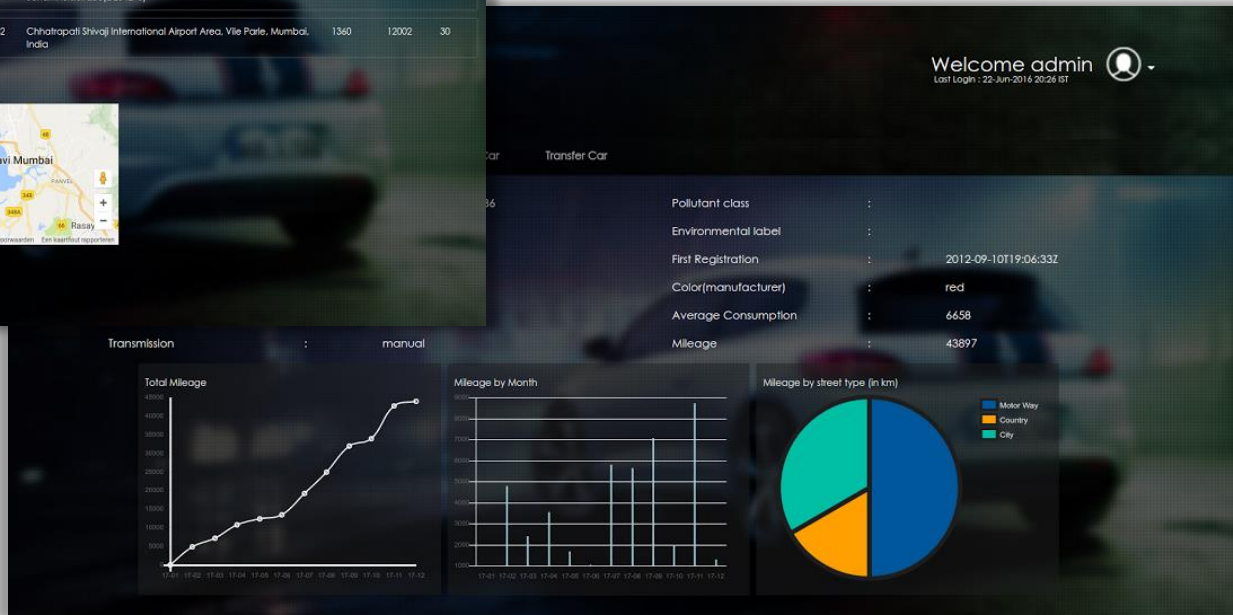


BIGCHAIN DB

innogy

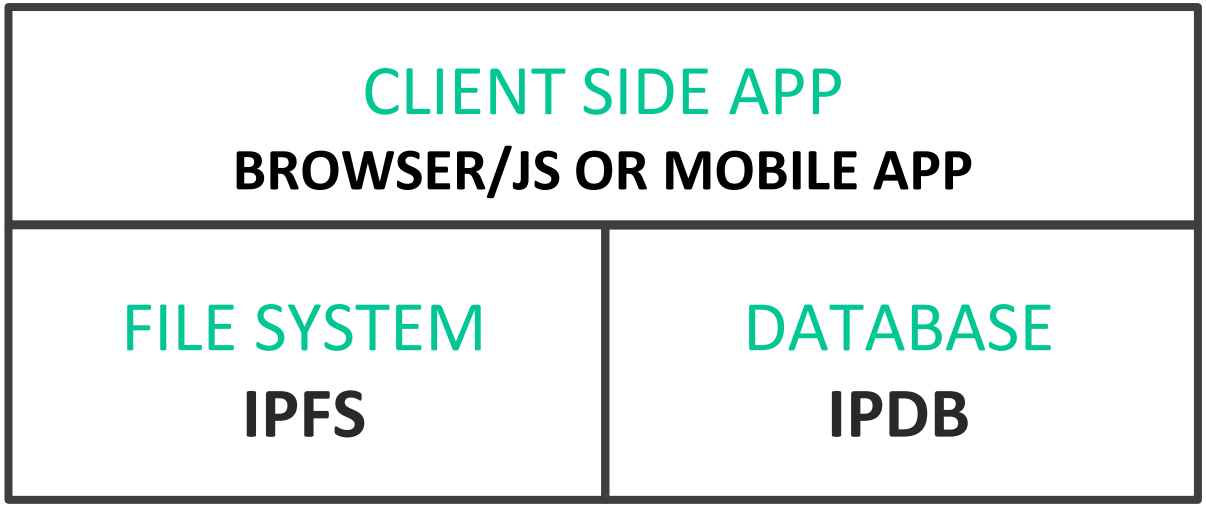
CAR PASS

riddle&code



Architecture: Single-page webapp

Data persistence via IPFS + IPDB
("AWS without the AWS")



FILE SYSTEM

HIGH PERF. COMPUTE

Problem: **Compute & Storage are Expensive**

Solution: **Tokenized, *Competitive* Markets for Compute & Storage**

Problem: Data is Expensive

What's the ultimate way to unlock data?

A Data Exchange

Mo' data
(and mo' compute)

↓

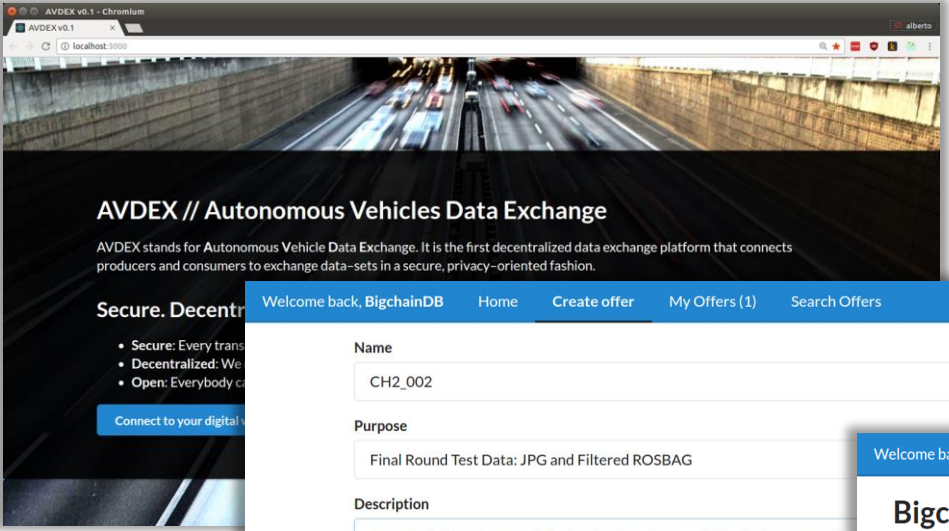
Mo' accuracy

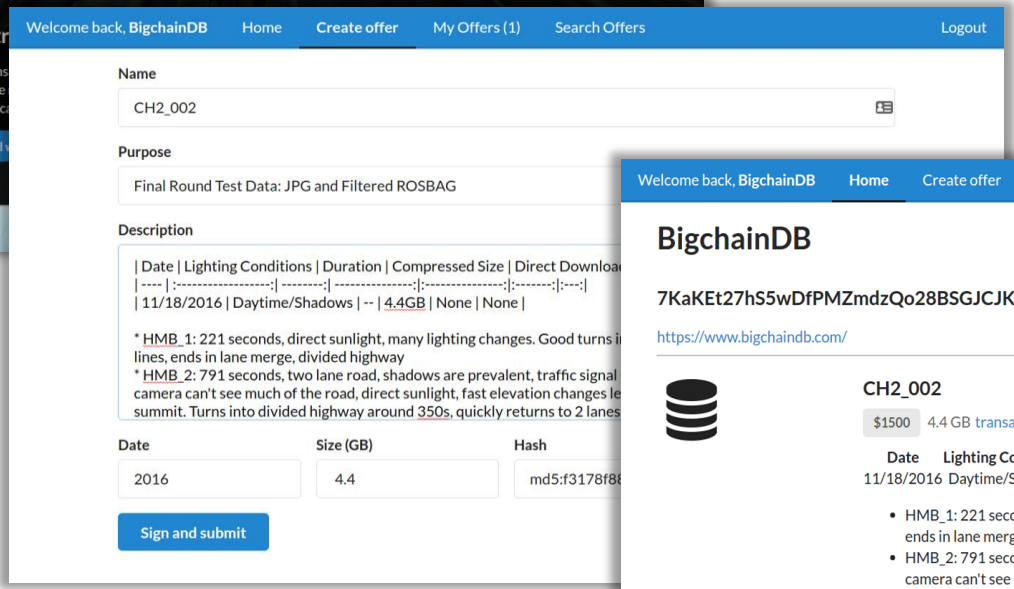
↓

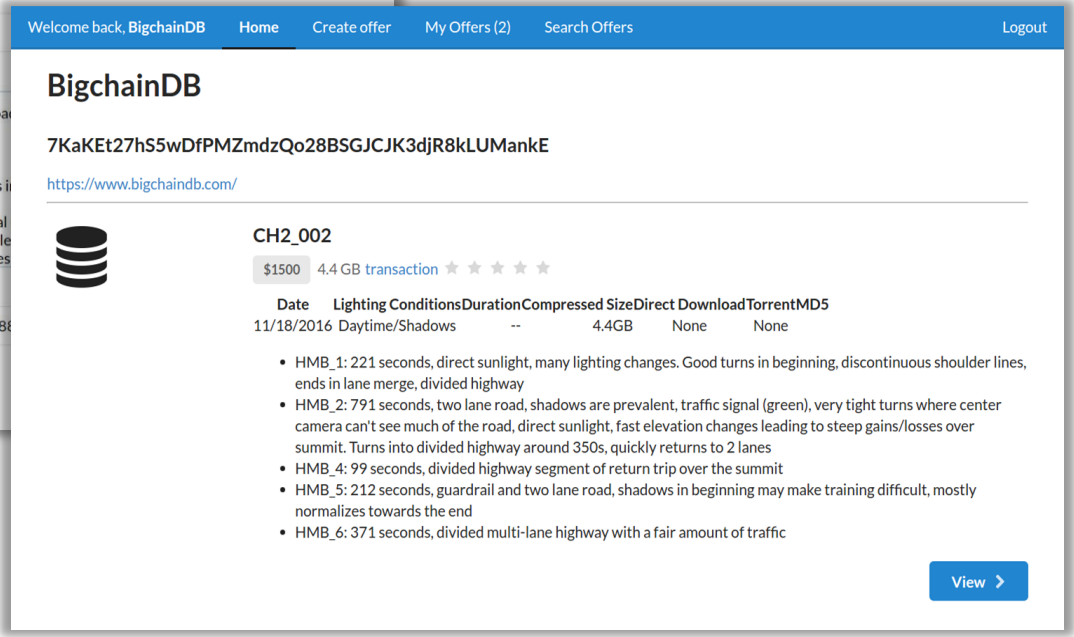
Mo' $

Problem: Data is Expensive

Sol'n: A Decentralized Data Exchange for Self-Driving Car Data





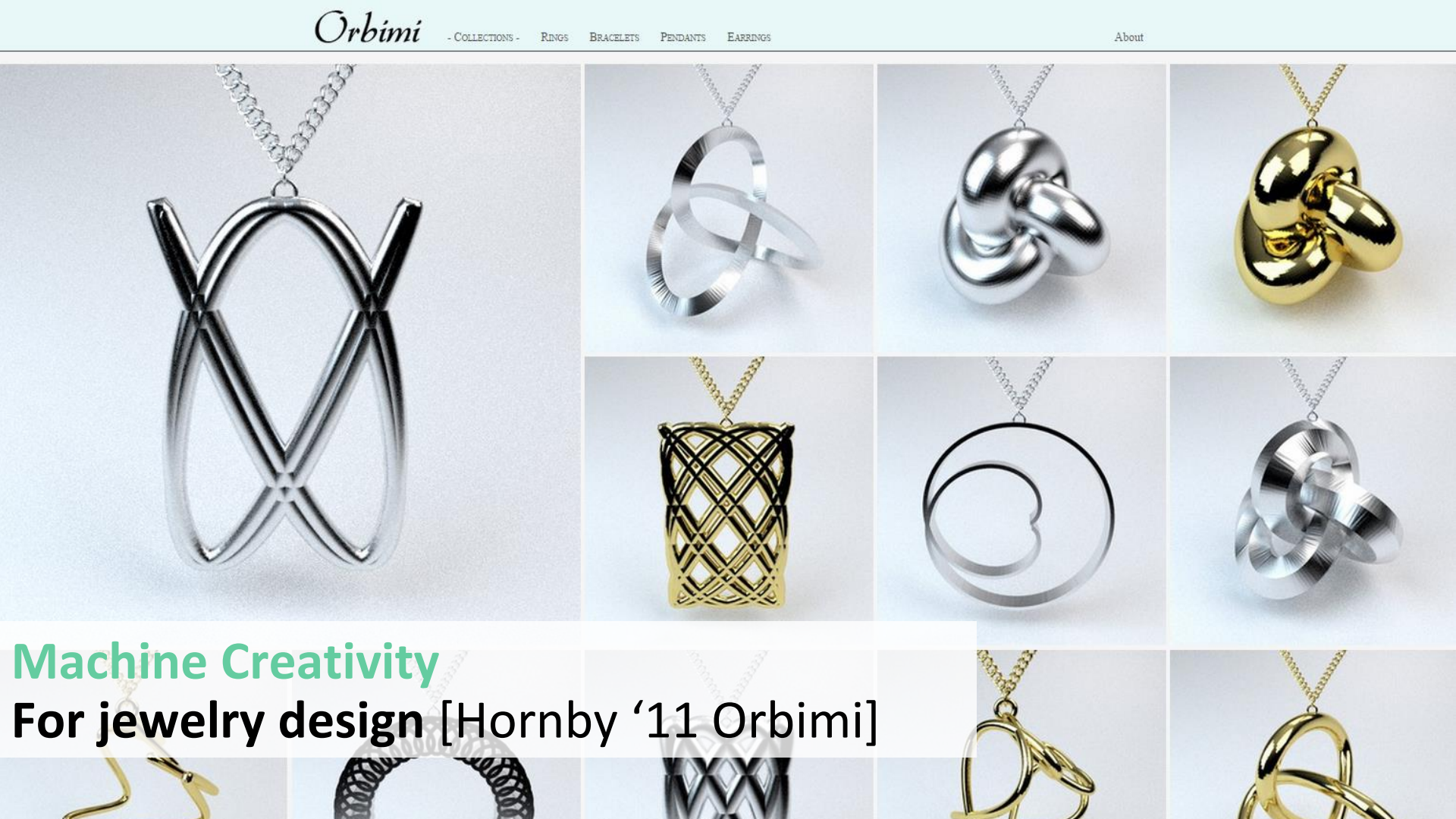


BigchainDB

TOYOTA RESEARCH INSTITUTE

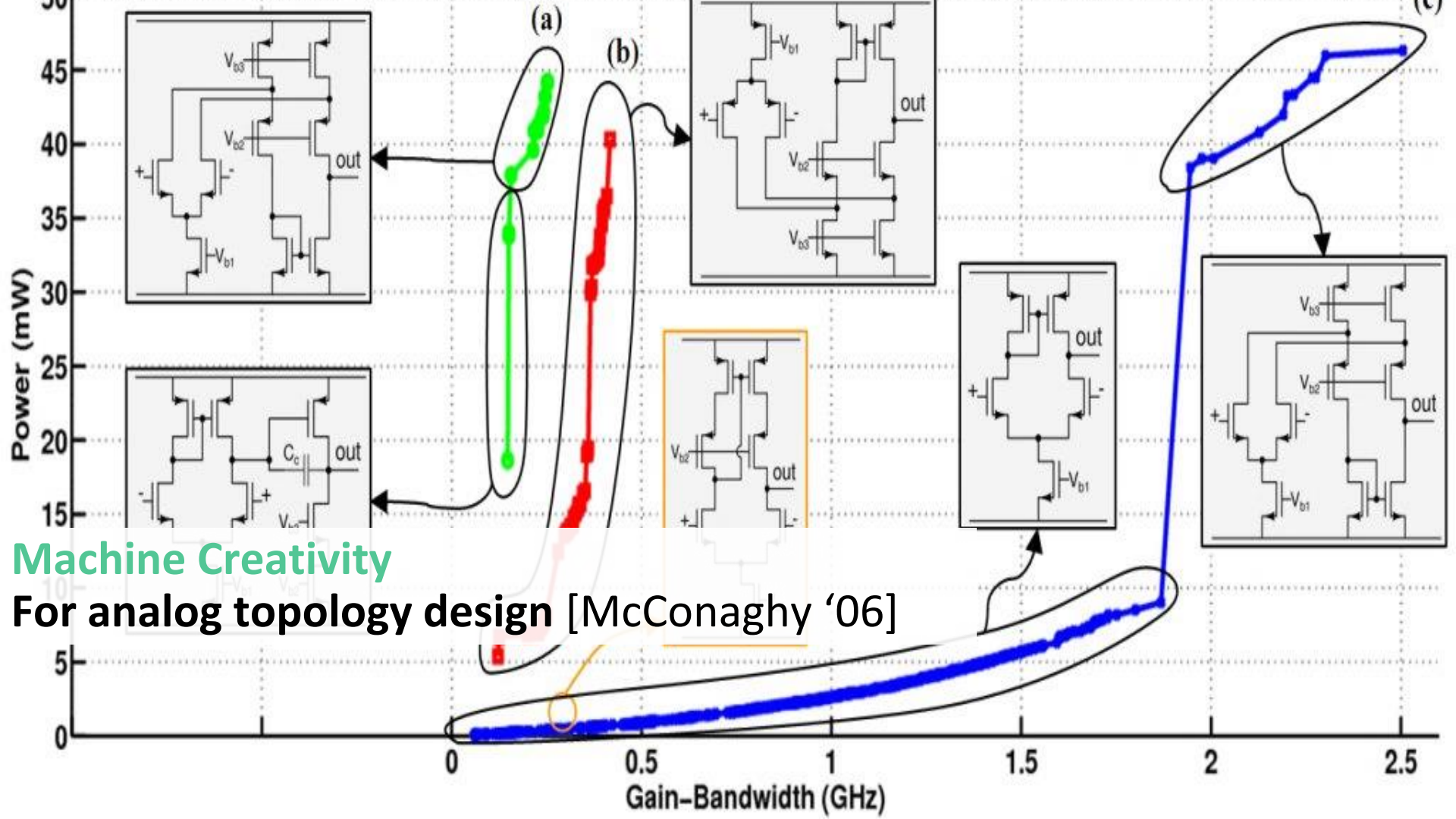
"Self Driving cars are the killer app for AI"
-Madrona Venture Group

AI * Blockchain Symbiosis:
AI DAOs



Machine Creativity

For jewelry design [Hornby ‘11 Orbimi]

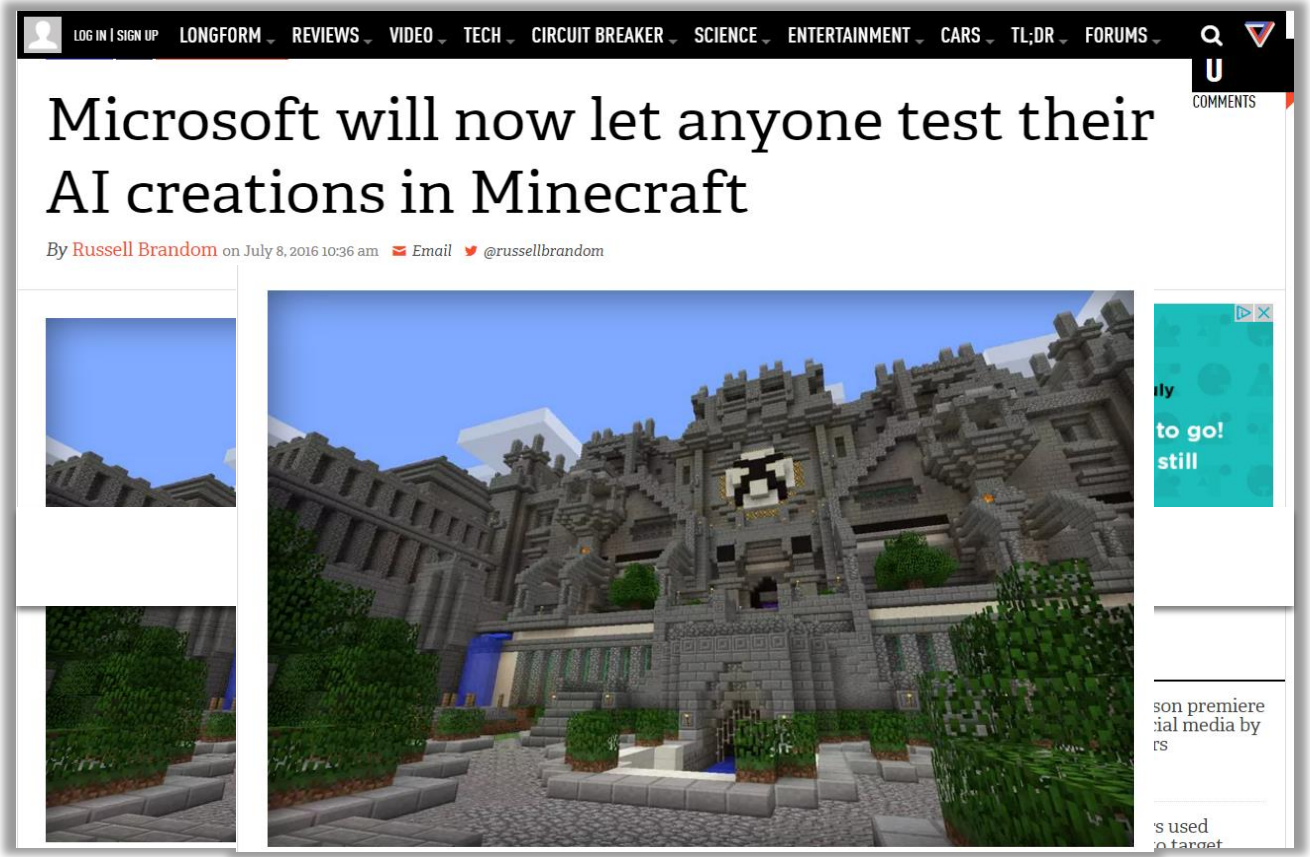


Machine Creativity

For analog topology design [McConaghy ‘06]

AGI: Artificial *General* Intelligence

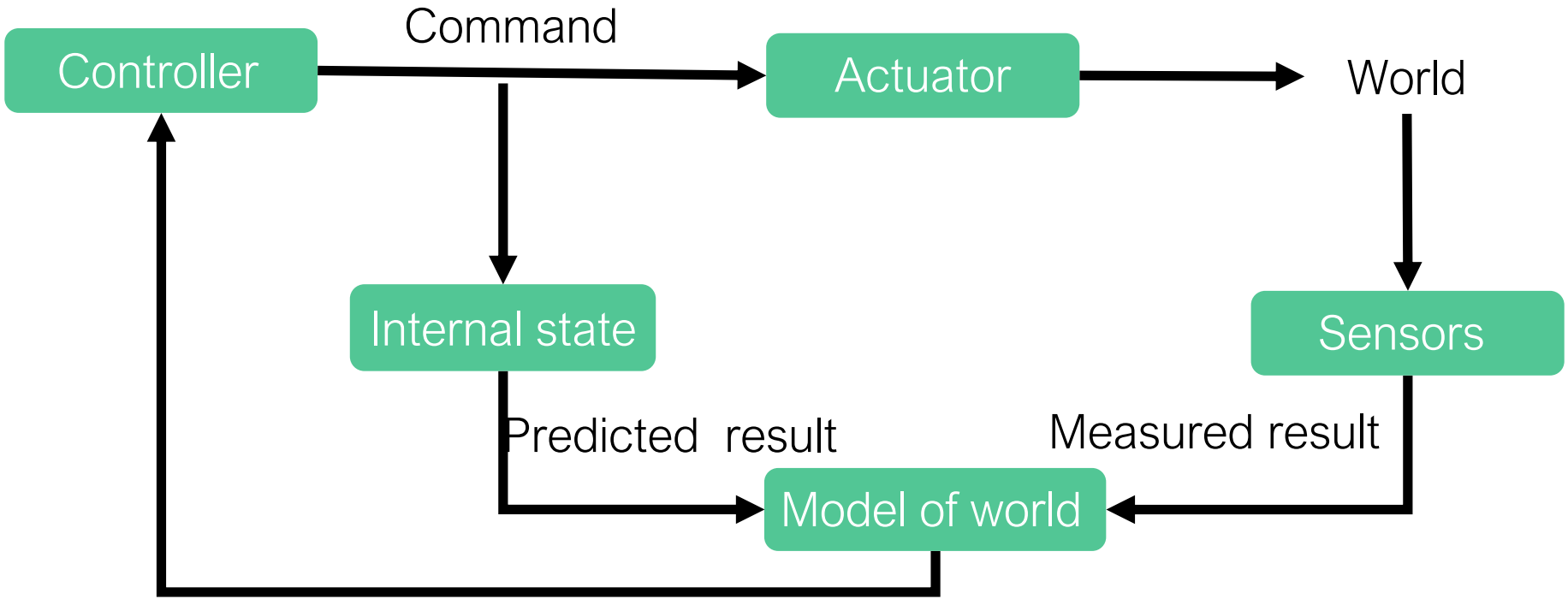
Agents that sense, model, and act



AGI: Artificial General Intelligence

"AI meets Feedback Control Systems"

Update internal state based on estimate of world state



Example: The ArtDAO

Algorithm…

1. Run AI art engine to generate new image
2. Claim attribution in blockchain
3. Post editions for sale onto a marketplace, using Getty (centralized), or OpenBazaar (decent.)
4. Sell the editions. $ goes to ArtDAO, in exchange for IP

Repeat! Create more art, sell it, get wealthier

Example: The ArtDAO

Algorithm…

1. Run AI art engine to generate new image
4. Sell the editions. $ goes to ArtDAO, in exchange for IP

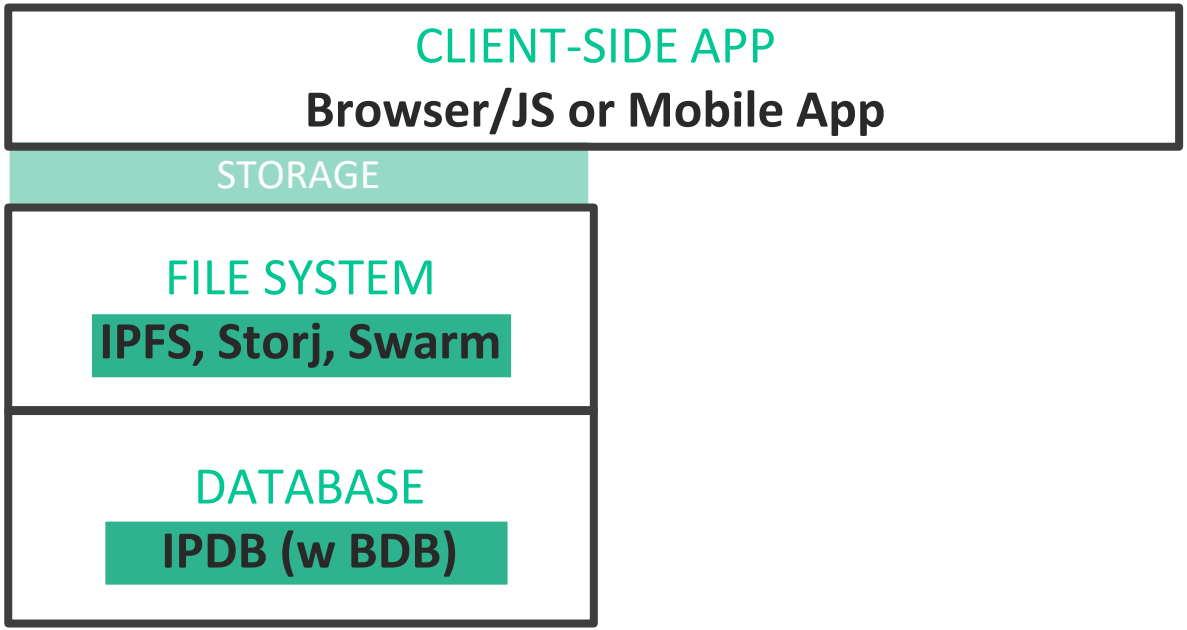
Over time, if ArtDAO makes more money from sales than from generating new art, then it will accumulate wealth. And, you can't turn it off.

Repeat! Create more art, sell it, get wealthier

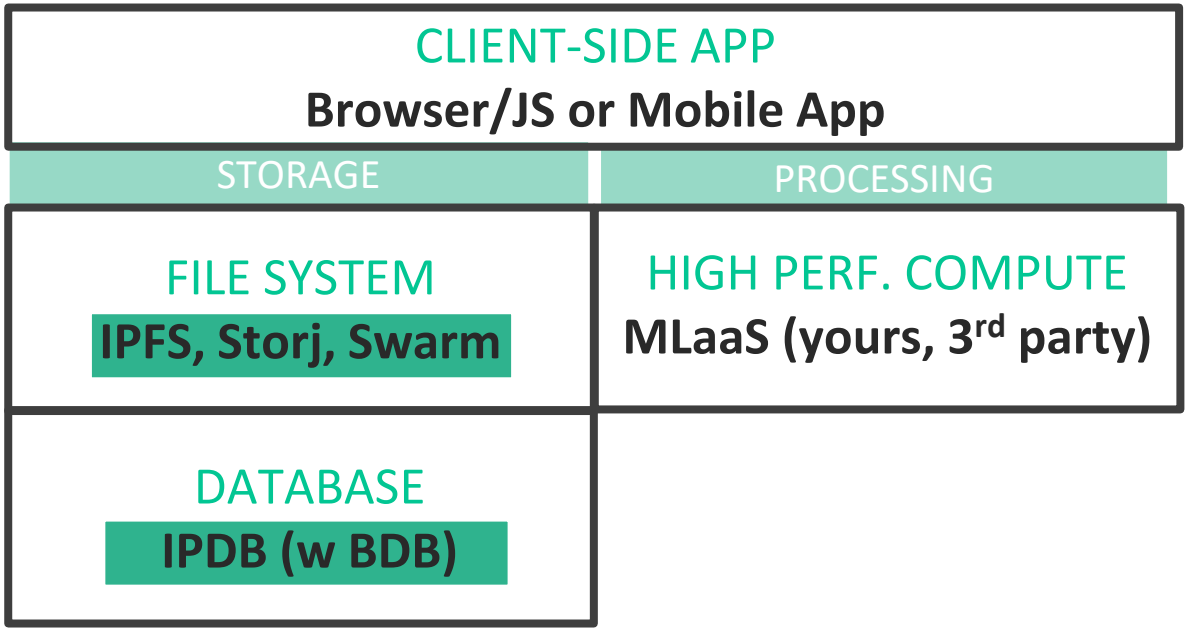
Deployment Architectures

A spectrum of decentralization choices

Single-Page Webapp (Simple!)



Single-Page Webapp, With Your AI

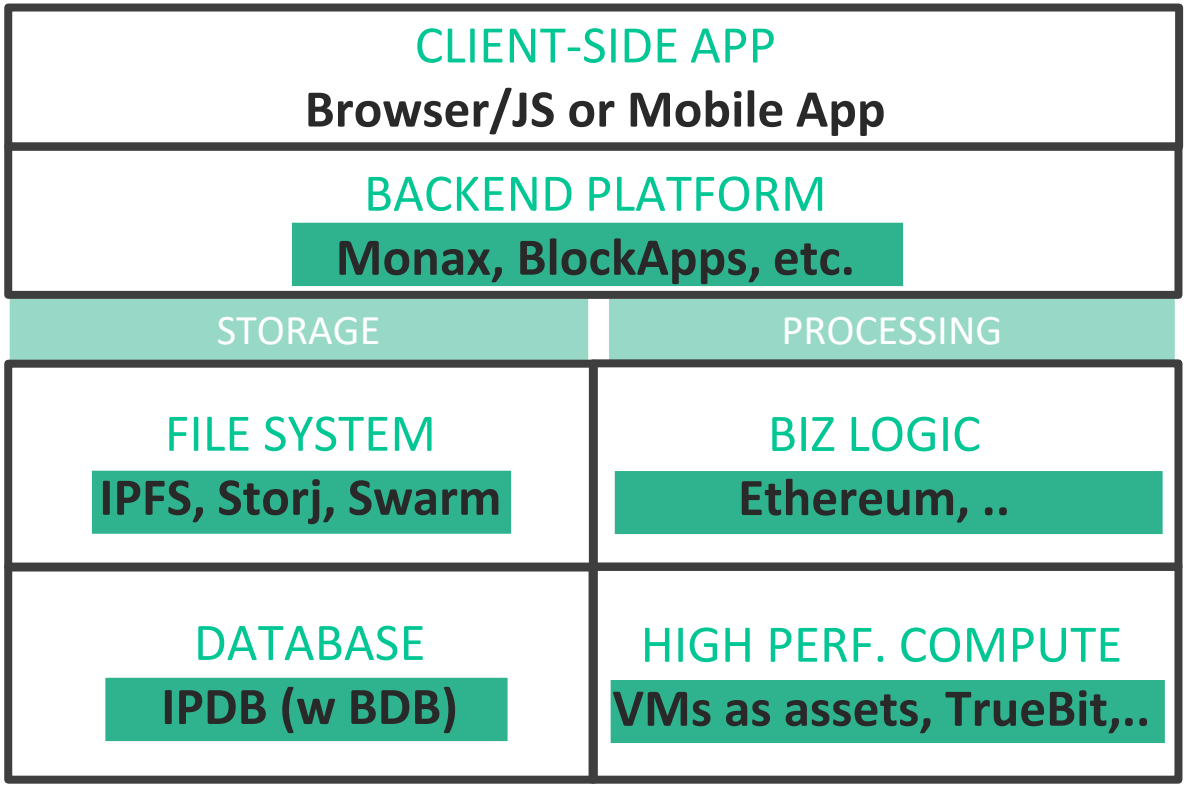


Decentralize DB of "Who Owns What",

Keep the rest the same

CLIENT-SIDE APP **Browser/JS or Mobile App**	
BACKEND PLATFORM **Django, Flask, Lambda**	
STORAGE	PROCESSING
FILE SYSTEM HDFS, S3, **maybe IPFS**	BIZ LOGIC EC2
DATABASE MongoDB, **IPDB (w BDB)**	HIGH PERF. COMPUTE Nvidia GPU, Goog TPU, MapReduce, Spark

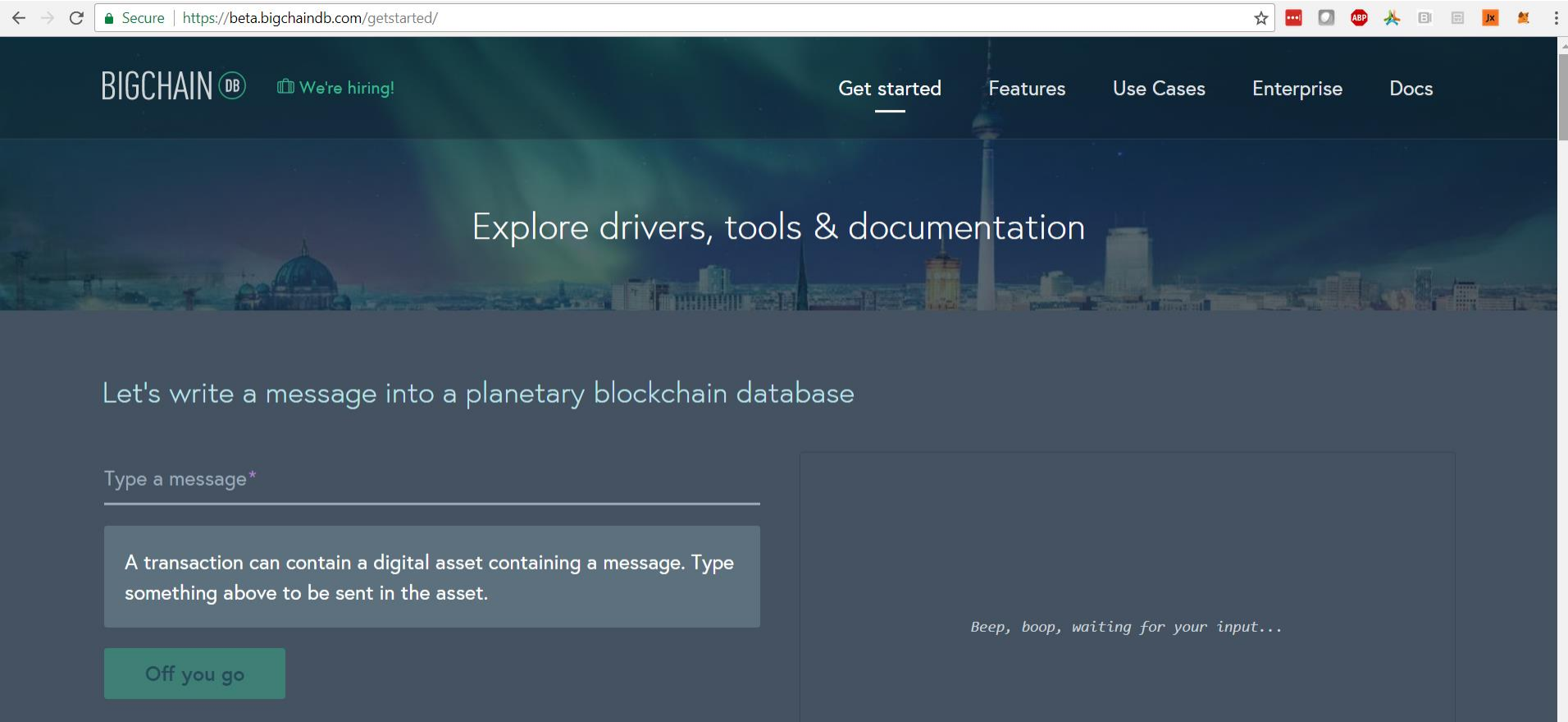
Decentralize All The Things



How to start doing
AI * Blockchain

Get started

beta.bigchaindb.com/getstarted/



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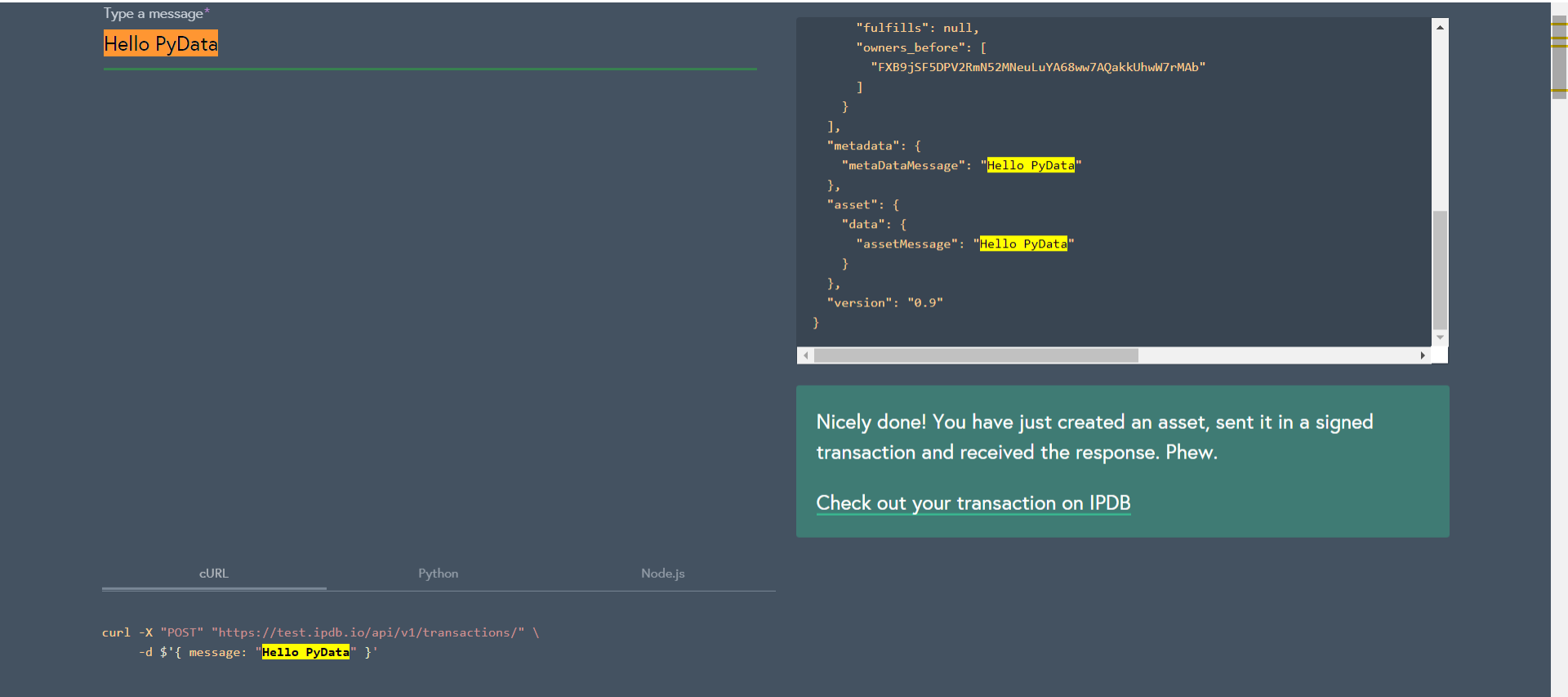

Get started

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cURL | Python

```python
from bigchaindb_driver import BigchainDB
from bigchaindb_driver.crypto import generate_keypair

bdb = BigchainDB('https://test.ipdb.io/api/v1/')

alice = generate_keypair()

tx = bdb.transactions.prepare(
    metadata={ "message": "Hello PyData" }
)

txSigned = bdb.transactions.fulfill(
    tx,
    private_keys=alice.private_key
)

bdb.transactions.send(txSigned)
```

Get started

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```

To bring in the AI:

```
import sklearn
```

…

Conclusion

- Blockchains can *really* help AI
- It's all about the data
  - Getting the data
  - Getting *good* data - with provenance
- (Plus those pesky AI DAOs)
- You can get started with AI + blockchain easily