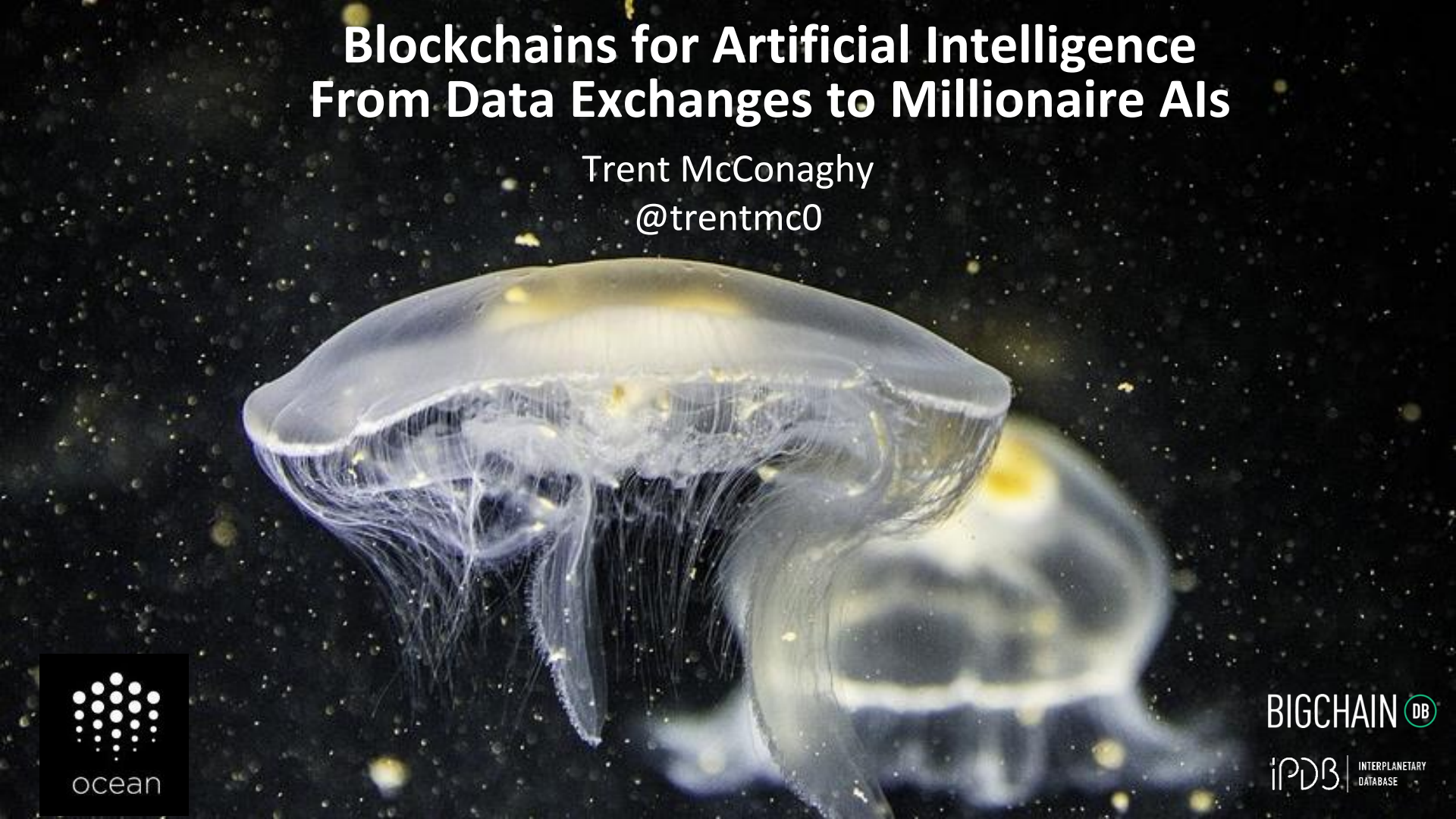
Blockchains for Artificial Intelligence
From Data Exchanges to Millionaire AIs

Trent McConaghy
@trentmc0



ocean

BIGCHAIN DB

IPDB INTERPLANETARY DATABASE


Blockchains


r/btc
MAGIC
Internet
money
Join us

Blockchain: A Special “Spreadsheet in the Sky”

What’s special:

- no one owns it
- anyone can add to it
- no one can delete from it

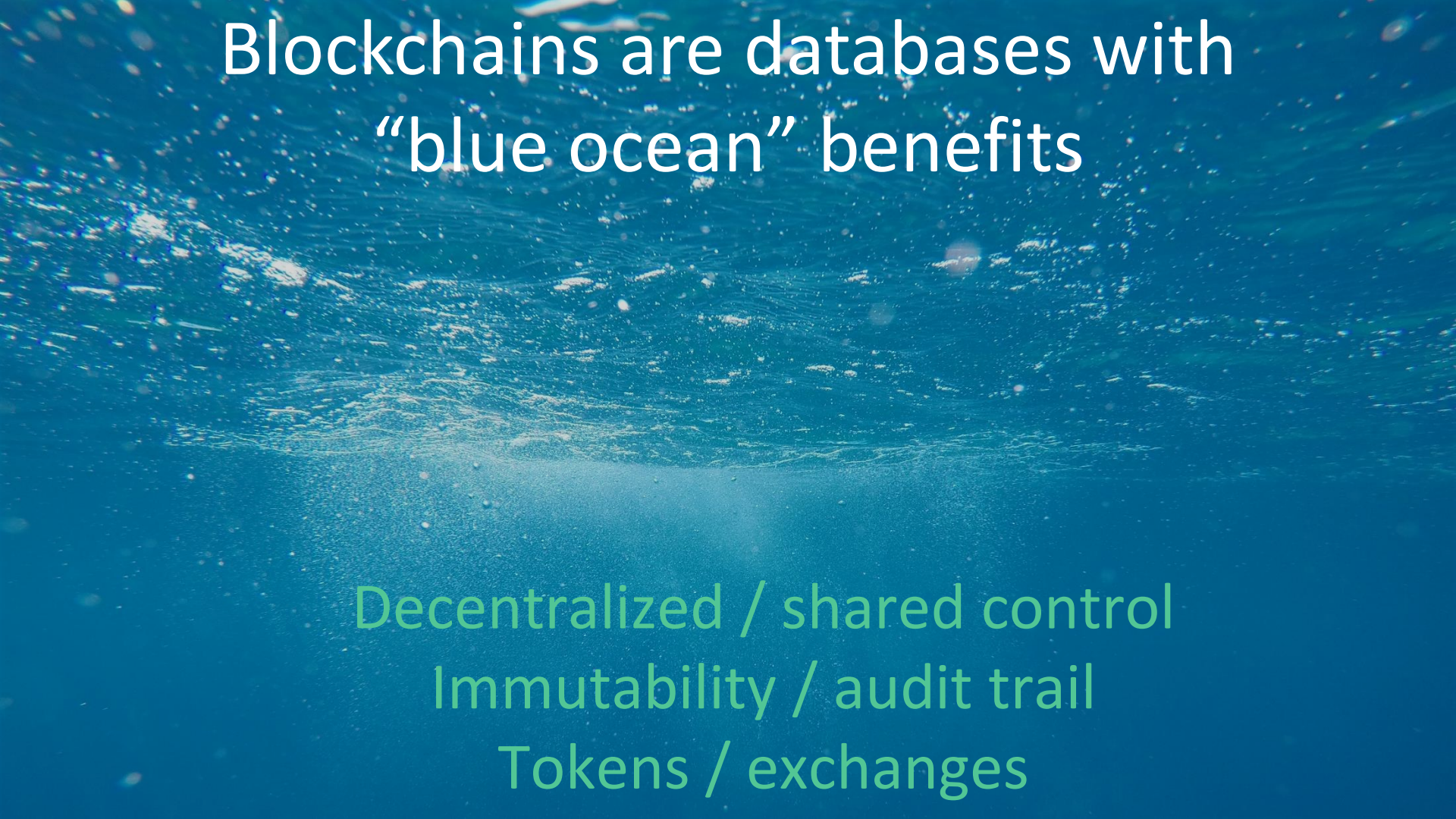
- Writing to a blockchain is like etching in stone.
- Which allows us to issue assets, and transfer them

The Internet of Everything needs a Ledger of Everything.

The **blockchain** is a truly open, distributed, global platform that fundamentally changes what we can do online, how we do it, and who can participate. Call it the **world wide ledger**.

Don & Alex Tapscott

Blockchains are databases with “blue ocean” benefits



Decentralized / shared control

Immutability / audit trail

Tokens / exchanges

How to build a scalable blockchain database (e.g. BDB)

1. Start with an enterprise-grade distributed DB, e.g. MongoDB
2. Engineer in blockchain characteristics

Decentralized / Shared Control	• Each DB node is a federation node
Immutable / Audit Trails	• Hash Previous Blocks • Append-only
Native assets	• “Own” = have private key • Asset lives on the database


Example real-world use:
ascribe


ascribe®
for Artists & Creators
SIGN IN / SIGN UP
ascribe is a fundamentally new way to lock in attribution, securely share and trace where your digital work spreads.

the scenery made most people ignore each other

Register your work

Your Work

Drag file here

or

choose a file to upload

Artist Name

(e.g. Andy Warhol)

Title

(e.g. 32 Campbell's Soup Cans)

Year Created

(e.g. 1962)

Specify editions

Register work

contemporary

A temporary online exhibition of art for bitcoin

Marian Tubbs

Orbiting (A Melodrama)

2016
video
1920 × 1080 pixels

Edition of 50

Learn more about Digital Editions

→ **Artist Vita**
→ **Description of Work**
→ **Artist Website**

Orbiting (A Melodrama), 2016
4 of 50
Offered for **0.07 Ƀ**

.zip

Share Tweet Download .zip

Event Listeners

CREATED BY Harm van den Dorpel

DATE 2015

EDITION 24 of 100

ID 1CbB2YEnBQUkHjWZvqfNNfjK8wh2cg69zQ

OWNER Masha McConaghy

ACTIONS EMAIL TRANSFER CONSIGN LOAN DELETE

+ Certificate of Authenticity

- Provenance/Ownership History

Apr. 17, 2015, 16:15:21

Registered by mail@harmvandendorpel.com

Apr. 20, 2015, 20:54:16

Transferred to Masha McConaghy

+ Consignment History

+ Notes

.zip

Share Tweet Download .zip

Event Listeners

CREATED BY Harm van den Dorpel

DATE 2015

EDITION 24 of 100

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+ Consignment History

+ Notes

Certificate Of Authenticity

As of 30 November 2015, 17:36:00 GMT, Masha McConaghy is the owner.
To verify current owner, please visit http://ascri.be/1luAOpo

Currency

Date: 2014
Edition: 3 of 100
Created by: Dan Perjovschi
Owner: Masha McConaghy

ARTWORK DETAILS

Artwork ID: 17uZBwSbLGfXy3vRRMWzF5PMjFVNc1tkQ2
File: currency-2014.jpg (499 KB)

PROVENANCE/OWNERSHIP HISTORY

Apr. 30, 2015, 12:36:19 - Registered by mail@cointemporary.com
May. 01, 2015, 09:46:08 - Transferred to admin
May. 08, 2015, 13:04:59 - Transferred to trent
Nov. 27, 2015, 19:35:14 - Transferred to Masha McConaghy

CRYPTOGRAPHIC STAMP

Use the summary and signature below to authenticate this certificate:
http://ascri.be/1Srz45Q

Summary: Dan Perjovschi*Currency*3/100*2014*2015Apr30-12:36:19

Signature: 438B24CE06182FA3AA82BC285F867D03FB73F3BCC0F73FDBA6
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BE75F08D0DEBD7AF55E4CB085B9A0A14583F135DBB399121B24
ED1L

Authenticated by ascribe®

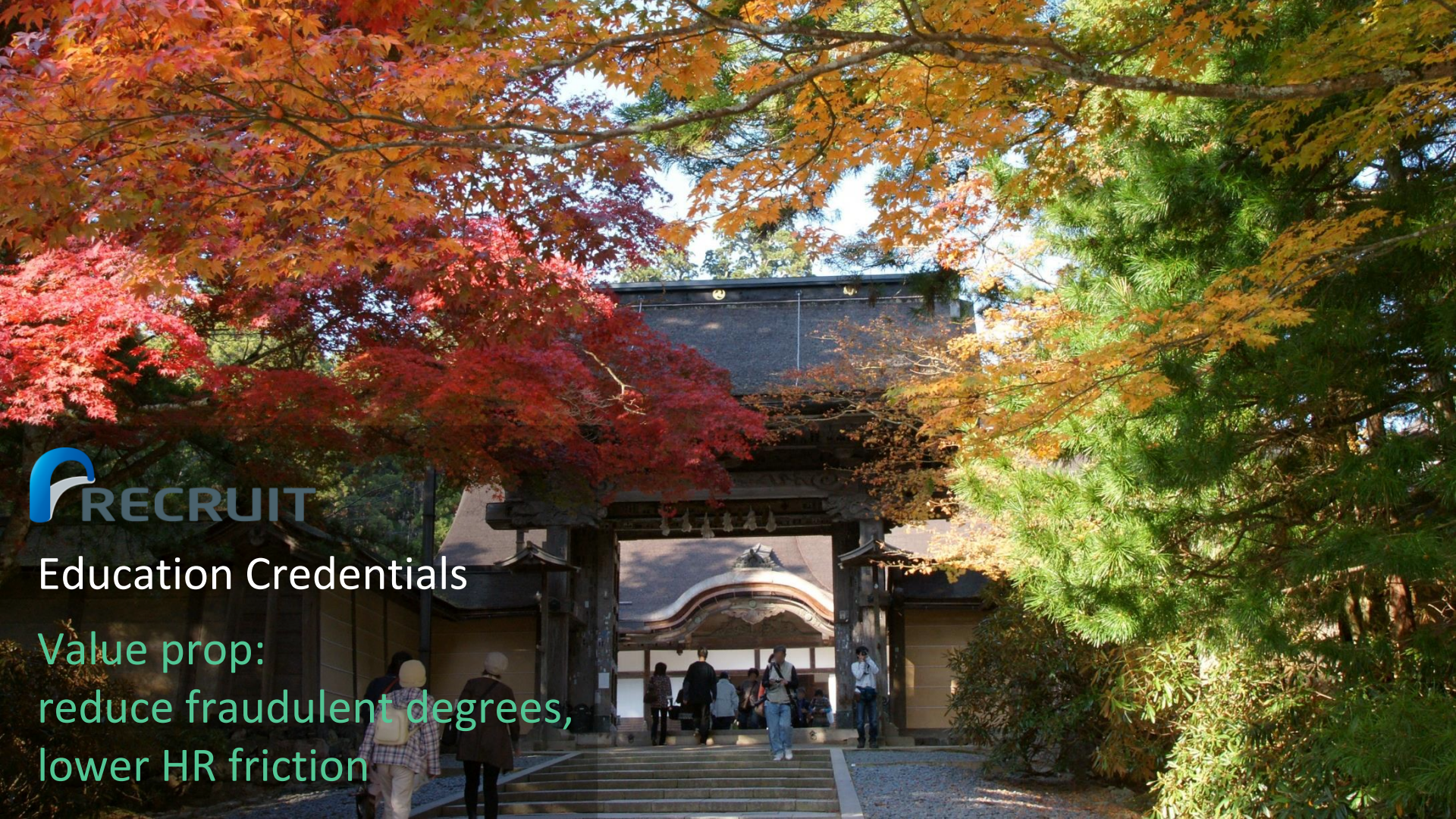

More examples


RWE
Energy
Value prop:
manage $ flow in
energy deregulation

res( )nate

Music rights

Value prop:
A streaming service
owned by all



Education Credentials

Value prop:
reduce fraudulent degrees,
lower HR friction


Data & AI

The Unreasonable Effectiveness of Data

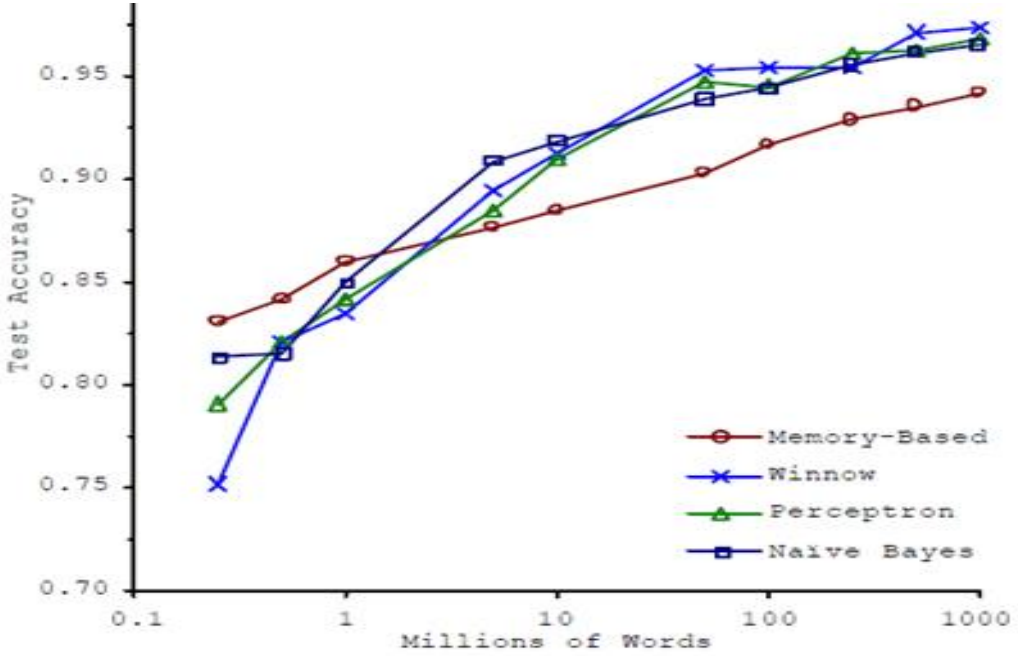


Figure 1. Learning Curves for Confusion Set Disambiguation

[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..

But all is not well in the world of AI

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And more..

Can decentralization help?


Blockchains & AI

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

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*

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GENESIS OF THINGS

Cognizant innogy 3D MAKERS ZONE. intel DB

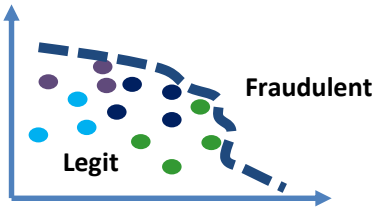
Online platform for industrial 3d printing.
E.g. spare aircraft parts

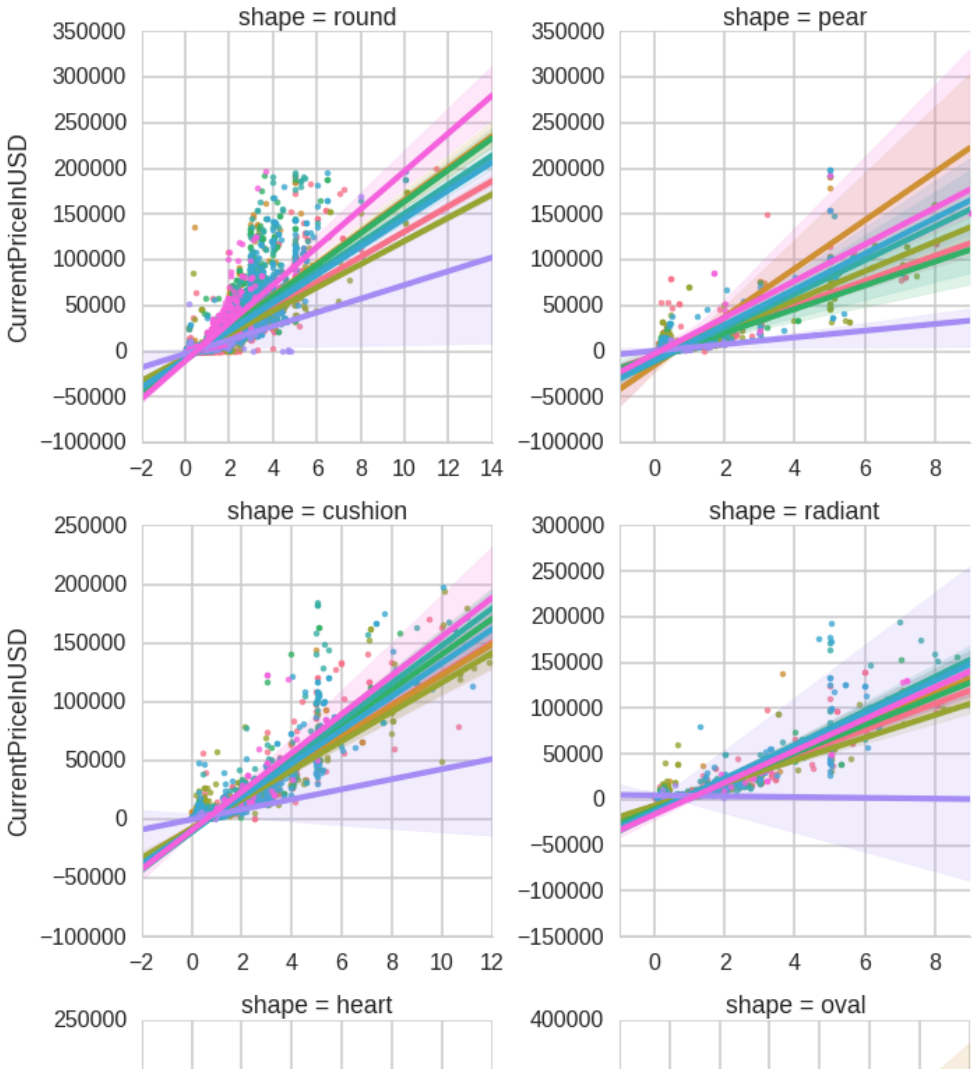
- Find and contract the best 3d printer
- Securely transfer production files
- Pool data in ecosystem → 1-class classifiers for fraud detection

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

Problem: Data Hoarding (3)

Sol'n: OpenMined:
Let the data hoarders hoard, just compute a model on their encrypted data

Federated Learning
Homomorphic Encryption
Blockchain

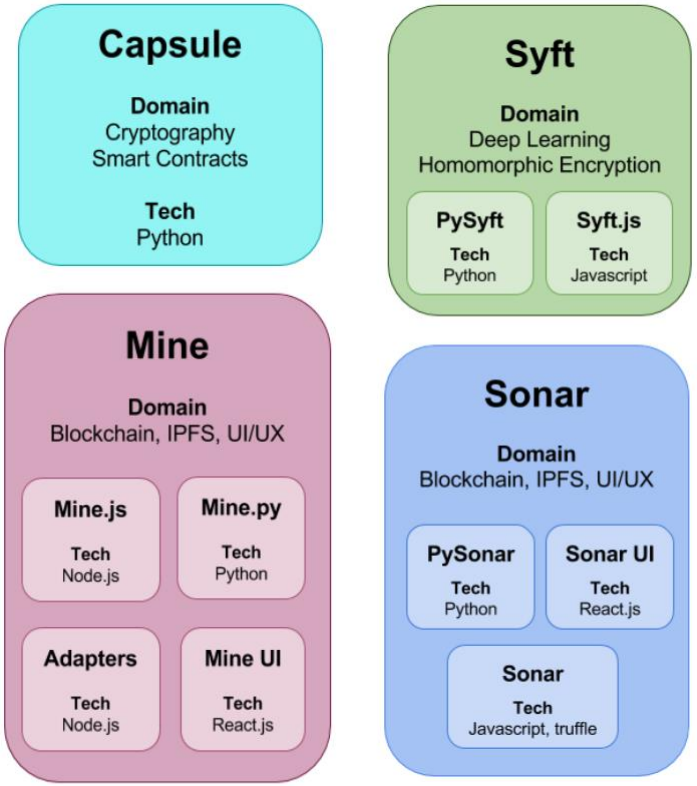
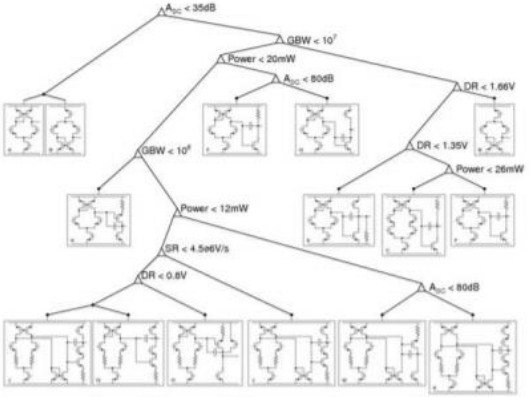


Image: github.com/OpenMined/Docs

Certificate of Authenticity

ascribe®

As of Nov. 06 2016, 19:10:42, trent is the owner.
To verify current owner, please visit https://www.ascribe.io/app/coa_verify/



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

Nov. 06, 2016, 19:10:42 - Registered by trent

CRYPTOGRAPHIC STAMP

Use the summary and signature below to authenticate this certificate on:

Link: https://www.ascribe.io/app/coa_verify/

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: High Friction to Monetize Algorithms (3)

Solution: Tokenize your AI: SingularityNet

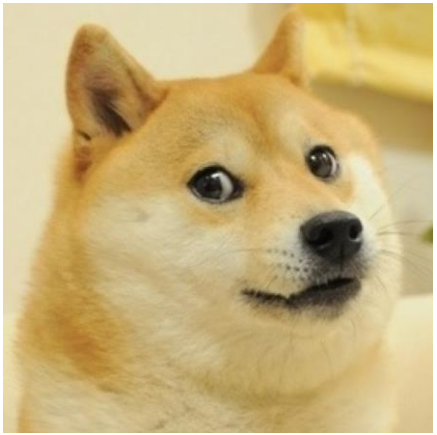
Steps

1. Submit your AI algorithms
2. They get wrapped into SingularityNet agents
3. And act as a decentralized MLaaS

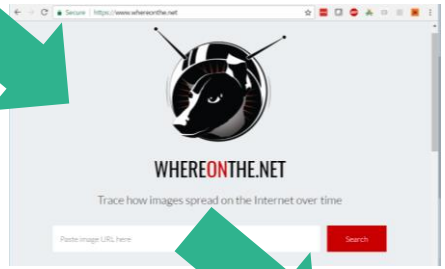
Image: @UlvBjornsson

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

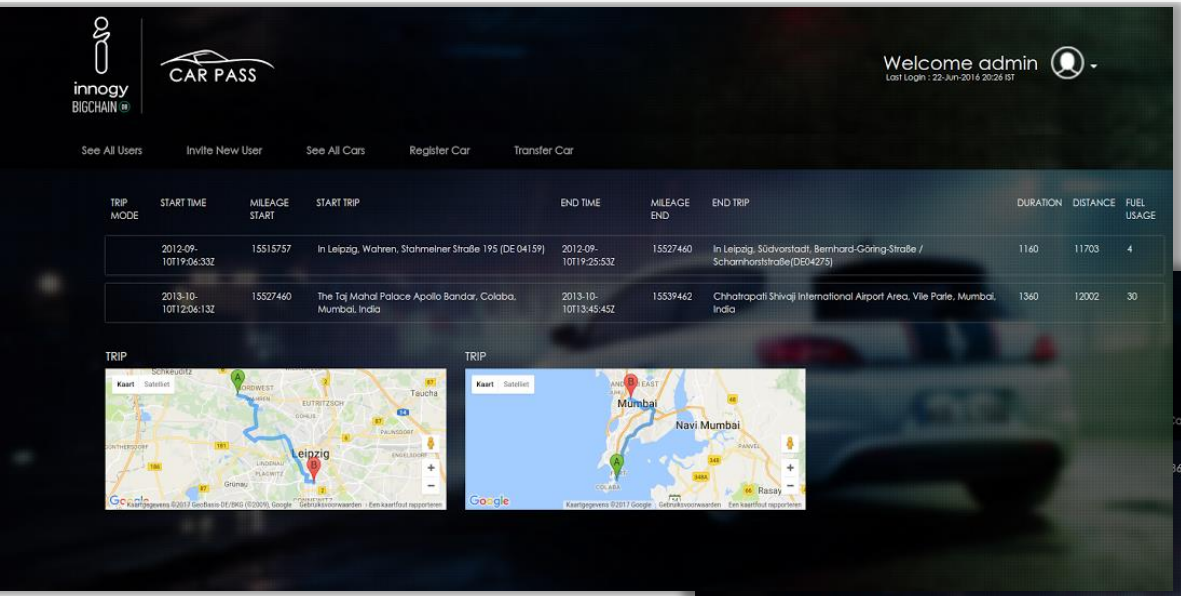
Provenance in model deployment:

- 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)

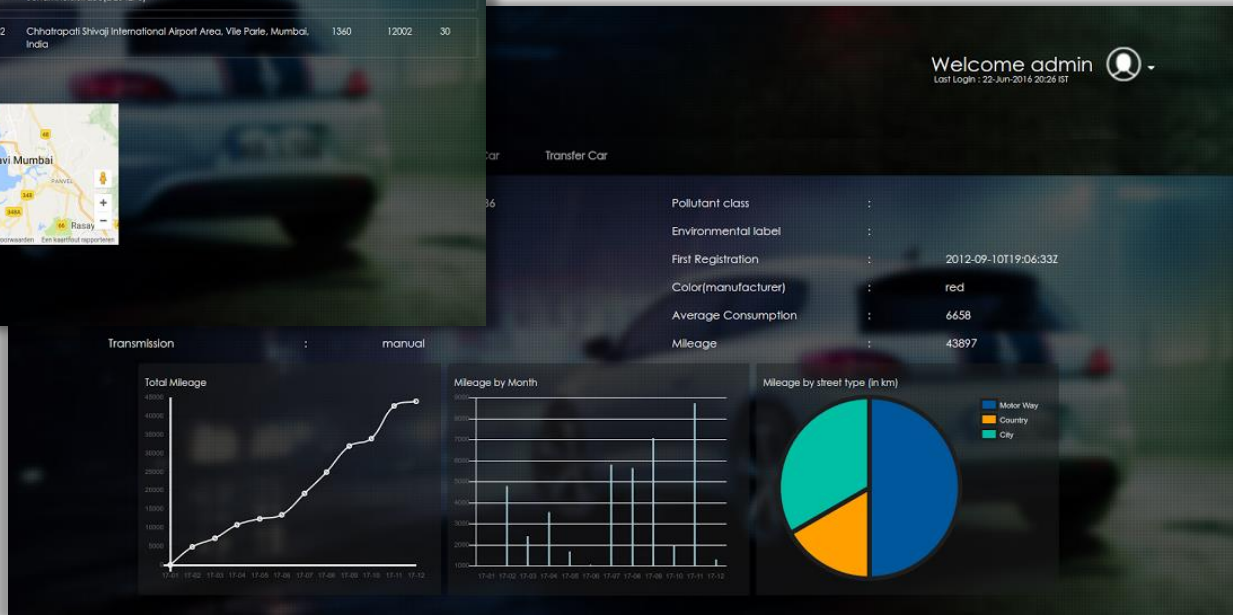


BIGCHAIN DB

innogy

CAR PASS

riddle&code



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 Marketplace

Mo' data
(and mo' compute)

↓

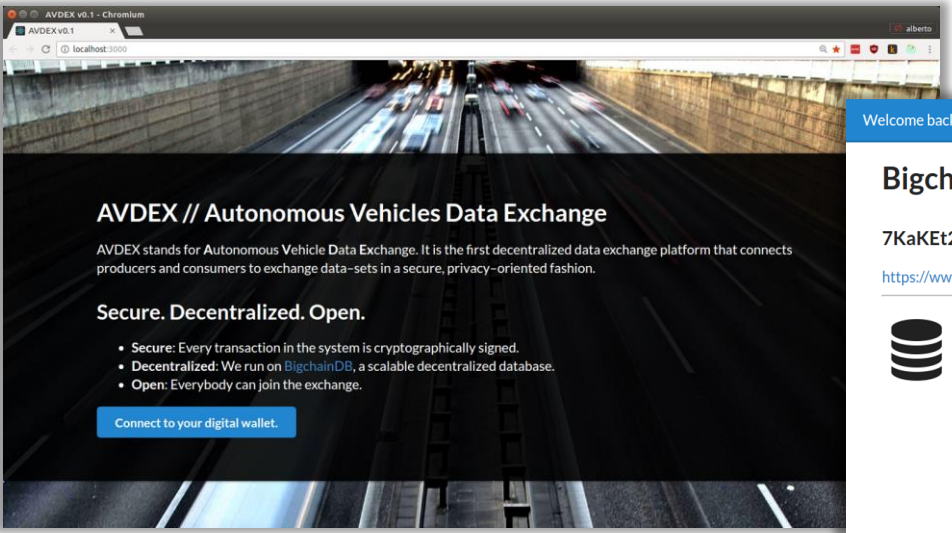
Mo' accuracy

↓

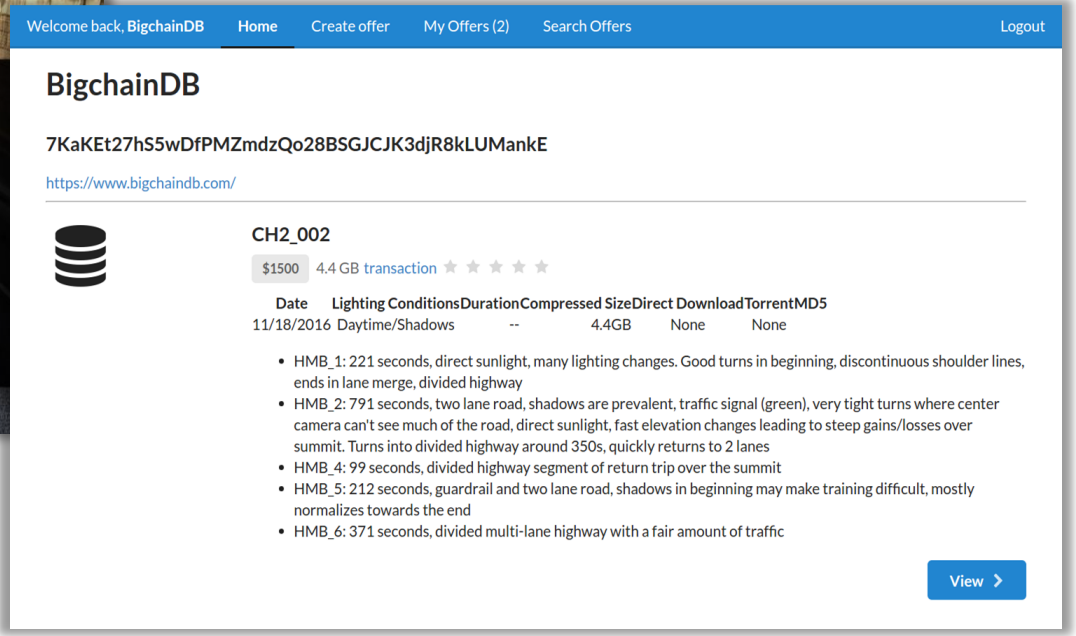
Mo' $

Problem: Data is Expensive

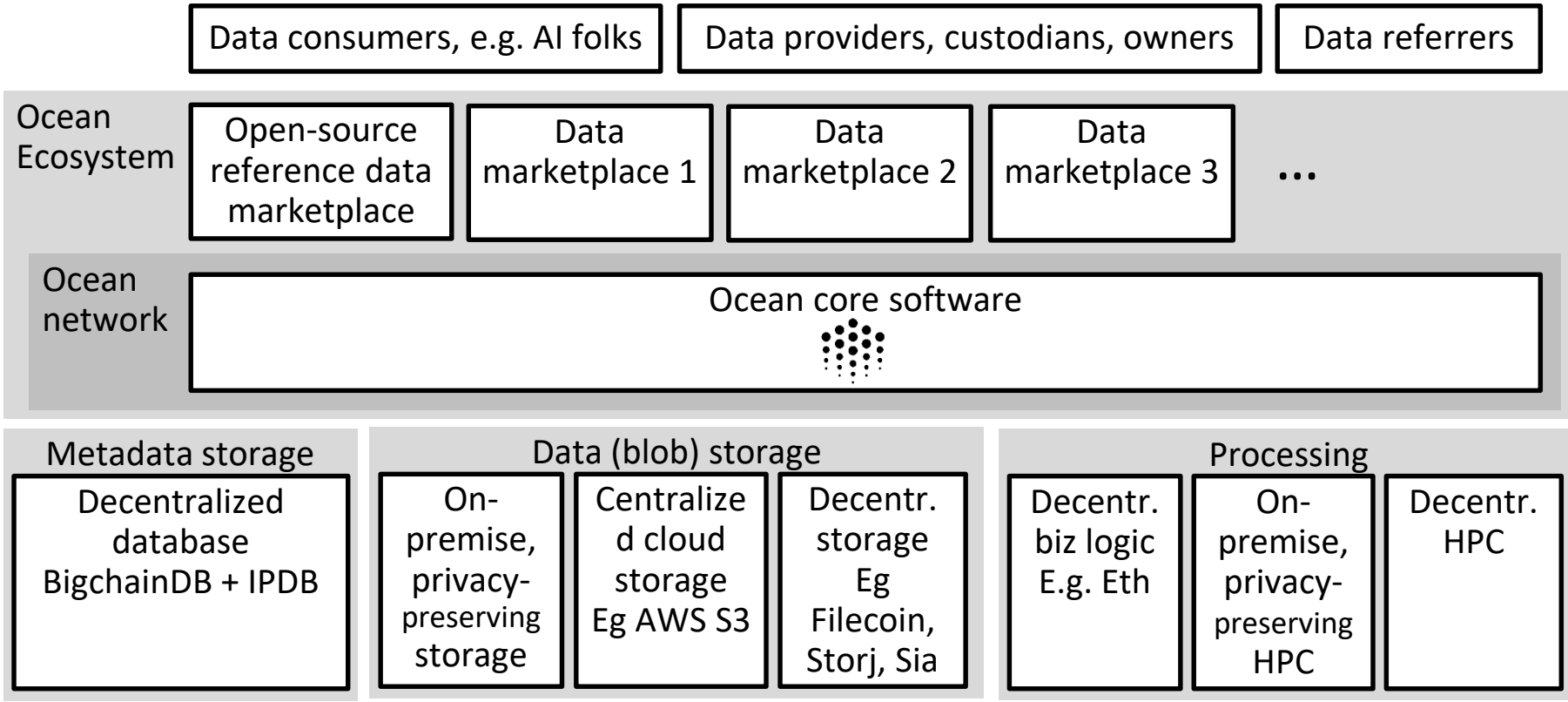
Sol'n: A Decentralized Data Market for Self-Driving Car Data



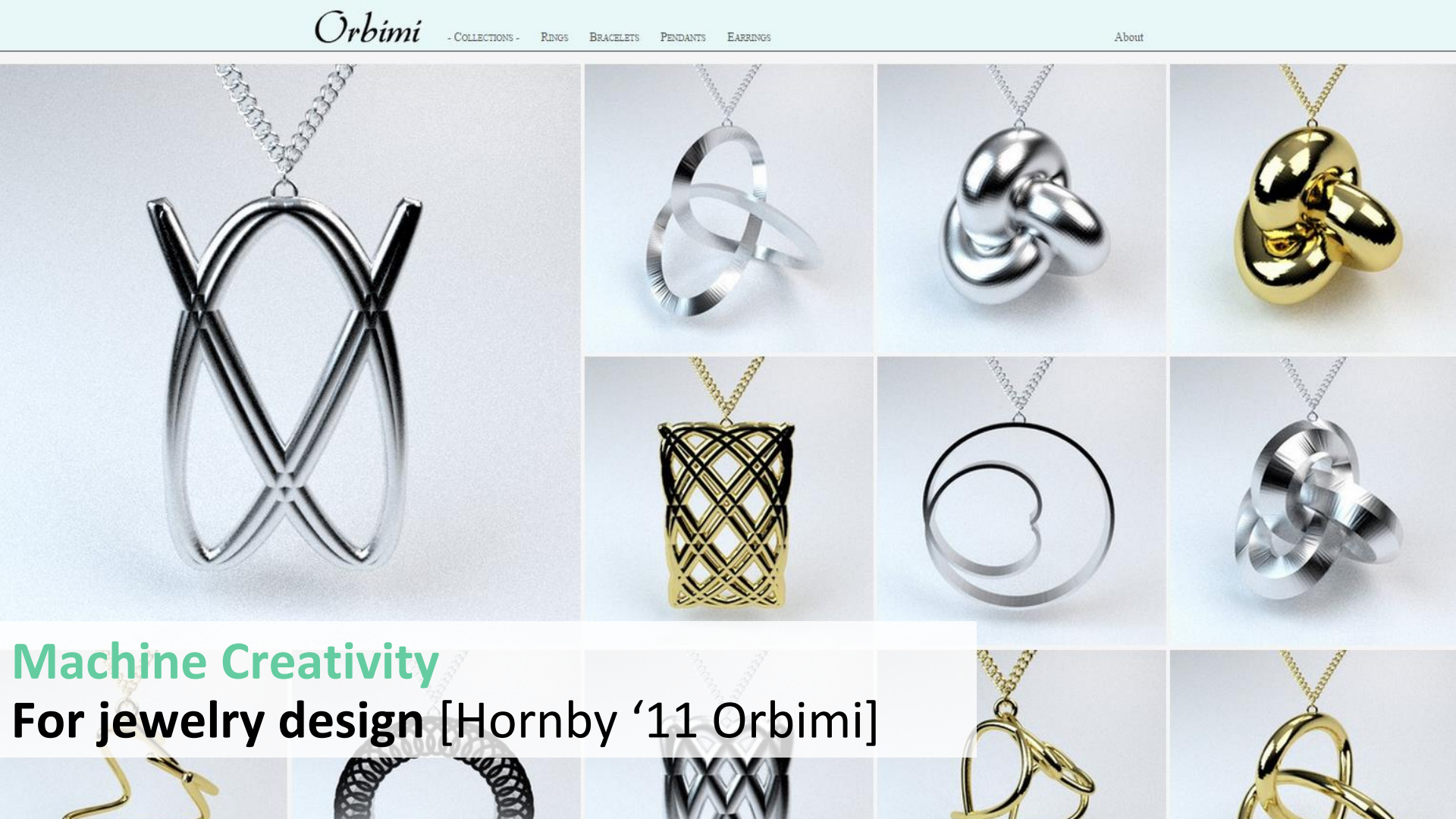
BigchainDB TOYOTA RESEARCH INSTITUTE



Problem: Data marketplace silo. Solution: *1000* marketplaces!
A Decentralized Data Exchange *Protocol* and *Network*. Ocean.

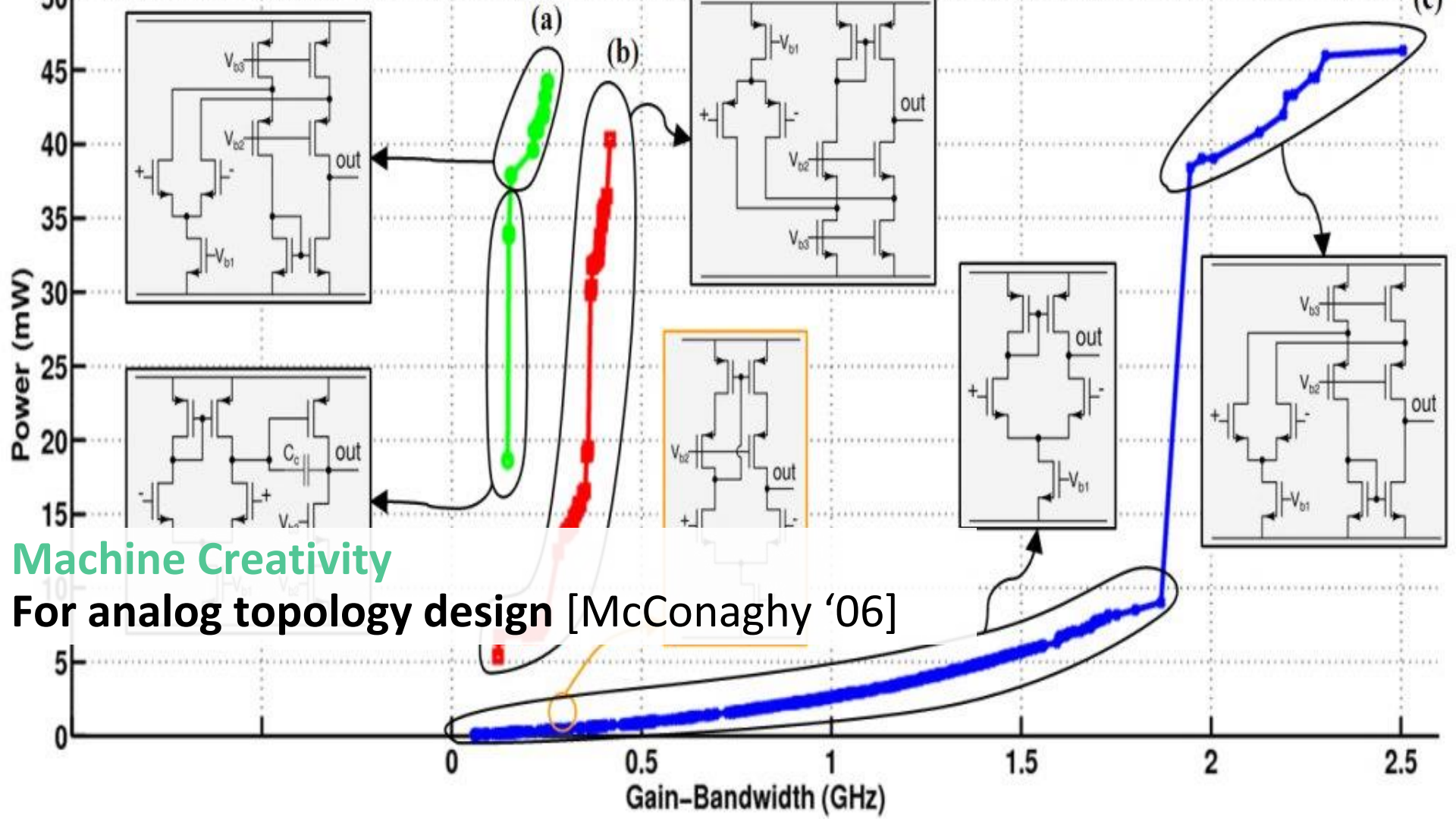


AI * Blockchain Symbiosis:
AI DAOs



Machine Creativity

For jewelry design [Hornby ‘11 Orbimi]

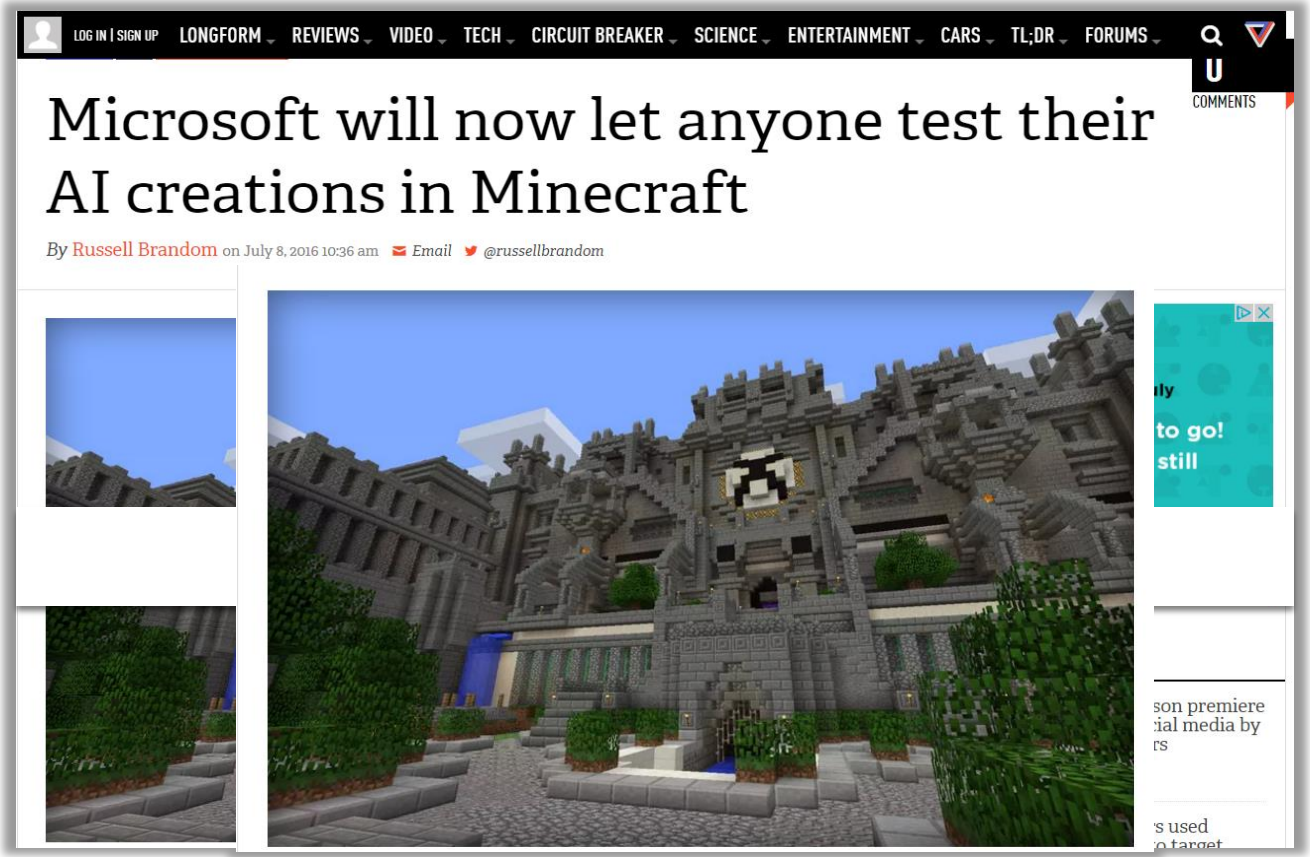


Machine Creativity

For analog topology design [McConaghy ‘06]

AGI: Artificial *General* Intelligence

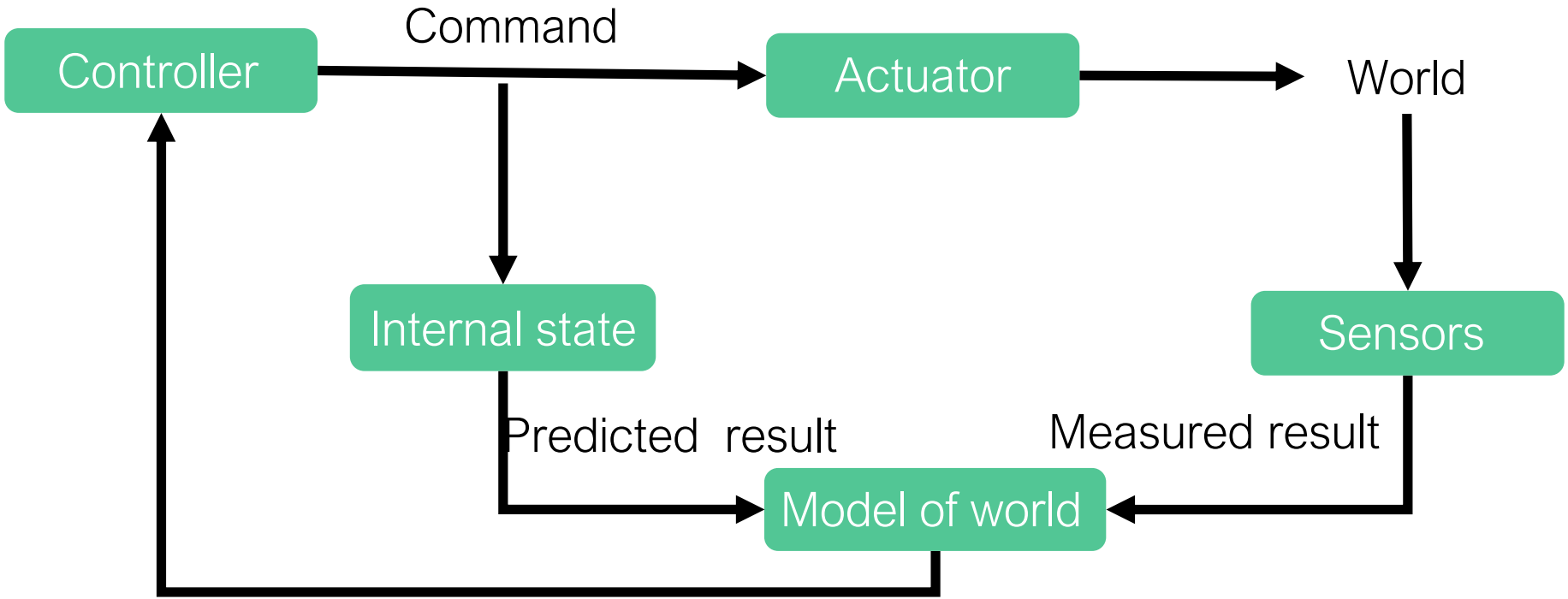
Agents that sense, model, and act



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…

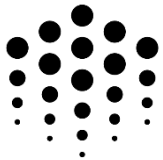
1. Run AI art engine to generate new image
4. Sell the editions. $ goes to ArtDAO, in exchange for IP

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

Conclusion

- Blockchains can *really* help AI
- It's all about the data
  - Getting the data
  - Getting *good* data - with provenance
  - All roads lead to a data exchange protocol
- (Plus those pesky AI DAOs)



BIGCHAIN DB

IPDB INTERPLANETARY DATABASE