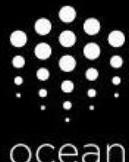


Blockchains for Artificial Intelligence From Data Exchanges to Millionaire AIs

Trent McConaghy
@trentmc0



Blockchains





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**.

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

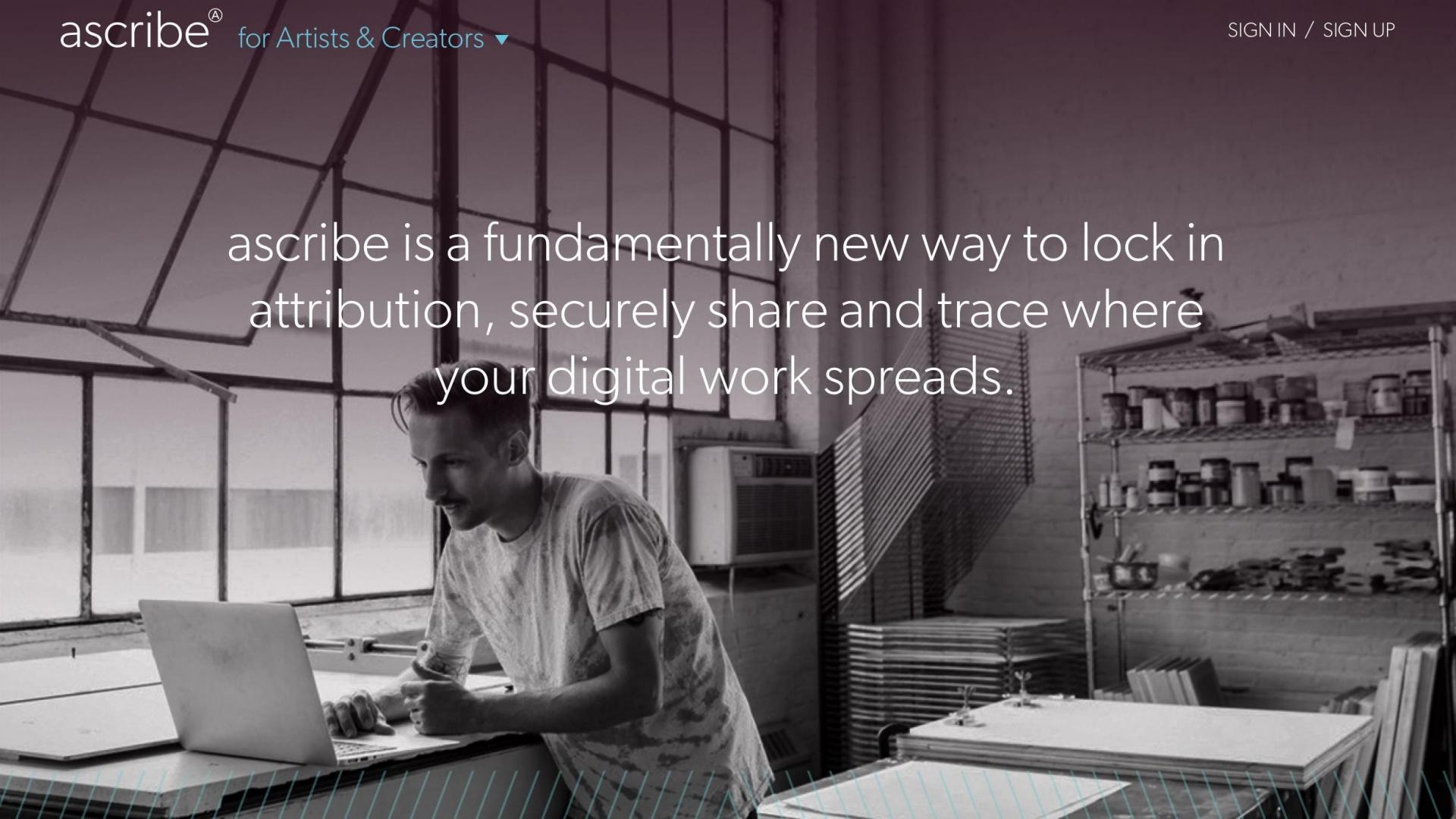
- Hash Previous Blocks
- Append-only

Native assets

- “Own” = have private key
- Asset lives on the database

The background of the slide features a dark, star-filled night sky. A vibrant green aurora borealis arches across the upper portion of the frame from the left. In the foreground, the dark silhouettes of many bare tree branches are visible against the light of the aurora.

Example real-world use:
ascibe



ascibe is a fundamentally new way to lock in attribution, securely share and trace where your digital work spreads.

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 B

.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
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

Certificate Of Authenticity

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



DOLLAR
EURO
Swiss FRANCS
JEFF KOONS
BITCOIN

Currency

Date: 2014

Edition: 3 of 100

Created by: Dan Perjovschi

Owner: Masha McConaghay

ARTWORK DETAILS

Artwork ID: 17uZBwSbLGfx3vRRMWzF5PMjFVNc1tkQ2

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 McConaghay

CRYPTOGRAPHIC STAMP

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

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

Signature: 438B24CE06182FA3AA82BC285F867D03FB73F3BCC0F73FDBA6
EC2BFF7088E011E60355B7DC75D5745A9D5CA2A8115512FF835
C4ABEF6869BF6A991668A820F3FB03A48C6A9E05834716F6500
68E8E07E5266620BA815948DC265605D23FAF016CB46ACD4BC
BE75F08D0DEBD7AF55E4CB085B9A0A14583F135DBB399121B24
ED1L



More examples



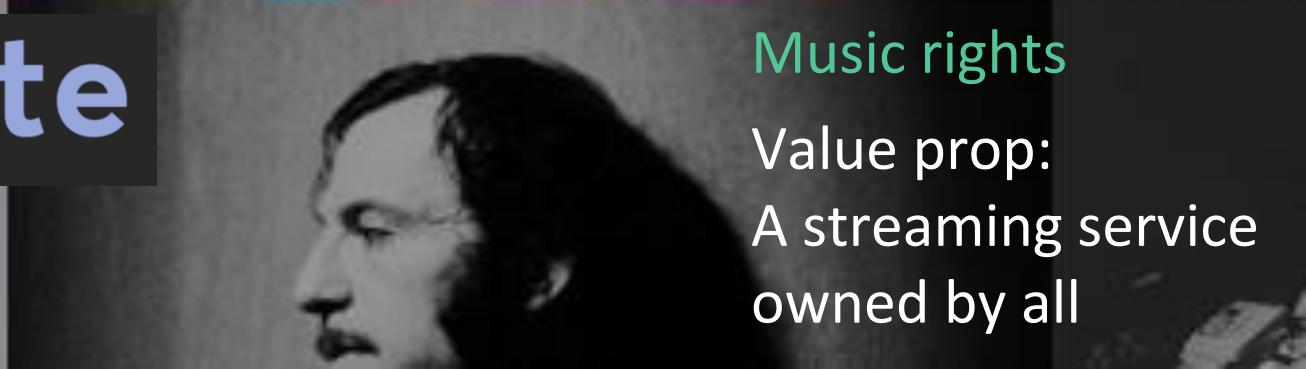
Energy

Value prop:
manage \$ flow in
energy deregulation





res()nate



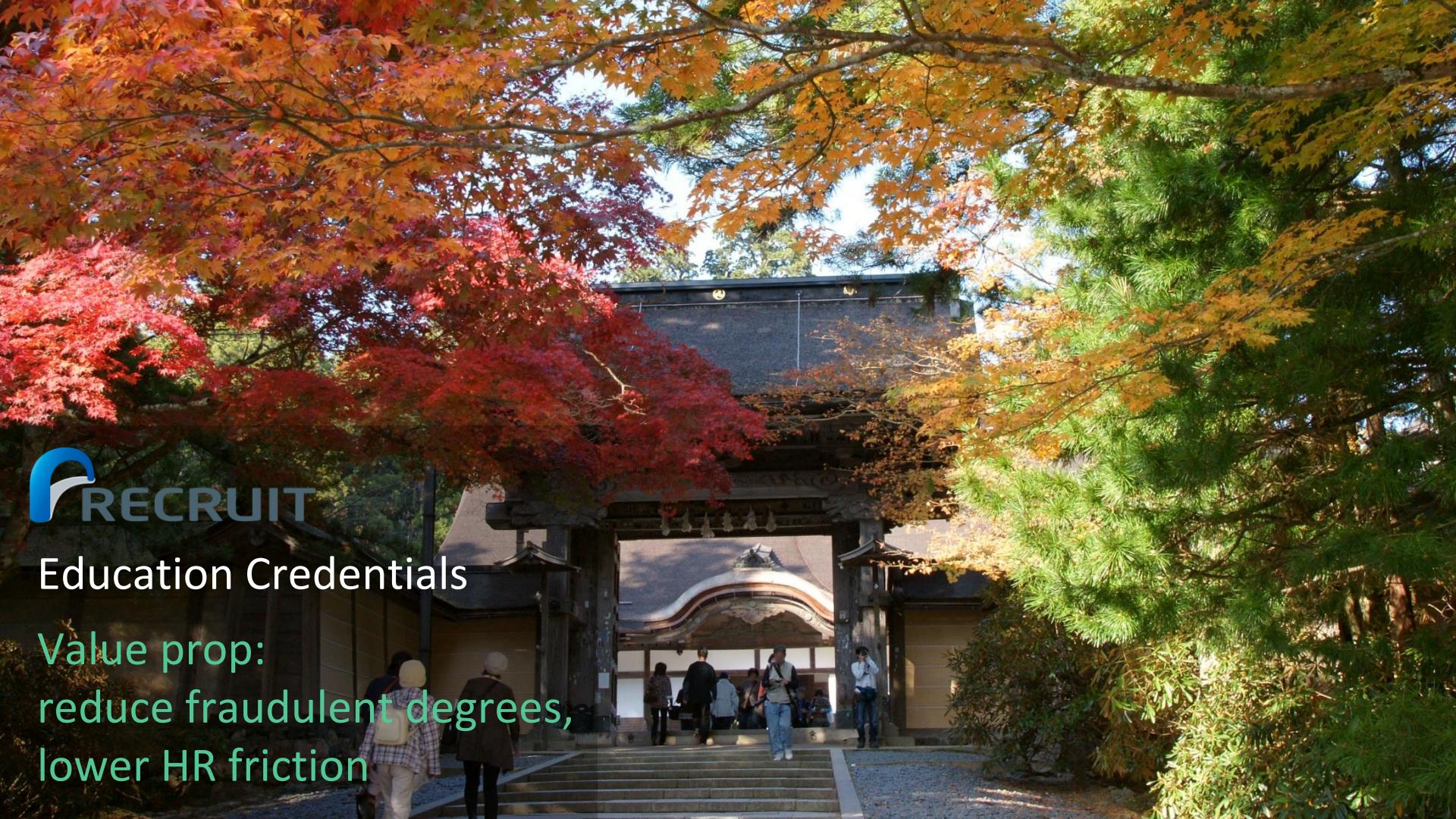
Music rights

Value prop:
A streaming service
owned by all



Education Credentials

Value prop:
reduce fraudulent degrees,
lower HR friction



The background image shows a dark night sky filled with stars. A vibrant green aurora borealis (Northern Lights) arches across the upper portion of the frame, its light glowing against the dark sky. In the foreground, the silhouettes of many bare trees stand in a dense line, their branches reaching upwards. The overall atmosphere is mysterious and ethereal.

Data & AI



The Unreasonable Effectiveness of Data

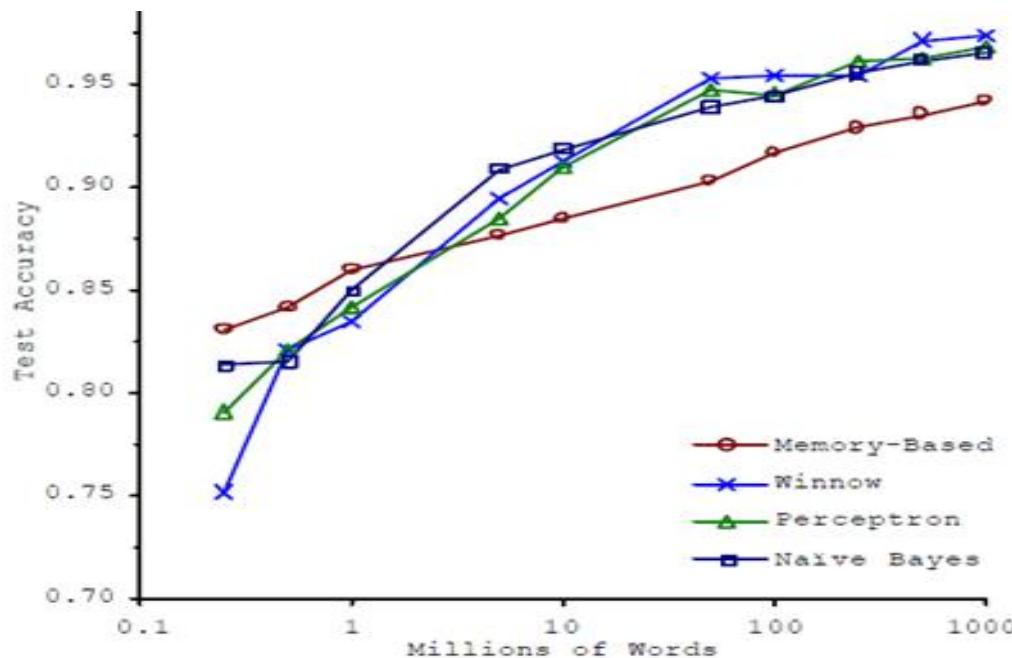


Figure 1. Learning Curves for Confusion Set Disambiguation
[Banko and Brill, 2001]

The world's most valuable resource



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

FILE SYSTEM

HDFS, S3

DATABASE

MongoDB,
Cassandra

PROCESSING

BIZ LOGIC

CPU, EC2

HIGH PERF. COMPUTE

Nvidia GPU, Goog TPU,
MapReduce, Spark

COMMUNICATIONS

DATA

TCP/IP, HTTP

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

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

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

FILE SYSTEM
IPFS/FileCoin, Swarm

DATABASE
BigchainDB/IPDB

E-GOLD / E-CASH
Bitcoin, zcash, .*

PROCESSING

BIZ LOGIC
Ethereum, Hyperledger

HIGH PERF. COMPUTE
TrueBit, Golem, iExec,
VMs, client-side compute

COMMUNICATIONS

DATA
TCP/IP, HTTP

VALUE
ILP, Cosmos

State
PolkaDot, Aeternity

THE 3 ELEMENTS OF COMPUTING, *DECENTRALIZED*



Key Blocks in AI Landscape

STORAGE

FILE SYSTEM

IPFS/FileCoin, Swarm

DATABASE

BigchainDB/IPDB

E-GOLD / E-CASH
Bitcoin, zcash, .*

PROCESSING

BIZ LOGIC

Ethereum, Hyperledger

HIGH PERF. COMPUTE

TrueBit, Golem, iExec,
VMs, client-side compute

COMMUNICATIONS

DATA

TCP/IP, HTTP

VALUE

ILP, Cosmos

State

PolkaDot, Aeternity



Cognizant



innogy



3D
MAKERS
ZONE.



Online platform for industrial 3d printing.

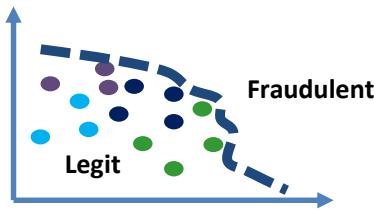
E.g. spare aircraft parts

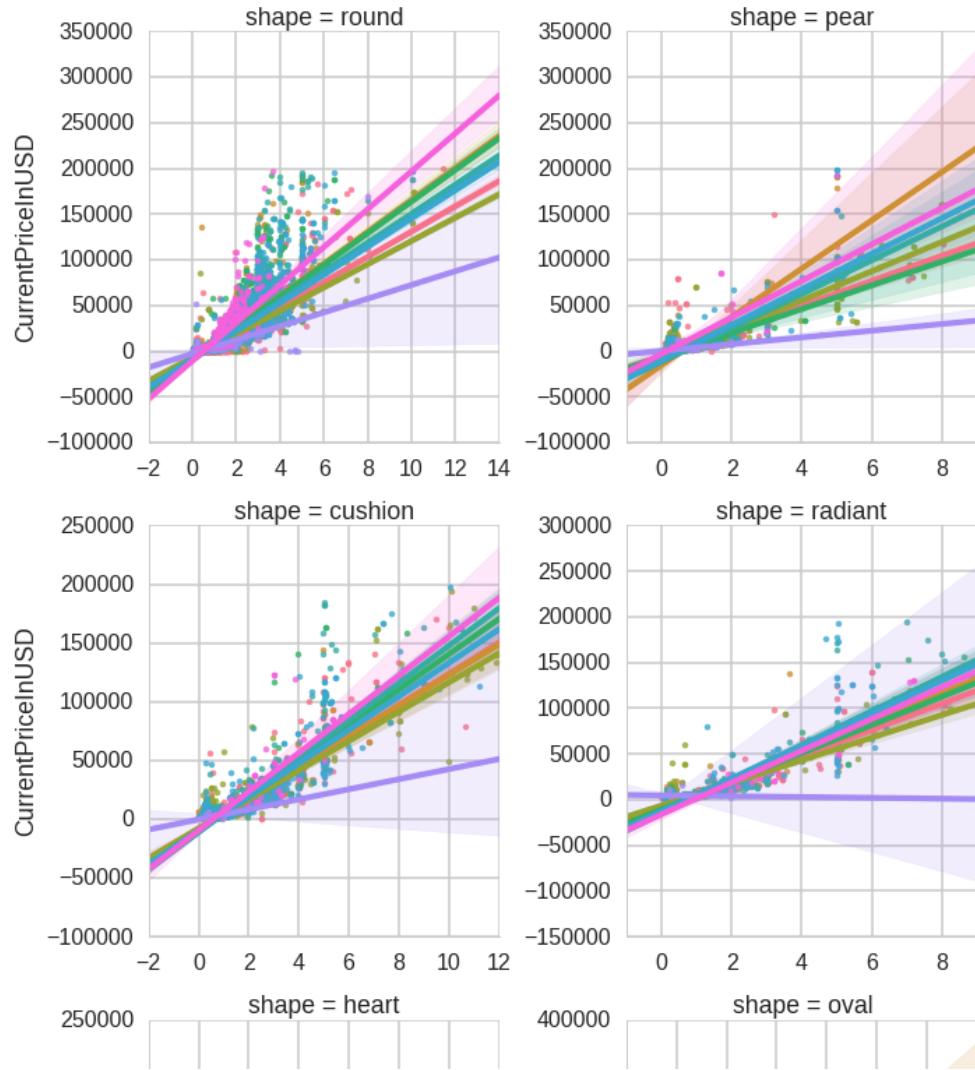
- Find and contract the best 3d printer
- Securely transfer production files
- Pool data in ecosystem → 1-class classifiers for fraud detection

Problem: Data Hoarding

Sol'n: Data Pooling

For More Accurate Models





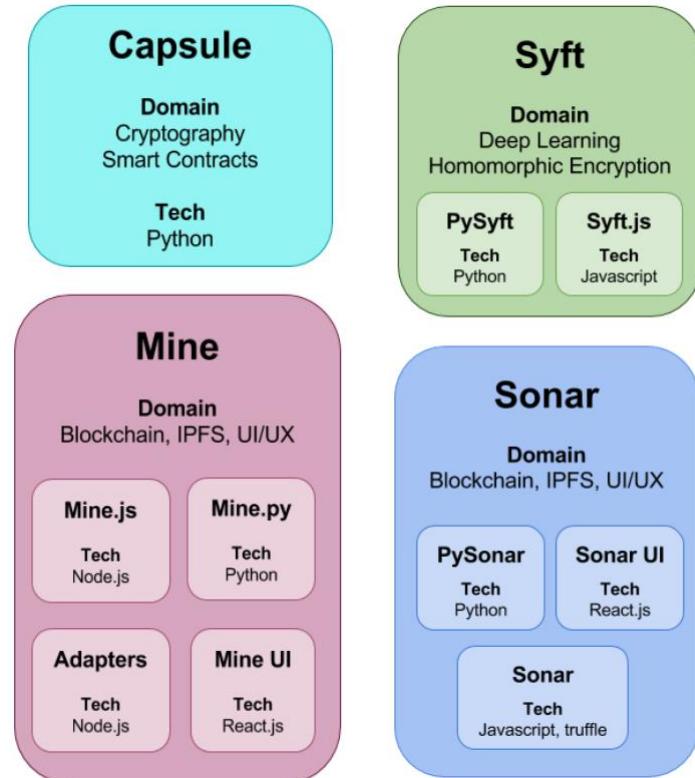
Problem: Data Hoarding (2)
Sol'n: Data Pooling For More Accurate Models

**Diamond price prediction
for fraud detection:
Warn if predicted price \neq
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

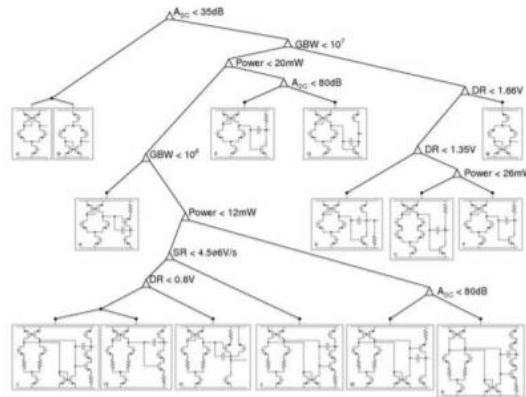


Certificate of Authenticity

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/

ascribe[®]



Circuit Decision Tree

Edition: 1/3

Created by: Trent McConaghy

Owner: trent

ARTWORK DETAILS

Artwork ID: 136UbLGSNHqY9kjxQ3tDy83K7P69zDjeN

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/

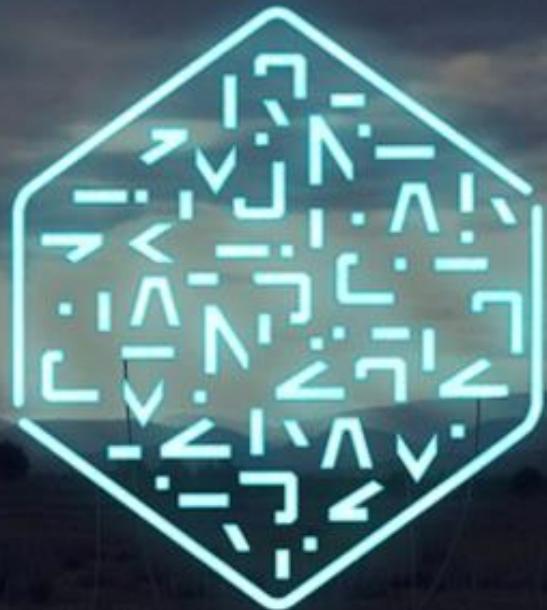
Summary: Trent McConaghy*Circuit Decision
Tree*1/3*2008*2016Nov06-19:10:42

Signature: C38D56C823CEC09E40B3589D27D48B9C8EF9ADECC9592F469
CE0144CF9ECA406B3ABF1D976AD87813895379A66F9F7C327B
B0EE090A52F6A8274F3F4AC9EE3D7DF0FA98964C834678A6F4
8E54F6E87E7B4243F8F65FF57315CB7391A03874CD4BDFCB357
18F1742AB5256B72A4C2D2593F3492372A66C82679263E398A
B9996EL



Problem: High Friction to Monetize Algorithms
Sol'n: Claim & License Your Algorithm IP





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

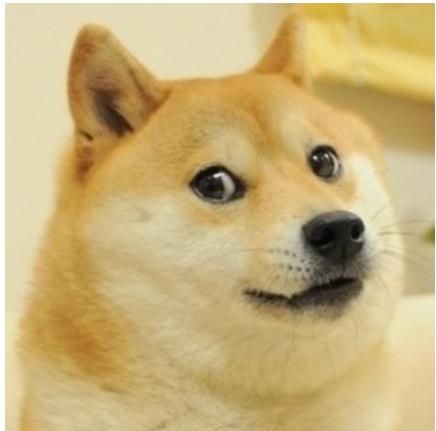


Image: @UlvBjornsson

Problem: blockchain-secured data spreads online



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



WHEREONTHE.NET



Paste image URL here

Search

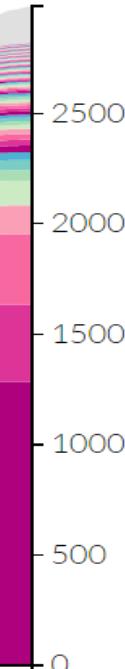
2014

2015

2016

2017

0



2500

2000

1500

1000

500

0

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 →

Problem: Weak Data History (2)

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

The screenshot shows the CarPass web interface. At the top, there are logos for innogy, BIGCHAINDB, CAR PASS, and riddle&code. The main header says "Welcome admin" with a user icon and "Last Login : 22-Jun-2016 20:26 IST". Below the header are navigation links: See All Users, Invite New User, See All Cars, Register Car, Transfer Car. A table lists two trips:

TRIP MODE	START TIME	MILEAGE START	START TRIP	END TIME	MILEAGE END	END TRIP	DURATION	DISTANCE	FUEL USAGE
	2012-09-10T19:06:33Z	15515757	In Leipzig, Wahren, Stahlmeyer Straße 195 (DE 04159)	2012-09-10T19:25:53Z	15527460	In Leipzig, Südstadt, Bernhard-Göring-Straße / Schornstraße (DE 04275)	1160	11703	4
	2013-10-10T12:04:13Z	15527460	The Taj Mahal Palace Apollo Bandar, Colaba, Mumbai, India	2013-10-10T13:45:45Z	15539462	Chhatrapati Shivaji International Airport Area, Vile Parle, Mumbai, India	1360	12002	30

Below the table are two maps: one showing a route from Leipzig to a location in Leipzig, and another showing a route from Mumbai to a location in Mumbai.

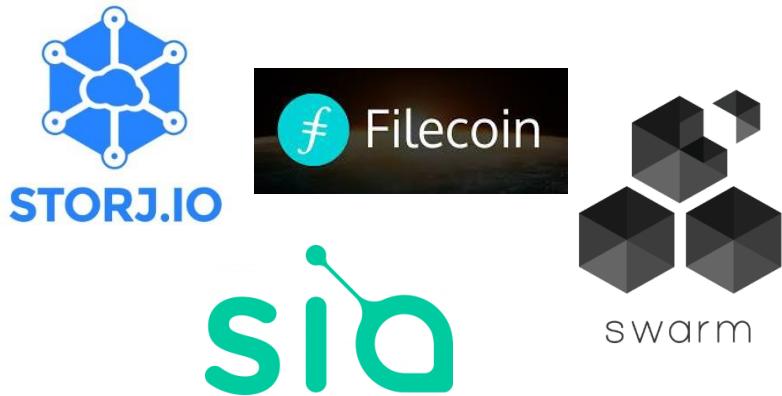


The screenshot shows the CarPass web interface. At the top, there are logos for innogy, BIGCHAINDB, CAR PASS, and riddle&code. The main header says "Welcome admin" with a user icon and "Last Login : 22-Jun-2016 20:26 IST". Below the header are navigation links: See All Users, Invite New User, See All Cars, Register Car, Transfer Car. A table lists vehicle details:

Pollutant class	:
Environmental label	:
First Registration	:
Color(manufacturer)	:
Average Consumption	:
Mileage	:

Below the table are three data visualizations: a line chart of Total Mileage over time, a bar chart of Mileage by Month, and a pie chart of Mileage by street type (Motor Way, Country, City).

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

Data and the new rules
of competition

Mo' data
(and mo' compute)



Mo' accuracy



Mo' \$

Problem: Data is Expensive

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

Welcome back, BigchainDB

Home Create offer My Offers (2) Search Offers Logout

BigchainDB

7KaKEt27hS5wDfPMZmdzQo28BSGJCJK3djR8kLUMankE

<https://www.bigchaindb.com/>

CH2_002

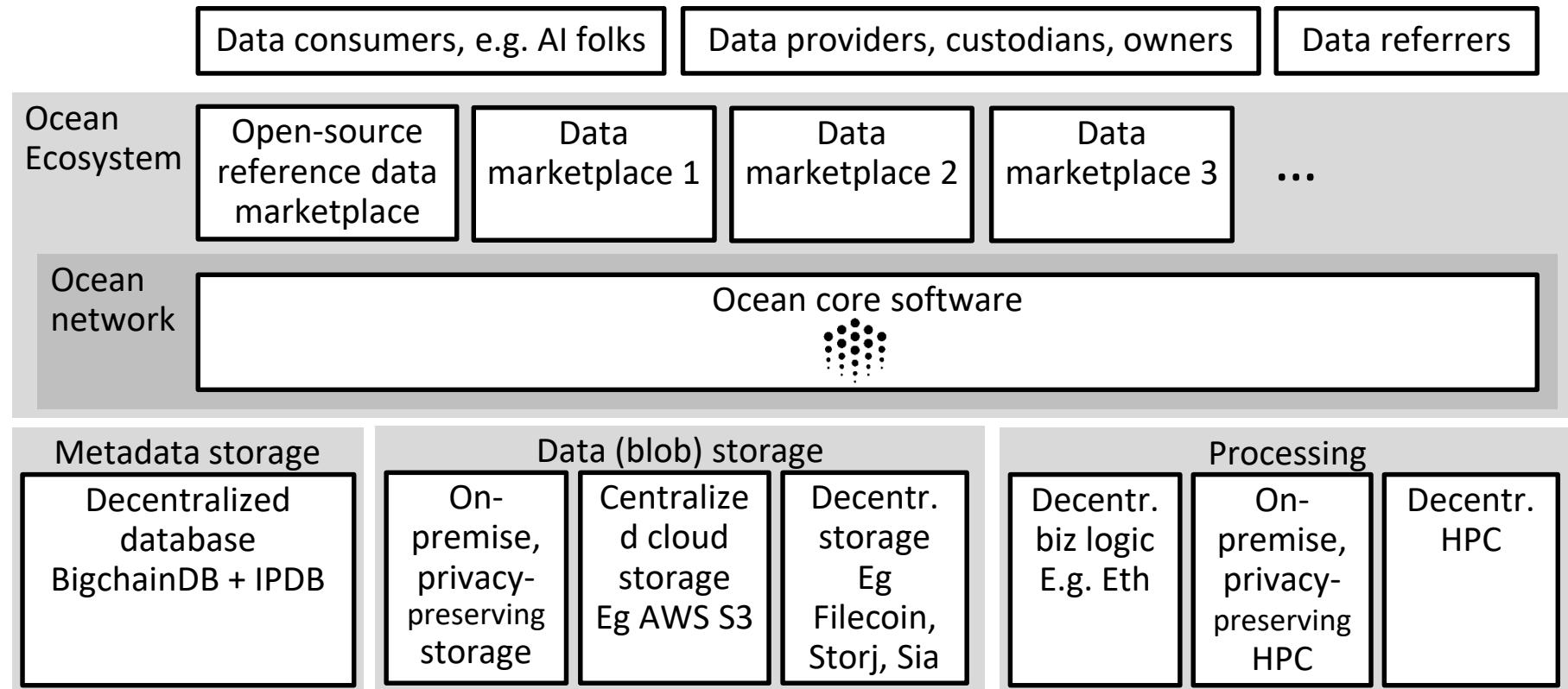
\$1500 4.4 GB transaction ★ ★ ★ ★ ★

Date	Lighting Conditions	Duration	Compressed Size	Direct Download	Torrent	MD5
11/18/2016	Daytime/Shadows	--	4.4GB	None	None	

- HMB_1: 221 seconds, direct sunlight, many lighting changes. Good turns in beginning, discontinuous shoulder lines, ends in lane merge, divided highway
- HMB_2: 791 seconds, two lane road, shadows are prevalent, traffic signal (green), very tight turns where center camera can't see much of the road, direct sunlight, fast elevation changes leading to steep gains/losses over summit. Turns into divided highway around 350s, quickly returns to 2 lanes
- HMB_4: 99 seconds, divided highway segment of return trip over the summit
- HMB_5: 212 seconds, guardrail and two lane road, shadows in beginning may make training difficult, mostly normalizes towards the end
- HMB_6: 371 seconds, divided multi-lane highway with a fair amount of traffic

[View >](#)

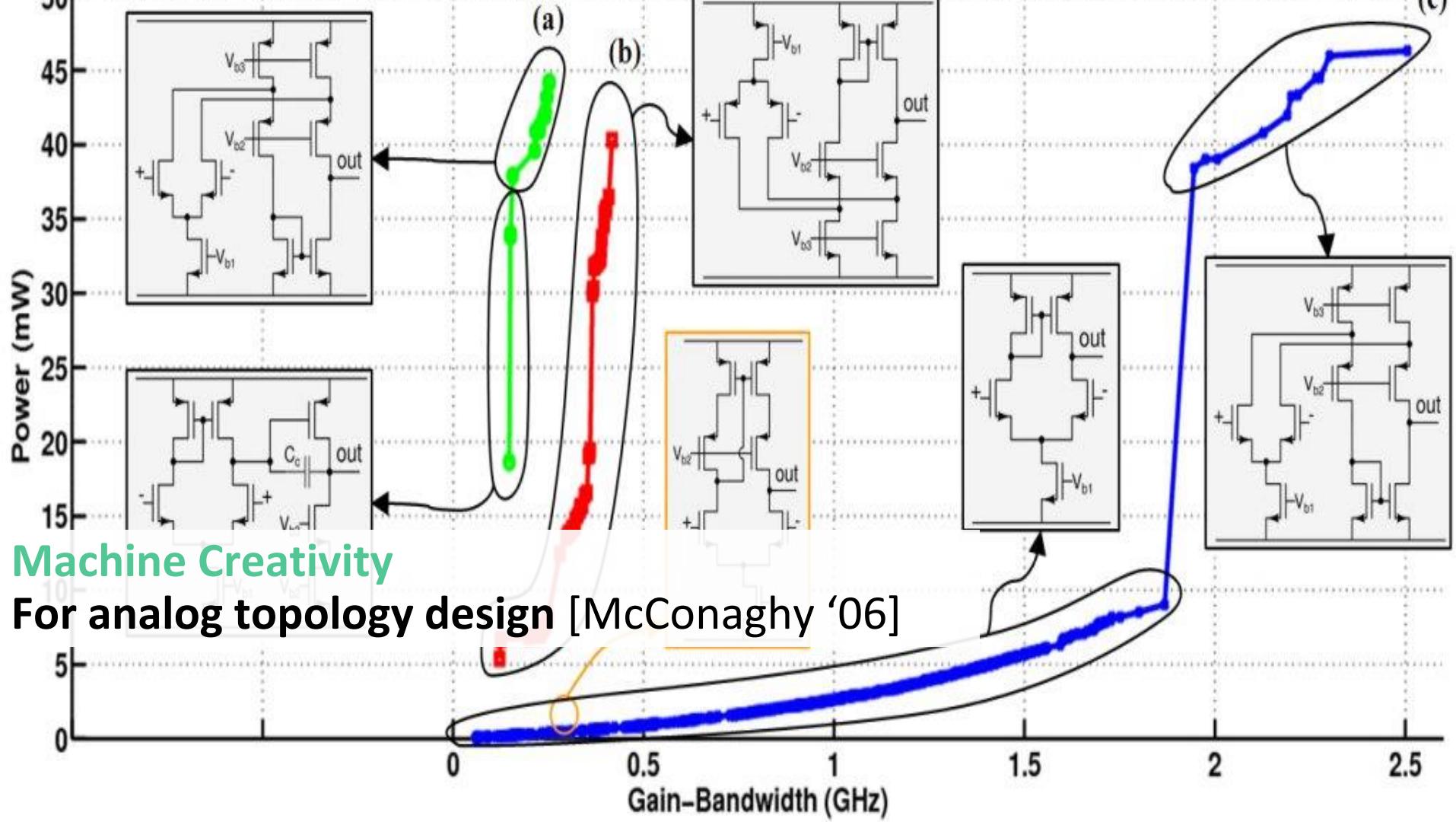
Problem: Data marketplace silo. Solution: 1000 marketplaces! A Decentralized Data Exchange *Protocol* and *Network*. Ocean.



AI * Blockchain Symbiosis: AI DAOs



Machine Creativity
For jewelry design [Hornby '11 Orbimi]



AGI: Artificial *General* Intelligence

B
DB

Agents that sense, model, and act

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Microsoft will now let anyone test their AI creations in Minecraft

By [Russell Brandom](#) on July 8, 2016 10:36 am [Email](#) [@russellbrandom](#)



...ly
to go!
still

son premiere
ial media by
rs

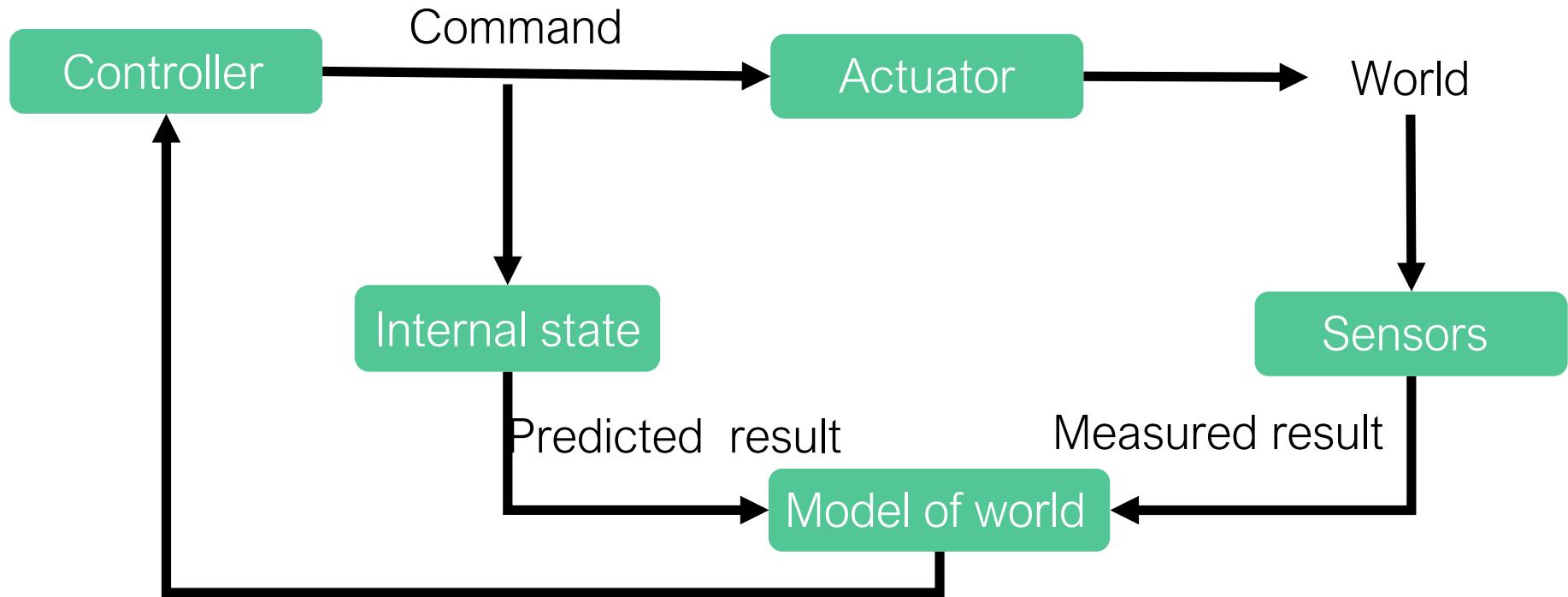
s used
o target

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.

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.

4. Sell the editions. \$ goes to ArtDAO, in exchange for IP

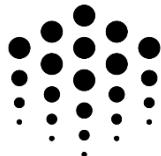
Repeat! Create more art, sell it, get wealthier

Conclusion

The
mist

The world's most
valuable resource

- 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)



Data and the new rules
of competition

BIGCHAIN DB
IPDB | INTERPLANETARY DATABASE